MILITARY COMMUNICATIONS—1968

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HEARINGS

BEFORE A

SUBCOMMITTEE OF THE COMMITTEE ON GOVERNMENT OPERATIONS HOUSE OF REPRESENTATIVES

NINETIETH CONGRESS

SECOND SESSION

JUNE 17 AND 18, 1968

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Committee on Government Operations

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MILITARY COMMUNICATIONS—1968

MONDAY, JUNE 17, 1968

HOUSE OF REPRESENTATIVES,
MILITARY OPERATIONS SUBCOMMITTEE
OF THE COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D.C.

The subcommittee met at 10 a.m., in room 2203, Rayburn House Office Building, Hon. Chet Holifield, chairman of the subcommittee, presiding.

Present: Representatives Holifield and Erlenborn.

Also present: Herbert Roback, staff administrator; Douglas Dahlin, counsel; Paul Ridgely, investigator; and Joseph Luman, defense analyst.

Mr. HOLIFIELD. The committee will be in order.

The purpose of these hearings is to update the subcommittee on recent developments in the military use of satellite communications and place satellite communications in the broader context of military communications worldwide in their diverse forms.

Today we will start with the second item. Lt. Gen. Richard P. Klocko, Director of the Defense Communications Agency, will review for us the organization, functions, and resources of his agency and the Defense Communications System (DCS) which the agency administers.

General Klocko's presentation is classified "Secret" and so the members are requested to return their copies of the statement to our staff at the close of the hearing this morning.[1] Not all of the discussion is necessarily classified. General Klocko will be present at the open hearing tomorrow and will be available for further discussion.

Tomorrow morning we will hear Dr. Gardiner L. Tucker, Deputy Director of Research and Engineering Electronics and Information Systems. Dr. Tucker was before our subcommittee last July when, I believe, he made his first congressional appearance.

Dr. Tucker will review the plans and progress of the Department of Defense in military satellite communications, including the initial system, the pending phase II, the tactical satellite communications program, and other matters of interest.

Now we welcome General Klocko and his associates.

I see you have a presentation, so you may proceed.

[1] The classified portion of General Klocko's statement has been deleted.

STATEMENT OF LT. GEN. RICHARD P. KLOCKO, U.S. AIR FORCE, DIRECTOR, DEFENSE COMMUNICATIONS AGENCY; ACCOMPANIED BY REAR ADM. VICTOR A. DYBDAL, U.S. NAVY, DEPUTY DIRECTOR FOR PLANS; WALTER H. MORSE, COUNSEL; JAY J. COHEN, TECHNICAL ADVISER FOR SATELLITE COMMUNICATIONS; LT. COL. WALTER A. HOGGE, JR., U.S. AIR FORCE, CHIEF, COMMERCIAL POLICY OFFICE; WALTER E. GRUVER, OFFICE OF COMPTROLLER, ALL OF DEFENSE COMMUNICATIONS AGENCY; AND DAVID L. SOLOMON, OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE FOR ADMINISTRATION

General KLOCKO. Mr. Chairman and members of the committee: It is a great pleasure for me to appear before your committee. My predecessor, Lt. Gen. Alfred D. Starbird, you will recall, appeared before you on the 24th and 25th of July last year. At that time General Starbird's remarks and the committee's interest were centered on satellite communications, commercial as well as those of the Defense Satellite Communications System, and the activities of the National Communications System.

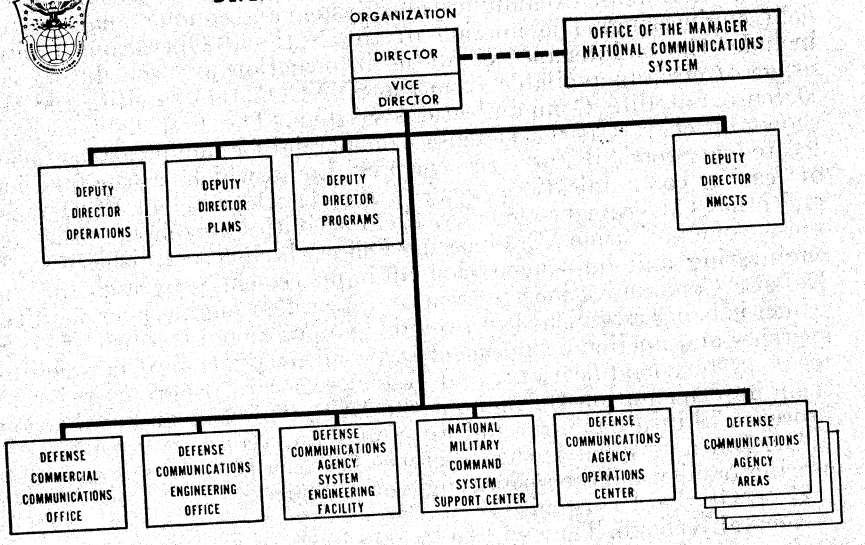
Today I shall update you on recent developments in these areas, attempt to outline for you the total responsibilities of DCA, and to give you a view of the present existing subsytems of the Defense Communications System. Before doing so, however, and in order to avoid repeating information that will be presented tomorrow by Dr. Gardiner L. Tucker, Deputy Director of Defense Research and Engineering, I wish to state that in my testimony I will avoid discussing the phase II plans of the Defense Satellite Communications System, the programed successor to the IDCSP.

The responsibilities of DCA, and the organizations and authorities to carry out these responsibilities, relate to the Defense Communications System, including the Defense Satellite Communications System, the National Military Command System, and the National Communications System. To carry out these responsibilities, the Defense Communications Agency is organized into four major operating directorates, and supporting elements, and field activities as shown on chart 1.

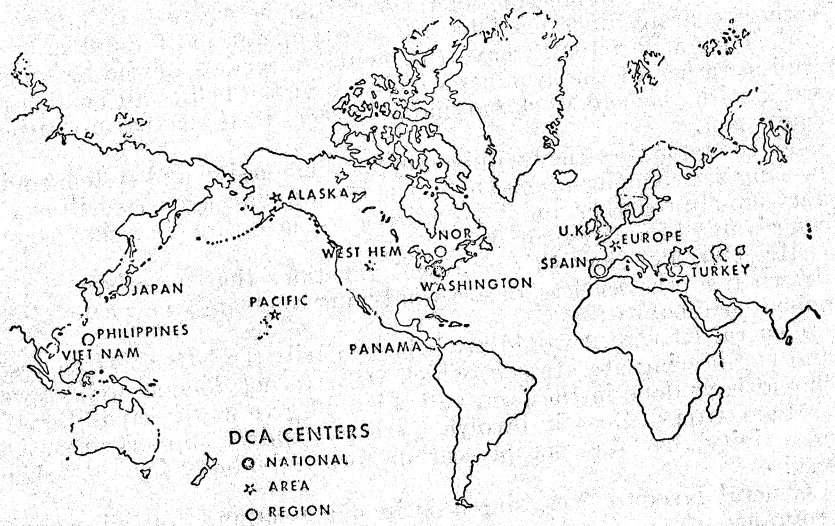
Defense Communications System. In the area of defense communications, I have responsibility for the planning, managing the acquisition, and directing the operation of the long-haul communications assets of the Department of Defense including the integration of Department of Defense activities related to communications satellites. There are three headquarters directorates to carry out these functions: plans directorate, which is charged with planning for continuous improvement, greater efficiency, and economy of operation in the DCS; programs directorate, responsible for managing the implementation or acquisition of approved projects; operations directorate, which is charged with day-to-day operational direction of the Defense Communications System to achieve its most effective use.

In addition, there is the operations center complex including a national operations center, four area operations centers, and eight regional centers, as shown on chart 2.

DEFENSE COMMUNICATIONS AGENCY



DEFENSE COMMUNICATIONS AGENCY
DCA WORLD-WIDE COMPLEX



The operations centers accomplish the day-to-day operational direction of the Defense Communications System and conduct analyses and field engineering. The mission of the National Operations Center includes the maintenance of status information and scheduling the usage of circuits available from the SYNCOM III satellite and the Defense Satellite Communications System. The first field activity shown on chart 1 is the Defense Commercial Communications Office located on Scott Air Force Base near St. Louis, which has the function of leasing communications services for the Department of Defense and other Government agencies. Field activities also include the Defense Communications Engineering Office which accomplishes overall engineering and implementation of improvement programs for the Defense Communications System and a system engineering facility, which is being established to provide an operational test bed of DCS switches and ancillary equipment to permit evaluation of new equipment, system modifications, and system software programs prior to their implementation throughout the DCS. This test and evaluation process will insure more technically sound and economic growth.

Mr. DAHLIN. What is the difference between the new system engineering facility and the former engineering offices?

How will that be organized?

General KLOCKO. They will be located in the Washington area. The Defense Communications Engineering Office, by and large, is involved with the engineering actions required in acquiring the DCS programs—the equipment, and systems. This office works very closely with the Program Implementation Offices in preparing specifications, reviewing the work of contracts, and this sort of activity.

Mr. DAHLIN. That contract supported this new facility?

General KLOCKO. No, sir. It will be inhouse.

The systems engineering facility will have two related, but very rather separate functions. One will be the operation of a system test-bed. They will actually have the switches, models of the switches, copies, rather of the switches which are in the field, will be able to work with them to work out improvements in the actual operating equipment.

At the same time they will be doing system design and system engineering for the long-range DCS. The two of these agencies will work very closely together and I visualize at some future time they could conceivably be amalgamated.

Mr. DAHLIN. Does this represent functions that have been withdrawn from the services, or are you trying to create a new capability nobody had before?

General KLOCKO. I would say it is primarily the latter. System test and engineering are areas in which we have not done as well as we should have done in the past, and this will give us the capability.

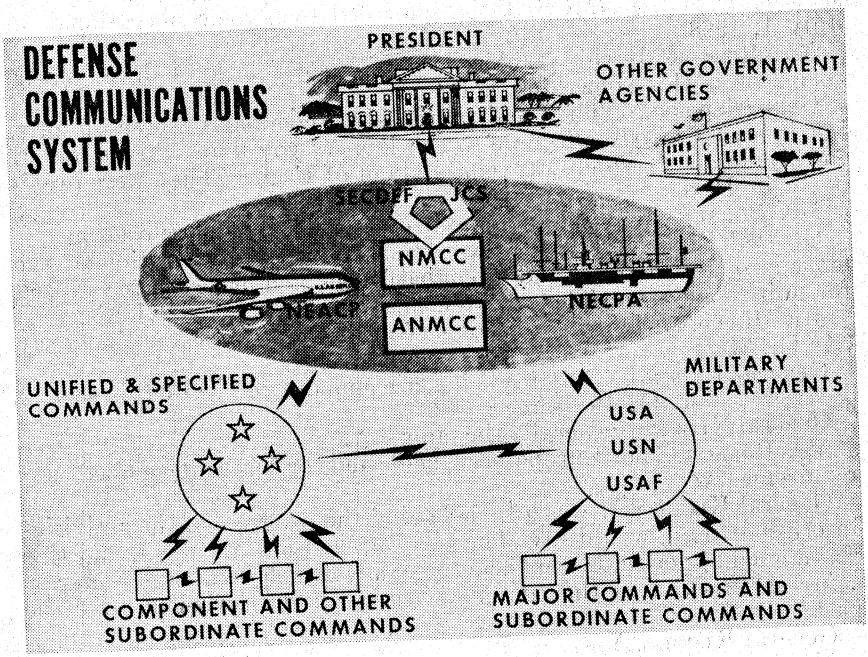
Mr. DAHLIN. Does it involve increased budget support; that is, of activity that was not present in former budgets for the other services?

General KLOCKO. Yes, sir; it is in our 1969 and following year programs.

Mr. DAHLIN. Thank you.

General KLOCKO. In the area of the National Military Command System, I am responsible for systems engineering and technical super-

vision of the implementation of technical support for the National Military Command System (NMCS). The National Military Command System is the principal component of the Worldwide Military Command and Control System, including the subsystems of the unified, specified, and component commands, as well as the subsystems of the military service headquarters. The NMCS consists of the facilities, personnel, equipment, doctrine, procedures, and communications designed to enable the national command authorities to exercise strategic direction of the Armed Forces of the United States in time of crisis, and limited or general war. The NMCS with its four command centers and interconnecting communications is shown on chart 3.



The interconnecting communications of the NMCS do not constitute a separate system, but consist of the facilities of the Defense Communications System and the National Communications System designed and provided in response to NMCS requirements. The DCA Operations Center provides direct communications support to the National Military Command Center, which is located in the Pentagon.

In addition to providing technical support for the NMCS, DCA also provides technical support, principally in the form of computer model development and operational automatic data processing support, to Offices of the Secretary of Defense, other Defense agencies, the several directorates and elements of the organization of the Joint Chiefs of Staff, and especially the Southeast Asia Programs Division, the Special Assistant for Strategic Mobility and the Joint War Games Agency. There is in the headquarters a National Military Command System technical support directorate to carry out these duties and

supervisory functions. There is also a National Military Command System Support Center, located in the Pentagon, which assists in the development, installation, and operation of the automatic data processing support capability. The computer facilities are operated on a 24 hours a day, 7 days a week, basis. Massive data files and large scale simulation models are developed and maintained on continuing basis.

As part of our continuing technical effort in support of the NMCS, during this past year an engineer plan and work statements for a new USCINCEUR Command Center have been developed. This new center, now in the final stages of construction and communications electronics installation at Stuttgart, Germany, was designed to meet USCINCEUR's command and control requirements and to interface actively with the NMCS. It is scheduled to become operational on July 1, 1968.

Mr. ROBACK. Is this catching up with some lack of development there; or is this something new?

General KLOCKO. They had previously a command center of sorts, but it wasn't nearly adequate to the job. As you know this is one of the headquarters which was relocated out of France. They were previously in Paris.

Mr. ROBACK. Was this new need occasioned by the relocation?

General KLOCKO. I would guess that it was a combination of the move into new facilities and a requirement which had been recognized for quite some time. The requirement actually is CINCEUR's.

Mr. ROBACK. Is this different from another theater like, say CINCPAC?

General KLOCKO. CINCPAC has a command center of this sort.

Mr. ROBACK. Of the same sort?

General KLOCKO. Generally the same sort.

Mr. ROBACK. Has Europe been neglected, or has it developed new requirements?

General KLOCKO. It was a little behind the progress of the activities in other areas, I would say. They had needed one all along, and this was a good opportunity for them to get a workable command center.

Mr. DAHLIN. Are the communications an improvement over the past?

General KLOCKO. Yes.

Mr. DAHLIN. It is not just a hardened control center, that sort of thing? This is brand new communications that weren't available to CINCEUR in Europe?

General KLOCKO. That is correct. They have considerably improved their capability to interphase with the National Military Command Center.

Mr. ROBACK. You had a discussion here about the tie-in with the White House among others. Is that part of the military control system of White House communications?

General KLOCKO. Not per se. The tie-in of the White House to the Pentagon is part of the service to the National Command Authorities.

Mr. ROBACK. That is part of what system?

You have so many systems here, no wonder you need a systems engineering analysis setup.

What part—when you have crisis communications in which the White House is involved, is that handled by this system you are talking about? The worldwide military system?

General KLOCKO. The National Military Command System, the worldwide system, more accurately, the National System which is in the Pentagon, is the one that keeps track of the National Command Authority. [Deleted.]

Mr. HOLIFIELD. All right.

General KLOCKO. The National Military Command Center (NMCC) in the Pentagon has been further linked to the Alternate National Military Command Center (ANMCC) with two new systems: A broadband link for secure digital video transmission and a high-speed computer secure magnetic tape-to-tape transmission system. New larger computers have been installed in the NMCS Support Center and in the ANMCC to improve response time and provide greater capacity. An Automatic Message Processing System (AMPS) is being installed in both the NMCC and ANMCC which will speed up the handling of record communications for these command centers.

Mr. DAHLIN. Is the broadband required in this case for data or for secure voice as well?

General KLOCKO. For the data itself.

Mr. DAHLIN. You do require some broadband lengths in addition to this for secure voice?

[Deleted.]

General KLOCKO. In the area of automatic data processing a large number of projects have completed successful development and are now being used routinely for operational support. Examples are computer maintaining files of current situations in Southeast Asia, status of forces worldwide, and contingency plans. Other examples are computer models as aids in planning or testing the feasibility of plans.

Efforts will be continued in connection with projected development of the NMCS automatic data processing capability, including a new concept of computer time sharing. Further efforts include providing two large capacity digital channels between the NMCC and ANMCC which will result in greater flexibility and responsiveness to the requirements of the users of the NMCS. [Deleted.]

General KLOCKO. Finally, I serve as the manager of the National Communications System and with a small staff, comprised of personnel assigned from several of the Government agencies participating in the NCS, perform the principal unified and technical planning for the establishment, development, and operation of the NCS, and in so doing, I coordinate the functions of several civilian Federal as well as Department of Defense activities.

The President directed that an NCS be established and developed by linking together, improving, and extending, on an evolutionary basis, the communications facilities and components of the various Federal agencies. Thus the objective of the NCS is to provide necessary communications for the Federal Government under all conditions ranging from a normal situation to national emergencies and international crises including nuclear attack.

In my capacity as manager, I provide technical advice and assistance to agencies participating in the NCS associated with their assigned tasks in the development and operation of the system; I allo-

cate, reallocate, and arrange for restoration of communications facilities to authorized users based on approved requirements and priorities; and I develop operational plans and provide operational guidance with respect to all elements of the NCS, including (a) the prescription of standards and practices as to operation, maintenance, and installation; (b) the maintenance of necessary records to insure effective utilization of the NCS; (c) the request of assignments of radio frequencies for the NCS; (d) the monitoring of freqeuncy utilization; and (e) the exercise and test of system effectiveness.

RELATIONS WITH COMSAT CORP.

Mr. ROBACK. Do you still have the responsibility for the dealings with Comsat satellite communications as part of your NCS policy?

General KLOCKO. As part of the NCS.

Mr. ROBACK. Where another Federal agency deals with Comsat you have supervision of that?

General KLOCKO. The only relationship we have with Comsat actually is the fact that they are supplying some of the circuits we are using. We ordinarily don't deal directly with them.

Mr. ROBACK. If another agency wants to deal with Comsat, under the NCS directive which the Secretary of Defense executes and you as manager do the actual work, do you have some responsiblity for supervision?

For example, NASA wanted some satellite circuits. In the first instance you had to go over the ground and approve it.

General KLOCKO. No; we won't approve that.

Mr. ROBACK. Maybe you are not acquainted with that segment of activity. You might call on one of your associates here.

Mr. SOLOMON. As you will recall, what Mr. Roback is referring to is that the manager of the National Communications System was authorized to deal directly with the Communications Satellite Corp. for all Government circuits, i.e., the Secretary of Defense in his role as executive agent for NCS was instructed by the President and authorized to pass on these activities and in general carry out these relationships with the corporation.

However, the authority was made rather moot by the ruling by the Federal Communications Commission which requires that most all such circuitry would in fact be leased from the commercial carriers rather than the Communications Satellite Corp. Its role was all satellite circuitry which is leased by any member of the National Communications System is leased from one of the communications carriers, and accordingly is not leased under the specific or exclusive authority of the manager of NCS.

Referring back to the question you asked, if NASA or any other Federal agency had a rather large outstanding circuit requirement which, in our opinion, would meet the criteria of the Federal Communications Commission decision in the *Authorized User* case, we would again, under the aegis of the National Communications System, look at this matter and entertain such activities with the Communications Satellite Corp.

Mr. ROBACK. Well NASA had contracted, with the approval of the Department of Defense, for satellite circuits for the APOLLO program, and I understand that now additionally NASA is seeking wideband circuitry which may be provided by Comsat even if not directly. Do you get involved?

Mr. SOLOMON. Mr. Roback, in some cases if the question was whether or not Comsat would serve this requirement directly, the Director of Telecommunications Management would be asked for his opinion as to whether, in his opinion, such service directly by the corporation to the user met the criteria of the *Authorized User* decision. If it did, then we would be involved. If, however, it was ruled that such service would be rendered via one of the commercial carriers—such as ITT, WorldCom, RCAC, or Western Union International—then the matter becomes moot and the agency requiring the service would deal directly with the carrier as he does for all other requirements.

Mr. ROBACK. Has the National Security Council directive on your role in this regard been changed, or does it still stand, as you interpret it?

Mr. SOLOMON. It stands exactly as it did. Whereas in the past we went to the satellite corporation for all our requirements, now we are directed to go only for those which are, if you wish, unique or vital or outstanding in the sense they must be ruled upon by the Director of Telecommunications Management as provided for in the decision of the Federal Communications Commission.

Mr. ROBACK. I notice on page 39, not to anticipate the general's testimony, there is a statement that agencies which intend to lease transoceanic circuits coordinate their actions with the DCA office.

Mr. SOLOMON. That is another matter. That meant in any case where any agency required a transoceanic circuit, they would check with this office to insure there would not be duplication of facilities.

For example, one agency might have a channel across an ocean in which there were spare telegraph legs and these could be used for the other agency requirements. This meant in the expensive area of transoceanic communications, such would be coordinated before they would be leased directly.

Mr. ROBACK. So since this new requirement of NASA, as I understand it, is transoceanic, they would have to coordinate with the Defense Communications Agency?

Mr. SOLOMON. Yes. They would do that in any regard because the requirement is so large and so definitive and so new, that it would be discussed thoroughly, particularly if there was any question that the satellite corporation should supply such circuitry directly.

Mr. ROBACK. You might supply us a little description paper on this point.

Mr. SOLOMON. Right. I have myself not heard of this requirement.

General KLOCKO. I have not either.

Mr. ROBACK. It may be the requirement hasn't developed sufficiently. It is my understanding that it is a requirement that has been developed, General.

(The information referred to follows:)

NASA currently is using both cable (via London) and satellite circuits to Spain. These 4KHZ circuits are leased by NASA from the international carriers.

It is now possible to obtain groups of 12 4KHZ circuits by satellite and NASA recently asked the international carriers the cost of such 12-channel groups to Spain. As expected this cost was less than the total for 12 individual 4KHZ channels. Consequently, NASA has awarded one of the international carriers a contract to provide a 12-channel group to Spain effective February 1969 and will allow the termination of 12 separate 4KHZ channels at a savings of $235,000 per year.

This action was not coordinated in advance by NASA with the manager, NCS, since:

(*a*) There will be no resulting spare capacity which can be used by other NCS operating agencies.

(*b*) This is not a new requirement and in effect is a Telpak arrangement providing the same service to NASA with the only change being reduced cost.

General KLOCKO. May I now review the Defense Communications System, the worldwide, long-haul, point-to-point communications systems of the DOD. It is a composite of all transmission media, control centers, operating personnel, facilities, and resources associated with such a system. The satellite communications capability is, therefore, an integral part of it.

The Defense Communications Agency's mission is to insure that this system is so planned, engineered, established, improved, and operated as to effectively, efficiently, and economically fulfill DOD long-haul requirements. May I review several of our projects underway to fulfill these three mission characteristics of efficiency and effectiveness with economy?

To facilitate discussion and understanding, I will divide the system into its two major parts:

The transmission system which provides paths or channels between customers in all parts of the world.

The switches which select the paths for interconnecting these customers.

The switched networks will be covered first. [Deleted.] I will briefly define each one, set forth its present program and projected costs, and indicate offsets made or anticipated.

Economy in transmission systems can be attained by concentration of user traffic in a manner insuring maximum use of a minimum number of channels efficiently and effectively. Technological advances provided automatic or electronic switches permitting concentration to gain economies in channels with speed and efficiency. Effectiveness is retained through polygrid routing and enhanced by capability of the switches to recognize precedence levels and preemption. These switches form the nucleus of our [deleted] switched networks.

[Deleted.]

AUTOVON

The first for review is the automatic voice network (AUTOVON) for worldwide interconnect of nonsecure administrative, logistic, and operational traffic. It will also accept digital data service which is connected to the switch in an analog mode.

This network is being implemented in two phases: Continental United States and overseas.

The CONUS program calls for installation of 74 switches of which 9 will be located in Canada. The 65 switches in the United States will be leased with service provided by the A.T. & T. and nine independent

telephone companies. The Canadian portion will be lease operation from Canadian companies. The switches are entering operation on an incremental basis with 42 in operation at this time. The total 74 are scheduled for completion in 1972.

The DCA and Canadian forces headquarters have negotiated an agreement defining the implementation, operation, and management procedures for the introduction of the nine Canadian switches (Canadian switched network) into the CONUS AUTOVON system. This agreement provides for the cost sharing of facilities under existing continental air defense integrated network (CADIN) agreements. The agreements also detail cost sharing of backbone and trunking costs. The agreement was executed by the Canadian forces headquarters representative on April 21 and the Director, DCA, on May 2, 1968.

Mr. ROBACK. What is the role of the companies in that agreement? They have to agree also, don't they?

General KLOCKO. No. The companies work directly with the Canadians and the Canadians work with their companies the same as we do with ours, so the agreement was between the Canadian forces and DCA, both representing their respective Governments.

Mr. ROBACK. If you arrive at an agreement with the Canadian Government on cost sharing, that automatically becomes accepted by the companies, because they have to work out certain cost-sharing arrangements too, don't they?

General KLOCKO. That's right. The Canadians pay for their portion of the network in Canada, which is used internally in Canada. There are some other arrangements which have been made for the portion of the system which is used in the air defense role.

Mr. ROBACK. Does that have a separate billing system? A separate cost allocation?

General KLOCKO. There is a separate system of costing it.

In other words, on those particular communications, the United States pays two-thirds of the cost for our air defense, and the Canadians pay one-third, but the billing is——

Mr. ROBACK. Does this go back to the SAGE and——

General KLOCKO. Yes, sir.

Mr. ROBACK. Was that the way it was before?

General KLOCKO. Yes. It is an integrated communications system in support of Norad—North American defense.

Then there is a balancing of the books between the Canadians and Americans once a month, I believe.

Mr. ROBACK. Do they have transfers of payments?

General KLOCKO. Yes, sir. That is done through DECCO, Defense Commercial Communications Office, Scott Air Force Base.

The overseas portion will be Government-owned and operated. The initially approved program called for 22 switches. However, relocation from France and other considerations has necessitated restudy to relocate these switches. Proposed relocation of one has been temporarily deferred by the Secretary of Defense and proposed siting for a second is awaiting his decision. Tentative locations for two others have been selected and responsible commands in the selected areas are collecting supporting data. Plans for these locations will be developed shortly. The fifth will be installed in the DCA system engineering facility soon to be activated.

Action to install the remaining program of 17 switches continues. Of these, 10 will be in the European area, six in the Pacific and one in Panama. These switches will be cut over into operations in groups as follows:

Cut 1: Two in Germany and one each in United Kingdom, Italy, Panama, and Hawaii in November 1968.

Cut 2: Two in Germany and 1 each in United Kingdom, Spain, Guam, and Philippines in May 1969.

Cut 3: One each in Italy, Greece, Japan, Okinawa, and Taiwan in October 1969.

Mr. DAHLIN. Does each switch have to be approved by the Secretary of Defense?

General KLOCKO. No, sir. The location of these generally, are based on recommendations and requirements from the users. Passed on by JCS as a package and sent to offices of the Secretary of Defense.

Mr. ROBACK. Does the location of the switch have an operational significance, or is it political?

General KLOCKO. Operational significance.

Mr. ROBACK. It might be more efficient to be in one part of Germany than another, if it were located there?

General KLOCKO. Yes. It is located according to the subscribers, the needs of the military commands.

Mr. ROBACK. What difference does it make whether you put the switch bank or whatever you call the switch network in Weisbaden or put it in Bonn, let's say? Outside of the convenience of having a facility there and personnel stationed there?

General KLOCKO. The switches locations are generally determined by the subscriber densities. You have to pay for the lines into the switch and the closer you have the switch to a major grouping of subscribers, the less costly the system.

Mr. DAHLIN. Did it require new land and facilities in each case? Is that why it is a major problem on the location of each one?

General KLOCKO. No. By and large, they are on existing military bases overseas. There weren't any problems. Are you talking about these 17 switches?

Mr. DAHLIN. Yes.

General KLOCKO. By and large, they are put on military bases close to the ——

Mr. ROBACK. What is the switch? Is it a whole series of black boxes?

General KLOCKO. It looks like a data processing installation.

Mr. ROBACK. Is it big? Are there acres of these things, or——

General KLOCKO. Oh, no. One would fit in a room this size.

Concerning costs, the annual leased cost of the CONUS portion will go from $62.8 million in 1968 to $140.2 million by fiscal year 1972 when the 65 U.S. switches are operational. These costs cover switches, interswitch trunks, and access lines.

The investment cost for the overseas portion when completed is estimated at $90.7 million—$84.2 million procurement and $6.5 million for construction. This cost includes purchases of 21 operational and one training switch; modifications of private branch exchanges—PBX—to interface with the network; expansion of technical facilities; station reconfigurations; system engineering; contractor maintenance and support equipment and initial spares and publications.

The annual operating cost for this overseas AUTOVON are estimated to reach $17 million by 1972 when the system will be completely operational. Of this figure, $2.9 million will cover military personnel and $14.1 million covering leased backbone and access line costs.

For offsets, the activation of the AUTOVON in CONUS has permitted economies by the elimination or integration of dedicated nets such as SAGE/BUIC, reduction in tolls and wide area telephone service.

Further reductions in dedicated nets and Government facilities will be possible as the overseas program becomes operational.

Mr. ROBACK. Let me ask a question there, General. The dedicated nets in certain cases can be eliminated so that economies can be effected. Are there any dedicated nets for logistics?

General KLOCKO. Not that I know of.

Mr. ROBACK. I won't take time to develop it now, but I want to discuss after the conclusion of your statement, the communications requirement for logistics systems.

General KLOCKO. Yes. They are very considerable.

Mr. ROBACK. The lease cost for the AUTOVON, does this include the actual telephone bill? Or is that a separate charge? You're talking about a lease cost being $140 million in fiscal 1972 for these switches. This doesn't include the traffic cost, does it?

General KLOCKO. Yes, it's the switches and transmission paths.

Mr. ROBACK. What other telephone bills do you pay in the United States?

General KLOCKO. Pardon me?

Mr. ROBACK. Besides these leasing costs, what telephone bills do you pay in the United States for military purposes?

General KLOCKO. The services have some other costs. For instance, SAC has a PAS, primary alerting system.

Mr. ROBACK. When you talk about AUTOVON, the use of that system, does the lease cost include the use of the system?

General KLOCKO. Yes, sir.

Mr. ROBACK. So there is no service charge on top of the leasing cost?

General KLOCKO. No, sir. The leasing cost includes the trunks, switches and the access lines into the system. It is generally the backbone net.

Mr. ROBACK. If one asked what was your domestic telephone bill outside of special systems, roughly this is the cost of the telephone service?

General KLOCKO. Almost completely. On an industrial fund, I might say, also.

Mr. ROBACK. Under an industrial fund?

General KLOCKO. Yes.

Mr. ROBACK. In other words, the moneys are paid into the fund?

General KLOCKO. Yes.

Mr. ROBACK. Does the fund carry itself?

General KLOCKO. Yes, sir.

Mr. ROBACK. How are the tariffs determined? In other words, is there a special rate for the Government or is this a commercial tariff?

General KLOCKO. This is a completely Government system, so we lease it under commercial tariffs and then spread the lease costs of the system among the subscribers.

Mr. ROBACK. Do you negotiate a tariff?

General KLOCKO. First let me state that the subscribers' rates are sent to the Department of Defense once a year. We determine a rate which will make the lease cost paid from the industrial fund to zero balance as best we can judge it.

Mr. ROBACK. Do you actually negotiate each year with the telephone companies?

General KLOCKO. No, sir. There is a flat price to the AUTOVON subscribers.

Mr. ROBACK. Flat price. Unless and until that is changed, you keep on paying that?

General KLOCKO. Yes.

Mr. ROBACK. That is negotiated without any time limit?

General KLOCKO. Yes.

Mr. ROBACK. How do you know in any given case that you are not overcharged? Whether the rates are high or not. Do you have any—on what basis could you identify whether you are getting a fair charge?

General KLOCKO. We have several processes where we can identify something.

Mr. ROBACK. Is there any way in which you audit costs? This is a special tariff, as you said. This is not a commercial tariff?

General KLOCKO. That's correct.

Mr. ROBACK. This AUTOVON system was developed largely for the military, was it not?

General KLOCKO. Completely for military.

Mr. ROBACK. Even though it might be used commercially. Technically there is no reason why it couldn't be used for commercial purposes, is there?

General KLOCKO. No.

Mr. ROBACK. But in any case, now you are the chief customer of AUTOVON?

General KLOCKO. Yes, sir.

Mr. ROBACK. And a rate has been developed in recognition of that fact.

Mr. ERLENBORN. Can I interrupt a moment? You may be confusing two things. There is one annual leasing cost to the commercial company that operates the system. Isn't that right?

General KLOCKO. Yes.

Mr. ERLENBORN. This is something you negotiate and pay an annual cost, regardless of the amount of traffic?

General KLOCKO. That's correct.

Mr. ERLENBORN. The tariff cost you're talking about is completely internal, isn't it? Isn't that what the system charges the individual base or user? In other words, the tariff is not paid to the commercial company that operates the system. The tariffs are completely internal, aren't they? Distribution of the cost among the users?

General KLOCKO. That's correct.

Mr. ROBACK. Maybe I'm using the wrong word, but how do you know that the amount that you pay the telephone company is reasonable?

Mr. ERLENBORN. Because it's a leased line. There is so much cost for a leased line.

General KLOCKO. So much for the switches and for the transmission media between the switches.

Mr. ERLENBORN. No one else uses this system?
General KLOCKO. Just the Government.
Mr. ERLENBORN. Entirely the Defense Department, or the Canadians that use this CONUS system?
General KLOCKO. That's right.
Mr. ERLENBORN. So you're paying for a leased line, isn't that right?
General KLOCKO. That's correct.
Mr. ERLENBORN. And switches?
General KLOCKO. Yes.
Mr. ERLENBORN. The entire cost of operating the system. No one else uses the system?
General KLOCKO. That's correct, Mr. Erlenborn.
Mr. ERLENBORN. Then the tariffs developed are merely to apportion the cost of these leased lines among the various users?
General KLOCKO. Yes.

COST DATA ON CARRIER CHARGES

Mr. ROBACK. In other contracts the military has cost plus, or fixed price. What I was asking is, how do you determine what is the proper cost? Do you require them to submit cost data?
General KLOCKO. We have asked for it.
Mr. ROBACK. You have asked for it. I assume from what you say you haven't gotten it.
General KLOCKO. That's correct.
Mr. ROBACK. What is the theory there?
General KLOCKO. Colonel Hogge knows this story.
Colonel HOGGE. Tariffs contain the rate schedules which are the carrier's charge for its services. We receive telephone bills based on these schedules from the carriers which we pay.
We take the lease cost rate that we paid to the carriers and break out the AUTOVON backbone cost. This cost is then prorated among all the AUTOVON subscribers.
This proration of the lease costs among the subscribers is what General Klocko was describing to you. These prorated costs are not called tariffs as suggested.
Mr. ROBACK. Tariff is what you pay the telephone company.
Colonel HOGGE. The tariffs have the force and effect of law, and contain the rate schedules of the carriers which are paid by the Government upon receipt of the monthly statements. When a rate is developed by a carrier for a specific service, our people in DECCO negotiate as far as they can with the carrier; based on as much information as they can obtain from the carrier. DECCO issues a communications service authorization to a carrier for its service based on estimated costs pending filing of the new rates with the FCC or the State regulatory authority.
Mr. ROBACK. You say negotiation is possible. Is this limited by the fact that your statutory access to the records exempts the regulated industry?
Colonel HOGGE. Our contracts with some of the carriers do not provide for our access to their records. However, some do.
Mr. ROBACK. That is based on their willingness?
Colonel HOGGE. Yes, sir.

Mr. ROBACK. Some are willing and some are not?

Colonel HOGGE. That is correct.

Mr. ROBACK. I interrupted you. Go ahead.

Colonel HOGGE. Once the carrier has filed his rates with the appropriate regulatory authority, then we have a look at the filing. If it appears to us to be reasonable, and we have sufficient cost data, then we can permit the new rates to go into effect without a protest. In such cases we have in effect accepted such rates as being reasonable. However, if we can find some reasonable basis to question the rates that are filed, we go through the normal regulatory process of filing a protest with the Commission.

Mr. ROBACK. Filing a complaint with the FCC?

Colonel HOGGE. Yes, sir.

Mr. ROBACK. Have you filed any?

Colonel HOGGE. Yes, sir.

Mr. ROBACK. Do you have any pending?

Colonel HOGGE. Yes, sir, several pending.

Mr. ROBACK. What does the FCC do? Investigate the complaint?

Colonel HOGGE. The FCC orders an investigation of the complaint and holds hearings. The FCC does not advocate on behalf of a complainant, but merely sits and listens to the evidence as provided.

Mr. ROBACK. Have you got any AUTOVON rates reduced on the basis of these complaints?

Colonel HOGGE. Yes, sir. We recently filed a protest against the Bell System for the electronic switching rates and the FCC ordered a hearing based on our complaint. We felt the rate they were charging or wanting to charge was too high. We didn't like the termination liability they were applying or the spread between the switch sizes. As a result of our filing, the case that the carrier put on, and our cross-examination of the carriers' witnesses, we were able to get the Bell System to sit down and negotiate what we consider an equitable settlement. This case was disposed of by a negotiated settlement with the carrier and approved by the FCC.

Mr. ROBACK. Can you provide conveniently a summary of recent complaints and their disposition?

Colonel HOGGE. Yes, sir; I will be glad to.

General KLOCKO. We have a list right here.

Mr. ROBACK. Submit that and we can look that over.

(See appendix 4, p. 106.)

Mr. DAHLIN. Does the Bell System provide the contract support or management of the AUTOVON system on the domestic picture?

General KLOCKO. They are by and large our point of contact. There are several other independent companies involved, but Bell usually is the spokesman.

Mr. DAHLIN. How about overseas?

General KLOCKO. All Government-owned.

Mr. DAHLIN. Do you have any contract support to run the AUTOVON system overseas or is that also in-house?

General KLOCKO. That is in-house. We will have some contract help to work with us, technical help to work on improvements in the system.

Mr. DAHLIN. Who is that?

General KLOCKO. That will be Western Union, Mr. Dahlin. Pardon me, Western Electric Co.

Mr. DAHLIN. Thank you. Go ahead, General Klocko.

Mr. ROBACK. You had finished your discussion of the AUTOVON.

General KLOCKO. Yes. [Deleted.]

AUTODIN

General KLOCKO. I will now turn to the record communications programs. The automatic digital network (AUTODIN) is the worldwide automatic record communications system designed to support DOD record traffic requirements including operational command and control, logistics and administrative types. It is capable of accepting and switching traffic in the form of teletypewriter, data card, and magnetic tape with security. The switches will accept these messages of different format, speed, or code and convert them into a common format for high-speed transmission between switching centers. Implementation of this network was also conducted in CONUS and overseas phases.

The CONUS portion consists of nine switches located in the United States and Hawaii. These switches are leased from Western Union. The overseas portion will consist of 11 Government-owned switches being procured from and installed by Philco-Ford. Nine of these switches have been accepted for initial operating capability as follows: three in Southeast Asia; two in Europe; and one each Philippines, Japan, Okinawa, and Guam. The remaining two are scheduled for initial operation in Alaska and Italy in July and December of this year.

To provide the required capability for high-volume and/or data-type customers, digital subscriber terminal equipments (DSTE) are being developed by and procured from General Dynamics Electronics. These equipments will be Government owned and operated. They will consist of appropriate combinations of high- and low-speed paper tape punches, reader and page printers, universal keyboards, and ancillary equipment. Contractor delivery of equipments required for the various terminal configurations will begin in September of this year and continue through December 1970. Pending availability of these terminals we have leased as Government-furnished equipment (GFE) certain equipments from Sperry Rand, Univac, and IBM. This leased GFE has also been utilized in CONUS locations for connection to and through the Western Union-leased switches. In May 1966 Western Union filed a tariff change without prior coordination with DOD. This change stated that "all channel facilities, all switching center equipment, and all station equipment utilized in the AUTODIN network shall be furnished by the telegraph company" except in a minimum number of specified instances. At the time of filing virtually all facilities were being procured from Western Union. However, the Western Union tariff did not provide for the terminal-type equipment required by high-volume and/or data subscribers indicated previously. Prolonged negotiations were conducted with Western Union during which the DOD protested that it must have the right to provide terminal equipment of its own choice including Government-owned equipment. New tariff language was agreed to and published as follows:

Station equipment * * * may be furnished by the customer when required for reasons of military necessity * * * or when the Telegraph Company is unable to provide requisite or suitable equipment within a reasonable time.

Mr. ROBACK. What was the issue there? Restate it in a little more pointed form. I'm not too clear from this what the issue was.

General KLOCKO. Western Union viewed the AUTODIN system as a complete and separate communications system. You will recall that this was inherited, the AUTODIN system was inherited and had been developed for logistics purposes, originally. The Air Force Logistics Command started COMLOGNET which was to be a switched data system for use between the various depots. It went through a process of change and eventually was taken over by DOD to serve all DOD agencies, not just one portion of the Air Force.

The original contracts the Air Force made with Western Union were for, in effect, a complete system that passed information from a terminal through a switched network to a terminal on the other end, whether the terminal be teletype or computer or whatever. When the Department of Defense came into the picture and took it over as a defensewide program or system, there were variations in this basic pattern and there were different types of terminal equipments, low speed, high speed, different formats, some using paper tape, some using magnetic tape, all types of inputs and outputs.

Western Union was not prepared to supply the variety of equipments that were needed for this system. However, they did for a while allow the Department of Defense to procure either Government equipment or equipment from other companies, and put these equipments into the system, even though this was not necessarily in strict accord with the original tariffs.

At some point in time, they apparently made a company decision, in which they said we will have to stop this, let's get back into the original basis on which we started, and try to make the Department of Defense come completely through Western Union to get all equipment.

That was the reason for these discussions. So they finally—there was finally an agreement reached, where it was decided that they, the company, Western Union, would supply most of the equipment unless there was a military necessity requirement or they simply said we can't supply you the equipment at the proper time and place.

The situation still is not settled, as you will see later on in the statement. We are still in the process of negotiating. I will cover this in the next paragraph.

In the summer of 1967, DECCO was receiving increasing requests for lease of Univac and IBM equipments for connection to AUTODIN by leased Western Union circuits. In September 1967 Western Union advised DECCO they could provide such equipment within a reasonable time at a price 3 to 4 percent above the price for direct Government lease. They also declined to interconnect Government-leased equipment direct to the AUTODIN switches. The initial question was whether or not lower cost constituted military necessity. Larger questions of procurement, policy, network integrity, and so forth, were then interjected. The problem was examined by OASD (I. & L.). A task group was formed to clarify the relationship between DOD and Western Union pertaining to AUTODIN.

As a result of subsequent discussions, a memorandum of understanding was executed by representatives of OASD (I. & L.), DCA and Western Union which clarifies the issues. In general, the agreement provides wider latitude than now provided under tariffs in DOD selection of the contractor providing the outstation equipment although it encourages procurement from Western Union. It also clarifies several other issues pertaining to software ownership, interconnection, responsibility for system integrity and management and military personnel participation in CONUS switch maintenance for training and retention of skills before or between overseas assignments to AUTODIN switch location. In addition, the memorandum contains an acknowledgment by DOD to make equitable settlements for premature withdrawal from service of switching center hardware and specialized terminal equipments.

Mr. DAHLIN. You say the agreement provided "encouragement" to procure from Western Union. For instance, how was the contract made with General Dynamics for the DSTE equipment?

General KLOCKO. That was recognized and accepted by Western Union and the original contract was signed several years ago. They accepted it and DSTE will now be Government equipment which Western Union has in effect said we will allow you to interconnect.

When we come to leasing, for instance, if somebody wants an IBM terminal, 360/20 for instance, which is being used, we will go to Western Union and they will get the equipment from IBM, install it and presumably maintain it or make the arrangements for maintaining it for us. For this service they will charge us the 3 to 4 percent.

Mr. ROBACK. It becomes a question of whether the Government can save any money by direct procurement of some of the hardware in this communications set up.

General KLOCKO. Certainly.

Mr. ROBACK. You are not estopped from doing that, but generally speaking, the arrangement favors the use of the contractor's equipments or at least his decision as to what equipment should be put in?

General KLOCKO. Or use him to get the equipment for us.

Mr. ROBACK. Does AUTOVON have a contractual requirement that equipment be Western Electric hardware?

General KLOCKO. No. We contract to them for the system and they presumably get it from Western Electric.

Mr. ROBACK. But you don't have any similar problem there?

General KLOCKO. No.

Mr. ROBACK. You don't have occasion to lease or buy equipment from others?

General KLOCKO. No, sir. Not yet.

Mr. ROBACK. How does this issue bear on the question of lease versus purchase, which GAO and others have been interested in? Do you have to make decisions in that field?

General KLOCKO. We started out with a leased system in both AUTODIN and AUTOVON in the United States and I think that having started it it would be most advantageous to the Government to continue. This does bring up, and one of the important issues at stake here, was the right to interconnect on circuits not only the equipments, the terminal equipments, but also for us to be able to interconnect Government circuits into the system or interconnect between A.T. & T.

and Western Union, because we would like to use the AUTOVON trunking system to carry some of the AUTODIN traffic. This has always been a sticky point.

Mr. ROBACK. Is that partly because jurisdiction of those companies between voice and data has been separated?

General KLOCKO. It has been because of the way the two systems evolved separately, we are trying to bring the two together so we will in effect have a single transmission trunking system.

Mr. ROBACK. Does this involve regulatory approval?

General KLOCKO. I think we can work it out without that.

Mr. ROBACK. You don't think this requires the FCC approval?

General KLOCKO. No.

Mr. ROBACK. It doesn't involve the jurisdiction of the company? That is to say, as to whether Western Union thereby will get into the voice area, or something like that?

General KLOCKO. No, Mr. Roback. It doesn't involve that basic issue. There is the issue, however, of the interconnect between the two systems and I think we are getting agreement from both companies, A.T. & T. and Western Union, that they will——

Mr. ROBACK. Interconnect between the Government and the leased systems, between overseas and domestic, is that the issue?

General KLOCKO. No. Between the carriers in the United States. We recently had a case before FCC in which both Western Union and A.T. & T. said that they would not interconnect between an AUTODIN switch at Fort Dietrick and an AUTOVON switch which was close by, very close by. [Deleted.]

We took that case to the FCC trying to get the FCC to force them to interconnect when it was in the Government's interest, and as a result of these deliberations with Western Union we have withdrawn our case and both Western Union and A.T. & T. have agreed to interconnect.

Mr. LUMAN. Does the effect of this understanding mean every time you change the family of computers you use you have to pay Western Union this 3- to 4-percent commission?

General KLOCKO. If we change the computer, yes. If we get a new one we would presumably go to Western Union as the contractor, tell them what it is we want, and they would undertake to get it for us.

Mr. LUMAN. Do you get anything for the 3- or 4-percent charge, really?

General KLOCKO. Yes. We will be paying a reasonable charge for a service that will give us one contractor for transmission and terminal facilities, which will result in a better melding of the equipment into the system. They take the full responsibility for the equipment and its capability and interface with the system as a whole. When we supply our own equipment we become responsible for that.

Mr. LUMAN. They are really providing a service now?

General KLOCKO. Yes.

Mr. ROBACK. Is there an antitrust problem in any respect?

General KLOCKO. No, sir.

Mr. ROBACK. A question of a lock-in of equipment?

General KLOCKO. No, sir.

Mr. ROBACK. Limiting competition?

General KLOCKO. When we get equipment, Western Union has no chance to make a profit on it. It's for their company purposes, which is understandable.

Mr. ROBACK. Are there any antitrust problems associated with limitations on Government buying of equipment?

Mr. MORSE. I'm not aware of any. In what respect?

Mr. ROBACK. In respect that possibly competition among equipment suppliers might be reduced this way.

Mr. MORSE. Not necessarily, because each of the suppliers are going to Western Union and offering their equipment. Also——

Mr. ROBACK. It's not a question of Western Union having its own equipment, as in the case of Bell where they might have Western Electric.

Mr. MORSE. They might, but if a customer in DOD wants a particular piece of equipment to meet his own requirements, he will make the request to DCA and it will pass it on to Western Union to process. Western Union couldn't force a piece of equipment on DCA and say this is all you'll get. That isn't the way it will operate. That is, Western Union will not be able to corner the market for a particular piece of equipment.

Mr. ROBACK. It becomes a question of whether they will be your procurement agent for equipment in view of their other contract responsibilities for providing service?

Mr. MORSE. Yes, sir. It's related to some extent to the "computer inquiry" presently pending before the FCC in which the FCC pursuant to a notice of inquiry, is investigating the relationships of computers to communications services. The Commission is looking into the entire problem as to whether or not it should take jurisdiction over computers as they are related to communications.

Mr. ROBACK. Has the Department of Defense filed a statement of that?

Mr. MORSE. Yes, sir; with the GSA jointly.

Mr. ROBACK. With the GSA?

Mr. MORSE. Yes, sir.

Mr. ROBACK. Has GSA been your advocate in regard to your rate problems?

Mr. MORSE. In the case of appearances before regulatory bodies we have an area of understanding agreement which dates back to 1950 between GSA and DOD. This agreement is based upon the fact that GSA, pursuant to the Federal Property and Administrative Services Act, has the authority to represent the Government before the FCC. The act also provides that GSA can delegate this responsibility. The agreement provides that where the DOD has the sole interest in a particular service, and no civilian agency of the Government has a similar interest, the DOD shall represent itself before the FCC.

The agreement also provides that where DOD has the predominant interest, the DOD will represent itself, provided it obtains a specific delegation of authority from GSA to do so. In all other instances, where the civilian agencies have the predominant interest or GSA decides not to grant the delegation even though the DOD might have the predominant interest GSA will represent the Government.

In this particular instance, the "computer inquiry," GSA agreed with the DOD that we should jointly represent the Government.

Mr. ROBACK. I would like to get a copy of the FCC filing.

Mr. MORSE. Yes, sir.

(The information referred to was furnished and is being retained in the subcommittee files.)

Mr. ERLENBORN. I wonder if I could ask a question to clarify in my own mind these charges that are made by the private companies—Western Union, for instance.

You talk about tariffs. Does this mean you are charged for transmission or is the tariff a lease of a line for a period of time?

General KLOCKO. It is the lease of a system. Including in the case of AUTODIN and the switches and the transmission media and Western Union in turn goes to A.T. & T. for a good many of the trunks.

Mr. ERLENBORN. So the cost does not vary according to the amount of traffic on that line.

General KLOCKO. That is right.

Mr. ERLENBORN. Charge per call.

General KLOCKO. That is right. The traffic is of no interest to them other than as it affects the operation of the system. The traffic management within the system. Whether it is overloading or saturating at a particular element. This is all they care about. If there were no traffic sent we would still pay the full tariff.

Mr. ROBACK. The whole system, once you get it, it is yours?

General KLOCKO. In effect, yes.

Mr. DAHLIN. Would this present generation of switches handle interconnection of AUTODIN and AUTOVON that you want to get or will that take a whole new generation of switches in order to make that system interconnection possible?

General KLOCKO. No. The present system will handle what is required.

Mr. DAHLIN. So there is no additional cost involved in that problem. Merely a policy and FCC question, regulatory question.

General KLOCKO. That is correct.

Mr. ROBACK. Continue. Maybe we can get through this and then spend whatever remaining time we have on questions. I don't want you to be caught short on the presentation.

General KLOCKO. All right.

The estimated investment cost for the AUTODIN program through fiscal year 1969 is 226.4 million. The CONUS portion of this cost is 63.1 million for the expansion of five switching centers, contruction of three new centers, and subscriber data equipment. The remaining 163.3 million relates to implementation of the 11 overseas switching centers. These funds cover construction of switching center buildings and supporting power and air conditioning; procurement and installation of switch hardware; procurement of the subscriber data terminal equipment; terminal site preparation to include environmental conditioning; ancillary transmission and encryption hardware; and a training facility for instruction on switch and terminals.

The annual operating costs in support of AUTODIN are estimated at 91.7 million—of which 53.6 million is CONUS and 38.1 million for overseas. These costs cover subscriber to switch access lines, circuitry between switches and operation, and maintenance of the switching centers.

Installation of the AUTODIN system in CONUS has permitted phaseout of 11 teletype relays and nine data relays previously operated by the military departments.

Installation of the overseas system will permit phaseout of 13 and phasedown of 10 teletype relays. It also permits phaseout of 14 manual data relays.

Mr. DAHLIN. Could you provide the breakdown and cost and location of those phaseouts present or planned?

General KLOCKO. Yes, sir; we shall. We have that.

(The information referred to follows:)

Cost and personnel savings on the closeout of manual relays replaced by AUTODIN, $40.8 million; 3,578 military and 320 civilian, for a total of 3,898. (Other information was furnished for committee files.)

[Deleted.]

IMPROVEMENT PLANS

General KLOCKO. My preceding remarks have reviewed the switched networks which select the paths for interconnecting customers. I will now discuss the transmission system which provides these paths or channels in the DCS. This system is made up of several types of transmission media including radio, tropo, microwave, submarine cable, landline, and satellites. These media having varying characteristics and capabilities must be installed and interconnected to meet the quality and quantity standards required by the many types of traffic being passed. It provides the long-haul backbone capability. However, these long-haul requirements may range from short-leg lengths of 10 or so miles to long-leg lengths such as those from Southeast Asia to Washington. Our task in transmission is to insure proper selection, installation, and interconnect of the various media in an economical, efficient, and effective manner to meet these varying requirements.

The transmission systems within the DCS require almost continuous review, improvement, or realinement to insure that the systems meet the demands placed upon them. Transmission improvements are required in terms of improved quality, increased capacity, and greater reliability. It is expected that all DCS systems meet DCS standards and that improvement projects be planned and implemented in time to satisfy user requirements.

With these views in mind, I would like to review the many programs for improving the effectiveness of the DCS transmission system.

As you probably know, high frequency radio has, in the past, been the mainstay of military long-haul and transoceanic trunking. However, because of the rapidly changing technology, other means of communications now surpass HF in the ability to meet most customer demands. We are, therefore, reducing our HF long-haul trunking. Concurrent with this reduction is a quality improvement program—better antennas, transmitters, receivers, frequency utilization, et cetera—of a selected number of the remaining trunks. The present program extends through fiscal year 1970. Depending upon the success of the follow-on military satellite program (phase II), we will be initiating another HF program in which we expect even further reductions in HF trunking.

I would now like to turn our attention to the DCS plans for improving communications in the Pacific and Southeast Asia. [Deleted.]

The integrated wideband communications system (IWCS) is the DCS long-haul communications subsystem in Vietnam and Thailand. This subsystem forms the backbone transmission circuitry required in and between Thailand and Vietnam for command and control, logistics, administrative, intelligence, and other types of traffic. The number and dispersion of troops greatly determines the requirement for types, quality, and quantity of equipments utilized in the nework. [Deleted.] Details concerning these phases are most complex. With your permission, I would like to summarize our actions. If more detailed briefing or information is desired on any particular phase or aspect of this program, it will be provided.

Basically, our implementing actions for the initial three phases have included all or portions of the following:

Integration of existing broadband systems composed of fixed and transportable equipments.

Replacement of tactical broadband being used in a fixed comm role to release them for tactical use or IWCS extension into areas of increasing requirements.

Installation of new, additional tropo and microwave lines to improve or increase quality and quantity of channels.

Installation of technical control facilities at nodal points permitting more effective interconnection in internal SEA and interface with the DCS in external areas.

This implementation is effected by contract—by Philco-Ford in Thailand and Page in Vietnam. Phases I and II have been completed. Acceptance of the phase III effort is underway on a link-by-link basis—with the last link scheduled to be completed in November.

Funding of this program was complicated by several factors. First, the initial cost estimates have to be derived from desktop engineering and costing techniques. Site surveys and detailed engineering efforts proved them to be low. Additional equipment needs were also developed later in the program. Many problems associated with military, political, and terrain factors added further complications. These difficulties necessitated reprograming and additional program budget requests. However, current programs show approximately $250 million committed to phases I through III in fiscal years 1966–68. An additional $18 million is programed in fiscal year 1969 for claims against these phases, some due to Tet and other actions.

[Deleted.]

General KLOCKO. Although much of our recent communications improvement efforts have been in the Pacific, the needs of the Western Hemisphere and Europe (including the Middle East and Africa) have not been overlooked.

[Deleted.]

General KLOCKO. Another matter worthy of note, at this time, is the use of commercial communications for transatlantic DCS use. At the present time, our major reliance on quality communications across the Atlantic is upon the submarine cable systems. However, we have started using commercial satellites in January of this year and expect to increase this use as the capability of satellite communications increases. A basic concept essential to communication reliability used by DCA is the diversification in the use of transmission media. It is difficult to predict with precision the future amount of communications

that will be required by the DCS across the Atlantic. However, our future planning is directed toward meeting about one-third of the DCS needs by military and two-thirds by lease of circuits in the commercial cable and satellite systems. To this end, we view with interest the recent FCC decision to authorize the new TAT–V submarine cable from North America to Spain and Italy, and will take advantage of the increased diversification by the system.

[Deleted.]

PROGRESS IN IDCSP

Mr. ROBACK. Continue.

General KLOCKO. When General Starbird appeared before this committee last July he described the status of the IDCSP and the planning for the follow-on system. I shall update you on progress made during the past year while trying to avoid repeating information already presented to the committee. I shall cover briefly the following subjects:

(a) First, the status of the satellites and ground terminals of the IDCSP.

(b) Second, the operational experience gained during the past year, and

(c) Third, our planning for the future.

At the time of our appearance last year, we had just completed the third successful launch and had 17 functioning IDCSP satellites in orbit. I am pleased to be able to report that all of those satellites are still functioning. In fact the only satellite that was indicated last year as not operating satisfactorily after launch came back to life and provided some operational capability until May of this year. At that time it was once again listed as unstable. During this period, four satellites have switched to the redundant traveling wave-tube amplifiers. There are now five satellites operating on the backup amplifiers.

Mr. HOLIFIELD. What does that mean?

Mr. COHEN. We have two traveling wave-tube amplifiers in the final output power stage of the satellite. They are redundant. We use one at a time.

Mr. HOLIFIELD. These are the secondary or reserve that ordinarily were used if the first ones go out?

Mr. COHEN. That is right; there is a one-time switch. When it senses a failure in the system it switches to the backup traveling-wave-tube amplifier and will never switch back. We don't know whether the failures were traveling-wave-tube amplifiers or failures someplace in the redundant switching. We feel that most of these amplifiers switched because the one time switch failed and not the traveling wave tube.

Mr. ROBACK. These might limit the life of the satellite conceivably?

Mr. COHEN. Conceivably they could.

General KLOCKO. Once again we come to this committee immediately after a successful launch. On last Thursday, June 13, another payload of eight IDCSP satellites was successfully launched and placed into orbit by the Air Force abroad a Titan IIIC. These satellites are now gradually separating in space and will soon begin to take up some of the load from the older satellites. We, therefore, now have a total of 25 functioning satellites in orbit.

Without a specific history of failures, it is difficult to predict how long the satellites will continue to operate. Our best guess is that, based on the successul launch of last week, we should maintain a usable system of at least 15 satellites until some time in 1971. You will note, however, that with a system of this type with 15 satellites the length of outages on long East-West links such as across the Pacific may become excessive. You should also note that each of these satellites contains a switch which will automatically turn it off after 6 years. We will therefore begin to lose satellites in 1972 even if all other portions of the satellite continue to operate. Also, by early 1973 we will lose at least 15 of the 25 satellites now in orbit. All of this contributes to our planning for the follow-on system.

However, before I proceed to that phase of our effort, let me review the status of the ground system. I am certain that you recall that we have four types of terminals in the program: large fixed terminals with 60-foot antennas (AN/FSC–9): medium transportable, 40-foot terminals (AN/MSC–46); small transportable, 18-foot terminals (AN/TSG–54); and shipboard 6-foot terminals (AN/SSC–3). Last year we reported that nine terminals, including the CONUS AN/FSC–9's were deployed for use. At the present time, or as of May 15, we have 17 terminals in operational status. These include the AN/FSC–9 in California and New Jersey, AN/MSC–46's in South Vietnam (2), Ethiopia, Germany (2), Hawaii (2), Okinawa, the Philippines, Guam and in CONUS at Brandywine, Md.; and AN/TSC–54 at Guam, Australia, Korea and Thailand. Additionally AN/TSC–54's will soon become operational in Alaska, Colorado, Guam, Hawaii, and Maryland. The Navy's shipboard terminals are currently undergoing extensive design and modification study prior to final deployment for operational utilization.

The performance and reliability modifications to the AN/MSC–46 terminals have been almost completed. The major outstanding item is the 12-channel multiplex equipment for four of the terminals. This equipment is expected this fall with the firm delivery depending on competing priorities and a strike at the manufacturers plant. [Deleted.] Performance and reliability of the terminals have improved greatly during the past year. We can now rely on better than 90 percent availability of the terminals on most of the links. The failures that have been experienced are being studied, and all future failures will be watched to determine what, if any, additional modifications will be required. The performance and reliability record of the AN/TSC–54 terminals are also being carefully watched for any patterns of failures which may justify equipment modifications. We have not obtained sufficient performance data on this terminal to come to a conclusion at this time.

The majority of our operational use of the satellite system is common-user voice service. There are, however, several 16-channel teletypewriter tone packages used on some of the circuits, particularly the Hawaii-Vietnam, Hawaii-Brandywine, and Ethiopia-Germany portion of the system.

[Deleted.]

Mr. HOLIFIELD. Does Comsat transmit pictures as well as——

General KLOCKO. Yes, sir, TV.

Mr. HOLIFIELD. TV comes through Comsat?

General KLOCKO. Yes.

Mr. HOLIFIELD. These pictures we get on TV from Vietnam are through Comsat rather than yours?

General KLOCKO. None of our pictures have been on TV.

Mr. ROBACK. This TV is just reels that are flown in?

General KLOCKO. I would think so. I am not sure on that.

Mr. COHEN. There is no TV in Comsat. At the present time they have the capability, but in order to transmit TV on the Comsat facilities in the Pacific, they would have to turn off all or most of their voice communications.

Mr. HOLIFIELD. So these are films that are flown in, that we see?

Mr. COHEN. Yes. Some of them are transmitted at times by Comsat after having been flown to Japan.

Mr. ROBACK. They have a station in Japan?

Mr. COHEN. They use a large terminal in Japan.

Mr. HOLIFIELD. Thank you.

General KLOCKO. It should also be noted that on two instances during the past year, the DSCS was used to restore communications lost as a result of cable breaks. This capability was not otherwise available. The breaks occurred between Hawaii and Philippines and the SEASIA coastal cable between Thailand and Vietnam.

That completes my summary of the status of the IDCSP. Now I would like to touch briefly on several developments for the near future. Only one AN/MSC–46 and one AN/TSC–54 remain to be deployed and that will be completed shortly. The completion of the 12-channel upgrading of the AN/MSC–46 and the correction of difficulties in the Navy's AN/SSC–3 terminals will then be the only outstanding items in the IDCSP.

As you know, the United Kingdom has ordered two satellites similar to the IDCSP but in a synchronous orbit. These satellites, known as SKYNET, are being produced by Philco-Ford under an Air Force contract. Although the scheduled launch of the first of these satellites has slipped from late 1968 to mid-1969, everything appears to be progressing satisfactorily in this program.

After many months of negotiation, NATO has finally decided to procure two of the SKYNET-type satellites. These are also being produced by Philco-Ford under an Air Force contract. [Deleted.] SHAPE, as agent for NATO, recently requested bids on ground terminals to operate with these satellites. Because of the agreed production-sharing formula the ground terminals will be produced by a consortium of European and Canadian industry with the U.S. share being taken up by the satellites and launch vehicles. A contract for the ground terminals is expected before the end of this year.

[Deleted.] We have undertaken through a series of discussions to insure a measure of interoperability between United States, United Kingdom, and NATO ground terminals and satellites. We are near a general agreement on the principle of the need for interoperability, particularly under stressed conditions, and are endeavoring to work out the technical details.

As I explained earlier, we have a reasonable probability that the present system will provide us with some operational capability until around 1971. We also know that beyond that time, and particularly starting in mid-1972, the system will degrade to an unusable level.

Even the operational capability we can now obtain with 25 satellites, and up to 24 terminals, is not satisfactory. The primary factors restricting the potential utility of the system are the nonavailability of satellites due to the drifting nature of the orbit, the limited capacity due to the low power output, or effective radiated power of the satellites and terminal outages due to a lack of redundancy in the terminals and a lack of backup terminals. For these reasons I have recommended an improved system utilizing the present state-of-the-art technological developments produced by NASA, the Comsat Corp., and DOD programs, including TacSatCom and the Defense satellite communications program.

Now, if I may, I would like to turn for a few minutes to the National Communications System (NCS).

Last year the finalization of a system of assigning the priority of restoration of disrupted communication circuits was reported. There is now a common set of criteria for assignment of priorities by all communications users, whether they represent the Government or industrial requirements, and centralized management for review of the propriety of these assignments. This system was implemented by domestic and international U.S. communications common carriers during 1967.

The NCS emergency action group, normally on standby at my call, was convened to assist my office in carrying out its emergency mission during the Near East crisis in June 1967. This group is composed of representatives of the NCS operating agencies.

Procedures for processing requirements for communications circuits were clarified so that agencies which intend to lease transoceanic circuits coordinate their actions with my office. This procedure provides the opportunity to secure effective utilization of these expensive and, in some cases, scarce facilities.

A system for assigning precedence, or relative priority, to telephone calls in the National Communications System was developed and forwarded to the President for approval.

In the area of long-range planning, the third long-range plan covering the period fiscal years 1969–73 has recently been reviewed by the Special Assistant to the President for Telecommunications. This plan outlines further steps for increasing survivability and flexibility of our overall Federal and common carrier assets, and is oriented toward increased integration and interconnection of the telecommunication assets of the several participating agencies to meet Federal Government needs more effectively and economically. The review by the President's office approved the assignment of the Atomic Energy Commission's SADIE system (secure automatic data information exchange system) as an NCS asset. The next long-range plan is now in initial coordination.

In the area of actions for the future, the Special Assistant to the President for Telecommunications, the Bureau of the Budget, and the Executive Agent, NCS, have determined it is now appropriate to apply planning-programing and budgeting processes to insure that NCS plans and agency plans and programs are on a consistent basis. The Executive Agent, NCS, has assigned me the responsibility to develop specific procedures for this purpose.

I wish to thank you for giving me this opportunity to appear and present to you the major programs and activities of the DCA and the NCS. Before concluding, however, I would like to refer to Secretary McNamara's letter of February 13, 1967, to you in which he attached his comments to your report of October 1966. I ask you to note that in accordance with your recommendations there has been achieved an operational capability with an expanded capacity in the IDSCS as well as a system that has been upgraded and replenished. Additionally, it should be noted that the 30 commercial satellite circuits in the Pacific, procured by DCA from Comsat, have been assigned to the international record carriers.

If you have any questions I shall be glad to attempt to answer them.

Thank you, Mr. Chairman.

Mr. HOLIFIELD. General Klocko, I just want to say as an individual that it has been interesting since we started exploring the need of this service for the military's own communications methods, why I certainly am pleased with this report of progress and establishment of effective communication. It goes beyond my expectations at the time we started certainly that you have made as much progress and have improved it as much as you have.

General KLOCKO. I am certainly glad to hear your words. I personally can't take credit for all this ,but it has been the result of a lot of work on the part of a great many people.

Mr. HOLIFIELD. Yes. It has taken a lot of work. I know that. But we were determined that the Defense Department should have in addition to Comsat something that was of its own and that it can develop to its peculiar needs. It seems to me as a layman that you have done a good job.

General KLOCKO. Thank you.

Mr. ROBACK. I might go over a little ground here. We have a little time. [Deleted.]

Your statement about utilizing the technological developments produced by NASA, Comsat and DOD programs, including this technical one, does that statement imply that the Defense Department has lagged technologically behind NASA and Comsat, would you say?

General KLOCKO. No, sir. We just use everything that everybody has in the developing of our follow-on plans.

Mr. ROBACK. You wouldn't say at this stage of the game, NASA with its advanced technological satellite and Comsat with its program down to Intelsat No. 4 and maybe beyond that for all I know, you wouldn't say they are ahead of the Defense Department technologically?

General KLOCKO. No, sir. I think we are all using the same technological base in the country to produce these systems.

Mr. ROBACK. Are the decisions to utilize that technology keeping up with the technology?

General KLOCKO. You might ask Dr. Tucker that.

Mr. ROBACK. That is his department? Well, let's ask you, then—your organization has been strong for developing a satellite capability, has it not?

General KLOCKO. Yes, sir.

Mr. ROBACK. Do you envisage that there could be an elimination of obsolete or otherwise costly or unnecessary systems if you had a strong satellite capability?

General KLOCKO. Yes, sir. The first, as I mentioned in this statement here was HF. I think it will be an early victim of the upgrading resulting from satellites.

Mr. ROBACK. What section of your agency deals with the problems of extending satellite technology where it is economical and more efficient?

General KLOCKO. Admiral Dybdal, who is Deputy Director for Plans——

Mr. ROBACK. Can you give us some idea of where satellites can be more efficient and economical?

General KLOCKO. Yes, sir. [Deleted.]

Mr. ROBACK. Does the military have any other cable in the Pacific?

General KLOCKO. They have a cable between the Philippines and Southeast Asia and then a 60-channel cable system in Southeast Asia along the Vietnam east coast, including one cable from Vietnam into Thailand.

Mr. ROBACK. Those are all military cables?

General KLOCKO. Yes.

Mr. ROBACK. Government owned?

PROBLEMS WITH TERMINALS

Mr. ROBACK. What is the problem with the Navy terminals? I gather from what you said that the Navy terminals are experiencing unusual difficulties. Is it the question of stability?

Mr. COHEN. The Navy terminals ran into some problems similar to the ones we ran into on the MSC–46 when they first got in the field. Mostly reliability performance problems under shipboard conditions. They have isolated most of the problems at the present time and they are in the process of designing modifications to take care of it.

Mr. ROBACK. What is the type of problem? Is it a question of other radio emissions on shipboard?

Mr. COHEN. No. These are problems under shipboard temperature conditions, shipboard environment, not interference with other equipment. Some damage as a result of vibrations on the ship as a result of gunfire and things like that.

Mr. ROBACK. What is the objective of the Navy program outside of trying to see whether it is useful? They don't really plan to have terminals on all ships, do they?

Mr. COHEN. No, sir. These terminals are intended for use on the major fleet commanders and task force command ships.

Mr. ROBACK. Selected ships?

Mr. COHEN. Yes. They have only built seven terminals at the present time. Two of these go on national emergency command post afloat ships. The others go on major command ships.

Mr. ROBACK. Your reference to the AN/TSC–54 terminal sounds like it, too, is a questionable item. You sound like you don't know whether it will be any good or not. Isn't it late in the game to express that kind of concern?

Mr. COHEN. We have had several technical problems with the TSC–54, primarily in the prime power supply. The power supply we sent along with the equipment. We have not had——

Mr. ROBACK. What do you mean you sent along?

Mr. COHEN. We sent a turbogenerator, 400-cycle power generator with the equipment to operate it in the field instead of connecting it to commercial power or whatever is available.

Mr. ROBACK. You think the power source is limited?

Mr. COHEN. The power source has been our most serious problem.

Mr. ROBACK. That is external to the——

Mr. COHEN. It is external to the electronics of the equipment, but it is part of the overall set. It is required in order to operate it.

Mr. ROBACK. So what do you do? Get more power?

Mr. COHEN. We have been studying the reliability of these power supplies and the possibility of modifying the prime power system to enable it to be tied to commercial power. Once that is resolved I think most of our problems will be——

Mr. ROBACK. You mean those mobile stations will not be useful unless you have a commercial power supply in the area?

Mr. COHEN. No. The equipment contains a 400-cycle power supply that goes along with it. At the present time that has been one of our main problems; because it is 400 cycle we can't tie it into most of the other power supplies that are available at 60 cycles. We are going to provide a power converter with the terminals so that they can tie into other power sources, either commercial or military, that happen to be at the same stations.

Mr. ROBACK. When did this power problem develop? It seems to me this is an original design problem. What kind of power supply do you design to? Wasn't this tested out in the early stages?

Mr. COHEN. Yes, it was tested and a standard tactical power supply was provided with the equipment. It is a 400-cycle Marine Corps turbogenerator set.

Mr. ROBACK. And it is not working properly, Mr. Cohen?

Mr. COHEN. It works properly when it is properly set up and operated. Most of these problems have been the proper training and supply of personnel to support and maintain the power equipment. We think it is a problem that can be resolved in a very short time.

Mr. ROBACK. If the problem is not resolved, that means you have a degraded system, but not necessarily a useless one?

Mr. COHEN. That is right.

Mr. HOLIFIELD. Isn't this in the basic power? It would seem like we have enough experience in providing basic current to do this job without too much trouble. I can't quite understand why——

Mr. COHEN. It is in the basic power. I agree we should have enough experience to provide basic power systems and that is one reason we feel it should be resolved in a very short time.

Mr. LUMAN. Is this in the manufacturer's equipment or in the equipment you give them?

Mr. COHEN. Government-furnished equipment.

Mr. HOLIFIELD. Did you depart from commercial designs and design something special and unique?

Mr. COHEN. No, sir. We took a standard Marine Corps tactical equipment.

Mr. HOLIFIELD. What is it? Inadequacy of power or unreliability of the equipment?

Mr. COHEN. It has been primarily of sufficient trained personnel to set it up and operate it and maintain it properly. We have plenty of

people trained on the electronics of the equipment but not on the prime power equipment.

Mr. ROBACK. What is your program for satellites in the Atlantic? Are you negotiating for Atlantic circuits?

General KLOCKO. I think we have six——

Mr. ROBACK. Are you buying any satellite circuits in the Atlantic?

General KLOCKO. Yes. We started in January.

Mr. ROBACK. Who is supplying circuits?

General KLOCKO. Comsat—the number six is correct. Comsat.

Mr. ROBACK. That you have under lease?

General KLOCKO. Right.

Mr. ROBACK. Dealing directly with Comsat?

General KLOCKO. Through international carriers.

Mr. ROBACK. Give us a little statement on the situation.

General KLOCKO. We will get you a statement.

(The information referred to follows:)

As of late June 1968, six leased circuits (3 from ITTW, 2 A.T. & T. and 1 WUI) between the United States and Europe, and four (ITTW) between the United States and the Ascension Island, were being provided by satellite. In addition, seven more circuits are on order to be provided by satellite on or before 1 September 1968, and at least three more are programed for service prior to the end of the year. These are not all new services—in several instances, service is presently being provided through the trans-Atlantic cables. The activation of several new earth stations in Europe, however, has permitted the DOD to take a significant step toward achieving the desired mix of services between cables and satellites.

Mr. HOLIFIELD. I still can't understand why a standard basic power plant is not effective. I would have thought we had such a variety of those for all purposes. I have seen them in all sizes and dimensions and used by the Navy and Air Force and everyone else. It is hard for me to believe.

It seems to me that in the area where you might be expected to have trouble you are not having any, and then in the less sophisticated area you are having this trouble.

General KLOCKO. I understand your surprise, sir. However if I remember the figure correctly, and this is close, about 40 percent of our outages in the communications system are a direct result of power failure and not the electronics gear associated with it. Power is one of our major problems today.

Mr. HOLIFIELD. That is an amazing statement to me, but when we think of the long history of development of all types of cycles and phases and types of turbines and——

General KLOCKO. One of the things is that the power requirements for communications gear is so much more delicate because it has to be within certain parameters which are different from say to light the room or a refrigerator or anything else you use. Any slight transients in the power supply will throw the communications gear out completely in a very short time. Like when the lights flicker——

Mr. HOLIFIELD. In other words the fluctations you can stand for in ordinary usages you can't stand here?

General KLOCKO. When you see the lights flicker in this room it doesn't make any difference to us here in using the light. This would put out a station and particularly it's cryptographic gear which is

synchronized for some of the sights up to a period of as much as 3 or 4 hours just from a flick.

There are several other parameters which have to be very closely followed in the power which most of the people who are dealing with power are not accustomed to.

Mr. HOLIFIELD. This helps explain it.

You require a quality of power, let us say, free from variations which are tolerable in ordinary circumstances.

General KLOCKO. That's correct.

Mr. HOLIFIELD. And do you plan to run the regular power through some type of adapted or converter that would give you a steadier flow of power with less variation?

General KLOCKO. Within about the last 2 years the communications community has realized the acuteness of the power problem and there are several power upgrade projects in being now which are addressing this particular problem because of the criticality of it, sir.

COMMUNICATIONS FOR LOGISTICS

Mr. ROBACK. I mentioned earlier, General, the relationship of communications to logistics. We are a little later on going to review with the services some of their basic logistic and supply concepts, and the question arises let us say, as to the logistic system of a service, if additional communications were required, would they be available?

We gather from some preliminary discussions in the Army that their system, which has some deficiencies in it today, would be notably improved if they had a dedicated logistics circuit. Is that practical or is that uneconomical?

General KLOCKO. Well, let me say to start that the logistics systems of all the services are the largest users of the AUTODIN system now.

Mr. ROBACK. But they claim that any time there is any crunch on the system, logistics takes the lower end. They are last in precedence.

General KLOCKO. I think this is by and large true unless they have emergency requirements where they can put the proper precedence on their messages but the vast bulk of what they use does not have any critical time element associated with it and ordinarily doesn't get through the speed of operational type traffic.

Mr. ROBACK. What would be entailed in a dedicated system for Army logistics? What would it require in terms of extra capability?

General KLOCKO. It would require duplication of our present common user system, sir. To that extent you would have to buy a new system.

Mr. ROBACK. Could you just set aside a circuit, let's say? After all you have to trade off some additional cost here against improving the Army logistic system, which is an expensive system.

General KLOCKO. Well, there are certain circuit switching capabilities in the system but they don't necessarily satisfy all of the Army's needs.

Mr. ROBACK. What part of your agency negotiates with logistics users on requirements? I might want to send somebody over there.

General KLOCKO. Well, the requirements is Admiral Dybdal but ordinarily it wouldn't be sorted out that way. We would get a request from the Army for so many circuits or so many entries into the AUTO-

DIN system from this depot and that depot, so we would supply the circuits.

Mr. ROBACK. You are just supplying circuits on request. The question comes up and would have to be examined whether a dedicated circuit which might cost more, which might be not altogether cost-effective from the standpoint of communications, might be quite more effective from the standpoint of logistics, where your savings would be considerably more.

You look at it from the standpoint of communicator.

The logistician might have a big need for this. I am trying to see if there is any communication between the logistician and the communicator.

General KLOCKO. I am surprised because we heard only words of praise from the logistics.

Mr. ROBACK. We will develop that.

Mr. LUMAN. One final question on that. Would your system give the logistics people dedicated channels from one computer to another?

General KLOCKO. Yes, under certain conditions.

Mr. LUMAN. If they wanted a line from 14th ICC computer back to the States 24 hours a day, no one else could get on that line?

General KLOCKO. They can do that, yes.

Mr. ROBACK. You are not doing that now, are you?

General KLOCKO. In certain cases we are. The one example I can think of now is between the Air Force depots in the United States.

Mr. ROBACK. I am not sure of the nature of the problem technically. I don't know what is involved. I raised it because it looked like the Army needs some better communications for logistics purposes.

General KLOCKO. Sure. Let me look into the present communications and I will put it in the record for you.

(The information referred to follows:)

AUTODIN service provided by the Defense Communications System is contingent upon requests for service validated by the Department of the Army inter alia, reviewed and approved by the JCS and Secretary of Defense in accordance with current directives and then submitted to the Director, DCA for implementation.

In accordance with Department of Defense directives the military departments (Army) are responsible for developing communication requirements, reviewing and validating subordinate command requirements. DCA responsibilities as set forth in these directives are to receive, consolidate and analyze telecommunications requirements validated by the Joint Chiefs of Staff, Unified and Specified Commands, the military departments, and other DOD agencies, and other Government agencies as directed to ensure that DCS capabilities are considered in fulfillment of the requirements.

The Army's response to a recent survey consisted of a description of five programs involving the use of computers, including the joint uniform military pay system. The estimated data volume projected for AUTODIN amounted to 600,000 line blocks per month which was conservative compared to the Navy and Air Force.

The DCA Headquarters has no evidence that the requirements for AUTODIN service requested by the Department of the Army have not been fulfilled.

AUTODIN does not recognize traffic by functional type (i.e., logistics, administrative, command/control) but by one of four precedences which are initiated by the message originator depending upon the importance and speed-of-service desired for each specific message. The criteria for the speed-of-service of each precedence level is established by directives of the Joint Chiefs of Staff. The AUTODIN is designed to perform in accordance with this criteria and in most cases exceeds the required speed-of-service.

DCA RECOMMENDATIONS ON PHASE 2

Mr. ROBACK. You referred to phase 2 as the program successor to the initial system of communication. Now the successor, when was it programed?

General KLOCKO. Our plan for the requirement for the advanced—what is now the phase 2—was drawn up in January of 1967.

Mr. COHEN. June of 1966.

General KLOCKO. June of 1966.

Mr. ROBACK. You signed off when, as far as your agency was concerned, on phase 2?

General KLOCKO. I wasn't there but I think somebody did. Our plan was sent forward in June 1966. It was then ADCSP, sir.

Mr. ROBACK. You had signed off on that. That was your recommendation?

General KLOCKO. Yes.

Mr. ROBACK. Then it was not at your level that the reconsideration took place of what ought to be involved—maybe this plan was too ambitious or too costly or whatever the critique—that was not in your department?

General KLOCKO. We have been involved in the process, in the intervening 2 years, yes, sir.

Mr. ROBACK. When did phase 2, in distinction from ADCSP, become identified? When did that first emerge?

General KLOCKO. I would have to ask Jay.

Mr. COHEN. October 1966. In October of 1966 the ADCSP plan was returned with direction to develop a less costly alternative. At that time we went into what we called an evolutionary program which included phase 2 and a later phase 3.

Mr. ROBACK. Phase 2 and later phase 3.

Mr. COHEN. The phase 3 was to be what had been described as the ADCSP.

Mr. ROBACK. So this was in a sense an interim concept that you developed.

Mr. COHEN. It was an evolutionary growth.

Mr. ROBACK. When did phase 2 get passed on from the Defense Communications Agency?

Mr. COHEN. This has been done through a long series of discussions between DCA, the Joint Chiefs of Staff, the military departments, and D.D.R. & E. over the last 18 months.

Mr. ROBACK. Could you identify the different sectors of concern, Mr. Cohen?

Mr. COHEN. Satellite technology, requirements, cost, time schedule.

Mr. ROBACK. Presumably in the Secretary's office the cost was predominant, and in D.D.R. & E. technology was the concern, whereas requirements lie within the Joint Chiefs of Staff capability, I suppose.

Mr. COHEN. I think all have been concerned about all the requirements.

Mr. ROBACK. When does it leave D.D.R. & E.? It left your department for approval by somebody else at one time.

Mr. COHEN. It has been going back and forth. Our last—there were recommendations last fall from DCA and since then there have been

a series of versions of descriptions of the program developed and coordinated among all the parties.

Mr. ROBACK. When would you say that—I don't want to get into Dr. Tucker's area, but I want to get at least your side of the matter. When was there an agreed phase 2, so to speak, on the part of all parties? Was there such an agreement?

Mr. COHEN. I think that—of all parties?

Mr. ROBACK. Let's say not of all parties, but all parties who had responsibility for, you might say, signing off on the program until it comes to the final secretarial authority? In other words below the Secretary or the Under Secretary, whoever makes the decision to let it go as a budgetary item?

Mr. COHEN. Well, the final agreement was really left free as far as we are concerned. However, this was the final wording of a piece of paper that has been developed over the last 6 months.

Mr. ROBACK. Has the paper been before the final review authority for 6 months.

Mr. COHEN. No. It has been in the chain up through D.D.R. & E. for about that time.

Mr. ROBACK. Let me ask this:

What is the composition of the requirement? You have some R. & D. moneys. You have some procurement moneys. What are the components of the budget? Are you in a position, are you responsible for identifying that?

General KLOCKO. Four alternatives were considered for the followon program. It has the cost listed here for a 5-year period. They vary from the least costly, $100 to $265 million for this 5-year period to the most costly, which is $360 to $450 million.

Mr. ROBACK. This was the 5-year investment and operating cost?

General KLOCKO. Yes. As far as I know this has not been broken out in this particular paper which is up for approval between R. & D. and procurement.

Mr. ROBACK. What was up for approval? For example, was everything up for approval or only the procurement side?

General KLOCKO. No. The entire system, the entire program.

Mr. ROBACK. So if it were not approved, you wouldn't even have R. & D. on it?

General KLOCKO. That is correct.

Mr. ROBACK. It would just come to a grinding halt?

General KLOCKO. Yes, sir. That is why we pointed out in here that the phase 2 is quite important because the phase 1, IDCSP, will be out of business by about the 1971 time period and this would logically follow.

Mr. ROBACK. To accommodate the degradation of the initial system, what is your leadtime? What is your leadtime on getting phase 2?

General KLOCKO. Thirty months. It would just about coincide.

Mr. ROBACK. This was the year of decision.

General KLOCKO. Yes, sir.

Mr. ROBACK. This is the month of decision.

General KLOCKO. Yes.

Mr. ROBACK. This is the month of decision.

General KLOCKO. Yes, sir.

Mr. ROBACK. As far as you know, you have a decision.

General KLOCKO. Very close to it, sir.

Mr. HOLIFIELD. Had you had any intimation that this tremendous pressure on the budget, which is hitting in research fields all through the Government, that this is liable to cripple you and put you in a priority position where you wouldn't get what you expect?

General KLOCKO. No, sir. I think there is pretty general agreement on what is going to be the final program but here again I think Dr. Tucker tomorrow will have more definitive information for you, sir.

Mr. ROBACK. We will discuss that part with him.

General KLOCKO. He is actually the action officer on this paper.

Mr. HOLIFIELD. This tax bill we are going to vote on Thursday carries with it a $6 billion cut in expenditures.

General KLOCKO. I know.

Mr. HOLIFIELD. This is concerning all of us who are interested in what we consider high priority items like this, and we would be hopeful that if we could get this by without a cut——

General KLOCKO. Well, as far as I know, there is no specific breakout on the type of funds involved.

Mr. GRUVER. All but $1 million was denied in the 1969 military departments budget request for satellites. I forget the total request but the major portion of the fiscal year 1969 procurement budget for satellites was refused.

Mr. ROBACK. The money was in the budget for both R. & D. and procurement?

Mr. GRUVER. I am speaking now to procurement which I think is required primarily for phase 2. I think Jay can talk to that. I forget the total request but only a million dollars is in the fiscal year 1969 budget.

Mr. ROBACK. So the decision has to do with the quarterly allocation and not with the general acceptance of that item. The decision would be whether to approve it for the next quarter; is that right?

Mr. GRUVER. It would be reprograming action for procurement. There are not adequate funds in the fiscal year 1969 budget.

Mr. HOLIFIELD. This is the thing I was getting at. I hadn't any intimation before that this, if I understand you right, is going to slow up replacements. Are you ready to procure? To let hardware contracts?

General KLOCKO. No, sir; not at this point. There would be several studies that would have to be made. We have not had a program against which we could start any of these definitive actions.

Mr. HOLIFIELD. Then you could have enough in your design and study budget that a restriction at this point in the fiscal year 1969 budget would not necessarily cripple you on purchase of hardware. Or would it?

General KLOCKO. I'm not sure. You are getting into some things now which I think actually Dr. Tucker would be in a better position——

Mr. ROBACK. He doesn't have responsibility for the satellite budget, does he?

General KLOCKO. Yes, sir.

Mr. ROBACK. Is he the one that makes up the budget for satellites?

General KLOCKO. He is the one who recommends to the Secretary of Defense that the program go forward or not go forward in terms of the number of satellites, number of ground terminals, and the phasing of it.

Mr. ROBACK. It depends on what is involved. The Air Force is the

buyer of this satellite. It has been ready to go out on the street for over a year, hasn't it?

General KLOCKO. Yes, sir.

Mr. ROBACK. When you say that you are not ready to buy, it all depends on what you want to buy. If you change your requirements—for example, if you decided to buy a British type, one of the satellites you make for Britain, you could have done that 2 years ago.

General KLOCKO. Under any of these programs it is still the basic equipment. We are talking about the numbers and at what time we begin to buy them. But it is not changing the requirement or the configuration of the equipment.

Mr. HOLIFIELD. So it all depends upon budget allowance or budget approval; allocated funds.

Mr. ROBACK. I think the record is getting more, rather than less, confused. Rather than add to the confusion, I think we ought to have a little statement prepared on what is the budgetary situation as far as DCA is concerned. In other words, to the extent that your jurisdiction and responsibilities are involved, tell us what the budget situation is in writing.

General KLOCKO. Yes, sir. As of this point we have no funds for this program.

(The information referred to follows:)

Funds available for phase 2 of the DSCS—fiscal year 1969 R.D.T. & E. budget:

	Millions
Army	$6
Navy	2
Air Force	9
DCA	3
Total	20

Mr. ROBACK. Well, in your several alternatives, was one of them to buy the type of satellite being procured for NATO and the United Kingdom?

General KLOCKO. It will be an advanced satellite.

Mr. ROBACK. One of the alternatives was to buy that type of satellite.

General KLOCKO. No, sir. At one point it was considered but——

Mr. ROBACK. Not in these alternatives.

General KLOCKO. That's right.

Mr. ROBACK. You have gone beyond that.

General KLOCKO. Well beyond that.

Mr. ROBACK. You mentioned intercountry operability. What is involved? Are these being designed in such a way that ground stations and satellites can be interoperable?

General KLOCKO. Yes. Basically, most of the design on the satellites has been done in the United States, even for the United Kingdom and for NATO, so we know what is being designed and they are, in fact, interoperable or can be made interoperable.

Mr. ROBACK. It doesn't require any extensive modifications of any kind?

General KLOCKO. No, sir.

Mr. ROBACK. You will be able to use the United Kingdom satellite?

General KLOCKO. We have negotiated with the British on this.

Mr. ROBACK. It is a question of what the British will allow you to use, but there is no technical constraint?

General KLOCKO. Not with our present configuration.

Mr. COHEN. There are no problems in the satellite. It is all modes of operation at the ground terminals. Types of operation, modulation, at the ground terminals.

Mr. ROBACK. At the presently designed ground terminals there has to be some modification?

Mr. COHEN. Selection of modes of operations considering the present U.S. ground terminals, the planned British and NATO ground terminals, and our plans for the future. A matter of coordination of all of them.

There are no really highly technical problems. We want to be able to talk from one of our terminals through either our satellite or their satellite to one of their terminals and the same way coming back and it requires that the ground terminals have the same type of equipment.

Mr. ROBACK. Is there a technical working group that is now working on this?

General KLOCKO. Yes.

Mr. DAHLIN. With respect to that 6-year switch in the satellites, is there any expectation those will fail, as the one-time switch on the TWT failed? Any test data on it?

Mr. COHEN. No.

General KLOCKO. No. None have been to the 6 years yet so we don't know.

Mr. COHEN. It is very difficult to test. It is a timer. A one-time switch.

Mr. DAHLIN. How about the 12-channel multiplex equipment for the MSC–46? Is this going to multiply the capacity of the system further? Why has this lagged behind in procurement?

General KLOCKO. It is in the point of being upgraded to the 12 channel. It has been a process of getting the stations moved because they do have to go down with this modification.

Mr. DAHLIN. The 12-channel multiplex equipment is the same as that kind of equipment required for the upgrading program? The upgrading of the MSC–46? Is there any difference between this equipment and what was originally contemplated for the upgrading?

General KLOCKO. That is the upgrading.

Mr. DAHLIN. All right.

Now the cable breaks that the satellite was used to fill in for in the Pacific——

General KLOCKO. Guam and Philippines.

Mr. DAHLIN. Did that occupy the various stations in the satellite completely? Do you have to switch over to the whole system in order to provide that kind of emergency capacity? What does it mean to your satellites?

General KLOCKO. It is a matter of priorities. We used all the satellite capacity in order to pass the high-priority traffic which had previously been on the capability. It is just some of the lower priorities that weren't taken care of. There was a reroute capability there and it was used very successfully.

[Deleted.]

Mr. HOLIFIELD. Thank you, gentlemen.

We will adjourn to tomorrow morning at 10 o'clock.

(Whereupon, at 12:30 p.m., the subcommittee was recessed, to reconvene at 10 a.m. the following day.)

MILITARY COMMUNICATIONS—1968

TUESDAY, JUNE 18, 1968

HOUSE OF REPRESENTATIVES,
MILITARY OPERATIONS SUBCOMMITTEE
OF THE COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D.C.

The subcommittee reconvened at 10 a.m., in room 2203, Rayburn House Office Building, Hon. Chet Holifield, chairman of the subcommittee, presiding.

Present: Representatives Holifield and Rumsfeld.

Also present: Herbert Roback, staff administrator; Douglas Dahlin, counsel; Paul Ridgely, investigator; and Joseph Luman, defense analyst.

Mr. HOLIFIELD. The committee will be in order.

Yesterday morning, Lt. Gen. Richard P. Klocko, U.S. Air Force, Director of the Defense Communication Agency, reviewed for us in executive session the broad subject of U.S. military communications worldwide and the organization functions and resources of his Agency and the communications systems which the Agency administers.

Today we will hear from Dr. Gardiner L. Tucker, Deputy Director of Research and Engineering. Dr. Tucker will review the plans and progress the Department of Defense and military satellite communications including the initial system, the pending decision on phase 2, the tactical satellite communication program, and other matters of interest. This is Dr. Tucker's second appearance before our subcommittee.

We heard his presentation last July which I believe was his first congressional appearance.

General Klocko also is here today and will be available for questioning and commentary on matters which concern his Agency and the subject matter under discussion.

Dr. Tucker, you may proceed.

STATEMENT OF DR. GARDINER L. TUCKER, DEPUTY DIRECTOR, DEFENSE RESEARCH AND ENGINEERING (ELECTRONICS AND INFORMATION SYSTEMS), DEPARTMENT OF DEFENSE; ACCOMPANIED BY LT. GEN. RICHARD P. KLOCKO, U.S. AIR FORCE, DIRECTOR, DEFENSE COMMUNICATIONS AGENCY; E. GROGAN SHELOR, ASSISTANT DIRECTOR (COMMUNICATIONS AND ELECTRONICS); HERBERT BENINGTON, ASSISTANT DIRECTOR, COMMAND AND CONTROL, OFFICE OF THE DIRECTOR OF DEFENSE (RESEARCH AND ENGINEERING); WALTER H. MORSE, COUNSEL; JAY J. COHEN, TECHNICAL ADVISER (SATELLITE COMMUNICATIONS); AND LT. COL. WALTER A. HOGGE, JR., U.S. AIR FORCE, CHIEF, COMMERCIAL POLICY DIVISION, DEFENSE COMMUNICATIONS AGENCY

Dr. TUCKER. Thank you, Mr. Chairman.

I am Gardiner L. Tucker, Deputy Director of Defense, Research and Engineering for Electronics and Information Systems in the Office of the Secretary of Defense. It is a pleasure to appear again before this committee to discuss the achievements and plans of the Department of Defense in satellite communications. I am accompanied this morning by Lt. Gen. R. P. Klocko, Director of the Defense Communications Agency, by Mr. E. Grogan Shelor, Assistant Director for Communications and Electronics in D.D.R. & E., and by Mr. Herbert Benington, Assistant Director for Command and Control in D.D.R. & E. Mr. Shelor has cognizance in D.D.R. & E. over the tactical satellite communications R. & D. program. Mr. Benington has cognizance over the Defense Satellite Communications System.

In my statement, I would like to cover four areas: The status of the Initial Defense Communications Satellite Program; our plans for the next phase of the Defense Satellite Communications System; the status and plans of our R. & D. program in tactical applications of satellite communications; future planning to be done.

Last year I reported that we had 17 IDCSP satellites operating in near-synchronous equatorial orbits. All 17 of these satellites are still operational. Last week, on June 13, a successful launch from Cape Kennedy placed eight additional satellites into orbit and they are all operational. Thus, today we have 25.

The on-orbit life of these satellites has far exceeded our original expectations. The original specification called for an average life of 1½ years and we hoped for three. We have experienced some component failures in orbit and some of the satellites have switched from the primary transmitter tube to the alternate backup tube. The redundancy designed into these satellites has, however, allowed them to continue to perform within specifications. A statistical analysis of experience to date leads to the prediction of a mean-time-to-failure for the satellites of well over 10 years. However, each satellite contains a switch designed to turn the satellite off after 6 years in orbit. Therefore, even with no further failures, we will begin to lose satellites in 1972, 6 years after the initial launch of seven satellites in June of 1966. We can expect to maintain at least 20 operational satellites in orbit until the end of 1971.

Mr. HOLIFIELD. Could I ask you a question?

You feel the average satellite might last 10 years and yet you have a mandatory switchoff at the end of 6 years. Why don't you have a command switchoff at the time you want to switch it off permanently rather than a fixed time, Dr. Tucker?

Dr. TUCKER. At the time of the——

Mr. HOLIFIELD. So you could get additional years of service in the event it was still working.

Dr. TUCKER. That is a very fair question.

At the time of the design of these satellites we weren't prepared—we didn't have the technology for giving secure commands from ground to the satellite and, therefore, a command turnoff would have been accessible to other parties besides the United States.

Mr. HOLIFIELD. I see.

Dr. TUCKER. At the same time there had been an unfortunate experience with one of the early satellites—the VANGUARD—which had a much longer life than expected and generated signals for a long time and caused interference. Therefore, we had a directive saying that satellites should have a provision for turning off their power. With a life design of 1½ years, 6 years was picked as a prudent number.

Mr. HOLIFIELD. Was there any other way to solve this problem? Such as a small destruct explosive that could be set off to effectively turn off the——

Mr. TUCKER. I think the essential requirement is an ability to turn off which only we can activate. Today we have confidence in the technology for secure command so that we can introduce turnoff switches or other devices under our unique control. At the time of this satellite system we weren't prepared with that kind of technology.

Mr. HOLIFIELD. That includes the last eight you launched.

Dr. TUCKER. They are identical in design.

Mr. HOLIFIELD. As the first.

Dr. TUCKER. Yes.

Mr. HOLIFIELD. You hadn't developed this secure method of turnoff at the time you built those.

Dr. TUCKER. That is correct. It is available for satellites now being designed. It would have added significantly to the weight of these satellites, and at this late date it didn't seem prudent to go back to a major redesign in order to incorporate that feature.

Mr. HOLIFIELD. All right.

Dr. TUCKER. These satellites are in independent orbits, each drifting about 15° per day along the Equator. Each satellite is visible to about 40 percent of our globe. However, because the orbits are independent, the satellites will occasionally bunch together so that none is simultaneously visible from two terminals between which a communications link is desired. For the link between Hawaii and South Vietnam, which is one of our longest and most important links, the probability of having at least one satellite in common view is 92 percent with a total population of 17, and this probability has improved to 96 percent with a population of 25. Shorter links, of course, have much higher availabilities.

Our terminal population has also grown considerably. A year ago we had in the field two fixed terminals with 60-foot antennas and seven transportable terminals with 40-foot antennas. Since then we have deployed six more of the 40-foot terminals and seven of the new

smaller and more readily transportable terminals with 18-foot antennas. We now have a worldwide operational system with terminals in the Washington area, in New Jersey, Colorado, California, in Hawaii, Guam, Australia, Korea, Okinawa, Philippines, South Vietnam, Thailand, and in Ethiopia and Western Germany.

We have introduced a shipboard terminal with a 6-foot antenna, and have six of these at this time. They have demonstrated the communications capacity for which they were designed, but we are not yet satisfied with their reliability. Accordingly we are incorporating modifications to these terminals and only two are currently operational. As the improved terminals become available they will be used on major command ships such as cruisers and aircraft carriers.

Last year we initiated an improvement program to upgrade the capacity of the 40-foot terminals from two voice channels to 12. Nine terminals have been upgraded thus far. The remaining four terminals have a present capacity of five channels each. The equipment to upgrade them to 12 channels is not expected until this fall and actual deliveries will depend upon competing priorities and the resolution of a strike at the manufacturer's plant.

The reliability of the 40-foot terminals has continued to improve during the past year, and we now expect better than 90-percent terminal availability for most links. The performance of the 18-foot terminals has been good, but we do not yet have sufficient operating experience with them to predict their long-term reliability.

The IDCSP has been operational for about a year now, and it has performed some very important functions for the Department of Defense. It is primarily used to provide trunks for voice communications. It is also routinely providing "packages" of 16 teletype channels. On two occasions during the past year breaks have occurred in submarine cables. One disabled the Hawaii-Philippines cable, the other interrupted the coastal cable linking South Vietnam to Thailand. Each of these breaks required 10 days to repair and restore service. During those periods there was very heavy usage of the IDCSP links to carry high-priority traffic.

Another service which we have provided uniquely with the IDCSP is the rapid transmission of photographic images from South Vietnam to the United States. We can transmit high-resolution photographs at the rate of 6 minutes per frame, utilizing two satellites and four terminals. I have brought some typical transmitted photographs to show the committee at your pleasure, Mr. Chairman.

I would like now to discuss briefly the cooperative programs which we have undertaken with our allies in satellite communications. As you know, we are procuring two synchronous satellites, the SKYNET satellites, for the United Kingdom as part of the IDCSP.

There has been some slippage in this program. Originally the first launch was set for late this year. The program is now progressing satisfactorily and a first launch is scheduled for mid-1969.

The United Kingdom is developing and processing its own earth terminals and will control the operations of the SKYNET satellites after the U.S. Air Force has positioned them in orbit. Joint efforts are underway to insure the interoperability of the United States and United Kingdom satellites and terminals.

I reported to you last year that Ambassador Cleveland proposed to NATO a program similar to the United Kingdom program, financed by NATO, to provide operational satellite communications for that organization. NATO has recently accepted this offer and work is now underway to procure two SKYNET-type satellites for NATO use. The first launch is planned for late 1969. As in the United Kingdom program, NATO nations will provide their own terminals. In this case, however, the United States will control the satellite. In each of these cases two satellites are being procured to provide a high assurance that one will be successfully placed in a fixed position above the equator.

Our third international effort is the cooperative R. & D. program on tactical applications of satellite communications. I reported last year that we were negotiating with six NATO countries to establish a joint program. I am pleased to report that the United States and the six countries signed a memorandum of understanding last November, establishing a joint testing program utilizing the LES–5 experimental satellite. This program is progressing smoothly.

I would like to turn now to our plans for the next phase of the Defense Satellite Communications System. We have recently decided that we will, after consultation with the Congress, procure several advanced satellites and place some of these in synchronous equatorial orbits several new satellites by late 1970 or early 1971. These satellites are to be equipped with so-called earth coverage antennas which direct most of their radiated power toward the earth so as to cover fairly uniformly that portion of the earth visible to the satellite. They are further to be equipped with narrow-beam antennas which direct most of their radiated energy into a very narrow beam which illuminates an area of the earth's surface 1 to 2,000 miles in diameter, and these antennas are to be steerable, so that the beams may be directed toward any selected area of the earth's surface which is visible to the satellite. The satellites are to be positioned above the equator so that most of the earth's surface will be visible to at least one of the satellites at all times. Each satellite will be capable of providing hundreds of voice channels over the portion of the earth that is visible to it, and additional hundreds of channels within the much smaller area illuminated by the narrow beams.

In addition we have decided to program for roughly twice as many terminals, and to initiate development of certain new types of terminals. We have left for later decision the possibility of still more extensive terminal procurements.

Procurement of the new synchronous satellites and development of the new terminal types will be initiated in fiscal year 1969: All other major expenditures will take place in fiscal year 1970 or later.

This next phase of the Defense Satellite Communications System will enable us to provide many times as many channels for unique and vital military needs as are provided by the IDCSP. The concentration of radiated power provided by the narrow beams will enable us to establish these channels to the terminals with smaller antennas which are highly transportable.

Thus we will have the capability, should the urgent need arise, to deploy terminals quickly into a new theater of operations and establish vital communication links into the theater and within the

theater to connect the headquarters of major commands or authorities.

In addition this next phase can give us an important capability to supplement the capacity of the Defense Communications System where necessary.

Because we will shortly be issuing requests for proposals in connection with the next phase of the system, I feel it is inappropriate to discuss the details of design further at this time.

I would however like to review for you some of the factors which have influenced our planning of this next phase.

The technology of satellites and of satellite communications, in particular, has been and is evolving very rapidly. This evolution is driven by the R. & D. programs sponsored by the DOD, by NASA, by the Comsat Corp. and private industry. A continuing sequence of experimetnal and operational satellites have been flown. Most have incorporated and tested innovations or modifications of satellite technology. The cumulative effect of this innovation, testing and evaluation leads from time to time to the engineering judgment that a new level of operational performance is feasible. A particularly striking example has occurred in the past year. Last summer the evidence was in hand to support the judgment that satellites which kept stationary positions above the earth and provided antenna beams which concentrated most of their power in the direction of the earth could be confidently designed for operational use. The accumulation of engineering experience with satellite borne sensors, motors, bearings, electronics, and controls has led, in the past several months, to the confidence that mechanical platforms can be provided and controlled on satellites which are stable in their orientation to within less than a degree in angle, and that mechanisms for steering and pointing antennas can be provided on these platforms and controlled to comparable accuracy, and that such systems can attain mean-times-to-failure measured in years. Thus the combined effects of progress in many areas of technology has made prudent the use of narrow beam antennas for operational systems. Because these antennas concentrate their radiated power into a small area of the globe they can deliver within that area 100 times the power that could otherwise have been delivered.

Thus a very imporant new option has become available.

During this same period, in reviewing our experiences in Southeast Asia and elsewhere, we have gained very clear appreciation of the role which high quality, rapidly established communications channels can play as contingency situations unfold. In Southeast Asia we have spent hundreds of millions of dollars providing long-range communications to and within the theater. Since much construction was required for these conventional fixed plant facilities, the full communications capacity has often lagged many months behind the buildup of forces.

The realistic possibility of narrow beam steerable antennas and smaller highly transportable terminals, together with the clear requirement for a capability for rapid buildup of command communications in contingency situations has led to a qualitative shift in our thinking and planning for the next phase of the Defense Satellite Communications System.

If the main purpose of the satellite system is to provide tough trunking links to the Defense Communications System for unique and vital traffic, then the narrow beams are a poor buy. In the Pacific theater, for example, we have to interconnect Alaska, the continental United States, Hawaii, Guam, Japan, Southeast Asia and Australia, so the value of a narrow beam is small. Its addition increases the system cost, delays initial launch, and reduces satellite reliability.

However, since the main purpose includes requirement to provide rapid communications into and within contingency areas, then the addition of the narrow beam is well worth the cost, delay, and difficulty.

Next I will discuss our progress in research and development in the tactical applications of satellite communications. As we indicated last year our objective is to determine how the technology of satellite communications can best be used to meet some of the important needs of the highly mobile, lower echelon, land forces within the field army and analogous air and sea operations.

As you know, the MIT-Lincoln Laboratory experimental ultra-high-frequency satellite (LES–5) was successfully launched last July into a subsynchronous, equatorial orbit. Since that time, joint test operations have been conducted by the military departments using "off-the-shelf" terminals. In March of this year, the satellite experienced some degradation due to a transistor failure in a preamplifier of the receiving circuit which has limited testing between the smallest terminals. The larger terminals including those of the six NATO countries can still access the satellite and are collecting useful test data.

Another Lincoln Laboratory experimental satellite, the LES–6 satellite, is now in its final stages of checkout. It is scheduled for launch later this summer. This satellite, of much greater effective radiated power than the LES–5, will permit limited multiple access testing, an important feature for a tactical satellite communications system.

The largest experimental satellite in this program, known as TacSatCom No. 1, continues under test and delivery is expected in the latter part of this year. This will permit launch early next year, within a few months of the target date previously reported. In the meantime, the development of the experimental ground, sea, and airborne terminals will be completed under separate contracts and the delivery schedules provide for suitable deployment prior to launch of the satellite.

A joint test plan, which will be completed within the next 12 months, will provide for testing with TacSatCom No. 1 in a variety of networks and configurations, including terminals installed in tactical vehicles, submarines, small and large ships, and operational aircraft of the three military departments. These joint tests will allow the testing of the experimental space and surface satellite communications hardware.

They will, furthermore, provide for tests of operational concepts to determine how best to provide required communications between many diverse terminals of varying size and capability. Many of those tests will take place in simulated tactical environments during the first half of 1969.

Let me conclude this statement by summarizing our progress to date and planning that remains. We have an operational IDCSP system that is providing unique support to the Defense communications system and to our efforts in Southeast Asia. We expect this system to last until at least 1971 by which time we will have deployed several much more capable satellites that will provide significant improvements in global and theater communications. We have approved initial procurement of terminals for the improved system. We are conducting a vigorous R. & D. program to determine how satellite communication technology can support tactical users.

Much remains to be done. We must examine where satellite communications should substitute for other capabilities, and procure corresponding numbers of terminals. We must plan for complementary or follow-on systems which will encompass those tactical applications found feasible and desirable in the TacSatCom tests. We must continue to contribute to the rapid advancement of technology for satellite communications.

I look forward with pleasure to the continued interest and influence of this committee in the development of satellite communications for defense.

Thank you much.

Mr. HOLIFIELD. Thank you, Dr. Tucker.

Developments have been quite rapid since a year ago, haven't they?

Dr. TUCKER. Yes, sir.

Mr. HOLIFIELD. Very pleasing, I am sure, to the members of the committee.

Do you have any questions?

Mr. RUMSFELD. No.

Mr. HOLIFIELD. Mr. Roback?

Mr. ROBACK. Would you discuss a bit the relationship between the ground terminals and the satellites in terms of system cost generally and also the state of the technology? Is it the case that satellite technology is progressing rapidly and terminal technology is lagging?

Dr. TUCKER. I think it is the case that satellite technology is progressing very rapidly. This is in part due to the fact that satellite technology is still very new. The technology of the terminals is certainly moving. Most of the technology is an older art which has been used in communications before satellite communications so the pace of improvement is less dramatic.

We expect that the life of terminals in these systems will be long compared to the life of the satellites with which they operate. The IDCSP terminals will continue to operate with the new satellite system. Those terminals and the ones we introduce with this satellite system will continue to operate after the probable life of these satellites is over.

There is a longer term continuity in the terminal technology.

Mr. ROBACK. But there have been many problems in getting them to operate well. That is, once you get them operating they will last longer but apparently you have had problems all along the line with the terminals, outside of the two old terminals that have been operating since way back in the Syncom days, the 60-foot terminals.

Dr. TUCKER. Well, I think that it is certainly true of the ground terminals——

Mr. ROBACK. Am I right on that? Somebody has a quizzical expression in the audience. Are the 60-foot terminals the ones that have been operating from the old Syncom days?

Dr. TUCKER. Yes, that is correct.

Mr. ROBACK. I didn't want to be in error there. You have a development program for the 40- and 18-foot, and your statement is that in the 18-foot terminals—at this stage of the game—it is hard to tell anything about their reliability or lifetime.

Dr. TUCKER. Yes. I think that the operational experience has not yet been sufficient to be able to make reliable projections. There have certainly been a number of initial problems with them which lend themselves to straightforward correction. When those corrections are made then we will be in the realistic position to assess what the long-term reliability is for these terminals.

RELATIVE COSTS OF SPACE AND GROUND SEGMENTS

Mr. ROBACK. Are the costs roughly equal for the ground and the space systems?

Dr. TUCKER. Mr. Benington, can you answer?

Mr. BENINGTON. The space system is much more expensive than one terminal. A terminal would be 1 or 2 percent of the space system so there is a question of balance as we indicated last year. In order to get an effective system from a cost point of view you have to add enough terminals so you can amortize your costs over enough terminals.

Mr. ROBACK. Once you have the space system operating, the efficacy of the system depends on the number of terminals and kind of terminals.

Mr. BENINGTON. Yes. What happens is if you have very few terminals and you are too low in your terminal population, your effective costs are very high because you are spreading these high space costs over a few terminals. As you increase the number of terminals, you reach a point where you reach the minimum cost per terminal. Then as you add more terminals, and this may make sense, you are adding them so you can have more accesses to the system. Those terminals won't necessarily operate all the time. You make the maximum use of their capability. They will give the user access to the system he wouldn't have otherwise.

We believe the minimal terminal population we have programed gives us this minimum cost point per terminal.

Now we want to see how the requirement for additional access matches off against the cost of the additional terminals.

Now the cost of the terminals is becoming a dominant part of the calculation.

Mr. ROBACK. The cost effectiveness of the terminal population is one consideration.

Another is that if you have budget constraints, you may have less terminals than might be cost effective. Is that right, Mr. Benington?

Mr. BENINGTON. Well——

Mr. ROBACK. That is to say, you might devise an optimum terminal population but if there were budget constraints generally, you might say, "we will defer some of the terminals because we don't have the money this year."

Mr. BENINGTON. We are programing the number of terminals that will let us operate at this minimum cost per terminal. On the other hand effectiveness is more than minimizing cost. It is giving people who need access to the system access to the system.

What the cost effectiveness studies are doing is finding out who has priority need to gain access to the system and how many terminals we should procure to give them access. That will be cost effective even though it costs more.

TECHNOLOGY OF SPACE AND GROUND SEGMENTS

Mr. ROBACK. To what extent does your directorate supervise the Army development program in the terminal business? Is this something which your are closely involved in or is this something which you monitor from a distance?

Dr. TUCKER. Well, I am not sure the phrase monitor from a distance is quite correct—but we review the plans and programs and approve the budgets and set up our objectives and guidelines. Then there is a great deal of delegation in the exercising of the program. If there are serious troubles, clearly we can move in and review and raise further questions and issue new guidance as needed. But these are development matters.

Once the goals are set and the plans are firm it is our normal practice to delegate them very substantially.

Mr. ROBACK. The general sense of the question is: In view of the fact that the space segment always seems to be more dramatic than the grubby issues on the ground, the Army is always saddled with a less dramatic program, and apparently one is entitled to make the preliminary judgment that the technology on the terminal side has really not gotten the same amount of attention and therefore is not keeping pace with space.

Would you say that is true or not?

Dr. TUCKER. I think there is a very important differentiation to be made that a satellite, once launched, is completely inaccessible to any engineering change or improvement or modification. Therefore, the engineering policy has to be to put in added expense and added effort to gain a level of assurance which is very high that it will perform.

In the case of a terminal, after early production there can be a continuing series of engineering changes after you gain initial operational experience, and one puts greater stress on economy of design so that the design philosophy may differ between a completely inaccessible system and one which can be improved if necessary thereafter.

I am not saying you plan to have errors in the system, but I am saying the premium you pay for guaranteed performance may differ. I think the significant number of the terminal problems have been associated with the higher power levels that go into these systems than we have been practicing in a more stable art.

It may take some effort to get the reliability in these high power systems under the kind of control that is generally practiced in our communications electronics.

General Klocko, would you like to comment further?

General KLOCKO. Well, from daily watching of the performance of the system, I would say one difficulty with the ground terminals is we sometimes forget they were originally R. & D. They don't have the

redundancy, the spare parts or the logistics back-up we ordinarily have in an operational system. This has been at the root of a good many of our outages on the terminals. We simply don't have the back-up for the R. & D. effort.

Mr. ROBACK. Why have they been categorized as R. & D? Has this been a budget convenience?

General KLOCKO. No. It was originally designed as an R. & D. effort. Finding out, with the first system we had, it has been declared operational well in advance of the time it ordinarily would be. I don't think there were any particular budgetary restraints I know of.

Mr. ROBACK. In an earlier hearing, General Klocko, we reviewed among other problems the difficulties of terminal refrigeration. Is that an R. & D. problem which has been displaced? That is, are you redesigning systems without refrigeration?

Mr. BENINGTON. In the larger 40-foot terminal there is a cooled parametric amplifier and in the 18-foot terminal there is not. That means that you have fewer problems with respect to that element in the smaller 18-foot terminal than we do with the 40 foot.

PROBLEMS WITH AN/TSC-54

Dr. TUCKER. I think it is our judgment that the AN/TSC-54 is a good terminal with good electronics. It has suffered some problems which are within the power supply and these problems are correctible, and the performance of the electronics to date has been very good.

Mr. ROBACK. Are the problems of the power supply external to the design of the ground terminal?

Dr. TUCKER. Yes.

Mr. ROBACK. Is this because of the incidence of conventional power availability? That is, the kind of generators that might be available in the neighborhood?

Dr. TUCKER. This is Government-furnished equipment to accompany the terminals.

Mr. ROBACK. This is Government-furnished equipment which might have been designed for some other purpose and the hookup doesn't work out too well; is that the problem?

Mr. BENINGTON. It is a movable turbine-powered prime power supply that we use in the field and it is my understanding that one of the problems we are having is with respect to the training of people to maintain that. This is the sort of problem we expect in a program like this and we think we can fix it.

Mr. ROBACK. Is it a matter of improving the generator or improving the terminal?

Mr. BENINGTON. Not that we know of.

SUBSTITUTION OF SATELLITE LINKS

Mr. ROBACK. We discussed with General Klocko the role of satellite communications in displacing other systems and in effecting more efficient and more economical operations.

Can you give us any illumination on this subject? What are the possibilities?

Dr. TUCKER. I think that there are a number of possibilities, certainly. Our total communications system is made up of a diversity of

kinds of links of cables and tropospheric scatter links and high-frequency radio. It is certainly true that this new satellite communications capability will provide important alternatives to those.

We expect that it will replace some planned additions, that it will displace some of the links which are in operation today.

Now that we have the plan to establish the next phase of the DSCS we are undertaking a careful tradeoff study of just which of these things are candidates for displacement. As Mr. Benington mentioned, we have programed the procurement of enough terminals to make the addition of a terminal an economically reasonable thing.

Now the planning of how many further terminals to procure depends on these detailed examinations of displacement of other links with satellite links. That study is in progress.

Mr. ROBACK. You always have a problem of leadtime. One of the services needs a communications facility in a given part of the world. It has to budget for it, prepare for it, and has to rely on what is available. In another department somebody is planning the future of satellite communications.

What is the cross-consideration that will prevent commitment in systems which are potentially obsolete?

Dr. TUCKER. I think now that we have a firm and specific plan for providing the satellite subsystem and we have the performance of available terminals clearly defined, it becomes a straightforward problem to optimize the choice amongst the alternative kinds of links. This is an available link. Two terminals can produce a satellite link with capacities and costs which are now clear.

Mr. ROBACK. Is there any way you can identify some tentative displacements, Dr. Tucker, of older systems?

Dr. TUCKER. Well, Mr. Roback let me divide it into two parts. I mentioned replacement and displacement. I think one of the first issues to examine is the substitution of satellite links for planned additions to our communications plans. An example is the North Atlantic radio system for which there are plans for expansion and it may be that we should substitute satellite links there. There may also be expansions of communications into the Southeast Asia area.

The satellite links now become a reasonable proposal for substitution of those expansions. This is the first set of questions which needs immediate examination and decisions for fiscal 1969 apportionment.

The further questions of replacement of older systems must be worked out in time for the fiscal 1970 apportionments where procurement of new terminals in phase with the establishment of the space system have to be decided.

Mr. ROBACK. Now these are decisions which are pending for the quarterly allocation? There is some decision pending for the next quarterly budget allocation?

Dr. TUCKER. The apportionment exercise is current; yes.

Mr. ROBACK. For the remaining 1969 and for the 1970 budget allocations, where you have made some decisions which have to do with replacement and displacement, will you let us know about that when they are made?

Dr. TUCKER. Oh, yes, I certainly will undertake to do that. Yes.

Mr. ROBACK. To what extent does your directorate participate or direct these decisions? Is this your responsibility?

Dr. TUCKER. We take part in the consolidated review of the communications program so we are taking part in it. However, at this stage they become procurement decisions rather than——

Mr. ROBACK. General Klocko, do you have the responsibility for determining what the economical and efficient mix of communications systems is?

General KLOCKO. We will certainly study that. As I mentioned yesterday, we are already drawing up plans in some of these areas for submittal to the Joint Chiefs to see if they are acceptable and whether they satisfy the military requirements. We will have several. We already have started some and will undoubtedly get into other areas such as the ones Dr. Tucker mentioned.

Mr. ROBACK. The Joint Chiefs lay down requirements, and it is your responsibility to determine how best to meet them in a most economical and efficient way; is that correct?

General KLOCKO. That is right. We draw up the plans to satisfy the requirements and submit them to the Joint Chiefs for approval.

NAVY TERMINAL DEFICIENCIES

Mr. ROBACK. What is the problem with the Navy? What is the problem with the Navy shipboard stations?

Mr. BENINGTON. There are a variety of problems we expect to iron out. This terminal was a very ambitious terminal. It is operating in a somewhat hostile environment of sea water and the ship is pitching and rolling. We had a variety of problems.

For example, some in the control mechanism. Unlike a fixed platform the terminal must keep tracking the satellite and the platform is moving so you are constantly moving the terminal antenna. There have been some problems in that system. We believe these will be licked.

Mr. ROBACK. Is that in the direction of stabilizing the platform or adjusting the tracking mechanism?

Mr. BENINGTON. Adjusting the control mechanism so it can very reliably, given the ship's attitude which is known for other reasons—for example, controlling guns—it can take the known ship's attitude and known position of the satellite and constantly keep the antenna pointing at the satellite.

Mr. ROBACK. What else were you going to say?

Mr. BENINGTON. Other problems in the electronics. Problems of sea water getting in and hurting some of the equipment.

Mr. ROBACK. In what sense is the program ambitious? In the sense of the smallness of the terminal?

Mr. BENINGTON. That coupled with the fact that we wanted to get a terminal that could operate with the IDCSP where we could start doing operational evaluation. We have an R. & D. program underway now which is looking at alternative ways of doing this, given roughly the same terminal configuration and size but making sure we have a terminal that this time has been engineered for very high reliability.

LIFETIME OF TACSATCOM

Mr. ROBACK. You mentioned the joint test plan for the tactical satellite. What is the anticipated orbital lifetime of the tactical satellite which will be launched?

Dr. TUCKER. The TacSatCom 1 experimental—Mr. Shelor, can you answer that?

Mr. SHELOR. We estimate approximately 30 months.

Mr. ROBACK. Is that going to be turned off in 30 months due to being a new technology? Offhand, why isn't this a 6-year proposition?

Mr. SHELOR. The answer to the first question is that we will be able to command the turnoff. We have a link that only we can control.

Mr. ROBACK. So you wouldn't have the problem of permanent turnoff?

Mr. SHELOR. That is right. No time limit. The answer to the second question: This is a very sophisticated and complex satellite and we think 2½ years is a pretty good goal to shoot for in the R. & D. program.

Mr. ROBACK. Does this conform to the practice of the trade? Having 30 months lifetime for the first one.

Dr. TUCKER. Practice in the trade? I am not sure there is a practice in the trade.

Mr. ROBACK. What was the operating life with Syncom? Eighteen months predicted or scheduled?

Mr. SHELOR. I am not sure. The IDCSP originally was 18 months.

Mr. ROBACK. Maybe Syncom was 18 months. Apparently, from what we have been advised by General Klocko, he is still getting information out of it, is that right?

General KLOCKO. Yes.

Mr. ROBACK. Still operating?

General KLOCKO. Yes.

Mr. ROBACK. How many years now, General?

General KLOCKO. Four years.

POSSIBLE USES FOR LONGER LIVED TACSATCOM

Mr. ROBACK. In view of the 30-month life of the first tactical satellite, you have not predicated any communications resource on the basis of that satellite. That is, one that would require some extended operational time.

Dr. TUCKER. No. It is an R. & D. satellite. Its purpose is to enable us to carry out the test plan to evaluate the use of satellites in tactical operation so that we can make a proper decision about what kind of operational system we ought to have.

It may well be that at the end of the special program the satellite will still be alive in orbit, and we can then use it for some limited additional purposes, but this is not a major intent of the program.

Mr. ROBACK. If you acquire bonus lifetime, so to speak, Dr. Tucker, what might you do with it?

Dr. TUCKER. Mr. Shelor, can you address what we might do with the capability that remains?

Mr. SHELOR. We might reposition it over any portion of the world where we had a situation that could be helped by a limited number

of tactical channels. Limited in that we wouldn't have a large number of terminals or an operationally designed satellite.

Dr. TUCKER. Use it for selected coverage.

Mr. SHELOR. That system only has an earth coverage antenna on it. It does not have a high-gain antenna.

Mr. ROBACK. Is there any rationale for a high-gain antenna on that type of satellite?

Dr. TUCKER. Yes, there might well be. The answer I think will depend on the results of the test program and the analysis of the sorts of tactical operations which satellite communications will support. If they are of a character where you need operation within limited areas, it's very likely.

It's also likely because the directional antenna gives you a much higher power at the earth's surface and therefore you can use much small terminals. So it's a very plausible feeling that an operational tactical satellite might have such steerable antennas.

It also depends on the choice between the superhigh frequencies and ultrahigh frequencies, both of which are being studied in the special system.

Mr. ROBACK. Can you briefly describe in a public statement what you will be testing in this joint test program? The types of communications capabilities or possibilities?

Dr. TUCKER. Yes. Mr. Shelor?

Mr. SHELOR. We will be testing a number of different types of operational networks, including ship to shore, ship to ship, air to air, between tactical-type aircraft or some strategic-type aircraft, submarine to shore—

Mr. ROBACK. How about submarine to jeep? That isn't feasible?

Mr. SHELOR. It's feasible, but it's not a normal type of network.

Mr. ROBACK. Will there be jeep antennas?

Mr. SHELOR. Yes, jeep terminals. Even team packs that can be carried by three men, and we will be testing those in conjunction with the jeep-mounted and the 1¼-ton, which is the largest we have. There is also a broadcast receiver, alert receiver, with a receive only capability that can give general alerts.

Mr. ROBACK. What is the maximum transmission distance? In other words, can you have long-distance communication to the man in the field? From the Pentagon to the man-pack? Can you communicate long distance with this tactical satellite?

Mr. SHELOR. You conceivably could if the satellite was within line of sight of the two terminals. That is the only requirement.

Mr. ROBACK. I can see where the President will be giving a morale booster to the sergeant, and also probably trying to run the platoon operations.

Dr. TUCKER. We may use the one-way receive-only terminals [Laughter.]

Mr. ROBACK. This launch is scheduled for the fall of this year, would you say?

Mr. SHELOR. Early part of next year. First of the year.

Mr. ROBACK. Is this on schedule?

Mr. SHELOR. Approximately. It is a couple or 3 months later than we gave you last year when we testified.

Mr. ROBACK. There has been some slippage in the development program?

Mr. SHELOR. There have been a few unexpected problems, but a small amount of slippage compared to the complexity of the satellite, we believe.

Mr. ROBACK. Are the problems in the public domain?

Mr. SHELOR. No. One—I wouldn't want to discuss them in an open hearing.

STEERABLE NARROW-BEAM ANTENNA

Mr. ROBACK. In view of the pending procurement of the phase 2 satellite, you said you didn't want to discuss the details, but can you discuss here the technical state of the art in the steerable narrow-beam antenna?

You said evidence of workability was in hand last summer. Where did the evidence come from?

Mr. BENINGTON. From a number of programs, Mr. Roback. Many of them have not been associated with communication satellites; some of them being classified. I think one very important development was a way of stabilizing the platform without spinning it, so we could have the portion which generates and handles the radio frequency stabilized and not spinning around.

This sort of stabilization technique is being developed in the tactical satellite program. So that is one important source of competence. In addition, there have been numerous engineering studies on the part of the Department and on the part of manufacturers as to what sort of risks are involved as we get an accumulation of technologies from many sources.

And these studies convinced us and some of the more knowledgeable manufacturers who support us, NASA and the Intelsat program, that this technology is coming about. As a matter of fact, this narrow-beam technology is not unique to the Government, but the Intelsat 4 satellite is considering using this same form of technology.

Mr. ROBACK. Why would a commercial communications entity be interested in that? Is that for dedicated or specialized service?

Mr. BENINGTON. For example, in going between the United States and Europe. By proper selection of the beam to cover Europe where you tend to have a lot more traffic within highly populated areas, both within the European area and coming back to the United States, and this could turn out to be an attractive feature.

Mr. ROBACK. The concentrated energy would be in the high-density traffic areas. That is the rationale.

Mr. BENINGTON. Exactly, yes.

Dr. TUCKER. And by using two steerable beams, one directed to one population center and another to another population center, you could establish links between them with very high volume.

Mr. ROBACK. Some of this technology was developed in relation to the Comsat program, you say?

Mr. BENINGTON. Or manufacturers anticipating what Comsat would be looking for, yes.

Mr. ROBACK. So you benefited from the general work that has been done for Comsat in this area.

Mr. BENINGTON. I think it would be more fair to say that a number of agencies in the Government and private industry have been pushing a number of technologies. There is a common pool of technology that has been coming, and I think it would be unfair, in most cases, for any particular supporting agency to take credit for something in that particular pool of technology.

The management problem is one of deciding, as Dr. Tucker indicated in his testimony, when to precipitate out this technology and deploy a system.

Mr. ROBACK. You did have some rather specific defense programs in this area, is that right?

Mr. BENINGTON. Yes.

Dr. TUCKER. That is right.

ANNOUNCEMENT OF PHASE 2 DECISION

Mr. ROBACK. You stated, and I take it in a sense announced, at this hearing that phase 2 programs are going to go ahead, Dr. Tucker. This was a matter of consideration over a period of time. Let us talk a bit about what the decision is. What were the alternatives?

Was one of them not to go ahead? That is, to defer—or perhaps to discontinue?

Dr. TUCKER. Well, Mr. Roback, we reviewed many alternatives and seriously treated four. The first was to continue research and development, but to postpone any procurement until fiscal 1970. The second was the——

Mr. ROBACK. This would have had some budget value in the sense that you wouldn't have to spend procurement dollars, right?

Dr. TUCKER. It would have had procurement value. It would have given us an opportunity to inaugurate further technology at a later date.

Mr. ROBACK. To some extent the directorate of R. & D. is always interested in looking to new technical possibilities, having thereby, perhaps, some tension with the operating area that General Klocko is concerned about. The R. & D. man wants to wait for the more promising potential. The operator is crying for communications. Has that difference been involved?

Dr. TUCKER. I would say the directorate of R. & D. is very much concerned with delivering the products of R. & D. to an operational situation. That is our purpose in being. So we don't do research for the sake of research. We do research and development in order to introduce things into operation which could make a difference.

Mr. ROBACK. Now, Dr. Tucker, you were discussing the first or second alternative?

Dr. TUCKER. I am ready to define the second alternative, which is the one we have selected. The third alternative agreed with the second one in terms of the space segment, but programed a larger total of terminals.

The fourth alternative was also predicated on the same space segment and the larger terminals, but shifted the terminal buy earlier into time, so it was initiated with fiscal 1969 funds. All of these last three alternatives assumed the same space segment because there is a very considerable conviction that we have now arrived at a capability or an

important step ahead in the kind of space system which we can deploy with the steerable antennas.

And there is really no debate about the appropriateness of that. The alternatives for a decision to procure differed in the treatment of the terminals. Those were the four alternatives considered.

Mr. ROBACK. Then it is fair to say that as far as the technology of the space segment is concerned, within this time frame, that technology is optimized and there is no serious question about that.

Dr. TUCKER. That is true.

Mr. ROBACK. But any budget compromise or adjustments that are made apply to the terminal population.

Dr. TUCKER. Yes.

Mr. ROBACK. But that is not a degrading feature, because as soon as funds become available, you increase the population to its cost effective number, is that right, Dr. Tucker?

Dr. TUCKER. I think, Mr. Roback, that we should say that the terminal buy which we have decided on is cost effective in the sense which Mr. Benington described. It does get you to a minimum cost per additional terminal.

The further buy is therefore predicated on the question of displacing other systems with a cost advantage, or picking up new requirements and capabilities which are justified in themselves, so the decision on further terminal acquisitions is one of economic tradeoff or functional requirement.

Mr. ROBACK. You referred in your statement to the fact that this decision would be made after consultation with appropriate committees. Does this suggest you have some reprograming decisions that have to be made?

Dr. TUCKER. There will be some effect in the fiscal 1969 apportionment, but I think the point is that in initiating any major new program of this sort, we do review it with the appropriate congressional committees as a matter of policy and procedure.

Mr. ROBACK. But there isn't any qualification on the decision, Dr. Tucker, as far as Defense Department is concerned?

Dr. TUCKER. The Defense Department has made a clear decision, Mr. Roback. We must review that decision with Congress.

Mr. ROBACK. Would you characterize the Defense sponsorship of R. & D., of technological progress in this field, as lagging behind that of NASA or Comsat or ahead of it?

Dr. TUCKER. No, sir; I certainly would not. I think we are playing a very large role in the sponsorship of R. & D. throughout this pool. We have a cooperative program with NASA. We review the total effort with them, and we share their results, and they share ours.

I believe the Department of Defense made a large and leading contribution in the field.

NATO COOPERATIVE PROGRAM

Mr. ROBACK. What is the nature of the joint research effort with NATO? What are you seeking in that research area?

Dr. TUCKER. In the cooperative program with NATO in the tactical——

Mr. ROBACK. That is in the tactical applications?

Dr. TUCKER. Yes. Mr. Shelor, do you want to address the joint goals?

Mr. SHELOR. Primarily it is an exchange of measured data and performance on the satellite and terminals. Such things as propagation data, multipaths, scintillation.

Mr. ROBACK. Would all the terminals of the NATO, United States, and United Kingdom be compatible with all systems here; that is to say, with both the phase II satellites and the tactical satellites?

Dr. TUCKER. It is our goal to make the terminals interoperable so that they can work through the SKYNET satellite system or through our satellite systems. The way in which this is implemented is something we are still working out.

Mr. ROBACK. Is there going to be any design adaptation for that. You refer to an exchange of data on a tactical program. Will the United Kingdom ground stations be able to communicate over TacSatCom, or whatever it's called?

Mr. SHELOR. The agreement at the present time only concerns the LES–5 satellite. This, of course, I would remind you is a UHF satellite, so those terminals can only communicate on the LES–5 satellite. They can't interoperate with IDCSP, for example.

COMPATIBILITY OF U.S. SYSTEMS

Mr. ROBACK. What is the compatibility situation between phase 2 synchronous satellites and tactical satellites in this country?

Dr. TUCKER. This is a question which, as I indicated in my testimony, is still ahead of us. The question of the way in which we will provide the tactical applications which are justified as a result of our special study with the TacSatCom. As we have the results of that study in hand, part of the issue to be determined is how the systems to satisfy the tactical requirements and the systems to satisfy the requirements which DSCS are addressing, how these are to be handled in a most effective manner.

I think it is premature for me to take a position now on the optimum solution of that problem until we see more clearly what those tactical applications will be, and how they will best be handled. In particular, it depends——

Mr. ROBACK. Will the stations be operable that you have for phases 1 and 2? Will they be operable technically, or will they have to be improved, Dr. Tucker?

Dr. TUCKER. Insofar as the tactical terminals are in the UHF frequency range, Mr. Roback, they can't operate in the DSCS system. The satellite only handles SHF signals. Insofar as the terminals are communicating at SHF, the larger terminals could go through the space repeater in the DSCS system.

It would then be technically possible, and the question would be the network control or the allocation of power to these terminals. That is a matter we can work out.

NEEDS OF NATO

Mr. ROBACK. What is the NATO interest in the satellites, so far as capability goes? I don't want to get in a field you may not be directly concerned about. Perhaps General Klocko can address this question.

Why does NATO need a satellite as far as space is concerned? That is to say, they have a concentrated area. There is talk about NATO

extending its concern to other parts of the world, but I assume they have a fairly localized traffic.

General KLOCKO. I could surmise, but I would guess that the NATO community has been trying to keep up with the state of the art in getting a method of communication, which they don't have which has a reliability, survivability, and certain other aspects not true of some of the other methods of communication they have.

Mr. ROBACK. Would it be able to bypass the French or Italian telephone systems? That might be an asset.

General KLOCKO. It would indeed. [Laughter.]

Mr. HOLIFIELD. Incidentally, this committee's first interest in this matter was when we found an Air Force base in the tip end of Italy was depending upon the Italian commercial telephone line to get their signal from NATO. That was several years ago.

That was the only communication they had. That was when we started pushing for these independent communication systems which would not be dependent upon local commercial systems.

Dr. TUCKER. I think it's very clear to us that one of the important advantages of the satellite communications system to the United States is the independence of these communication links on any third party or system owned by others. The fact that the terminals are located where we are located and the satellite is under our control is a very important feature.

I presume the same feature is important to the NATO organization.

Mr. BENINGTON. At the time that Ambassador Cleveland proposed this program, I think there was considerable concern on the part of various NATO states that the heads of government and the foreign ministries and ministries of defense could communicate well with the North Atlantic Council.

These would be rugged, independent, secure communications. The proposal was very receptive.

Mr. ROBACK. Is the fact mentioned here, that the United States will control the ground stations, due to the fact that the SHAPE commander is American?

Dr. TUCKER. I think that is primarily due to the fact that we have a technical capability of controlling the positioning of the satellites.

Mr. BENINGTON. Position keeping of the satellite in its synchronous orbit position—not control of the ground terminals.

Mr. ROBACK. Excuse me. This was in contradistinction to the United Kingdom, which would control its own satellite after orbit. But in NATO we would be controlling. This is a matter of capability rather than protocol.

Dr. TUCKER. This is engineering control of the command to the satellite to position it and so forth. The United Kingdom has that capability. We have that capability.

Mr. HOLIFIELD. One of the reasons we felt that the Defense Department should be independent of Comsat was the international control of the ground stations, and we looked forward with some apprehension to the time of crisis when that control would be out of our hands.

Mr. ROBACK. What is the significance of the packaged teletype channels from a communications standpoint, General Klocko?

General KLOCKO. It's standard communication procedure. On one voice channel you pack 16 or 26 or 28, possibly even more, teletype channels. It's the same type of communications operation which takes place in any type of communication, cable, tropo, microwave, anything.

FACSIMILE COMMUNICATIONS FROM VIETNAM

Mr. ROBACK. Is there anything you can say about the photographic communications? Are photographic communications common in, say, commercial satellite communications, or any other kind of communications?

General KLOCKO. No, sir; well——

Mr. ROBACK. Is this a new development?

Mr. BENINGTON. The technique we are using——

Mr. ROBACK. We would like to see that exhibit now, if you don't mind. I would like the Chairman to see it.

Mr. BENINGTON. The technique we are using is a very high-speed facsimile. In that sense it's quite unique.

Mr. ROBACK. Mr. Benington, I interrupted you. Excuse me.

Mr. BENINGTON. I merely wanted to point out this is a high-speed facsimile—a very high-quality facsimile technique. Unlike television, where a picture is transmitted in real time at the same time the action is developing, in this technique we take the photograph and put it under a sensor device whch can get very high resolution and transmit that picture.

That is a unique technique.

Mr. ROBACK. Is there any reason why Comsat can't use this commercially for newspapers or whatever?

Mr. BENINGTON. There are some aspects of it that are still classified.

Dr. TUCKER. In addition, I think there is the problem that to arrange for this kind of channel capacity means a considerable displacement of normal voice communication.

Mr. ROBACK. It's not an efficient use of the communication channel commercially.

Dr. TUCKER. It might not be a commercial use.

Mr. ROBACK. It takes up spectrum space and circuitry.

Dr. TUCKER. Yes.

STATUS OF 30 CIRCUITS IN FAR EAST

Mr. ROBACK. I wanted to ask General Klocko, while we have him here, to summarize briefly, if he would, the situation with regard to the assignment of the Comsat contract for 30 circuits in the Far East. This assignment, which was recommended by the committee, and was, I suppose, part of the FCC order, has taken a considerable time to effect.

I want to know what the problem was.

General KLOCKO. I have a statement here which I would like to read, which recaps this. With the approval of the Secretary of Defense in September of 1965, DCA initiated negotiations with the Communications Satellite Corporation, Comsat, and the U.S. international carriers to provide 30 satellite channels for restoral and diversity of high-priority cable channels in the Far Pacific area.

On the basis of competitive procurement practices, the award was made to Comsat on July 11, 1966. The contract covers the lease of 10 alternate-voice data satellite channels between Hawaii and Japan, Hawaii and the Philippines, and Hawaii and Thailand, for a total of 30, with a service date of April 1, 1967.

Provision was made in the contract for Comsat to assign its rights under the contract to the international common carriers if it were to be determined to be in the national interest or directed by appropriate authority.

In mid-August of 1966, the circumstances surrounding the DCA lease of 30 circuits from Comsat was the primary subject of the Holifield hearing. On February 1, 1967, FCC ruled that Comsat could initially provide the service to DOD, that is, the Department of Defense, until transfer to the international common carriers after service became operational.

Based on the FCC ruling, DCA directed an equitable assignment of the 30 circuits to the international common carriers. As a result of this action, Japan and Thailand took exception to the assignment of leases to certain U.S. international carriers.

This matter was formally presented to the FCC for resolution in May of 1967. Meanwhile Comsat provided the services to the Philippines in April of 1967, to Thailand in May of 1967, and to Japan in June of 1967.

In late August 1967, FCC replied to the effect that the DCA-directed assignment could not be achieved and that Thailand would only accept an assignment of the 10 circuits to RCAC, RCA Communications, and Japan would not accept any assignment to Western Union International.

On September 8, the director of DCA directed the chief of (DECCO), Defense Commercial Communications Office, to assign the 30 circuits to the international carriers, with a target date of October 1, 1967. Are you interested in the assignments to each carrier?

Mr. ROBACK. You can submit that for the record. Go ahead, if it isn't too long.

General KLOCKO. Because of legal, contractual and administrative problems, the assignment could not be effected on October 1. On October 3, the PhilComsat organization advised Comsat that it had decided to maintain the current working relations between Comsat and PhilComsat, and not to disturb the contractual relationship pertaining to Philippine channels.

The director of DCA advised the FCC on October 17, 1967 that this problem would preclude an assignment until DCA could make an equitable assignment calling on one carrier being responsible for a circuit on an end-to-end basis. The FCC referred this matter to the State Department.

On January 16, of this year, word was received that PhilComsat had agreed to the assignment and the assignment to the carriers was accomplished on May 1, 1968. I have the distribution which will be in the record.

Mr. ROBACK. What was the problem of the end-to-end? In other words, if the Philippines only wanted to deal with Comsat, and Comsat wasn't in a position, because it only had the space control, to give end-to-end service, is that the point?

General KLOCKO. We had conflicting directives. DCA was directed to assign the circuits to the international carriers, but the Philippines didn't want the international carriers. While at the same time we couldn't keep the United States end of the Philippine circuit with Comsat because that was against the FCC ruling.

We were in effect in a stalemate until the Philippine Government did actually agree to allow the international carriers to take the channels.

Mr. ROBACK. So the Philippine Government had started off with Comsat, had gone to the carriers, come back to Comsat and now are back with the carriers.

General KLOCKO. Yes, sir.

Mr. ROBACK. Adjustments had to be made in the case of the other carrier allocations somewhat, in view of the stated preferences of the Government of Thailand and the Government of Japan.

General KLOCKO. Yes. We readjusted to get the distribution as equitable as we could.

Mr. ROBACK. Now the assignment is working. The contract has been assigned, the traffic is being handled by the carriers.

General KLOCKO. Yes, sir; as of the first of May this year.

Mr. ROBACK. Have you any information, any new information on the rate situation?

General KLOCKO. Yes, sir. A particular aspect.

Mr. ROBACK. What has happened? What kind of developments? Also, would you address yourself to the problem of whether you are going to procure any Atlantic satellite circuits?

General KLOCKO. Yes, sir. The rates have come down on the foreign side. In the Philippines, in 1967, when they originally had the agreement with Comsat, they were charging $26,645 for their down-link. The price now is $10,710. Next year it will be going down to $9,210.

There has been a considerable reduction. Thailand, in the same way, from an original price of slightly over $27,000, they are now down to $8,850.

Mr. ROBACK. These have been substantial reductions.

General KLOCKO. Yes.

Mr. ROBACK. The fact that there has been a composite rate, which in a sense was worked out to effect this assignment, and also to effect a rate reduction to the Government, hasn't been—it can't be said that it is discouraging the economic benefits of new technology, necessarily.

General KLOCKO. No, sir.

Mr. ROBACK. The point was that if Comsat wasn't going to deal directly with the Government, and DCA was somewhat involved in saying this, allegedly the benefits of the new technology couldn't be derived, but this composite arrangement has effected substantial rate reductions as far as the Government is concerned.

General KLOCKO. The composite arrangement applies only to the up-leg on the U.S. side. The main reason for the lowering of the rates on the downside is the size of their ground terminals. They have put in recently—these countries, the Philippines and Thailand, larger ground terminals, which cuts down the cost of each channel.

Mr. ROBACK. Have you any savings figures projected over a period of any given recent time?

General KLOCKO. I would say that the 30 channels in 1967 cost $767,000. The same channels next year will cost $410,000 or a little more than half of the original cost.

Mr. ROBACK. What about the savings that applied to across-the-board reductions? How are they affected? That is to say, composite rate savings.

General KLOCKO. Composite rate savings, I forget the numbers on that.

Mr. ROBACK. You can submit a little summary.

General KLOCKO. We will give you the estimate we have.

Mr. ROBACK. Submit us a little paper on that point.

General KLOCKO. Yes. With respect to the Atlantic, we certainly hope to take advantage of the Intelsat activities in the Atlantic area. Exactly what this will be will depend upon the requirements at the time this becomes operational. We do have some channels now, as I mentioned yesterday, and we hope to get some additional channels.

(See app. 5, p. 108.)

Mr. ROBACK. You have some satellite channels in the Atlantic.

General KLOCKO. Yes, sir.

Mr. ROBACK. For the record, can you tell us how many?

General KLOCKO. Six.

Mr. ROBACK. They are bought from one of the carriers——

General KLOCKO. One or more.

Mr. ROBACK. One or more carriers.

General KLOCKO. Yes. As a matter of policy, we ordinarily try to spread across the carriers.

CONTRACTOR STUDIES

Mr. DAHLIN. You mentioned you were undertaking at the present time a study of the possible displacements or replacements. Where is that type of study being done? In-house, or is there some contractor involved?

Dr. TUCKER. That is done within OSD.

Mr. DAHLIN. Including DCA?

Dr. TUCKER. Yes.

Mr. DAHLIN. Whose function is that kind of study?

Mr. BENINGTON. The detailed analyses are done by the operating agencies such as DCA and the studies are integrated within OSD.

Mr. DAHLIN. Are there any task orders put on the support contractors for this kind of study? Or is all this a matter of in-house man-hours as far as the studies being conducted?

Mr. BENINGTON. I think General Klocko should comment on that.

General KLOCKO. I am sorry I didn't hear the first part of the question.

Mr. DAHLIN. Are there task orders being placed on your support contractors for this type of function?

General KLOCKO. No, not that I know of. We don't have any that I know of, any contracts out now.

Mr. DAHLIN. Have you had in the past?

General KLOCKO. We will run the study ourselves but some of the engineering details may be supplied by contractor.

Mr. DAHLIN. How about the studies of tactical communications? Does that all come under DCA?

General KLOCKO. No, sir. Tactical communications is under the Joint Chiefs of Staff.

Mr. DAHLIN. Are there any studies necessary of the interfaces between tactical and DCA-type communications?

Mr. SHELOR. Yes. We anticipate those studies would be conducted by the services, JCS, DCA, and participated in by OSD.

TACTICAL SATELLITE EXECUTIVE GROUP

Mr. DAHLIN. Is that the kind of problem that comes under the triservice committee?

Mr. SHELOR. The triservice executive group, which has been renamed since the Marine Corps became represented in the group, is the tactical satellite executive group now, and is concerned with administering the advance development program so they would participate and would be the focal point for the services, Mr. Dahlin, but since the relationship with DSCS is involved in operational questions, it also involved DCA, JCS, and OSD.

Mr. DAHLIN. If further decisions have to be made, is this tactical satellite group going to serve as the primary means of managing the tactical satellite program for the foreseeable future? Or are you about coming to the end where you can have a committee effort?

Mr. SHELOR. We believe that this group has been very effective and should continue through the advanced development phase.

Mr. DAHLIN. Through the advanced development phase. That is how long?

Mr. SHELOR. Through the joint test. About the next 12 months. We will consider how the program should be managed following that.

Mr. DAHLIN. That is through the test of the LES–6?

Mr. SHELOR. Through the test of the TacSat–1.

Mr. DAHLIN. Through the test of the TacSat–1.

Mr. SHELOR. Yes.

Mr. DAHLIN. You plan to keep TSEG in operation that long?

Mr. SHELOR. Yes.

Mr. DAHLIN. Have there been any funding or coordination problems in this connection with TSEG? Does it seem to work effectively?

Mr. SHELOR. No; it worked quite effectively. There have been a number of common buys in areas such as terminal equipments and modules where one service is procuring for all services so there is a lot of commonality and saving in dollars. In other words, we have gotten more terminals for the given amount of R. & D. dollars we had to invest. I think it worked out well. The joint test on the LES–5 has been well coordinated and planned and there has been no problem in coordination between the services.

DCA SUPPORT CONTRACTS

Mr. DAHLIN. Does Systems Science Corp. still support the DCA effort?

General KLOCKO. Systems Science? Yes; it does.

Mr. DAHLIN. Is there still a hardware ban problem in connection with that company?

Mr. COHEN. Yes. Same hardware exclusion clause as applied before.

Mr. DAHLIN. Is there discussion of a pending merger of that corporation with another company that would involve complications of that sort?

Mr. COHEN. The parent corporation of Communications & Systems, Inc., is Computer Sciences Corp. who is planning a merger at the moment with Western Union.

Mr. DAHLIN. Will that affect the support given to DCA?

Mr. COHEN. The hardware exclusion applies to Communications & Systems, Inc., and maintains an effective wall between Communications & Systems and all other parts of the parent corporation and, therefore, the same separation should be maintained between Communications & Systems and Western Union if that becomes another subsidiary of Computer Sciences.

Mr. ROBACK. Western Union, if it takes over the parent——

Mr. COHEN. Western Union would be taken over by the parent, by Computer Sciences.

Mr. ROBACK. What happens to Western Union's contractual operations in the AUTODIN program? Does that create any problems?

General KLOCKO. I would not think that would be affected.

Mr. ROBACK. In other words, the new corporation would take over. You wouldn't have any conflict of interest with regard to having one of the subsidiaries as close-in adviser, considering the fact that the FCC is concerned about and has received submissions from many industrial sources about the close relationship between communications and computers? You get into a whole complicated field of operations here.

Mr. DAHLIN. Is there any approval required by DCA in the event of this merger, General?

General KLOCKO. I should not think we would be consulted.

Mr. DAHLIN. You are consulted only in the sense you have to approve the transfer agreement in connection with that hardware ban, is that correct?

Mr. MORSE. Conceivably we will get involved. To what extent I don't know. It depends on the relationships between Western Union and the parent company. As to the effect of the hardware exclusion clause, how it will affect the total picture, I don't know yet until I see what the merger will be and what the relationships will be. Also what the FCC's position will be in the matter I don't know either. As Mr. Roback said, the relationships between computers and communications services which the FCC is looking at could also have an effect.

I think these are all things we will have to study. At this point in time I am not prepared to say what position we should take in the matter.

Mr. DAHLIN. I hope we have enough people to study these things.

Could you submit a supplementary statement of the various support contractors and the present size of their contracts and at least a description of their present tasks and assignments in all fields related to DCA and any major ones of the services that are directly affected and that coordinate with these particular operations that you have if there are any such?

General KLOCKO. I know we have them for DCA. We can probably get them from the services, Mr. Dahlin.

(The information referred to was furnished and is being retained in the subcommittee files.)

CONTINGENCY COMMUNICATIONS

Mr. DAHLIN. Has anyone studied this function of providing contingency terminals in communications as a separate tradeoff sort of problem to see if it is done effectively or not? That is, different kinds of contingency terminals and how much total money and resources are being put in by each of the services?

Dr. TUCKER. The contingency capability that we anticipate with the satellite system is in many ways unique to the satellite system. There are some questions of tradeoff, certainly, with the development of transportable troposcatter terminals and so forth, but there are quite a number of applications in which the satellite terminals are uniquely capable of giving rapid deployment of online communications, so it is viewed primarily as an additional capability rather than as an alternative to other means.

TECHNOLOGY AND RESEARCH

Mr. DAHLIN. You talked about that in connection with the replacement of the North Atlantic HF channels. Didn't you mention that as one of the possibilities of a net kind of replacement? There are also developments in the trade, aren't there, and attempts to provide better communications in all these modes and those have to be traded off——

Dr. TUCKER. That is absolutely true. We have a variety of communication links or a variety of technologies which we can use and there is continuing progress in research and development and changes in the economics for all of these media. They certainly have to be considered as you make decisions where the best solution is to use the satellite system.

I think the progress in the satellite area has recently been most dramatic, Mr. Dahlin, because of the confidence in the steerable antenna which makes a rapid change in the economics for that kind of technology.

Mr. DAHLIN. As a related kind of technology there is a story in a recent journal, Journal of the Armed Forces, talking about "bandwidth compression" or compressed communications. Is DCA or the Department of Defense sponsoring any considerable amount of research in this area of "compressing" bandwidth, trying to get more use and channels out of it?

Dr. TUCKER. Oh, yes. It is a subject which has been of concern in the R. & D. community for some time. Defense has been active in considering bandwidth compression techniques.

Mr. DAHLIN. So far there is no danger anyone can "compress the bandwidth" faster than the development of other modes, I take it.

Dr. TUCKER. Any significant bandwidth compression will be utilized I suspect in most of the modes we are talking about. It means that you have the ability to transmit speech, for example, using less of the total bandwidth which is available in your system. If you make the investment in terminal complexity required to do that bandwidth compression, then you can gain in the capacity of the communications system which you are using so it is a very important tradeoff.

Mr. DAHLIN. In that respect, how about digital communications itself? Is the Defense Department supporting that kind of research with its own funds or are you just taking advantage of other technology?

Dr. TUCKER. We are supporting that research ourselves.

Mr. SHELOR. For example, the common joint mode of operation in the TacSatCom advanced development program will be a digital mode of communications for both data and voice.

Mr. DAHLIN. Could you supply a supplementary statement of the amounts of money and the types of contracts that you are presently putting into both compression and digital types of development?

Dr. TUCKER. We will be happy to provide you with a statement.

(The information is classified and furnished for committee files.)

CHANNEL CAPACITY OF AN/TSC–54 TERMINALS

Mr. LUMAN. One question about TSC–54.

In your statement you point out you upgraded the MSC–46 to accommodate a much greater number of channels. Are you going to give the 54 any greater capacity?

Mr. BENINGTON. We do not plan to at this time.

Dr. TUCKER. No plan at this time to do so.

Mr. BENINGTON. When operating with the IDCSP, that is an important qualification. When operating with the phase 2 system, we had some proposals to go to several hundred channels per 20-foot antenna.

Mr. DAHLIN. You at the present time are not buying any equipment that is called multiplex, I take it, where you get many channels out of present equipment. Is it mainly in that area that this multiplex development takes place or——

Mr. BENINGTON. We had been doing preliminary developments of equipment here that can be used for phase 2 and now that we know more precisely what phase 2 system we are proceeding with, those engineering developments will accelerate so by the time the advance space system is available we will have suitably modified terminals available to take advantage of it. These would be modifications primarily in the electronics, not in the power, antennas, or the drives.

Mr. DAHLIN. But you have to start now to develop that sort of terminal equipment, is that the point, Mr. Benington?

Mr. BENINGTON. That is correct. It is well within the state of the art. We have to make sure we engineer the proper multiplex equipment to operate with the new system, Mr. Dahlin.

AIRCRAFT CNI COMMUNICATIONS

Mr. DAHLIN. What is the present relationship of the Air Force-managed programs in communication, navigation, et cetera, multipurpose systems to the tactical and strategic communications that are now being worked out? In other words, there are some proposed nets for CNI satellites or others in air traffic control.

Are there areas of coordination where you have to have development work going in now in these fields to work out future problems?

Mr. SHELOR. That effort is in the early stages of exploration. The requirements, the general concepts are just being developed. It lags—

it would appear to lag considerably behind the first generation of the tactical or the second generation of the DSCS. It is coordinated. We are monitoring this from within Dr. Tucker's——

Mr. DAHLIN. Two years off at a minimum?

Mr. SHELOR. At least.

Mr. DAHLIN. If there were this kind of particular satellite for mainly aircraft use, I take it, it would have to be a dedicated satellite. Is that the present idea? You couldn't make a TacSatCom work for this purpose, let's say?

Mr. SHELOR. Actually if you want to obtain navigation from the satellite, most of the concepts require multiple satellites in synchronous- or near-synchronous-type orbits providing both the communications and the navigation capability. I think it is something that TacSat might evolve into along with the next generation of Navsat but I think it is in that time frame.

Mr. DAHLIN. Is it then the kind of problem that would be solved by some successor organization of TSEG? Some day they will merge in management, is that it?

Mr. SHELOR. In my view it certainly requires an interservice consideration because navigation is a common requirement to all the services and to the civil community also and I think that the requirements DOD-wise, the joint requirements, need to be laid down and the system concepts evaluated against those requirements. So it may not be TSEG but some way we have to pull this information together.

LEASE OF BANDWIDTH

Mr. DAHLIN. This is probably more in General Klocko's area but I understand there are moves to buy satellite communications in terms of bandwidth rather than just channels. Is that a problem for the DCA at the present time?

General KLOCKO. Well, we are going to wider bandwidths. We are still in the process of buying by channels, however. I know there are some other governmental requirements which are being expressed in terms of bandwidth rather than channels. To the present time we haven't done any of it in DCA.

Mr. DAHLIN. Is this a matter of buying for reasons of economy or because there are kinds of equipment that require wider and wider bandwidths as far as you are concerned?

General KLOCKO. I am not sure what the other agency requirement is.

Mr. DAHLIN. If you were to have wide-band requirements at the moment would you be looking for as many channels as you could get out of any particular bandwidth, or in order to handle new kinds of equipment coming along?

General KLOCKO. I would say it would probably be the requirement for a block of bandwidth rather than a collection of channels, thinking here in terms of things like secure voice.

Mr. DAHLIN. That would be your normal concern. If you procure wider bandwidths or have to in the future, it would be because there is special purpose machinery——

General KLOCKO. Specific purposes that would require the wider bandwidth.

MALLARD PROJECT COORDINATION

Mr. DAHLIN. Is there any present relationship between the Army's MALLARD project and DCA's? How do you coordinate the future planning or the technology necessary to go into that project with the DCA kind of effort or the TacSatCom effort?

Mr. SHELOR. The MALLARD project was specifically directed to coordinate with the DCA on the interface between the MALLARD system and their system. Also to study the applicability of satellite communications to the MALLARD system. Both of these efforts have been going on.

Mr. DAHLIN. Have they finished their studies?

Mr. SHELOR. No. The MALLARD system studies are currently underway. They are contract studies. They will be completed in about 9 or 10 months from now.

Mr. DAHLIN. Who is conducting those studies?

Dr. TUCKER. The MALLARD program is aimed at 1975 to 1977 time frame.

Mr. SHELOR. There are two U.S. systems study contractors, RCA and Sylvania, and there is a United Kingdom systems study contractor that is a consortium. I don't remember offhand the list of companies.

General KLOCKO. I may add to that. I have a permanent liaison officer at Fort Monmouth who works daily with the MALLARD project officer and also I have an officer in the Washington area who sits on the MALLARD Steering Group. There is very close liaison on these programs.

COMMERCIAL COMMUNICATIONS RATES

Mr. ROBACK. We mentioned yesterday that the committee is interested in, and will review with the military services and the defense agencies, their logistics and supply concepts. The problem of communications in relation to worldwide logistics enters in, and we asked you to prepare a statement on that subject for inclusion in the record.

We also discussed somewhat yesterday the problem of the AUTOVON and AUTODIN networks, and we got into somewhat of a discussion about the manner of determining rates.

The committee has been and is interested in many procurement problems, including the problems of military procurement in regulated industries, and previously we reviewed somewhat the kind of procurement situation you get into when you try to utilize conventional competitive solicitation as against authorized user- and tariff-regulated pricing.

So the discussion came around to how do you determine pricing in your AUTOVON and AUTODIN programs? And you might briefly recap that information.

General KLOCKO. Our negotiations with the common carriers are carried out by the Defense Commercial Communications Office at Scott Air Force Base.

Mr. ROBACK. That is the same one that deals with the satellite problems. Like the 30-circuit procurement.

General KLOCKO. Yes. They are the procuring and contracting officer for communications services.

Mr. ROBACK. All commercial communications, General?

General KLOCKO. Yes.

Mr. ROBACK. That includes AUTOVON and AUTODIN?

General KLOCKO. Yes. They, over a period of years, have developed quite a bit of experience in equitable and inequitable rates and they review all the quotas in the tariff which are proposed by the carriers, judge and advise DCA whether they appear to be proper and equitable and go ahead and carry out the contract if they are in fact equitable. In those cases where in their opinion based on their experience and comparable services which they know are being produced for other people they let the DCA know, let me know in all cases, and we then make the proper protest. Sometimes to the company—if we can't negotiate the price, which we have done in the past, in some cases we go to the FCC and protest.

Mr. ROBACK. So you have the alternatives of renegotiating, of negotiating a new price or else of trying to get adjustment by the FCC regulatory agency?

General KLOCKO. Yes, sir.

Mr. ROBACK. What is the adjustment procedure in the FCC if you protest?

General KLOCKO. They have a public inquiry and make a finding either in favor of us or in favor of the company.

Mr. ROBACK. Do they get into the contractor's books or do they take his submissions?

General KLOCKO. I am not sure offhand of the extent.

Mr. ROBACK. How do you get at the problem of cost?

Colonel HOGGE. The Commission relies on the testimony that is provided at its inquiry by the carrier and by the complaining customer. It has the statutory authority for access to the books and records of the carrier. It has been our experience based on a recent case concerning the AUTOVON electronic switching system where we requested cost information be made available to us at the hearing and the Commission being represented by a hearing examiner did not require the carrier to make that information available, so your question is very difficult to answer. The FCC has the right to this information, it is questionable whether or not the FCC has the capability to audit or take advantage of this right. Certainly from our experience in the past it has not.

Mr. ROBACK. They don't have enough auditors.

Colonel HOGGE. That is correct.

Mr. ROBACK. How many auditors do they have for defense business?

Mr. MORSE. We were advised they had five auditors for the total business of the Commission.

Mr. ROBACK. Do you have access to contractor's books when you negotiate?

Colonel HOGGE. With some carriers we do have access to records.

Mr. ROBACK. As a matter of agreement.

Colonel HOGGE. Yes, sir.

Mr. ROBACK. You don't have any statutory right.

Colonel HOGGE. No, sir.

Mr. ROBACK. A utility is exempted.

Mr. MORSE. You are correct. By law we have no access to records under the Truth in Negotiation Act because regulated industries are exempt from the requirement of presenting cost or pricing data.

Mr. ROBACK. That is under the Access-to-Records Act.

Mr. MORSE. Public Law 87–653.

Mr. ROBACK. All right. That is for purposes of checking the accuracy of the data, but there are other antecedent statutes with regard to access. Thus in a cost-plus contract you have the statutory right of access.

Mr. MORSE. That is right.

SUMMARY OF RATE REDUCTIONS

Mr. ROBACK. I just wanted to understand what the problem was.

Will you present us with a summary of your actions which have led to rate reductions?

General KLOCKO. Yes; we will put that in the record.

(See app. 5, p. 108.)

Mr. ROBACK. We won't pursue this problem further, Mr. Chairman, because we probably will be able to take it up at another session. That is all.

Mr. HOLIFIELD. Thank you, Dr. Tucker, and your associate witnesses.

We will adjourn the meeting at this time for today. Meeting is adjourned.

(Whereupon, at 12:05 p.m., the subcommittee was adjourned.)

APPENDIXES

Appendix 1.—Department of Defense Correspondence

THE SECRETARY OF DEFENSE,
Washington, February 13, 1967.

Hon. CHET HOLIFIELD,
Chairman, Subcommittee on Military Operations, Committee on Government Operations, House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: With your letter of October 27, 1966, you transmitted, for my consideration, a copy of House Report No. 2318 entitled "Government Use of Satellite Communications," prepared by the Military Operations Subcommittee under your direction. This report has been carefully studied by my staff and by other appropriate elements of the Department of Defense. I am attaching comments pertaining to those recommendations of the subcommittee in this report which affect activities of the DOD.

With particular reference to the second pargaraph of your letter, we have carefully studied the question of assignment to conventional carriers of the Defense Communications Agency's contract with the Communications Satellite Corp. for 30 cricuits in the Pacific. This was delineated in your Recommendation No. 6 and further proposed in your letter on the basis of across-the-board rate reductions which would effect net savings to the Department. The Department of Defense intends to assign this contract to one or more of the international record carriers shortly after the initiation of service through the Communication Satellite Corp. This was stated by the Federal Communications Commisison in their Public Notice No. 95477 of February 2, 1967.

You, your subcommittee, and your staff are to be complimented on the comprehensive and objective assessment of this complex subject.

Sincerely,

ROBERT S. MCNAMARA.

Comments Pertaining to the Committee Recommendations of House Report No. 2318, "Government Use of Satellite Communications"

The following comments are referenced to the committee recommendations of H.R. 2318. Each recommendation of H.R. 2318 requiring comment is extracted and stated before each comment for ready reference.

NO. 1, INITIAL SYSTEM READINESS

"To serve urgent communications needs to South Vietnam and other points in the Far East, the Department of Defense should take all possible steps to bring to a state of operational readiness its initial military system for satellite communications. The most immediate, pressing problem is to correct the deficiencies in transportable ground stations and to place operable terminals at required overseas points. The committee endorses the recent action taken by the Army during our hearings to give top priority to critical components for these terminals."

Comment

The Department is fully aware of the need for additional communications support to Southeast Asia and of establishing increased satellite communications to that area as rapidly as possible. As noted by the committee, the Army has actions underway to correct deficiencies in the deployed ground terminals; these actions are being monitored and supported by DCA and D.D.R. & E. and are resulting in a consistent increase in terminal reliability as experience is gained in actual field operation. The Department will continue to move toward providing

the terminals, satellites, and trained manpower necessary to achieve an early satisfactory operational satellite communications capability.

NO. 2, CAPACITY EXPANSION

"The initial system, for which $112 million has been obligated through fiscal year 1966, was designed with too limited capacity. Despite the large investment, the system is designed to provide only two voice or a 'handful' of data circuits. There are options to expand this capacity with comparatively modest extra cost by redesign of ground and space equipment, or by adding terminals and satellites beyond those scheduled. Some capacity expansion will be obtained by improvement or redesign of ground terminals, now underway. The committee recommends that the Department of Defense expand the capacity of the initial system of 10 to 20 times by an optimum combination of capacity expansion factors."

Comment

In contrast to civil satellite communications systems, which emphasize capacity per unit cost, the most important measures of the value of a military satellite communications system are the extreme reliability, toughness, coverage, and flexibility which it provides to deployed forces, especially during any periods of duress—not simply the capacity of the system. We plan, of course, to have a total capacity available to our forces to enable them to meet the total military needs, including extreme crisis management. At present, we are expanding the capacity of the initial system by adding terminals and by upgrading, threefold, the capacity of some links. We will look to sources other than the military satellite communications system to provide the bulk of this total need.

NO. 3, SYSTEM REPLENISHMENT AND UPGRADING

"The initial system, planned with research and development objectives in mind, will be replaced by an advanced, operational system by 1970. It is important in the intervening period to maintain initial system replenishment by providing necessary boosters and satellites and timely launches for continuous effective operations, particularly after the research and development objectives have been achieved. The committee recommends that the initial system be replenished and upgraded for continued useful service until an advance system is in operation."

Comment

The Department supports the recommendation and agrees that it is important to provide the necessary satellites, boosters, and launches to achieve and maintain a useful, operating space subsystem. Eight satellites were added to the space subsystem in January 1967; these launches have established a minimally acceptable initial operating system. We expect to launch four more by midsummer. Our current calculations show the probable need for additional launches in early 1968 and again, perhaps, in 1969. The early 1968 satellites will be of essentially the same design as those now in orbit; leadtime constraints preclude major redesign of the spacecraft for this launch. The possibility of deploying improved satellite repeaters to meet the 1969 date is being intensely investigated at the present time.

Before committing the DOD to a particular follow-on system, it is essential that we be in a position to fully capitalize on the experience and knowledge gained from the initial system. The primary objective of the initial system is to obtain system experience so that comparisons can be made with conventional communications means. To complete the system demonstration there remains the task of integrating satellite communications into the DCS network and the testing of procedures and techniques that will be required to obtain a true operational capability.

NO. 4. ADVANCED SYSTEM CAPABILITY

"The advanced system, for which six preliminary configuration studies have been made under contract, and which will enter the contract definition phase in fiscal year 1967 upon approval by the Joint Chiefs of Staff and the Secretary of Defense, will also be a multimillion-dollar project. To insure that the advanced system effectively meets essential military needs and yields a better return on the taxpayers' investment, the committee recommends that the system be designed and built to provide a significant fraction of military traffic. The system should have a capacity of at least 100 to 200 voice-grade circuits to

major overseas points of interest. The military needs its own hard-core system of secure, reliable, flexible, and survivable communications not affected by the business, labor, and international complexities and incidents of commercial operations. At the same time, as satellite and cable technologies advance, and commercial capacity expands to meet growing traffic needs, the military can be expected to continue relying on commercial sources for the bulk of its routine communications."

Comment

As the committee knows, the advanced system is being planned to meet unique and vital national security needs. Although system capacity in numbers of voice channels is often used as a measure of the size of a system, we must keep in mind that the way in which the system is used is often more important. In this respect, the advanced system will be designed to serve a multitude of relatively small capacity users rather than to carry large volumes of traffic between major centers. The committee was provided with a copy of the representative requirements upon which the system definition studies were made. A new study is under way by the office of the Joint Chiefs of Staff to update these requirements.

The Department agrees with the committee view that we do have the need for a hard-core military communications system in addition to placing continued reliance on commercial sources for the bulk of its routine communications. It would not be surprising if the total global capacity of the Defense satellite communications system eventually were to reach the equivalent of the 100–200 voice-grade circuits postulated by the committee.

NO. 5, TACTICAL SYSTEM DEVELOPMENT

"In accord with an earlier committee recommendation, the Department of Defense is developing a tactical system of satellite communications for use by combat and other field units with small mobile terminals in jeeps, trucks, aircraft, ships, and submarines. Program management at this state is the responsibility of a triservice steering group. In view of the great importance of tactical satellite communications for future military effectiveness, consideration should be given now to strengthening the management of the program and giving it surer direction. The committee believes the program should have a project office-type organization, with full representation by the military services. This office should be appropriately located in an existing Defense-level agency or military department."

Comment

To the present time, the triservice steering group has served the purpose of directing the tactical satellite communications R. & D. program quite effectively.

As the time arrives when true operational concerns—in contrast to early R. & D. experiments and demonstrations—begin to become important, then the question of program management will again be reviewed. In the meantime, the group is keeping the DCA fully and promptly informed of their programs in order to be sure that the "strategic" and "tactical" programs are properly related.

NO. 6, PROCUREMENT OF COMMERCIAL SATELLITE SERVICES

"There is a clash of policy within the Government between the Department of Defense and the Federal Communications Commission regarding the procurement of satellite services from Comsat. The issue is whether Comsat is to be mainly a carrier's carrier or to supply services directly whenever the Government orders them. The committee recommends that the DCA assign the Comsat contract to one or more U.S. international carriers, based upon an across-the-board substantial reduction in charges for satellite and cable circuits in the Pacific area. Carriers have declared their willingness to make such reductions if the contract is assigned. An assignment of the contract would have these advantages: (a) The Department of Defense would realize substantial net savings from a reduced composite rate for satellite and cable services; (b) these savings to the Government might well be doubled because of the strong probability that foreign carriers would make commensurate rate reductions for their portion of the circuits; (c) Comsat would suffer no loss in revenues since it would supply, through Intelsat, the space segment services in any case; (d) the action would accord with the considered decision of the U.S. regulatory agency; (e) more harmonious relationships among Government agencies and within industry would be promoted."

Comment

As you are aware, by its memorandum, opinion, order, and certificate of February 1, 1967, the Federal Communications Commission issued authorizations to the international record carriers to acquire satellite circuits from the Communications Satellite Corp. to meet the requirements of the DOD for 30 such circuits between Hawaii and the Far East. At the same time a short-term temporary authorization to furnish such channels to DOD was granted to Comsat in order to permit it to make any arrangements necessary to facilitate the provision of the service. It is the intention of the DOD to assign these 30 circuits to one or more of the international record carriers shortly after the initiation of service through Comsat.

NO. 8, TIMELY NOTICE AND ADVANCE FILINGS

"The Defense Communications Agency, on order of the Secretary of Defense, undertook a sole-source procurement with Comsat and then invited competitive offers from other carriers after Comsat had a long head start in negotiating with foreign entities for the necessary terminals and interconnections for through service. The ground rules were not clear, and much confusion and needless controversy were engendered by this attempt to (*a*) conduct competitive negotiations when one offeror was in an advantaged position; (*b*) evaluate, in a regulated industry, price and service offers which had not been approved by the FCC; and (*c*) maintain the argument that competition was not necessary because the Government, as an authorized user under the Satellite Act, was entitled to deal with Comsat exclusively on a sole-source basis. The committee recommends that if and when competitive negotiations are in order, the Defense Communications Agency cooperate with the FCC, give the carriers timely notice of the need for new services, and request advance filings of new tariffs and authorizations for the required services."

Comment

The DCA, in the subject procurement, followed existing DOD policy, i.e., a procurement shall be made on a competitive basis to the maximum practical extent. Accordingly, DCA requested proposals from all carriers, including Comsat, in order to obtain the greatest overall advantage to the Government. To suggest, however, that the evaluation of proposals be made subject to FCC approval would, in effect, constitute a delegation of procurement responsibility for which there exists no authority, if this is what is meant by your recommendation that the DCA should cooperate with the FCC. No exception, however, is taken to the recommendation that carriers be given timely notice of the need for new services since the DCA follows such a policy when circumstances permit. On the other hand, to request advance filings of new tariffs and authorizations for required services before a contract is negotiated for the required service would, in effect, put the carrier in a position of prejudging the Government's disposition of its offering. This appears to be undesirable from the Government's point of view.

NO. 12, CLEARER DELINEATION OF POLICY

"The committee's studies and investigations in the past 3 tor 4 years have shown a lack of clear delineation in responsibilities for telecommunications policy formation and management. The Director of Telecommunications Management gives overall policy guidance, and the Secretary of Defense is executive agent in a technical role for the National Communications System, which is being developed to serve the telecommunications needs of major Government users. In this capacity, by order of the President, the Secretary of Defense also reviews and approves Government agency requirements for satellite services and proposals to deal with Comsat. The committee pointed out an earlier report that the the Department of Defense, as a major claimant on telecommunications resources is not in the best position to identify and evaluate other Government user requirements for communications or to make policy decisions affecting them. We recommend that this responsibility be assumed by the Director of Telecommunications Management. The committee renews this recommendation and also recommends specifically in this connection that the Director be assigned responsibility for review and approval of Government agency decisions to deal with Comsat. A reconsideration of existing orders and directives and a redefinition of interagency responsibilities and relationships with respect to these matters are in order."

Comment

This recommendation is essentially a reiteration of a statement made in the 23d report by the Committee on Government Operations, titled "Missile and Space Ground Support Operations" (H.R. 1340). In commenting on that statement, we pointed out that the role of an executive agent in Government is not an unusual one and should not result in difficult challenges to his ability to make fair and impartial decisions in matters affecting his own organization. We reiterate our understanding that this arrangement was fully considered when the assignment of responsibilities was made in the organization of the national communications system. We believe that the national communications system planning and coordination efforts are proceeding in an orderly and effective manner under the present arrangement. The testimony of Mr. Horwitz and Mr. O'Connell in the recent committee hearings stress the very close cooperation and coordination that exist between the Office of the Executive Agent, NCS, and that of the Director of Telecommunications Management. Further, Mr. O'Connell in his testimony (p. 348 of the hearings) expressed the view that his office should not logically be the executive agent for the NCS, and that it is quite proper and most effective to have the Department of Defense as the executive agent. In view of the foregoing, no compelling need for a change from the present arrangements and relationships is seen.

NO. 13, DEFENSE MANAGEMENT OF TELECOMMUNICATIONS

"The Secretary of Defense has delegated his administrative responsibilities as executive agent of the national communications system to the Assistant Secretary of Defense for Administration. The Director of the Defense Communications Agency serves as general manager of the system and has, in addition to his responsibilities for managing the Government-wide system, the management of the defense communications system. From the standpoint of other Government members of the NCS, it is often difficult to tell which layer of authority is controlling, and what authority the executive agent or the general manager in the Department of Defense has over the civil agency head in matters of procurement affecting his own agency. Pending a redirection of responsibilities as recommended in 12 above, and to clarify relationships within the Department of Defense and between the Department and NCS members, the committee recommends that the Secretary of Defense redefine by written directive his responsibilities for telecommunications management, the several delegations of these responsibilities, and the procedures for dealing with other NCS members."

Comment

The basis for this recommendation is not clear, either from the hearings or from day-to-day experience. As far as we know, none of the NCS agencies have experienced difficulty in identifying the proper channels for NCS matters. Certainly, none have advised the NCS management of such difficulty.

The procedures and working relationships for the NCS are set down in an attachment to the August 21, 1963, Presidential memorandum establishing the NCS. This was addressed to the heads of all executive departments and agencies. DOD directives 5100.41 and 5110.1 make clear within the Department of Defense the delegation of functions therein which pertain to the NCS generally. The White House memorandum of March 26, 1964, makes clear to all major agencies of Government the designation of the Secretary of Defense as executive agent, NCS, to arrange with COMSAT for the procurement of satellite communications services for the NCS. It is believed these definitions are clear, but if questions develop the necessary further clarification will be given.

NO. 16.—SATELLITE POWER FOR THE FUTURE

"Future space systems for satellite communications such as the military tactical system and direct television or voice broadcasting to home or community receivers, and for other purposes, will require greatly increased electrical power supplies in the space segment. One of the most promising potentials for more powerful space systems is in the nuclear field. The Atomic Energy Commission in collaboration with NASA has invested large amounts in research and development for space nuclear power devices, both isotopic and reactor, but the using agencies have not defined requirements nor instigated sufficient exploratory programs to maintain progress in this field. The committee recommends that the matter of Government research and development in nuclear space power be

reviewed at the level of the National Aeronautics and Space Council, whose Executive Secretary has publicly emphasized the need and importance of advancing space power technologies."

Comment

We agree that the availability of a family of nuclear power devices capable of generating 1 kilowatt and more of electrical power may become important to the future of such space systems as those employed in providing satellite communications. DOD will continue to cooperate with the AEC and NASA and prosecute DOD research and development to obtain safe, inexpensive, and reliable generators of this type.

In connection with present space projects, DOD has considered the use of nuclear power devices as a candidate power source. This fact was brought out by Mr. Rogers at your hearings (hearings, pp. 159–160). However, to this point in time, nuclear generators have fared poorly when compared to more conventional power sources on the basis of mission, safety, cost, reliability, survivability, and technical risk. This unfavorable comparison is due, in part, to the fact that the nuclear materials most suitable to this application have been in extreme short supply and, therefore, costly. We will continue to closely watch the developments in this area and will consider their use when they are considered to be reasonable and cost effective.

OCTOBER 9, 1967.

Dr. JOHN S. FOSTER, Jr.,
Director of Defense Research and Engineering, Office of the Secretary, Department of Defense, Washington, D.C.

DEAR MR. FOSTER: As you know, we have been following rather closely the Defense program for satellite communications. When Dr. Tucker appeared before our subcommittee on July 24, 1967, he stated with regard to the next phase that the Department was "aiming for a firm plan and decisions well before" the end of the year (p. 47). Timely decisions would make possible an operational capability by 1970.

The purpose of this letter is to inquire as to the status of these decisions. I am well aware that there are budget pressures in the Department, but I believe very strongly that this is one of the essential programs and quite low-cost relative to its importance.

A progress report would be greatly appreciated. Perhaps this can be included as part of the Department's comment on our recent report (H. Rept. 613, "Government Use of Satellite Communications, 1967"). Mr. Stempler advised me in a letter of September 5 that the report was being reviewed by the appropriate officials.

Sincerely yours,

CHET HOLIFIELD,
Chairman, Military Operations Subcommittee.

DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING,
Washington, D.C., October 20, 1967.

Hon. CHET HOLIFIELD,
Chairman, Military Operations Subcommittee, House of Representatives, Rayburn House Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: I am pleased to have the opportunity afforded by your letter of October 9, 1967, to give you a report on the status of our planning the Defense satellite communications program. I am forwarding this information separately from departmental comments on your report, "Government Use of Satellite Communications, 1967."

Currently, my office is completing a comprehensive analysis of departmental communications needs and definition of alternative programs which together will form the basis for my recommendations to Secretary McNamara. I believe that we will have a firm plan and necessary decisions before the end of the year.

I am very much aware and appreciative of your subcommitee's interest in our satellite communications program. Please contact me at any time should you wish further information.

Sincerely yours,

FINN LARSEN
(For John S. Foster, Jr.).

APPENDIX 2.—FEDERAL COMMUNICATIONS COMMISSION CORRESPONDENCE

FEDERAL COMMUNICATIONS COMMISSION,
Washington, D.C., June 12, 1968.

Hon. CHET HOLIFIELD,
House of Representatives,
Washington, D.C.

DEAR CONGRESSMAN HOLIFIELD: Pursuant to an informal request of a member of the staff of the Military Operations Subcommittee, we have reviewed the current leasing of overseas telecommunications channels by U.S. Government agencies to determine whether there were further savings from the filing of lower rates since our last report to you dated August 11, 1967. Such report was based on the filing by the overseas carriers of lower composite cable-satellite rates for voice circuits in early 1967 with the institution of satellite service with certain points in the Pacific and Europe.

Since that time, one further reduction has been filed and another is expected in the near future. Effective August 1, 1968, the U.S. carriers' terminal charges for voice circuits with points in Europe will be lowered to $6,000 per month from the current rate of $6,500, and with substantially increased capacity from the opening of the new 720-circuit, Florida-U.S. Virgin Islands telephone cable (expected early summer 1968) the monthly rate for U.S. mainland-Puerto Rico and U.S. mainland-Virgin Islands voice circuits will go from $8,550 to $5,000 for both terminals. The annual savings from these reductions are as follows:

	Number of voice grade circuits leased as at May 1, 1968	Present monthly rate	Proposed monthly rate	Single circuit reduction	Total savings
Continental United States to Europe	57	$6,500	$6,000	$500	$28,500
Puerto Rico	11	8,550	5,000	3,550	39,050
Total monthly savings	68				67,550
Annually					810,600

Annual savings by U.S. agency

DOD	$641,400
FAA	42,600
NASA	60,000
State	12,000
Weather Bureau	54,600
Total	810,600

We are not aware of any further reductions in foreign terminal charges since those shown in our last report to you, except for the adjustment made by the United Kingdom as a result of the recent devaluation of the British pound. Such adjustment resulted in lower U.S. dollar payments by U.S. Government agencies of over $90,000 annually.

To summarize, currently U.S. Government agencies are leasing over 300 voice circuits. The net savings to the U.S. Government since October 1, 1966, the base date for our several reports to you, amount to some $10.5 million annually for those voice circuits to points which have been subject so far to lower composite cable-satellite rates. It is expected that lower rates for voice circuits will be extended to additional overseas points when earth stations, now under construction in several Latin American countries and additional places in the

Pacific, will go into service during the remainder of 1968 or in 1969. I should also point out that further savings to the U.S. Government as well as other users have been provided for in our authorization of May 27, 1968, to lay a fifth telephone-type submarine cable to Europe (TAT–5) (copy enclosed). In such document, the U.S. overseas carriers are ordered to reduce rates for all services with points which will be served by the new cable at the time it is placed in operation, presently expected no later than March 31, 1970. The magnitude of the reduction for lease of voice circuits is "more than 25 percent." Therefore, if most of the Western European countries expand their facilities with the United States through use of TAT–5 circuits, the future annual cost to U.S. Government agencies of their present requirements of 57 voice circuits with European countries will be reduced at a minimum by over three-quarters of a million dollars at a 25-percent reduction, not including any amount from lower foreign terminal charges which can be also expected. In fact, if use of TAT–5 to Europe is general as is now contemplated, we can expect further reductions at the foreign end of the circuits to total some $2,300,000 a year.

U.S. Government agencies lease a much smaller number of teleprinter circuits, totaling approximately 70 circuits as at December 31, 1967 (the latest data available). Of this number, 40 were with points for which lower U.S. terminal rates have been filed since October 1966. These reductions represent annual savings of over $580,000. Rates for teleprinter circuits with European points are also subject to the reductions called for in our TAT–5 authorization. Savings to U.S. Government agencies under this authorization from the 18 teleprinter circuits under lease as at December 31, 1967, should be at least $100,000 annually for the U.S. terminal, if service is provided via the TAT–5 cable, plus an even larger amount for the European terminals.

I am enclosing a table which sets forth the details of the computations of the savings mentioned herein. Should you require further information, we shall be glad to furnish it.

Sincerely yours,

ASHER H. ENDE,
Acting Chief, Common Carrier Bureau.

BEFORE THE FEDERAL COMMUNICATIONS COMMISSION, WASHINGTON, D.C.

File Nos. P–C–7022, S–C–L–40

IN THE MATTER OF AMERICAN TELEPHONE AND TELEGRAPH COMPANY; ITT WORLD COMMUNICATIONS INC.; RCA COMMUNICATIONS, INC.; WESTERN UNION INTERNATIONAL, INC.

Applications for authorization to participate in the construction and operation of an integrated submarine cable and radio system between the U.S. mainland and Spain, Portugal, and Italy, and for a license to land and operate a submarine cable comprising part of that integrated cable-radio system.

ERRATA

Subparagraph (g) of the first ordering paragraph included as a part of the memorandum opinion, order and authorization in the above-entitled matter, released May 27, 1968, is corrected to read as follows:

"(g) The aforementioned carriers are authorized to make available to the following carriers on an IRU or ownership basis, to the extent required for circuits assigned to them as indicated in the application herein and set forth in appendix A hereto, the following numbers of whole and half circuits in the TAT–5 cable:

CTNE, six whole and 91 half-circuits;
ITALCABLE, six whole and 178 half-circuits;
ENTEL, 15 half-circuits;
CPRM, 21 half-circuits."

FEDERAL COMMUNICATIONS COMMISSION,
BEN F. WAPLE, *Secretary.*

Released: May 31, 1968.

BEFORE THE FEDERAL COMMUNICATIONS COMMISSION, WASHINGTON, D.C.

File Nos. P–C–7022, S–C–L–40

In the Matter of American Telephone & Telegraph Co.; ITT World Communications Inc.; RCA Communications, Inc.; Western Union International, Inc.

Applications for authorization to participate in the construction and operation of an integrated submarine cable and radio system between the U.S. mainland and Spain, Portugal, and Italy, and for a license to land and operate a submarine cable comprising part of that integrated cable-radio system.

MEMORANDUM OPINION, ORDER AND AUTHORIZATION

(Adopted May 22, 1968; released May 27, 1968)

By the Commission: Commissioner Cox concurring and issuing a statement; Commissioners Loevinger and Wadsworth absent; Commissioner Johnson dissenting and issuing a statement.

1. The Commission is here concerned with joint applications filed on April 1, 1968, by American Telephone & Telegraph Co. (A.T. & T.), ITT World Communications Inc. (ITTWC), RCA Communications, Inc. (RCAC), and Western Union International, Inc. (WUI), (a) for authority, pursuant to section 214 of the Communications Act of 1934, to participate in the construction and operation of an integrated submarine cable and radio system between the U.S. mainland on the one hand, and Spain, Portugal, and Italy, on the other, and (b) for a license, pursuant to "An Act relating to the landing and operation of submarine cables in the United States" (47 U.S.C., sections 34–39), to land and operate the transatlantic submarine cable portion of such system at Green Hill, Rhode Island, U.S.A. The record carriers, ITTWC, RCAC, and WUI, also submitted supplemental information and requests, in letters dated April 2, 4, 5, 22, and 23, with respect to the allocation of a portion of circuits in the proposed system.

Description of Proposed System

2. The proposed cable and radio system would be used for communications services between points in or reached via the United States and points in or reached via Europe and the Mediterranean area. It would be constructed, owned, and operated pursuant to a general plan set out in principles of agreement executed among applicants and communications entities in Spain, Italy, and Portugal, viz., Compania Telefonica Nacional de Espana (CTNE) and Empresa Nacional Telecommunicaciones de Espana (ENTEL) in Spain. Italcable Servizi Cablografaci Radiotelegrafici e Radiolettrici S.p.A. (Italcable) in Italy, and Companhia Portuguesa Radio Marconi (CPRM) in Portugal.

3. The proposed facilities will consist of (a) TAT–5, comprised of a submarine cable, having a basic capacity equivalent to 720 voice-grade 3-kilocycle bandwidth circuits, between Green Hill, Rhode Island, and San Fernando, Spain,[1] with a connecting dedicated microwave relay system between San Fernando and Sesimbra, Portugal, having a capacity of 266 voice-grade circuits, and (b) MAT–1, comprising a dedicated mircowave system between San Fernando and Estepona, Spain, having a capacity of 417 voice-grade circuits, with a connecting armorless type submarine cable with rigid transistorized repeaters, having a basic capacity of 640 voice-grade 3-kilocycle circuits, between Estepona and Castelfusano, near Rome, Italy. The system will be initially equipped to provide its full capacity, except the MAT–1 cable, which will be initially equipped to provide the equivalent of 417 circuits.

4. For TAT–5, the construction cost is estimated at about $70.4 million for the cable portion and $1.8 million for the microwave portion. For MAT–1, the cable portion will cost about $16.8 million, and the microwave portion about $0.8 million. The cost of each segment in the system is to be shared by applicants and their correspondents in proportion to the number of equivalent voice-grade circuits in each section assigned to each. The proposed allocation of ownership, as among applicants, on the one hand, and each of the foreign participants on the

[1] This cable will be the Bell system-designed SF-type submarine cable with two-way rigid transistorized repeaters. The core will be a central conductor consisting of a steel strand with a copper wrapping, insulated with a water impervious material (polyethelene) and surrounded by a return copper conductor. The cable, except where it is in shallow water, will be armorless; it will be buried on the continental shelf of the United States, and probably also off Spain, to protect it from trawlers.

other, for each segment of the system is shown in appendix A hereto. The proposed allocation of circuits is shown in appendix B hereto, and includes 403 circuits in the cable section of TAT–5, 185 circuits in the Spain-Portugal radio link, and 149 circuits in the MAT–1 system, which are assigned jointly to applicants for use with correspondents beyond Portugal, Spain, and Italy. The proposed allocation of capital, maintenance, and operating costs, for each segment of the system, is shown in appendix C hereto. The joint applications represent that the allocation of costs is based on A.T. & T. receiving 149, 58 and 76 respectively, of the circuits listed above for service beyond Portugal, Spain, and Italy, with ITT, RCAC, and WUI filing separately for allocation by the Commission of the remaining circuits, totaling 120, between them, and without prejudice to the right of such carriers to maintain that the total number of such circuits remaining to them, after deduction of the A.T. & T. circuits, is not sufficient for their needs. On this approach, the estimated cost to A.T. & T. of the proposed system is $47.1 million, and the estimated cost to ITT, RCAC, and WUI, as a group, is $18.5 million. It is anticipated that this cost will be reduced as applicants reach agreements with foreign correspondents for use of these circuits, with such correspondents paying 50 percent of the cost of each circuit operated with applicants.

Prior Commission Consideration

5. Prior to the filing of the instant applications, the Commission had been informed of the negotiations being held between the above-mentioned carriers with respect to the proposed system, which was to be operative in 1970. It also was advised that the Communications Satellite Corp. (Comsat) was formulating plans under which it and its partners in the International Telecommunications Satellite Consortium (Intelsat) would provide additional communications capacity, by means of a greatly augmented global satellite communication system, between the U.S. mainland and Europe, as well as between other points located throughout the world, at about the same time that the cable system would be put in service.

6. In view of the asserted need in 1970 for expanded transatlantic capacity, the policy considerations involved, and the need for prompt decisions on such applications as might be filed for such needed facilities, the Commission informally wrote on October 4, 1967 to A.T. & T., RCAC, ITTWC, WUI and Comsat requesting detailed information concerning timing, capacity, cost, revenue requirements and other relevant factors relating to the proposed cable, and possible alternative satellite facilities to meet transatlantic traffic demands. Replies were received from these carriers by November 2, 1967, and comments concerning these replies were received by November 9, 1967. On December 13, 1967, the carriers and Comsat were requested to furnish further data and were afforded an opportunity to furnish additional information by December 26, 1967. Comments on data supplied by others were requested by January 4, 1968. On the basis of the information received, the Commission, by letters of February 16, 1968 to the several carriers, tentatively concluded that it would be appropriate for the applicants herein to file applications for the proposed system, subject to the following conditions:

(a) Submission of details on a construction program which would clearly demonstrate that, if authorized, the cable would be operational during the first quarter of 1970 to meet foreseeable traffic requirements;

(b) Incorporation of agreements among all entities who will share ownership in the system, or will have indefeasible rights of user therein, providing that rates for telephone message service would be reduced, no later than the time the cable is opened for service, by at least 25 percent from the rates applicable immediately prior to such reduction, that rates for leased service would simultaneously be reduced by more than 25 percent from the levels applicable immediately prior thereto, and that appropriate downward revisions would be made in charges for telegraph-type services;

(c) A showing that the entities owning the cable, or having indefeasible rights of user therein, have agreed to use satellite circuits for the handling of traffic in numbers sufficient to assure that the cable and the satellite facilities provided to handle traffic between the United States and their respective countries would each be filled at the same proportionate rate, proportionate fill being defined to mean that the unfilled capacity of the satellites would be leased at a rate, with appropriate adjustments, so that, when added to the use made of the satellite facilities by noncable users, unused satellite capacity would be leased by all users as the cable is filled to the end that both types of facilities reach 100 percent fill at approximately the same time.

No objections to the Commission's letters of February 16, 1968, were filed by the applicants or by Comsat.

Notice of Filing Applications and Responses Thereto

7. Public notice of the filing of the captioned applications was given on April 2, 1968. Copies of the applications, with notices extending opportunity to file comments, were mailed on April 2 and 3, 1968, to the Secretary of State, Secretary of Defense, Director of Telecommunications Policy, Defense Communications Agency, National Security Agency, Governor of Rhode Island, Office of the Director of Telecommunications Management, the President's Task Force on Communications Policy, Communications Satellite Corp., and French Cable Co. In response to such notice, a statement was filed by the Communications Satellite Corp.

8. Pursuant to Executive Order No. 10530, dated May 10, 1954, relating to the issuance of cable landing licenses, the Department of State, by letter dated April 22, 1968, advised the Commission that it approved the issuance of the requisite cable landing license as proposed in the application here under consideration, provided that the conditions contained in the Commission's letters of February 16, 1968, were set forth in either the cable landing license or in the concurrent authorization under section 214 of the Communications Act. In a second letter dated April 22, 1968, the Department of State set out its view that approval of the applications must not prejudice the earliest establishment of large-capacity satellites, particularly the proposed Intelsat IV. Further, the State Department advised that our national commitment to Intelsat, and to its future growth, as stated by the President on August 14, 1967, leads logically to this position. The State Department also stated it reads the Commission's letter of February 16, 1968 as expressing a similar view.

Applicants' Statements in Support of Applications

9. Applicants state that the proposed new facilities are justified by the following factors:

(a) There will be a serious shortage of transatlantic circuits in 1970, unless additional high-capacity facilities are now authorized The following total equivalent voice-grade circuits will be required for applicants' individual requirements for the following periods:[2]

	END OF YEAR	
	1970	1972
A.T. & T.	1,006	1,612
ITTWC	91	118
RCAC	143	179
WUI	121	173
Total	1,361	2,082

Available transatlantic cable and radio facilities are becoming saturated, and based upon information supplied to the Commission by Comsat on October 30, 1967, all satellite facilities now scheduled to be available for transatlantic service will also be saturated by 1970. Any delay in providing additional facilities beyond that time would result in a critical shortage of transatlantic circuits.

(b) Given reasonably prompt authorizations, the proposed cable/radio system can be operational by early 1970 to help alleviate the anticipated circuit shortages; while, on the other hand, it is doubtful that the needed facilities can be made available at that time through the expansion of the satellite system.

(c) The proposed TAT–5 will provide diversification of transatlantic facilities and assure a reasonable balance between cables and satellites, enable a flexible choice of the best medium (cable or satellite) to fulfill customers' service requirements, and also provide cable circuits for use with satellite circuits in tandem to connect widely separated points (e.g. United States and India) which cannot be served satisfactorily by two satellite links because of the long transmission delay.

(d) The proposed system the first connecting the United States to Southern Europe, will permit a more direct cable route to southern Europe and the Mediterranean area, now reached via cables to northern Europe and thence via land-

[2] These figures were submitted in response to our informal inquiry of Oct. 4, 1967.

lines over long distances across intermediate countries, thereby strengthening and improving communications in this area.

(e) An authorization will move forward needed cable technology; other European telecommunication administrations strongly support the system and will purchase interests; and the system will be an economically sound project.

10. Applicants state that they and their European partners have agreed to the following conditions[3] and each applicant proposes to negotiate similar arrangements with other countries desiring to acquire circuits in the system on an indefeasible right of user basis for communication with the United States:

(i) if the necessary governmental authorizations are obtained within a reasonable time, the cable between the United States and Spain will be placed in operation in the first quarter of 1970, and the parties will use their best efforts to complete the other sections of the system for operation at that time.

(ii) The parties agree, subject to necessary governmental authorizations, to make the following rate reductions no later than the time that the TAT–5 cable is operational, provided that the annual revenue requirements of satellite half circuits reasonably approximate those now projected for the 1970–73 time frame, that is, $31,100–$20,700 for the U.S. half, of which $9,600–$6,600 is for the projected Intelsat revenue requirements for the space segment, with these revenue requirements being reflected in Comsat charges to the U.S. carriers and with adjustments in charges to the European carriers for the European half of said circuits reflecting the above projected revenue requirements:

(*a*) For message telephone and private line voice-grade channel service, A.T. & T., CPRM, CTNE, and Italcable agree to make effective reduced rates as specified in appendix D hereto, it being stated that, while the extent of these reductions will vary by country, the overall result will reduce charges to all customers in the countries by at least 25 percent for message telephone service and 25 to 30 percent for private line voice-grade channels;

(*b*) For record services, including voice-data service, ITTWC, RCAC, WUI, CPRM, CTNE, ENTEL and Italcable agree, subject to the necessity of an overall fair rate of return, to make effective rate reductions for service between the United States, on the one hand, and Italy, Portugal, and Spain, on the other hand, of approximately 25 percent for voice-record channels (with consideration of the cost of special conditioning to provide data capabilities so that charges reflect reasonable costs); approximately 25 percent in existing rates for 50 baud teleprinter leased channels, and approximately 15 percent in existing telex rates.

(iii) The parties agree in principle to use satellite circuits between the United States, on the one hand, and Italy, Portugal, and Spain, on the other, in numbers sufficient to insure that the unfilled portion of the TAT–5 cable and of new satellite facilities (i.e., Intelsat III–1/2 or IV) provided within the 1970–72 time frame to handle traffic within the Atlantic Basin will each be filled at the same proportionate rate, on the assumption that the maximum unfilled equivalent voice-grade capacity of the satellites (after transfer of the then existing satellite circuits) to which this agreement applies will not exceed 3,500 such circuits. In this connection, the parties assume that each of the European parties shall be able to use the European earth station operating with the United States which is nearest to the party concerned unless such party chooses to use a more distant earth station operating with the United States.

11. A.T. & T. proposes to acquire its ownership interest in that portion of the TAT–5 cable located in Spanish territory in the name of its wholly owned subsidiary, Transpacific Communications, Inc. Each of the other applicants indicates it may also elect to acquire its ownership interest in such cable in the name of a wholly owned subsidiary or affiliate.

Statement of Communications Satellite Corp.

12. In its statement filed in response to the public notice given of the subject applications, Comsat refers to its contention, at the time we informally requested information relating to the instant project, that the proposed cable is unnecessary and would handicap the economic potential of satellite communications. It also states that it demonstrated at that time that such cable would be unduly burdensome to ratepayers and would detract from the U.S. commitment to provide lost-cost satellite communications services to economically less developed areas. It goes on to say that its submissions, as well as those of others, have been considered by the Commission, in connection with other interested agencies of the

[3] See Memorandum of Agreement Supplementing the Principles of Agrement dated Feb. 21, 1968, attached to the applications.

U.S. Government, that it therefore appears that the fundamental questions have been settled and the Commission's determination to entertain formal applications for authority to construct the cable, subject to certain conditions, is tantamount to a tentative decision in the matter. Insofar as this decision is tentative, Comsat requests that its earlier submissions be incorporated herein by reference.

13. Comsat then states that there appears to be some misunderstanding of the significance of the revenue requirement data filed by the interested parties in response to our informal inquiry, pointing out, as an example, statements in a concurring statement by Commissioners Cox and Loevinger to our February 16 letters. It believes that a correct evaluation of costs would clearly favor satellite facilities.

14. Comsat also comments on the response of applicants to the three conditions set out in our letter of February 16, and requests that any authorization we may grant to applicants herein clarify questions raised in its statement, and include appropriate conditions to assure implementation of the conditions stated in our February 16 letters. In the alternative, it requests that the applications be denied.

Need for additional facilities

15. We have reviewed the circuit growth estimates submitted by the applicants; those submitted in our informal inquiry; those used by the Intelsat partners in estimating satellite circuit requirements; and those developed at the Mexico City world plan meeting in 1967. Our analysis indicates that, for communication between the United States and Europe, Africa, and the Near East, some 800 circuits will be required in 1970 and some 1,500 circuits will be required in 1972, above those now available in transatlantic cables, and that even greater quantities may be required as a result of traffic stimulation by rate decreases and other factors.

16. According to information furnished by Comsat, the only firm additional facilities contemplated to be available for the Atlantic Basin service by early 1969 are two Intelsat III satellites (replacing then-existing satellites). These are expected to have a theoretical capacity of about 1,000 circuits each. However, because of the need to serve a number of earth stations, some with relatively few circuits each, and because of the technical inability to assign satellite capacity on a circuit-by-circuit basis, it appears that only 75 to 80 percent of this theoretical capacity may be realized. Moreover, all of the additional capacity provided by these satellites will not be used for U.S. transatlantic traffic. According to our analysis, some 450 circuits may be required for United States-Latin American traffic; traffic between non-United States points may require some 350 circuits, and the U.S. Government will have special requirements for about 170 circuits. In addition, considerable capacity will be required for television, and possible wide-band data service.

17. Thus, on the basis of the foregoing, it appears that, absent any additional capacity in the Atlantic Basin other than that added by the two Intelsat III's, there will be a shortage of several hundred circuits in 1970. This shortage will become greater as time goes on.

18. Comsat itself indicates that these two satellites may become saturated by 1970 and that plans are being formulated to augment Atlantic Basin satellite capacity through even larger capacity satellites—the Intelsat III-½'s and/or the Intelsat IV series to replace one or both of the Intelsat III satellites (earth station limitations and the need to cross-haul traffic indicate that the use of more than two satellites is not feasible or economically sound). These plans, however, are not presently definite and require agreement of the Intelsat partners before work can go forward. This uncertainty exists not only as to the technical parameters of the satellites to be used, but also as to their operational dates. It is conceivable that such satellites could be delayed until well beyond the time frames set forth above when additional capacity will be urgently required. These and other matters will have to be resolved before we can act on any application that may be filed by Comsat with us for necessary authorizations relating to the construction, placing in orbit, and use of such satellites.

19. There exists, therefore, no assurance that satellite facilities will be available to meet all 1970 circuit requirements. On the other hand, authorization of the instant applications will provide reasonable assurance of this. Applicants state that the cable to be used is beyond the development stage, and support their views by a detailed timetable of proposed manufacture, construction, and cable-laying schedules. They are, therefore, confident that the cable can be available early in 1970, with a tentative service date of March 15 for the system.

20. We think that it is evident, absent countervailing considerations, that the public interest in a strong, efficient communications system requires that adequate facilities be available when required to meet demand. This is particularly true in an increasingly complex world society which depends more and more on reliable and instant communications.

21. There are, of course, other benefits to the public interest which require no extended discussion here in the circumstances (e.g., added diversity of facilities, the desirability for additional nonsatellite facilities for combination with satellite facilities to serve distant areas which cannot be reached via a single satellite in synchronous orbit, foreign policy consideration, enhanced ability to meet national defense and security requirements, and the opportunity for prompt and substantial rate reductions by both the U.S. carriers and the foreign counterparts). In connection with the latter point, we note that our experience indicates that the availability of high quality facilities at reduced rates stimulates substantial increases in demand. Accordingly, we believe that it is entirely possible and indeed probable that the total demand for satellite circuits may actually be higher with TAT–5 and its impact upon rate reductions than without TAT–5 and no reductions, or reductions of a lesser magnitude.

22. Finally, for the reasons set forth in paragraph 24, infra, we do not believe that any useful purpose would be served by going over relative costs or the revenue requirement data filed by the interested parties in response to the Commission's informal inquiry. In any event, our decision to grant these applications is based on the above broad spectrum of considerations.

Relation to Global Communications Satellite System

23. There is no doubt that the global satellite system, strongly supported by this Government, has not yet reached its maturity. Equally, there is no doubt that additional and improved satellites will be needed to reach this state of maturity, so that modern communications will be available to all countries on a practical and economic basis, and so that the benefits of communications satellites will be fully realized. We do not, however, think that a grant of the instant applications will inhibit development of the global satellite system, nor delay this development in any way. Our analysis of circuit demands in the decade of the 1970's indicates that both the proposed cable and any augmented satellite system will receive sufficient traffic to be economically viable. As already noted, we are confident that the satellite system will benefit from an increase in demand for transatlantic service resulting from service improvement and rate reductions resulting from the cable system proposed herein.

24. We stress that this is not a situation where we are choosing between the proposed cable and the next generation of satellites. As we have made abundantly clear, we support plans for a large, efficient, flexible and longer life satellite and look forward to affirmative action on such proposal by Intelsat. We are confident that as satellite technology moves from its initial stages to more sophisticated satellites it will provide increasingly more economical facilities in future years. Accordingly, we do not feel it necessary to make definitive findings on the relative economic merits of TAT–5 and present satellites, those now being constructed and those proposed for the early 1970's.[4] In this connection, see also paragraph 31, infra.

Comsat statement

25. Comsat, in the statement filed by it herein, states that reasonable protection would be afforded to the future growth of the satellite system traffic by the condition in our February 16 letters relating to allocation of circuits between the proposed cable system and the satellite system. We also note that Comsat does not request denial of the instant applications if the several questions it raises in its statement are clarified and appropriate conditions imposed to assure implementation of the conditions set out in our February 16 letters.

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[4] We do note in passing that there are difficulties in making comparisons between cable and satellite costs, as is evident from the difference in the methodology used by Comsat and A.T. & T. in the filings. In short, Comsat uses a year-by-year method to derive its rate base, whereas A.T. & T. uses an average investment method over full life to derive its base. Also, Comsat, in its filing, computed average revenue requirements for all areas served, whereas A.T. & T. computed them for its shorter Atlantic cables separately from those for its longer Pacific cables. Comsat included all costs and total capitalized research and development, whereas A.T. & T., in order to place cable costs on the same basis as its costs for leased satellite circuits, included only costs directly attributable to the cables in question. Comsat included unrecovered portions of the investment in satellites replaced and no longer revenue producing, whereas A.T. & T. continues to use each generation of cables to recover revenues over their entire anticipated service lives.

26. Comsat believes that the requirement in the Commission's letter of February 16, 1968, regarding proportional fill offers reasonable protection for the future of the satellite system. It also believes that the assumption of the parties that the unfilled capacity of the satellite facilities will not exceed 3500 circuits may well be true. However, it sees no purpose in imposing what it calls such an artificial limitation.

27. We can appreciate both Comsat's concern and the interests of the cable partners in incorporating definitive terms in their agreement with respect to proportionate fill. It appears to us that the difference between the two is more apparent than real since all data submitted to us does not indicate that any satellite which may reasonably be expected to be operational in the 1970–72 time frame would in fact have more than 3,500 unfilled circuits. We, therefore, regard the cable partners' agreement as designed to achieve proportionate fill. In addition, our order, directed at the carriers subject to our jurisdiction, will maintain this requirement for proportionate fill.

28. Comsat also notes that the agreement between the carriers with respect to proportionate fill is based on the "assumption" that each of the European parties will be able to use the nearest earth station unless it chooses to use another earth station. Comsat urges that the assumption shall not weaken or vitiate the proportionate fill requirement and requests that we condition any authorization herein to eliminate any doubts regarding the obligation of the U.S. carriers to implement the spirit and extent of the proportionate fill requirement.

29. We appreciate Comsat's concern for the integrity of the proportionate fill requirement. We also understand the concerns which led to the assumption regarding the ability to use the nearest earth station. Assignments of units of satellite utilization to earth stations are made by INTELSAT and are not under the control of the European parties of the cable project. They have a legitimate concern that they should not be required to undertake long and expensive landline hauls in Europe to reach an earth station which has capacity available to handle the satellite circuits which they would be required to use under Comsat's proposal; for example, Portuguese traffic routed via earth stations in England or Germany. We do not expect INTELSAT, or Comsat as manager of INTELSAT, to configure its system in such fashion except in unusual or emergency situations. If this should occur for a temporary period, then we would expect that achievement of the proportionate fill goal would be deferred until an adequate number of circuits are made available at nearby earth stations at which time we would expect that the deficit would be made up before additional cable circuits are used by the carriers involved. We further note that the proportionate fill requirement is not related to particular circuits or countries. The agreement provides that the exact ratio of cable to satellite circuits may vary from country to country as long as the overall proportions designed to insure a rate of fill under which the cable and satellites reach complete fill at the same time are maintained. In any event, as set forth in our order, we are retaining jurisdiction over the activation of circuits in TAT–5 and will be able to take such action to implement the proportionate fill requirement as the situation at any time may require.

30. Comsat requests that we note that the carriers' rate reductions seem to depend largely on the economic success in the development of the satellite system and not solely on the allegedly low revenue requirements of the TAT–5 cable. There is no doubt that this is true. But it is true because of the proportionate fill requirement in our order. Under this provision the carriers may be required to take as many as four or five satellite circuits for each cable circuit they use. Thus, the cost of satellite circuits rather than that of cable circuits is the controlling factor in the carriers' revenue requirements.

31. It should be clear, however, that the estimated cable costs themselves fully justify the proposed rate reduction and that there is no element of subsidy from the satellite circuits involved in these reductions. We do expect, however, that as the satellite technology matures and the potential economies are realized, the progressively reduced Comsat charges will provide a basis for further and continuing large scale reductions in charges for service to the public. It is this potential and our desire that it be realized as quickly as possible which was the basis for our letter of February 16, 1968 to Comsat expressing an expectation that Comsat would proceed promptly in cooperation with other members of INTELSAT to implement its plans for high capacity, flexible, long life and economical satellites of the next generation.

32. Finally, Comsat expresses concern that there is no statement in the application regarding the possible use of Time Assignment Speech interpolation (TASI) equipment or similar equipment on the TAT–5 cable. Comsat requests that we act to preclude the use of such equipment unless authorized by us. We have included such provisions in previous authorizations and will do so herein. If and when any application is filed for authority to use such equipment, Comsat will have an opportunity to make its views known and we will take such action as the public interest requires, including the imposition of such conditions as are then appropriate if such authority is in fact granted.

ALLOCATION OF CIRCUITS AMONG U.S. CARRIERS

33. The applications disclose that the U.S. carriers are in agreement with respect to the number of circuits to be acquired by each carrier in the TAT–5 and the MAT–1 cable system for service between the United States, on the one hand, and Italy, Spain, and Portugal, on the other hand. The circuits each carrier is to acquire in the cable systems for these purposes are listed in categories I, II, and III of appendix B. It further appears that the parties have agreed that the European parties will obtain circuits as specified in appendix B (see categories IV, V IX, XI, and XII) for service between (1) Portugal and Italy, (2) Spain and Italy, (3) Spain and points beyond Portugal, (4) Spain and points beyond the United States, (5) Italy and points beyond the United States, and (6) Italy and points beyond Portugal or Spain. The U.S. carriers and the European partners have also agreed on the total number of circuits (categories VI, VII, and VIII) to be assigned to the U.S. carriers jointly for services between (1) the United States and points beyond Portugal, (2) the United States and points beyond Spain (except via Italy), and (3) the United States and points beyond Italy. The total number of transatlantic circuits assigned to these services, respectively, are 185, 69, and 149, with matching extensions beyond Spain to Portugal and to Italy. The applications also set forth that, without prejudice of the rights of ITTWC, RCAC, and WUI to maintain that the number of circuits in categories VI, VII, and VIII remaining for allocation among them is not sufficient, the allocation of such circuits to A.T. & T. will be as follows: (1) 149 circuits in category VI, leaving 36 for the record carriers, (2) 58 in category VII, leaving 11 for the record carriers, and (3) 76 in category VIII, leaving 73 for the record carriers. On this basis, the total number of United States-Spain circuits remaining for allocation among the record carriers would be 120.

34. In their supplemental filings, each of the record carriers indicates that this number of circuits will be insufficient to meet their needs. It is pointed out that we previously provided that the telegraph carriers should be able to acquire 50 percent of the circuits in the TAT–4 cable, that existing transatlantic cables are already saturated, in less than 4 years after TAT–4 was allocated, and that record carriers now find it necessary to lease from A.T. & T. at tariff charges to meet capacity needs. RCAC makes the only suggestion for a specific number of circuits to be allocated jointly to the telegraph carriers, namely 132. RCAC also points out that if 132, rather than 120, circuits are allocated to the telegraph carriers A.T. & T. would still receive 67 percent of circuits in categories VI, VII, and VIII.

35. It is clear that, despite apparent agreement on the allocation of circuits beyond the European terminal points of the system, A.T. & T. and the record carriers have in fact not reached a meeting of the minds. The record carriers desire circuits in addition to the 120 specified in the application. Furthermore, as set forth below, the record carriers have not agreed among themselves as to how circuits assigned to them for traffic beyond the European terminals in categories VI, VII, and VIII should be divided.

36. We note that in their responses to the Commission's letter of October 4, 1967, the record carriers indicated that the circuits then in use by them (for service to Europe, Africa, and the Middle East) were, respectively, RCAC, 57 (46 percent); ITTWC (excluding radio circuits), 38 (31 percent); and WUI, 28 (23 percent). These responses further show that, based on revenues, RCAC has 43 percent of the record carriers' total to Europe, Africa, and the Middle East; ITTWC has 27 percent; and WUI has 30 percent. In its filings, RCAC asks the Commission to resolve the allocation question by taking into account the carriers' present relative use or share of business, and the effect of the planned rate reductions for service, which it claims indicates that its share of such rate reductions will be 44 percent of the total for the record carriers. RCAC also claims to have unique requirements for transfer of substantial

services from high frequency radio to TAT–5/MAT–1 circuits. RCAC further suggests that, if the Commission decides to allocate 132 circuits to the record carriers, but not now allocate all 132 among such carriers, a minimum of 112 should be allocated, with 48 (43 percent) to RCAC and the remaining 64 between ITTWC [5] and WUI, with 20 circuits being reserved for allocation on the basis of subsequent needs.

37. ITTWC states that requirements for each of the carriers must be estimated on the basis of future growth trends, which are changing. It suggests, however, that, assuming an allocation of 120 circuits in these categories to the record carriers, the Commission allocate 30 circuits to each carrier, with the remaining 30 circuits, or such higher number as the Commission may allocate to the record carriers, to be owned jointly by the record carriers and subsequently assigned to each carrier on an "as needed" basis.

38. WUI states that its present share of the total transatlantic revenues of the three record carriers is already 33 percent, and is on a definite upward trend. On the basis of certain message and telex statistics, which it cites, WUI asserts that it is now the leading carrier of transatlantic record traffic to Europe, and that it has higher growth trends and greater requirements in the Atlantic basin than either of its two competitors (RCAC and ITTWC). WUI proposed that, assuming 120 circuits are allocated to the record carriers for the categories VI, VII, and VIII, it would agree, in a spirit of cooperation, to a minimum of 40 of the 120 circuits as its share, subject to the conditions that (1) the Commission retain jurisdiction to allocate additional circuits to WUI as future circumstances may warrant, and (2) each of the other two international record carriers agrees to accept no more than 40 circuits.

39. We are, therefore, confronted with two problems: (a) The manner in which available circuits in categories VI, VII, and VIII should be divided between A.T. & T. and the record carriers as a group, and (b) the manner in which circuits available to the record carriers should be divided among them. However, we recognize that attempts now to allocate discrete numbers of circuits among the several carriers for service with particular points can vary from those actually required at the time service is instituted, in view of inherent uncertainties in forecasting. In view of this, we believe that we should hold a limited number of circuits in reserve as between A.T. & T. and the record carriers, on the one hand, and as among the record carriers, on the other, to be assigned in the future on the basis of their proven need.

40. As to the first allocation, A.T. & T. appears to concede that at least 120 circuits should be made available to the record carriers, while only RCAC, of the record carriers, quantifies their requirements, suggesting 132 circuits. We think it best, therefore, to reserve 12 circuits sought by A.T. & T. for service beyond Spain, Italy, and Portugal until negotiations by applicants with their foreign correspondents beyond those nations have further progressed, and we are in a better position to evaluate needs. With this reservation, we shall assign to A.T. & T. 142 circuits in category VI, 56 circuits in category VII, and 73 circuits in category VIII.

41. We have carefully reviewed all of the foregoing contentions of the record carriers concerning relative circuit use and future requirements. We believe that, to the extent practicable, we should give some recognition to all the factors the carriers ask us to consider. We particularly note that RCAC apparently has in use the largest number of circuits and derives more revenues from the areas involved than the other two carriers. We also note that while ITTWC has in use a larger number of circuits than WUI (38 versus 28 as discussed above), WUI, on the other hand, has a greater share of the revenue than ITTWC (30 percent versus 27 percent). Taking all the foregoing factors into consideration, we believe we should initially allocate circuits in the three categories involved to the record carriers so as to recognize RCAC's larger current share but to make due allowance for the faster growth rate of WUI. On balance it also appears that WUI and ITTWC should have the same percentages at present. All of these factors lead us to conclude that of the circuits to be allocated now to the record carriers, the percentages should be approximately 38 percent to RCAC and 31 percent each to ITTWC and WUI.

42. We turn now to the question of the number of circuits to be allocated now and the number to be held in reserve for future allocation. On the one hand, a sufficient number must be allocated now to allow meaningful use by the many

[5] And its subsidiary, Press Wireless, Inc.

countries beyond the overseas terminal points which may desire to participate in the use of TAT-5. On the other hand, a sufficient number must be held in reserve to allow for future meaningful allocations in the light of actual requirements. It appears that our goal can be achieved by allocating a portion of the 132 circuits at present and holding the remainder in reserve for future allocation.

43. Both ITTWC and RCAC have suggested that only a part of the circuits available to record carriers might be allocated initially under categories VI, VII, and VIII, and that a pool of unallocated circuits be held in reserve for future allocations. As indicated above, we believe that this suggestion has merit. While WUI is a relatively new company, its growth rate appears to be somewhat higher than that of either RCAC or ITTWC for certain types of service. Our analysis of future growth rates submitted by each of the U.S. carriers indicates a continued high growth rate in total, but the relative growth rates as between individual carriers is somewhat less clear. We therefore conclude that it is neither practicable nor equitable at this time to allocate all of the circuits which we propose to assign to the carriers. We feel that a more equitable allocation can be made at a later date when more precise information will be available concerning relative circuit usage and revenue data for each carrier. However, we consider it appropriate at this time to make a partial allocation of circuits to the record carriers so that they can begin negotiations with their foreign correspondents on a firm basis.

44. Accordingly, we will allocate 90 of the 132 circuits to the record carriers in categories VI, VII, and VIII, and reserve a pool of 42 circuits to be allocated in the future. On the basis of our determination in the preceding paragraph, we will initially allocate 34 circuits to RCAC and 28 circuits to each ITTWC and WUI. We will also require that the capital investment for the 42 circuits held in reserve shall be shared equally between A.T. & T., RCAC, ITTWC, and WUI, and further, that when a given applicant acquires any circuits initially allocated to another applicant or acquires one of the circuits in the reserved pool, the reimbursement to the other carrier or carriers shall be on the basis of depreciated original cost (or the pro rata accumulated cost of such circuit if the system is not then operational).

45. Based upon the foregoing approach, we will allocate to A.T. & T. 142 whole circuits for category VI, points beyond Portugal, including the San Fernando-Sesimbra system, leaving a total of 43 whole circuits to be allocated among A.T. & T. and the three record carriers and to be held in reserve. Of that total, we will reserve a pool of 18 circuits for future allocation, and allocate 9 of the 25 remaining circuits to RCAC, and eight to each ITTWC and WUI. For service to points beyond Spain, category VII, we shall allocate 56 circuits to A.T. & T., four to RCAC, three each to ITTWC and WUI, and hold three in reserve. Similarly, for category VIII, points beyond Italy, including the San Fernando-Estepona system and the Spain-Italy cable, we will allocate to A.T. & T. 73 whole circuits, leaving 76 whole circuits to be allocated ultimately to A.T. & T. and the record carriers. Of that total, we will reserve a pool of 21 circuits for future allocation and allocate 21 of the remaining circuits to RCAC, and 17 to each ITTWC and WUI. The requirements specified in paragraph 44 apply also to the foregoing circuits. In order that we may be in a position to make meaningful allocations of the circuits held in reserve we will entertain future applications from A.T. & T. and the record carriers supported by a substantial showing that the public interest would be served by an allocation of any circuit or circuits for a particular service to any country or a group of countries. We will also provide that no applicant herein shall make any final agreement with any overseas correspondent regarding the disposition of any interest in or use of any whole circuit held in reserve or in which the applicant owns the whole through circuit unless such agreement provides that the conditions with respect to rates and proportionate fill specified herein will be satisfied.

46. Appendix E summarizes the number of equivalent whole circuits allocated to each of the applicants herein and for completeness also lists the equivalent whole circuits for which capital contributions by the overseas participants are anticipated. This appendix also indicates the number of circuits in each segment to be held in a reserve pool, and the method whereby the U.S. carriers will participate in capital contributions for such reserved circuits.

47. We will also retain jurisdiction to reallocate the interests initially held by U.S. carriers in all of the circuits in the TAT–5/MAT–1 project, where justified by future circumstances. This option may be required not only to readjust the

proportion of ownership and use as between the U.S. carriers, but also in the event it becomes appropriate to allow other European countries to participate in the construction phase or the acquisition of interests from U.S. carriers after construction is completed. We are also cognizant that policy legislation for a merger of the overseas U.S. carriers may be enacted. Such retention of jurisdiction is also desirable, in the event of the passage of legislation relating to merger, consolidation, or other restructuring of the industry, and the approval by the Commission of an application submitted pursuant to such legislation, so that the Commission may make each reassignment of the interests authorized herein as may then be found to be appropriate.

48. The application states that A.T. & T. proposes to acquire its ownership interest in the portion of the cable between the United States and Spain located in Spanish territory in the name of its wholly owned subsidiary, Transpacific Communications, Inc. It is also stated that each of the other applicants may also elect to acquire its ownership interest in such portion of the cable in the name of a wholly owned subsidiary or an affiliated company. We assume that should they so elect, they will so advise us, giving relevant information and seeking appropriate modification of our authorizations herein.

49. We also note that applicants' financial and legal plans are based on an estimated 25-year life of the system. Our authorizations should be consistent with this period, and we will therefore issue our cable landing license for a term ending 25 years after the cable is placed in service.

50. Finally, we should like to point out that our action herein relates solely to the application before us. It is not to be construed as indicating any policy whatever with respect to the authorization of transoceanic cable facilities in the future. If and when applications for such facilities are filed, we will consider them on their merits in the light of then-existing circumstances.

CONCUSIONS

51. The foregoing factors lead us to conclude:

(*a*) That the public interest, convenience, and necessity would be served by a grant of the application considered herein for authority pursuant to section 214 of the Communications Act, to construct and operate, with communications entities in Spain, Italy, and Portugal, the cable and radio system described in the application between the United States on the one hand and Spain, Italy, and Portugal on the other; with the conditions hereinafter set forth; and

(*b*) That the application considered herein, filed under the Submarine Cable Landing License Act of 1921, for a cable landing license, should be granted, and that a license pursuant to that act be issued to applicants to land and operate near Green Hill, R.I., the cable between the United States and Spain, comprising part of the cable and radio system described in the application.

ORDER AND CERTIFICATE

It is hereby certified that the present and future public convenience and necessity require the construction, operation and landing in the United States of the cable and radio system described in the application file No. P–C–7022;

It is ordered that the aforementioned application, as amended, to construct and operate, with entities in Spain, Italy, and Portugal, a 720-circuit cable between a location near Green Hill, R.I., and San Fernando, Spain, together with a microwave system between San Fernando, Spain, and Sesimbra, Portugal, a microwave system between San Fernando, Spain, and Estepona, Spain, and a cable system between Estepona, Spain, and Rome, Italy, as more particularly described in the application of A.T. & T., ITTWC, RCAC. and WUI, filed April 1, 1968, file No. P–C–7022, is granted, subject to the following terms, conditions, and limitations:

(*a*) A.T. & T. is authorized to own 271 whole circuits and 240 half circuits in the TAT–5 cable (and may acquire in the name of its wholly owned subsidiary, Transpacific Communications, Inc., such portion of these circuits as may be in Spanish territory), and to acquire by indefeasible right of user IRU 142 whole circuits and 16 half circuits in the San Fernando-Sesimbra microwave system, and 73 whole circuits and 154 half-circuits in the San Fernando-Estepona microwave system and the Estepona-Rome cable system, and to use such half circuits to provide those services it is now authorized to provide with Spain, Portugal, and Italy;

(*b*) RCAC is authorized to own 34 whole circuits and 22 half circuits in the TAT–5 cable, and to acquire by IRU 9 whole and 2 half circuits in the San Fernando-Sesimbra radio system, and 21 whole and 8 half circuits in the San Fernando-Estepona and Estepona-Rome systems; and to use such half circuits to provide those services it is now authorized to provide with Spain, Portugal, and Italy;

(*c*) ITTWC is authorized to own 28 whole circuits and 22 half circuits in the TAT–5 cable and to acquire by IRU 8 whole and 2 half circuits in the San Fernando-Sesimbra radio system and 17 whole and 8 half circuits in the San Fernando-Estepona and Estepona-Rome systems, and to use such half circuits to provide those services it is now authorized to provide with Spain, Portugal, and Italy;

(*d*) WUI is authorized to own 28 whole circuits and 21 half circuits in the TAT–5 cable and to acquire by IRU 8 whole and 1 half circuit in the San Fernando-Sesimbra radio system and 17 whole and 8 half circuits in the San Fernando-Estepona system and the Estepona-Rome system, and to use such half circuits to provide those services it is now authorized to provide with Spain, Portugal, and Italy, respectively;

(*e*) Each applicant is authorized to contribute one-fourth of the capital cost of the circuits to be held in reserve as indicated on the last line of appendix E, pages 1 through 3, viz: 42 circuits in the TAT–5 cable, 18 circuits in the Spain-Portugal microwave system and 21 circuits in the Spain-Italy microwave/cable systems, and each applicant may, no earlier than January 1, 1970, seek authority to acquire and operate one or more of these circuits, showing adequate justification to so acquire and operate such circuit or circuits, including the need for the circuits and services to be provided;

(*f*) When a given applicant acquires an ownership or IRU interest in any circuit initially allocated to another applicant or acquires one of the circuits in the reserved pools, the reimbursement to the other applicant(s) shall be on the basis of depreciated original cost (or the pro rata accumulated cost of such circuit if the system is not then operational); and

(*g*) The aforementioned carriers are authorized to make available to the following carriers on an IRU basis, to the extent required for circuits assigned to them, as indicated in the application herein, the following numbers of whole and half circuits in the TAT–5 cable:

CTNE, six whole and 91 half circuits.
ITALCABLE, six whole and 178 half circuits.
ENTEL, 15 half circuits.
CRPM, 21 half circuits.

It is further ordered, that the applicants shall take all steps necessary to construct and install the necessary components of the TAT–5 cable segment of the system to assure its being placed in service no later than March 31, 1970, and shall take all reasonable steps necessary to assure that the other segments of the system will be operational at the same time;

It is further ordered, that any agreement entered into by any applicant herein with respect to service over any whole circuit it is herein, or is in the future, authorized to acquire shall provide for implementation of the conditions specified in the immediately following two ordering clauses;

It is further ordered, that no later than 90 days prior to the date the cable and microwave facilities authorized herein are placed in service with Spain, Portugal, and Italy, and at least 30 days before such facilities are used for service with each other country (unless shorter notice is authorized) each applicant shall file rates with the Commission for such services as they are authorized to provide over the facilities herein authorized, which shall, with respect to rates in effect at the date of this order, provide for at least a 25-percent reduction for message telephone service; more than 25 percent for private line services, including voice grade, telegraph grade, and voice/record service; at least 15 percent for telex service; and for reductions in message telegraph service;

It is further ordered, that at least 30 days prior to the activation by A.T. & T., RCAC, ITTWC, and WUI of any circuit or circuits, any such applicant is authorized to own or acquire in the TAT–5/MAT–1 system, it shall notify the Commission in writing of such intent, together with a showing that the proposed activation of the circuit or circuits is in accord with the third condition of our letters to them of February 16, 1968, regarding the TAT–5/MAT–1 cable system (which requires that the entities owning the cable or having IRU's therein use satellite circuits for the handling of traffic in numbers sufficient to assure that the cable and any commercial satellite facilities provided to handle traffic between

points in North America, South America, Europe, Africa, and the Middle East, shall each be filled at the same proportionate rate; that is the unfilled capacity of the satellite facilities shall be leased at a rate, with appropriate adjustments, so that, when added to the use made of the satellite facilities by entities not using the cable portion of TAT–5, unused satellite capacity is leased by all users, including those not having access to the cable, at the same rate as the cable is filled to assure that both types of facilities reach 100-percent fill at approximately the same time); and that such circuit activation may take place unless the applicant is given written notice to the contrary by the Commission prior to the date specified for such activation;

It is further ordered, that the Commission retains jurisdiction with respect to the requirements set forth in the two ordering clauses immediately above;

It is further ordered, that, insofar as the U.S. carriers' interest in the TAT–5/MAT–1 cable system is concerned, the Commission retains jurisdiction to reassign circuits authorized to applicants herein, to implement any merger, consolidation, or other restructuring of overseas carriers or facilities which the Commission may authorize in the future pursuant to enabling legislation which may be enacted for such purposes;

It is further ordered, that jurisdiction is retained by the Commission to reallocate the U.S. carriers' interests in circuits herein authorized, as the public interest may require, with, where required, the concurrence of the foreign administrations or carriers concerned, and, further, jurisdiction is retained by the Commission over all matters relating to applicant's ownership, management, maintenance, and operation of this cable as authorized herein, to assure the most efficient use not only of this cable but of all means of communications between the U.S. mainland and Europe;

It is further ordered, that no applicant herein shall dispose of any interest in any circuit in the TAT–5/MAT–1 facilities they are herein authorized to acquire in any way without prior authorization by the Commission;

It is further ordered, that no increase in the number of usable cable voice-grade circuits beyond the initial 720, whether by carrier or other equipment, shall be undertaken by any owner or operator of the TAT–5 cable circuits, nor shall additional circuits be derived by the installation of TASI equipment, unless authorized by the Commission;

It is further ordered, that no circuits in which the applicants have an interest in the cable portion of TAT–5 shall be subdivided into more than 22 telegraph circuits unless authorized by the Commission;

Provided, however, that this authorization is issued subject to the terms and conditions of any license issued to the applicants herein under the act entitled "An act relating to the landing and operation of submarine cables in the United States" (47 United States Code, sec. 34–39), covering the subject submarine cable, and shall become effective upon the acceptance of the aforementioned license by all such parties.

FEDERAL COMMUNICATIONS COMMISSION,*
BEN F. WAPLE, *Secretary.*

Appendices A–E.

PROPOSED OWNERSHIP INTERESTS (PERCENT)

	A.T. & T., ITT Worldcom, RCA, and WUI	CPRM	CTNE	ENTEL	Italcable	Total
TAT–5:						
1. Green Hill Cable Station (A.T. & T.)	100.00	0	0	0	0	100
2. United States-Spain cable and associated terminal equipment	77.16	1.46	7.15	1.04	13.19	100
	0	0	100.00	0	0	100
3. San Fernando Cable Station						
4. San Fernando-Sesimbra radio system:						
a. Portion within Spain	0	0	100.00	0	0	100
b. Portion within Portugal	0	100.00	0	0	0	100
MAT–1:						
1. San Fernando-Estepona radio system	0	0	100.00	0	0	100
	0	0	100.00	0	0	100
2. Estepona Cable Station						
3. Spain-Italy cable and associated terminal equipment	0	6.71	12.85	.56	79.88	100
	0	0	0	0	100.00	100
4. Castelfusano Cable Station						

*See statement of Commissioner Cox, to be issued at a later date. See attached statement of Commissioner Johnson.

PROPOSED ASSIGNMENT OF EQUIVALENT VOICE-GRADE CIRCUITS

	TAT–5		MAT–1	
	United States-Spain cable	San Fernando-Sesimbra radio system	San Fernando-Estepona radio system	Spain-Italy cable
I. Services between the United States and Spain:				
CTNE and A.T. & T. jointly	70			
CTNE and ITT Worldcom jointly	7			
CTNE and RCA jointly	7			
CTNE and WUI jointly	7			
ENTEL and ITT Worldcom jointly	5			
ENTEL and RCA jointly	5			
ENTEL and WUI jointly	5			
II. Services between the United States and Portugal:				
CPRM and A.T. & T. jointly	16	16		
CPRM and ITT Worldcom jointly	2	2		
CPRM and RCA jointly	2	2		
CPRM and WUI jointly	1	1		
III. Services between the United States and Italy:				
Italcable and A.T. & T. jointly	154		154	154
Italcable and ITT Worldcom jointly	8		8	8
Italcable and RCA jointly	8		8	8
Italcable and WUI jointly	8		8	8
IV. Services between Portugal and Italy: CPRM and Italcable jointly		24	24	24
V. Services between Spain and Italy:				
CTNE and Italcable jointly			46	46
ENTEL and Italcable jointly			2	2
XI. Services between Italy and points beyond the United States: Italcable	6		6	6
XII. Services between Italy and points beyond Portugal or Spain: Italcable		12	12	12
Total	720	266	417	417

Note: A circuit assigned to 2 parties jointly will be considered as ½ circuit assigned to each party. The total number of circuits in the United States-Spain cable assigned to categories VI, VII, and VIII may be reassigned within those categories by agreement of the American parties.

PROPOSED ALLOCATION OF CAPITAL, MAINTENANCE, AND OPERATING COSTS (PERCENT)

	A.T. & T., ITT Worldcom, RCA, and WUI	CPRM	CTNE	ENTEL	Italcable	Total
TAT–5:						
1. Green Hill-San Fernando cable system	77.16	1.46	7.15	1.04	13.19	100
2. San Fernando-Sesimbra radio system	73.47	8.47	9.03	0	9.03	100
MAT–1:						
1. San Fernando-Estepona radio system	57.07	2.88	5.52	.24	34.29	100
2. Estepona-Castelfusano cable system	57.07	2.88	5.52	.24	34.29	100

MESSAGE TELEPHONE SERVICE RATE SCHEDULE, ITALY-PORTUGAL-SPAIN

	Station to station		Person to person		Additional minutes	
	Full	Reduced	Full	Reduced	Full	Reduced
Present:[1]						
Italy	$9.00	$9.00	$12	$12	$3.00	$3.00
Portugal			12	9	4.00	3.00
Spain			12	9	3.00	2.25
Proposed:[2] All countries	9.00	6.75	12	9	2.25	1.70
	6.75	5.10				

[1] Present: Italy, no reduced night or Sunday rates; Portugal, no station-to-station rates, reduced rates apply all day Sunday, no night reduced rates; Spain, reduced rates apply on weekdays 5 p.m. to 5 a.m. and all day Sunday.
[2] Proposed: All countries, reduced rates apply weekdays 5 p.m. to 5 a.m. and all day Sunday.

PRIVATE LINE VOICE RATE SCHEDULE, ITALY-PORTUGAL-SPAIN

	A.T. & T. portion	European portion
Present monthly rates: [1]		
New York to:		
Rome	$6,500	$9,000
Lisbon	6,500	9,000
Madrid		
Proposed monthly rates:		
New York to:	[2] 4,750	6,600
Rome	[2] 4,750	6,600
Lisbon	[2] 4,750	6,600
Madrid		

[1] A.T. & T. portion filed Feb. 8, 1968, effective Mar. 13, 1968.
[2] Minus 27 percent.

TAT-5 AND MAT-1 CIRCUIT ALLOCATIONS

TAT-5 CABLE

	Categories I, II, III, IV, V, IX, X, XI, XII				Categories VI, VII, VIII				Total in all categories	Percent of total
Carriers	Half	Equivalent whole	Whole only	Totals in these categories	VI	VII	VIII	Totals in these categories		
A.T. & T.	240	120.0		120.0	142	56	73	271	391.0	54.3056
RCA	22	11.0		11.0	9	4	21	34	45.0	6.2500
ITTW	22	11.0		11.0	8	3	17	28	39.0	5.4167
WUI	21	10.5		10.5	8	3	17	28	38.5	5.3472
CTNE [1]	91	45.5	6	51.5					51.5	7.1528
ENTEL	15	7.5		7.5					7.5	1.0417
CRPM	21	10.5		10.5					10.5	1.4583
Italcable	178	89.0	6	95.0					95.0	13.1944
Reserved					18	3	21	42	42.0	[2] 5.8333
Total				317.0	185	69	149	403	720.0	100.0000

[1] The allocations to the overseas carriers and their corresponding contributions are shown only to present a complete view of the entire segment.
[2] One-fourth of this, or 1.4583 percent, will be added to the percentage of each carrier, A.T. & T., RCA, ITTW, and WUI shown above to compute that carrier's total initial contribution for this segment of the project.

TAT-5 AND MAT-1 CIRCUIT ALLOCATIONS

SPAIN-PORTUGAL MICROWAVE SYSTEM

	Categories I, II, III, IV, V, IX, X, XI, XII				Category VI	Total in all categories	Percent of total
Carriers	Half	Equivalent whole	Whole only	Totals in these categories			
A.T. & T.	16	8.0		8.0	142	150.0	56.3910
RCA	2	1.0		1.0	9	10.0	3.7594
ITTW	2	1.0		1.0	8	9.0	3.3835
WUI	1	.5		.5	8	8.5	3.1955
CTNE [1]			24	24.0		24.0	9.0225
CRPM	45	22.5		22.5		22.5	8.4586
Italcable	24	12.0	12	24.0		24.0	9.0225
Reserved					18	18.0	[2] 6.7670
Total				81.0	185	266.0	100.000

[1] The allocations to the overseas carriers and their corresponding contributions are shown only to present a complete view of the entire segment.
[2] One-fourth of this, or 1.6917 percent, will be added to the percentage of each carrier, A.T. & T., RCA, ITTW, and WUI shown above to compute that carrier's total initial contribution for this segment of the project.

TAT–5 AND MAT–1 CIRCUIT ALLOCATIONS

SPAIN-ITALY MICROWAVE AND CABLE SYSTEMS

Carriers	Categories I, II, III, IV, V, IX, X, XI, XII				Category VII	Total in all categories	Percent of total
	Half	Equivalent Whole	Whole only	Totals in these categories			
A.T. & T.	154	77		77	73	150	35.9712
RCA	8	4		4	21	25	5.9952
ITTW	8	4		4	17	21	5.0360
WUI	8	4		4	17	21	5.0360
CTNE[1]	46	23		23		23	5.5156
ENTEL	2	1		1		1	0.2398
CRPM	24	12		12		12	2.8777
Italcable	250	125	18	143		143	34.2925
Reserved					21	21	[2] 5.0360
Total				268	149	417	100.0000

[1] The allocations to the overseas carriers and their corresponding contributions are shown only to present a complete view of the entire segment.

[2] One-fourth of this, or 1.259 percent, will be added to the percentage of each carrier, A.T. & T., RCA, ITTW, and WUI shown above to compute that carrier's total initial contribution for this segment of the project.

TRANSATLANTIC CABLE (II)

DISSENTING OPINION OF COMMISSIONER NICHOLAS JOHNSON

The Commission here formally acknowledges and approves by order what it invited by "informal letter" to A.T. & T. last February—authorization for the building of a new transatlantic cable between the United States and Spain with connections to Portugal and Italy. I dissented to that decision because there was no economic justification for building the cable. Despite the opportunity to make such a case during the interim, the applicants and the Commision have not been able to do so and I therefore adhere to my dissent of last February. See A.T. & T., 11 F. C. C. 2d 957, 960 (1968). I will not repeat the substance of that opinion here.

In plain language, the Commission is saying today that the best way to provide 720 additional communications circuits between the United States and Spain, Portugal, Italy, and connecting points for the next 25 years is to allow private companies to make an estimated $90 million investment in a cable and other facilities. This will be 720 of a projected 5,200 trans-Atlantic channels by about 1975. This expense will be recaptured from consumers in telephone bills over the life of the cable—in addition to operating expenses and a "fair rate of return." As an added bonus, A.T. & T. is to provide most of the equipment from its manufacturing subsidiary.

This decision is made despite the fact that probably by the time the cable is operational, and certainly within the next 5 years, providing an additional 720 circuits through a high-capacity (thousands of circuits) satellite could be done for virtually no additional investment or operating expense.

At least the Commission has today come around to a less hypocritical position on the merits of its decision. It has now simply abandoned its earlier effort to provide economic justification for its action. Thus, the Commission says in paragraph 22 of its opinion:

"[W]e do not believe that any useful purpose would be served by going over relative costs. * * *";

And in paragraph 24:

"[W]e do not feel it necessary to make definitive findings on the relative economic merits of TAT–5 and present satellites, those now being constructed and those proposed for the early 1970's"—as though decisions about the proper mix of satellites and cables in the Atlantic for the next 25 years could be made without such findings.

In my judgment, such other "reasons" as the Commission is able to muster for authorizing the cable are not sufficient, alone or together, to justfy the investment proposed here.

And, of course, it is not adequate to only compare satellites and cables as point-to-point carriers—a kind of communications distribution system which the satellite has rendered nearly obsolete. For it is now possible to communicate with any point on earth without the added cost of expensive land line interconnection of trans-ocean cable terminal and ultimate inland destination. The remotest point on earth, once equipped with an earth receiving station, can be reached as cheaply as a major urban center. As population, trade, and communication needs shift, the satellite merely redirects its beam—the cable owner must be another multimillion-dollar cable, It is almost impossible to compare the costs of a point-to-point system with a system that covers the earth. It is certainly unfair to make economic judgments about the communications satellite as a system for moving information between two fixed points. But the economics of satellite communications are such that even when they are used to provide this uneconomic point-to-point service they are still cheaper than cables.

This is one instance in which consistency is a very expensive hobgoblin. I regret the Commission's insistence on holding to its February invitation.

CONCURRING STATEMENT OF COMMISSIONER KENNETH A. COX

1. I concur in the findings and conclusions reached by the Commission in its memorandum opinion and authorization herein and believe that, with the terms and conditions specified, a grant of the TAT–5 application is completely justified. It appears to me, however, that certain statements in Commissioner Johnson's dissent should not go unchallenged. In addition, the Communications Satellite Corp. (Comsat) in its statement of April 22, 1966, raised certain questions regarding Commissioner Loevinger's and my statement of February 16 which merit consideration.

2. I must confess that I am at something of a loss to understand the thrust of Commissioner Johnson's dissent. He states that the Commission has now simply abandoned its earlier effort to provide economic justification for its action. However, as even a cursory reading of the Commission's earlier letter to A.T. & T. and the record carriers, released on February 16, 1968, will indicate, there was never any statement, or even intimation, that its position was based primarily upon the economic advantages of the proposed TAT–5 cable. Instead, as set forth in that letter, pointed out in my concurring statement and reiterated again in the memorandum opinion and order adopted on May 22, the Commission's conclusions were based on numerous considerations, including the availability of facilities when needed; enhanced ability to satisfy national defense and security requirements; potential benefits of diversity; assurances of prompt and substantial rate reductions by both U.S. carriers and all their foreign counterparts who will make use of the cable; foreign policy requirements; and the desirability of additional nonsatellite facilities which could be used in connection with satellite facilities to reach distant areas not accessible by means of a single satellite in synchronous orbit. Nor should the Commission's statement that it did not feel it necessary to make definitive findings on the relative economic merits of TAT–5 and present satellites, those being constructed or those under consideration for the future, be taken to mean, as Commissioner Johnson intimates, that we ignored the economic and cost data submitted to us. In a situation where the considerations outlined above were controlling, we believe it is sufficient that the data before us indicated that the TAT–5 cable would provide facilities considerably more economical than those now available via satellite or those to be provided by the next generation of satellites which it is expected will be launched sometime in the latter part of this year. In this connection, it is pertinent to note that Comsat, in its lengthy statement on the TAT–5 applications, did not challenge this conclusion in my previous concurring statement but alleged only that the figures I cited were based on dissimilar data (see pars. 6–10 below for a further discussion of this matter).

3. It is undoubtedly true that satellite facilities which are expected to be available later in the 1970's will, in fact, be more economical than TAT–5. However, I believe that a regulatory agency has a basic obligation to authorize facilities to provide efficient economical service when needed, and to meet the other objectives which the Commission outlined and which are set forth herein above. TAT–3, which became operational in 1963, provided facilities at about one-third the cost of TAT–2 which had been opened for service a scant 5 years earlier. Similarly Intelsat III will provide facilities at a very considerable

reduction from present channel costs of Intelsat I which became operational less than 4 years before the expected date of service of Intelsat III. In neither case, however, does this mean that we should have denied applications for the earlier generations of either cable or satellite because of our expectations that within a few years a better or cheaper facility would become available. Each generation of users is entitled to the best that technology can offer at a given time and must not be deprived of additional service because something better or cheaper will probably be operational within 3 to 5 years.

4. Commissioner Johnson is certainly accurate in pointing out that satellites and cables provide service through different distribution systems. However, the differences are not as great as he would imply. It is true that signals by way of a satellite may be transmitted between any two points from which the satellite is mutually visible. The "truth" is subject to a single but very important proviso, namely, that the two points desiring to communicate via satellite each must have an earth station. In the present state of the art and, according to information supplied to us by Comsat, for the foreseeable future such earth stations require relatively large initial investments and relatively high annual operating costs. Their ability to provide economical service is dependent upon high volume usage as there is no direct proportionate relationship between earth station investment or operating costs and the number of circuits handled. Thus, a country requiring 10 circuits does not have significantly different total earth station costs from one requiring several hundred circuits, but obviously the per circuit costs for the one having little traffic are higher by a great many magnitudes than those of the country whose earth station handles vastly larger volumes. In the cable technology the situation is entirely different. Thus, Portugal, which requires only about 10 circuits of the total of 720, will be required to invest less than 1½ percent of the overall costs of the TAT–5 system, a sum far less than would be required for it to construct its own earth station to satisfy such requirements. Its annual operating costs for the cable facilities will also be a relatively small fraction of the comparable costs for satellite facilities to satisfy the same requirement. In fact, one of the serious concerns with respect to the developing satellite system is the effect of the installation and operation of high capacity, high cost earth stations in countries having small traffic requirements upon the overall system costs.

5. It is certainly true that in the United States, where the earth stations now handle several hundred circuits and are expected to be handling several thousand in the near future, the per circuit costs will be relatively low. However, the cost for a through circuit between the United States and a country which has requirements for 10 circuits or fewer consists not only of the costs of our earth station and the space segment, but also includes the per circuit cost of the distant low usage earth station. I would hope that this problem would continue to receive careful consideration from Comsat and all other entities to the end that satisfactory service can be provided to economically less developed countries. Only if means are found to provide earth station facilities economically to countries with relatively low circuit requirements can Commissioner Johnson's statement that "the remotest point on earth, once equipped with an earth receiving station, can be reached as cheaply as a major urban center" be true. Until that is done, the cost of reaching "the remotest point on earth" via satellite will continue to be very high.

6. Comsat, in its statement of April 22, 1968, alleges that the specific comments in my concurring statement were confused and erroneous. Comsat makes lengthy comparisons between revenue requirements for the first four transatlantic cables ($28,000), its charges per circuit to the carriers ($45,600), and charges by the carriers to the public ($78,000). It then alleges that the figure for carrier revenue requirements via the first four cables must be inaccurate because of the wide disparity between this figure and the charges to the public ($50,000). The Comsat figures, however, do not provide an adequate basis for judging charges to public users for leased circuits. First, Comsat does not take into account that the figures it uses related to circuits with TASI, a device used to increase the number of usable circuits for toll message telephone service but not applicable to leased circuits. This device increases the equivalent number of voice grade circuits available to A.T. & T. for its services on the four existing transatlantic cables from 239 to 340, or an increase of 46.5 percent. Secondly, it does not consider the cost of handling traffic from the cable head to A.T. & T.'s central office in White Plains averaging several hundred dollars a month. Finally, it does not allow all

of the operational overheads applicable to the maintenance of an ongoing business. Furthermore, as set forth in the footnote to paragraph 24 of the Commission's memorandum opinion and order adopted May 22, 1968, there are differences between the manner in which the cable carriers compute their costs and the manner in which Comsat, a relatively new enterprise, has thus far felt compelled to compute its costs. There are also differences resulting from the fact that when the carriers lease circuits from Comsat they must pay it a sum sufficient to cover not only operation and maintenance of the earth station and satellites, as well as depreciation on these facilities, but also a proportionate share of total corporate overheads and a return on Comsat's investment. Before making a service available to the public, the carriers must add on a sum sufficient to cover their own corporate overheads; thus, cable costs include but a single corporate overhead, whereas satellite facilities include two corporate overheads.

7. I agree with Comsat that under these circumstances direct and explicit comparisons are difficult, if not impossible. However, I see nothing in their pleading or upon further review of data filed in this matter which would require substantial modification of my original concurring statement, aside from a specific note that the carrier revenue requirements to which I referred were based on average investment over the life of the facility whereas the Comsat data were based on year-by-year requirements reflecting then-undepreciated investment. The Comsat data also indicates higher per circuit revenue requirements because their facilities at the time were only partly filled, whereas the first four TAT cables were substantially filled. Finally, because of the need to serve many points, and the manner in which units of utilization must be assigned under present operating modes, the satellite may not be expected to achieve a fill of more than about 80 percent of designed capacity, whereas the cable can and does achieve 100 percent fill.

8. In commenting on my comparisons between the Intelsat satellites and TAT–5, Comsat alleges that they were based upon dissimilar data. This is true, but the differences result from the inherent nature of the two media. Satellite facility costs are not segregated for each generation as cable costs are, because as each satellite generation is filled a new and larger satellite generation is put into service and all traffic, or nearly all traffic, is transferred to the newer and larger satellite. The older generation, although it may still be physically capable of handling traffic, ceases to be revenue producing unless other uses can be found for it in other regions of the world. This course of action is followed in the satellite technology to obviate the need for building additional expensive earth station antennas or, if antennas are available, to obviate the need for expensive cross hauling. On the other hand, when cables are filled they are supplemented, rather than replaced, by succeeding generations and thus each generation continues to be revenue producing.

9. Secondly, Comsat alleges that the stated TAT–5 revenue requirement consists only of direct costs, whereas Comsat's stated revenue requirement included both direct and indirect costs. This, again, is true, but here also the difference results from the fact that use of cable facilities requires, as noted above, satisfaction of a single corporate overhead, whereas Comsat in fixing its rates to the carriers must necessarily include its overheads and the carriers, in turn, in fixing charges to the public, must include the total sums paid to Comsat plus an amount sufficient to pay for their own overheads. The appropriate comparison, therefore, is between the cost of cable circuits without corporate overheads as against the price paid for satellite circuits which does include the Comsat overheads. In each case the carrier adds an appropriate factor per circuit for recovery of its own overheads. Again, there is a difference in the costs included but a uniformity of treatment for the purposes of comparison.

10. Finally, Comsat points out that TAT–5 costs were derived by using average revenue requirements for a 20-plus-year period, the estimated life of the cable, whereas annual satellite circuit costs related only to shorter periods ending in 1973. Comsat is right in this and I recognized this fact in my conclusions by making reference to the period of the next 5 to 7 years. I further pointed out in several places that we hope and expect to realize the economies to which Comsat refers from later generations satellites. Furthermore, the Commission itself, in paragraph 24 in its memorandum opinion, expressed its confidence that as satellite technology moves to more sophisticated satellites it will provide increasingly more economical facilities in future years, with corresponding large scale reductions in charges for service to the public.

11. In conclusion, I should like to emphasize, as the Commission stated, that we were not called upon to judge the relative economies of cables and satellites in the years to come, nor did we do so. We found only that, in the circumstances now confronting us, the public interest would be served by granting the TAT–5 application at this time. We expect that satellite technology, if aggressively pursued and intelligently applied, will provide major economies in the years to come. In fact, competitive efforts by competent personnel working in the cable and satellite technologies—and in others not even visualized at the present time—offer the best assurance that our communications industry will continue to provide high quality, flexible, and increasingly lower cost services to satisfy the growing demand for international communication services and facilities.

Before the

FEDERAL COMMUNICATIONS COMMISSION

Washington, D.C.

File No. S–C–L–40

IN THE MATTER OF AMERICAN TELEPHONE AND TELEGRAPH CO.; ITT WORLD COMMUNICATIONS INC.; RCA COMMUNICATION, INC.; WESTERN UNION INTERNATIONAL, INC.

LICENSE AUTHORIZING THE LANDING AND OPERATION OF A SUBMARINE CABLE BETWEEN THE STATE OF RHODE ISLAND AND SPAIN

CABLE LANDING LICENSE

Adopted May 22, 1968; released May 27, 1968

By the Commission: Commissioners Loevinger and Wadsworth absent, Commissioner Johnson dissenting.

The Commission having under consideration an application, File No. S–C–L–40, filed by the American Telephone and Telegraph Co., ITT World Communications Inc., RCA Communications, Inc., and Western Union International, Inc., requesting a joint license to land and operate a submarine cable between the State of Rhode Island and Spain. Hereby Grants and Issues, under the provisions of an act entitled, "An act relating to the landing and operation of submarine cables in the United States" (47 United States Code, secs. 34–39) and Executive Order No. 10530, dated May 10, 1954 (delegating to the Federal Communications Commission certain Presidential functions relating to submarine cable landing licenses) to the American Telephone and Telegraph Co., a corporation organized under the laws of the State of New York, and to ITT World Communications Inc., RCA Communications, Inc. and Western Union International, Inc., all corporations organized under the laws of the State of Delaware a submarine cable as follows:

A single submarine cable with rigid two-way repeaters, providing for telephone and telegraph communications, between the State of Rhode Island and Spain (TAT–5), subject to the provisions of the above-cited act entitled, "An act relating to the landing and operation of submarine cables in the United States," the Communications Act of 1934, as amended (47 United States Code, sec. 151–609), subsequent applicable acts and all rules and regulations heretofore or hereafter made by the Federal Communications Commission pursuant to authority vested in it; subject to any treaties or conventions relating to communications to which the United Staes of America is now or may hereafter become a party; subject to any action by the Commission or the Congress of the United States of America rescinding, changing, modifying, or amend-

ing any rights accruing to any person hereunder; and subject to the following conditions:

(1) That the location of the cable within the territorial waters of the United States of America, its territories, and possessions, and upon the foreshore thereof, shall be in conformity with plans approved by the Secretary of the Army, and the cable shall be moved or shifted by the Licensees at their expense upon the request of the Secretary of the Army whenever he considers such course necessary in the public interest, for reasons of national defense, or for the maintenance or improvement of harbors for navigational purposes;

(2) That the Licensees shall at all times comply with any requirements of appropriate United States Government authorities regarding the location and concealment of the cable buildings and apparatus with a view to protecting and safeguarding the cable from injury or destruction by enemies of the United States of America;

(3) That ample repair service shall be maintained, as may be required by the Federal Communications Commission;

(4) That the Licensees or any person or company controlling them or controlled by them does not enjoy and shall not acquire any right for the purpose of handling traffic to or from the United States, its territories or possessions, to land, connect, or operate cables or landlines, to construct or operate radio stations, or to interchange traffic, which is denied to any other United States company by reason of any concession, contract, understanding, or working arrangement to which the Licensees or any person or company controlling them or controlled by them is a party;

(5) That the operation of facilities herein authorized shall be limited to the provision of such communication service or services as may be authorized by the Federal Communications Commission for these facilities upon proper application therefor;

(6) That the Government of the United States of America shall be entitled to the same or similar privileges with respect to its official Government messages to be transmitted over the cable as may by law, regulation, agreement or otherwise be granted by the Licensees to any other Government;

(7) That neither this license, the rights herein granted, nor the cables herein authorized shall be transferred, assigned, or in any manner either voluntarily or involuntarily disposed of or disposed of indirectly by transfer of control of the Licensees to any person, unless the Federal Communications Commission shall give prior consent in writing;

(8) That this license is revocable after due notice and opportunity for hearing by the Federal Communications Commission in the event of breach or nonfulfillment of any of the conditions set forth herein, or for the reasons specified in section 2 of the above-cited act entitled, "An act relating to the landing and operation of submarine cables in the United States";

(9) That this license shall expire on March 31, 1995, unless renewed or extended upon proper application duly filed no less than 6 months prior to the expiration date and that upon expiration thereof all rights granted herein shall terminate;

(10) That this license may be transferred upon due notice by the Commission to implement any merger of overseas carriers which the Commission may authorize in the future pursuant to enabling legislation which may be enacted for such purposes;

(11) The terms and conditions upon which this license is given shall be accepted by a duly authorized officer of each Licensee, and evidence, of said acceptance shall be filed with the Federal Communications Commission, Washington, D.C.

FEDERAL COMMUNICATIONS COMMISSION.
BEN F. WAPLE, *Secretary.*

COMPUTATION OF ESTIMATED SAVINGS TO U.S. GOVERNMENT FROM THE FILING OF LOWER RATES FOR LEASED OVERSEAS CIRCUITS. SAVINGS ON AVD AND VOICE CIRCUITS ARE BASED ON RATE CHANGES SINCE JAN. 20, 1967, AND ON TELEPRINTER CIRCUITS ON RATE CHANGES SINCE OCT. 1, 1966.[1]

From	Leased by U.S. Government agencies			Savings from changes in rates for AVD and voice circuits				Savings from changes in rates for teleprinter circuits			
	AVD and voice (May 1, 1968)	Teleprinter (Dec. 31, 1967)[2]		Rate as at Jan. 20, 1967	Rates on file as at June 1, 1968	Reduction, col. (3) —col. (4)	Monthly savings, col. (5) × col. (1)	Rates for 66 WPM service		Reduction, col. (7) —col. (8)	Monthly savings, col. (9) × col. (2)[3]
		100 WPM	66 WPM					As at Oct. 1, 1966	On file as at June 1, 1968		
	(1)	(2a)	(2b)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Continental United States to:											
Europe:											
France	1										
Germany	19	1									
Italy	1	1									
Spain	9		1								
United Kingdom	26	1	12	$6,500	[4] $6,000	$500	$28,500	$3,000	$2,400	$600	$10,980
U.S.S.R. (via United Kingdom)	1		1								
U.S.S.R.			1								
Cyprus		3									
Total, Europe	57	6	15					4,000	(6)		
Africa:											
Liberia		1									
South Africa Republic			2								
United Arab Republic			1					4,000	(6)		
Total, Africa		1	3								
South Atlantic:											
Argentina	3	1	1								
Bahamas	1		1	2,500	(6)			4,000	(6)		
Barbados	16	5		4,500	(6)			1,500	(6)		
Bermuda		1		4,500	(6)						
Brazil		1	1					2,000	1,800	200	1,100
Chile			1					4,000	(6)		
Colombia	1			[5] 2,000	(6)			4,000	(6)		
Cuba		1	3	7,000	(6)			4,000	2,500	1,500	1,500
Dominican Republic	2	1						3,000	(6)		
Ecuador			1	5,000	(6)			4,000	(6)		
Guatemala	14							4,000	2,000	2,000	2,200
Haiti			1					3,000	(6)		
Panama Canal Zone								4,000	(6)		
Paraguay											

Peru	1	3		8,000	(6)				4,000	(6)		
Puerto Rico	11			[8] 8,550	[5] [8] 5,000	3,550	39,050		4,000	(6)		
Uruguay		1							4,000	2,500	1,500	1,650
Venezuela		1										
Total South Atlantic	49	15	9									
Asia and Oceania:												
Hawaii	73	3		[8] 9,800	(6)				[8] 4,800	[8] 2,750	2,050	6,765
Guam	7	2	2	[8] 16,000	(6)				[8] 8,000	[8] 5,600	2,400	10,080
Australia	3		5	15,000	(6)				4,000	(6)		
Japan	9			10,000	(6)							
Philippines	4		1	10,000	(6)				4,000	3,500	500	500
Total, Asia and Oceania	96	5	8									
Hawaii to:												
Guam	14	2	1	[8] 12,000	(6)				[8] 8,000	[8] 4,200	3,800	12,160
Australia	6		1	12,423	(6)				4,000	3,313	687	687
Fiji			2						(7)	2,500		
Japan	24		1	7,100	(6)				4,000	2,840	1,160	1,160
Philippines	28			7,100	(6)							
Thailand	10			7,100	(6)							
Total	82	2	5									
Guam to:												
Australia	1		1	(6)	8,700				(7)	2,600		
Japan	4			4,500	(6)							
Philippines	13			4,500	(6)							
Total	18		1									
Grand total of circuits	302	29	41									48,782
Total monthly savings								67,550				585,384
On annual basis								810,600				

[1] The base date for determining further savings on voice and alternate voice data (AVD) circuits is Jan. 20, 1967, the effective date of the lower composite cable/satellite rates for voice-grade circuits. Oct. 1, 1966, is the base date for teleprinter circuits since no report of savings from rates changes for this type of circuit after that date has been computed. (See our report of savings to the Military Operations Subcommittee submitted with our letter of Apr. 4, 1967.)

[2] Except that data for 1 carrier is at June 30, 1967.

[3] Where 100 words per minute (WPM) service has been leased (col. (2a)) the savings are computed on a rate of 110 percent of the rate for 66 WPM service. For example:

Europe:	
15 to 66 WPM circuits at $600	$9,000
3 to 100 WPM circuits at $660	1,980
Total savings	10,980

[4] Filed by 1 carrier on May 9, 1968, effective Aug. 1, 1968.

[5] Not filed as at June 1, 1968. However, the FCC staff has been informally advised that this rate will be filed to become effective with opening of Florida/U.S. Virgin Islands 720-circuit cable expected early in early summer, 1968.

[6] No change.

[7] Teleprinter service not offered on Oct. 1, 1966.

[8] Indicates that rate is for both terminals.

APPENDIX 3.—STATE DEPARTMENT CORRESPONDENCE

DEPARTMENT OF STATE,
Washington, D.C., June 7, 1968.

Hon. CHET HOLIFIELD,
Chairman, Subcommittee on Military Operations, Committee on Government Operations, House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: Your subcommittee has been concerned with rates charged to the U.S. Government for leased voice circuits in the international service. Although we did not participate in hearings of your subcommittee on July 24 and 25, 1967, the Department has noted pertinent portions of the resultant study embodied in the Seventh Report by the Committee on Government Operations. Noting rate reductions on the part of U.S. international communications carriers, the committee specifically urged the Department of State and the Federal Communications Commission to make every appropriate effort to bring about comparable reductions by foreign carriers.

More recently you may have noted proposals for the establishment of a fifth transatlantic submarine cable (commonly known as TAT–5) and related systems. On May 22, 1968 the Federal Communications Commission authorized the construction and operation of the integrated submarine cable and radio system between the United States Mainland and Spain, Portugal and Italy. At the same time, and with the Department's specific approval, the Commission issued the necessary landing license for the cable portion of the system. Prior to these decisions the Department participated with the Commission and other interested Government agencies in prolonged and thorough studies of questions raised by the joint proposals of the American Telephone and Telegraph Co., ITT World Communications, Inc., RCA Communications, Inc., and Western Union International, Inc. Although our concern related mainly to the possible impact of TAT–5 upon the future development of INTELSAT, the question of rates, among other matters, was also the subject of serious concern.

As a result, the Commission addressed letters to the U.S. carriers on February 16, 1968, tentatively concluding that it would be appropriate for the applicants to file applications for the proposed system, subject to certain conditions. With the Department's concurrence the latter included a requirement "that rates for telephone message service would be reduced, no later than the time the cable is opened for service, by at least 25 percent from the rates applicable immediately prior to such reduction, that rates for leased service would simultaneously be reduced by more than 25 percent from the levels applicable immediately prior thereto, and that appropriate downward revisions would be made in charges for telegraph-type services."

The U.S. applicants subsequently reached agreement with their European partners, "subject to necessary governmental authorizations, to make the following rate reductions no later than the time that the TAT–5 cable is operational, provided that the annual revenue requirements of satellite half circuits reasonably approximate those now projected for the 1970–73 time frame, i.e., $31,100–$20,700 for the U.S. half, of which $9,600–$6,600 is for the projected Intelsat revenue requirements for the space segment, with these revenue requirements being reflected in Comsat charges to the U.S. carriers and with adjustments in charges to the European carriers for European half of said circuits reflecting the above projected revenue requirements:

"(*a*) For message telephone and private line voice-grade channel service, A.T. & T., CPRM, CTNE, and Italcable agree to make effective reduced rates as specified in appendix D hereto,[1] it being stated that, while the extent of these reductions will vary by country, the overall result will reduce charges to all customers in the countries by at least 25 percent for message telephone service and 25 to 30 percent for private line voice-grade channels;

[1] Not attached.

"(b) For record services, including voice-data service, ITTWC, RCAC, WUI, CPRM, CTNE, ENTEL, and Italcable agree, subject to the necessity of an overall fair rate of return, to make effective rate reductions for service between the United States on the one hand, and Italy, Portugal, and Spain on the other hand, of approximately 25 percent for voice-record channels (with consideration of the cost of special conditioning to provide data capabilities so that charges reflect reasonable costs); approximately 25 percent in existing rates for 50 band teleprinter leased channels, and approximately 15 percent in existing telex rates."

On the basis of this agreement the Commission's authorization to proceed with conclusion of the new system provided "That no later than 90 days prior to the date the cable and microwave facilities authorized herein are placed in service with Spain, Portugal, and Italy, and at least 30 days before such facilities are used for service with each other country (unless shorter notice is authorized) each applicant shall file rates with the Commission for such services as they are authorized to provide over the facilities herein authorized, which shall, with respect to rates in effect at the date of this order, provide for at least a 25-percent reduction for message telephone service; more than 25 percent for private line services, including voice grade, telegraph grade, and voice-record service; at least 15 percent for Telex service; and for reductions in message telegraph service."

From the foregoing you will note that establishment of the new facility is conditioned upon a more than 25 percent reduction of rates for all leased services. Not only the American carriers but all of the European correspondents making use of the system will give effect to the proposed reductions.

I am confident that you will find this an encouraging development. You may be assured that the Department will continue to seek possibilities for further reductions in the future and will work closely with the Federal Communications Commission and the American carriers toward that end. If I can be of any further assistance in this or any other matter, please do not hesitate to let me know.

Sincerely yours,

WILLIAM B. MACOMBER, Jr.,
Assistant Secretary for Congressional Relations.

Appendix 4.—Summary of Department of Defense Protests on Charges by Communication Carriers

Investigation of all interstate and foreign rates of A.T. & T. and its associated companies. A GSA petition for leave to intervene was filed in November 1965. Cross-examination of A.T. & T. expert economic witnesses will resume on January 27, 1969. DOD/GSA testimony for phase 1B will have to be filed 14 days after the completion of cross-examination. It is now anticipated that testimony will be filed for both General Grant and General Williams (GSA). Written testimony is due July 22, 1968 and cross-examination begins September 25, 1968.

Interdependence of computer and communications services and facilities, docket 16979. An inquiry by the FCC to decide if it should take jurisdiction. The joint DOD/GSA comments were filed on March 5, 1968. We are awaiting the next step by FCC. DCA has urged free and unrestricted interconnection.

Domestic telegraph service investigation, docket 14650. An investigation into Western Union's operations and services—reliability of service, plans for improvement, interconnection, financing, etc. The telephone and telegraph committees have issued their report, the proceeding is now in a dormant stage, and is not expected to become active again until after the A.T. & T. Investigation. DOD comments filed with the Commission on June 25, 1962.

TELPAK service investigation, docket 14251. An investigation of charges which resulted in the A. & B. TELPAK's being terminated by FCC order as being discriminatory against private line users. DOD and GSA were cocounsel. Remaining issues re C. & D. TELPAK's in this proceeding will be considered in the A.T. & T. Investigation, docket 18128. DOD filed a protest on behalf of all executive agencies of United States to the new revised rates on May 10, as costs to do would increase on September 1 by more than $1.5 million per month.

Protest of A.T. & T. and Western Union's unified private line rates, docket (open). GSA and DOD protesting rates and classification of service—short and long haul, on July 17, 1966. Rates were allowed to go into effect. FCC deferred decision until after the completion of docket 16258, the A.T. & T. investigation.

Investigation of Northwestern Bell Telephone Co.'s charges for communications facilities to Offutt Atlas missile complex, docket 17478. DOD complaint filed with the Commission on July 3, 1967. FCC issued an order directing an investigation. A prehearing conference has been held and most of facts have been stipulated. The carrier has failed to reduce its termination charges (the issue), negotiations are still in process.

Investigations of RCAC, Hawaiian Telephone Co., A.T. & T. cable rates in the Pacific, and investigation of A.T. & T. cable rates in the Atlantic. Voluntary reductions in rates have been filed since these petitions were filed with the Commission. DOD filed petition for investigation of rates in 1964. The Commission has not yet ordered an investigation of these rates, but has indicated that they will be considered in phase 2 of docket 16258. If the FCC does not take such action, we will consider a new petition to the Commission demanding a hearing.

Investigation of A.T. & T.'s rate for COPAN service, docket 18031. A DOD complaint was filed against A.T. & T.'s COPAN (command post alert network) rates on February 15, 1968. A.T. & T.'s answer is due. Negotiations are underway to attempt a settlement of the case which involves unreasonable charges on terminal equipment and need for FCC jurisdiction versus that of the States.

Private line service—Monthly supplementary charges, docket 18137. DOD protest against the Chickasaw Telephone Co. for unlawful charges as they might affect access line costs in AUTOVON. Complaint filed on May 31, 1968.

Night Watch, A.T. & T. Co. Petition for investigation pending. Protest for unreasonable charges for air-to-ground communications negotiations in process. DOD petition for investigation filed with the FCC on February 14, 1968.

DOD CASES TO BE FORWARDED TO FCC

Tariff classification of equipment used by the ADC at the Cheyenne Mountain complex. The Bell System has classified certain equipment associated with interstate channels as intrastate. Formal complaint to FCC being drafted.

Tariff classification of 309 AUTOVON key equipment. The Bell System classifies 309 AUTOVON key equipment as interstate so long as there is no local exchange service terminated on the key equipment. If local exchange service is terminated on the key equipment, the Bell System reclassifies the equipment intrastate. Formal complaint to FCC being drafted.

Tariff classification of ADC weather communication network. The Bell System originally classified the ADC weather teletypewriter network as interstate, but now Bell has taken action to reclassify certain portions of the equipment as intrastate. Formal complaint to FCC being drafted.

Tariff classification of private-line service between Kansas City, Mo., and Olathe, Kans. The FAA leases private line service from the Bell System between Kansas City. Mo., and Olathe, Kans. The Bel Co. classifies this service as intraexchange. It is the opinion of DOD that the service should be classified as interstate. Formal complaint being drafted.

Investigation of termination of service, Dickinson, N. Dak. Formal complaint to be initiated with the FCC concerning classification of service, the method of filing termination liabilities, and the settlement of termination charges so as to permit payments on the basis of actual costs rather than on filed charges based on estimates.

Interpretation of special construction charges (Chicago/Milwaukee microwave system for Army defense). Complaint being drafted to FCC covering the application of excess construction charges by the Bell System.

Informal DOD cases before the FCC Guam-Japan switching problem. KDD of Japan has refused to permit circuits to be switched at Guam without participating in the U.S. carriers' revenue. The FCC has been provided by DCA its future plans for AUTOVON in the Pacific with a minimum of switching at Guam as a bargaining factor for the FCC in its consultation with KDD. DTM requested and has been furnished by ASD(A) all DCA correspondence on this issue.

DOD CASE PENDING BEFORE THE STATE COMMISSION

Complaint against increased charges for access line terminations in the Centrex—C.U. system. DOD filed a complaint on June 5 and 11, 1968, against the Chesapeake & Potomac Telephone Co. of Virginia, Washington, and Maryland covering tariff rates and charges for switched circuit automatic network access line terminations.

RECENT CASES COMPLETED BEFORE FCC

AUTOVON (ESS) rate investigation, docket 17028. An investigation re rates, practices, charges, and termination liabilities for AUTOVON service using the ESS switch. Joint DOD/A.T. & T. motion to dismiss and approve settlement pending before the Commission. Charges have been reduced and savings of $3 million realized plus rebate of $169,000.

Protest of Western Union's AUTODIN interconnection rules, docket 17137. Commission approved DOD/Western Union settlement of case which permits the Government to interconnect on the basis of "military necessity" or when the carrier is "unable to furnish requisite or suitable equipment within a reasonable time." The matter may have to be reopened depending upon present DOD/Western Union discussions concerning AUTODIN program relationships.

"30" satellite circuits in the Pacific. In accordance with the FCC order in docket No. 16058 restricting the authority of Comsat to furnish satellite circuits to the Government, the FCC on February 2, 1967, granted temporary authority to Comsat to furnish DCA 30 satellite circuits in the Pacific. Thereafter ASD(A) directed that the circuits be assigned to the international record carriers. A novation agreement was consumated and the assignment effected on May 1.

Interconnect of transmission facilities, docket 17185. Complaint filed to require A.T. & T. and General Telephone of Florida to interconnect at Polk City, Fla., in accordance with section 201 of the Communications Act (service to MacDill Air Force Base). Carriers agreed to complaint.

Interconnect of transmission facilities, docket 18045. Complaint filed to require A.T. & T. and WU to interconnect AUTOVON and AUTODIN at Fort Detrick. Complaint withdrawn on May 29 on complete compliance by the carriers.

Appendix 5.—Defense Communications Agency Information on Rate Reductions for Leased International Service

In September 1967, it became generally understood that a composite rate for cable/satellite service would be available for transatlantic services upon the receipt of an order by industry for full-time service to be provided by satellite. Accordingly, a requirement was submitted by DCA for such service. However, the commercial carriers were not able to provide the service because of technical problems, primarily with the foreign earth stations and interconnecting links. Nevertheless, a rate reduction from $8,000 to $6,500 per month for the U.S. portion of transatlantic service, reflecting a composite rate for cable or satellite service, became effective on October 1, 1967. Shortly thereafter an order for service was issued by DCA's Defense Commercial Communications Office.

In April 1968 the DOD accepted an unsolicited proposal from one of the U.S. international carriers effecting a reduction in the foreign end charges of United States-Panama cable service from $6,000 per month to $5,000 per month (through rate $10,000) in return for an order for a minimum package of 10 circuits. This reduction in the foreign-end charges was possible because of the financial interest of the carrier's parent, I.T. & T., in the foreign entity. The proposal was accepted, and the charges for all services (15) to Panama were reduced by $1,000 per month. Four additional circuits are expected to be installed prior to the end of the year, also at the new, lower rate.

In another action, carriers were invited to bid on three packages of four circuits each between the United States and European points. Individual circuits were quoted by all of the carriers that offered the service at the existing $6,500 rate to midpoint. However, RCA Globe Comm quoted a rate of $6,000 to midpoint if the services were ordered as packages. The offer was accepted and the lower rate has been filed with the FCC, with a proposed effective date of August 1, 1968, which will result for all services in the Atlantic of a reduction of $26,000 per month to the DOD.

A rate reduction from $8,550 to approximately $5,000 per month for service between Florida and Puerto Rico is expected to become effective about August 1, 1968.

The DOD is continuing to seek reductions in the cost of leased services, particularly through the filing of composite rates, by ordering wideband service (for use as wideband service or for channelization by either the contractor or the DOD), by package ordering, and by the reduction in foreign-end rates. An area of particular interest at the moment concerns the separate cable and satellite rates for service between Hawaii and Philippines. In spite of the fact that the cost of the 10 existing satellite services (provided by three different carriers) is $17,810 per circuit per month versus $19,600 for cable services, quotations by U.S. international carriers for new satellite service between the two points ranged from $19,600 (ITTW) to $22,585.15 (RCAGC) to $22,603 (WUI).

DOD LEASED INTERNATIONAL/TRANSOCEANIC CHANNEL COSTS

Area	Number of channels, July 1967 [1]	Number of channels, June 1968 [1]	Single channel rate, Oct. 1, 1966 [2]	Single channel rate, June 1968 [3]	Reduction under Oct. 1, 1966 rates [4]
California-Hawaii	56	60	14,000	9,800	252,000
California-Japan	7	8	30,000	23,500	52,000
California-Philippines	2	4	29,026	25,000	16,100
California-Guam	5	5	27,000	16,000	55,000
Hawaii-Guam	7	7	18,000	12,000	42,000
Hawaii-Japan	11	22	23,500	18,100	118,800
Hawaii-Philippines	19	15	23,000	([5])	53,000
Hawaii-Philippines	0	10	([6])	([7])	51,900
Hawaii-Philippines	0	10	([6])	([7])	
Hawaii-Thailand	0	1	([8])	26,528	
Hawaii-Australia	9	11	12,737	11,500	13,600
Guam-Philippines	4	6	13,000	11,500	9,000
Guam-Japan	8	10	18,250	17,250	10,000
Philippines-Japan	4	4	9,000	9,000	
Florida-Bermuda	12	15	11,000	10,000	15,000
Florida-Canal Zone	8	10	9,000	8,550	4,500
Florida-Puerto Rico	21	37	16,500	[8] 14,215	[7] 125,400
New York/Europe (via England)	13	5	18,000	[8] 15,500	[9] 12,500
New York/Europe (via France)	0	6	([9])	[8] 15,500	[9] 15,000
New York/Europe (via satellite)					
Total		246			845,800
Annual rate					×12
					10,149,600

[1] Voice grade circuits.
[2] Gateway-to-gateway charge for voice grade circuit, per month.
[3] Monthly composite rate, gateway-to-gateway where both cable and satellite service available, except Hawaii/Philippines.
[4] Per month, based on services in being June 1968.
[5] Cable.
[6] No rate.
[7] Satellite.
[8] No service.
[9] Estimated. Country-by-country comparison difficult because of different rates TAT cables, longer extension circuits from cablehead than from earth stations, currency devaluation in some countries, etc.

APPENDIX 6.—CORRESPONDENCE CONCERNING ASSIGNMENT OF 30 PACIFIC SATELLITE COMMUNICATION CIRCUITS

FEDERAL COMMUNICATIONS COMMISSION,
Washington, D.C., August 25, 1967.

Lt. Gen. ALFRED D. STARBIRD,
Director, Defense Communications Agency,
Department of Defense,
Washington, D.C.

DEAR GENERAL STARBIRD: In my letter to you of July 13, 1967, I informed you that we had requested the Department of State to ascertain from the appropriate authorities in Thailand their views in regard to the contract between RCA Communications, Inc. and the Government of Thailand with respect to the 10 circuits required by DCA.

We are now advised by the Department that it is informed by the Government of Thailand that it unilaterally determined that, since RCAC had been handling Thailand traffic satisfactorily for a number of years, it should be permitted to operate the 10 circuits required by DCA. The Government of Thailand, however, would be glad to have other carriers share in any additional circuits that might be required by DCA or others.

In view of this it appears that you may now proceed to implement the assignment of the 30 circuits to the several terrestrial carriers within the limits set by the position of the Government of Thailand and Kokusai Denshin Denwa.

Sincerely yours,

ROSEL H. HYDE, *Chairman.*

DEFENSE COMMUNICATIONS AGENCY,
Washington, D.C., September 8, 1967.

To: Chief, Defense Commercial Communications Office.
Subject: CSA #CMSA 6N6ND–60000, COMSAT Channels in Pacific.
Reference:

(a) DECCO Ltr, D321/jd, 28 Apr 67, subject as above.
(b) DECCO Ltr, D321/jd, 3 Mar 67, to COMSAT.
(c) DCA Ltr, 8 May 67, to FCC.

1. By reference (a), you advised this Agency of problems which precluded the assignment of the 30 satellite circuits to the Far Pacific in accordance with reference (b). By reference (c), this Agency initiated a request to the FCC to resolve these problems to permit a fair and equitable assignment of the 30 circuits among the four U.S. International Carriers.

2. The FCC has advised this Agency that WUI must make their own arrangements with the Japan carrier without representations to that carrier by the Commission and that the Thailand Government unilaterally determined to operate the present 10 circuits with RCAC in the event of an assignment by COMSAT. The FCC also advised that the Thailand Government has agreed to operate with the other U.S. International Carriers for any additional circuits that might be required by DCA or others.

3. Since we are now confronted with the execution of the assignment provision in our CSA with COMSAT which was awarded on a competitive basis, it is not mandatory that the strict application of your apportionment procedures be made in directing the assignments. The unusual and unique circumstances surrounding the lease of the 30 satellite circuits justify an equitable assignment among the carriers without regard to your apportionment procedures which would dictate the assignment recommended in reference (a).

4. In view of the above, it is requested that the following assignments be made with an effective date of October 1, 1967:

	HAWTEL	ITTWC	RCAC	WUI	Total
Hawaii to:					
Philippines	2	2	0	6	10
Thailand	0	0	10	0	10
Japan	5	5	0	0	10
Total	7	7	10	6	30

5. The above assignments may not be considered in any future award.

6. It is expected that the foreign-end charges for each Thailand circuit will be reduced to $26,200 with the effective date of October 1, 1967. This reduction has been proposed by RCAC conditioned upon their receipt of an assignment of all 10 circuits to Thailand. A copy of our letter to RCAC reminding them of their offer will be provided to your office.

ALFRED D. STARBIRD,
Lieutenant General, U.S. Army, Director.

DEFENSE COMMUNICATIONS AGENCY,
DEFENSE COMMERCIAL COMMUNICATIONS OFFICE,
Scott Air Force Base, Ill., September 12, 1967.

COMMUNICATIONS SATELLITE CORP.,
Director of Procurement and Contracting,
Washington, D.C.
(Attention: Mr. Lewis C. Meyer).

DEAR MR. MEYER: In accordance with the terms and conditions of CSA, CMSA–6N6ND–60000, you are hereby requested to assure that the following action is taken expeditiously:

(*a*) Assign all COMSAT rights under this CSA, CMSA–6N6ND–60000, and subsequent detailed service CSA's together with those rights under all contracts with such foreign communications authorities relating to the acquisition by the company of circuits from them, to the following international record carriers:

	HAWTEL	ITTWC	RCAC	WUI	Tota
Hawaii to:					
Philippines	2	2	0	6	10
Thailand	0	0	10	0	10
Japan	5	5	0	0	10
Total	7	7	10	6	30

(*b*) Obtain approval from the foreign authorities and entitles to assign your agreements to the above specified U.S. international carriers.

(*c*) Obtain the U.S. international carriers' acceptance of all terms and conditions of CSA CMSA–6N6ND–60000. Further, the requirements of paragraph 9 of the CSA should particularly be brought to the carriers' attention with regard to their obligation to obtain reduction in the foreign charges.

(*d*) Provide this office with all assignment agreements entered into by the Communications Satellite Corp., and its carriers, including copies of agreements prepared by the carriers and foreign entitles concerning rates, terms, and conditions of service, for review and approval by this office prior to their execution.

(*e*) Insure that the Communications Satellite Corp., by its assignments, executes a total release to the Government of all obligations and liabilities incurred under the CSA.

(*f*) Assure that the assignment of the Government's termination liabilities for the foreign earth stations is as follows:

Japan: ITT World Communications, Inc.
Philippines: Western Union International, Inc.
Thailand: RCA Communications, Inc.

(*g*) Advise this office of any problems in administering the assignments.

The above assignments will become effective as of October 1, 1967 by separate CSA's issued by this office.

If further assistance is required in regard to the above, please feel free to contact this office.

Sincerely,

JOHN F. PAWLINGS,
First Lieutenant, U.S. Air Force,
DCA Contracting Officer.

COMMUNICATIONS SATELLITE CORP.,
Washington, D.C., October 4, 1967.

JOHN F. RAWLINGS,
First Lieutenant, U.S. Air Force, Defense Communications Agency, Defense Commercial Communications Office, Scott Air Force Base, Ill.

DEAR LIEUTENANT RAWLINGS: Attached herewith is a copy of a letter which was received this date from PHILCOMSAT with respect to the allocation of the 10 circuits between Hawaii and the Philippines under CSA CMSA–6N6ND–60000.

Please advise as to any actions that you may desire.

Sincerely,

LEWIS C. MEYER.

PHILIPPINE COMMUNICATION SATELLITE CORP.,
Manila, October 3, 1967.

COMMUNICATIONS SATELLITE CORP.,
Washington, D.C.,
(Attention: Lewis C. Meyer, Director of Procurement and Contracting).

SIRS: This has reference to your Telex No. 1781/PC regarding the proposed apportionment of the 10 DCA circuits and our initial Telex reply thereto. In this connection, we have decided to maintain the current working relations between COMSAT and PHILCOMSAT and at the same time not to disturb the original agreement in the handling of the above-mentioned 10 DCA circuits.

Very truly yours,

MANUEL B. SYQUIO,
Chairman and President.

Enclosure.

FEDERAL COMMUNICATIONS COMMISSION,
October 11, 1967.

Dr. JOSEPH V. CHARYK,
President, Communications Satellite Corp.,
Washington, D.C.

DEAR DR. CHARYK: In the Commission's memorandum opinion, order, and certificate released February 9, 1967 (File No. T–C–2014 et al.), the Communications Satellite Corp. (Comsat) was awarded temporary authority to provide the Defense Communications Agency (DCA) with 10 satellite circuits between Hawaii and Japan, 10 satellite circuits between Hawaii and the Philippines. Such authority, however, satellite circuits between Hawaii and Thailand, and 10 is to terminate without further action by the Commission as circuits to a particular point (Thailand, the Philippines, or Japan) are ordered by DCA from a terrestrial carrier in lieu of Comsat, and service is instituted by such carrier. We understand that by letter dated September 12, 1967, from John F. Rawlings, DCA contracting officer, Comsat was requested to assign the communications service authorization issued by DCA for the 30 circuits, as well as its agreements with overseas correspondents, to the regular overseas carriers as set forth in such letter. The assignments were to be effective October 1, 1967, by separate communications service authorizations issued by DCA. However, as of this date, the service involved is still being provided by Comsat.

In view of the underlying rationale of the Commission's memorandum opinion, order, and certificate, Comsat is under an obligation to effectuate the transfer of the service to each of the points involved as quickly as possible to the terrestrial carriers. In this connection, we are unaware of any question regarding an immediate transfer of the Thailand and the Japan circuits and, accordingly, the transfer of such circuits can and should be effectuated forthwith as contemplated by the Commission's memorandum opinion and order.

With respect to the Philippine circuits, we are aware of the letter dated October 3, 1967, from the Philippines Communications Satellite Corp. (Philcomsat) to Comsat regarding the proposed apportionment of 10 DCA circuits between Hawaii and the Philippines, in which the former states that "* * *we have decided to maintain the current working relationships between Comsat and Philcomsat and at the same time not to disturb the original agreement in handling of the above mentioned 10 DCA circuits." It would appear that the Philcomsat advice is predicated on a misunderstanding of the short term nature of Comsat's authority to provide the 10 circuits in question, an authority which is to be terminated at the earliest practicable date. Accordingly, it is assumed that Comsat is taking prompt action to clarify the matter with Philcomsat, so that it will be in a position to assign these circuits as contemplated by the Commission's order. We would appreciate receiving copies of all relevant exchanges between Comsat and Philcomsat, so that we may be in a position to assist in a resolution of the matter.

May we have your response by next Wednesday, October 18, which, among other things, should advise us of the steps you are taking to effectuate an immediate transfer of the Thailand and Japan circuits, as well as to correct the misunderstanding on the part of Philcomsat as to the interim nature of your authority.

Sincerely yours,

BERNARD STRASSBURG,
Chief, Common Carrier Bureau.

DEFENSE COMMUNICATIONS AGENCY,
October 17, 1967.

MR. BERNARD STRASSBURG,
Chief, Common Carrier Bureau,
Federal Communications Commission,
Washington, D.C.

DEAR MR. STRASSBURG: I am in receipt of your letter of October 13, 1967, enclosing a copy of your letter of Dr. Charyk, president of Comsat, with respect to effectuating the transfer of the 30 Pacific Satellite circuits from Comsat to the international carriers.

As you were advised in our letter of May 8, 1967, we attempt to apportion circuits to insure the maximum possible equity to all authorized carriers, and also, as I believe you know, to assign to a single carrier responsibility for the technical sufficiency of the entire circuit. Accordingly, our letter of September 12, 1967, from the contracting officer advised Comsat to follow these policies. However, we have been informed by Comsat of their inability to comply with the directed assignment of the 10 circuits to the Philippines because of the position taken by Philcomsat on October 3, 1967, that they had "decided to maintain the current working relationships between Comsat and Philcomsat."

It is still our intent to make equitable assignments of the 30 circuits between the carriers and to assign to one carrier responsibility for end-to-end technical sufficiency for each circuit. This won't be possible without clarification of the situation in the Philippines. Therefore, I am instructing the DCA contracting officer to make no assignments for the time being.

I would appreciate any information you may have on this matter as a result of your correspondence with Comsat and others. Should you desire, we are available for discussion, particularly if you feel it is necessary that you must take any additional action.

Sincerely,

RICHARD P. KLOCKO,
Major General, U.S. Air Force,
Deputy Director.

COMMUNICATIONS SATELLITE CORP., OCTOBER 17, 1967.
Washington, D.C.
(Attention: Mr. Lewis C. Meyer, Director of Procurement and Contracting).

DEAR MR. MEYER: Reference is made to your letter of October 4, 1967, to the DCA contracting officer in the matter of allocating the 10 satellite circuits between Hawaii and the Philippines under CMSA–6N6ND–60000.

In the light of your letter, this is to advise you not to effect any assignment of any of the 30 satellite circuits until such time as the matter in the Philippines is resolved.

We would appreciate being kept advised as to the future course of events.

Sincerely,

JOHN F. RAWLINGS,
First Lieutenant, U.S. Air Force,
DCA Contracting Officer.

MEMORANDUM TO ASHER ENDE, DEPUTY CHIEF,
COMMON CARRIER BUREAU, FCC,
October 18, 1967.

DEAR ASHER: In accordance with your telephone request, the attached paper explains the portions of General Klocko's letter which you questioned.

WALTER H. MORSE,
Counsel.

Enclosure.

It is DOD policy not to have more than one carrier responsible for the operation of a circuit. The basis for this policy is that if there is more than one carrier involved in the operation of a circuit and an outage occurs, it has been the experience of the DOD that attempts to pinpoint the responsibility for the outage results in each carrier blaming the other. Accordingly, in order to avoid this situation, one carrier is made totally responsible for the circuit and separate CSA's are not issued for any segments that may exist in the circuit.

The effect of this policy in the present situation can be seen in the following possibilities that might occur. If Philcomsat stands firm on its position that it wishes Comsat alone to provide satellite circuits to the Philippines and the FCC stands firm on its position that Comsat will not be authorized to provide the service directly to DCA, this will necessitate fragmenting the circiuts if DCA wishes the service. That is, since Comsat will not be able to provide the uplink to the satellite it will be necessary for assignments to be made to the international carriers for this link. With respect to the downlink, since the international carriers will not have authority into the Philippines for satellite circuits, it will be necessary to make a separate assignment for the downlink to Philcomsat. If this is done, it will be contra to the existing DOD policy which calls for end-to-end technical sufficiency to be in one carrier since two rather than one CSA will exist for the circuits.

If the 10 circuits to the Philippines were to be fragmented, DCA might then be under pressure from all the international carriers, except RCAC, to also fragment the uplink on the 10 circuits to Thailand and Japan. It will be these carriers' position, and logically so, that if DCA can live with fragmented circuits to the Philippines it should also live with fragmented circuits into Thailand and Japan in order to achieve a more equitable distribution of all of the 30 circuits.

Additionally, if it were decided to make the temporary authority of Comsat for the 10 satellite circuits to the Philippines permanent authority it would, of course, again disrupt the equitable distribution of the circuits to the international carriers. In fact, it would result in WUI receiving "0" number of circuits since KDD will not permit WUI into Japan and RCAC will have the 10 circuits into Thailand.

Because of the above, it naturally follows that clarification of the situation in the Philippines must precede any equitable assignment of the 30 circuits.

COMMUNICATIONS SATELLITE CORP.,
Washington, D.C., October 18, 1967.

Mr. BERNARD STRASSBURG,
Chief, Common Carrier Bureau,
Federal Communications Commission,
Washington, D.C.

DEAR MR. STRASSBURG: Reference is made to your letter of October 11 relative to the matter of the 10 satellite circuits between Hawaii and Thailand, the 10 satellite circuits between Hawaii and Japan, and the 10 satellite circuits between Hawaii and the Philippines, which service is being provided to the Defense Communications Agency (DCA).

Your letter indicates that the Commission is unaware of any reasons why the assignment of the Thailand and Japan circuits should not be effectuated forthwith. Such assignment clearly requires the acquiescence of the Defense Communications Agency. As you know, we have prepared all of the documents related to the assignment but have looked to appropriate instruction in this connection from the DCA. We are informed by message dated October 17 from John F. Rawlings, DCA contracting officer, that no transfers are to be effected until the matter with respect to the Philippine circuits is resolved. Accordingly, we are unable to take the actions with respect to the Thailand and Japan circuits which you suggest.

In connection with the Philippine circuits, I do not believe that the Philcomsat advice is predicated on a misunderstanding of the Commission's memorandum opinion, order, and certificate released February 9, 1967 (file No. T–C–2014 et al.). On the contrary, I believe Philcomsat is completely familiar with the nature of the present authority. In any event, the matter potentially raises questions which may involve relationships between the Governments of the Philippines and the United States. Accordingly, we have felt that it would be inappropriate for Comsat to seek directly to alter the decision by Philcomsat without first receiving appropriate guidance from the Department of State. We are informed by the Department that in the light of potential international implications, we should refrain from any direct contacts with Philcomsat in this connection until the Department has had an opportunity to fully review the matter. We will inform you promptly of any advice we receive in this respect. In the meantime, we will not plan to make any direct contact with Philcomsat in this matter.

If the actions proposed above do not meet with your complete concurrence, please advise us as soon as possible.

Sincerely,

JOSEPH V. CHARYK.

DEFENSE COMMUNICATIONS AGENCY,
DEFENSE COMMERCIAL COMMUNICATIONS OFFICE,
Scott Air Force Base, Ill., April 30, 1968.

COMMUNICATIONS SATELLITE CORP.,
Washington, D.C.
(Attention: Mr. Lewis C. Meyer).

DEAR MR. MEYER: This is in reference to your letter of April 25, 1968.

The original signed copy of the novation agreement, dated April 25, 1968, has been executed on behalf of the Government and is forwarded to your office for appropriate distribution.

If you have any questions regarding the above, please contact Capt. John F. Rawlings at AL 6–2378, area code 618.

Sincerely,

JOHN F. RAWLINGS,
Captain, U.S. Air Force,
DCA Contracting Officer.

This novation agreement made and entered into this 25th day of April 1968, by and among the United States of America, acting through the Defense Communications Agency of the Department of Defense (hereinafter referred to as "DCA"); the Communications Satellite Corp., a corporation duly organized and existing under the laws of the District of Columbia (hereinafter referred to as the "assignor") and the following U.S. international carriers (hereinafter collectively called the "assignees"): Hawaiian Telephone Co. (also herein referred

to as "Hawtel"), a corporation duly organized under the laws of the Kingdom of Hawaii and existing under the laws of the State of Hawaii; ITT World Communications Inc. (also herein referred to as "ITT Worldcom"), a corporation duly organized and existing under the laws of the State of Delaware; RCA Communications, Inc. (also herein referred to as "RCA"), a corporation duly organized and existing under the laws of the State of Delaware; and Western Union International, Inc. (also herein referred to as "WUI"), a corporation duly organized and existing under the laws of the State of Delaware.

Witnesseth that:

Whereas DCA and the assignor have heretofore entered into the general contract DCA 20066C148, which constitutes a basic agreement for communications facilities and services; and

Whereas pursuant to the provisions of such general contract, DCA has issued and the assignor has accepted Communications Service Authorization No. CMSA–CN6ND–60000 and CMSA–OC–CNGND–60000–01 and subsequent detailed CSA's (collectively referred to as the "CSA"), under which the assignor agreed to provide certain communications services and effect a transfer thereof in the Pacific Ocean area; and

Whereas the assignor has entered into contracts with certain foreign communications authorities for the purpose of providing such communications services; and

Whereas, pursuant to an order of the Federal Communications Commission (hereinafter referred to as "FCC") and in accordance with the provisions of the aforementioned CSA, DCA requested the assignor to assign to the assignees all its rights under the aforementioned CSA and contracts with foreign communications authorities, provided the assignees would assume all the duties and obligations of the assignor thereunder; and

Whereas the assignor has complied with DCA's request and has assigned its rights to the assignees under such foreign communications contract and the assignees have assumed all the duties and obligations of the assignor thereunder, all with the consent and approval of the foreign communications authorities; and

Whereas the parties hereto desire to take such further steps as are necessary to meet the requirements of DCA;

Now, therefore, in consideration of the mutual covenants herein contained, it is agreed as follows:

1. The assignor hereby assigns its rights under the aforementioned CSA to the assignees.

2. The assignees hereby accept such rights and assume, pro tanto, the duties and obligations of the ASSIGNOR under the aforementioned CSA, provided however, that DCA and the assignees hereby agree as follows:

(a) The 30 alternate voice/data channels (circuits) provided for pursuant to the provisions of the aforementioned CSA shall be furnished as follows:

	HAWTEL	ITTWC	RCAC	WUI	Total
Hawaii to:					
Philippines	2	2	0	6	10
Thailand	0	0	10	0	10
Japan	5	5	0	0	10
Total	7	7	10	6	30

(b) The charges set forth in paragraph 3 of the aforementioned CSA are hereby amended as follows from the effective date of this Novation Agreement through March 31, 1968:

Hawaii to Japan, $18,100 per circuit.

Hawaii to the Philippines, $33,745 per circuit. Hawaii to Thailand, $33,300 per circuit.

(c) The charges set forth in paragraph 4 of the aforementioned CSA are hereby amended as follows, effective April 1, 1968, or such other date as may be agreed to by DCA and the assignees:

Hawaii to the Philippines, $17,810 per circuit.

Hawaii to Thailand, $17,550 per circuit.

As of January 1, 1969, the charges shall be further reduced to the amounts specified below:

Hawaii to the Phillippines, $16,310 per circuit.

Hawaii to Thailand, $15,950 per circuit.

(d) In the event DCA exercises its right of termination under the CSA, DCA's liability for termination charges under paragraphs 5, 6, 7, 8, and 13 of the CSA shall be as follows:

(i) for the temporary earth station at the Philippines, DCA shall be liable to WUI in accordance with paragraph 5 of the CSA and, as provided in paragraph 13 of the CSA, DCA shall also be liable to WUI for the nonrecoverable costs incurred by WUI in connection with the termination of the space segment allotment to the Philippines;

(ii) for the temporary and fixed earth stations at Thailand, DCA shall be liable to RCA in accordance with paragraphs 6 and 7 of the CSA and, as provided in paragraph 13 of the CSA, DCA shall also be liable to RCA for the nonrecoverable costs incurred by RCA in connection with the termination of the space segment allotment to Thailand; and

(iii) for the fixed earth station at Japan, DCA shall be liable to ITT Worldcom in accordance with paragraph 8 of the CSA and, as provided in paragraph 13 of the CSA, DCA shall also be liable to ITT Worldcom for the nonrecoverable costs incurred by ITT Worldcom in connection with the termination of the space segment allotment to Japan.

3. The assignees shall pay the assignor, on the date this agreement becomes effective, the sum of $43,836 as reimbursement for all its costs incident to the provision of communications service to DCA, which sum has not been reimbursed to the assignor by DCA, as follows:

Hawtel	$10,228
ITT Worldcom	10,228
RCA	14,612
WUI	8,768

4. DCA and the assignor hereby release and discharge each other from all obligations, claims and demands whatsoever resulting from the aforementioned CSA, or from effecting this Novation Agreement, and DCA hereby accepts the duties and obligations of the assignees, as herein described, in lieu of the duties and obligations of the assignor, and DCA also agrees to be bound by the terms of such CSA, as such terms are herein modified, in all respects, but does not assume any costs or obligations incurred by the assignees in effecting this novation agreement.

5. This novation agreement shall become effective upon a date to be specified by DCA, such date to be coincident with the effective date of an appropriate order from DCA to the assignees for the communications services herein identified.

In witness whereof, each of the parties hereto, having been duly authorized, has executed this agreement as of the day and year first above written.

UNITED STATES OF AMERICA,
JOHN F. RAWLINGS,
Captain, U.S. Air Force, DCA Contracting Officer.
COMMUNICATIONS SATELLITE CORP.,
L. C. MEYER.
HAWAIIAN TELEPHONE CO.,
WARREN E. BAKER.
ITT WORLD COMMUNICATIONS INC.,
JOSEPH J. GANCIE.
RCA COMMUNICATIONS INC.,
C. J. RENNIE.
WESTERN UNION INTERNATIONAL, INC.,
H. G. CATUCCI.

ASSIGNMENT, CONSENT, AND RELEASE

This assignment, consent, and release, made and entered into this 8th day of February, 1968, by and between Communications Satellite Corp., a corporation organized and existing under the laws of the District of Columbia (hereinafter called the "assignor"); post and telegraph department, acting on behalf of the Government of the Kingdom of Thailand (hereinafter called the "administration"); and RCA Communications, Inc., a corporation organized and existing under the laws of the State of Delaware (hereinafter called the "assignee").

Witnesseth that: Whereas the Administration and the assignor have entered into a satellite communications service agreement, dated October 17, 1966 (hereinafter called the "service agreement"), for the purpose of meeting communication requirements of the U.S. Government; and

Whereas pursuant to an order of the United States Federal Communications Commission, the Defense Communications Agency of the U.S. Government requested the assignor to assign to the assignee all the rights of the assignor under the service agreement, provided the assignee assumes the duties and obligations of the assignor under the service agreement; and

Whereas the assignee, pursuant to said request of the Defense Communications Agency of the U.S. Government, desires to obtain from the Administration 10 voice-data grade circuits, as described in the service agreement, and to undertake to perform the duties and obligations of the assignor under the service agreement; and

Whereas the Administration is willing to consent to said assignment by the assignor and to release and discharge said assignor from all of its obligations under the service agreement; provided that the assignee undertakes to perform the duties and obligations of the assignor under the service agreement:

Now, therefore, in consideration of the mutual covenants herein contained, it is agreed as follows:

1. The assignor hereby assigns its rights under the service agreement to the assignee.

2. The assignee hereby accepts such rights and assumes the obligations under the service agreement as if said assignee were a party to the service agreement in lieu of the assignor.

The Administration and the assignor hereby release and discharge each other from all obligations, claims and demands whatsoever in respect to the service agreement and the administration hereby consents to the assignment specified in paragraph 1, supra, and accepts the obligations of the assignee in lieu of the obligations of the assignor.

4. This assignment, consent and release shall become effective upon a date to be specified by the assignor, such date to be coincident with the effective date of an appropriate order from the Defense Communications Agency to the assignee for the communications services herein identified.

In witness whereof, the undersigned, duly authorized, have signed this assignment, consent and release, the present text of which shall be the only authentic version, on the day and year hereinabove first written.

COMMUNICATIONS SATELLITE CORPORATION,
LEWIS C. MEYER.
RCA COMMUNICATIONS, INC.,
CYRIL J. RENNIE.
POST & TELEGRAPH DEPARTMENT,
MANUS LEEVIRAPHAN.

ASSIGNMENT, CONSENT, AND RELEASE

This Assignment, Consent, and Release, made and entered into this 25th day of April, 1968, by and between Communications Satellite Corp., a corporation organized and existing under the laws of the District of Columbia (hereinafter called the "assignor"); Philippine Communications Satellite Corp., a corporation organized and existing under the laws of the Republic of the Philippines (hereinafter called "Philcomsat"); and the following United States International Communication Carriers (hereinafter collectively called the "assignees"): ITT World Communications, Inc., a corporation organized and existing under the laws of the State of Delaware (also herein referred to as "ITT Worldcom"); Hawaiian Telephone Co., a corporation organized under the laws of the Kingdom of Hawaii and existing under the laws of the State of Hawaii (also herein referred to as "Hawtel"); and Western Union International, Inc., a corporation organized and existing under the laws of the State of Delaware (also herein referred to as "WUI").

WITNESSETH THAT:

Whereas Philcomsat and the assignor have entered into a satellite communications service agreement, dated December 16, 1966 (hereinafter called the "service agreement"), for the purpose of meeting communication requirements of the U.S. Government; and

Whereas, pursuant to an order of the U.S. Federal Communications Commission, the Defense Communications Agency of the U.S. Government has re-

quested the assignor to assign to the assignees all its rights under the service agreement; provided the assignees assume the duties and obligations of the assignor under the service agreement; and

Whereas the assignees, pursuant to said request of the Defense Communications Agency of the U.S. Government, each desire to obtain from Philcomsat voice-data grade circuits, as described in the service agreement, and to undertake to perform, as hereinafter described, the duties and obligations of the assignor under the service agreement; and

Whereas Philcomsat is willing to consent to said assignment by the assignor and to release and discharge said assignor from all of its obligations under the service agreement; provided that the assignees undertake to perform, as hereinafter described, the duties and obligations of the assignor under the service agreement:

Now therefore, in consideration of the mutual covenants herein contained, it is agreed as follows:

1. The assignor hereby assigns its rights under the service agreement to the assignees.

2. The assignees hereby accept such rights and assume, jointly and severally, the obligations under the service agreement, as if said assignees, acting jointly and severally, were parties to the service agreement in lieu of the assignor; provided, however, that as between Philcomsat and the assignees:

(a) The 10 voice-data grade circuits to be provided by Philcomsat pursuant to article I of the service agreement shall be furnished, subject to renewal annually commencing December 31, 1968, to the assignees as follows: two circuits to HAWTEL, two circuits to ITT WORLDCOM, and six circuits to WUI. In the event of a failure to renew by reason of any action or inaction on the part of PHILCOMSAT, the assignees shall not be responsible for any termination liabilities or obligations.

(b) WUI undertakes to assume sole and exclusive responsibility for the performance of the obligations specified in article VI—termination of the service agreement on the understanding that the maximum liability in the amount of $1,764,000, as specified in paragraph C of such article VI, applies to the period up to but not beyond April 1, 1968, and thereafter the maximum liability shall not exceed $325,000.

3. Philcomsat and the assignor hereby release and discharge each other from all obligations, claims and demands whatsoever in respect to the service agreement and, pursuant to article XI: assignment of the service agreement, Philcomsat hereby consents to the assignment specified in paragraph 1, supra, and accepts the obligations of the assignees, as herein described, in lieu of the obligations of the assignor and agrees to be bound by the terms of the service agreement, as such terms are herein modified, in all respects.

4. This Assignment, Consent, and Release shall become effective upon a date to be specified by the assignor, such date to be coincident with the effective date of an appropriate order from the Defense Communications Agency to the assignees for the communications herein identified.

In witness whereof, the undersigned, duly authorized, have signed this assignment, consent, and release, the present text of which shall be the only authentic version, on the day and year hereinabove first written.

COMMUNICATIONS SATELLITE CORP.,
By L. C. MEYER.
ITT WORLD COMMUNICATIONS, INC.,
By JOSEPH J. GANCIE.
HAWAIIAN TELEPHONE CO.,
By WARREN E. BAKER.
WESTERN UNION INTERNATIONAL, INC.,
By H. G. CATUCCI.
PHILIPPINES COMMUNICATIONS SATELLITE CORP.,
By MANUEL B. SYQUIO.

ASSIGNMENT, CONSENT, AND RELEASE

This Assignment, Consent, and Release, made and entered into this 25th day of April 1968, by and between Communications Satellite Corp., a corporation organized and existing under the laws of the District of Columbia (hereinafter called the "assignor"); Kokusai Denshin Denwa, Co., Ltd., a corporation orga-

nized and existing under the laws of Japan (hereinafter called "KDD"); and the following U.S. International Communication Carriers (hereinafter collectively called the "assignees"): ITT World Communications, Inc., a corporation organized and existing under the laws of the State of Delaware, (also herin referred to as "ITT Worldcom"); and Hawaiian Telephone Co., a corporation organized under the laws of the Kingdom of Hawaii and existing under the laws of the State of Hawaii (also herein referred to as "Hawtel").

WITNESSETH THAT: Whereas KDD and the assignor have entered into a satellite communications service agreement, dated September 12, 1966 (hereinafter called the "service agreement"), for the purpose of meeting communication requirements of the U.S. Government; and

Whereas, pursuant to an order of the U.S. Federal Communications Commission, the Defense Communications Agency of the U.S. Government requested the assignor to assign to the assignees all its rights under the service agreement, provided the assignees would assume the duties and obligations of the assignor under the service agreement; and

Whereas the assignees, pursuant to said request of the Defense Communications Agency of the U.S. Government, each desire to obtain from Comsat five voice-data grade circuits, as described in the service agreement, and to undertake to perform, as hereinafter described, the duties and obligations of the assignor under the service agreement; and

Whereas KDD is willing to consent to said assignment by the assignor and to release and discharge said assignor from all of its obligations under the service agreement; provided that the assignees undertake to perform, as hereinafter described, the duties and obligations of the assignor under the service agreement:

Now, therefore, in consideration of the mutual covenants herein contained, it is agreed as follows:

1. The assignor hereby assigns its rights under the service agreement to the assignees.

2. The assignees hereby accept such rights and assume, jointly and severally, the obligations under the service agreement as if said assignees, acting jointly and severally, were parties to the service agreement in lieu of the assignor; provided, however, that as between KDD and the assignees:

(a) Pursuant to article I, A. of the service agreement, KDD shall furnish five voice-data grade circuits for combination with the same number of equivalent circuits provided by ITT Worldcom, and five voice-data grade circuits for combination with the same number of equivalent circuits provided by Hawtel, all such circuits to be leased to the U.S. Government under tariffs to be filed by ITT Worldcom and Hawtel reflecting the appropriate provisions of the service agreement, and

(b) ITT Worldcom undertakes to assume sole and exclusive responsibility for the performance of the obligations specified in article V: termination of the Service Agreement.

3. KDD and the assignor hereby release and discharge each other from all obligations, claims, and demands whatsoever in respect to the service agreement and, pursuant to article X: assignment of the Service Agreement, KDD hereby consents to the assignment specified in paragraph 1, supra, and accepts the obligations of the assignees, as herein described, in lieu of the obligations of the assignor and agrees to be bound by the terms of the service agreement, as such terms are herein modified, in all respects.

4. This assignment, consent, and release shall become effective upon a date to be specified by the assignor, such date to be coincident with the effective date of an appropriate order from the Defense Communications Agency to the assignees for the communications services herein identified.

IN WITNESS WHEREOF, the undersigned, duly authorized, have signed this assignment, consent, and release, the present text of which shall be the only authentic version, on the day and year hereinabove first written.

COMMUNICATIONS SATELLITE CORP.,
By L. C. MEYER.
ITT WORLD COMMUNICATIONS, INC.,
By J. T. STINSON.
HAWAIIAN TELEPHONE CO.,
By WARREN E. BAKER.
KOKUSAI DENSHIN DENWA, CO., LTD.,
By TOKI HACHIFUJI.

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SALINE WATER CONVERSION PROGRAM

HEARING

BEFORE THE

SUBCOMMITTEE ON WATER AND POWER RESOURCES

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS UNITED STATES SENATE

NINETY-SECOND CONGRESS

FIRST SESSION

ON

S. 716

TO AUTHORIZE THE APPROPRIATION OF $27,025,000 TO PROVIDE FOR THE AMOUNT REQUESTED IN THE PRESIDENT'S BUDGET FOR FISCAL YEAR 1972 FOR THE FEDERAL SALINE WATER CONVERSION PROGRAM

S. 991

TO EXTEND THE FEDERAL SALINE WATER CONVERSION PROGRAM FOR 5 FISCAL YEARS BEYOND FISCAL YEAR 1972, AND TO REDISTRICT THE PROGRAM BASED ON EXPERIENCE THUS FAR

APRIL 2, 1971

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SALINE WATER CONVERSION PROGRAM

FRIDAY, APRIL 2, 1971

U.S. SENATE,
SUBCOMMITTEE ON WATER AND POWER RESOURCES
OF THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10 a.m., in room 3110, New Senate Office Building, Senator Clinton P. Anderson (chairman of the subcommittee) presiding.

Present: Senators Anderson, Allott, Jordan, and Fannin.

Also present: Senator Bellmon.

Staff members present: Jerry T. Verkler, staff director; William J. Van Ness, chief counsel; Daniel Dreyfus, professional staff member; and Charles Cook, minority counsel.

Senator ANDERSON. The hearing will come to order.

The purpose of this hearing before the Water and Power Resources Subcommittee this morning is to take testimony on two measures concerning the Federal saline water conversion program.

S. 716, which was submitted by the Department of the Interior, would authorize an appropriation of $27,025,000 for the program for fiscal year 1972.

S. 991, which was introduced by Senators Jackson and Allott and myself would extend the saline water program for 5 more fiscal years beyond fiscal year 1972 and make a number of changes in the administration of the work. This bill is based upon the progress reports of the Office of Saline Water and the hearings which this committee held last year.

Today we expect to review the status of the program and the proposed activities for fiscal year 1972 and the future.

The texts of the two bills and the relevant executive communications will be included in the record at this point.

(The documents referred to follow:)

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D.C., January 29, 1971.

Hon. SPIRO T. AGNEW,
President of the Senate,
Washington, D.C.

DEAR MR. PRESIDENT: Enclosed is a draft of a proposed bill "To authorize appropriations for the Saline Water Conversion Program for fiscal year 1972, and for other purposes."

We recommend that the bill be referred to the appropriate Committee for consideration, and we recommend that it be enacted. This Department's Office of Saline Water (OSW) has made considerable progress in the development of practical, low-cost methods for producing fresh water from saline, brackish, and other mineralized or chemically-charged waters. It has fostered the development of desalting technology and has encouraged water planners and the desalting

industry to cooperate in developing viable plans for meeting the Nation's water requirements.

The legislation under which the OSW conducts its program, the Act of July 3, 1952, as amended (42 U.S.C. 1951 *et seq.*), authorizes "to be appropriated such sums, to remain available until expended, as may be specified in annual appropriation authorization acts." In order to meet fiscal year 1972 program requirements, we propose an appropriation of $27,025,000 to enable the OSW to conduct its research and development program as follows:

I. Research and development operating expenses, $15,675,000;

II. Design, construction, acquisition, modification, operation, and maintenance of saline water conversion test beds and test facilities, $7,385,000;

III. Design, construction, acquisition, modification, operation, and maintenance of saline water conversion modules, $1,425,000; and

IV. Administration and coordination, $2,540,000.

Major changes from the fiscal year 1971 program of $28,677,934, are described as follows.

Research and development operating expenses activity contains a net increase of $495,066. Sizable cutbacks or elimination of effort for 1972 have been made in the materials, crystallization, and electrodialysis research and development programs. Additional emphasis is planned for environmental research and development to assure that measures for protection of the ecology are incorporated in the process developmental program. Also, funds are required for additional equipment involved in further development of distillation processes.

Design, construction, acquisition, modification, operation, and maintenance of saline water conversion test beds and test facilities activity reflects an increase of $1,985,000 and includes a request for three additional positions. Two of the three positions are for managerial support at the Roswell, New Mexico and Freeport, Texas facilities. The manager at each of these facilities is the only OSW representative on site. The expanded activities require that the managers be provided assistance in technically coordinating the programs. The third position is for the Wrightsville Beach, North Carolina, Test Facility to assist the physical science technician in responding to the increasing analytical requirements associated with evaluation of new and improved sea water desalting development plants.

Included in the program for this activity in FY 1972 is $2,100,000 for acquisition of two reverse osmosis test beds. Acquisition of a reverse osmosis sea water plant is an essential intermediate step toward the advancement of economical desalting of sea water by this process. Past engineering and economic studies have shown that reverse osmosis is more economical than distillation for desalting sea water in plant sizes up to 5 million gallons per day. The plight of small communities where the population depends upon bottled water for cooking and drinking indicates a need for production plants of this type.

A 500,000 to 750,000 gpd High Product Recovery test bed plant is needed primarily to reduce the volume of brine effluent that must be disposed of without adverse effect on the environment, particularly in inland areas. Recognizing the need for development of high product recovery and high flux membrance plant technology OSW, over the past 3 years, has devoted significant efforts to develop suitable hardware and system components required for these plants. Evaluation of the technology on a test bed scale is now necessary to confirm pilot plant data prior to scale up to prototype and commercial plants of multimillion gallons per day capacity.

Design, construction, acquisition, modification, operation, and maintenance of saline water conversion modules activity is decreased by $4,170,000. This decrease is attributable to the acquisition cost of the Vertical Tube Evaporator/Multistage Flash Module that was authorized for fiscal year 1971.

Administration and coordination activity shows an increase of $37,000 and includes a request for two additional positions in the OSW Washington headquarters. These positions are: (1) a project management engineer to assist in planning cooperative programs with other water planning agencies and other field test programs; and (2) a budget clerk to assist the budget officer in preparing and managing the OSW budget.

The appropriation authorization requested for FY 1972 reflects two other changes from the FY 1971 authorizations. It omits the dollar limitation on foreign expenditures and it provides for a 2 percent overrun in administration and coordination activity.

Deletion of limitation on foreign expenditures. The FY 1971 authorization limited foreign expenditures to $100,000. Restoration of foreign authority is re-

quested for the continuation of highly promising research grants in the reverse osmosis area to foreign institutions. The FY 1971 funding of this activity is approximately $65,000. Since the enactment of the restriction on foreign expenditures, OSW has not been receiving research proposals from foreign institutions. In the past, OSW has only funded those research proposals that were unique and showed a high degree of promise. Removal of the restriction will help to assure that the United States will obtain the information possessed by foreign research scientists. The exchange of information between this Nation and foreign nations is most decidedly one way, i.e., we provide more information than we receive. Although it is not expected that expenditures for foreign research will be significant, it is hard to estimate precisely what the requirement will be.

Reprogramming—Administration and Coordination. The administration and coordination activity, approximating 10 percent of the total authorization, must provide for all OSW headquarters costs, of which 90 percent are for personnel. The authorization for this activity in fiscal year 1970, adjusted for the pay increase under Public Law 91–231, exceeded actual charges by less than $10,000. An inordinate degree of control is required throughout the year to assure that no action is taken which might result in overobligation of the authorized funds in this account. As an example of the problem, if personnel employment within the authorized ceiling exceeds the estimate by only one man-year and if sufficient savings cannot be made in the relatively small balance of the funds in other than personnel costs, the OSW may be required to seek congressional relief. A 2 percent reprogramming authority (approximately $50,000) appears reasonable.

A statement concerning significant environmental impacts of the proposal pursuant to section 102(2)(c) of the National Environmental Policy Act of 1969 will be forwarded to accompany the bill.

The Office of Management and Budget has advised that this proposed legislation is in accord with the program of the President.

Sincerely yours,

JAMES R. SMITH, *Assistant Secretary.*

92D CONGRESS
1ST SESSION

S. 716

IN THE SENATE OF THE UNITED STATES

FEBRUARY 10 (legislative day, JANUARY 26), 1971

Mr. JACKSON (for himself and Mr. ALLOTT) (by request) introduced the following bill; which was read twice and referred to the Committee on Interior and Insular Affairs

A BILL

To authorize appropriations for the saline water conversion program for fiscal year 1972, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is authorized to be appropriated to carry out the provisions of the Saline Water Conversion Act (66 Stat. 328), as amended (42 U.S.C. 1951 et seq.), during fiscal year 1972 the sum of $27,025,000 to remain available until expended as follows:

(1) Research and development operating expenses, not more than $15,675,000: *Provided,* That notwith-

standing the provisions of section 8 of the Saline Water Conversion Act (66 Stat. 328), as amended (42 U.S.C. 1958), such funds may be obligated for the procurement of research services through contract with institutions or individuals in foreign countries;

(2) Design, construction, acquisition, modification, operation, and maintenance of saline water conversion test beds and test facilities, not more than $7,385,000;

(3) Design, construction, acquisition, modification, operation, and maintenance of saline water conversion modules, not more than $1,425,000; and

(4) Administration and coordination, not more than $2,540,000.

Expenditures and obligations under any of such items may be increased by not more than 10 per centum, except item (4) which may be increased 2 per centum, if such increase is accompanied by an equal decrease in expenditures and obligations under one or more of the other items.

92D CONGRESS
1ST SESSION

S. 991

IN THE SENATE OF THE UNITED STATES

FEBRUARY 25 (legislative day, FEBRUARY 17), 1971

Mr. BYRD of West Virginia (for Mr. JACKSON) (for himself, Mr. ALLOTT, and Mr. ANDERSON) introduced the following bill; which was read twice and referred to the Committee on Interior and Insular Affairs

A BILL

To authorize the Secretary of the Interior to continue a program of research, development, and demonstration of processes for the conversion of saline and other chemically contaminated water for beneficial use and for the treatment of saline and other chemically contaminated waste water to maintain or improve the quality of natural waters, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Act of July 3, 1952 (66 Stat. 328), as amended, is hereby further amended to read as follows: "The Congress in consideration of the Federal responsibility for water resource conservation by means of comprehensive planning, planning and construction of water resource development

projects, administration of the navigable waterways, and maintenance of water quality standards finds that the technology for the conversion of saline and other chemically contaminated waters is vital to all thesse areas of responsibility. It is the policy of the Congress, therefore, to provide for the development and demonstration of practicable means to convert saline and other chemically contaminated water to a quality suitable for municipal, industrial, agricultural, and other beneficial uses and to improve the quality of saline and other chemically contaminated waste waters to protect the quality of natural waters."

SEC. 2. The Secretary of the Interior is authorized and directed to:

(a) conduct, encourage, and promote basic scientific research and fundamental studies to develop effective and economical processes and equipment for the purpose of converting saline and other chemically contaminated water into water suitable for beneficial consumptive uses or for the purpose of treating waste waters to achieve qualities suitable for disposal into surface streams, groundwater bodies, or the ocean;

(b) pursue opportunities arising during the course of research and studies authorized by subsection (a) of this section which have potential practical applications unrelated to water treatment in order to advance the

work to the stage where such studies and research can be published in an effective form for utilization by others;

(c) conduct engineering and technical work including the design, construction and testing of pilot plants, test beds, and modules to develop desalting processes and plant design concepts to the point of demonstration on a practical scale;

(d) study methods for the recovery and marketing of byproducts resulting from the desalination of water to offset the costs of treatment and to reduce impact on the environment from the discharge of brines into lakes, streams, and other waters; and

(e) undertake economic studies and surveys to determine present and prospective costs of producing water for beneficial consumptive purposes in various parts of the United States by the saline water processes as compared with other standard methods, and by means of mathematical models or other methodologies prepare and maintain information concerning the relation of desalting to other aspects of State, regional, and national comprehensive water resource planning: *Provided*, That in carrying out this function, the Secretary shall coordinate these studies with planning being performed under the

provisions of the Water Resources Planning Act (79 Stat. 244), as amended.

SEC. 3 (a) The Secretary is authorized and directed to conduct preliminary investigations and to explore potential cooperative agreements with non-Federal governmental entities and utilities in order to develop recommendations for Federal participation in the construction, operation, and maintenance of prototype plants utilizing desalting technologies for the production of water for consumptive use.

(b) The Secretary is authorized and directed to report to the President and to the Congress, not later than one year after the date of this Act, his recommendation as to the best opportunity for the early construction of a large-scale prototype desalting plant. In making his selection the Secretary shall consider the following:

(i) plant size and process type best suited, within the presently available technology, to demonstrate the practicability of construction and operation of a large-scale plant for water supply on a reliable basis and best suited to provide information on the management problems and economics of such operations;

(ii) availability of cooperating entity or entities willing and capable of entering into agreements and contracts providing a market for water and an operating agency for the plants;

(iii) the availability of a site and the environmental considerations of an energy source and brine disposal; and

(iv) the need for the development of new water sources in the location.

(c) In carrying out the provisions of this section, the Secretary shall utilize the expertise of the water and power marketing agencies of the Department of the Interior and of other Federal agencies as may be applicable to insure that the economic, financial, and engineering analyses of any potential plant and the agreements among participants which may later result will give full consideration to the integration and compatibility of the water production, energy use, and possible energy production of the prototype plant with the water and power systems of the region.

(d) The Secretary is authorized to accept financial and other assistance from any State or public agency in connection with studies or surveys relating to saline water conversion problems and facilities and to enter into contracts with respect to such assistance, which contracts shall detail the purposes for which the assistance is contributed.

SEC. 4. In carrying out his functions under this Act, the Secretary may:

(a) make grants to educational institutions and

scientific organizations and enter into contracts with such institutions and organizations and with industrial or engineering firms;

(b) acquire the services of chemists, physicists, engineers, and other personnel by contract or otherwise;

(c) utilize the facilities of Federal scientific laboratories;

(d) establish and operate necessary facilities and test sites at which to carry on the continuous research, testing, development, and programing necessary to effectuate the purposes of this Act;

(e) acquire secret processes, technical data, inventions, patent applications, patents, licenses, land and interests in land (including water rights), plants and facilities, and other property or rights by purchase, license, lease, or donation;

(f) assemble and maintain pertinent and current scientific literature, both domestic and foreign, and issue bibliographical data with respect thereto;

(g) cause on-site inspections to be made of promising projects, domestic and foreign, and, in the case of projects located in the United States, cooperate and participate in their development in instances in which the purposes of this Act will be served thereby;

(h) foster and participate in regional, national, and

international conferences relating to saline water conversion;

(i) coordinate, correlate, and publish information with a view to advancing the development of low-cost saline water conversion projects; and

(j) cooperate with other Federal departments and agencies, with State and local departments, agencies and instrumentalities, and with interested persons, firms, institutions, and organizations.

SEC. 5. (a) Research and development activities undertaken by the Secretary shall be coordinated or conducted jointly with the Department of Defense to the end that developments under this Act which are primarily of a civil nature will contribute to the defense of the Nation and that developments which are primarily of a military nature will, to the greatest practicable extent compatible with military and security requirements, be available to advance the purposes of this Act and to strengthen the civil economy of the Nation.

(b) The Secretary will cooperate with the Environmental Protection Agency to insure that research and development work performed under this Act makes the fullest possible contribution to the improvement of processes and techniques for the treatment of saline and other chemically contaminated waste waters and to insure that the experience,

expertise, and data regarding desalting technologies which have been acquired in the performance of the Saline Water Conversion Act and which will be acquired in performance of this Act will not be needlessly duplicated by other programs.

(c) The fullest cooperation by and with the Atomic Energy Commission, the Department of Health, Education, and Welfare, the Department of State, and other concerned agencies shall also be carried out in the interest of achieving the objectives of this Act.

(d) All research within the United States contracted for, sponsored, cosponsored, or authorized under authority of this Act, shall be provided for in such manner that all information, uses, products, processes, patents, and other developments resulting from such research developed by Government expenditure will (with such exceptions and limitations, if any, as the Secretary may find to be necessary in the interest of national defense) be available to the general public. This subsection shall not be so construed as to deprive the owner of any background patent relating thereto of such rights as he may have thereunder. Within six months of the date of this Act, the Secretary shall publish rules in the Federal Register to give effect to the provisions of this subsection and shall subsequently publish all revisions in the same manner.

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(e) The Secretary may dispose of water and byproducts resulting from his operations under this Act. All moneys received from dispositions under this section shall be paid into the Treasury as miscellaneous receipts except where such operations may be undertaken as a part of a Federal reclamation project in which case the financial provisions of Reclamation Law (32 Stat. 388 and Acts amendatory thereof and supplementary thereto) will govern.

(f) Nothing in this Act shall be construed to alter existing law with respect to the ownership and control of water.

SEC. 6. The Secretary of the Interior may issue rules and regulations to effectuate the purposes of this Act.

SEC. 7. (a) There are authorized to be appropriated such sums, to remain available until expended, as may be specified in annual appropriation authorization acts to carry out the provisions of this Act during the fiscal years 1973 to 1977 inclusive, and to finance, for not more than three years beyond the end of said period, such grants, contracts, cooperative agreements, and studies as may theretofore have been undertaken pursuant to this Act and such activities as are required to correlate, coordinate, and round out the results of studies and research undertaken pursuant to this Act.

(b) The Secretary shall submit to the President and to

the Congress not later than December 31, 1975, a report on—

(i) the status of research and development work in progress under the provisions of section 2, subsections (a), (b), (c), and (d), along with a program for the orderly termination of these activities in accordance with subsection (a) of this section; and

(ii) the status of work in progress under the provisions of subsection 2 (e) and section 3 along with recommendations for the integration of these remaining functions within the ongoing water resource programs of the Department of the Interior.

(c) No new commitments shall be made under authority of this Act for cooperation with public or private agencies in foreign countries which require the expenditure of funds appropriated pursuant to this Act.

SEC. 8. As used in this Act—

(a) the term "Secretary" means the Secretary of the Interior;

(b) the term "saline water" includes sea water, brackish water, mineralized ground or surface water, and irrigation return flows;

(c) the term "other chemically contaminated water" includes agricultural runoff, municipal and industrial effluent, mine drainage, and naturally contaminated

waters which contain chemicals not susceptible to removal by conventional sewage treatment methods but susceptible to removal by desalting processes;

(d) the term "United States" extends to and includes the District of Columbia, the Commonwealth of Puerto Rico, and the territories of Guam and the Virgin Islands;

(e) the term "pilot plant" means an experimental unit of small size, usually less than one hundred thousand gallons per day capacity, used for early evaluation and development of new or improved processes and to obtain technical and engineering data;

(f) the term "test bed" means an intermediate-sized, experimental desalting plant of up to two million gallons per day capacity used for further evaluation and refinement of processes in the field and designed to facilitate the incorporation of experimental features for performance testing and to permit process changes and improvements as required;

(g) the term "module" means a section or integral portion of a desalting plant which is used initially to study large scale technology and critical design features in preparation for subsequent prototype construction;

(h) the term "prototype" means a full-size, first-of-a-kind production plant used for the development,

study, and demonstration of full sized technology, plant operation, and process economics.

SEC. 9. This Act may be cited as the "Saline Water Conversion Act of 1971".

EXECUTIVE OFFICE OF THE PRESIDENT,
OFFICE OF MANAGEMENT AND BUDGET,
Washington, D.C., April 2, 1971.

Hon. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: This is in response to your request for our comments on S. 991, a bill to continue the saline water conversion program conducted by the Department of the Interior.

The Office of Management and Budget supports the basic aims of S. 991. We believe, however, that these aims could better be attained through enactment of the proposed "Saline Water Conversion Act of 1971," which was transmitted to the Congress by Interior on April 1, 1971. Accordingly, we urge that the Committee give prompt and favorable consideration to Interior's proposed bill, enactment of which would be consistent with the Administration's objective.

Sincerely,

WILFRED H. ROMMEL,
Assistant Director for Legislative Reference.

U.S. DEPARTMENT OF INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D.C., April 1, 1971.

Hon. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: This responds to your March 1, 1971, request for the views of this Department concerning S. 991, a bill "To authorize the Secretary of the Interior to continue a program of research, development, and demonstration of processes for the conversion of saline and other chemically contaminated water for beneficial use and for the treatment of saline and other chemically contaminated waste water to maintain or improve the quality of natural waters, and for other purposes".

We support the general objectives of the bill, but recommend the enactment instead of the Administration's proposed "Saline Water Conversion Act of 1971", which we forwarded to the President of the Senate under cover of a letter dated April 1, 1971.

S. 991 would continue the present saline water conversion program of the Office of Saline Water (OSW) for an additional 5 years beyond the June 30, 1972, expiration date of its current authority, with an additional 3 years to complete projects in progress and to integrate desalting functions into other water resource programs of the Department of the Interior. In addition, S. 991 would provide for preliminary work on prototype desalting plants for full-scale use of desalting techology.

A memorandum reviewing the main differences between the Administration's proposal and S. 991 on a section-by-section basis is enclosed, and our comments herein are limited to the more significant differences.

Present authority to dispose of property acquired in the course of the desalting program is very limited. Broader authority to acquire and dispose of equipment and facilities is desirable and is provided for in section 4(e) of the Administration's proposal.

Both S. 991 and the Administration proposal recognize that prototype plant construction is the next major phase of the saline water conversion program. We believe the Administration proposal provides more satisfactorily for this development through its provision (section 5), that some other entity participate with OSW in construction and operation of such plants and that the Federal contribution not exceed 50 percent (and not extend past the first 3 years of operation) if the other participant is a non-Federal agency. This recognizes that OSW's function is to carry out research and development of desalting processes rather than to supply water on a continuing basis. A significant financial interest on the part of some other entity would assure support for, and the feasibility of, such a plant and encourage better utilization of the facility. Establishing the 50 percent limit at the present time would clarify the basis for entering the prototype phase and limit the parameters of negotiation with participating agencies.

Throughout the life of the desalting program OSW has submitted periodic reports to the President and the Congress. It is considered desirable to continue

this practice for their information and review. In its requirement (section 9) of such periodic reporting, the Administration bill differs from S. 991.

S. 991 provides for appropriations for fiscal years 1973–1977 with an additional 3 years to conclude projects in progress. At the end of this period, S. 991 provides that desalting functions will be integrated into other programs of the Department of the Interior. The Administration proposal provides an additional year for the preparation of a final report comprehensively summarizing the activities and the status of desalting projects (section 11).

The Administration proposal permits expenditure of up to 2 percent of research and development appropriations for research in foreign countries subject to approval of the Secretary of State (section 11). S. 991 prohibits new commitments of money for cooperation with public or private agencies in foreign countries. There are many competent scientists in foreign countries with unique expertise in technical areas of interest to the desalting program in the United States. If their activities can be directed to selected areas of research, they can make a significant contribution to the desalting program in the United States and we, therefore, believe limited expenditures for foreign research is appropriate.

In the case of any agreements concluded with other entities for desalting programs and the construction of facilities, we believe it desirable to have a statutory provision making the liability of United States contingent upon appropriations being available as is done in section 12 of the Administration proposal. It would provide clearly for terminating projects in the desalting program should unexpected costs increase prove excessive.

As state, although we support the general objectives of S. 991, we prefer the Administration's proposed "Saline Water Conversion Act of 1971" which we believe will accomplish those objectives more effectively.

The Office of Management and Budget has advised that there is no objection to the presentation of this report and that enactment of the proposal forwarded to the Congress by this Department would be consistent with the Administration's objectives.

Sincerely yours,

JAMES R. SMITH, *Secretary.*

SECTIONAL COMPARISON OF ADMINISTRATION PROPOSED SALINE WATER CONVERSION ACT OF 1971 WITH S. 991

The paragraph headings below refer to the specified sections of the Administration proposal.

Section 1—Purposes

The corresponding provision is section 1 of S. 991 which sets forth roughly comparable purposes.

Section 2—Definitions

Definitions are set forth in section 8 of S. 991. S. 991 defines the terms "saline water" and "other chemically contaminated water" in two separate definitions, covering the same elements defined as saline water in the Administration's bill. S. 991 defines the terms "Secretary" and "United States", while the Administration proposal does not. The Administration proposal defines "desalting", while S. 991 does not have this definition.

Section 3—Secretarial duties

Subsection (a)—The S. 991 equivalent section 2(a) does not provide for by-product recovery, but provides for it in section 2(d).

Subsection (c)—While the Administration proposal broadly covers organizations which might cooperate in a prototype program, section 3(a) of S. 991 specifically directs OSW to consider arrangements with non-federal governmental entities and utilities. S. 991 provides a specific date for the report required in subsection 3(c). S. 991 also provides for the Secretary to undertake certain preliminary work on a prototype plant. Section 3(c) of S. 991 further directs the Secretary to utilize the water and power marketing agencies of the Federal Government to insure that the plant will be integrated into the water and power systems of the region in which it is located, requirements with are more generally provided for in sections 3(c), (d), and (e) and 4(1) of the Administration proposal. Section 3(e) of the Administration proposal provides for coordination on a broader basis than section 4(e) of S. 991.

Section 4—Secretarial authority

Subsection (e)—S. 991 does not provide for disposal of property acquired under this Act and does not enumerate the ways in which property may be acquired.

Section 5—Prototype construction and operation

Subsection (a)—S. 991 does not provide for participation of other entities in prototype construction and operation. The Administration proposal limits the Federal financial contribution toward prototype plants.

Section 6—Report on prototype work

Section 7(b)(2) of S. 991 provides for a roughly equivalent report by December 31, 1975 (instead of June 30, 1976) and requires a recommendation for phase-out of these functions.

Section 7—Interagency cooperation; treatment of information

S. 991 specifically directs cooperation and coordination with the Environmental Protection Agency to avoid duplication.

Section 8—Effect on water law

Section 5(f) of S. 991 is identical.

Section 9—Periodic reports

S. 991 makes no provision for periodic reports to the President and the Congress.

Section 10—Implementing rules and regulations

Section 6 of S. 991 is identical.

Section 11—Authorized appropriations; use of funds

The Administration proposal provides for appropriations for fiscal years 1973 through 1977, with an additional three years to conclude projects in progress, and an additional year to prepare a final report. Section 7 of S. 991 does not provide the final additional year. S. 991 requires a status report by December 31, 1975, including recommendations for the integration of OSW functions within the programs of the Department of the Interior. The Department bill provides that 2% of any one year's research and development monies may be expended in foreign countries for research. S. 991 prohibits such expenditures.

Section 12—Contracting authority and liability

S. 991 contains no comparable provision making the liability of the United States under contracts contingent upon appropriations being available.

Section 13—Outside assistance

Section 7(d) of S. 991 authorizes the Secretary to accept outside financial and other assistance only for studies and surveys. The Administration proposal permits acceptance of such assistance for the additional purposes of research, construction, maintenance, operation and other activities authorized by the Act. S. 991 does not make any provisions for the return to the public agencies of any unexpended monies and S. 991 does not provide that the receipt of contributed funds shall not be the basis for entering contracts obligating the United States for amounts in excess of such funds unless actual appropriations have been made for such contracts.

Section 14—Short title

Section 9 of S. 991 is identical.

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D.C., April 1, 1971.

Hon. SPIRO T. AGNEW,
President of the Senate,
Washington, D.C.

DEAR MR. PRESIDENT: There is enclosed a draft bill "To expand and extend the desalting program being conducted by the Secretary of the Interior."

We recommend that the proposed bill be referred to the appropriate committee for consideration and that it be enacted.

With the enactment in 1952 of the Saline Water Act (66 Stat. 328), the Congress recognized the potential crisis that confronted the Nation in the disproportion between the available supply and the increasing demand for water. In that

legislation, the Congress declared the policy of "providing for the development of practicable low-cost means of producing from sea water, or from other saline waters, water of a quality suitable for agricultural, industrial, municipal and other beneficial consumptive uses on a scale sufficient to determine the feasibility of the development of such production and distribution on a large-scale basis, for the purpose of conserving and increasing the water resources of the Nation."

The 1952 Act, as amended, authorized annual appropriations for the purpose of initiating new projects only through fiscal year 1972, with an additional period of 5 years during which only appropriations to complete such projects could be made. The Federal desalting program will, accordingly, begin to phase out after fiscal year 1972 unless new authority is provided.

In continuing the desalting program, our main objectives will be: (1) to carry forward our basic and applied research and development program, building on the impressive gains in developing desalting systems which have already been made; (2) where desalting technology has been sufficiently developed, to stimulate its application to existing water problems; and (3) to develop large-scale prototype plants to evaluate and demonstrate the viability of desalting as an alternate water source to meet the pressing requirements that will arise in the last quarter of this century for more and better water. The location of such prototype plants will be selected on the basis of water needs and the availability of an entity or entities to participate in the construction and initial operating costs.

This bill would provide new authority for continuing with research and development activities for an additional 5 years, from fiscal years 1973 through 1977, with an additional 3-year period for completing those activities and an additional 1 year for preparing the final report. Periodic reports to the Congress no less frequent than 2 years would be required. Although the format has been changed, in substance this bill contains the same general authority as present law with the following exceptions.

1. The bill would require the Secretary of the Interior to complete and submit a preliminary report on the feasibility of constructing and operating large prototype desalting plants in order to verify that large-scale desalting is practicable by the distillation or reverse osmosis processes.

2. By the end of fiscal year 1976, the Secretary would be required to submit a report to the President and the Congress describing the status of the program authorized by the Act, including recommendations on the future role the Federal Government should play in encouraging the development and application of desalting technology. It is anticipated that information developed during this period would provide the basis for recommendations on the role of desalting in the Western United States Water Plan (Colorado River Basin Project Act of September 30, 1968, 82 Stat. 885).

3. More comprehensive definitions of the terms "pilot plant", "test bed", "module", and "prototype" are provided.

4. The scope of the research and development work on processes for the recovery of commercially valuable byproducts and for the minimization of environmentally harmful effects associated with desalting processes would be expanded.

5. New emphasis would be given to studies, surveys, and analyses that will include the use of desalting technology in comprehensive water resource planning and in other practical applications. Coordination of such studies with studies being conducted under other legislation would be required.

6. The Secretary would be authorized to acquire or dispose of property or rights in compliance with applicable property procurement and disposal laws. No disposal authority is provided in the present legislation except with respect to water and other byproducts of the desalting process. This has impaired the Secretary's flexibility in participating in arrangements with other entities and has created other complications inimical to the purposes of the Act.

7. The Secretary of the Interior would be authorized to continue research to preserve from loss disclosures or discoveries that were not directly related to desalting in the course of authorized research and studies.

8. Cooperation and participation in foreign research, not to exceed 2 percent of the appropriated research and development funds in any fiscal year, would be authorized.

Also enclosed herewith is a sectional analysis of the proposed bill and an environmental impact statement as required by section 102(2)(C) of the National Environmental Policy Act of 1969.

The Office of Management and Budget has advised that the presentation of this proposed legislation would be consistent with the Administration's objectives.

Sincerely yours,

JAMES R. SMITH, *Secretary.*

A BILL To expand and extend the desalting program being conducted by the Secretary of the Interior, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Act of July 3, 1952 (66 Stat. 328), as amended (42 U.S.C. 1951–1958g), is further amended to read as follows:

SEC. 1. In view of the increasing shortage of usable water in many parts of the Nation and the importance of finding new sources of supply to meet present and future water needs, it is the policy of the congress to provide for development and demonstration of practicable means for large-scale production from saline water of low-cost water suitable for municipal, industrial, agricultural or any other beneficial purpose, and for studies and research related thereto.

SEC. 2. When used in this Act—

(a) "Saline water" shall mean seawater, brackish water, and other mineralized or chemically charged water.

(b) "Desalting" shall mean any process for the reclamation or treatment of saline water for any beneficial purpose.

(c) "Pilot plant" shall mean an experimental unit of up to 100,000 gallons per day capacity, used for early evaluation and development of new or improved desalting processes and also for investigations in areas of supporting research and development to obtain needed technical and engineering data.

(d) "Test bed" shall mean an experimental desalting plant of up to two million gallons per day capacity, used for further evaluation and refinement of selected processes beyond that permitted by a pilot plant.

(e) "Module" shall mean a section or integral portion of a desalting plant which is used initially to confirm new or improved desalting technology on a large scale and the critical design features required for subsequent prototype construction.

(f) "Prototype plant" shall mean a first of a kind water-producing plant of sufficient scale and detail used for complete process verification of pilot plant test bed or modular tested technology and process economics.

SEC. 3. The Secretary of the Interior shall—

(a) conduct or provide for fundamental and applied research and studies to develop the best and most economical desalting processes, including processes for the recovery of commercially valuable byproducts produced during desalting and for the minimization of environmentally harmful effects associated therewith;

(b) conduct or provide for engineering and technical development work, including the construction and testing of pilot plants, test beds, modules, or any components thereof, for the purposes of evaluating the research and studies authorized by section 3(a) of this Act and advancing desalting processes and plant designs to the point where they can be demonstrated on a practicable scale;

(c) report to the President and to the Congress his recommendation as to the best opportunity for the early construction of large-scale prototype desalting plants. Plant siting shall consider the need for new water resources in a comprehensive plan for the area selected, plant size and best-suited technology to demonstrate the practicability of construction and operation of large-scale plants for water supply, and the availability of cooperating entity or entities willing to enter into agreements for marketing the water produced;

(d) conduct or provide for studies, surveys, and analyses (i) to determine the potential needs for, and uses of, desalting processes, (ii) to determine the present and prospective costs of reclaiming or treating saline water in various parts of the United States, and (iii) to furnish the technical and economic information to water resource planners as to the feasibility of constructing and operating proposed desalting plants;

(e) coordinate the studies, surveys, analyses, and reports authorized by this section 3 with those authorized by the Water Resources Planning Act of July 22, 1965, P.L. 89–80, 79 Stat. 244; the Colorado River Basin Project Act of September 30, 1968, 82 Stat. 885; the Federal reclamation laws (Act of June 17, 1902), 32 Stat. 388, and acts amendatory or supplementary thereto the Federal Water Pollution Control Act of June 30, 1948, 62 Stat. 1155, as amended and supplemented; and the National Environmental Policy Act of 1969, 83 Stat. 852.

SEC. 4. In carrying out his functions under this Act, the Secretary of the Interior may—

(a) make grants to educational institutions and scientific organizations and enter into contracts with such institutions and organizations and with industrial or engineering firms;

(b) acquire the services of chemists, physicists, engineers, economists, and other personnel by contract or otherwise;

(c) utilize the facilities of Federal scientific laboratories;

(d) undertake or provide for the construction, operation, and maintenance of the facilities necessary to carry out the research, studies, testing, development, and other functions authorized by this Act;

(e) acquire by purchase, contract for construction, license, lease, or donation, secret processes, technical data, inventions, operation, patent applications, patents, licenses, land or any interest in land, water rights, plants and facilities, and other foreign, and in the case of projects located in the United States, cooperate and as well as dispose of any such property or rights when no longer necessary for such activities: *Provided*, That such property or rights shall be acquired or disposed of as provided in the Federal Property and Administrative Services Act of 1949, as amended.

(f) assemble and maintain pertinent and current scientific literature, both domestic and foreign, and issue reports and bibliographical data with respect thereto;

(g) cause on-site inspections to be made of promising projects, domestic and foreign, and in the case of projects located in the United States, cooperate and participate in their development and operation in instances in which the purposes of this Act will be served thereby;

(h) foster and participate in regional, national, and international conferences relating to desalting;

(i) coordinate, correlate, publish, and otherwise make available information with a view to advancing the development of low-cost desalting processes;

(j) take necessary measures to preserve from loss such disclosures or discoveries as are not directly related to desalting made in the course of the research and studies authorized by section 3(a) of this Act;

(k) dispose of water or byproducts resulting from activities authorized by this Act in such manner as the Secretary shall determine best promotes the purposes thereof, with all monies received by dispositions under this section or section 4(e) to be paid into the Treasury as miscellaneous receipts;

(l) cooperate and participate in any of the foregoing activities together with other Federal departments and agencies, with state and local departments, agencies, and instrumentalities, or with interested persons, firms, institutions, organizations.

SEC. 5. In providing for the construction and operation of such prototype desalting plants as may hereafter be authorized, the Secretary of the Interior may participate with a Federal or state agency (including a political subdivision thereof.) Whenever the other participant is a non-Federal agency, the Federal financial contribution shall be limited to 50 percent of the construction cost and 50 percent of the operating and maintenance cost during the initial operating period, not to exceed three years following plant acceptance.

SEC. 6. By the end of fiscal year 1976, the Secretary of the Interior shall submit a report to the President and the Congress describing the status of the program authorized by this Act and shall include recommendations on the future role that the Federal Government should play in the desalting program.

SEC. 7. The Secretaries of the Interior, Defense, State, Agriculture, Commerce, Health, Education, and Welfare; and Housing and Urban Development; the Atomic Energy Commission and the Administrator of the Environmental Protection Agency shall each cooperate and coordinate their respective programs to effectuate the purposes of this Act.

SEC. 8. Nothing in this Act shall be construed to alter existing law with respect to the ownership and control of water.

SEC. 9. The Secretary of the Interior shall make reports no less frequently than every two years to the President and the Congress describing the action taken or instituted by him under the provisions of this Act.

SEC. 10. The Secretary of the Interior shall issue rules and regulations to effectuate the purposes of this Act.

SEC. 11. There are authorized to be appropriated such sums, to remain available until expended, as may be necessary (a) to carry out the provisions of this Act during fiscal years 1973 to 1977, inclusive, (b) to finance, for not more than three years beyond the end of said period, such grants, contracts, cooperative undertakings, and studies as may theretofore have been undertaken pursuant to this Act, and (c) to finance, for not more than one additional year, such activities as are required to correlate, coordinate, and summarize in a final report to the President and the Congress the results of the research and development undertaken pursuant to this Act: *Provided*, That not more than two percent of the

funds to be made available in any one year for research and development may be expended, subject to the approval of the Secretary of State to assure that such activities are consistent with the foreign policy objectives of the United States, in cooperation with public or private agencies in foreign countries for research useful to the program in the United States: *And Provided further*, That contracts or agreements made in pursuance of the foregoing proviso shall require that the results or information developed in connection therewith be available without cost, both to the Secretary of the Interior and the general public in the United States.

SEC. 12. When appropriations have been made for any activity authorized by this Act, the Secretary of the Interior may enter into contracts for such periods of time as he shall determine to be necessary but under which the liability of the United States shall be contingent upon appropriations being available therefor.

SEC. 13. The Secretary of the Interior is authorized to accept financial and other assistance from any State or public agency to conduct the program authorized by this Act and to enter into contracts with respect to such assistance which specify the purpose or purposes for which the assistance is to be used. Any funds so contributed shall be available for expenditure by the Secretary of the Interior for the purposes for which they were contributed in like manner as if they had been specifically appropriated as authorized by section 11 of this Act, any any funds not expended for these purposes shall be returned to the State or public agency from which they were received: *Provided*, That receipt of such funds shall not be the basis for entering into contracts that obligate the United States contingently or otherwise, for amounts in excess of such funds, unless actual appropriations have also been made for such contracts.

SEC. 14. This Act may be cited as the "Saline Water Conversion Act of 1971".

PROPOSED SALINE WATER CONVERSION ACT OF 1971

SECTIONAL ANALYSIS

Section 1—declares Congressional policy to provide for development and demonstration of practicable means for large-scale production from saline water of low-cost water suitable for beneficial purposes and to provide for studies and research related thereto.

Section 2—defines the following terms:

2(a) "Saline water"—seawater, brackish water, and other mineralized or chemically charged water.

2(b) "Desalting"—any process of reclamation or treatment of saline water for any beneficial purpose.

2(c) "Pilot plant"—an experimental unit of up to 100,000 gallons per day capacity used for early developmental and investigatory work.

2(d) "Test bed"—an experimental desalting plant of up to 2 million gallons per day used for further evaluation and refinement of desalting technology.

2(e) "Module"—section or integral portion of desalting plant used initially to confirm technology on a large scale and critical design functions for prototype construction.

2(f) "Prototype plant"—first of a kind water-producing plant of sufficient scale and detail for complete process verification of technology and economics.

Section 3—directs the Secretary of the Interior (Secretary) to (a) undertake research and studies to develop the best and most economical desalting processes, including processes for recovery of commercially valuable byproducts and for minimizing adverse environmental effects; (b) undertake engineering and technical development work, including construction and testing of pilot plants, test beds, modules or components thereof; (c) make a report and recommendation to the President and to Congress concerning the best opportunity for early construction of large-scale prototype desalting plants; (d) undertake studies, surveys and analyses of needs for and uses of desalting processes, desalting costs in various parts of the United States and the feasibility of desalting plants; (e) coordinate these studies, surveys and analyses with activities under other Federal laws affecting water quality or quantity.

Section 4—authorizes the Secretary to (a) make certain grants or enter contracts with educational institutions or scientific organizations and with industrial or engineering firms; (b) acquire the services of professional and other personnel; (c) use Federal scientific facilities; (d) accomplish the construction,

operation and maintenance of facilities necessary to carry out authorized functions; (e) acquire and dispose of property or other rights in compliance with applicable law; (f) collect and disseminate pertinent scientific information; (g) inspect projects and, in the case of projects located in the United States, join in their development and operation where the Act's purposes will be served; (h) foster and participate in desalinization conferences; (i) coordinate, correlate, publish and otherwise make available information with a view to advancing the development of low-cost desalting processes; (j) preserve disclosures and discoveries not directly related to desalting made in the course of authorized research and studies; (k) dispose of water and byproducts resulting from activities authorized by the Act; (l) cooperate and participate in these activities with others.

Section 5—provides that in undertaking construction and operation of any prototype plants which may be subsequently authorized, the Secretary may participate with a Federal or State agency. Where the other participant is a non-Federal agency, the Federal share of costs involved shall not exceed 50 percent of construction and of initial operating and maintenance costs (continued no more than 3 years).

Section 6—requires the Secretary to submit a report on the status of the desalting program with recommendations concerning the future Federal role in it, not later than the end of fiscal year 1976.

Section 7—requires the cooperation and coordination of Federal departments and agencies to effectuate the Act's purposes.

Section 8—provides that the Act shall not alter existing law with respect to ownership and control of water.

Section 9—directs the Secretary to report to the President and Congress on the desalting program not less frequently than every two years.

Section 10—provides for issuance by the Secretary of rules and regulations to carry out the Act's purposes.

Section 11—authorizes appropriations as may be necessary (a) to carry out the Act's provisions during fiscal years 1973 to 1977; (b) to finance activities undertaken within such period for an additional 3 years; and (c) to finance for not more than one additional year activities necessary to prepare a final report to the President and Congress. The section permits expenditure for foreign research activities of up to 2 percent of research and development appropriations provided the results of, or information developed in connection with, such research shall be available without cost to the Secretary and to the general public in the United States.

Section 12—provides that when appropriations have been made for any activity authorized by the Act, the Secretary may enter contracts for such duration as he may determine to be necessary, except that the liability of the United States shall be contingent throughout upon the availability of appropriations.

Section 13—permits the Secretary to accept certain financial and other assistance, with contributed funds being available for the designated purposes as if appropriated under section 11. Unused funds will be returned to the donors. The receipt of such funds shall not be the basis for entering contracts obligating the United States unless actual appropriations have also been made.

Section 14—provides that the Act's short title shall be the "Saline Water Conversion Act of 1971".

Proposed Bill To Expand and Extend the Desalting Program Being Conducted by the Secretary of the Interior

Environmental Impact Statement

1. Nature of proposed bill

The proposed bill would amend the Act of July 3, 1952 (66 Stat. 328), as amended (42 U.S.C. 1951–1958g) to expand and extend the desalting program being conducted by the Secretary of the Interior. The details are specified in the bill which this statement accompanies, and further in the covering letters to the President of the Senate and to the Speaker of the House of Representatives. The proposed legislation does not provide for a substantive redirection of the existing program.

2. Environmental impact of proposed bill

Because of increasing shortage of usable water, and in view of the importance of finding new sources of supply to meet present and future needs, section 1 of the

bill makes it the policy of the Congress "to provide for development of practicable means for large-scale production from saline water of low-cost water of a quality suitable for municipal, industrial, agricultural, or any other consumptive use or any other beneficial purpose, and for studies and research related thereto."

The saline water conversion program is the only Federal research and development program for providing practical means of converting saline waters into water suitable for beneficial uses. The proposed bill would continue this program, but in no way change the direction presently followed under existing law.

Our water supplies must be augmented to provide for the needs of a growing population and expanding economy. The means for increasing such supplies are limited. Precipitation management, use of available geothermal and ground water supplies, additional river and stream flow-management and desalination are the principal sources at this time.

The bill under consideration would have a limited immediate effect on the environment. The extension of the existing program will continue present operations of Office of Saline Water Test Facilities at the following five locations: San Diego, California; Roswell, New Mexico; Freeport, Texas; Wrightsville Beach, North Carolina; and Webster, South Dakota. These experimental facilities operate intermittently, have a negligible effect on the environment, and the effluents (hot brine and gas emissions) fully comply with all present State standards and the requirements of Executive Order 11507, Prevention, Control and Abatement of Air and Water Pollution at Federal Facilities.

The bill does not provide for the construction of new facilities, test beds and modules, and would require that the Secretary of the Interior recommend to the President and the Congress, not less than a year after passage, his recommendation as to the best opportunity for early construction of large-scale prototype desalting plants. Any of these activities may have significant environmental effects requiring statements in accordance with Section 102(2)(C) of the Environmental Quality Act of 1969. Such statements will be prepared when new projects are identified as to proposed location and data become available.

Environmental effects of existing Office of Saline Water Facilities are described as follows:

(a) San Diego, Calif., test bed and facility

Steam is purchased from the existing operating power plant of the San Diego Gas & Electric Company, adding nothing to emissions produced in that company's normal operations. Brine is discharged through San Diego Gas & Electric discharge facilities to the San Diego Bay and to Western Salt Company evaporation ponds. There is no adverse effect on water quality or discernible increase in thermal pollution over that created by San Diego Gas & Electric cooling water discharge.

(b) Roswell, N. Mex., test bed and facility

Brine is discharged into plastic lined ponds built by the City of Roswell on city owned property donated by the State of New Mexico. There is no adverse environmental effect. Natural gas is used as fuel; no adverse emissions result.

(c) Freeport, Tex., test bed and facility

Steam is purchased from the existing production facilities of the Dow Chemical Company. Brine is discharged through that company's facilities. There is no discernible increase in the thermal pollution over that from normal Dow Chemical operations.

(d) Webster, S. Dak., test bed and facility

Negligible gas emission. Brine effluent is discharged at ambient temperature into a local brackish lake. The facility effluent is of higher quality than the lake itself. The environmental effect is insignificant.

(e) Wrightsville Beach, N.C., test facility

A minimal amount of emissions, fully in compliance with North Carolina and Federal standards, is produced from this facility. Brine effluent is cooled in a pond before discharge into the Intercoastal Waterway with no adverse environmental effect.

4. Alternative to the proposed bill

None, other than termination of or continuation for a different period of the Saline Water Conversion program.

5. Relation between local short-term uses and long-term productivity of the environment

In the short run, the program has little or no impact on the environment. The long-run potential is significant. Positively, the production of commercial quantities of water from saline waters, at competitive cost, could provide high quality water for blending with natural stream flows for wtter quality improvement, and, by virtue of increased supply, reduce the need for added streams flow regulation. It could reduce the depletion of ground water supply in critically water short areas. Negatively, there is no question that large-scale desalting plants, as contemplated, may have slight local environmental impact. These, largely, will result from heat, brine and air emissions. The research program is designed to provide answers to these environmental questions, as well as to reach the technological objectives. Future state legislation could impose constraints on proposed test facility programs which can be overcome by investment in items such as cooling towers and long outfall systems. In this manner environmental impact would be minimized.

6. Irreversible and irretrievable commitments of resources

None.

Senator ANDERSON. I have received the following statement from Senator Bible, which will be included in the record at this point.

(The statement follows:)

STATEMENT OF HON. ALAN BIBLE, A U.S. SENATOR FROM THE STATE OF NEVADA

Mr. Chairman, first let me commend the chairman of the full committee as well as the chairman of the Water and Power Resources Subcommittee for their interest and foresight in sponsoring legislation not only to continue water desalting research but to channel this work toward a definite and productive goal.

To me, saline water conversion has always held the brightest short range promise among all the various efforts to solve the growing problem of water resource supplies. Many other programs and project proposals have great potential—weather modification, trans-basin projects, anti-evaporation research and the like—but none are so readily within our grasp. We must move forward on all fronts to head off what will otherwise become a water supply crisis of disastrous proportions. We can neglect no reasonable approach to a solution, and I am convinced we *must not* neglect saline water conversion.

As chairman of the Interior Appropriations Subcommittee, it is my duty to review the annual budget requests of the Office of Saline Water, and I hope that I have helped from time to time in giving direction and purpose to this important program. Great strides have been made since this effort was first launched by Congress in 1952. The cost of converting seawater has been chopped down from $4 per thousand gallons in 1952 to 65 cents today, and the former director of OSW testified before my subcommittee just last month that there are real hopes for reducing that by another 15 percent in the reasonably near future through a combination of processes that will also cut capital costs by some 30 percent.

This was the thrust of testimony before my subcommittee, as I say. Some predictions have costs going even lower, perhaps in the area of 40 cents per thousand, which would make desalted water competitive in cost to average municipal rates.

We are still a long way from our goal of converting seawater for low-cost agricultural use, but this goal is no longer a distant, unreachable objective As Dr. Chung-Ming Wong stated:

"Let me say, 40 cents per thousand gallons is equivalent to one dime per ton, or 10 cents for 2,000 pounds of water delivered to your kitchen. The only thing cheaper is air. Dirt costs more than a dime a ton. We are aiming at that as our target, and while we have not achieved a dime a ton at this time, we are coming closer."

We cannot overlook the additional fact that saline water conversion is developing important side benefits along the way. Headway has been made in applying desalting methods to the problem of water pollution control, to salvaging the water resources of geothermal steam and to converting brackish inlands waters.

At the same time, I have some concern in my own mind about the dangers inherent in fragmenting research. I would not like to see the goals blur and the thrust wander. After all, as it was put to my subcommittee, the United States invested more than $182 million between 1952 and 1970 in saline water conversion research—about $10 million a year. That kind of investment and that kind of effort must have a firm direction and a solid goal.

Further, it was repeatedly stressed during this testimony that large scale pilot projects must be brought into the research effort to bring results. The bigger the plant, the cheaper the cost per gallon and the more effective the technology that is developed.

With all this in mind, the proposal advanced in the Jackson-Anderson legislation that would focus on the construction and operation of a large-scale prototype desaling plant would certainly appear to have merit. It strikes me that in balance, looking back over what we have achieved and looking forward to extending this program another five years, we must undertake a determined effort to begin applying what we have developed. We should not neglect the side benefits, but we cannot become preoccupied with them, either. We must keep the main target in sight, and that target is the eventual production of converted seawater at an economical cost that will bring a significant addition to our dwindling water resources.

I do not believe the Interior Department and this committee are too far apart on their approaches to the application of desalting technology; perhaps only on emphasis. Certainly we must act promptly to assure the continuation of this program, not just through fiscal 1972 authorizations but for a carefully directed five-year effort with new emphasis on large-scale application of the technology that has been developed.

Through annual appropriations review and through the analysis and reporting requirements carried in the authorization bill, I believe Congress will be fully capable of keeping this important program on a vigorous, productive course.

STATEMENT OF JAMES R. SMITH, ASSISTANT SECRETARY OF THE INTERIOR, ACCOMPANIED BY JOHN W. O'MEARA, ACTING DIRECTOR OF THE OFFICE OF SALINE WATER

Mr. SMITH. Mr. Chairman, I have a summary statement which I would like to read, and a longer statement which I should like to submit for the record.

Senator ANDERSON. Without objection, we shall do it that way.

Mr. SMITH. Thank you, Mr. Chairman.

Mr. Chairman and members of the committee, it is an honor and a pleasure to be here today to support legislation for the 5-year program of the Office of Saline Water. I am submitting a longer statement for the record which I will summarize. Accompanying me is Mr. J. W. O'Meara, Acting Director of the Office of Saline Water. At the conclusion of my highlight statement he will be available to answer your questions, and also present our request for the authorization for program activities during fiscal year 1972.

My statement today deals primarily with the legislative request to expand and extend the saline water conversion program submitted by the Department of the Interior; S. 991 has similar objectives. When we compare the provisions of S. 991 introduced by the distinguished chairman of this committee, Mr. Jackson and the cosponsors of the bill, Mr. Allott and Mr. Anderson, with the legislation proposed by the Department of the Interior, it is obvious there is general agreement that the saline water conversion program should be extended for 5 years. The differences between the two legislative proposals are relatively small when judged against the overall intent of both.

The two bills are quite similar for the most part since they are largely concerned with continuing the existing authority beginning in fiscal year 1973. S. 991 recognizes the widespread potential which desalting technology holds for applications in addition to desalting. We intend to make our technology available to all who can use it.

The Department's request reflects our internal planning and represents a shift in emphasis from R. & D. to increased application of technology. The scope of S. 991 is indicative of how closely the Congress has followed our progress. We are encouraged by this expression of interest and the continued support of our program by this committee.

As we examine the water problems we face now and those that loom ahead in the remainder of this century, the prospects for supplying many parts of our Nation with the necessary quantities of good water will be greatly enhanced by desalting. The fact is that the increasing use of water caused by our continuing population growth, accompanied by expanding industrial and agricultural activity, will turn many of our presently available fresh waters brackish. This is already happening today in some parts of the Southwest.

Urbanologists foresee enormous metropolitan areas covering much of the Atlantic and Pacific coasts. Desalting advances will make the nearby oceans a source of fresh water to meet these anticipated demands.

It is not necessary to search the future for any mandate for this technology. There are many communities, most of them small, whose water supplies do not now meet EPA standards.

Our task, then, is to continue the development of the technology which soon will be urgently required, and to apply the technology we have already developed to solve current water supply problems. This is the purpose of the legislation you are considering today.

The authorization to continue the desalting program is justified by several factors:

1. In the light shed by our recently increased knowledge of our water resources and environment, there is a clear indication that desalting technology will be required to provide new sources of water, to reuse water, to remove pollutants from water, and to recover valuable byproducts.

2. Government participation is required because of the complexity of our water resources system, which inherently involves values above and beyond economic considerations. This participation must include coordination, information, support of desalting technology to insure that it will be ready when required, as well as assistance to communities to apply the technology, encouragement of technical and managerial innovation leading to a stable, broadly based desalting industry.

3. The Federal Government and potential users must keep informed on the current capabilities and the future prospects of the technology to develop long-range plans for the optimum utilization of resources and maximum protection of the environment.

4. Desalting can achieve any desired degree of water renovation required by the intensive use of water due to population growth.

5. Desalting will provide new water as we approach the limits on the quantity we can impound, and produce a reliable high quality supply.

6. The desalting program must continue uninterrupted because considerable time is required for technology refinement, water supply planning, and plant construction.

The bills before the Congress would primarily extend the existing authority of the desalting program. The Department request, how-

ever, would grant additional authority to enable us to contract for a small amount of research with foreign organizations and individuals to make available their expertise to the U.S. desalting industry.

During the period covered by the new legislation, the desalting program will have four main objectives. First, where the desalting state of the art has been developed sufficiently, we intend to stimulate its application to existing water problems. In this regard, we would expect to furnish information and direction to agencies with loan and grant-in-aid authority to encourage consideration of desalting as an alternative in water resource programs under their jurisdiction. We feel that the most immediate need desalting will satisfy will be in improving the quality of small community water supply systems. The second major objective will be to continue our basic and applied research and development program to build a base knowledge upon which desalting can continue to build. The third will continue the development of technology for large-scale plants which will be required in the last quarter of this century to provide water in large quantities for our cities, industry, and agriculture. Finally, our program will strive to improve Federal and State water planning through cooperative studies in addition to engineering and economic studies relating to desalting costs.

We anticipate that during the 5 additional years of the full-scale program, we will undertake the cooperative construction of several types of prototype plants. A variety of prototypes is required because there is no single optimum process for the variety of feed waters, site characteristics, and product water quality with which we must contend. At this time distillation is most economical for sea water, while membrane processes are more economical for lower salinity brackish waters.

We will be reporting to you, Mr. Chairman, to the Congress, and to the President on our plans for constructing prototype plants. During this fiscal year, construction will begin on a distillation module of 3-million-gallon-per-day capacity to provide the technological base for plants of 200 million gallons per day. We would expect to expand this module to a prototype as the development of technology permits. We are also considering an 8-million-gallon-per-day single-purpose plant and a 30- to 50-million-gallon-per-day sea water conversion prototype plant.

In our reverse osmosis program we are considering three prototype plants. Two of these will be of 1- to 3-million-gallon-per-day capacity. One would be operated on high hardness ground brackish water and the second would convert surface brackish water contaminated by industrial effluents, agricultural run off, and sewage effluent which has undergone secondary treatment. The third plant, of 3- to 5-million-gallon-per-day capacity, will be designed to convert 95 percent—a very high percent, incidentally—of brackish feed to product water. The problem of brine disposal from all three plants will receive special attention.

In our applied research, the emphasis will be placed on the development of new membranes and ancillary equipment. In addition, we will continue our work on freezing, ion exchange, environmental problems, and the utilization of brackish and the utilization of geothermal waters. As many of you will recall, the desalting program had as one of its original objectives that of desalting sea water to provide

fresh water for agriculture. This is still an ultimate goal, but by far the most difficult to achieve. We intend to explore, in conjunction with other Federal agencies and State universities, an experimental program to develop an optimized agricultural system which could feasibly use moderate-cost, high-quality water.

Our fundamental and applied research will continue to provide the solid foundation for our development programs and to seek out new processes, materials, and process effects. We will give particular emphasis to those processes which offer the highest probability of a scientific breakthrough, and will continue to search for materials that will enable us to reduce the capital investment required for desalting plants.

We have defined our 5-year desalting program to meet the needs of potential areas of use where desalting offers an alternative.

Our estimated costs for this program are $240 million.

I want to thank this committee again for the opportunity to testify in behalf of a program which certainly the Department of the Interior considers to be very vital to this Nation.

(The prepared statement follows:)

STATEMENT OF JAMES R. SMITH, ASSISTANT SECRETARY FOR WATER AND POWER RESOURCES, U.S. DEPARTMENT OF THE INTERIOR

Mr. Chairman and members of the committee, I am glad to have the opportunity to appear before you today to provide comments on S. 991 and testify in behalf of the Department of the Interior's legislative proposal for a five-year program to further advance the technology for low-cost desalting processes as well as our request for $27,025,000 authorization of appropriations for the fiscal year ending June 30, 1972 (S. 716).

The Office of Science and Technology Report recently transmitted to the Congress by the President sets forth goals for a national program. Our request, which entails some changes in the scope of our authority, is commensurate with these goals. I would like to discuss briefly the basis for this legislation, summarize the salient points, and present our plans for the period covered by the request.

The work of the Office of Saline Water and of the Office of Water Resources Research has been integrated within the Department of the Interior with the program of the Bureau of Reclamation under the responsibility of the Assistant Secretary for Water and Power Resources. This program now presents and exceptional opportunity to conduct a unified water research, development, and management program of broad scope.

My review of the many achievements of the desalting program has convinced me of its sound potential for continuing progress. The technology is now available to meet the water needs of small communities and many specialized situations. Our program must now address itself to the objectives of continued reductions in desalting costs and developing large-scale technology. We must get the developing technology to the people of our Nation who need it.

Like many members of this committee, I am keenly interested in the potential of desalting to provide an alternate source to assist us in meeting the constantly increasing demands for more and more fresh water.

When we study the population projections and relate those projections to the demand for water, it is clear that we must use every practical program the mind of man can devise to conserve and make wise use of our existing sources of supply. Furthermore, we need to supplement that supply through technological creativity, such as water purification and reclamation systems, desalting processes, and comprehensive management systems.

When we look at the projections of water consumption through the year 2000 and compare these projections with those for water availability, it becomes apparent that desalting technology will be a very important tool of water management.

Our expanding population will also require increased industrial activity. This increase in industrial activity will be in more than direct ratio to the population growth because of increased personal income and expanded buying power. In-

dustrial trends indicate reuse, increase recirculation ratios, and even closed-cycle operations, but they also indicate an overall increase in consumption. Therefore, the ever-increasing problem of dissolved solids combined with the reduction in volume of the diluting water will increase the salinity even further.

In its assessment of the Nation's water resources, the Water Resources Council projects intensive use of the available water by the year 2000. At that time, the ratio of withdrawal to availability will exceed 100% in five of the regions studied, with two of these regions exceeding 170%. Of the remaining 16 regions, four will exceed 50%. (In 1965, only three regions exceeded 50% and only one of these exceeded 100%). Therefore, in less than 30 years, over 40% of our water resource regions will be using water very intensively. Desalting technology can make substantial contributions in reducing the salinity of our natural waters and in preventing the build-up of concentrations of many toxic substances.

The U.S. Public Health Service has established criteria for drinking water, including a recommended level of not more than 500 parts per million (ppm) of total dissolved solids and a maximum level of 1,000 ppm. Studies show that, although for much of the country the quantity of water will be adequate for the foreseeable future, its quality will become increasingly unacceptable as it is used more intensively.

Several hundred communities are now using water containing more than 1,000 ppm. Desalting will provide water of more acceptable quality.

This committee is acutely aware of the increased attention that has been focused on the environment in the past few years. Our awareness of ecological problems is rapidly increasing; but, we still do not know the effects of many substances contained in our industrial and municipal effluents. We find that desalination can make a sizable contribution to the problem of water quality beyond that of removing total dissolved solids, because desalination processes remove many other contaminants as well. The processes have also been effective in reducing concentrations of harmful bacteriological organisms. While the Nation is taking significant steps in sewage treatment and improving water supply treatment, there still remains a gap to close. Desalination technology is especially well suited to bridging that gap.

Further, the state of this technology has reached the point where more desalting plants can be built with confidence. It is the small community which presently needs the most help in improving their water supplies.

Beyond the question of health indicated by water supplies containing more than 1,000 ppm is that of economic limitation. Many industries require ultrapure water.

Since its inception, the desalting program has made considerable progress in reducing the cost of product water. In 1952 it was upward of $7 per 1,000 gallons in 1970 dollars. Today, commercial sea water distillation plants of 7–10 million gallons per day (MGD) produce fresh water for 65¢–85¢ per thousand gallons and membrane process plants of up to 2 million gallons per day (MGD) desalt lower salinity brackish waters for 30¢–40¢ per thousand gallons. We are confident that we can continue to improve upon this economic progress during the next five years.

The criterion of product water cost is not the only one which must be applied to this program. As I have mentioned, the water supply of many communities does not meet Public Health Service recommended standards. As the use of our surface and ground waters becomes more intensive due to the growth of our population and increased industrialization, additional communities will be faced with this problem. The criterion of water quality is as significant as product water cost.

The desalting program has four major elements. The first of these is basic research, where we seek to expand our fundamental knowledge of processes and materials which can be utilized in the separation of salts from water. An important aspect of this element has been the development of new processes and data and the evaluation of existing processes, materials, and process modifications.

Second is the development program, which has converted more promising research developments into engineering achievements through testing and evaluation.

The third is our test bed and prototype program, which is necessary to prove on a practical scale the engineering and economic feasibility of these processes applied to real water problems.

The fourth element is studies which provide information on desalting costs and how desalting can help meet water supply needs. These studies, which may be carried out in cooperation with Federal or state water planning agencies,

provide desalting technology to them and give OSW information on utilization of various desalting processes, on possible sites or areas for future desalting use, and indicate needs for research and development emphasis. The desalting studies thus support the first three program elements.

The OSW program has been carried out through a series of grants and contracts with educational institutions, industry, and cooperating Federal, state, and local agencies. We can now see a growing desalting industry with exciting potential.

The following considerations justify the need for legislation to continue for 5 years the existing authority of the Secretary of the Interior to conduct the Saline Water Program. This legislation is justified by several factors:

1. Current information about our water resources and environment, much of which has been developed only in the last decade, clearly indicates that desalting technology will be required to reuse water, and to recover valuable by-products.

2. An effective water resource program must be based on the realization of the complexity of the water resource system. Optimum utilization of our water resources involves both economic and other considerations. In the light of all this, the program provided for in this legislation includes coordination; information; stimulation of those areas of desalting technology which may either lag behind or require exceptionally long lead times; encouragement of technical and managerial innovation; technical assistance to communities; and encouragement of a stable broadly-based desalting industry.

3. Where desalting is the only technique that will meet a requirement, there is no decision problem. With other alternatives existing, the Federal Government and potential users must keep pace with the current capabilities and the future prospects of water technology to develop viable long-range plans for the maximum use and protection of water resources.

4. The intense concern over the environment in the last few years has revealed that we need to know more about its problems. Thus, Federal participation in desalting provides greater flexibility in dealing with problems of environmental control.

5. Our population will continue to increase. This growth of necessity means a more intensive use of water and a resultant build-up of contamination. It is possible to achieve any desired degree of water renovation by using such desalting technology as distillation and reverse osmosis.

6. Further, as our population increases, we will approach the limits on the quantity of water we can impound and thus approach the limits of water storage.

7. During long droughts, stream flow will be reduced and stored water will be depleted. Water systems including desalting plants would insure a continuous supply of fresh water.

8. Since a considerable time is required for refinement of the technology and construction of plants, the desalting program, with the continued development and the rapid application of the technology including plant construction and acquisition of data under a variety of conditions, must continue.

This new legislation will give the OSW desalting program the tools needed for it to make its proper contribution to the future water needs of the Nation.

You will note that we have requested authorization of the necessary monies subject to a biannual review by the Congress throughout the life of the desalting program. The considered advice and guidance of this committee have been invaluable; therefore, it is our intention to present not only the Appropriations Committee but this committee with a periodic review.

We anticipate that as part of our program, we would provide limited technical assistance upon request since many of the smaller communities cannot retain an engineering staff with training in desalting technology. Similarly, we would expect to furnish information and direction to agencies with loan and grant-in-aid authority to encourage consideration of desalting as an alternative in water resource programs under their jurisdiction.

We are also requesting authority to sponsor research projects with foreign organizations. There are many competent investigators abroad who have singular expertise in highly specialized areas, some of whom we would like to sponsor, particularly in fundamental research. Where the investigations of these scientists appear to promise significant process improvements or occasionally new processes, it would be to the benefit of the program to determine whether, in fact, their results warrant further investigation and eventual process development. It is not the intention of OSW to create or sponsor foreign desalting

industries, but rather, to make available foreign technological developments to the U.S. desalting industry.

Although the principal thrust of our program has been and will continue to be the development of desalting to provide fresh water, some of our technology holds significant promise in other applications. The new legislation will enable us to pursue such opportunities as they arise.

OSW has participated in economic feasibility and cooperative desalting studies, both on a limited basis. The results of these activities encourage us to request expanded authority in this area, with specific provisions to make OSW a part of several long-range water resource planning studies. The new authority would expand and emphasize this area.

It is necessary that we have the opportunity to build prototype plants. These plants represent the culmination of the orderly scientific progression from the laboratory to integral elements of large municipal water supply systems. During the next year we will develop our recommendations concerning the design and construction of future prototype plants. It is imperative that we accomplish this now if we are to have the technology available when it is critically needed in the last quarter of this century.

During the period covered by the new legislation, the previously stated elements of the desalting program will provide the impetus for pursuing four main objectives. First, where the desalting state-of-the-art has been developed sufficiently, we intend to stimulate its application to existing water problems. We think that the most immediate need it will satisfy will be improvement of small community water supplies. Studies with state water agencies have indicated possibilities for improving water quality in small plants in the near future in brackish water areas and future possibilities for large-scale desalting use in the Northeast and Gulf Coast areas. Another opportunity is conjunctive use of desalting plants with natural water reservoir systems.

The second objective is the development of large-scale technology which will be required in the last quarter of this century to provide water in large quantities for our cities, industry and agriculture. The third major objective will be to continue our basic and applied research and development program to provide a base of knowledge upon which desalting can continue to build.

The final objective will be to improve Federal and state water supply planning through cooperative studies in addition to engineering and economic studies relating to desalting costs. In this way, we get preliminary feasibility information on how desalting may be able to supply supplemental or new water supplies, or to improve the quality of existing supplies. In such studies the Office of Saline Water's primary contribution is providing desalting technology and data to conform with the water resource planning agency's activities. Presently, OSW is cooperating with the Bureau of Reclamation in the Western U.S. Water Plan. The results of recent cooperation with the Pacific Southwest Interagency Committee (Water Resources Council), together with those of other prior cooperative studies, have shown that water supply augmentation by desalting could have major applications to meet long-range water needs in that region, both as to quantity and quality.

Any new technology, such as desalination, cannot be successfully developed unless it is based on a solid foundation of basic and applied research. The proposed five-year program is geared to develop further this new technology through innovation, invention, breakthrough, and new processes and phenomena. We will give particular emphasis to those processes which offer the highest probability of a real scientific breakthrough. We will also continue to search for materials that will enable us to reduce the capital investment required for desalting plants, since this one item accounts for approximately 40% of the cost of desalted water.

These studies will include development of a better understanding of the mechanism by which materials deteriorate, development of data essential to the design engineer through operation of the corrosion loops at the Materials Test Center, and development of new and/or improved materials. This work will involve new alloys based on iron and aluminum, studies of titanium and various high quality alloys, and stainless steels. In addition, essential data will be obtained on polymer coatings, cladding, and protective films.

Basic research will seek a thorough understanding of water, salt, and energy transport, the structure of water and membranes and the characteristics of aqueous solutions, a new electrostatic process and a new modified freezing

process, and biomembranes both living and synthetic. It is quite possible that the ultimate desalting process may come from the biological field.

Considerable emphasis will be placed on developing a theory and better understanding of the new pressure dialysis process. Synthesis of better mosaic membranes and support systems for this new process will be emphasized.

Applied reearch will concentrate on development of new membranes; high flux, high salt rejection, new compositions, sheet, tubular, tubules, and hollow fiber configuration, porous supports for composite membrances, new designs for membrane processes, new means of fabrication, and in-situ removal of membranes from a plant.

We anticipate that during the five additional years of the full-scale program, we will undertake the construction of several types of prototype plants which are required since there is no single optimum process for the variety of feed waters, site characteristics and product water quality with which we must contend. At this time distillation is most economical for sea water, while membrane processes are more economical for lower salinity waters. We will report to the President and the Congress on our plans for constructing prototype plants.

During this current fiscal year, construction will begin on a distillation module of up to 3 MGD capacity to provide the technological base for plants of 200 MGD. As soon as we obtain sufficient data from the module, we plan to expand it to a prototype plant of 12–15 MGD. We are also considering a 30 to 50 MGD seawater conversion prototype plant, as well as an 8 MGD plant.

In our reverse osmosis program we are also considering three prototype plants. Two of these would be of 1–3 MGD capacity. One would be operated on high hardness ground brackish water and the second would desalt surface brackish water contaminated by industrial effluents, agricultural run off, or sewage effluent. The third plant, of 3–5 MGD capacity, will be designed to convert 95% of brackish feed to product water, as compared to the present 50%–60%. Special emphasis will be given to minimize the effects of brine disposal in all of these plants.

Two test beds will explore the potential of reverse osmosis for sea water conversion.

Supporting research and development projects include high pressure pumps of new designs and materials of construction that permit high efficiency and low maintenance, and suitable feed water pretreatment methods for contaminants removal to extend membrane life.

Distillation and membrane development will be supported by pilot plant tests to determine the performance, service life and design integrity of new membranes, membrane supports, and new plant designs.

Other processes are being evaluated as well as pretreatment methods, brine disposal, and by-product recovery.

As many of you will recall, the desalting program had as one of its original objectives that of desalting seawater to provide fresh water for agriculture. This still remains an ultimate goal but by far the most difficult to achieve.

Studies carried out for OSW by the Bureau of Reclamation during the past several years show that high quality water together with innovative irrigation techniques can be utilized for the production of high value crops and increased yields in areas now dependent on mildly saline naturale supplies. Substantive economic benefits have been shown even though desalted water costs are more than the prices charged for irrigation water. As a follow-up on this concept, the Bureau of Reclamation, with cooperation by OSW, is proposing an experimental program to further develop such application and obtain definitive data on benefits to be obtained.

OSW is participating in the Department Task Force in assisting the Bureau of Reclamation in a study of the potential development of both water and power of the geothermal resources of the Imperial Valley Region. OSW's interest is in evaluating the potential of desalting existing geothermal brines and in developing processes to recover fresh water economically. This study is a facet of the Department's Western U.S. Water Study.

Our estimated cost for the proposed new program is $240 million. This amount would continue our research and development for an additional five years from FY 1973 through FY 1977 with an additional three-year period for completing these activities and one year for preparing a final report.

We urge the committee to adopt the proposed legislation and provide the tools to enable us to proceed toward the goals of this vital program.

Senator ANDERSON. Mr. Smith.

Mr. SMITH. I would like to make one more brief comment in this context. As many of you gentlemen know, since approximately the first of the year, the Office of Saline Water, as well as the Office of Water Resources Research, were transferred to the jurisdiction of the Assistant Secretary for Water and Power Resources. This was done in an effort to put under one management head virtually all of the water-related activities of the Department of the Interior so that we could have the kind of broad coordination that can be made possible where there is one boss. And I personally look at desalting, water resources research, and work with the Bureau of Reclamation, as the melding of Interior's water-resource programs which can do nothing except make for better management, better operation, and a stronger program for the future.

Mr. Chairman, that concludes my remarks. Mr. O'Meara is here to answer questions. I, of course, would be more than happy to answer any questions which you care to address to me.

Senator ANDERSON. Senator Jordan?

Senator JORDAN. Thank you, Mr. Chairman.

Mr. Secretary, several year ago, there was a proposed multipurpose project to be installed on a man-made land off the coast of southern California. It was before your time and I do not know whether this question should be addressed to you or perhaps to Commissioner Ramey. But this project, with its joint venture for nuclear energy production and desalting of water, was to be joint ventured by private utilities, by the Government, by municipal agencies in southern California, and it sounded very promising at the time. Do you know what has happened to that project and what chance there is for its revival?

Mr. SMITH. I would not be able to say what chances there are for a revival. Of course, I have been told so many different stories about why the Bolsa Island project fell apart that it is a little hard to sort out where the true facts lie. But if I were to attempt to make an educated guess as to what happened, it was twofold. No. 1, the costs completely out of line as location and design factors were refined, and No. 2, they may have had too many cooks and spoiled the broth.

Senator JORDAN. Do you see any prospect for its revival for something of that magnitude in the foreseeable future?

Mr. SMITH. I assume that in that context, you are talking about the construction of a true prototype larger scale desalting facility?

Senator JORDAN. Yes. That was a tremendous size—I have forgotten the numbers that went with it, but it was not only for energy production but also for enough water to take care of the domestic and industrial needs of a city of a million people.

Mr. SMITH. One of the ultimate goals of the saline water program is the development of technology and under the bill which is before you, a recommendation will be made to the Congress and to the President as to the best type of a plan which can and should be undertaken of a large prototype desalting facility. So I would say that whether it is a Bolsa Island or some other facility, we look forward to construction of a prototype desalting plant. Otherwise, I really see very little use in continuing the existence of the Office of Saline Water if they cannot demonstrate the end result that we are seeking.

Senator JORDAN. If this committee should decide to include a 1-year

requirement for a proposal for a large-scale prototype, something of the nature we have been talking about, would you be able to present the Congress with such a proposal within that time frame?

Mr. SMITH. Based upon the technical advice of the director and his highly proficient technical and scientific staff, my answer to that would be "Yes."

Senator JORDAN. Thank you. I will yield.

Senator FANNIN. Mr. Secretary, it is certainly a pleasure for me to have a chance to visit with you about the potentialities of this very important program, because I feel we have slighted it tremendously. I wholeheartedly support these appropriations and certainly agree with what Senator Jordan said that unless we have a test for building a large plant, I doubt if we will ever achieve our goals. I do not know if we will achieve our goals, but I can recall back in, I believe it was 1965, when we had a worldwide symposium on water. At that time, the Secretary, then Secretary Udall, announced that they had had this tremendous breakthrough where they could produce water at 22 cents a thousand and with a projection that it would go down to 15 or 10 cents a thousand. At that time, we had the different companies here—I can remember Westinghouse and Flour Corp. that had plants here that would certainly do a commendable service in desalinization. But the officials who were here with the display, both Westinghouse and the Flour, almost countermanded the statements made by the Secretary when they said that we did not have a breakthrough of that magnitude; in fact, we could not produce water at twice that cost. Are you familiar with what happended at that time?

Mr. SMITH. Senator Fannin, to be honest, I am not familiar with that. Mr. O'Meara was with the Department at that time, with the Office of Saline Water.

Do you care to comment?

Mr. O'MEARA. I will comment briefly that the original study conducted by an architect engineering firm that——

Senator FANNIN. Would you identify yourself for the record, please?

Mr. O'MEARA. I am J. W. O'Meara. The study for this plant, which envisioned a plant built on a manmade island to use two nuclear reactors to produce 1,800 megawatts of power and 150 million gallons per day of fresh water, did not include in that study an escalation factor. Based on 1964 dollars, when the plant was studied, it appeared feasible to achieve that goal. But the economy and the rising cost of doing business, in which the Office of Saline Water and the desalting business is sensitive, forced that price up to the point where the power companies decided it would not be feasible for them to proceed with the project.

Senator FANNIN. I followed it very closely and even had meetings with the power companies involved, so I recall certainly your statement is correct.

But I still feel there was a miscalculation at that time, evidently, because we had not had a breakthrough discussed at that time. I know I talked to Mr. Flour himself and he stated that he did not know of any type of equipment that would bring desalination of water down to that cost. Was not that project, was it not 50-million-gallon-per-day units that were involved?

Mr. O'MEARA. Yes, sir.

Senator FANNIN. Were they not going to have three?

Mr. O'MEARA. Yes, sir.

Senator FANNIN. And they discussed having just one on an experimental basis, as I recall, and then finally, the private industry pulled out because of the increased cost and also the information could not be verified that it would be that successful, as I remember. Then they talked about a big reactor and I can recall—why I am bringing this out is just what followup has taken place since that time?

Mr. O'MEARA. One comment about the project I would like to put in the record, is when the project was abandoned, the partner in that project that was to construct the desalting plant, the Metropolitan Water District of Southern California, was the only partner that wanted to continue the project. The desalting plant and the cost of water from that desalting plant was still considered by MWD to be a viable project.

Now, in the 5-year program that we are asking the Congress to approve today, we would expect to proceed with a prototype plant in the range of 30 to 50 million gallons per day.

Senator FANNIN. What are we doing to encourage private industry to proceed on their investigations?

Mr. O'MEARA. The Office of Saline Water continues at all times to support the development of processes and we do this through contracts with private industry.

Senator FANNIN. Have those been rather limited? I can recall that we had great hopes of building projects and of getting more cooperation—I will not say cooperation—more of a coordination of effort by private industry, but I have heard very little about that in recent years.

Mr. O'MEARA. No, sir; I think we are working very closely with private industry and considerable progress is being made.

Senator FANNIN. Could you give me a figure as to what we are spending now with private industry in this regard?

Mr. O'MEARA. In the development of process technology, we are spending approximately 75 percent of our annual budget. This year, that budget is $28 million.

Senator FANNIN. Is that a concentration on the distillation system, or is it combined membrane-distillation?

Mr. O'MEARA. It is divided about equally, sir, between membranes and distillation processes.

Senator FANNIN. With the experience we had with atomic energy, we did not have a real breakthrough. We had a few plant failures; that is, they were not equally souped. As I remember—the chairman here is much more familiar with this than I would be, but as I recall, in our atomic energy activities, we built, I do not know how many, but I believe we had maybe five or six that were proven uneconomical and impractical. That is when we then had these breakthroughs.

Do you think this will perhaps be true in this activity, that we must go ahead and build some large plants if we are ever going to know whether or not we will have some success? Because in trying to achieve success and building those large plants, we do develop the techniques. Is that your idea?

Mr. O'MEARA. Yes, sir, the breakthrough, in your context of the word, will be achieved by applying the technology we now have to large-scale production.

Senator FANNIN. I can recall when we were discussing this plant in the Middle East and we were talking about agriculture and the fact that it really would be unsound economics to try to build a plant with the information that we have today and promising something for agriculture. Is that not true?

Mr. O'MEARA. Yes, sir, agricultural water is the cheapest water on the market. Therefore, it is the most difficult for us to achieve. It is our ultimate objective and the objective to which we aim. But because of the cost of agricultural water, it is the last objective we will be able to achieve.

Senator FANNIN. Of course, when we talk about 22-cent water, we are talking about $71.50, approximately, per acre-foot. Here we have farmers screaming when they have to pay $8 or $10 per acre-foot. I know in southern California, they provide water for less than $3 per acre-foot, and still feel that this will continue. At the same time, I think we have to recognize that water coming down from north California, as I recall, would cost about $75 per acre-foot. So it is supplemental water we are really talking about as far as agriculture is concerned; is that not true?

Mr. O'MEARA. Senator, I would like to make an observation that when the desalting program began in 1952, the cost of 1,000 gallons of desalted water was approximately equal to the cost of an acre-foot of irrigation water being delivered in the Imperial Valley. There have been some substantial changes in that situation.

The cost of desalting has been brought down now to where small plants are producing water in the range of $200 an acre-foot. On the other hand, I have been informed by members of the Orange County Water District that they will be buying Colorado River water for about $82 per acre-foot and that water will be 800 parts per million salinity. The California water they expect to get from the State will be in the range of $92 per acre-foot. By the time they add their ad valorem taxes, they need to add to those figures another $50 per acre-foot.

So right now, they are facing prices for natural fresh water in the range of $130 to $140 per acre-foot.

Senator FANNIN. You said the first figure was about $325 per acre-foot was what you started with?

Mr. O'MEARA. It was higher than that, sir. It was more on the order of nearly a thousand dollars.

Senator FANNIN. I know, but I meant when you started talking about bringing down southern California water, it was about $325 at that time?

Mr. O'MEARA. Yes, sir.

Senator FANNIN. Now they have cut that more than in half.

But what chances do we have? What is your estimate of what it would cost for water if we built the large plant that you talk about? I realize that these are estimates; and understand, I am wholeheartedly with you. I feel that we should concentrate on this to a much greater extent than we have in the past. We should appropriate a large sum of money, whatever is proven to be feasible and practical. But what is your estimate as to what you could do now with the present information that you have available?

Mr. O'MEARA. In a 50-million-per-day first-in-kind distillation plant Senator, we would expect that we should be able to produce fresh water from sea water in the range of $150 per acre-foot.

Senator FANNIN. That is double what they estimated back at the water symposium. Is that true?

Mr. O'MEARA. Yes, sir.

Senator FANNIN. Thank you.

Senator ANDERSON. Senator Bellmon?

Senator BELLMON. Thank you, Mr. Chairman. I appreciate your giving me a chance to participate, though I am not a member of the subcommittee. I will try to make my comments very brief.

Mr. Secretary, in reading the bills and listening to your testimony, I get the impression that the thrust of the Office of Saline Water is mostly toward the purification of sea water. Is this true?

Mr. SMITH. No; it is not true. The saline water program has a dual purpose. I come from the same kind of country that you do. If the attention of the Office of Saline Water were not also directed toward the improvement of the desalting techniques for the brackish underground and surface water, I do not think it would be doing its full chore. So we are going forward on the dual thrust of sea water as well as brackish water.

Senator BELLMON. Well, I notice in S. 716, there is a provision here for research and development operating expense of $15 million or more, and then design, construction, acquisition of saline water conversion test beds and facilities. That, I suppose, is all sea water?

Mr. SMITH. I will ask the Director, Mr. O'Meara, to give you the breakdown between the two.

Mr. O'MEARA. No, sir. We are proposing, actually, more money for test beds and test facilities for brackish water plants in the fiscal year 1972 than we are for the sea water distillation plants.

Senator BELLMON. Now, there is an additional problem that I want to call to your attention that you may be working on.

Let me just ask the question this way. What is the Office of Saline Water doing in attempting to control or improve the stream flows where there is a high degree of natural pollution? As I am sure you are aware, much of the wells, the streams discharge large amounts of salts into the streams and makes the streamflows unusable for municipal or industrial purposes later on. Are you working in this field at all?

Mr. SMITH. Yes, the Office of Saline Water is working on that problem and is working in close collaboration with the Bureau of Reclamation on that subject.

Senator BELLMON. Do you work at all with the Corps of Engineers?

Mr. O'MEARA. We have provided the Corps of Engineers with some technical information concerning the use of desalting technology to alleviate the salinity problems in the Arkansas-Red-White River basin.

Senator BELLMON. You are active, then, in the Arkansas River area?

Mr. O'MEARA. Only by providing technology. We are not in the field to do this kind of work.

Senator BELLMON. Is there some reason you are not active in the field?

Mr. O'MEARA. Yes, sir, we are charged by the Congress to be a research and development organization, to develop the technology so

that others may apply this technology to the real problem. In this context, as the Secretary said, we work with the Bureau of Reclamation, with the corps, and with the State agencies, to provide technical information for their planning studies.

Senator BELLMON. Your thrust is at coping with the removal of these salts once they get into the stream. Do you do anything to keep them out of the stream?

Mr. O'MEARA. No, sir.

Senator BELLMON. This is the responsibility of the corps?

Mr. O'MEARA. In one sense, yes, in the Arkansas-Red-White where they are trying to block off some of the salt springs, yes, sir.

Senator BELLMON. And there is nothing in this bill that would give you authority to get into this other field?

Mr. O'MEARA. No, sir.

Mr. SMITH. No, sir.

Senator BELLMON. That is all, Mr. Chairman.

Senator ANDERSON. Senator Allott is here. He has been a long time friend of this subject. I am happy to have him with us today.

Senator ALLOTT. I thank the chairman. I understand that Mr. O'Meara has a statement of his own. Is that correct?

Mr. O'MEARA. Yes, sir.

Senator ALLOTT. I think I would just as soon wait until that has been given, Mr. Chairman.

Senator ANDERSON. Senator Jordan?

Senator JORDAN. I have some questions that Senator Moss would like to ask someone. Maybe I had better ask them now.

Senator Moss has asked that these questions be propounded to some of the saline water witnesses: The Office of Saline Water, the Atomic Energy Commission, and the State of Utah cooperated in a study several years ago on the potential brackish water desalting-power installation for the Wasatch Front in Utah. Where would the project be located?

Mr. O'MEARA. We have conducted this cooperative study, which was an in-house feasibility study, as you said, Senator, undertaken with the AEC and the Division of Water Resources of the State of Utah. The study was a preliminary assessment of reclaiming brackish return flows entering Great Salt Lake through desalting. Simultaneous production of power and steam to serve developing mineral recovery industries utilizing brines of the Great Salt Lake also were studied. The study was completed and the report was released in February 1969. A follow-on study with Utah is contemplated with the Dow Chemical Co. as a participant. A detailed review of mineral recovery aspects of the study is to be made.

The major result of the study we conducted is that brackish river return flows entering the Great Salt Lake—from the Jordan, Bear, and Weber Rivers—is a potential long-range supplemental source for municipal and industrial waters for the Wasatch Front. This envisions a plant in the range of 50 to 100 million gallons per day.

The second is that a unique opportunity exists in the Great Salt Lake are for the simultaneous production of desalted water, power, and process steam to meet the projected water and industrial requirements of that area. A large potential mineral repossessing industry using brines of Great Salt Lake exists, requiring both power and

process steam. The lake would serve as a natural basin for brine disposal.

Third, both distillation and membrane processes could practically be used. Water costs are estimated at $70 to $100 per acre-foot.

Senator JORDAN. Well, now, just what did you really read, the prospectus of a proposal or the results of something that has been done already?

Mr. O'MEARA. This is the study that has been made in cooperation with the State of Utah as a part of their long-range water plan. This project would envision construction in the time period of about 1990. Their water needs would be such at that time that they could use supplemental water.

Senator JORDAN. How large would the operation be, what would be the byproduct, how much electricity and steam would be produced, what kind of fuel would be used, and has anything been done to follow up this schedule?

Mr. O'MEARA. The only followup is that we are contemplating a project now with Dow Chemical Co. to look at the various byproduct chemicals that could be recovered from those brines and how they could be used in a chemical complex operating in the area.

Senator JORDAN. What kind of fuel would you use?

Mr. O'MEARA. We have considered the possibility of using both nuclear and fossil fuels.

Senator JORDAN. How much electricity would be produced?

Mr. O'MEARA. I do not know the size of the powerplant. Perhaps one of my staff can provide me with that information—500 megawatts of power.

Senator JORDAN. What would the cost be?

Mr. O'MEARA. We will supply that information for the record with your permission, Senator.

Senator JORDAN. All right.

(The information referred to follows:)

SUMMARY OF POWER AND PROCESS STEAM COSTS

Plant [1]	Power [2] (mills/kwh)	Process steam (cents MBTU)
500 megawatts:		
Nuclear	5.39	26.5
Fossil	4.06	26.0
1,000 megawatts:		
Nuclear	4.10	21.2
Fossil	3.84	23.5

[1] At Little Mountain (north of Salt Lake City).
[2] 13 percent fixed charge rate (FCR), 1968 cost basis.

Senator JORDAN. How large would it be and what would be the byproducts? Maybe you can supply that, too.

Mr. O'MEARA. Yes, sir.

(The information referred to follows:)

SIZE AND BYPRODUCT

As previously indicated, the study envisages a plant size of 50 to 100 million gallons per day.

As reported in 1968, the salts from Great Salt Lake, Utah, will produce major salt compounds in the following proportions: sodium chloride—75.9%, magnesium chloride—10.9%, sodium sulfate—9.5%, potassium chloride—3.2%, cal-

cium sulfate—0.34%, calcium carbonate—0.15%. Bromine and lithium salts are less than 0.1%.

Those compounds that presently may be extracted profitably from the Great Salt Lake (GSL) brine are sodium chloride, magnesium chloride, sodium sulfate, potassium chloride, lithium chloride, and bromine. Magnesium metal, magnesium compounds, and potassium chloride are expected to be the main items extracted from the GSL brines.

Senator ANDERSON. Do you have a statement?

Mr. O'MEARA. Mr. Chairman and members of the committee, my statement deals with the authorization for the Office of Saline Water for fiscal year 1972, S. 716. I would like to preface my remarks by saying that we are convinced that continued progress toward competitive desalted water can be achieved. I personally have great faith in the competence and the ability of the American scientific community to solve this very difficult problem.

The progress we anticipate is necessary because of the ever-increasing demands for water. The potential of desalination to provide alternative sources of water supply is just beginning to be realized. Its long-range impact on the water supply of this Nation, particularly in the Southwest and in major metropolitan areas throughout the country will become more important with each passing year.

You have previously received a justification to cover our proposed operations for fiscal year 1972. Before I present a brief highlight summary of the fiscal year 1972 program, I would like to briefly discuss the major activities we have conducted during fiscal year 1971.

One of our most important activities, Mr. Chairman, was authorized by this committee last year. This was for the construction of a module, or a slice, of a VTE/MSF plant. This is a combination of the two leading distillation processes which our studies indicate will provide lower-cost water than either of the processes operating independently. At the time we asked for our authorization, we planned to construct this plant on the property of the San Diego Gas & Electric Co. in Chula Vista, Calif. But we were unable to obtain an extension of our lease with the San Diego Gas & Electric Co. and, therefore, we sought a new location for the plant. We have been able to sign a memorandum of understanding with the Orange County Water District of Orange County, Calif.

Quite frankly, Mr. Chairman, I am delighted with this new partnership arrangement. I would like to acknowledge that the chairman of the Orange County Water District is present at the hearing this morning, Mr. Henry Segerstrom.

The Orange County Water District is an aggressive and enlightened water management organization. They are responsible to provide water in one of the fastest growing counties in the United States. It has a potential population increase in excess of 10 percent per year. This population is expected to reach 2 million people by 1980, and the total water requirement by that time is expected to be 500,000 acre-feet annually.

The chief sources of water for the district are ground water basin and importations from the Colorado River through the metropolitan water district system. They rely very heavily on ground water in the area and in order to protect their ground water sources, they are creating an underground fresh water barrier between their ground water aquifer and the ocean. In order to build up this barrier, they are planning to construct a sewage reclamation plant. They will take

the reclaimed sewage water and inject into the ground to form the water barrier. But the reclaimed sewage will have a total salinity content of about 1,400 parts per million. By locating our plant adjacent to their sewage reclamation plant, they will take the high quality product water of our plant and blend it with the reclaimed sewage, giving them an overall higher quality water for their injection system.

We are delighted to be able to locate our experimental plant where the product can be used to a real water situation, where the water we produce will find a beneficial use.

In our distillation program, during the past year, we have completed construction of an experimental facility that we call the VTE–X. This has been constructed at San Diego, and we are now getting operating data on large tube bundles for the VTE/MSF project.

We are operating the Clair Engle plant at San Diego at temperatures up to 350 degrees Fahrenheit. This is singular in that is it 100 degrees higher than any commercial plant operating at this time. The significance is the higher temperature at which we can learn to operate these plants, the more product water we can obtain from a single pass of the sea water through the plant.

Our installation at Roswell, N. Mex., has been modified by the addition of a jet compressor. An initial test has been run which shows that this modification provides an excellent way of economizing fuel.

In the membrane program, we are proceeding with this at an accelerated level. We are authorized to build a 250,000 gallon per day reverse osmosis test bed plant and we will soon have that under construction. This plant will be designed to recover 80 percent of the feed water as product.

Considerable information has been gained over the past year that will be incorporated in the construction of this test bed. We have not yet selected a location for the plant.

The reverse osmosis field test program, that we reported to you last year has been continued. We have completed testing at Las Animas, Colo., and on the Potomac Estuary. Field tests employing the Mobile Test Facility are continuing in the Yuma, Ariz., area. Results of this field test program have provided us with valuable information on desalting of various brackish waters in the Pacific Southwest.

We have decided to discontinue the operation of the electrodialysis test bed at Webster, since our engineers and scientists insist this plant has served its usefulness to the program. This E-D test bed has been in operation since 1961 and has provided much valuable data. We will continue the operation of some of our small pilot plants at Webster, but the test bed plant itself will be discontinued.

In addition to the cooperative efforts being planned for Orange County, we have been studying, in cooperation with the State of California, the possibility of constructing a 30- to 50-million-gallon-per-day prototype plant within the next few years. Cooperative studies have been conducted with other States as well as California. Study areas include Texas, New York, New Jersey, Utah, New Mexico, Colorado, Montana, and we have recently signed a contract with Pennsylvania to try to provide assistance on their acid mine water problem.

Other States have expressed interest in this activity, including Nevada, North Dakota, Florida, Wyoming, Oklahoma, Kansas, Iowa and Nebraska. OSW's effort in this activity is limited to cooperative

feasibility studies with OSW funding a portion of the cost and the State supplying direct funds or personnel to the programs.

I am pleased to report to this committee that the construction of the plant in Jibba, Saudi Arabia, is now complete. Initial startup operations are underway and we expect to have the plant in commercial operation by midsummer.

Another interesting development that I am pleased to report to the members of this committee is that the Department of the Interior has formed a task force which will utilize the best expertise of the bureaus and agencies of the Department for an in-depth coordinated study of the potential development, for both power and water, of the geothermal resources of the Imperial Valley region. An important part of this task force effort will be an evaluation of the potential of existing processes to desalt mineral laden geothermal brines and to develop new processes or combinations of processes, as required, to recover economically fresh water from this presently untapped source of supply.

This study of geothermal resources along with other desalting alternatives are important facets of the Department's Western U.S. Water Plan Study. Even from preliminary studies, we can foresee that desalting may have major application to meet the long-range water needs in this region, both as to quantity and quality.

There is universal agreement that the water supply of the Colorado River is inadequate to meet future demands. There is further widespread agreement that augmentation of the natural flows of the river will be necessary, as a solution to rising water demands. Augmentation by desalting may well provide opportunities to improve the quality and quantity of Colorado River basin's water supply.

Turning to our program that we propose for 1972, we are asking for an appropriation authorization of $27,025,000. In the current year, fiscal year 1971, we have available for our program $28,573,000. By simple arithmetic, this indicates a decrease of $1,548,000. However, in our 1971 appropriation, there is a nonrecurring item of $4.3 million for the construction of the module in Orange County. So if we take that into consideration, we are actually asking this committee for an expanded program of approximately $2.7 million greater than we requested last year. We believe that the fiscal year 1972 program provides for an aggressive research program, both basic and applied, and also provides for the construction of two reverse osmosis test bed plants. We are also seeking five additional positions very badly needed for the effective conduct of our operations.

Our authorization for appropriation is divided into four categories. Category 1 is our research and development operating expenses. In this category, there is an increase of $495,000. This increase results primarily from additional program effort for environmental and general applied research and development. Such programs as materials, crystallization and electrodialysis research and development programs were cut back. Additional emphasis needs to be directed to the areas of environmental protection. Since we in the Office of Saline Water are concerned with improving the environment through the development of desalting technology, it is imperative that we assure that desaltination has no adverse environmental effect.

In category 2, which is our test bed and test facility program, we are requesting an increase of $1.9 million. The increase represents two

reverse osmosis test beds, planned at a cost of $2,100,000. This will be for a 250,000-gallon-per-day sea water desalting plant and a 500- to 750,000-gallon-per-day high product recovery desalting plant. Reverse osmosis sea water plants capable of producing 250,000 gallons per day will benefit the small coastal communities and open up a new market for U.S. manufacturers overseas. Three new positions for this category are requested—one assistant to the manager at Roswell, N. Mex., one assistant to the manager at Freeport, Tex., and one lab technician at Wrightsville Beach.

Category 3, our modules category, is decreased by $4,170,000, which reflects the nonrecurring item appropriated for the VTE/MSF module in fiscal year 1971.

In our fourth category, administration and coordination, we are requesting an increase of $37,000, which includes the addition of two positions.

The only change that we are requesting in our authorization this year is we are proposing that we be permitted reprograming authority for category 4. We have reprograming authority of 10 percent for categories 1, 2, and 3, and we are asking for a 2-percent reprograming authority for our administration and coordination.

In conclusion, I should like to urge the committee to give favorable consideration to this authorization request. I shall be pleased to answer any questions concerning the current activities we have programed to continue the advance of desalting technology.

(Mr. O'Meara's prepared statement follows:)

STATEMENT OF J. W. O'MEARA, ACTING DIRECTOR, OFFICE OF SALINE WATER, U.S. DEPARTMENT OF THE INTERIOR

Mr. Chairman, it is a great pleasure to have the opportunity to appear before this Committee.

Up until November 1970 the Offices of Saline Water was under the administrative responsibility of the Assistant Secretary for Water Quality and Research. With the establishment of the Environmental Protection Agency, and the transfer of the Federal Water Quality Administration to EPA, the position of Assistant Secretary for Water Quality was abolished. By Secretarial Directive, the Office of Saline Water was organizationally reassigned to the Assistant Secretary—Water and Power Resources. These two Offices, together with the Bureau of Reclamation provide, under a single administrative responsibility, an opportunity to coordinate a water research, a water development, and a water management program that is broad in scope and unified in purpose.

We are convinced that continued progress toward competitive desalted water can be achieved. This progress will make available large volumes of new water to meet the ever increasing demands for this vital commodity. The potential of desaltination of provide alternative sources of water supply is just beginning to be realized. Its long-range impact on the water supply of this Nation, particularly in the Southwest and in major metropolitan areas throughout the country will become more important with each passing year.

I can assure the members of this committee that I have carefully studied the program we are proposing to undertake in fiscal year 1972, and I urge the committee to give the program favorable consideration.

You have previously received a justification to cover our proposed operations for fiscal year 1972. Before I present a brief highlight summary of the fiscal year 1972 program, I would like to briefly discuss the major activities we have conducted during fiscal year 1971.

FISCAL YEAR 1971 PROGRAM

VTE/MSF Module

When we appeared before this Committee last year, it was our plan to construct the VTE/MSF Module at San Diego, but we were unable to extend our

lease with the San Diego Gas and Electric Company at that time and thus found it necessary to seek an alternate location.

The vertical tube evaporator/multi-stage flash (VTE/MSF) Module authorized for fiscal year 1971 is to be constructed in cooperation with the Orange County Water District (OCWD) adjacent to the Orange County Sanitation Plant No. 1 in Fountain Valey, California. In acordance with the memo of understanding signed by OSW and the OCWD, the Office of Saline Water will design, construct and operate the VTE/MSF module on land leased at no cost to OSW from OCWD, OCWD will furnish intake, outfall, steam generator, and all the shop buildings. OCWD's participation is estimated to cost about $3.2 million. A construction contract is scheduled to be awarded in June 1971, with completion scheduled in an 18-month period. OCWD is charged with providing water for an area of more than 200,000 acres with a population of over one million people.

Orange County is one of the fastest growing counties in the nation with a potential population increase in excess of 10% per year. This population is expected to reach 2,000,000 by 1980 and the total water requirement by that time is expected to be 500,000 acre feet annually.

The chief sources of water for the District are ground water basin and importations from the Colorado River through the Metropolitan Water District System. Discharge of the Santa Ana River, estimated at 85,000 acre feet annually is a part of the District water supply, but as much as 90% of this has been estimated to enter the ground water as recharge. Importation of the Colorado River waters through the MWD is a necessity to meet the water demands. However, the availability of imported supply varies from year to year, depending upon other major demands for the water in the state aqueduct development.

Preservation and utilization of the ground water aquifer estimated to have storage of as much as 500,000 acre feet is a very important part of the District's water management program. Since, historically, there have been periods of overdraft (which are expected to continue) when importations were insufficient to meet the balance of demands, it is necessary that the ground water storage reservoir be protected so it can sustain extensive overdraft during short periods without permanent damage to its reservoir utility through sea water intrusion. Water spreading projects in the Santa Ana River Basin are one means being employed to increase ground water storage.

Even more critical is the prevention of salt water intrusion from the ocean into the ground water basin. For this purpose, the Board of Directors of OCWD has authorized the Orange County Coastal Barrier Project which includes injection of fresh water into the aquifer and pumping salt water from the aquifer. A portion of the injection water in due course becomes a regular part of the ground water storage and eventually supplies the regular water wells in the area. Hence the quality of the injected water is important.

There are alternate souces of water for injection. One is the Colorado River Water from the MWD system and another is reclaimed sewage effluent from the sewage treatment plant located near the injection wells. Waste water reclamation is believed to have an economic advantage and, hence, the District has devoted approximately $1,000,000 to study the treatment of secondary sewage effluent to make it suitable for injection. The average salinity of the reclaimed waste water is reported to be 1400 ppm, which makes it of marginal quality for injection into the barrier. Dilution with imported water does not offer a suitable solution since Colorado River water already averages 700 to 800 ppm salinity and is costly to transport. For this reason the OCWD is vitally interested in the high quality product from a desalting plant to dilute and improve the quality of the water used in the injection barrier. It plans to construct a waste water reclamation plant and blend the high quality desalted water with the reclaimed waste water. I will keep the Committee fully informed as this project progresses.

Distillation Program

The construction of the VTE–X at San Diego is completed, and we are now obtaining operating data. The modifications to the Freeport Test Bed are scheduled to be completed in mid-April. Information collected from these two test projects will be used for the final design of the VTE/MSF Module. With the modification of the Clair Engle Plant at San Diego, we have obtained operating temperatures up to 350° F. This is nearly 100° above the operating temperatures of commercial plants.

The installation of a high temperature water jet compressor at Roswell has been completed and initial tests have been run. With the installation of the

non-mechanical compressor, it is hoped that more efficient operations can be obtained leading to lower cost water.

Membrane Program

The membrane program is proceeding at an accelerated level. The 250,000 gpd RO test bed plant will soon be under construction. This plant is designed to recover 80% of the feed as product. Considerable information has been gained over the past year that will be incorporated into the construction of this test bed. We have not as yet selected a location for this plant. Under the RO field test program that we reported to you last year, we completed testing at Las Animas, Colorado and on the Potomac estuary in FY 71. Field tests employing the Mobile Test Facility are continuing in the Yuma, Arizona area. Results of this field test program have provided us with valuable information on desalting of various brackish waters in the Pacific Southwest.

Webster Test Bed

We have decided to discontinue the operation of the electrodialysis *test bed* at Webster since our engineers and scientists insist this plant has served its usefulness to the program. This San Diego test bed has been in operation since 1961 and has provided much valuable data. Operation of Test Facility at Webster *for pretreatment and pilot plant testing* will continue during FY 1972.

Cooperative Work

In addition to the cooperative efforts being planned for Orange County, we have been studying, in cooperation with the State of California, the possibility of constructing a 30 to 50 mgd prototype plant within the next several years. Cooperative studies have been conducted with other states as well as California. Study areas include Texas, New York, New Jersey, Utah, New Mexico, Colorado, and Montana. Other states have expressed interest in this activity, including Nevada, North Dakota, Florida, Wyoming, Oklahoma, Kansas, Iowa and Nebraska. OSW's effort in this activity is limited to cooperative feasibility studies with OSW funding a portion of the cost and the state supplying direct funds or personnel to the programs.

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Plant construction is complete and the plant is now being put in operation. Barring unforeseen difficulties, we expect to have the plant in full commercial operation in approximately three months. If the plant operates satisfactorily, it may be possible to complete performance tests and take final acceptance of the plant approximately one to two months after plant reaches commercial operation.

Geothermal

I am pleased to report to the members of the committee that the Department of the Interior has formed a task force which will utilize the best expertise of the bureaus and agencies of the Department for an in-depth coordinated study of the potential development, for both power and water, of the geothermal resources of the Imperial Valley region. An important part of this task force effort will be an evaluation of the potential of existing processes to desalt mineral laden geothermal brines and to develop new processes or combination of processes, as required, to recover economically fresh water from this presently untapped source of supply. Desalting geothermal brines will present several unique and difficult problems, but solving these problems may well mean the creation of as much as 1 billion gallons of fresh water per day in the very heart of a critically water short area of the Nation.

This study of geothermal resources along with other desalting alternatives are important facets of the Department's Westwide Water Study. Even from preliminary studies, we can foresee that desalting may have major application to meet the long-range water needs in this region, both as to quantity and quality. We have assigned one of the Office of Saline Water's best process engineers as a full time member of the Westwide Study team to assure that the full potential of desalination is properly considered.

Large Scale Desalting

There is universal agreement that the water supply of the Colorado River is inadequate to meet future demands. There is further widespread agreement that augmentation of the natural flows of the river will be necessary, as a solution to rising water demands. Augmentation by desalting may well provide opportunities to improve the quality and quantity of Colorado River basin's water supply.

If an aggressive research and development program in desalting continues, with emphasis on applications, we foresee large quantities of desalted sea water being produced at costs of $100 an acre-foot or less, through the construction of a prototype plant, hopefully before 1982. We are confident that water cost from a "first-of-a-kind" prototype plant will be further reduced by succeeding commercial plants. While this is relatively expensive water, it must be recognized that the addition of pure distilled water will enhance the overall quality of the river downstream from the point of delivery, with attendant benefits to all users.

FISCAL YEAR 1972 PROGRAM

With your permission, I would like to briefly review the program we are proposing for FY 1972.

The OSW program for FY 72 of $27,025,000 is a reduction of $1,548,000 from the FY 71 program of $28,573,000. The decrease is due to the authorization and the appropriation of funds for FY 71 to construct the VTE/MSF module.

The FY 72 program provides for an aggressive research program, both basic and applied and also provides for the construction of two reverse osmosis test beds. We also are seeking five additional positions very badly needed for the effective conduct of our operations.

Category I.— Research and Development Operating Expense

There is an increase of $495,066, in this category. This increase resulted primarily from additional program effort for environmental and general applied research and development. Such programs as materials, crystalization and electrodialysis research and development programs were cut back. Additional emphasis needs to be directed to the areas of environmental protection. Since we in the Office of Saline Water are concerned with improving the environment through the development of desalting technology, it is imperative that we assure that desalination has no adverse environmental effect.

Category II.—Test Beds and Test Facilities

An increase of $1,985,000 is requested for this category. The increase represents two reverse osmosis test beds, planned at a cost of $2,100,000 for a 250,000 gpd sea water desalting plant and a 500,000 to 750,000 gpd high product recovery desalting plant. Reverse osmosis sea water plants capable of producing 250,000 gpd will benefit the small coastal communities and open up a new market for U.S. manufacturers overseas. Three new positions are requested: one assistant to the manager at Roswell; one assistant to the manager at Freeport; and one lab technician for Wrightsville Beach.

Category III.—Modules

This category shows a decrease of $4,170,000. This reflects a reduction of $4,320,000 for construction of the vertical tube evaporator/multi-stage flash (VTE/MSF) module authorized in FY 1971.

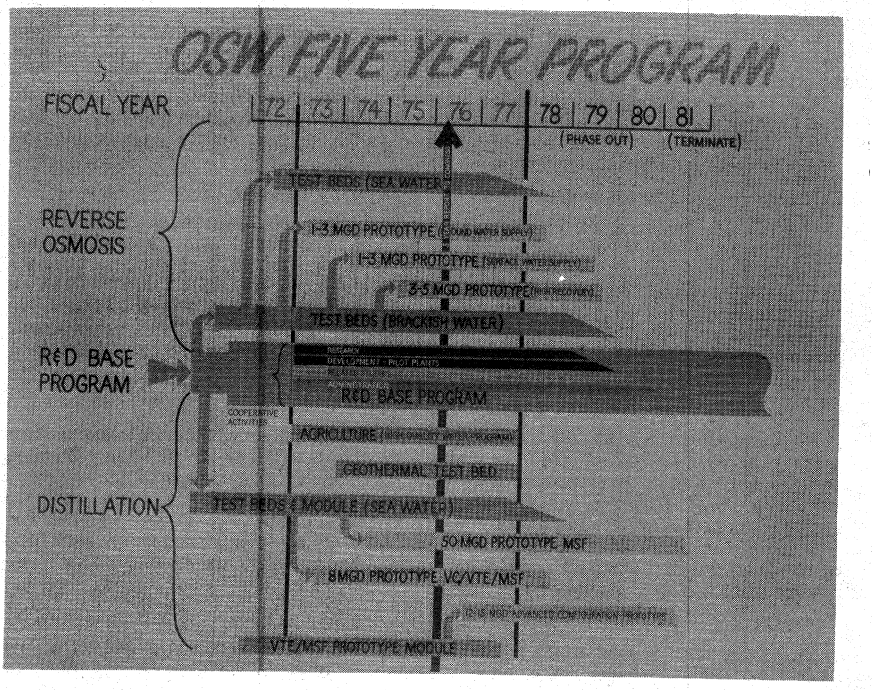
Category IV.—Administration and Coordination

Administration and coordination shows an increase of $37,000 which includes the addition of two positions. This is a minimal increase to cover the conduct of the business aspects of the program.

You will also note that we are proposing a change to the appropriation language to delete the limitation on reprogramming of funds into the administration and coordination activity. The proposed authorizing legislation for FY 72 provides for 2% reprogramming authority into this category. As you know, the other three categories provide for 10% reprogramming authority. This 2% reprogramming authority proposed is the minimal amount to cover emergency situations that may occur in this category.

Senator ALLOTT. In connection with the Westwide water study you mention, it is supposed to be completed in 1977. Now, with the schedule which you have provided for the record, will you have any definitive results of the desalting program to incorporate in the Westwide study, and if so, what will they be?

Mr. SMITH. Hopefully, the large-scale prototype will be completed just about at that time, I think in 1977. All of the capital costs going into that large scale will be known at that time. The project should be



on time, and operating. I think the initial preliminary operating data will be available and of course, whatever is, will be cranked into the Western U.S. water plan study. I think perhaps the words "definitive results" are the heart of your question, Senator Allott. It will be as definitive as we can make it, consistent with the fact that the plant will not have been operated very long.

Senator ALLOTT. Well, now, let's take a look at this whole picture, where we are. The Senator from New Mexico, the chairman of this committee, and to many of the rest of us, he has really been one of the

big pushers of the desalination program since it started, and the rest of us have joined with him. Now, how much money to date on the desalination program?

Mr. SMITH. $211 million.

Senator ALLOTT. We have conducted a lot of tests. We have gotten several methods and combinations of methods of extracting water—good water, from both brackish and sea water. I suppose you would say that to this date, all we have really done is define possible methods which could lead to commercial feasibility.

Mr. O'MEARA. That is essentially right, Senator; however, there is considerable commercial application of desalting technology at this time. There are nearly 700 desalting plants in operation around the world, producing about 350 million gallons of desalted water everyday. Now, these are located in areas of very short water supply, where there is no alternative. And as the cost comes down, the market for desalting plants will increase.

Senator ALLOTT. Well, the statement as far as America is concerned, the United States, it is probably fairly close to accurate.

Mr. O'MEARA. Yes, sir; there is only one city in the United States obtaining its municipal water by desalting sea water. That is Key West, Fla. There are several cities improving their water supply by desalting brackish waters.

Senator ALLOTT. And we have a plant in the Virgin Islands?

Mr. O'MEARA. There are several plants in the Virgin Islands, yes, sir.

Senator ALLOTT. I am just trying to put this whole thing in perspective. What you are really proposing here now it is that, having worked on this all this time and developed these various techniques, we now proceed past an experimental type plant and actually go into a production plant. In other words, it is time to find out where our technology is and where it can lead us. Is that right?

Mr. SMITH. You are absolutely correct. We are now to the point where we should and can move into large-scale proof of that which has already been learned. But the reason I hesitated momentarily is that this bill does not request the authority for us to build a prototype. It says that if we wish to come back to you and to the President within a period of time, whether it be a year or whether that time requirement is not in the bill, to ask for permission to construct a prototype.

Senator ALLOTT. Well, whatever the period is, if it is a year. But at least, I am just trying to put the program in the context of the whole development to find out where we are. I know that this is the way you are thinking, that we are now at a point in time to start getting at the problem of large scale desalting to obtain some definitive answers.

Mr. SMITH. Yes, sir.

Senator ALLOTT. Now, one of the things which Mr. O'Meara touched on in his statement was the geothermal possibilities in the lower California-Mexicali area—the idea of extracting water from the geothermal steam there. Would you also be able to use that steam as a power source with extraction?

Mr. SMITH. It is very likely that it could be done in combination. What we are trying to do at this moment is to see whether or not water recovery is possible from our geothermal resources in addition to the use of steam for the generation of electric power. I have the personal feeling that as we have gone along here thinking of geothermal resources, we have been too concerned with its potential as a power source, perhaps to the degree of neglecting its real potential in terms of a water source to augment that water deficient lower southwestern United States area. We are now in a position of trying to find out, working with the Bureau of Reclamation and the Geological Survey, to determine whether or not that is an efficient use of geothermal resources. Hopefully, we can come back to the Congress in a year or so and explain the results of the studies. We are planning to budget in fiscal year 1973 an extensive program for geothermal investigations. After we have dug some exploratory holes to measure the temperatures, and after we complete some analyses of the subsurface structure we hope to verify the feasibility of withdrawing anywhere from 4 to 5 million acre-feet per year of the potential geothermal resource from that area. We do not now know that this is possible. We are trying now to determine whether that is a feasible proposition and if so, we hope then in the year or two hence to drill a deep pilot to actually extract some of that geothermal brine, with the cooperation of OSW, on a pilot or an experimental basis, to see what happens when we desalt it, answering questions on what kind of water we get, what kind of brine disposal problems we have, and whether if, in fact, there is a usable geothermal water resource.

Senator ALLOTT. Would you say at this time, then, that there has been no hard definition of an actual geothermal resource at that point?

Mr. SMITH. I would have to answer that question yes. I might get an argument from some of the scientific community, but we do not know enough yet.

Senator ALLOTT. And this is one of the things you expect to do in the next year or two?

Mr. SMITH. Yes, sir.

Senator ALLOTT. I hope it is not over 2.

One other question. We have been prone to think in big terms, particularly after the Bolsa Island project I notice that you have closed down the South Dakota installation. There are many, many communities in this country who have brackish water and have no apparent access to any other water for community use. One such is the city that you mentioned in your statement, Mr. O'Meara, the city of Las Animas in southeastern Colorado on the Arkansas River. From your testing there, what can you say that you have found out as far as moving toward a situation where you could advise them with respect to a program for the provision of municipal water? I believe that that water is just about as bad as the water we turn over to Mexico, and people drink it. At least I have been so informed. Now, where are we on this?

Mr. O'MEARA. Senator, we have only recently completed our experimental work in Colorado. We are continuing to evaluate the situation there not only in Las Animas but in several other water quality

problem areas in Colorado. What we have learned from our test operations is that the types of water that exist in the Arkansas basin can be desalted with the type of equipment we have and we have only some very general estimates of what the cost of desalting that water would be. We have estimated the water at Las Animas could be desalted for about $1.19 per thousand gallons. That is in a plant of about 1½ million gallons per day.

Senator ALLOTT. Well, I used Las Animas because you mention that in your statement. My question really is not confined just to Las Animas or to the two or three places in Colorado of which we are thinking. But knowing the western parts of Kansas, the Dakotas, Nebraska, New Mexico, and all through the West, outside of the Pacific coast area, where you get saline waters—really saline waters—there is a great area in which a great amount of good can be done if our processes can be brought down to within the reach of these people.

Let me ask you this question: What steps are being taken to make the communities in the West—and I use this term roughly, the area I am talking about—to make them aware of the results that have been achieved and what might be done to help them engage in efforts to find a solution to their own water problems?

Mr. O'MEARA. Senator Allott, the program of providing this technology to the cities and communities we are conducting through the States. In the State of Colorado, we are working with the State water conservation board and we are studying the cities of Brighton, Fort Lufton, Fort Morgan, La Junta, Lamar, and Las Animas, which are representative of the cities in Colorado which have quality water problems. This is extended to other States as I mentioned in my testimony—Texas, California, and the other States. And by working with the States, we are passing the information on to the individual communities.

Senator ALLOTT. Well, I want to point out my interest is not directed just to an individual city in Colorado. Having spent my life in this area of the country, I know the problems that literally hundreds, I suppose, of small towns and cities have. Will you have some kind of a followup, or will you do a followup to see that the States or the responsible State water board, however it is called, in the various States are following up in the dissemination of this information? I am not sure whether they are or are not. I have gotten personally very little reaction, it does not do any good to do this unless we get it to the people who can use it.

Mr. O'MEARA. There is a very important reason why it is important that we do this, Senator, because our research and development program is not standing still. We are constantly making progress, especially with the development of membrane processes that have desalting applications in the inland areas. So we have to continually go back to the States and follow through on these programs so they can have the advantage of the latest technological developments that are occurring in this program.

If I might take just one moment, Senator Fannin has talked about breakthroughs. In my opinion, the greatest breakthrough the Office of Saline Water has achieved occurred in 1955, when at the University of Florida, we were able, for the first time, to remove a dissolved solid from water without a phase change of the water, without going from

a liquid to a vapor and back to a liquid, even though with the membrane they had at the University of Florida, they measured the amount of water obtained in microliters per day per square foot of membrane. I like to say that the membrane sweat a little one afternoon. Perhaps at a Senate hearing I should say it perspired. It was not, until 1961, that Sidney Loeb at UCLA developed a membrane that had a flow rate of 5 gallons per square foot of membrane per day. At that point, reverse osmosis became a potential process. From the 5 gallon Loeb membrane, we have proceeded to 10 gallons, 15 gallons, 20 gallons; now we are working on a development we call the 97/97 membrane because it has a flow rate of 97 gallons of water per square foot of membrane per day with 97 percent salt reduction. Dr. W. Sherman Gilliam, our Assistant Director for Research reported to me just this week of the research work he is sponsoring at Oak Ridge National Laboratory, where they have achieved a flow rate of 145 gallons per square foot of membrane per day. When they operated this membrane on 600 parts per million water, they had a flow rate of 195 gallons per square foot of membrane per day. For these reasons, we have to go back to the States and tell them there are new developments in our technology.

Senator ALLOTT. I think somebody ought to see that this information does get out to them.

Thank you very much.

Senator ANDERSON. Any additional questions?

Senator JORDAN. Just one, Mr. Chairman.

Mr. O'Meara called our attention to a fact of which this committee is well aware, that the Colorado River is inadequate to meet the future demands and it will require augmentation because of the fact that we have nationalized the requirements to meet the Mexican Treaty and took it off our backs or that of the Colorado River people.

But I think you are a little too optimistic when you say that augmentation by desalting may well provide opportunities to improve the quality and quantities of Colorado River Basin water supply when you project that by 1982, perhaps we will be able to desalt water for $100 an acre-foot. Where would you do this $100 an acre-foot water, where would you introduce it into the system on an economical basis, and how much quantity are you talking about, either for improving quality of Colorado River water or enhancing its quantity?

Mr. O'MEARA. Senator, the figure is based on improving the quality of the river water by reverse osmosis processes in very large plants. Of course, when we engage in a project as big as improving the quality of the major river of the Southwest, we have to be talking of very large plants. And with the large plants and the new membranes, we have every confidence that we can achieve a cost of $100 an acre-foot.

Senator JORDAN. I am not an expert on the Colorado River, but I do remember that the compact, the Colorado River Compact called, I believe, for the delivery to the lower basin by the upper basin of some 75 million acre-feet of water every 10 years. Now, $100 an acre-foot, that is $7.5 billion. So you are talking about a value here that I think, when you talk about $100 an acre-foot, I do not know where you would use it unless it could be to substitute along those coastal areas the domestic and industrial water that is now piped in from the water-

sheds. I do not think you will ever put $100 an acre water on the land anyplace.

Mr. O'MEARA. Senator, there is one program in which we are beginning to engage with the Bureau of Reclamation to study at the value of high quality water in irrigation. Even though it is higher cost, we feel that with desalted water, that better crops can be obtained if better irrigation practices are developed. We are only beginning to study this application, but we know of operations in Israel and other places where they have been able to develop irrigation practices and use water far more expensive than we ever thought of using in this country, and they are doing it economically. It is a difficult question to comment on. I am not saying that we are going to make the deserts bloom. We have a lot of work ahead of us in order to accomplish this objective. We are not trying to hold out false hope, but we are heading in that direction.

Senator JORDAN. I will turn it over to Senator Fannin. He talked about water costs that his irrigation district found almost prohibitive of $3 a foot.

Senator FANNIN. Thank you, Mr. Chairman.

We, of course, have the farmers complaining about water where they are using 4 or 5 acre-feet of water for crops in some of these areas. But of course, in the Imperial Valley, they do feel that they should have very inexpensive water and $3 an acre-foot is considered at least not cheap water by them. We know in the State of Arizona, if we can get supplemental water for $15 to $25 an acre-foot, many of the farmers would, in some instances, save a crop because it is the additional water that is very important. If they have 3 acre-feet of water at, say, $10 an acre-foot and then they have to supplement it with the additional acre-foot of water to save a crop, it is worth most any price. I realize that.

What I am concerned about is that since 1965, we have been talking about this plant, this large plant, a plant of great magnitude. At that time, there was considerable publicity on water conservation programs that industry was very active in. I recall, maybe it was brought to my attention more forcefully because they had this symposium in Washington, D.C. But we hear very little about this from industry compared to that time. Do you feel that the industrial concerns that were involved at that time are going forward with their programs, or do they become disappointed and drop them, or what has happened?

Mr. O'MEARA. There is no question about the fact that industries are going forward with their programs, Senator. The market for desalting equipment does not exist in the United States today. We foresee that developing in the coming decade. And there will be a market for their technology at that time. But at the present time, the market is developing quite rapidly in some overseas areas, particularly in the Mediterranean Basin, which includes the Middle East, and in the Caribbean.

Senator FANNIN. When you go across the Middle East you see the product of the program they have adopted and we have seen some of these programs. Where you are using water in limited amounts for crops, I can understand it. But when you are talking about $100 an acre-foot water, you are limiting yourself considerably, especially

when we did not think it feasible to go forward when we were talking about $70 an acre-foot water when the Secretary brought out the 22 cents per thousand gallons.

What I am concerned about is the delay. Now, in your statement, you say the possibility of constructing a 30 to 50 m.g.d. prototype plant in the next several years, with the cooperation of Orange County—can that target date be set now or is there a target date?

Mr. O'MEARA. Yes, sir; our target date on the large plant is to have it in operation in 1977.

Senator FANNIN. With a 30 to 50 million gallons per day?

Mr. O'MEARA. Yes, sir.

Senator FANNIN. By 19——

Mr. O'MEARA. 1977, sir.

Senator FANNIN. Well, that is something I did not know about before, because we worry about what is happening. I am particularly concerned as to what is happening from the industry standpoint, whether or not we are coordinating our efforts with industry. I am glad to hear that these programs are continuing, although there is very little publicity about them. I can recall ads that were placed at the time, maybe because we were having this worldwide symposium, and other countries of the world displayed their equipment, as you remember. They had some equipment here or at least diagrams of all that was involved. Are we coordinating our efforts with some of the other countries now?

Mr. O'MEARA. Yes, sir, we are obtaining some information from foreign countries. But from the point of view of export of technology, in terms of the competition for plants that are being built in the world today, it is very keen. Some other nations of the world do not conduct their desalting program in the same manner that we conduct ours. I am referring to the fact that all of the technology we develop is available to anyone who wishes it. Other countries consider the technology they develop in desalting as proprietary information and it is not released so that we can find out what their developments are.

Senator FANNIN. Do you have any reason to believe that they have had breakthroughs that we have not had?

Mr. O'MEARA. No, sir.

Senator FANNIN. How much money is going forward in foreign research from your Department?

Mr. O'MEARA. In the current fiscal year, in foreign research, we are spending $100,000 from our program.

You say from our program?

Senator FANNIN. Yes; what other programs are involved from the standpoint of cooperation with some of the other countries that we have in this field?

Mr. O'MEARA. We have exchanges of information, and they are limited somewhat, with other countries such as Japan, with Great Britain, France, Italy, and Israel. We are trying to develop a cooperative exchange agreement with the Government of West Germany, which is beginning a desalting program.

Senator FANNIN. You probably recall—I do not—the countries that were going forward to a great extent in 1965 when they were here on that worldwide symposium. Was Germany involved at that time?

Mr. O'MEARA. No; there were only one or two industries in Germany

that were at all interested. They were minor in nature compared to the work that was being done in other countries.

Senator FANNIN. Now, back to geothermal or whatever might be possible—I know we have had testimony from Dr. Robert Rex, I think of the University of California at Riverside. He was very optimistic as to the potentiality. I understand that we do have research programs with the University of California at Riverside. Is that going forward?

Mr. SMITH. Yes, sir; that is with the Bureau of Reclamation.

Mr. O'MEARA. We have a program with the University of California at Berkeley to begin to examine what processes might be applicable to the geothermal brines; yes, sir.

Senator FANNIN. Are these programs going forward in other schools? I know the University of Arizona did have a program on the—I do not think it was on atomic energy.

Mr. O'MEARA. Solar energy.

Senator FANNIN. That is right; a plant that they built with Mexico. That plant is still operating, is it not?

Mr. O'MEARA. Yes, sir.

Senator FANNIN. Are we still considering the plant on the gulf that has been talked about with Mexico? The atomic energy plant in connection with a water program?

Mr. SMITH. There are at present going on some continuing low-level studies—low-profile studies—with the Government of Mexico and with the Atomic Energy Commission and the Bureau of Reclamation and the Office of Saline Water to get a better feel for whether or not such a project might be feasible as a joint venture with the country of Mexico.

Senator FANNIN. As I remember Dr. Rex's testimony, it was to the effect that Mexico perhaps had gone forward more rapidly than we have as far as geothermal steam is concerned. Is that still the case?

Mr. SMITH. Well, to the degree that they are actually using it on a production basis; I would suspect you are correct at Rosarito, for example.

Senator FANNIN. But we are still cooperating with them, benefiting jointly with the research in that?

Mr. SMITH. Yes, sir.

Senator FANNIN. Thank you very much.

Our next witness is Mr. Ramey of the Atomic Energy Commission.

Thank you very much.

Mr. SMITH. Thank you very much, Mr. Chairman, gentlemen.

STATEMENT OF JAMES T. RAMEY, COMMISSIONER, U.S. ATOMIC ENERGY COMMISSION; ACCOMPANIED BY W. WILLIAMS, JR., CHIEF, DESALTING BRANCH DIVISION OF REACTOR DEVELOPMENT AND TECHNOLOGY, AEC

Mr. RAMEY. Mr. Chairman, members of the committee, I am very pleased to have the opportunity to appear before you again. You may recall that I have had the pleasure of appearing before this committee on several occasions to discuss the Atomic Energy Commission's program for the use of nuclear energy in the intermediate and large-scale desalting of sea water, and our cooperative endeavors with the Office

of Saline Water. I might add, Mr. Chairman, I have with me Mr. Bill Williams, the Chief of our desalting staff from our Reactor Development and Technology Division.

Before commenting on S. 991, I would like to summarize briefly the background and interests of the AEC in desalting activities. We believe that there is a natural partnership between nuclear power and desalting. By joining the vast energy resources of the atom with the unlimited waters of the sea, we open the prospect of solving for the future the problems of adequate fresh water and energy for human needs.

The potential for achieving major economies in desalting of combining desalting with nuclear energy in large, dual-purpose plants was first recognized in 1955, Mr. Chairman, when you, then chairman of the Joint Committee on Atomic Energy, requested, in connection with the McKinney Panel study, the advice of the Atomic Energy Commission's Los Alamos Scientific Laboratory on whether nuclear energy could be used to advantage in the large-scale desalting of sea water. The answer then was yes, but that both nuclear and desalting technologies would have to be further developed and scaled up in size.

Improvements in both technologies which had come about by 1962, led to the conclusion that the development of dual-purpose, nuclear desalting plants producing large amounts of power and fresh water should be vigorously pursued. Following a favorable assessment by the Office of Science and Technology,[1] President Johnson directed the Department of the Interior and the Atomic Energy Commission to undertake such a joint program in 1964.

Our experience with nuclear power, which is typical of some other new technologies, demonstrates that, if a vigorous program of research, development, and actual plant scaleup and construction is carried out, evolutionary improvements can be expected which should result in further major improvements in economics. I might interpolate here, Mr. Chairman, to point out that, of course, nuclear power has been scaled up, it is commercially available; there are over 100 plants under construction; there are 20 plants in operation. We expect that by 1980, nuclear power will be producing about 25 percent of the total electric energy requirements of this country.

At the Atomic Energy Commission's Oak Ridge National Laboratory, under the leadership of its Director, Dr. Alvin Weinberg, and of Dr. R. Philip Hammond, Director, nuclear desalination program, a coordinated program of the Department of the Interior and the AEC has been conducted to assure a close coupling of new developments in nuclear energy and desalting.

During the past 7 years, the Oak Ridge National Laboratory has undertaken investigations and developments for the Office of Saline Water in the areas of heat transfer, scale control, and basic water research as well as engineering studies, conceptual designs, component development and systems analyses. Mr. O'Meara referred to some of the recent work at Oak Ridge in the reverse osmosis field in his testimony.

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[1] Office of Science and Technology, Executive Office of the President, "An Assessment of Large Nuclear-Powered Sea Water Distillation Plants," and appendixes, March 1964.

Work at the Oak Ridge National Laboratory under AEC sponsorship during this time has included studies of the optimum coupling of nuclear powerplants and large desalting systems, development of analytical systems simulation for the analysis and design of control systems of coupled nuclear power and desalting systems, studies of siting requirements, investigation of industrial processes for use in multipurpose plants, and economic analyses of various nuclear desalting concepts. AEC's effort has amounted to about $11 million since 1964 with approximately 80 percent of this total through Oak Ridge National Laboratory.

As part of our desalting endeavors, we have also participated with the Office of Saline Water in cooperative studies of the engineering and cost potentials of large-scale desalting for applications in the United Arab Republic, Israel, Greece, Mexico, New York, southern California, and Utah. There have been recent discussions, as Secretary Smith mentioned, between representatives of the United States and Mexico which indicate that follow-on studies and technical activities of a cooperative nature between our two countries could be mutually beneficial. And, the power and water and university organizations of the State of Arizona have been quite interested in these studies and we have been keeping them informed on our progress.

An outgrowth of the power-desalting studies has been the energy center concept.[2] This is the concept where a large nuclear energy source forms the nucleus for an integrated power intensive industrial complex which could incorporate intensive and scientifically managed agriculture. A study of one industrial type complex, or nuplex, for the southern coast of Puerto Rico was recently completed and the study of nuclear agro-industrial complexes for the Middle East is nearing completion. The latter study was undertaken in response to Senate Resolution 155 of the 90th Congress, introduced by Senator Baker, which called on the administration to explore the potential of large nuclear desalting projects in providing fresh water and power for arid regions in the Middle East.

I might interpolate here to mention that some of the ideas back of this concept were provided by Mr. Frank Di Luzio when he was Assistant Secretary of the Interior and by Mr. Lewis Strauss as a part of the Strauss-Eisenhower plan for the Middle East.

Through studies such as those noted above, it has been indicated that large-scale desalting plants using low-cost energy from nuclear reactors can produce fresh water at costs considered economically viable for many municipal and industrial uses. With further advances in technology it appears that, within the foreseeable future, desalted water could also be economic for agriculture in selected applications.[3]

I believe it is interesting to note that the AEC-OSW effort was one of the first to identify the benefits of dual-purpose and multipurpose plant operation, especially with respect to the more effective and efficient uses of energy and to achieve reductions in thermal discharges from powerplants. It is from such a basic that many of the proposed beneficial uses of waste heat have been developed and the future role of nuclear energy in the process industry identified.

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[2] "Nuclear Energy Centers, Industrial and Agro-Industrial Complexes, Summary Report," Oak Ridge National Laboratory (ORNL–4291), July 1968.

[3] R. Philip Hammond, "Agricultural Innovations and the Agro-Industrial Complex," a paper presented at Agricultural Research Institute annual meeting, Washington, D.C., October 14–15, 1969.

The AEC did not request specific funding or authorization for its desalting activities in fiscal year 1972, but intends to continue its priority desalting activities at ORNL as part of its general research and development effort. The AEC's desalting program will probably be at a lower funding level than in prior years as a result of other competing programs of a priority nature. As several members of this committee who are also members of the Joint Committee on Atomic Energy may recall, this matter was discussed at some length during the Joint Committee hearings of March 4, 1971, when the fiscal year 1972 authorization request for reactor development for AEC was considered. Even at a reduced level, we believe the AEC will continue to provide a meaningful contribution to the Federal nuclear desalting program and effectively cooperate with the Office of Saline Water.

It is quite likely, however, that under the pending budgetary restraints we would be hard pressed to support any new cooperative desalting study efforts, either domestic or foreign, without major reprograming and adverse impact on other priority efforts in our environmental and reactor development fields. If a demonstration project for nuclear desalting under cooperative terms should develop, we would, of course, need to request specific authorization and funding for any AEC participation.

Turning now to S. 991, I would like to comment on several general areas. First, we support a strong and dynamic Federal program in the desalting field. With the increase in our population and the associated demands for water and energy, there can be little doubt that we will not only have to tap our available resources with increasing severity, but also develop new resources where natural supplies are limited. Already the energy crisis has highlighted the urgent need for increased sources of energy. And, I am sure that this committee does not need me to remind it of the increasing demands that are being placed on our naturally available fresh water supplies.

The AEC has long been convinced of the necessity for prototype or demonstration projects and the role that they play in introducing a new technology to the potential users. We not with accord that S. 991 recognizes this need and that the demonstration should be made on a practical scale. While a diversity of desalting technology has been developed, and numerous small plants have been operated, there is not yet a prototype or demonstration project of a size that could be extrapolated with confidence to meet the large metropolitan or regional-type application. It is indeed unfortunate that the Bolsa Island project did not go forward because it would have served a vital demonstration function, not only to the Federal program, but also to the water and power planners here and abroad. The provision of S. 991 which call for recommendations regarding the best opportunity for the early construction of a large-scale prototype are believed to be timely indeed.

The importance of the role of demonstration projects has not always been appreciated. In the past there has been a tendency to hold back a development project until a specific requirement or mission has been formally established by a user. Yet, the user very often is not in a position to establish such requirements until a project or development can demonstrate its value. I have referred to this dilemma in the past

as the "Requirements Merry-Go-Round." [4] [5] In many respects desalting falls into this category.

Too often during the past have we heard that there was little or no immediate requirement in the United States for desalting and that when the needs materialize then technology can be developed to handle the situation. It is of interest that these are almost the same thoughts that were expressed some two decades ago in connection with the development of nuclear energy. I would strongly suggest that the Federal desalting program be oriented to a set of clearly defined objectives rather than requirements, and that each of the processes developed by application oriented at the earliest practical time. The lead time for water resource planning in most cases will require the early demonstration in a water supply environment if desalting is to be considered a valid alternative.

The AEC's desalting program has been primarily directed at adapting the reactor technology developed under the civilian power program for central station plants to large dual-purpose power and water plants. The principal technical problems are related to the coupling of two new technologies (nuclear power and desalting) together in a single plant. But, the management problems of large-scale dual-purpose plants both at the power and water utility level as well as the government level may be equally troublesome. This has already been referred to. I commented on this particular problem in my remarks at the nuclear desalination symposium in Madrid, Spain on November 18, 1968.[6] My remarks drew from the experiences gained from the Bolsa Island project and pointed to the need in project management for a lead organization with sufficient authority to provide sound and coordinated direction for the design, construction and operation of large nuclear desalting projects.

In undertaking any large project based on advanced technology, a systems approach is almost certainly a prerequisite to its success. We are pleased to note that the report on a proposed Federal desalting program which was recently submitted to this committee by the Office of Science and Technology, supports this position and notes that "A systems approach will be needed to achieve the maximum economies for any large-scale plant developments, taking into account the interaction of the desalting plant with its energy source as well as with the systems into which it will be introduced."

At the Government management level, I believe greater emphasis could be given to the use of the joint office concept between Interior and AEC for the direction of the development effort for large-scale nuclear desalting, particularly for any project oriented activities. This approach probably provides one of the better means for coordinating a major program in which more than one agency is involved. While our experience with joint offices has been varied, we have had good success with such arrangements with the Navy under Admiral Rick-

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[4] James T. Ramey, "The Requirements Merry-Go-Round: Must Need Preceed Development?," *Bulletin of the Atomic Scientists*, November 1964.

[5] James T. Ramey, "The Requirements Merry-Go-Round, Phase II," remarks before Atomic Industrial Forum, San Francisco, California, December 2, 1964 (AEC Press Release IN–543).

[6] James T. Ramey, "Practical Considerations in Desalting and Energy Development and Utilization," remarks before Symposium on Nuclear Desalination, Madrid, Spain, November 18, 1968. (AEC Press Release S–51–68).

over and with NASA in connection with our NERVA and SNAP projects.

In conclusion, I would like to emphasize that we are looking forward to the continuation of the Federal desalting program and the early demonstration and application of large-scale desalting. We expect the atom to assist in making desalting a viable water alternative in the foreseeable future, particularly in the arid southwest, and look forward to providing the continued expertise and support of our staff and the AEC's national laboratories to the Federal program.

Thank you very much.

Senator ANDERSON. Senator Allott?

Senator ALLOTT. Yes.

The Secretary of the Interior now has general authority to propose construction prototype desalting plants with Federal participation. Since the Bolsa Island proposal of 1967 failed to be carried out, however, no further proposals have been made. S. 991 would require the Secretary to report within one year. Do you believe that a definite requirement to work toward a prototype will be valuable?

Mr. RAMEY. Yes, sir, I do, in this sense: I believe that from Secretary Smith's and Mr. O'Meara's testimony, they gave every indication that they had a desire and intent to come up with a concrete proposal, together with its factual backup, in a year. On the other hand, I believe a statutory requirement approved by the President would provide some guidance, equally, to the staff of the Bureau of the Budget, now called the OMB, who are always a little sticky and a little negative on any kind of development project, including desalting efforts.

Senator ALLOTT. I was interested in one thing in your statement in particular, and that was the systems management approach which you suggested as a necessity to successful completion and operation.

Mr. RAMEY. Yes, sir.

Senator ALLOTT. The thing that struck me when you said this, would you attribute the demise of the Bolsa Island project, at least in a major part because the systems management approach was not used in that instance?

Mr. RAMEY. Yes, sir, I think that was a large factor. As the project was originally conceived and proposed, the partners who were, as you know, the Southern California Edison people, the city of Los Angeles department of water and power, and the metropolitan water district. They were the principal proposers and in addition there were the Department of Interior and AEC at the Government level. The general idea was that they were going to have the Bechtel Corp. as a major architect-engineer constructor as sort of the systems manager for the project. But, before the project even got through the planning phase, it became clear that this approach was not going to be followed. There was not a corporate setup established for the management of the project and we had a sort of loose consortium. This, therefore, made it very difficult, and as Secretary Smith mentioned, there were just too many cooks. It was a kind of uneasy consortium with one group pulling loose on one aspect and another group pulling loose on another.

I think, of course, the other major factor involved in Bolsa Island was that it came along just at the time that costs were beginning to escalate due to increased labor charged and increased interest costs. Accordingly, one of the utilities decided that it was just a little too

risky in terms of the projected cost increase. But I believe it is interesting to note that when one looks back with hindsight, the costs of alternate sources of water also increased. The costs of the State of California water plan and all types of water supply have gone up. The costs of nuclear power and coal and oil plants have gone up. In some ways, the Bolsa Island project might have been a bargain.

As Mr. O'Meara pointed out, the metropolitan water district has continued to be interested in this project. They retained their lease rights for the island and they retained their substation rights on the shore and transmission corridors. So in the future, perhaps, it could be revived.

But it is probably not going to be the first project, since hopefully, we may get a large prototype started somewhere along the coast earlier.

Senator ALLOTT. Well, we are aware of the cost situation in this, but I think perhaps even more significant than that is the systems management approach.

Mr. RAMEY. Yes, sir.

Senator ALLOTT. Somebody once said that a camel was a horse that had been put together by a committee.

Mr. RAMEY. Yes, sir.

Senator ALLOTT. I think we want to avoid that type of thing on this approach.

Mr. RAMEY. I think you are right, sir.

Senator ALLOTT. One final question. Do you believe, taking into consideration your comments about systems management, and taking into consideration the best information we all have about escalating costs, do you think that it is possible at this point—I do not mean today or tomorrow, but a point within a year or a year and a half, to provide plans and financing for a plant and construct it without having the costs outrun us before the plant is in operation?

Mr. RAMEY. Well, I believe it is possible to provide conservative cost estimates that take into account the best knowledge that we have at the time as to the cost and escalation trends, and put in contingency factors so that when the plant is constructed, the costs will be within range of the general estimates.

Senator ALLOTT. The reason I ask this is that the last 2 weeks, I have been attending hearings on the Public Works Subcommittee of Appropriations in which these costs have not been estimated, they have been made upon present day existing costs as of that time, knowing full well that that construction work can't be done within that time and the escalation was not figured into the original analysis. But you think it could be done reasonably?

Mr. RAMEY. Yes, sir, I do. And I think the costs that will be associated with a first plant will be high. Certainly based on our experience in nuclear power, your first prototype will not produce cheap water and you will need probably several plants or add-ons before you can develop the technology and the industry to build an economic plant. That has been the history of nuclear power. The Shippingport prototype that Senator Anderson was so interested in getting started in the 1950's was not an economic plant and people criticized it and criticized Admiral Rickover because it was a high-cost plant. But that plant provided the technology for the subsequent pressurized water reactor plants. Shippingport was a 60,000 kilowatt plant and now

they are building plants that produce 1,200,000 kilowatts of electrical power with this same type reactor. These bigger plants, starting with the Connecticut Yankee plant and the other plants that have followed are competitive and economical.

Senator ANDERSON. Senator Jordan?

Senator JORDAN. Commissioner Ramey, I think we are all agreed that systems management is necessary when you have such diverse interests as were joint venturing the Bolsa project. But before we get to that point now, in order to revive the interest and get a prototype program going again, you suggest that perhaps a joint venture concept between Interior and AEC—a joint office concept, rather, between Interior and AEC—would be better than just a loose kind of cooperative relationship such as you presently have. You mentioned that you have such a joint office relationship with Navy and with NASA?

Mr. RAMEY. Yes, sir.

Senator JORDAN. And it works very well in those two instances?

Mr. RAMEY. Yes, sir, it works excellently. In the case of the Navy program, Admiral Rickover is the director of the AEC's Division of Naval Reactors and he is also an Assistant Chief of the Bureau of Ships on the Navy side.

Senator JORDAN. Yes.

Mr. RAMEY. And that is a very closely integrated program and is run as one program.

Senator JORDAN. Yes.

Mr. RAMEY. And it has been from the start. I happen to have been this counsel in Chicago that wrote the original contract for the development of the *Nautilus* prototype and it has been run as a joint effort all the way through.

On the NASA work, we have a joint office with NASA that Harry Finger originally headed up and now Milt Klein heads up. Harry Finger came from the NASA organization, but he was working for both NASA and AEC. The money has been split on the development of the NERVA rocket and the development of these smaller electric power sources that are used on the moon and on satellites. The present director happens to be an AEC employee. but the office and the effort are run as a single organization. We believe, especially if we come to a large prototype project in the nuclear desalting area, this joint office setup would probably provide the best means of coordinating the activities. The AEC is a very development and systems-oriented organization having had great experience with industry and we believe that we can make a real contribution. OSW, of course, has done a great job of bringing the desalting technology to where it is today but they do not have as much industry experience as we do.

Senator JORDAN. You believe, then, that as an essential constructive first step it would be important to have a joint office set up between Interior and AEC in order to revive and get a prototype project going again?

Mr. RAMEY. I do not think it is an essential first step, Senator, but I think it would help. I think somewhere down the line, though, where we are working on getting a proposal and so on, it would be useful. And once a project is authorized, it is essential.

Senator JORDAN. All right, I will ask you the same question I asked the Secretary then. If this committee decides to include a 1-year pro-

posal for a large-scale prototype, would you be able to present to the Congress such a proposal within that time frame?

Mr. RAMEY. Well, working with the OSW and the Bureau of Reclamation and with the Department of the Interior, we certainly would make every effort to help in providing that. I mentioned in my testimony that we are going to be a little short of finding in the next fiscal year and this requirement would necessitate some reshuffling of our priorities.

Senator JORDAN. We would like to help you if we can.

Mr. RAMEY. Thank you.

Senator ANDERSON. Senator Fannin?

Senator FANNIN. Thank you, Mr. Chairman.

Mr. Ramey, I wholeheartedly agree with the goals you set forth in your statement and with your comments on page 7, where you say the important role of the demonstration project has not always been appreciated. This has been a great problem, I think. As many times as we have been prone to say, when you prove it, we will build it.

How many of the first five plants are still being utilized—of the five first atomic energy plants that we built here in this country, how many of them are still being utilized in their original construction? In other words, on the same basis on which they were built.

Mr. RAMEY. Well, the Shippingport plant was the first prototype pressurized water reactor. It has been modified some and is currently—has operated for the last 14 years. It first went into operation in 1957. It has been modified to gain improvements in technology, particularly in fuel, and we are now modifying it again for what we call a light water breeder. So it is still useful.

Senator FANNIN. But if they had never built the first one with the design that you had available to you, you would never have really been able to have benefited by the new technology? In other words, you would not have developed a new technology without developing the first one, is that true?

Mr. RAMEY. Yes, sir; that is right.

Senator FANNIN. So you have benefited and you were able to correct these problems mainly because you had something to build upon.

Mr. RAMEY. Yes, sir.

Senator FANNIN. If you had just left it to the slide rule, you probably would never have developed a successful and comprehensive plan; is that correct?

Mr. RAMEY. That is absolutely correct. You not only have to build prototypes, you have to build experiments. You have to go scaling up.

Senator FANNIN. Are we still utilizing the first five?

Mr. RAMEY. I was trying to think.

Senator FANNIN. I do not mean to go into detail.

Mr. RAMEY. In the water reactor field, there is the Indian Point plant, Indian Point No. 1, which is still being utilized. It has been run by Consolidated Edison in New York. It was begun in the middle or late fifties, went into operation in the early sixties, and it is running now. It had been out due to a pipe failure but has resumed operation.

There is the Humboldt Bay, which was the first of the small boiling water reactor plants that followed some of the experimental reactors. This plant, located in Eureka, Calif., is still running.

There is Dresden 1, which is a boiling water reactor, built 50 miles south of Chicago. It is still running and running well.

There is also the Yankee Rowe plant, which was the follow-on plant from the Shippingport and it has been operating for the last 10 or 11 years and running well.

Senator FANNIN. My point was, though, in their original design, it is my understanding that none of them could produce power economically in the original design?

Mr. RAMEY. The Shippingport plant could not, which was a prototype. The Dresden 1 and the Yankee plant both had to have some subsidy to be economic and they have been improved in ways of improved fuel, and so forth. But some of the greatest economic improvements in these plants have come from the extrapolation in size on subsequent plants, Senator Fannin.

Senator FANNIN. That is exactly what I mean. Unless we build a first plant for desalination, we probably will not have these tremendous breakthroughs we are talking about. Would you agree?

Mr. RAMEY. That is right. You see, the Dresden plant and the Yankee Rowe plant, were plants of around 200,000 electrical kilowatts. It was not until the second round plants which were built in the 400,000 and 600,000 kilowatt size that they began to be competitive with other fuel sources and now, as I mentioned earlier, plants are being built that are twice that size and six times the size of the original Yankee and Dresden plants, and they are commercially available.

Senator FANNIN. That is why I think it is so essential that we build these prototype plants of large magnitude, of the size that you are talking about and size like they had at Bolsa. Of course, that was a unit.

Mr. RAMEY. That is exactly the case.

Senator FANNIN. What are we doing as far as the actual construction of a plant with Mexico? We have had that Gulf of California plant under consideration. Is that still going forward?

Mr. RAMEY. Well, we are hoping to continue with these low level studies that Secretary Smith mentioned. Secretary Smith, Mr. Herman Pollock of the State Department, and I went down to Mexico City at the invitation of the foreign minister and met with him and the new chairman of their Atomic Energy Commission to discuss ways in which we could continue this study of large nuclear desalting plant that would utilize water from the Gulf of California. We would hope that in the next few months we could work out an arrangement to continue these studies. This would include looking at the three sites recommended in the preliminary study. There certainly has to be more engineering work carried out, the cost have to be updated, siting problems have to be resolved, and ecology and environmental matters have to be looked at in much greater depth. It might be that we would want to look at interim projects smaller than the very large plant that was initially studied.

Senator FANNIN. Thank you, Mr. Ramey, very much.

Mr. RAMEY. Thank you, sir.

Senator ANDERSON. Mr. Teerink?

STATEMENT OF JOHN R. TEERINK, DEPUTY DIRECTOR, DEPARTMENT OF WATER RESOURCES, STATE OF CALIFORNIA

Mr. TEERINK. Mr. Chairman, members of the committee, my name is John Terrink. I am director of the large capacity sea water

desalting technology as described in S. 991 of this Congress. I am pleased to present this statement in support of the program to develop large-capacity sea water desalting technogoly as described in S. 991, 92nd Congress, first session.

On March 2, 1970, we appeared before this subcommittee to outline California's desalting objectives. Our statement is on record in your file, and contains background information on the Department's desalting program, and our years of cooperation with the Federal Office of Saline Water. We informed this subcommittee that as the result of an updated cooperative agreement with the Office of Saline Water, one of the early joint efforts would be to explore thoroughly the feasibility of construction and operation of a large-capacity prototype desalter in California. There is a critical need to gather information on large-capacity desalting during the seventies so that it will be possible to make decisions in the eighties concerning the role desalting may play in meeting future water requirements. We are pleased to report considerable progress on the program presented to you last year.

In May of 1970, an agreement was signed between the Department of Water Resources and the Office of Saline Water to conduct a joint study for the development of a large-capacity prototype desalter of up to 50 million gallons per day—50,000 acre-feet per year—capacity. The study is being financed on a 50–50 basis between the two agencies. The work is being conducted by the Department and its consultants.

The construction and operation of a large-capacity prototype desalter is proposed to accomplish several important objectives, as follows:

1. Determine from a prototype desalter the technical and operating information needed for more accurate design and cost estimates of large-capacity desalters.
2. Operate a prototype desalter in conjunction with an electric power generation unit to evaluate interface problems between water and power production.
3. Provide the desalted water to a water service area in order to gain experience in the best means of integrating a supply of desalted water with other water supplies.
4. Establish means of environmentally acceptable operation, especially in connection with the discharge of warm sea water and brine back into the ocean.

The prototype desalter study was initiated in July of 1970. One of the first efforts was the determination of a water service area and a site where a prototype desalter might be constructed. In January of this year this determination was completed and the Department issued a report entitled "Site Selection for a Large Scale Desalting Plant." A copy of the report will be provided for the subcommittee file.

As part of the site selection study, the State of California, working with the Department of the Interior, evaluated eight potential water marketing areas along the California coast, between San Francisco and the Mexican border, which indicated an interest in using desalted water produced by a prototype desalting plant. These eight areas were evaluated as six water service areas, as follows: San Mateo-Santa Cruz, Santa Cruz-Monterey, San Luis Obispo-Santa Barbara, Santa Barbara-Ventura, Orange, San Diego.

Several steam-producing powerplants are located on the coast between San Francisco and the Mexican border. The majority of these are fossil-fueled plants. The only operating nuclear-fueled plant south of San Francisco is located in San Diego County. The only nuclear-fueled plant under construction on the coast is located in San Luis Obispo County.

Based on this evaluation, it was concluded that the most feasible water service area for the prototype desalting plant was a combination of a water marketing area composed of San Luis Obispo and Santa Barbara Counties. The State has a contract with the two counties to supply water from the State Water Project in the amount of 82,700 acre-feet per year. A desalting plant can provide some of this supply.

The site selected for the feasibility study is adjacent to the nuclear powerplant under construction by Pacific Gas and Electric Co. at Diablo Canyon. It is anticipated that the feasibility study will take the remainder of this year. A final report on the study is planned for early 1972.

At the present time the Department is working with the counties to determine the quantity of desalted water each can reasonably expect to use. Last month an architect-engineering firm (Kaiser Engineers) was engaged to make an engineering feasibility study of the desalting aspects of the study. The Department is working with the Pacific Gas and Electric Co. for a steam supply from its Diablo Canyon powerplant. The utility is cooperating by studying the means of providing steam from its powerplant in the amount, and under the conditions, that can be beneficially used by the desalting plant.

Another important part of this study is to evaluate the environmental impact of desalters. The California Department of Fish and Game will be evaluating the effect on the ocean environment of the discharge of warm brine and sea water from the desalter. We would expect the operation of the prototype desalter to be invaluable in providing many of the answers that would be need in the future if we are to design, build, and operate desalters on the California coast in environmentally acceptable manner.

Our support of S. 991 is specifically related to section 3, although we also support the research and development objectives. In that connection, we have been, and still are, participating with the Office of Saline Water in test bed and module development in the San Diego area.

In conclusion, we believe that the large-capacity prototype study that is presently underway by the Department of Water Resources and the Interior Department will afford the best opportunity for the early construction of a prototype desalting plant to satisfy the substantial national commitment as authorized and directed by section 3 of S. 991. All four of the considerations itemized in section 3(b) can more than adequately be met by the California study proceeding into the authorization, design, and construction phases. The plant size and process best suited for advancing technology can be selected. There is likely to be available cooperating, non-Federal entities to operate the plant and provide a water market. A site has been identified. A power supply is available. It is anticipated that environmental considerations can be adequately resolved. There is a need for an additional municipal and industrial water supply in the service area. The Counties of Santa Barbara and San Luis Obispo are looking to the State for augmenta-

tion of their water supplies. We therefore respectfully urge that S. 991 be enacted.

Senator ANDERSON. Thank you very much.

Senator Jordan?

Senator JORDAN. That is a very interesting statement. If your present plans hold to schedule, what is the earliest date you calculate now you might have a plant in production?

Mr. TEERINK. Our flow diagram shows that it should be on the line by the end of 1977.

Senator JORDAN. 1977 in production?

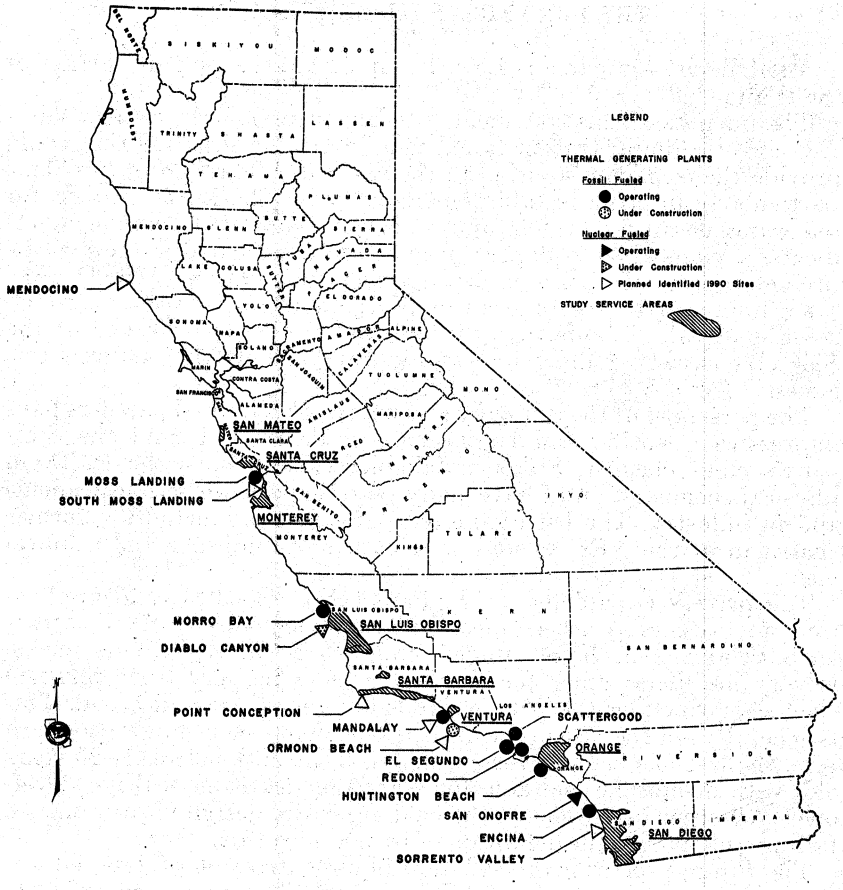
Mr. TEERINK. Yes, sir.

Senator JORDAN. We look forward to your progress. It is very interesting. Thank you.

Senator ANDERSON. Thank you very much.

(A chart attached to Mr. Teerink's statement follows:)

EXISTING AND IDENTIFIED 1990 THERMAL GENERATING PLANTS AND SITES
USING FULL-STRENGTH PACIFIC OCEAN WATER FOR COOLING
AND
PROTOTYPE DESALTER STUDY SERVICE AREAS



Senator ANDERSON. Mr. Lazare?

If you feel, Mr. Lazare, you want to read only a portion, we will print it all in full.

Mr. LAZARE. Well, I can leave out certain portions of it, but I think it might be interesting if I carried it out in full.

Senator ANDERSON. Go ahead.

STATEMENT OF LEON LAZARE, GENERAL PARTNER, THE PURAQ CO., PHILADELPHIA, PA.

Mr. LAZARE. My name is Leon Lazare, I am the general partner of the Puraq Co.

The purpose of this statement is to illustrate how the Saline Water Act and its administration failed in a particular situation that could provide the economic solution to the sea water desalination problem, particularly in large installations. Involved is the Puraq process for sea water desalting, which, at its present stage of development, indicates savings of 30 to 40 percent in cost of desalinated water over the present process of choice, multistage flash distillation (MSFD). We are a limited partnership and this partnership raised money through a series of sales of offerings through the small issues branch of the SEC. We have no underwriters and we raised about $550,000 from two issues.

The personnel of the company and many of its limited partners have impressive scientific and engineering credentials. I, and the company's chief chemist, Stephen Jakabhazy, both have the Ph.D. in physical chemistry, and I have many years' experience both in academe and in industry. The list of limited partners even includes a former chairman of the AEC as well as scientists of eminence and achievement.

The process is patented (U.S. Patent No. 3,386,913) and applications for patents have been filed in 25 countries; most of these patents have been granted, the remainder being processed. Since the invention is very novel, invoking for the first time some very basic physical chemical principles the patent claims are very basic and broad. This is generally not the case in the desalination field—basic innovations are rare, the last one being reverse osmosis, an invention already 20 years old, with membranes suitable for sea water desalting still not developed. All other inventions in the field are really design improvements, falling well outside the definition of basic innovation.

The Puraq process involves liquid-liquid extraction of desalted water from sea water, using specially synthesized polymeric solvents which have the property of absorbing the required amount of water at a given temperature, rejecting the salt, and also not contaminating the coexistent aqueous phase with solvent. Thus the brine concentrate is returned to the sea essentially free of solvent, and the product water, which is separated by decantation from the solvent at an elevated temperature, is also solvent-free. This important property is due to the polymeric structure of the solvent, and is the physical basis of the invention.

The overall result of this essential property is a flowsheet which is far more economical than any other sea water desalting process, either in use (such as multistage flash distillation) or being given active consideration by the Office of Saline Water. In effect, the plant is physi-

cally smaller, the total heat exchanger surface is 5 percent of that in an MSFD plant, the operating conditions are milder (maximum brine temperature is 177 degrees Fahrenheit as compared to 220 degrees and higher for MSFD), with scaling and fouling categorically eliminated.

To prove this concept, the company expended almost $600,000 on a laboratory program of 4 years' duration: over 300 solvents were synthesized and the pertinent properties painstakingly measured and correlated; the results were fed into a computer program (our development) to produce an engineering design of a large-scale plant, thus testing the suitability of each particular solvent. At the present time, we have a number of solvent compositions with a combination of properties adequate for an economic commercial design. In addition, investigations were conducted to verify other important aspects, such as the chemical stability of the solvents with respect to oxidation and to hydrolysis by hot sea water, the ability of off-the-shelf coalescing media to coalesce fine droplets of solvent that might be mechanically entrained in the product and brine concentrate streams, as well as the effects of molecular weight distribution on the pertinent physical properties. Other properties, important to engineering design, such as viscosities, specific gravities, interfacial tensions and diffusion coefficients were investigated. This tremendous program involved between eight and 12 people over the 4-year period, and approximately 70 notebooks of laboratory data were accumulated.

Thus, a complete and successful prepilot plant program has been carried out, and now, unfortunately, terminated for the lack of funds, although there are strong indications that by continuing the research there will evolve improved solvents, imparting even greater economic advantages to the process.

Furthermore, engineering studies performed by ourselves and by others have shown that the Puraq process, with the solvents now developed, results in savings of 10 to 20 percent in steam consumption, eliminates practically all chemical consumption, and that the capital requirements in plants of 10 million g.p.d. capacity will be one-third less than for MSFD, and one-half less in capacities of 40 million g.p.d.

The Puraq process has been validated by this laboratory program and by these engineering studies, and the technical risks from this point to commercialization have been characterized by other industrial organizations as moderate or nominal.

The company must now undertake a pilot plant and engineering development program requiring a total of $3 million, to include the construction of a 300,000 g.p.d. pilot plant, its operation for 2 years, engineering and hardware development, FDA and USPHS clearance for the solvents, and 4 years' continuation of the laboratory program. The company has not succeeded in promoting these funds from either the financial or the industrial community. Even though the return on investment is very high, there is a large time scale in the commercialization procedure and there is also a lack of confidence in the future of the desalination business.

Because of this and because our original funds have been exhausted, we have ceased our operations; Dr. Jakabhazy has found himself an excellent job at the Polaroid Corp., no mean feat in these times, and I am looking for a job, and the partners' investment may well go down the drain. The laboratory is open, and the experimental