TELONICS QUARTERLY™

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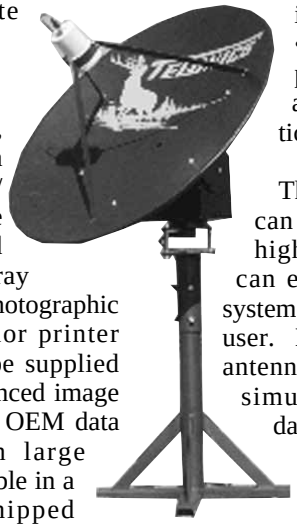
tiris™

Telonics Interactive Remote Imaging System

For the past several years, Telonics has been developing a low-cost system that would allow users to automatically schedule, acquire, process and image data from all HRPT-like satellites in an interactive, mouse-driven environment. The result is **tiris**, our new Telonics Interactive Remote Imaging System.



Completely Integrated

A self contained system, **tiris** includes tracking antenna and receiver/demodulator/ sectorizing subsystems, image processing hardware and software, continuous tone gray scale printer interface, and photographic quality high resolution color printer interface. The system can be supplied for stand alone use with advanced image processing capabilities or for OEM data acquisition integration in large workstations. It is also available in a version which can be shipped worldwide via United Parcel Service. This model offers a 1.5 meter reduced wind resistance parabolic antenna.

The outdoor assembly, including tracking antenna and positioner, is available in steel construction (standard) or low corrosion aluminum alloy (professional grade). The indoor equipment includes an integrated antenna control/ receiving system for coverage of all HRPT-like polar orbiting/LEO Satellites, including NOAA-HRPT, P.R.C. Fengyun (FY) and SeaWiFS/ SeaStar™.

Software Capabilities

The high speed miniature workstation operates in a 3 button mouse-driven graphics environment. It features 10 bit resolution for data handling and storage, and automatic pass inversion to eliminate upside down displays.

tiris is being interactively developed with the user community on a continuing basis and all specifications represent minimum capabilities:

- High resolution, full color graphic display of realtime and predicted satellite positions, tracks and relationships.
- Advanced 14-day scheduling with the ability to set start/stop points in a graphics environment.
- Automatic realtime video display of data acquisition with key stroke selection of all display (including zoom) and video characteristics.
- Sophisticated map generation capabilities merging a coastline and political boundary database and topographical database relating altitude to color.
- Extensive imaging and printout capabilities with an advanced Toolbox for sophisticated image processing.

The integrated printer interface can be configured for multiple high-resolution printers which can either be supplied with the system as an option or added by the user. Multiple workstations at the antenna site can be connected for simultaneous ingestion of live data with parallel, independent image processing.

An Affordable System

In developing **tiris**, we have carefully extracted the most cost effective features from our larger systems and developed new hardware and software that is both powerful and easy to use. You don't have to be programmer to manipulate imagery data with this system. Although **tiris** was not designed to replace high end workstations, it provides many professional capabilities in a user friendly, totally integrated environment at an affordable price. As a stand alone system designed primarily for educational institutions, the base price is $19,500 without a printer.

Applications

The system provides the professional science community already using HRPT data with the opportunity to acquire their own realtime satellite data acquisition and imaging capabilities. It also provides educational users with the opportunity to introduce students of all ages to satellite data, its technology and applications to meteorology, climatology, vegetation studies, fire control, geography and a variety of other environmental study applications.

The Telonics .I compressed data format and sectorization capability allows distribution of selected 10-bit deep raw data files as well as processed images via modem or networks. Unprocessed data can then be processed at sites remote from the antenna location. Stand alone **tiris** software packages are available from Telonics for educational institutions.

Upgrades Available

tiris specifications are conservatively rated and based on years of experience in designing, fabricating, and deploying AZimuth-over ELevation earth stations. The system will accommodate improvements in technology, and upgrades will require little or no hardware modification over the next few years.

Telonics is also committed to evolving the **tiris** software to accommodate new data streams, and providing upgrades at the lowest possible price. Free exchange of customer generated matrix filters, help screens, etc. is encouraged and system bulletins will be provided on a timely basis via the **tiris** bulletin board system.

For those of you not familiar with our THRPT-2 professional grade earth stations, the RF capabilities of THRPT-2 systems include the highest reliability in design, materials and processes, as well as the most advanced large signal handling capabilities available. The **tiris** system can be easily upgraded at any time to the capabilities and hardware of our higher end system configurations, or users can put together a custom configuration at any performance level between the THRPT-2 and **tiris**.

For more information, contact us for a full color booklet.

Microprocessor Controlled VHF Transmitter

Telonics has been using microprocessors (MPU's) to control various transmitters and receivers for years. ARGOS PTT's and the TR-4 Receiver are two examples. In the past, the extremely low current and low voltage requirements of VHF transmitters used in so many tracking studies made an MPU controller impossible. However, the newest MPU technology allows operation down to 2.0 vdc and at current levels of 15-20 microamps. This opens the door to the development of "smart" VHF transmitters and a broad range of new applications for research biologists.

MPU controlled transmitters provide capabilities beyond those offered by any other VHF transmitter designed for tracking and/or wildlife monitoring. These new capabilities include duty-cycling (turning transmitters ON and OFF at predetermined intervals), transmission of an ID code in the pulse stream, and transmission of activity indices. More traditional options such as mortality sensing and position sensing (e.g. head up, head down) remain available but with increased flexibility. Features will likely be expanded as new requirements are outlined by researchers.

The transmitter electronics in the new MPU controlled units measure 2.6 x 1.6 x 0.6 cm (1.0 x 0.6 x 0.25 in.) and weigh about 4 grams. They can be combined with various power supplies and packaged in numerous ways, allowing substitution for the existing transmitter in most of our VHF transmitting subsystems without an increase in package size or weight. Completed subsystems including the MPU transmitter will be available from about 20 grams and up.

One of the unique features of the MPU controlled transmitter is its duty-cycling capabilities, which can include up to eight different periods. In each period the transmitter can be enabled or disabled. The pulse rate can also be set independently for each period the transmitter is enabled. For example, in order to prolong life of a subsystem, transmission could be limited to 12 hours per day, or 3 days per week, etc. Alternatively, some species may be easiest to capture and mark at certain times of the year, but data collection may be primarily important at another time. The MPU controlled transmitter could be disabled until the period of interest, or enabled at a slow pulse rate and/or low intensity duty cycle until the period of interest. At that point, the transmitter could switch to a faster pulse rate and more intensive part of the duty cycle in order to make monitoring easier.

Another proposed application for studies of animal mortality is to operate many transmitters, perhaps on the same frequency, which remain disabled until the animal dies. The transmitters could be programmed to begin transmitting an ID code regardless of mortality status at the end of the study period. This would help eliminate bias caused by movement of animals out of the study area or by damaged transmitters. The ID code option allows a three-digit code to be periodically inserted in the pulse stream as a rapid series of pulses. In addition to use in mortality studies, this option could be utilized in other applications where it is necessary to operate multiple transmitters on the same frequency.

Transmitters with traditional mortality/motion sensors send an "inactive" pulse rate when there have been no triggers of an internal switch within a user-specified period, and they revert to the "active" pulse rate if the switch is triggered at least once. Such transmitters typically work well, but confusion sometimes results since scavengers can reset transmitters to the active pulse rate. With MPU controlled transmitters, user-defined thresholds determine when to switch from active to inactive state, and vice versa. For example, a researcher may decide to utilize a mortality qualification period of 6 hours, with less than 2 switch triggers during this period causing the transmitter to revert to the mortality pulse rate and 10 or more switch triggers during a following qualification period required to revert back to the active mode. Mortality/motion qualification periods of between 8 seconds and 6 days are available, providing the ability to collect motion or activity data over various time periods in accordance with individual project goals.

An index of activity data can also be collected. The microprocessor counts the number of switch transitions over a user-defined period and compares this number to a set of user-defined threshold values. The activity index is calculated based on this comparison and periodically transmitted until updated by a new value.

If you think the MPU controlled VHF transmitter would be useful, please contact our laboratory and we will be glad to discuss your application.

Bill Burger and Laron Swapp

New GOES Data Collection Platforms (DCP's)

Editor's Note: *Telonics has just completed the development of two new Data Collection Platform (DCP) transmitters for use with the GOES data collection system. The TGT-1 has been NOAA-certified for domestic use and the TGT-2 for international use. These cost-competitive units are smaller and technically superior to existing units on the market. They support a standardized serial interface which allows data to be transferred from data loggers to the DCP for uplink. For limited data collection applications, the GOES unit can accomplish the data collection role directly without the need for a full data logger.*

The GOES System

GOES is an acronym for Geostationary Operational Environmental Satellite. Managed by the National Environmental Satellite Data and Information Service (NESDIS) of NOAA, its primary function is to provide timely weather information and collection of environmental data on a regional basis over most of North and South America and the surrounding oceans.

The GOES satellite supports several instruments:

- Visible/infrared spin scan radiometer (VISSR) that transmits B&W images of one third of the earth every 30 minutes.
- Atmospheric sounder (VAS) for determining altitudes and temperatures of clouds.
- Space environmental monitor (SEM) to investigate solar particle emissions.
- Data collection system.
- In addition, one of the GOES spacecraft is capable of transponding signals from emergency locator transmitters aboard ships and planes.

The data collection system receives and relays a wide range of environmental parameters from sensors attached to the data collection platforms. Sensors monitor precipitation, river flow rates, river level, seismic activity, tides and other weather-related parameters.

The GOES spacecraft are in geostationary orbit at approximately 22,300 miles above the equator. Because of the great distance to a satellite in geostationary orbit, the DCP's must have a high output power (10 - 40W) to make the link. There are both stationary and

mobile applications for DCP's.

In stationary applications, a 10W DCP is used with a directional antenna which is pointed at the satellite. Directional antennas have high gain (8 db typical) and are available commercially at a cost of between $200 - $400. Telonics plans to introduce a low cost antenna specifically designed to support GOES DCP's within the next several months.

Mobile DCP's generally require a higher power output transmitter (20 - 40W) and an omni-directional antenna (lower gain) because they usually cannot use a directional antenna.

The GOES system provides a total of 232 channels for users to uplink messages, 199 regional and 33 international. The current data transmission rate is 100 bits/sec although higher data rates are planned. A typical assigned transmit window of 1 minute would allow 355 bytes of data to be sent (allowing for preamble and 15 second guard bands). Longer transmit windows can be applied for through NOAA.

GOES users are primarily U.S. based government agencies, private U.S. and non-U.S. users when sponsored by a U.S. based government agency. Use of the Data Collection System is limited to the collection of environmental data. There is at present no charge for use of the system. *Note: For more information, contact: Chief, Data Collection and Direct Broadcast Branch (E/SP21), National Environ-mental Satellite, Data and Information Service, NOAA, Washington, D.C. 20233.*

Data relayed from GOES spacecraft is received and demodulated at the NESDIS ground station in Wallops Island, Virginia, and relayed via a high speed link to the Central Data Distribution Facility in Camp Springs, Maryland. From there the information is processed and routed to the proper user queue. The data may be accessed through phone lines with use of a modem and is also available through a satellite downlink called DOMSAT.

METEOSAT and GMS System

The European METEOSAT satellite is managed by the European Space Agency (ESA). GMS is jointly managed by Japan's National Space Development Agency (NASDA) and the Japanese Meteorological Agency. METEOSAT and GMS are similar systems and part of the joint World Weather Watch. Telonics plans to introduce a METEOSAT DCP by the end of 1993.

In the meantime, the TGT-2 is certified on all shared channels designated as international by GOES, METEOSAT and GMS.

System Capabilities

A Data Collection Platform subsystem consists of a DCP, one or more sensors, battery and battery charging system (usually solar), directional antenna and, in many applications, a data logger. In operation, the data logger takes measurements from various environmental sensors and formats the information for transmission. Since the Telonics transmitters support data buffering, the data logger can immediately offload the data to the DCP. The DCP can also be used as a stand alone (without data logger) for single sensor or less intensive data collection applications.

Both TGT-1 and TGT-2 have 10 watts of output power during transmission, which requires approximately 2.1 Amps input current at 12 VDC and +25° C. They have been designed for operation over the temperature range of -40° C to +70° C (exceeding both NOAA and ESA requirements). The average quiescent current drain on each unit is approximately 9 mA. Overall dimensions are 8.9 x 18.3 x 11.2 cm (3.5W x 7.2L x 4.4H in.) and weight is approximately 0.95 kg (2.1 lbs.).

Three transmit modes are available in TGT-1: self-timed, random, or a combination of self-timed and random. In the self-timed mode, the DCP transmitters are programmed to transmit only within specific time windows, usually several times per day. In random mode, which is generally reserved for transmitting data exceeding an "alarm" threshold, the data is transmitted virtually immediately. It is then repeated several times at random intervals to improve the odds of being received. TGT-2 is restricted to self-timed operation only.

TGT-1 and TGT-2 are intelligent DCP's and contain microcontrollers to manage a 300 to 9600 baud serial interface (TTL or RS-232 level), buffer transmit data, schedule transmissions and perform other functions. Each DCP supports a command set which includes operation codes for initialization, obtaining unit status, and transfer of data. Both units have a 2 Kbyte buffer for storing self-timed data. In addition, the TGT-1 supports a separate 2 Kbyte buffer for storing data to be transmitted in the random mode.

Telonics GOES DCP transmitters contain the first implementation of a digitally temperature compensated crystal oscillator (DTCXO) in a GOES transmitter. The high stability oscillator prevents the frequency from drifting into adjacent channels. The microcontroller monitors a temperature sensor via an analog-to-digital converter and calculates a digital word which is output to a digital-to-analog converter that generates a compensated tuning voltage for the crystal oscillator. Performance of the oscillator is excellent and it typically has less than ± 0.1 ppm drift over the operating temperature range. The benefits of digital compensation as opposed to analog (thermistor) compensation are lower cost and tighter control of the frequency drift. An ovenized oscillator, while often providing less drift, historically requires substantially more current and is more costly.

To meet the required timing accuracy, the DTCXO provides timing to a real time clock that manages the transmit window scheduling. Once deployed, TGT-1's clock is capable of running (within GOES specifications) for 420 days without adjustment. TGT-2's time before adjustment is 240 days and is shorter because of a tighter time drift specification for the international platforms.

NOAA has certified that the Telonics regional and international DCP's meet all required standards. Telonics is developing and plans to submit a version of the DCP transmitter to the European Space Agency for certification for the METEOSAT regional channels by year end. GMS certification for regional use is also a possibility. In addition, a GOES uplink receiver is under development that will allow direct testing of DCP's, eliminating the need to test through the satellite. It would be used to verify correct DCP operation prior to and at the time of installation in the field.

For more information on the new DCP's, please don't hesitate to call or write. *Mary Hannah and Tim Rios*

Software Updates

Available for T-SUR-B Uplink Receiver, TPI-1 and LUT Local User Terminal.

The summer of 1992 was a summer to remember. The 1992 presidential campaign was in full swing; daytime temperatures in Phoenix were quite pleasant (no 122 degree days); and a few ARGOS system users began noticing strange occurrences in their decoding equipment. While I would not attempt to discuss the presidential campaign or the Phoenix weather patterns, I can provide insight into the performance of the decoding equipment.

When the ARGOS system was designed in the early 1970's, it was sized for 16,000 platforms. Identification numbers (ID numbers) were eventually all assigned and recycling of old codes was implemented. New ID numbers were soon being issued faster than existing codes were recycled. ARGOS decided to increase the identification numbers from 16,000 to 32,000. This increase directly affected the decoding equipment (i.e. T-SUR-B Uplink Receiver, TPI-1 Telonics Programming Interface and the LUT Local User Terminal).

ARGOS ID numbers are actually composed of the ID number and error detection bits. To increase the number of ARGOS ID's, bit assignments had to be altered. Although the ID numbers were still coded over 20 bits, there are now two different formats for the coding. ID numbers under 16,383 have 16 bits reserved for the actual ID and 6 error detection bits, while numbers over 16,383 have 15 bits reserved for the actual ID and 5 error detection bits. Existing software for the decoding equipment could not process ID numbers larger than 16,383; therefore, a revision in software was necessary.

Software updates for the T-SUR-B, TPI-1 and LUT are now complete and existing equipment can be modified. Modification of the TPI-1 and LUT software is relatively easy to accomplish. Upon request, a floppy diskette is sent to replace the existing software. *Note: the latest software revision for the TPI-1 is version 2.8 and the LUT revision is 2.5e.* The replacement diskettes are forwarded at no charge to the end user.

The software update for the T-SUR-B was a more complicated process and generated more expense. The revised software now looks at the ID number and formats according to whether numbers are under 16383 or over 16383. After modification, the receiver can automatically process any ARGOS ID number correctly. Modifying the T-SUR-B to version 2.0 requires sending the uplink receiver to Telonics for new software installation. Depending on current production schedules, receivers are processed and updated in approximately three to four weeks. The charge for modification is $179.00 U.S. per receiver.

The Telonics staff enjoys working with each of you and takes pride in customer satisfaction. We hope the increase in ARGOS ID numbers and the update in the decoding equipment will provide many additional years of successful research. So what did you think of the elections anyway? *Brenda S. Milam*

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