

AAP missions. Incidentally, cryo storage of oxygen has been utilized in all of our manned space flight programs to date, however, mission duration has a significant impact on storage system requirement. In order to liquefy oxygen, it must be cooled to below about minus 300° F. (the effect of pressure will not be discussed here). As heat leaks into the storage system, the oxygen will begin to "boil off" or convert from a liquid to a gaseous state with an attendant buildup in pressure. Therefore, the thermal and pressure characteristics of the oxygen cryogenic storage system must conform to the planned mission usage. A cryogenic storage system summary for oxygen is shown in figure 10. The current Apollo bottles (the best available) cannot meet our mission requirements and new bottles must be developed. (See fig. 11). The current Apollo bottles hold about 300 pounds each; therefore it would require a total of 12 to meet our 3,500-pound requirement. The size (26-inch diameter) and thermal performance of these bottles are proper for the missions to be flown in Apollo.

However, as shown on figure 10, we could not provide adequate oxygen for 56 days even if it were practical to use oxygen that matched this minimum boiloff rate. The new development AAP bottle will take advantage of two factors that improve thermal performance in meeting the oxygen system requirements (fig. 11). In the first place, we will make each individual bottle larger thereby improving thermal performance. The ratio of the mass of the liquid to the surface area through which heat can leak into the liquid (a significant system parameter) favors the larger bottle. Secondly, we will utilize some new techniques that will improve the thermal insulation between

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56 DAY MISSION OXYGEN SUMMARY - CRYOGENIC STORAGE

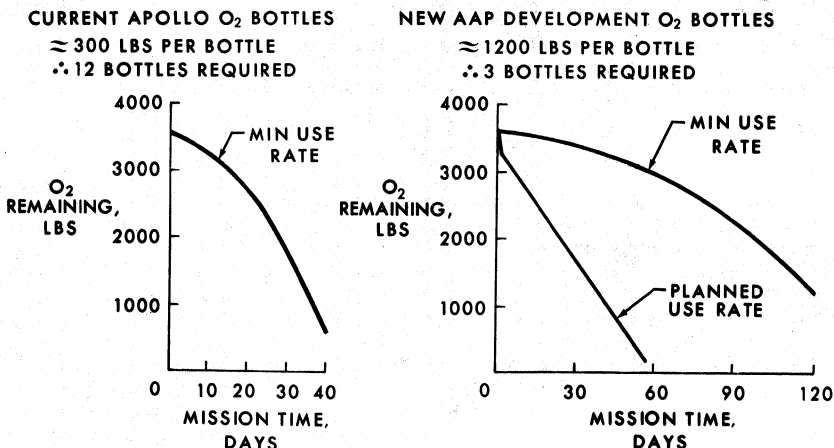


FIGURE 10