A second aspect of this is the necessity of keeping the gas produced by boiloff of the liquid in the top portion of the tank, so that gas alone—not liquid—will be vented overboard. In space there is no natural force to seat the propellant and keep it in place.

To maintain the hydrogen in a settled condition—as if the vehicle were standing upright on earth—designers must create an artificial gravity for the orbiting vehicle. The simplest way to do this is to accelerate the vehicle slightly, continuously, in its orbit. This acceleration must be sufficient to keep the hydrogen settled once the stage's small ullage rockets have settled it initially but must not use up too much fuel or accelerate the vehicle enough to change its orbit appreciably. The most promising way of providing this small continuing thrust is by venting the hydrogen tank itself—expelling beneficially the gases created within the tank by evaporation due to the heat input.

Boiloff gases expelled through two small nozzles pointing rearward gives the stage a minimum of about six pounds forward push which helps maintain the proper condition in the tank. This constant forward thrust keeps the propellants essentially settled. In the Saturn V mission, two 70-pound thrusters will fire just prior to restart of the main engine to "finish the job" and assure a completely acceptable state within the tank.

The LH_2 orbital experiment conducted on the A/S 203 flight verified the adequacy of the liquid hydrogen continuous propulsive venting system. The hydrogen fuel tank was instrumented to report to ground stations. Among the instrumentation was a television camera which sent pictures to four ground stations. Engineers observing TV monitors at the stations were able to see to what degree the fuel management techniques were successful.

In February, after the accident, we made several decisions. One of those was to proceed with the unmanned flights of the lunar module and the Saturn V Command and Service Module in the year 1967 (fig. 5, MC67–5782). Those decisions then are reflected in our planning.

The next slide shows the mission objectives of the AS–206 flight, which is an unmanned Lunar Module development flight (fig. 6, MC67–5779). There are three primary objectives, one is to verify the ascent and descent propulsion system and the Lunar Module structure. The second is to evaluate the staging. Here we have a basic kind of a

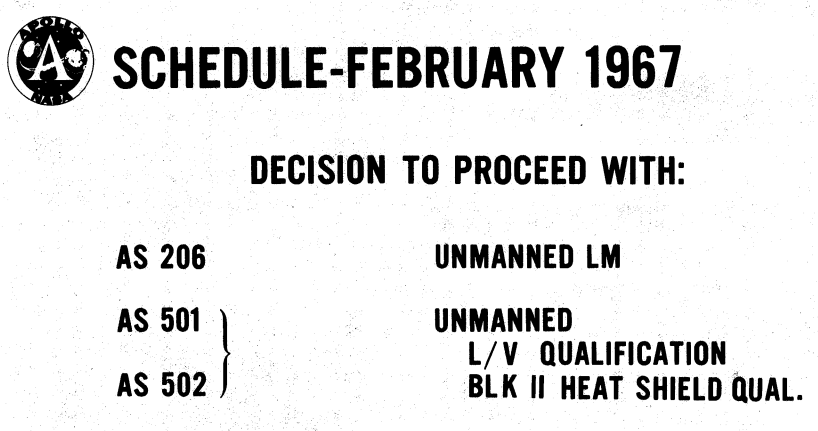

FIGURE 5