want any more. A third reason that birth rates are falling in the 14 countries is that more and more women of reproductive age are using modern methods of birth control — especially the pill, male or female sterilization or an intrauterine device. In fact, the current drop in birth rates appears to tally closely with how many women of reproductive age are using contraceptives. For instance, Costa Rica is enjoying an impressive reproduction curtailment, and 78 percent of Costa Rican women of reproductive age are currently using contraception, whereas in Pakistan or Bangladesh, which are experiencing only minor birth rate drops, only 10 percent or fewer of fecund women are using birth control. Nepal's continuing high birth rate can be attributed largely to Nepal's limited family planning programs, particularly in remote areas of the country. Only 22 percent of Nepalese women of reproductive age have ever heard of contraception, and only 10 percent of them are currently using it. □

Atomic clock keeps super-cool time

Keeping time has been one of man's obsessions since the dawn of civilization. At first, it was done by a wedge-shaped imprint on a clay tablet to keep track of the lunar cycles or a slab of stone stuck in the ground to mark the arrival of the solar equinox. As science progressed, so did its methods of timekeeping — from sun dials and water clocks, to pendulums and balance wheels.

During the last three decades, timekeeping has been dominated by atomic clocks, instruments that provide a frequency standard by measuring the oscillations of atoms or molecules. These devices brought time into the realm of the ultra-precise. Millions of years might pass before such clocks would lose one second. But researchers at the Harvard-Smithsonian Center for Astrophysics are trying to improve on that precision.

The accuracy of present-day atomic clocks is limited by the thermal noises inherent at room temperatures. Those noises can be reduced by entering the world of the super-cold, where temperatures approach absolute zero (−273.16°C). There is one problem, however, in doing this. Atomic clocks, like hydrogen maser clocks, may stop oscillating when they are cooled. Robert F. C. Vessot, Edward M. Mattison and Eric L. Blomberg recently overcame this obstacle by coating the super-cooled maser cavity with carbon tetrafluoride. With the CF_4 frozen on the interior surfaces of the cavity, the oscillating hydrogen atoms could be reflected off the walls without becoming perturbed, thus preserving the phase of the oscillations. By doing this, the three researchers were able to keep a hydrogen maser clock working at temperatures as cold as 25° Kelvin (−248.16°C).

"The clock was going like gangbusters," says Vessot. "It finally quit oscillating at 25°K, but we believe that was due to our running out of helium in the cryostat [apparatus for maintaining the low temperature]." The researchers cannot measure the accuracy of their super-cooled clock until they have a second clock with which to compare. They are now in the process of doing that. But calculations show that a hydrogen maser clock cooled to 25°K would have to run 300 million years before it would lose one second of time. This is six times better than the hydrogen masers currently in use. "We're now aiming to get it down to 4°K where the accuracy would be even better," Vessot told SCIENCE NEWS.

The Center for Astrophysics has been developing such maser clocks for long-baseline interferometry and satellite-tracking systems. Three years ago Vessot, in collaboration with NASA, launched one such clock into space to see how its frequency changed as gravity changed, an outcome predicted by Einstein's theory of general relativity. It was the first atomic clock sent into space for a relativity test.

One application of a cryogenic maser lies in the field of experimental gravitation. Such a super-cool clock could be put on a space probe to help in the search for gravity waves and provide clues toward understanding the sun's mass distribution and angular momentum. □

NOAA-6 satellite aloft

The TIROS-N satellite launched last Oct. 13 for the National Oceanic and Atmospheric Administration has been more than just another conventional weather-watcher. Besides providing twice-daily scannings of the land, sea and air, it monitors solar radiation above the atmosphere (which can affect events ranging from long-distance communications to the descent of Skylab) and relays data from numerous other sensors such as balloons and buoys. And now TIROS-N has a twin.

Called NOAA-6, the newcomer was launched on June 27, underwent a checkout period and was declared operational on July 16. The two satellites provide data for use in predictions by the National Weather Service, timed so that TIROS-N's information aids in preparing afternoon forecasts, while that from NOAA-6 is assigned to the morning line. The devices are the first two in a planned series of eight satellites in the program, with the next launching scheduled for 1980. NOAA hopes to keep two such satellites in orbit at all times through 1985. Besides their daily tasks related to periodic forecasting, TIROS-N and NOAA-6 also have research roles in the ongoing Global Weather Experiment of the Global Atmospheric Research Project (GARP). □