

Dr. MUELLER. Yes, sir.

Mr. FUQUA. I think this would be very helpful.

Mr. RUMSFELD. I thought you said two and a half times.

Dr. MUELLER. Mr. Fuqua asked me what the experimenters asked for.

Mr. RUMSFELD. I see. Is it possible to give us a breakdown; and I don't find it here in backup books on the cost per launch with the fact of experiments and mission support that go with each of the launches anticipated.

Dr. MUELLER. Yes. But that can be done for the basic launch vehicle, Mr. Rumsfeld. Each package has a different set of experiments. It is different in each case. We can provide that information.

(Information requested is as follows:)

Answer: We are engaged at NASA, not merely in landing an expedition on the moon, but in developing the whole range of technology to give the nation a rounded manned space flight capability. This development of itself has tremendous benefit for our whole country.

It helps to demonstrate our advanced position in science and technology before all the nations of the world.

It has an enormous impact on our educational system, challenging and stimulating our youth to new standards of excellence.

It creates basic new industries for our economy.

It is producing immediate benefits of direct use to people here on earth. Whenever a laboratory develops a new scientific concept or a piece of hardware for space purposes, the probability is high that the development will turn out to be useful somewhere in earth-bound life. Over the next 20 years, you will see an amazing parade of new products, improvements on old ones, and price cuts on expensive ones. In many cases, the origins of these new and revolutionary products will lie in research carried out as part of the national space effort.

Just as the necessities of World War II led to such lasting innovations as the jet plane and aerosol spray, the exploration of space has already started a beneficial fallout of commercial products and processes that promises profound effects on our economy and lives here on earth.

The list is a long one: lightweight plastics, developed for use in rockets, are being used in the construction of railway tank cars that weigh only half as much as their steel counterparts; new metals, developed by space researchers, are now being used in oil refineries where their resistance to corrosion is required; sealants, developed for the seams of spacecraft, are being used in caulking bathroom tiles and for sealing windows of automobiles; an alkali silicate paint that resists weather, solvents, and radiation, has been marketed commercially.

In addition to developing new products, space research has led to the discovery of new uses for old ideas and products. An example of this is the fuel cell, which was developed in the last century but found no marketable application until space researchers began to use it for supplying electrical power onboard the Gemini and Apollo spacecraft. Commercially, the fuel cell is now being used to power experimental golf carts, tractors, spot welders, fork-lift trucks, and smog-free, electric automobiles of superior efficiency.

In the field of medicine, we have already seen many benefits as a result of our space program. For example, the tiny bio-sensors used to monitor the astronauts' physical condition during flight are now being used in many hospitals to permit one nurse, seated at a central console, to monitor the condition of many patients at the same time.

Another medical device stemming from our space research is a tiny radio transmitter which is swallowed by the astronaut and suspended in the stomach without surgery. This enables doctors to monitor his physical condition, especially thermal stresses, gaseous conditions, and tensions. This device, which is only the size of a large vitamin capsule, also has extensive "earthly" application in the practice of medicine.

The future holds promise of many more benefits to medicine through space research. In the past we have used studies of patients during periods of long bed-rest as an analogy to determine the effects of prolonged weightlessness in space.