

HONR269i

To the Moon and Back: The Apollo Program

Discussion Questions

Session 23: Apollo 12: Precision Navigation

1. Adding up the total cost of flying the lunar landing missions and then dividing by the total number of minutes of moonwalks, it has been estimated that activities during a moonwalk cost a million dollars a minute in 1969 dollars; that's equivalent to more than \$5 million per minute today. On Apollo 12 the astronauts were working so quickly during their second EVA (the geology traverse) that they failed to adequately document the locations where they picked up rocks. Future astronauts would have been trained to work more carefully, and thus more slowly. But given the cost and the fact that this was a unique opportunity, there were always more things that needed to be done than there was time. The approach NASA chose to address this was to make the plan more flexible, so that things could be added or dropped depending on how much time earlier things had required. What would be the best way of doing this – plan too much and then drop some things if you really do get behind, or plan what you expect to be able to do but add some things if you find you have time for them? Who should make the decisions on which things to add or drop? How should they make those decisions? What factors should they consider?
2. Between Apollo 7 and Apollo 11, NASA was flying an Apollo mission about every 2.5 months. After Apollo 11's landing was successful, they could have continued to fly every 2 months, but instead they waited four months to fly Apollo 12 in order to allow for enough time for the more complex training for lunar surface operations and in order to allow enough time for the lessons from one mission to inform the design of the next one. But the costs NASA incurred continued to accumulate, since (almost) all the people still needed to be paid. Moreover, delaying missions could raise the chances that some might be cancelled, since it would put some of those missions in later budget years. On the other hand, the question of what would NASA do after Apollo ended would need to be addressed sooner if the missions were flown more quickly. Given these considerations, and others that you can come up with, what interval should NASA have planned between missions after Apollo 12? What would be the costs and benefits of the interval you have selected?
3. Neither the risk of the Apollo 1 fire nor the risk of the Apollo 12 lightning strike had been anticipated by NASA despite the physics of each situation being well understood by scientists long before the event occurred. Learning from mistakes is good, but not making bad design decisions would be even better. Clearly the Aerospace Safety Advisory Panel created after the Apollo 1 fire was not sufficient to anticipate and prevent the Apollo 12 lightning strikes. What more could have been done to identify this risk before the problem occurred? Should the ideas that you have come up with have been tried? Why or why not?