The space shuttle's oft-changing future

When 1984 began, the National Aeronautics and Space Administration's schedule for the space shuttle was showing 10 missions to be conducted before the year was out (SN: 1/7/84, p. 12). The first two have flown, but two of the remainder have been canceled and a third has been tentatively postponed until 1985, as have key items from the payloads of four others.

Yet five flights are still on the latest version of the list, with increasing numbers scheduled for upcoming years. And with the diversity and complexity of the shuttle's missions, carrying everything from individual experiments to whole satellites for a wide range of government and private customers—each with potential reasons for delay as well as NASA's own—the "manifest" that lists payload flight assignments is likely to be a continually evolving document.

The two canceled missions, for example, had both been assigned to the Department of Defense, and were scratched for DOD's reasons. Also shifted were the deployments from the shuttle of the second and third of NASA's Tracking and Data Relay Satellites, held up because of a problem with the upper-stage rocket that was correctly set out of the shuttlecraft, but which then placed the first satellite of the series in an incorrect orbit. On this year's first shuttle mission, two identical upper-stage boosters of another type suffered apparently identical malfunctions that mis-orbited a pair of communications satellites, which has delayed the deployment of Canada's Telesat I from the upcoming mission this month until next February. Other reasons for delays can range from difficulties with the payloads themselves to ensuring that no payload will have an adverse effect (such as from stray electromagnetic radiation) on others scheduled for the same flight.

And business is getting heavier. At present, NASA is listing 13 missions in 1985, 15 in 1986, 24 in 1987 and 18 through the first nine months of 1989.

One consequence of this is that the launchings will have to come closer together. The shortest span between launchings since the shuttle "went operational" in November 1982 has been the 60 days between the two takeoffs so far this year, and the upcoming mission (listed for June 25 as of this week's beginning) will represent at least an 85-day gap. Beginning after the following mission (designated 41-F, now targeted for Aug. 29), however, things will abruptly get a lot busier. Flight 41-G is scheduled to lift off only 33 days later, followed by flight 51-A 32 days after that and 37 more days to the year's final launching. During 1985, by the present schedule, the launchings from Cape Canaveral will come at intervals ranging from as little as 21 to no more than 43 days.

Present plans, in fact, call for one pair of shuttle launchings to be separated by only a single day. On Oct. 14, 1985, the original shuttlecraft, Columbia, is scheduled to take off from the Cape carrying the Spacelab research module and the largest astronaut crew yet—eight people. And on the 15th, Discovery (whose maiden flight is this month) is to become the first shuttle launched from Vandenberg Air Force Base in California, planned for a variety of military missions as well as to give access to pole-crossing orbits from which the whole world will pass beneath the shuttle's view.

Of the 98 shuttle flights now scheduled through September of 1989, 16 will be strictly DOD missions (though not all will be launched from Vandenberg), with DOD payloads to be included on 22 others.

To accommodate the heavy flight load in the coming years, NASA is doubling the size of its present two-shuttle fleet (Columbia and Challenger). Discovery joins the armada this month, while Atlantis will begin its career with a DOD mission set to take off on Sept. 20 of next year. The four craft will be used in an irregular rotation, though the maiden flight of Atlantis will begin a four-flight sequence in which it is followed by Columbia, Discovery and Challenger — the quartet of launches spanning 47 days.

Nearly half of the missions scheduled will carry communications satellites, to be deployed in orbit. Among the other payloads will be the European Space Agency's International Solar Polar Mission spacecraft (listed for launch on May 15, 1986), NASA's Galileo orbiter-and-probe of Jupiter (also May 1986), the Space Telescope (Aug. 1986) and the Venus Radar Mapper (April 1988). Also scheduled is a mission to repair the ailing Landsat 4 satellite in 1987, like last April's successful refurbishment of Solar Max. —*J. Eberhart*

Ancient Crete: Double dose destruction

The Bronze Age eruption of Santorini, roughly between 1200 and 1700 B.C., has been credited with an impressive list of feats. Scholars have tied it tentatively to the plagues during the exodus from Egypt, to the disappearance of that mysterious realm, Atlantis, and to the demise of the sophisticated Minoan culture on Crete. The actual date of the cataclysmic eruption still eludes scholars and scientists. Researchers from the University of Newcastle upon Tyne in England now report that the destruction at late Minoan sites on Crete occurred in two events separated by as much as 30 years. They also assert that earthquakes initiated by the eruptions may have caused the destruction on Crete.

In the June 7 NATURE W.S. Downey and D.H. Tarling describe their efforts to establish relative dates for deposits of eruptive products such as ash and denser volcanic debris from Santorini, and for artifacts from late Minoan sites on Crete 120 kilometers to the south. Their dating method, called archaeomagnetism, relies on the fact that super-heated materials retain a magnetic signature that records the intensity and direction of the earth's magnetic field when the materials were cooling. The researchers found that the magnetic signatures at archaeological sites on eastern Crete were identical to one another. They differed though from sites on central Crete where the ages also were consistent.

"These results were unexpected as it had been thought that the final destruction levels on Crete would have had similar ages," the authors write. They also were surprised to observe that the directions and intensities of magnetic signals for central Crete matched those of the heavy ashfall deposits on Santorini, whereas the directions from sites in eastern Crete matched those of the deposits that followed the volcano's paroxysmal eruption. During this second phase, the volcano collapsed, forming a huge caldera. Much of the island disappeared.

It has been known that the ashfall preceded the violent eruption, but researchers only now are demonstrating that a substantial interval, of from 10 to 30 years, may have elapsed between the eruptive episodes. Downey and Tarling support earlier findings that the ashfall did not contribute greatly to the downfall of Minoan culture. At most five centimeters of ash fell on the island, and this shower was mostly on eastern Crete, where civilization continued. The authors assert that the destruction on central Crete was caused by an earthquake, related to the volcanic convulsions, that might have led to intense burning if oil spilled and ignited. In central Crete only Knossos survived this phase.

The communities in eastern Crete also suffered intense fires due to seismic activity, the authors say. Their hypothesis differs in some respects from other explanations for ancient events. Haraldur Sigurdsson of the University of Rhode Island in Narragansett, for instance, credits the massive seismic seawaves that probably occurred with the eruption for much of the destruction, citing comparable waves mustered by the deadly eruptions at Tambora and Krakatau. Besides, he says, there are signs that the Minoan culture was already in decline, based on archaeological considerations. "Perhaps it was not as much of a holocaust as many people would have us believe." —*C. Simon*