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National Security and
International Affairs Division

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April 15, 1992

The Honorable Daniel S. Goldin
Administrator, National Aeronautics
and Space Administration

Dear Mr. Goldin:

We have completed our survey of NASA's space suit alternatives (code 397040) and have briefed the staff of the Subcommittee on Investigations and Oversight, House Committee on Science, Space, and Technology.

We have decided to close out the assignment; however, before doing so, we wanted you to be aware of our survey results. They point to a need to reevaluate the decision not to support the development of a new space suit if estimates of Space Station Freedom extravehicular activity (EVA) requirements are increased substantially in the future.

Our work on this assignment disclosed that NASA's decision in 1989 to stop development of a new, high-pressure space suit (extravehicular mobility unit) for the station was budget driven and resulted from the need to make cuts in station projects to meet restricted funding levels. The decision was made to delete the new space suit and to continue use of the low-pressure space shuttle suit modified to satisfy space station era requirements.

Our survey indicated that if the EVA requirements were increased, several factors concerning space suits would need to be reassessed. They are (1) the life-cycle costs of space suit alternatives, (2) the risks of decompression sickness or space debris harming the astronauts, and (3) the estimated impact on astronaut productivity.

Although it was generally recognized that a new space suit could potentially provide lower life-cycle costs, and savings estimates were provided to the Congress, station officials were unable to provide us with any detailed cost analysis of the suit's life cycle to document the savings estimates.

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Consequently, we could not verify the underlying support for the analysis or determine the critical factors that, if changed, might provide valid reasons for you to reconsider the decision to continue with the current shuttle suit. For example, based on our discussions with station and shuttle officials, we believe that the number of EVA hours would appear to be a key factor affecting the amount of expected savings that could be realized in the future by investing in a new suit. It appears that as the number of planned EVA hours increases, the potential life-cycle cost savings to be derived from a new suit increases accordingly. We are concerned, therefore, that without an agreed upon life-cycle cost analysis of space suit alternatives, NASA may not know at what point an increased level of EVA should prompt reconsideration of the space suit decision.

Under the current approach, safety is also a concern. A new high-pressure space suit was expected to increase astronaut safety whether viewed in terms of risk of decompression sickness or exposure to space debris. Based on current operational plans, there will be a 4.7-percent risk that an astronaut will experience serious decompression sickness during an EVA. We were told this risk is the same as currently accepted on a space shuttle mission.

On the other hand, the original space station requirement would have limited this decompression sickness risk to 1.1 percent, without a requirement to prebreathe a high concentration of oxygen for a period of time. The shuttle suit could provide similar safety but only with an increase in the amount of prebreathing time, and with an adverse impact on astronaut productivity. Any expected reduction in risk would become even more important as EVA hours increase. Furthermore, it is clear that the risk to astronauts from space debris will also increase as the number of EVA hours increases. If a new suit could provide additional protection from space debris, these benefits would also take on added importance with increases in EVA requirements.

Another unavoidable consequence of continuing to use the low-pressure shuttle suit is a reduction in astronaut productivity. The current requirement makes it necessary for astronauts to prebreathe a high concentration of oxygen for at least 4 hours before each EVA to reduce the risk of decompression sickness; a new high-pressure suit could eliminate the need for prebreathing. Increases in the station

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EVA requirements may decrease astronaut productivity due to the necessary prebreathing time. Furthermore, if the planned prebreathing procedure before an EVA is followed, astronauts would be limited in their ability to respond quickly to an emergency that might require an immediate EVA.

As noted, each of these concerns would be exacerbated with an increase above the current estimate of EVA requirements for the station. As the station design matures, however, the EVA estimates may change. If the estimates increase significantly, we believe another review of the need to develop a new high-pressure space suit would be prudent. We would appreciate being informed if there are any changes in the space station program that would cause you to perform such a reevaluation.

We very much value the courtesies and cooperation extended to our staff by NASA personnel during the course of our work. If you have any questions about the information contained in this correspondence, please contact me on (202) 275-5140.

Sincerely yours,



Mark E. Gebicke
Director, NASA Issues

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