

Mr. TEAGUE. Thank you, sir.

Mr. CARROLL. Mr. Len Tinnan, from our advanced systems operations, will now cover some of the things we have looked at downstream for Apollo Applications.

Mr. PETTIS. May I ask one question? Have you changed in any major way the aerodynamics of this total craft in the last little while? Has it proved to be pretty much what you wanted to begin with?

Mr. MYERS. Yes. The only thing we have to worry about in the aerodynamics of the vehicle is really the location of the center of gravity. All the wind tunnel tests we have made have proven the shape was right. By having the right location in the center of gravity, this ship gets its lift-to-drag ratio by having the center of gravity offset. It tilts in the wind and gets lift from the aerodynamic forces on the heat shield and the rest of the ship. By having that tilt, and by rolling the ship with the reaction control system, we can maneuver it to come in. So there has always been a very sharp control of the center of gravity by the proper location of equipment in the ship, and it has worked out very nicely as far as the flights go.

Mr. PETTIS. Just to look at this thing at launch, you would think the thing is really going to go out of control right off the bat.

Mr. MYERS. At launch, there is a buffeting right at the edge of the command module down against the service module because of that sharp break there. That buffeting is an acoustic-forcing function normally on the service module, but we originally designed it to have a thick sandwich honeycomb structure there, and we have had no problems with it. We have tested it to the acoustic conditions that we learned from these early flights that we had on Saturn I. It's in good shape, we haven't had any problem.

Mr. TEAGUE. Before you start, Len, what you are going to present, are they strictly North American ideas? Has it gotten down into NASA?

L. M. TINNAN. I'm going to touch on various aspects of what we call Apollo Applications programs, as we define them at North American. Some of these have been done in conjunction with and under contract to NASA; others have been done under our own funding and pertain to ideas that have been suggested to the Government. I will cover both types of activities.

I am actually pleased to state at the very outset, that since my last opportunity to meet with Mr. Wilson and other members of your staff during their visit here last summer, that the Apollo Applications program has improved from what we then considered to be a bleak and uncertain picture to an outlook now which is reasonably clear and meaningful. This improvement has resulted primarily from two factors: First, from among the many space missions and vehicle design options that were then under consideration, the NASA and the industrial contractors, like ourselves, have been able to chart a course of action that we believe to be of significant national value. Secondly, and of equal or perhaps even greater importance, is the fact that, whereas in fiscal year 1967 the funds available to support the Apollo Applications program were virtually nil, there now appears to be a high probability that within fiscal year 1968 a reasonable level of