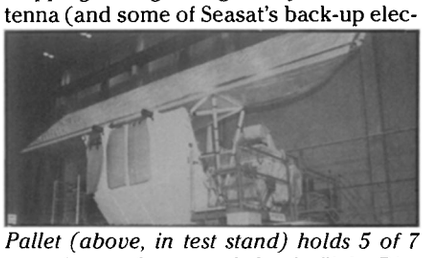
The Shuttle Gets Down to Business

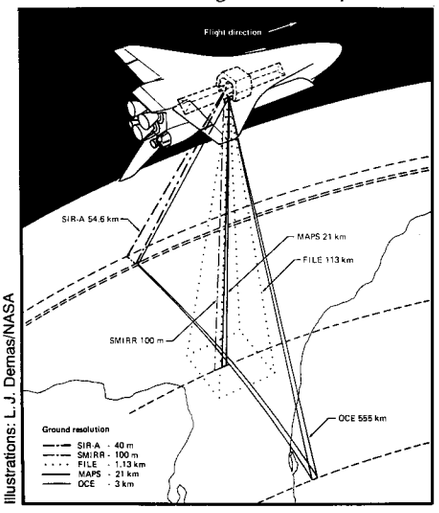
The recent flight of the space shuttle, although a resounding success, was still only a maiden voyage, with nothing but a package of test instruments occupying the craft's cavernous payload bay. The National Aeronautics and Space Administration plans three more test flights, extending well into 1982, before it is willing to certify that its complex, state-of-the-art vehicle is ready to be declared operational. Yet the upcoming mission, possibly due as early as Sept. 25, will be carrying nearly three tons of scientific experiments on the planned 100-hour flight.

Together known as OSTA-1 (for NASA's Office of Space and Terrestrial Applications), the payload consists of seven experiments, five of which will be mounted in the payload bay on a pallet that is the engineering model of the European Space Agency's Spacelab research module:

• **The Shuttle Imaging Radar (SIR-A).** In 1978, the Seasat satellite was launched with a sophisticated synthetic-aperture radar to evaluate the device for measuring wave heights and other ocean features. The instrument surprised its developers with its precise readings of elevations and surface roughness over land, and a similar unit is part of the OSTA payload to enable studies of the radar images for geologic mapping. Using a huge, 7-by-30-foot antenna (and some of Seasat's back-up electronics), SIR-A will operate over preselected regions with a total area about equivalent to that of the United States, providing 40-meter resolution both across and along the radar beam's ground track. Researchers hope that the data, combined with results from other radar systems and Landsat multispectral photography, can be used to identify such features as faults, rock types and exploration sites for oil and mineral deposits.



Pallet (above, in test stand) holds 5 of 7 experiments for second shuttle flight. Diagram (below) shows their respective spatial resolutions and ground "footprints."



Illustrations: L. J. Demas/NASA

• **The Shuttle Multispectral Infrared Radiometer (SMIRR).** Although Landsat data alone, covering a wavelength band from 0.5 to 1.1 microns, have not proved sufficient to distinguish among different rock types on the basis of their reflectances, studies with a field spectrometer indicate that many distinctions can be made with a band extended from 1.0 to 2.5 microns. The SMIRR will cover 10 bands over the whole 0.5-to-2.5-micron range, scanning geologic types around the world not for immediate commercial application, but as an aid to designing future mapping experiments. The experiment will evaluate such factors as the effects of atmospheric absorption, and the variations in reflectance of similar geologic units in different climates.

• **The Feature Location and Identification Experiment (FILE).** The broad coverage of earth-resources studies from orbit is a boon to users otherwise limited to small swaths and patches from lower-altitude sources such as aircraft, but the result is sometimes an unmanageably vast pile of data. FILE is an attempt to develop a system that can pre-censor its own information gathering. As a television camera scans the scene below, FILE's electronics will spectrally classify each image into one of four different categories — water, vegetation, bare gound, and snow or ice. After a predetermined number of scenes of each type have been recorded, FILE is designed to simply block the recording of additional such scenes. (Another built-in censor is a "sunrise sensor," which will keep FILE from operating except when the lighting is appropriate.) In an operational system, such a device could be set to photograph, say, global vegetation coverage, while automatically eliminating shots of oceans, deserts, and clouds. The key, however, will be whether sufficiently accurate spectral classifications can be made to enable proper censorship. To check, FILE will include an infrared film camera to photograph every scene the TV camera sees, recorded or not.

• **The Ocean Color Experiment (OCE).** Developed from airborne experiments carried aboard high-flying U-2 jets, OCE will attempt to map the distribution of marine algae, basis of the ocean food chain, by tracking the green color of the chlorophyll-a that is the algae's dominant pigment. The presence of algae can be an indicator of good fishing waters, as well as of the state of the marine ecosystem in general, such as in studies of its response to pollutants and chemical wastes. During the experiment, to include coastal waters off Peru, the eastern United States and western Africa, similar data will be gathered for comparison from surface ships and low-flying aircraft.

• **Measurement of Air Pollution from Satellites (MAPS).** Based on a sensor carried aboard the Nimbus G weather satellite, MAPS will conduct what OSTA-1 program manager Louis Demas says are the first global measurements of carbon monoxide distribution. The experiment will concentrate on the mid and upper troposphere (up to about 12 miles above the surface), tracing the movement of CO between the northern and southern hemispheres. An attached camera will photograph the cloud cover and terrain over which the data are gathered.

Two more tests will be conducted not from the payload bay, but from the crew cabin:

• **Night/Day Optical Survey of Lightning (NOSL).** The astronauts will use a handheld, 16-millimeter movie camera to photograph lightning flashes during night thunderstorms, guided both by their own observations and by meteorological information radioed up from the ground. There will also be a lightning alarm of sorts to catch the crew's attention, in the form of a photo-optical detector that produces an audible pulse in an earphone when it picks up a flash. In the daytime, the camera will be used to film the cloud structure and convective circulation in the storms.

• **Heflex Bioengineering Test (HBT).** The first shuttle flight of ESA's Spacelab module, now targeted for the 10th shuttle mission in mid-1983, is scheduled to carry an experiment to study the growth in zero-gravity of the dwarf sunflower plant. HBT consists of a suitcase-sized package containing 72 such plants, varying in soil-moisture content from 58 percent by weight (below which plant growth is minimal) to 80 percent (above which anaerobic conditions inhibit growth). The test is designed to indicate the amount of initial moisture that will produce the most plant growth when the Spacelab experiment is actually run.

The U.S. civilian space program faces an uncertain future in the present budgetary climate, but NASA at least is preparing to branch out in several directions. □