aerospace

DESIGN

Command module evolves

The Apollo command module design continues to evolve with each flight: at least seven changes were made in the Apollo 10 command module based on previous experience.

Space suit oxygen hoses, changed on Apollo 9 to fluorel plastic from beta-cloth-covered silicon for fear of abrasion, were changed back when Apollo 9 indicated little likelihood of abrasion damage.

Denser filters were provided on the optical tracking system to reduce glare in docking operations, but were made removable for star sightings.

Electronic components in the high-gain antenna were more rigidly mounted to resist vibration. Seals on the antenna pivots were replaced with simpler ones, when Apollo 9 showed that cold welding would not be a problem.

A docking probe component was more rigidly mounted in place to prevent it from accidentally jamming the probe open, which could prevent the command and lunar modules from firmly coupling together once they had performed their initial soft docking.

HYPER 3

Flat-bottomed shuttle

A new shape of lifting body, the proposed orbit-to-surface powered gliders being studied by the Air Force and NASA as possible crew shuttles or rescue vehicles, is being built for unmanned flight tests.

Called Hyper 3, the new configuration has a long, slender pointed shape with a flattened underside, in contrast to the broader trowel-like shape of existing versions. The shape was evolved at the space agency's Langley Research Center in Hampton, Va., and resembles some designs that have been considered in studies at the Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio.

Unmanned, instrument tests of the Hyper 3 would be run from the NASA Flight Research Center at Moffett Field, Calif. The new vehicle will be about the same size as existing lifting bodies such as the HL-10.

LUNAR LANDING

Apollo 11 schedule set

A minute-by-minute, albeit preliminary, plan for Apollo 11 lunar landing mission has been completed by the National Aeronautics and Space Administration, detailing events on the lunar surface as well as in flight.

The Wednesday, July 16, lift-off will take place at 9:32 a.m. from Cape Kennedy, with Astronauts Neil Armstrong, Edwin Aldrin and Michael Collins leaving earth orbit for the moon just after 12:16 p.m. and arriving in lunar orbit on July 19 at 1:27 p.m.

At 11:50 a.m. on July 20, the lunar module will uncouple from the command and service modules to begin its descent, with the historic touchdown on the moon set for 2:22 p.m. Nine hours and 50 minutes later, Armstrong will become the first man to set foot on the moon.

His first 15 minutes will be spent gathering a quick sample of lunar rock, in case an emergency necessitates a hasty take-off. Twelve minutes later, at 12:39 a.m. on July 21, Aldrin too will step out on the lunar surface, and the two astronauts will spend the next two hours deploying a television camera and scientific experiments (SN: 1/4, p. 17), and gathering more detailed samples.

At exactly noon, after rest and equipment checks, the LM ascent stage will take off from the moon, to rejoin Collins in orbit in the command module at 3:32 p.m. At 9:00 p.m. the flight home will be begin, with splashdown in the Pacific at 52 minutes 42 seconds past noon on July 24.

MARINER

Solar heat radiation

A new value for the amount of solar thermal radiation in deep space, labeled nearly twice as accurate as previous measurements, has been calculated, using equipment on the Mariner 6 and 7 spacecraft, now heading for summer flybys on the planet Mars.

According to the new data, the sun puts out thermal energy at a rate of 125.7 watts per square foot, compared with the old figure of 129.5. The probable error in the new value is one-half that of the old one, says Joseph A. Plamondon of the Jet Propulsion Laboratory.

The measurements were made by solar radiometers mounted at the end of each spacecraft's omnidirectional antenna mast, where the sensors would remain in sunlight with no chance of light being reflected to them from the spacecraft to distort the readings. Thermal shielding also keeps the instruments at a constant of 273 degrees F.

Exact knowledge of solar radiation is valuable to spacecraft designers because of the effects of temperature variations on equipment such as electronics.

In addition, the physical pressure of sunlight can actually alter the path of a spacecraft by thousands of miles on a long flight, and must be allowed for in launch and trajectory correction maneuvers.

LUNAR EXCURSION

LM models differ

Preliminary estimates before splashdown indicated that most lunar module difficulties encountered on Apollo 10 would be remediable by procedural, rather than physical changes. Certain differences, however, are included in the Apollo 11 LM destined to land on the moon.

One of the two LM cabin fans will be replaced with an additional liquid-cooling circuit, to enable possibly overheated astronauts returning from activity on the surface to receive cooling of 1,600 British Thermal Units per hour, compared with 800 from the fan.

To protect the underside of the LM from flying rocks, blast pressures and heat of the descent, the thin reflective shielding beneath the descent stage will be replaced with a heavier protective blanket.

Of the four landing probes which extend downward from the LM's four feet to signal contact with the lunar surface (as a cue to cut off the descent engine), the probe on the forward leg will be removed, since it represents a potential hazard of tripping space-suited astronauts descending the ladder on the front leg.