

highly simplified bar chart showing how we think the various subsystems stand. Perhaps I would better say this represents my opinion of how the subsystems stand, because I believe that almost anybody would vary it slightly, according to his own notions. The coding indicates the position as evaluated last August and the present. There has been progress in almost every case, and I should point out that some of the improvement indicated represents the net result of both setback and recovery. Not all of this progress has necessarily been steady and constant.

I don't intend to go through every one of these, but I think I should highlight a couple. In the case of the structure, which is the first bar, I noted earlier the fact that we were still working with the interaction of the ascent stage base heat shield and the engine starting pressures. I also have indicated a slight retrogression because the thermal shielding has proved to be a more difficult job than was originally visualized. In the case of the environmental control system, its evaluation is based on the fact that we still have not completed qualification of all of the components.

We also have not conclusively proved that we are free of problems with the water boiler and we are living with a very tight hardware availability. It will be several months before the situation makes a major improvement, but we expect to be able to live with it and do not expect the vehicles to be held up.

The guidance and navigation category includes the rendezvous radar and the landing radar. This evaluation reflects the concern which has existed for sometime as to the rate of development of the landing radar. I think recently we have seen some improvement in this, and believe that we are over the hump.

Representative WAGGONER. At one point you had some erroneous altitude information from this radar. Has that been corrected?

Mr. RATHKE. If that relates to the reflection off the heat shield, yes.

Mr. GAVIN. There have been basically two problems with the landing radar that concern us; one was the matter of reflections off the vehicle itself. We have explored this and it turns out that we can provide a sort of a fence that prevents the radar from seeing the bell of the descent engine, which is a vibrating body as far as the radar is concerned. The other had to do with the direction in which the antenna of the landing radar was pointing. After evaluating the various trajectories which form the likely envelope of operation, we have readjusted the direction in which it points, and we are now satisfied that this will work quite well.

Representative WAGGONER. The information made available from previous flights and photographs have been sufficient then for you to conclude that you are not going to get any erroneous altitude information from this landing radar, as a result of reflection, for example, from the surface of the moon itself?

Mr. GAVIN. The testing we have done doesn't lead us to be concerned about the reflections from the lunar surface. We have been struggling with reflections from the vehicle itself.

Mr. RATHKE. NASA has acquired data that indicate that the reflectivity of the lunar surface is somewhat better than we had jointly