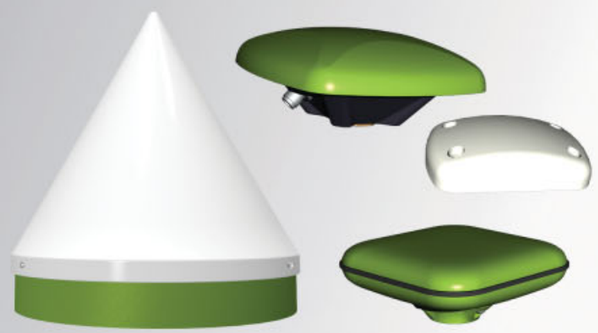
In this issue...

...TRIUMPH in focus

JAVAD GNSS, 1731 Technology Drive, San Jose, California 95110, USA

In Focus

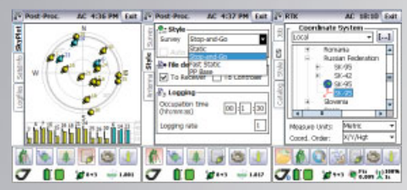
TRIUMPH-4X



GrAnt, TriAnt, RingAnt,
GyrAnt,TyrAnt, AirAnt,

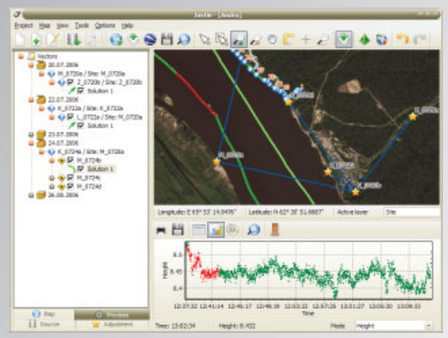
Modems

RTK Caddy and Umbrella

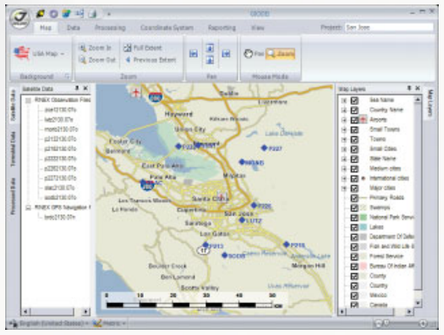


Tracy

Victor



Justin



Giodis

in the next issues

OEM Boards

We offer 7 OEM boards to cover the entire spectrum of precision applications and budgets. Each board is based on our TRIUMPH Technology implemented in our TRIUMPH Chip. For the first time in the GNSS history we offer up to 100 Hz RTK.

Each board includes the true Galileo option. We offer a FREE Galileo option for one year.

The on-board power supply on every OEM board accepts any voltage from +4.5 to +40 volts and delivers clean filtered voltage where needed. This eliminates the risk of power contamination (ripples) that can be created when clean power is generated elsewhere and delivered to the board via cables.

The CAN interfaces in each board are complete with all associated hardware and firmware, not just the CAN bus. The same is true with all the serial RS232/RS422 ports in our boards.

Each board also comes with large amount of flash for data storage. Each board also includes drivers for four LEDs, ON/OFF and function button controllers. Simply stated, additional functions are not need to incorporate any of our OEM boards.

In addition to timing strobes and event markers, each OEM boards also include the option of complete IRIG timing system.

We have been able to achieve tremendous advances in technology while reducing costs substantially. In the table below, we have summarized our features and included two other examples in the market to allow you make a comparison. Simple features like 1-PPS and serial ports are not included in the table below but are present in all of our boards. In the table below, G2 means GPS+Galileo, G3 means GPS+Galileo+GLONASS, and the trailing T means triple frequency.

Features/Boards	TR-G2	TR-G3	TR-G2T	TR-G3T	TRE-G2T	TRE-G3T	TRE-G3TAJ	Competition	
GPS L1	16	16	16	16	16	16	16	14	14
GPS L2/L2C	--	--	16	16	16	16	16	14	14
GPS L5	--	--	16	16	16	16	16	--	6
Galileo E1	16	16	16	16	16	16	16	--	--
Galileo E5A	--	--	16	16	16	16	16	--	--
GLONASS L1	--	16	--	16	--	16	16	12	12
GLONASS L2	--	--	--	16	--	16	16	12	12
SBAS	4	4	4	4	4	4	4	2	2
IBIR	--	--	--	--	--	--	Yes	--	--
Fast acquisition channels	110K	110K	110K	110K	110K	110K	110K	--	--
Ethernet	--	--	--	--	Yes	Yes	Yes	--	--
Complete CAN	Yes	Yes	Yes	Yes	Yes	Yes	Yes	--	--
Button/LED support	Yes	Yes	Yes	Yes	Yes	Yes	Yes	--	--
IRIG timing system	Yes	Yes	Yes	Yes	Yes	Yes	Yes	--	--
On-board Flash (MB)	128	128	128	256	4,000	4,000	4,000	--	--
4.5-to-40V Power supply	Yes	Yes	Yes	Yes	Yes	Yes	Yes	--	--
Hardware Viterbi	Yes	Yes	Yes	Yes	Yes	Yes	Yes	--	--
Size (mm)	40x55	57x66	57x66	57x88	100x80	100x80	100x80	100x60	125x85

Duo and Quattro... The Two- and The Four-in-One Boards

Quattro-G3D is a 100x160 mm Euro-card board that accepts inputs from up to four antennas. It is equivalent of four receivers which operate synchronously with a common oscillator and central processor to coordinate all communications and other activities. One of the receivers (the main) tracks 14 each of GPS L1/L2, GLONASS L1/L2 and Galileo E1. This receiver can perform long baseline RTK in conjunction with a base. The other three receivers each track 14 each of GPS L1/L2, and Galileo E1 and along with the main one can provide attitude (orientation) solutions.

Dual frequency GPS alone can provide very fast and reliable orientation solutions due to very short antenna separations (about one meter) and the fact that typical applications are in open fields. The main GPS+GLONASS L1/L2 unit can help in providing long baseline RTK solution.

Duo-G2D is a 100x80 mm half Euro-card board that accepts inputs from up to two antennas. It is equivalent of two receivers which operate synchronously with a common oscillator and central processor to coordinate all communications and other activities, and is ideal for heading applications. Each of the two receivers track 14 each of GPS L1, GPS L2, and Galileo E1.

100 Hz RTK, Duo, Quattro

In Band Interference Rejection

Consider your favorite FM radio station. It is assigned a frequency band and it cannot broadcast outside that band (to disturb others) and no one else can broadcast within its band (to disturb it). Assigning and protecting frequency bands is a highly contested and challenging task. Radio amateurs are often caught "trespassing" with their home made transmitters onto the properties of others. By that I mean transmitting within bands which belong to others.

At the global level, countries and organizations compete to obtain global frequency allocations for their national projects. GPS, GLONASS, and Galileo had to engage in international campaigns to receive their frequency allocations. A few years back the GPS frequency band was in danger of being "walked on" by international wide-band civil communications. This could have damaged GPS receiver performance. The efforts led by the US GPS Industry Council and Charlie Trimble saved the GPS band from that threat.

The GNSS frequency bands are in constant danger of being attacked by the nearby radio and TV stations, radars and other signal transmitters. Yes, no one is allowed to transmit outside of its allocated frequency band, but in reality all transmitters transmit not only their allocated frequency but they also transmit what are called "harmonics" of their frequency. Harmonics are the integer multiples of an allocated frequency. Such harmonics are much weaker than the main signal but they can interfere with the GNSS signal when a GNSS receiver gets close enough to a transmitter and when one of its harmonics falls within a GNSS band. Remember that the GNSS signal strength is comparable to a 100 watt light bulb 20,000 kilometers away.

When you tune your FM radio to a particular station you actually move a filter, which is like an electronic window. The filter allows the desired frequency band to enter the radio receiver and blocks all others. In GNSS receiver design, we filter out all signals outside of GNSS and make an open window for the GNSS signal band. This task is easy. The problem is when an undesired signal falls within the desired band. An example of an undesried signal would be a harmonic of a nearby radio station that falls within the GPS band. Defending against this phenomenon, which we call "In Band Interference," is not easy.

Marc Cheves, the editor of *The American Surveyor*, told me about an event that happened while he was driving near Memphis: both of his GPS receivers (from different manufacturers) stopped working for about an hour. Texas surveyor Jim Naismith reported to me that for two hours every day near Dallas-Fort Worth all of his GPS receivers stopped working. Now, it could be that an illegal or inadvertent signal was responsible, but I believe it's more likely that the GPS signal was being walked on by harmonics.

I'm pleased to announce that we have paid particular attention to this problem and have come up with what we consider to be a unique method to deal with harmonic interference: we call it In Band Interference Rejection (IBIR), and we believe no other civilian GNSS is equipped to protect against In Band Interference. We scan the GNSS bands, detect the interfering signal, determine its characteristics, and then generate an equal signal to cancel it.

Our IBIR can defend against all signals typical of civilian environments, including narrow-band continuous wave CW signals such as the harmonics that come from radio and TV stations and civilian communications. We cannot defend against sophisticated warfare jamming which occurs near battlefields. I say this to make it clear that we don't have "military anti-jamming capabilities," and while we are helping civilian users worldwide we will not cross certain boundaries.

Now you know a possible reason for why your GPS receiver sometimes stops working without any obvious reason. Our IBIR will easily pay for itself within a month by increasing your productivity.

Until the next issue
Regards,
Javad

Javad Ashjaee

www.javad.com

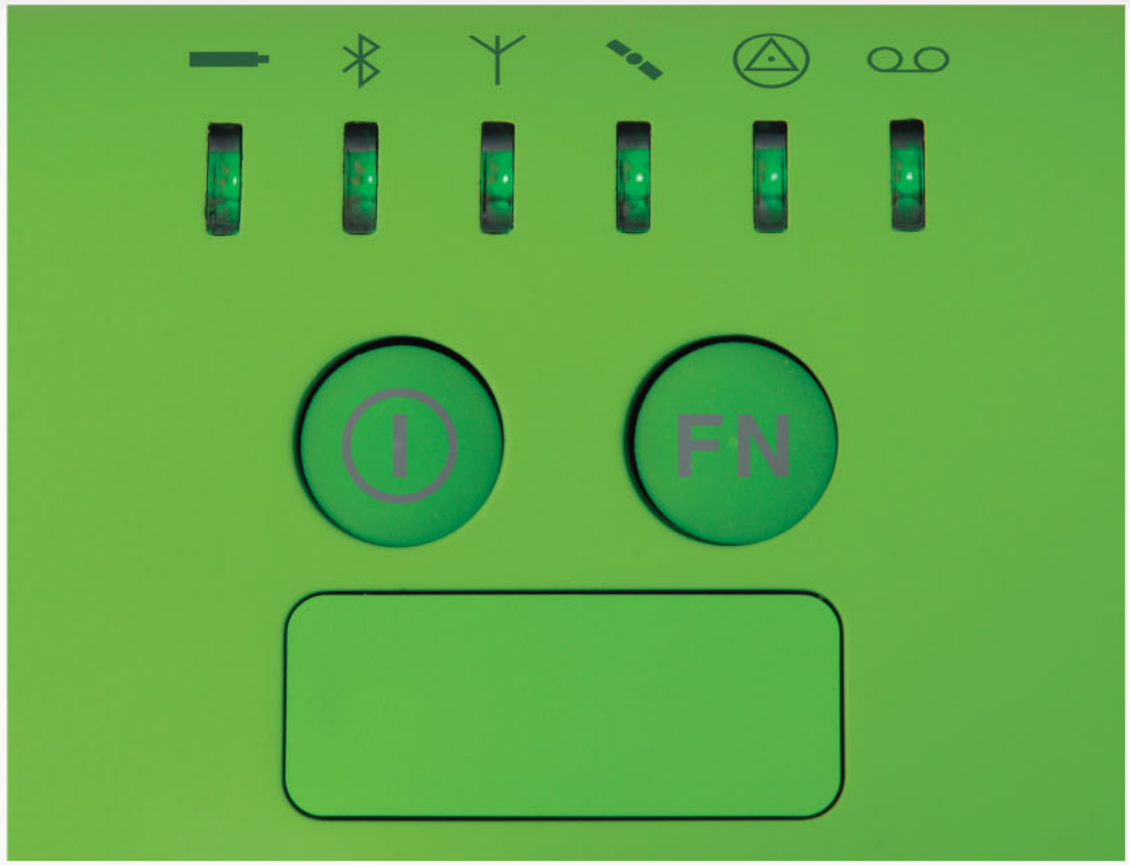
Advanced And Complete

TRIUMPH-1 with 216 sophisticated channels, in-band interference rejection, and a revolutionary multipath mitigation technique is the most advanced GNSS receiver available today. Its code and carrier tracking capabilities is far better than anything you had seen before. Due to its memory code capability, it is the only survey system in the market which can track Galileo's current and future signals. It can also deliver 100 Hz RTK. TRIUMPH-1 includes:

Triple GPS , dual GLONASS, and dual Galileo frequencies
GPS, GLONASS and Galileo antenna
Radio modem and antenna (inside the pole)
GSM and antenna
Bluetooth and antenna
WiFi and antenna
20 hours of rechargeable battery
Up to 4 gigabytes of internal data storage.

Best Performance And 100 HZ RTK

Simple And Easy



TRIUMPH-1 is very simple to operate. Turn it on and six green lights, one after the other, glow to tell you that all is going well. This is what they mean:

Enough power is available
Bluetooth is working
Radio Modem is working
Enough satellites are tracked
Position solution is calculated
Data recording is OK

And Cheerful!

Resourceful

Communication with TRIUMPH-1 is easy. Our "GNSS Receiver External Interface Specification" (GREIS) has rich command sets to easily and efficiently control and communicate with TRIUMPH-1 via different communication ports. In addition to two serial ports (A and B) and a USB, TRIUMPH-1 also has Ethernet connectivity. The Ethernet port puts TRIUMPH-1 directly in touch with the world. TRIUMPH-1 also has WiFi which can make this connection wirelessly. Connectors are waterproof and color coded.

It accepts any input power (any voltage from 4.5 to 40 volts) to operate and charge the internal batteries. It also has optional external GNSS antenna connector.

TRIUMPH-1 is packaged in a magnesium alloy box guarded with a protective bumper. It is small (18 x 18 cm), light (1.7 kg) and rugged.

Small, Light, Rugged

GrAnt

GrAnt is a small, light but a high quality geodetic antenna which can optionally be connected to TRIUMPH-1 as an external antenna. It can mounted on a pole or fastened to flat surfaces via four screws. The antenna cable can be connected via standard TNC connector or routed through the central pole for maximum protection in harsh environments. GrAnt measures 14x14x6 cm and weights about 510 grams.

Geodetic Quality