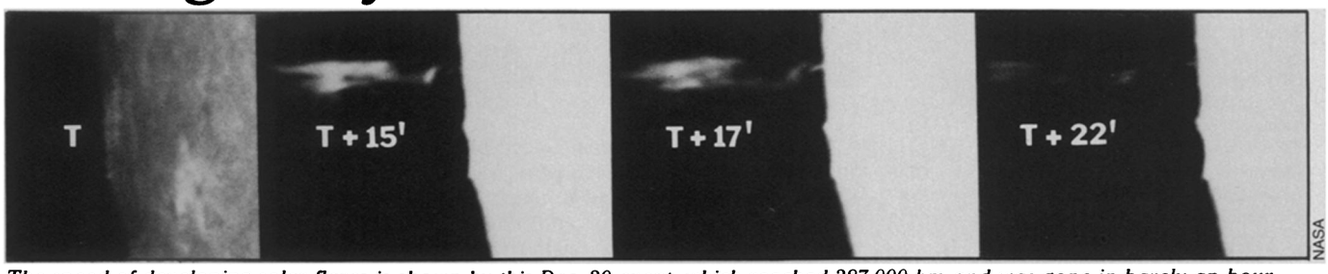
Casting an Eye on the Maximum Sun



The speed of developing solar flares is shown by this Dec. 20 event, which reached 287,000 km and was gone in barely an hour.

It may be upon us already, or there may be two or three months to go. But the maximum in the sun's 11-year cycle of activity is at hand, and that very uncertainty, in a factor that has been linked with phenomena ranging from radio blackouts to droughts, is a good illustration of the motivation behind the multi-nation project known as the Solar Maximum Year — actually a 19-month, 18-country endeavor that began last August (SN: 8/11/79, p. 103). A key participant in the project went on duty last week, with the Feb. 14 launching of a National Aeronautics and Space Administration satellite known as the Solar Maximum Mission, or Solar Max.

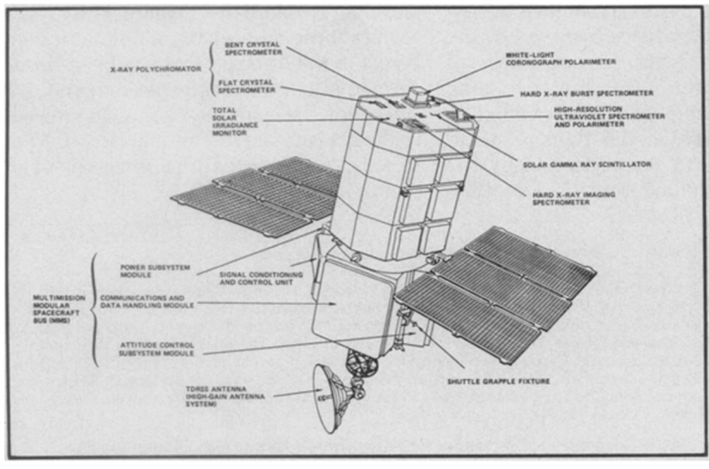
Carrying a suite of seven instruments, Solar Max will concentrate on solar flares — violent eruptions on the sun's surface — over a wide band of ultraviolet, X-ray and gamma-ray wavelengths. The instruments have been chosen to operate in harmony, monitoring high-energy X-rays from a flare's beginnings, shock-triggered gamma rays from its waning moments, and various effects as the huge energy surge propagates outward from the chromosphere through the inner and outer corona, into the depths of space — where, among other things, the earth lies.

Solar Max's seven principal scientists and dozens of their colleagues have their base of operations at NASA's Goddard Space Flight Center in Maryland, where, twice a day, they will receive flare data from about 20 ground-based solar observatories to help them plan the satellite operations on only a few hours' notice. Even this rapid response time is none too short, since flares can develop from a seemingly quiescent region of the sun, stretch outward for hundreds of thousands of kilometers and be gone in less than half an hour. To get a further jump on the sun, therefore, Solar Max has been designed to do some of its aiming on its own. One hard X-ray sensor with a relatively wide field of view, for example, will provide automatic positional information on the flares it detects to three more narrowly focused instruments, which can then slew around in seconds to take a look.

In addition, Solar Max's observations will be coordinated with data from several other satellites (such as the International Sun-Earth Explorers), sounding rockets and other devices. The present solar maximum will be the most widely observed in history, and possibly the most active since the one observed by Galileo in the early seventeenth century.

New knowledge of the sun, however, is only a part of NASA's interest in Solar Max. For, far from being just another instrumented probe, the device is the first in a new generation of satellites representing a radical change in a technological philosophy that has held sway since the beginnings of the Space Age. Traditionally, most satellites have been designed from the ground up (unless they are direct modifications of earlier models), with systems for attitude-control, data-handling, power and communications fully integrated each time into a totally new package. Solar Max, on the other hand, is the inaugural use of a design called the Modular Multimission Spacecraft (MMS), in which such components are standardized, pre-packaged into self-contained modules and mounted on an equally standardized frame. The cluster of scientific instruments — the "payload module" — is simply designed to match the MMS's bolt patterns, electrical connections and available "housekeeping" functions, and is then fastened on like any other module.

Designed at NASA Goddard, the one-size-fits-all MMS has been studied for its applicability to satellites ranging from a tiny, 200-pound weather-watcher called Stormsat to a four-ton astronomical observatory to a biology satellite that could keep animals as large as primates aloft for six months. A key to the idea's success will be the coming of the space shuttle, with its ability to retrieve broken satellites for repair on earth, or even to let astronauts fix them in orbit, by simply unplugging the faulty module and plugging in a new one. This could result in a decade of data from a single satellite, instead of requiring a series of two, three or four "old-style" satellites to achieve the same end. Although Solar Max is only planned for a two-year lifetime, it is equipped with a "grapple" for pickup by the shuttle, and NASA plans to do just that in late 1982 to show that the system works. Before bringing Max back to earth, furthermore, the shuttle crew may try swapping one of its modules as an additional test. The MMS is not for everyone — it's too heavy for most communication satellites, for instance, which need all the available weight for business — but NASA has estimated that over a decade, modularity and reusability could save more than $1 billion. (In another sign of times to come, Solar Max carries an antenna that will allow it to be tracked by NASA's planned Tracking and Data-Relay Satellite System, which will soon begin replacing many of the existing ground stations.) □



NASA

Solar Max spacecraft carries seven instruments, riding atop a standardized, modular section designed to handle many satellite designs.