

agency head we find that our people can deal with the laboratory directly. To the best of my knowledge, no impediment exists here.

Mr. ROUSH. Do you receive assistance from the Office of Science and Technology?

Mr. LEHAN. We receive advice and assistance from them.

Mr. ROUSH. Does that office ever do the pushing, or do you do the pushing?

Mr. LEHAN. Both.

Mr. ROUSH. Are there any other questions?

(No response.)

Mr. ROUSH. Thank you very much, Mr. Lehan, and we are glad to have you appear before the committee.

(Mr Lehan's prepared statement follows:)

PREPARED STATEMENT BY FRANK W. LEHAN, ASSISTANT SECRETARY FOR RESEARCH AND TECHNOLOGY, DEPARTMENT OF TRANSPORTATION

Mr. chairman and members of the subcommittee, I consider the subject of this hearing to be important to the future of research and development in the country. It is also one in which I am deeply interested personally. I, therefore, appreciate the privilege of appearing before you today to present my views.

The size and scope of transportation, in Government and in industry, are indicative of a very large investment. It accounts annually for about 20 percent of our gross national product.

With respect to Federal expenditures for transportation research and development, the Department of Defense, for FY-1968 spent approximately \$600 million on transportation related R&D, and NASA spent nearly \$100 million, performed by an extensive complex of Federal and industrial research organizations. It is our intention in DOT to utilize fully this existing capability to support our evolving research and development requirements. Our FY-69 R&D budget is close to \$350 million.

To this end, I have recently visited with Dr. John S. Foster, DOD, Director, Defense Research and Engineering, and I have been most pleased by the responsiveness of DOD in offering such cooperation to our Department. Similar discussions have been held with Dr. Mac Adams, Associate Administrator for Advanced Research and Technology of NASA, as well as Dr. Philip R. Lee, Assistant Secretary of Health, Education and Welfare, and currently, we are actively searching for more cooperative areas. We intend to intensify these positive steps to insure the technology developed for defense and space efforts in both DOD and NASA is available to meet the needs of the Department of Transportation.

My following comments are based upon 10 years experience at the California Institute of Technology's Jet Propulsion Laboratory in the management of electronic research, under Dr. William H. Pickering, who has recently been here to testify, plus work as Deputy Director of Electronics Laboratories at the Ramo-Wooldridge Corporation. This experience has been of great value to me in the insight it has provided in technical management of laboratories pursuing large research and development programs. It has also provided a sound basis for appreciating the concepts of systems engineering and technical direction, as associated with such programs. I have also observed, first hand, many of the problem that have beset contractors during the accomplishments of major projects and am aware of many of the factors critical to determining whether the effort will be successful.

This background convinces me that the Department of Transportation must work jointly in three basic areas with all laboratories that provide support in R&D programs. First, we must assure that detailed planning of the program is *very* thoroughly accomplished and documented. The second key to success relates to the relatively few but critical technical selections and decisions that must be correctly made at the outset of a R&D program. This is the conceptual phase of systems engineering. It is the heart of systems engineering, requiring thorough knowledge of the needs, capabilities, and strong creative talent. For example, such key decisions were involved in the ballistic missile program, when it was decided to emphasize inertial over radio guidance, and ICBM's over IRBM's. With these two first steps successfully accomplished, the third essential ingredi-