

Global Positioning System Now 24 Hours

The satellite location system is called NAVSTAR/Global Positioning System. It's been over a decade in its implementation, and now more than half of the proposed 21 satellites, plus 3 spares, are in perfect orbit to provide most parts of the country 24-hour-a-day position fixes. And for the emergency communicator, a precise latitude and longitude coordinate of the discovered crashed aircraft is a far better message to transmit than "We are just a little left of the big peak, about 1/4 mile from the grassy knoll, and a little over to the left." The new handheld GPS receiver will allow you to pinpoint your coordinates to within 100 yards of your actual position, day or night, anywhere in the continent, within 1 second of hitting the "fix" button.

The Global Positioning System will be the new national standard for position determining on land, in the air, and at sea. Not only will the orbiting satellites read out your exact location, but you will also know your height, velocity, and magnetic heading with a dynamic range greater than 1 second of your motion.

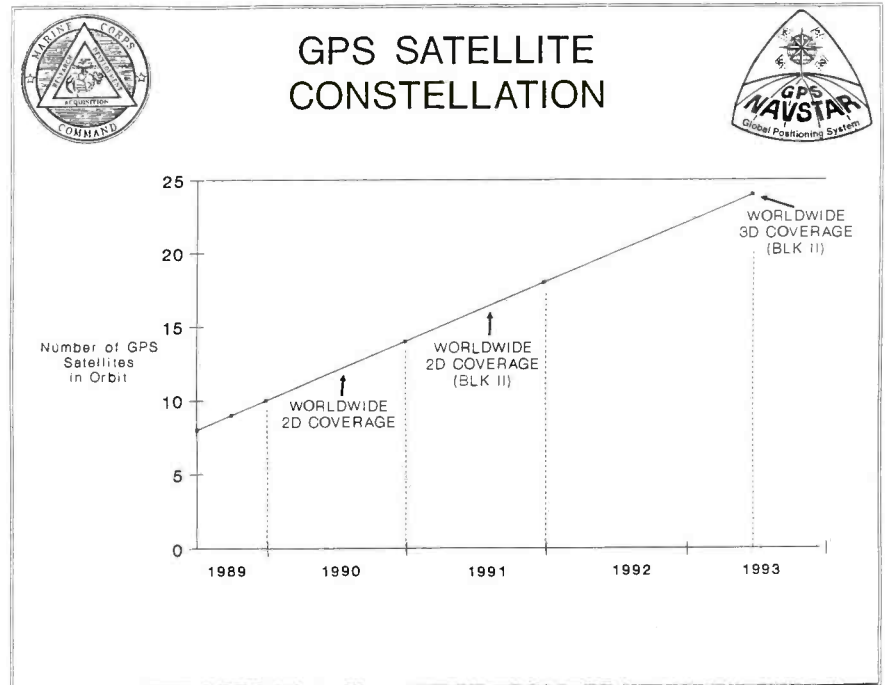
"Our Magellan NAV-1000 portable GPS receiver continuously collects almanac satellite data when operated in the continuous mode. This almanac data, a schedule of satellite positions stored in memory, allows our receiver to update the position of the operator every second," comments Richard Sill, Vice-President/Marketing & Sales, of Magellan Systems.

The GPS satellites serve as known reference points, and the receiver on earth determines its position by timing how long it takes radio signals from the satellites to arrive, comparing this data to the almanac information. The receiver then triangulates the position.

The GPS satellites transmit near 1,500 MHz, 10 times higher than the 155 MHz search and rescue band. A very small antenna captures these microwaves, and the radio waves are unaffected by engine noise, aircraft engines, skip, and atmospheric noise.

The satellites time their transmitted pulses with an onboard atomic clock. This \$100,000 clock is not nuclear powered, but does rely on the oscillations of a particular atom as a time reference. Your portable GPS receiver compares the time of the data transmission with its own clock in order to figure out the satellite's range. Receiver clock error is corrected by averaging the estimated ranges of several satellites until they intersect at a specific point.

A phenomenal accuracy of better than 25



GPS receiver with built-in electronic chart to better visualize your position.



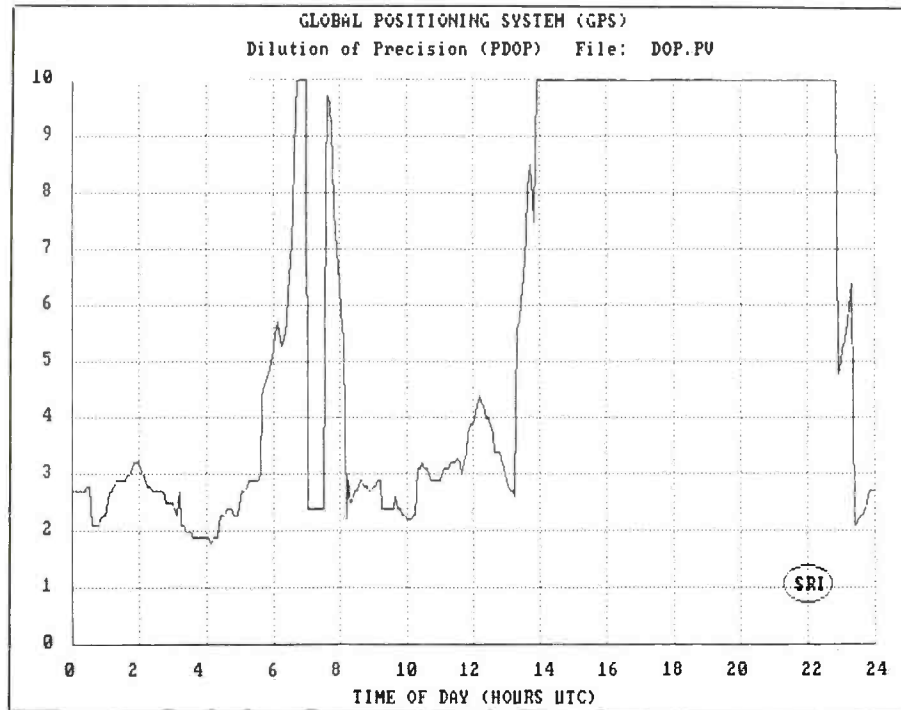
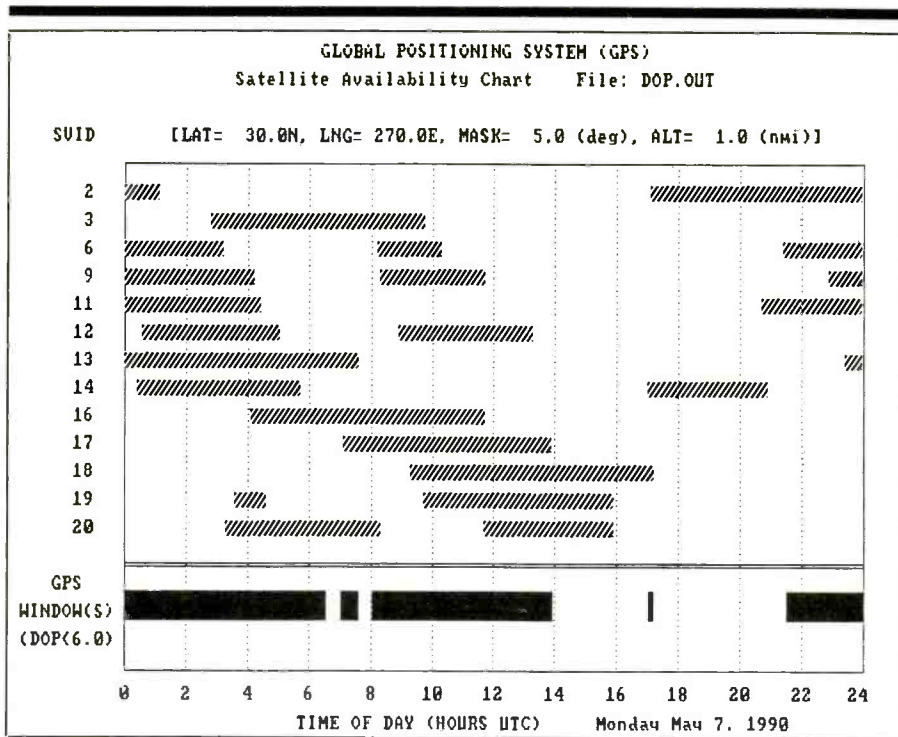
Gordon West tests new mobile GPS set on Harbor Patrol boat to mark the spot of a light plane crash in the ocean. Courtesy Gordon West.

yards of your precise position has been achieved until last June. In June, the Department of Defense "fuzzed up" the incoming signals, called Selective Availability, and this has now degraded our precise position information down to 100 yards, which is 300 feet. And 300 feet is worst case S/A. Most of your fixes will be better than 100 feet of your precise position.

By the end of this century, the new GPS navigation system may cause the phase out of more traditional forms of radio location, such as radio beacons, Loran, transit satellite, Omega, and aeronautical Omni and Tacan. By the year 2000, GPS will become

the national standard for surveyors, mariners, aviation, and rescue squads like yours, needing precise position information to transmit back to the rescue coordination center.

There are over 20 manufacturers of GPS receivers priced under \$5,000. The majority of these GPS receivers are designed for 12-volt permanent mounting in a boat, in a vehicle, in an airplane, or unattended operation on overland transportation devices where automatic transfer of position information is broadcast back through alternate satellite systems. In other words, a trucking company will know instantly where their ve



hicles are, all over the United States.

But it is the portable GPS receiver that holds the greatest promise for emergency communicators attached to cover the wilderness areas where there is not a benchmark or sign post for hundreds of miles.

Magnavox (2829 Maricopa Street, Torrance, CA 90503; 213-618-1200) has been producing "Man Pack" military GPS receivers for several years. Their tiny sets operate up to 12 hours between charges, but like most Magnavox gear, is priced "sky high" for civilian users. But that didn't stop Trimble (585 N. Merry Avenue, Sunnyvale, CA 94086) from developing a similar

looking device called "Trans-Pack", a completely portable receiver which sequences through the satellite under track at a rate of 50 times a second. This is more technically called "fast sequencing multiplex receive." The rate at which they sequence enables these receivers to read all the message bits from each satellite under track, typically 4, which transmitted at a rate of 50 bits per second. This fast sequencing portable receiver is quick to respond to a quick change in direction from an aircraft.

Magellan (260 E. Huntington Drive, Monrovia, California 91016), the first to premier an under-\$3,000 portable receiver,

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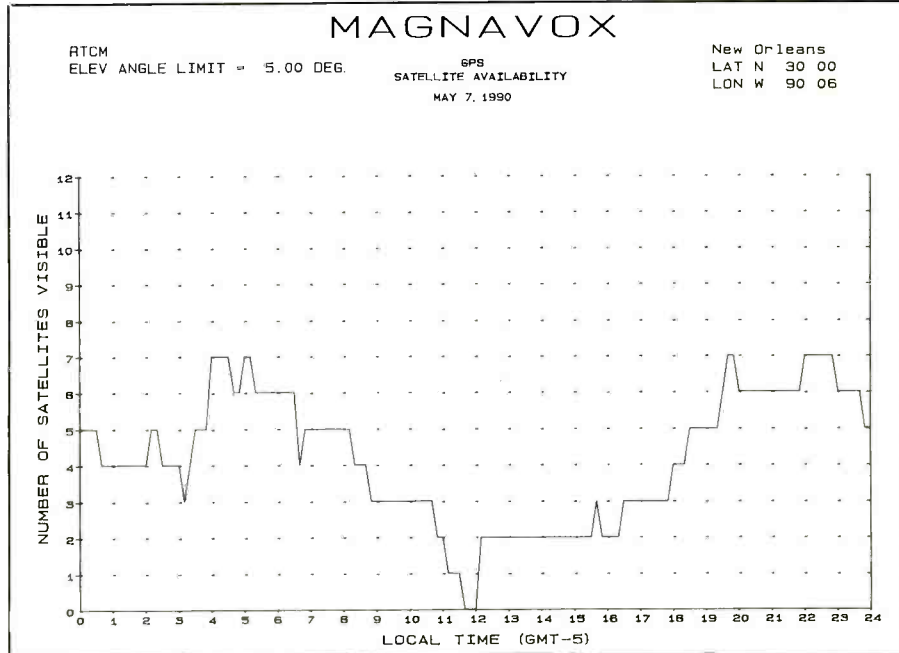
CIRCLE 51 ON READER SERVICE CARD



The portable Magellan receiver will also indicate direction to a stored "Way Point." Courtesy Gordon West.

keeps track of all satellites by single channel slow sequencing to establish pseudo-range measurements, plus almanac data. Although you might think that the Magellan unit might not react quickly to changes in direction as the Trimble set, its unique circuitry is quick to respond to any change in speed or heading that you should take. It's also the lowest priced unit on the market, now selling for around \$2,300 new.

A brand new GPS receiver has been announced by Pro-Nav International (11206 Thompson Avenue, Lenexa, Kansas 66219), which weighs only 25 ounces and measures 6.25 inches x 2 inches x 3.95 inches. The display is an easy-to-read, illuminated LCD with LCD back illumination for each keypad for nighttime operation. The receiver allows the GPS-100 form Pro-Nav to track up to 8 satellites and provide continuous navigation updates while consuming less power and space than any other system on the market. "The unit's built-in in-



Excellent GPS satellite coverage, except for an hour in the early morning.

telligence makes the receiver operation completely automatic and extremely easy to use," comments Gary Burrell, a well-known search and rescue flyer who was formerly with King Radio.

"We even have a built-in simulator for self-teaching someone who is not familiar with how a GPS receiver works," adds Burrell.

The suggested price for this completely portable GPS receiver is well below \$3,000.

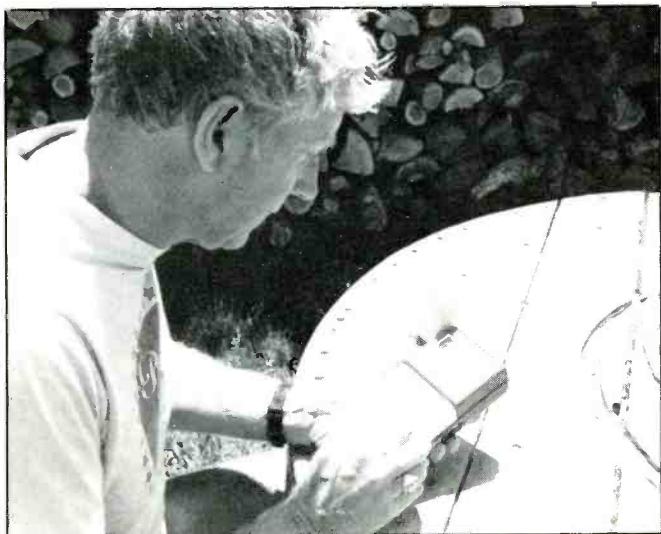
But there are some things that a GPS receiver can't do for the user—in deep canyons, it might take longer to acquire the orbiting satellites because the satellites must be in view of the tiny antenna. This also means the unit absolutely won't work in tunnels, deep inside an aircraft with no view of the horizon, nor underwater in a search sub.

For vehicle use, an external antenna will be required in order to "see" 3 or 4 satellites for a quick fix. Recently, the Department of Defense adjusted the orbits of the satellites coming over the U.S. to give us more available hours of day and night operation—now approaching 24 hours.

And every time you hear of a new successful launch of a GPS satellite aboard a modified Delta rocket, do know that it will add more and more satellites in the NAVSTAR orbit.

If your communications team is considering position finding instrumentation equipment, GPS is now your logical choice. Now that we have 24-hour-a-day coverage, there is nothing close to it for finding yourself within several feet of where you really are within 1 second.

PC



Gordon West operates portable Magellan 1000 GPS receiver for a quick position fix. Courtesy Gordon West.



Portable GPS receiver reads out position and bearings within 300 yard accuracy. Note small 1.5 GHz antenna on top of portable GPS set. Courtesy Gordon West.