aerospace

LUNAR LANDINGS

Future Apollo sites

Besides the lunar site selected for Apollo 12 in November, the National Aeronautics and Space Administration already has tentative site plans all the way through Apollo 20 in the summer of 1972.

Apollo 12 will be launched Nov. 14 or 16 toward one of two sites in a western mare region, the Ocean of Storms, with somewhat different terrain characteristics than the eastern Sea of Tranquility, where Apollo 11 landed. A highland, flat region of the sort characterized by the Fra Mauro formation is the goal for Apollo 13, with Apollo 14 planned for the cratered highlands near the crater Censorius.

Subsequent missions are contingent upon funds to provide the necessary scientific instrumentation. Apollo 15, late in 1970, is scheduled to land on the dark, apparently volcanic material in the Littrow area of the moon. The next visit, Apollo 16, will be to the impact crater, Tycho, which was also the landing site of Surveyor 7 on Jan. 10, 1968, and which is believed by some researchers to be the source of tektites.

Apollo 17 is destined for the Marius Hills area, rich in volcanic domes. With Apollo 18, officials hope to shed light on the elusive lunar transient events, by aiming for Schroter's Valley in the transient-rich Aristarchus area. Apollo 19 will seek to tell whether the Hyginus Rille is volcanic in origin. Apollo 20 will look for deep-seated lunar material brought to the surface around the crater Copernicus.

BOOSTERS

Mixing and matching

As the space agency plans expanded missions for the future, it is continuing to seek more powerful and versatile boosters with which to launch them, without incurring the cost of developing new ones.

The latest step is a planned study to evaluate half a dozen combinations of Saturn rocket stages, the Centaur high-energy upper stages and solid propellant boosters and strap-on auxiliary rockets.

All six would use the Centaur as the top stage, and the Saturn S-4B beneath it. For their first stages, five of the planned boosters would use one of the following: the Saturn S-2 (first stage of the booster that launched the first manned Apollo flight); a 260-inch-diameter solid rocket; a cluster of 156-inch-solids; the Saturn 1-C (first stage of the Saturn 5), or the first two stages of the Saturn 5 itself (making a four-stage booster). The other idea would be a two-stage version with two 156-inch solid rocket motors strapped on to the S-4B.

COMMERCIAL AIRCRAFT

Quieter jets

A pair of experimental jet engines is being built and tested for the National Aeronautics and Space Administration by General Electric, as part of the space agency's research into quieter commercial aircraft.

Two approaches will be tried in the engines, with the goal of producing a turbofan some 15 to 20 decibels quieter than present engines. One is to reduce the tip speed, or rotational speed, of the fan and increase the loading on the blades. The other is just the reverse: To increase tip speed by lightening the blade loading.

Both fans will provide the same overall compression to air entering the engine, giving 4,900 pounds of thrust at cruising altitude and 22,000 pounds for takeoff. This is similar to engines on present Douglas DC-8 and Boeing 707 airliners.

It has taken two years to evolve specifications for the engines, under previous contracts, between GE and the NASA Lewis Research Center in Cleveland. The company will use its CF-6 and TF-39 engines, developed for the DC-10 airbus and the C-5A transport respectively, as cores for the new engines, which should be a major saving over developing entirely new hardware.

The NASA-sponsored project will be coordinated with the Federal Aviation Administration.

ORBITING LABS

Field narrows to two

The manufacturers of the Gemini and Apollo spacecraft have now become the only competitors in designing a large, earth-orbiting space station, planned by the National Aeronautics and Space Administration for the mid-1970's.

On one side is the McDonnell Douglas Corp. Besides having built the Gemini spacecraft, the company builds the S-4B booster, the third stage of the Saturn 5 launch vehicle, which is being adapted into the orbiting workshop of the Apollo Applications Program.

The competition is North American Rockwell Corp., which makes the Apollo spacecraft, as well as the engines of the Saturn 5. Eliminated is a team headed by the Grumman Corp., builder of the Apollo lunar module.

Each company will spend 11 months working out a program definition for the space station, mapping its evolution from drawing board to orbit. Besides designing a program for the basic 12-man station, intended for a 10-year lifetime with rotating crews, each company will include a basic design for a 50-man space station, to be assembled in orbit in the late 1970's or early 1980's.

EARTH ORBITERS

Ready-made laboratory

The first orbiting workshop in the Apollo Applications Program will be outfitted on the ground rather than assembled by its astronaut crew, according to the National Aeronautics and Space Administration.

The laboratory, designed for a wide variety of studies, originally was to have been launched full of fuel as the second stage of a Saturn 1B booster. Once in orbit, the astronauts would have vented any remaining fuel, then installed the laboratory equipment (stored in the workshop's spacecraft docking collar) in the spent stage.

The space agency has decided, however, to launch the workshop empty, already assembled, using the first two stages of the much more powerful Saturn 5 as the launch vehicle.