tional Oceanic and Atmospheric Administration and the Commerce Department, say they expect it to pay for itself within six to eight years.

The main level of automation will be at the 52 Weather Service forecast offices, four national centers (for meteorology, severe storms, hurricanes, and climate), and 14 river forecast centers (see map). From there the system will be extended to some 225 to 230 smaller NWS field units.

The new system, dubbed AFOS (for Automation of Field Operations and Services), will have a vastly increased speed of transmission. A weather map will arrive on the TV-console displays in about 1/40th the time it takes on paper (15 seconds vs. 10 minutes for facsimile transmission of a standard 12×18 inch weather map). Printed matter will be transmitted about 30 times as fast (3,000 words per minute compared with 100).

Forecasters will be able to sit at the TV console unit and, by punching a few buttons, call up onto the screens a tremendous variety of weather maps, messages and satellite photographs, within seconds, to aid in preparing the forecasts for their areas.

One intriguing feature is designed to avoid another embarassing problem for weather forecasters: predicting clear skies just as it starts to pour rain, or predicting rain just as the clouds break and the sun comes out. Often this is due to the ponderous communications process that means the latest disseminated forecast is inevitably stale. The new system will obviously help there. But it also happens because the forecaster is often too tied up with routine duties to notice the developing divergence between his forecast and the weather. The new system will automatically alert the forecaster to such a discrepancy. The computers will continually compare incoming weather information with the predictions of the latest forecast. If the weather begins to vary from the forecast beyond predefined narrow limits the computer sounds an alarm. A high-pitched beeper starts sounding twice a second and a red light on the TV console begins flashing. It will continue to flash until the forecaster either revises his forecast or finds and corrects any error in the incoming weather data.

Radio and television stations, newspapers and Weather Service customers such as private meteorologists and airlines who have been receiving data by means of teletype and facsimile maps will continue receiving them as before, because the minicomputers are programed to drive these machines as well as to produce images on TV tubes. Later on, such subscribers may have the option of renting or buying the more sophisticated terminal equipment that will allow them to share more fully in the AFOS system.

Tests on the first "weather office of the future" incorporating the new equipment will begin soon at the Weather Service headquarters just outside of Washington. After the bugs are worked out, the new equipment will be gradually put into use around the nation. It may not result in any weather forecasting utopia, but says NOAA Administrator Robert M. White, "The public should receive a much higher quality of weather service than now." □

A rookie spacefarer aims for the stars

Your average experienced program manager at NASA would rather bet blind on the 1979 World Series than try to pick the exact month, several years in advance, that a satellite still in the barest idea stages would actually take off for orbit. The confident Dutch, however, have done just that, and this week appeared ready to collect on their bet—with their very first satellite.

Netherlands officials called their shot in 1969. August of 1974, they said, would be the target for launching that country's first space probe, a sophisticated skywatcher designed to study invisible ultraviolet and X-ray sources. This week, aboard a four-stage Scout rocket, the Netherlands Astronomy Satellite (ANS) was awaiting the signal that would send it into space from Vandenburg Air Force Base, Calif.

The Netherlands is hardly a major center of space research and development, even among European nations. It funds less than five percent of the European Space Research Organization and is doing less than three percent of the developmental work on Spacelab, the European laboratory module that will ride on several flights of the U.S. space shuttle in the 1980's. But the work that does go on there is respected: enough so that the Netherlands was selected as the site for the European Space Technology Center, ESRO's equivalent to the NASA Goddard Space Flight Center (although without the tracking and data-recovery capability—that's done elsewhere), where ESRO satellites are built and tested.

The Dutch satellite, however, is not an ESRO project. Designed, built and tested in the Netherlands, it is part of a cooperative program with NASA only because the U.S. space agency is handling the launching, providing one experiment and sharing in the data. The satellite itself is all-Dutch, a fitting entry into the unofficial but exclusive ranks of the world space club.

It is an ambitious start. Instead of being merely another simple atmospheric research probe, the usual opening bid from newly spacefaring nations, ANS is a junior version of the United States' elaborate Orbiting Astronomical Observatory satellites.

The major instrument aboard the 287-pound, steamer-trunk-shaped probe is its telescope, an ultraviolet instrument with a 22-centimeter aperture, provided by R.J.V. Duinen of Kapteyn Observatory in the Netherlands. An ultraviolet photometer with five channels between 1,500 and 3,000 angstroms will enable it to investigate the age, development and distribution of hot, young stars. Astronomers hope to learn more not only about individual stars, but about how groups of stars evolve and expand, as well as about the detailed structure of the Milky Way. Duinen also plans a study of the nature and distribution of interstellar grains—the material between the stars—particularly in regions where new stars may be forming. A prenatal study, so to speak. It will further be possible to integrate many of the continuum spectra from ANS with higher-resolution spectra obtained by U.S. astronomy satellites, to refine the classification of young stars.

In 1970, while ANS was still on the drawing boards, the Uhuru satellite was launched as the first orbiting probe devoted exclusively to X-ray astronomy. Uhuru expanded the number of known X-ray sources by almost seven times. Detectors for soft and hard X-rays, to be directed by A. C. Brinkman of the Space Research Laboratory of Utrecht in the Netherlands and Herbert Gursky and Herbert Schnopper of the Smithsonian Astrophysical Observatory in Massachusetts respectively, will examine a number of selected X-ray sources at high resolution. Part of the work will include time-studies of variable sources such as pulsars, whose X-ray emissions have periods as short as tens of milliseconds, as well as others that may have to be watched for several days at a time.

In part because of the pointing accuracy of the tri-axially stabilized satellite, the X-ray observations of ANS are likely to make major contributions to what is expected to become the major branch of satellite astronomy. A British-U.S. cooperative satellite called UK-5 is scheduled to be launched in October carrying six X-ray instruments, with four more to reach orbit in 1975 aboard another U.S. Small Astronomy Satellite. After that, X-ray studies from space will shift into high gear with the 1977 launch of the first High Energy Astronomy Observatory (see p. 130).

For a rookie spacefarer, the Netherlands is already moving in sophisticated company. □