



Next month...

YOU start leading...

With TRIUMPH!

## The TRIUMPH Chip... with 216 channels!!!

At the heart of our TRIUMPH Technology is our TRIUMPH Chip. In a 17x17 millimeter power-efficient 352-TFBGA chip we have packed impressive amount of state-of-the-art functions using *0.09 micron (90 nm)* integrated circuit technology.

The TRIUMPH chip has *216 (two hundred and sixteen) channels* for tracking all types of GNSS signals. These 216 channels are grouped in three categories of channels, some with 5 and some with 10 correlators, optimized to track all types of GNSS signals.

The TRIUMPH Chip can track all existing satellite signals as well as all those planned for the future. This includes all *GPS, GLONASS, Galileo, QZSS, WAAS, EGNOS, and Compass/Beidou signals*.

Additionally these 216 channels are accompanied by the equivalent of *110,000 regular correlators* for fast acquisition even when signal strength is very low.

Each channel is optimized to measure the most precise code, carrier and Doppler from each satellite system. The most advanced multipath reduction is also implemented for each channel. Each channel has 3-bit RF input and a tracking resolutions of 5 mm for code measurements and 0.005 mm for phase measurements.

The TRIUMPH Chip also includes a including a *220 MHz CPU* with *internal RAM* for on-chip data consumption and cost.

Harmonics of transmitters like within the GPS band and block against such in-band has *five sophisticated 64-th filters*, in five different signal multiple interferences by up to

Decoding the bit streams of GPS L5, Galileo, WAAS, EGNOS, and similar systems, which use Viterbi decoding schemes, are very computationally intensive. To facilitate this task we have implemented *Viterbi decoder and cyclical redundancy check (CRC)* module in the TRIUMPH Chip hardware. The implemented Viterbi decoder has 3-bit soft decision, decoding depth of 64 and capable of decoding frames of up to 512 bit with a decoding speed of 1 Mb/sec. It can support both stream and block modes. The CRC module has a polynomial length of up to 32.

TRIUMPH Chip also includes 40 flexible programmed RF input pins, three 1-PPS timing signal outputs, three Event inputs, and two embedded PLL-s.

The sophisticated power management implemented on the 90 nm technology reduces the power consumption of the chip to the range of 0.2 to 1 Watt depending on the modules activated.

Our TRIUMPH Chip not only offers impressive and unparalleled performance, it also provides for *substantial reduction in manufacturing cost*. It enables us to reduce the size and power consumption and offer products at lower cost. This is not a price war, it's a technology war, which we are back to fight for you!

very powerful microprocessor *Floating Point Unit (FPU)*, *4 MB* processing which reduces power



TV and radio stations may fall the reception. To defend interferences TRIUMPH Chip *order adaptive anti jamming bands*, capable of suppressing 60 dB.

Tracking all GPS, GLONASS, Galileo, Compass, QZSS, WAAS/EGNOS, etc... signals

## Over 70 dealers in 43 countries

We are pleased to announce that in the short period of time since the announcement of our new products, we have been able to attract over 70 dealers in 43 countries and the list is growing. The spectrum of our new dealers ranges from the legendary [redacted] in the US to newly-formed companies in newly-liberated countries. These newly-formed companies are guided by highly educated and motivated young individuals who want to do their best to promote our products and help support our customers. While we are proud and honored to have the support of my good friend [redacted], we will also focus on our new dealers to ensure the highest level of support for our customers and begin building new "[redacted] legends" in different parts of the world.



As you see in our Worldwide Dealer Map above, there are still many blank spots. We are eager to hear from organizations that have the qualifications, experience and desire to promote our products and support our customers worldwide. Please contact us via friends@javad.com.

Still looking for more of qualified organizations

## Staying connected with www.javad.com

A lot has happened since the last issue. First, we listened to your input regarding our OEM boards and added Duo to the portfolio. We also improved and simplified Quattro: The addition of L1/L2 GLONASS to all four units of Quattro adds eight extra RF circuits without contributing much to heading and attitude results because A) the baselines are very short — about one meter; and B) they are typically used in open areas. In applications where Quattro is also used to obtain RTK positions, only one of the four units needs to work with a base receiver (usually tens of kilometers away). Therefore, we kept only one of the four Quattro units with GPS L1/L2, Galileo E1, and GLONASS L1/L2 and the other three units with GPS L1/L2 and Galileo E1. We also optimized the other three units for better attitude performance. This modification did not change our production schedule because it involved only removing some parts and restarting the manufacturing process. I'll stop here because I have been warned to cut down on technical discussions! We know that many surveyors are not so interested in the detailed technical aspects, but rather just expect the equipment to work!

We also received questions regarding our plans for Galileo and Compass/Beidou. Regarding Galileo, we may extend the one year free Galileo option plan until our customers can experience the benefits of Galileo. Regarding Compass, we tracked Compass on September of last year but did not even mention it because it was a trivial task after our friends at Stanford University published the Compass signal structure. Our TRIUMPH Chip is Compass-capable, but we need to know more about the Compass deployment plan and schedule before we offer any Compass-capable products.

Our focus now is to put our products in the hands of our dealers and customers. Our manufacturing is progressing nicely and is on schedule. As stated earlier, we plan to accept orders in March and start shipment in April.

Also, we have built in a lot of flexibility and expansion capabilities for every product. We will ensure that each product that we ship will perform reliably according to our specifications. But we will not stop there. We will continue to provide improvements as new features become available. For example, as Galileo improves we will follow by providing you firmware updates and upgrades AUTOMATICALLY! While this idea is not new, it is the first time it has been brought to the GNSS community. GNSS is a very

dynamic technology, and we are dedicated to bringing you the latest quickly without interrupting your business and continuous usage of equipment and software. Get ready and sharpen up your Internet skills!

Since the last issue we have attracted over 70 dealers in 43 countries, and the list is growing. We will continue our effort to build the best support structure worldwide to complement our state-of-the-art Internet-based support. We expect the combination of the two to provide the most efficient and speedy support system in the world. Any competition among our dealers will be based solely on support. Our prices are universal and we will provide the best support to all of our dealers worldwide.

We will continue to allow customers to buy directly from us via our website Online Order. However, the direct prices are exactly the same as those offered by our local dealers. Given the local support that customers receive from dealers, there should be no reason for a customer to bypass their favorite local dealers. And although there is no restriction, we anticipate that our direct sales will be from areas where a local dealer is currently not available, or from specialty and research oriented customers who need special direct support, cooperation and co-development outside the scope of standard dealer activity.

As I have said before, GNSS is a very dynamic technology, and JAVAD GNSS is a very dynamic company. We will be summarizing our progress and news in every issue of this monthly magazine, and will also use the magazine's website for news and press releases. But a monthly publication is by no means enough to convey our messages and update you on our many developments in a timely fashion. Please also stay connected by visiting our website, www.javad.com, on a daily basis so you can stay up with our latest developments.

Until the next issue,  
Regards,  
Javad



*Javad Ashjaee*

www.javad.com

# OEM Boards... Galileo Free for One Year

We offer 6 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	Competition	
GPS L1	16	16	16	16	16	16	14	14
GPS L2/L2C	--	--	16	16	16	16	14	14
GPS L5	--	--	16	16	16	16	--	6
Galileo E1	16	16	16	16	16	16	--	--
Galileo E5A	--	--	16	16	16	16	--	--
GLONASS L1	--	16	--	16	--	16	12	12
GLONASS L2	--	--	--	16	--	16	12	12
SBAS	4	4	4	4	4	4	2	2
Fast acquisition channels	110K	110K	110K	110K	110K	110K	--	--
Ethernet	--	--	--	--	Yes	Yes	--	--
Complete CAN	Yes	Yes	Yes	Yes	Yes	Yes	--	--
Button/LED support	Yes	Yes	Yes	Yes	Yes	Yes	--	--
IRIG timing system	Yes	Yes	Yes	Yes	Yes	Yes	--	--
On-board Flash (MB)	128	128	128	256	4,000	4,000	--	--
4.5-to-40V Power supply	Yes	Yes	Yes	Yes	Yes	Yes	--	--
Hardware Viterbi	Yes	Yes	Yes	Yes	Yes	Yes	--	--
Size (mm)	40x55	57x66	57x66	57x88	100x80	100x80	100x60	125x85
Base Price	\$600	\$1,200	\$1,800	\$2,400	\$1,800	\$2,700		

## 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.

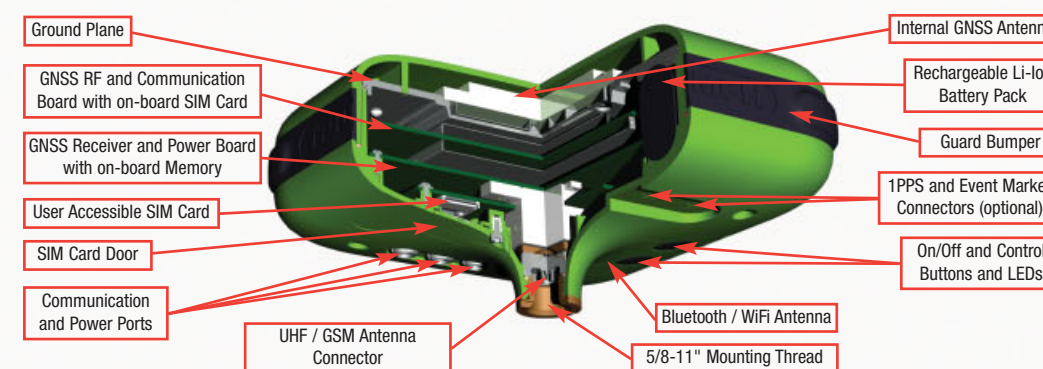
100 Hz RTK, Duo, Quattro

# TRIUMPH-1... The RTK package

Based on the TRIUMPH Chip, TRIUMPH-1 is a fully integrated package ready for your demanding jobs, offering precise and automatic performance beyond anything that you have experienced so far.

An elegant, rugged, light (1 kg, 16x16 cm), and hermetically sealed box accommodates all GNSS and Modem electronics, antennas, and up to 20 hours of rechargeable batteries and its sophisticated power management system. The close proximity of our batteries with the electronic section helps the batteries to absorb heat and function better in cold weathers. The batteries can be charged with any power supply from 4.5 volts to 40 volts, which includes car, ship and airplane batteries.

All GNSS, UHF, GSM, Bluetooth, and WiFi antennas are conveniently hidden and protected. An external antenna can also be connected to bypass the internal GNSS antenna. There are two SIM cards inside the box, one of them can be easily reached and changed via a small sealed door.



Antennas

TRIUMPH-1 also accepts external antennas. In addition to choke ring and avionics antenna, we have also designed two new high performance antenna in small sizes. GrAnt (left below) has the option of integrated IMU (three accelerometers and three gyros). TriAnt (right below) has smaller size and has three different mounting mechanisms. Both antennas have GPS, GLONASS and Galileo options.



## The RTK Caddy

We have come a long way since the days of several pieces of equipment in a backpack and lots of cables to connect everything to perform RTK jobs.

The existing systems still have the limitation that the pole should be constantly held by one hand.

We took the hint from golfers and offer the option of attaching the pole to a modified golf caddy which can also hold our Victor handheld controller and other field items and be easily wheeled around. Try it once and you get hooked.

Of course TRIUMPH-1 is very light (about 1kg) and can be handled easily with standard poles.



Galileo free for one year

# TRIUMPH-4X... The Cluster RTK

Conventional RTK uses one base and one rover yielding only one baseline with no checks and balances. Surveyors appreciate the power of networks, where many points and repeated measurements along with network adjustment remove outliers and give more accurate results.

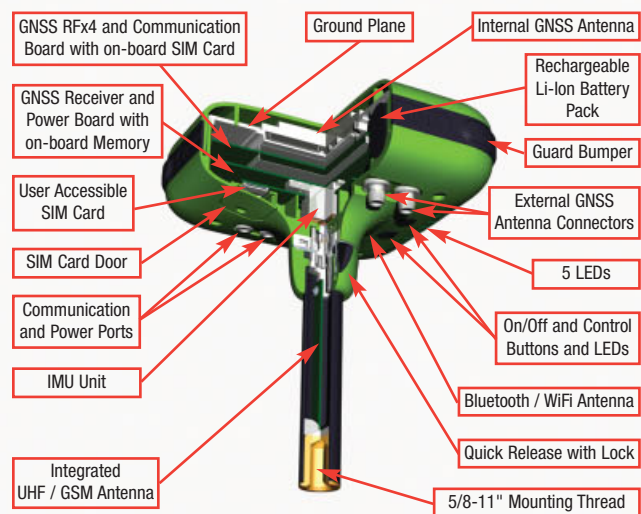
To improve the reliability of RTK, some users employ data from more than one base. Multiple bases are rare and not conveniently available.

*In a giant step forward along with introducing TRIUMPH-4X, we also introduce Cluster RTK, or 4x4 RTK, where sixteen baselines are processed in every single RTK measurement.*

For the first time in the history of GNSS, the power of survey techniques and network adjustments comes to RTK but without the burdens and complications. The operation is similar to conventional RTK. Surveyors and geodesists can now trust RTK measurements while improving accuracy, reliability and availability.

Now when we say 20 Hz RTK, we mean measuring 16 baselines of 8 points and performing equivalent of geodetic network adjustment on 16 baselines, removing outliers and providing reliable geodetic quality RTK solutions 20 times per second!

4x4 cluster RTK does not need a truck load of expensive equipment, multiple field operators, and complicated procedures. It is even simpler than conventional 1x1 RTK because you even do not need to level your pole!



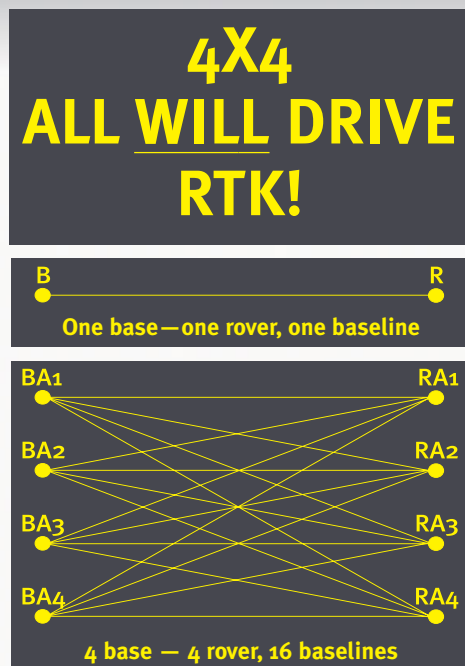
The RTK Umbrella

To make handling of the three additional antennas easy we have designed the RTK Umbrella. The receiver is mounted in the center and three small antennas on three folding arms. It is easy to store, transport and use in the field. The RTK Caddy is especially helpful when roving with TRIUMPH-4X.

The receiver also includes an IMU consisting of three accelerometers and three gyros. Combining a four-GNSS-receiver system with an IMU provides an extremely powerful tool in providing positioning solutions in most severe and adverse conditions.

In TRIUMPH-4X you do not need to level the pole. The four-antenna system and the IMU will determine the inclination and adjust the calculated position accordingly.

In areas under canopy and foliage you get much better chance because at least one of the 16 baselines may provide a solution. TRIUMPH-4X can also be used in a more general configuration to determine orientation or mounted in different sections of moving platforms in machine control applications.



TRIUMPH-4X is equivalent of 4 independent TRIUMPH-1 receivers packaged in the same small box. Furthermore, these 4 independent receivers are operating synchronously using the same local oscillator. A central processor coordinates internal activities of these four receivers as well as communications and data transmission with outside. *And all is done with a single TRIUMPH Chip inside. This is why it is neither heavy nor expensive.*

One TRIUMPH-4X base and one rover results in a 16-baseline RTK system. While systematic and correlated errors can be removed in single RTK systems, the uncorrelated errors degrade the RTK accuracy. In TRIUMPH 4x4 systems the uncorrelated (random) errors are reduced significantly. This improved accuracy and reliability is especially important in critical applications like machine control.



TRIUMPH-4X has integrated Inertial Measurement Unit

# Software

## Justin

A powerful office GIS software to process GPS&GLONASS data.

- Automatic project management from Import to Report via Scenario.
- Interactive mode for static data processing.
- Dynamic base and rover data processing.
- Single epoch solution for Javad receiver data.
- Stop & Go surveying.
- All user data is kept in the project.
- Support of topology for all layers (net, vector, solution, fiducial, stop&go). Each layer can have preset styles according to accuracy, solution mode, PDOP, etc.
- Export of maps to dxf.
- Ability to open vector map (ArcGIS, MapInfo), raster images with geo-referencing in the cartographic window.
- Change map projection, scale, labeling.
- Register raster imagery.
- Auto geo-referencing for aerial photography images with event data (mosaic).
- Graphic module for fundamental analysis of GNSS data (preset combinations and user macros).
- Google Earth viewer.
- Multilingual interface.

## Giodis

Full-featured office post-processing software.

- New high-precision post-processing engine:
  - Solves wide range of practical surveying tasks using advanced scientific approach.
  - Un-differenced GPS data vector and network processing based on multi-site and multi-session algorithms.
  - Direct estimation of ionosphere, troposphere, and satellite/receiver clocks.
  - Global metadata to improve processing.
  - Uses ITRF control points to make processing more robust.
- Network adjustment:
  - Free and constrained network adjustment of vectors and multi-site subnets.
  - Using both local and ITRF control points.
- Extended coordinate systems database:
  - Easily searchable and extendable predefined database with over 3000 global, national, and local coordinate system definitions, including transformation parameters and geoids.
- Points Data Catalogs:
  - Storage of points, coordinates and attributes.
  - Can be encrypted to protect business data.
- Internet Download Manager:
  - Unattended and explicit downloading of IGS and CORS data for over 7000 worldly distributed stations.
- Online data exchange between field controllers and the office.
- Background maps:
  - Detailed background maps covering the entire United States from the national level down to detailed street networks (TIGER data).
  - World maps of any location on Earth with common geographic features.
- Modern user interface:
  - Uploading and processing data with minimal interaction.
  - Advanced user can manage internal data flow by explicit request.
  - High-quality visualization, reporting, and printing.

## Victor

We complement our receivers with Victor, an ultra-rugged Windows Mobile controller with an ample amount of processing power and memory for most field applications.



Tracy

A comprehensive field software for Windows Mobile OS to control our receivers, automate GNSS post processing surveying tasks (Static, Fast Static, Stop&Go, Data Acquisition), and to perform RTK survey and stakeout tasks with the following features:

- Always provides information on receiver while surveying.
- Data logging to receiver and controller.
- Increased productivity and reliability with automatic occupation time control.
- Stop&Go data collection.
- Point offsets.
- In-field post-processing to estimate observation data quality.
- Data acquisition with feature codes.
- Base and rover receiver configuration and control.
- Works with corrections via radio and Internet.
- Support for survey and stakeout projects.
- National and local coordinate system and geoid support. Horizontal and vertical localizations.
- Built in COGO routines.

And soon all major third party software