WE ARE BACK TO LEAD AGAIN ... With TRIUMPH!
At the heart of our TRIUMPH TECHNOLOGY is our TRIUMPH CHIP 0.09 Micron Technology
TRIUMPH Chip (5 sections)

- GNSS Digital Signal Processing (DSP)
- Viterbi decoder & CRC
- CPU & FPU
- Memory
- PLL & I/O
• 216 channels for GNSS signal tracking (5 correlators per each channel)
• advanced multipath mitigation
• 8-bit RF input
• 5 mm code measurement resolution
• 0.005 mm phase measurement resolution

Details in the next five slides
72 CAP channels, each with 5 correlators. Each can track GPS or GLONASS C/A, SBAS (WAAS, EGNOS, etc), QZSS C/A, GLONASS P, or any equivalent signal.
48 PLC (96 normal) channels, each with 10 correlators. Each PLC channel can track GPS P1+P2, GPS L2C (both L2CM and L2CL), GPS L5 (both pilot and data), GPS/GLONASS C/A with special features for dual tracking. In fact each of the PLC channels are equivalent of two channels.
48 memory code (MC) channels, each with 5 correlators. Each channel may track any arbitrary code (up to 16 Mb length) including BOC and Alt-BOC modulation, for GPS L1C, Galileo, Compass/Beidu, etc.
Fast Acquisition module

• Equivalent of up to 110,000 regular correlators.
• 0.01 sec for complete frequency/code search of one GPS/GLONASS/Galileo satellite under normal conditions.
• Sensitivity: down to 20 dB.Hz carrier-to-noise ratio (equivalent to -150 dBm signal power)
• Five 64-th order adaptive anti jamming filters capable to suppress multiple narrowband and wideband interferences by up to 60 dB
• 40 flexible programmed RF input pins
• Three 1-PPS outputs
• Three Event inputs
• For WAAS/EGNOS decoding
• Viterbi decoder: 3-bit soft decision, up to 512 bit frame, decoding depth – 64, up to 1 Mb/sec decoding speed, support of both stream and block modes.
• CRC module: polynomial length – up to 32.
• 2 embedded PLL’s.
- 32-bit CPU compliant with the SPARC V8 architecture
- 64-bit FPU compliant with IEEE 754 standard
- Up to 220 MHz CPU/FPU clock speed
- 128 KB instruction/data cache size
- Memory Management Unit
- 4 MB internal RAM
- Up to 9 UART’s
- Up to 5 advanced SPI-s (four-wire serial with master/slave mode).
- Up to 3 CAN 2.0 controllers
- Up to 21 PWM (pulse-width modulation) outputs
- Up to 67 general purpose input/output pins
- External bus supported up to 512 MB SDRAM, 128 MB SRAM, 128 MB PROM and memory mapped I/O devices
OEM BOARDS

- G2: GPS + Galileo
- G3: GPS + Galileo + GLONASS
- D: GPS L1/L2 + Galileo E1
- T: GPS L1/L2/L5, GLO. GAL. Dual Freq.

Galileo is optional in all boards
<table>
<thead>
<tr>
<th>Features/Models</th>
<th>TR-G2</th>
<th>TR-G3</th>
<th>TR-G2T</th>
<th>TR-G3T</th>
<th>TRE-G2T</th>
<th>TRE-G3T</th>
<th>Duo-G2</th>
<th>Duo-G2D</th>
<th>Quat-G3D</th>
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<tbody>
<tr>
<td>GPS L1</td>
<td>16</td>
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<td>16</td>
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<td>4 x 14</td>
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<td>GPS L2/L2C</td>
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<td>16</td>
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<td>GPS L5</td>
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<td>Galileo E1</td>
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<td>2 x 14</td>
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<tr>
<td>GLONASS L1</td>
<td>16</td>
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<td>Yes</td>
<td>Yes</td>
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<td>IRIG timing system</td>
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<td>Yes</td>
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<td>On-board Flash</td>
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<td>Hardware Viterbi</td>
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<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Size (mm)</td>
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<td>57x66</td>
<td>57x66</td>
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<td>100x80</td>
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<td>Base Price</td>
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<td>$1,500</td>
<td>$2,250</td>
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</table>
TR BOARDS

- **TR-G2**: 16 each of GPS L1, Galileo E1.
- **TR-G2T**: 16 each of GPS L1/L2/L2C/L5, Galileo E1/E5A, GLONASS L1/L2.
- **TR-G3**: 16 each of GPS L1/L2/L2C/L5, Galileo E1, GLONASS L1.
- **TR-G3T**: 16 each of GPS L1/L2/L2C/L5, Galileo E1/E5A, GLONASS L1/L2.
TRE-BOARDS

TRE-G2T
16 each of
GPS L1/L2/L2C/L5,
Galileo E1/E5A.

TRE-G3T
16 each of
GPS L1/L2/L2C/L5,
Galileo E1/E5A,
GLONASS L1/L2.
DUO BOARDS

DUO – G2
Two synchronized sets of 14 each of GPS L1, Galileo E1.

DUO – G2D
Two synchronized sets of 14 each of GPS L1/L2/L2C, Galileo E1.

Heading and multi-antenna navigation
QUATTRO-G3D

One set of 14 each of GPS L1/L2/L2C, Galileo E1, GLONASS L1/L2;

And three sets of 14 each of GPS L1/L2, Galileo E1.

ALL SYNCHRONIZED.

For attitude determination
And multi-antenna navigation.
ALPHA SERIES

• Internal battery
• Charger
• Bluetooth
• GSM

For:

TR-G2T
TR-G3
TR-G3T
DELTA SERIES

For:
- TRE-G2T
- TRE-G3T
- Duo-G2
- Duo-G2T
- Quattro-G3D
SIGMA SERIES

- Internal battery
- Charger
- Bluetooth
- Modem
- GSM

For:

TRE-G2T
TRE-G3T
Duo-G2
Duo-G2T
Quattro-G3D
A complete and compact unit for precision GIS and asset management. Versatile mounting, wearing, attaching, carrying mechanisms.
32 channels of GPS and GLONASS L1, code and carrier
• All GNSS Electronics & data storage
• GNSS Antenna
• UHF Modem & Antenna
• WiFi & Antenna
• Ethernet
• Bluetooth & Antenna
• GSM (accessible SIM card) & Antenna
• Battery (20 hours) & Charger
CONNECTIVITY

POWER  SERIAL-A  SERIAL-B  ETHERNET  USB

plus

WiFi & BLETOOTH
TRIUMPH-4X

4 x 4

ALL WILL DRIVE RTK!
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. We took the hint from golfers and offer a modified golf caddy. The RTK Caddy is easy to store, transport and use in the field. It is especially helpful when roving with TRIUMPH-4X.
**4X4 RTK**

- **one base – one rover, one baseline**

- **4 base – 4 rover, 16 baselines**
TRIUMPH-1 and -4X
TRIUMPH-4X

- 4 independent receivers
- Operating synchronously (one Osc.)
- Coordinated activities and Com.
- Integrated IMU in central antenna
- 16 baselines & Network Adjustment
- Improved availability, reliability, accuracy
- Machine Control, Foliage, etc.
- Orientation applications
- Field portable (RTK Caddy/Umbrella)
TRIUMPH-4X

Ground Plane

Internal GNSS Antenna

Rechargeable Li-Ion Battery Pack

Guard Bumper

External GNSS Antenna Connectors

On/Off and Control Buttons and LEDs

Quick Release with Lock

GNSS RF and Communication Board with on-board SIM Card

GNSS Receiver and Power Board with on-board Memory

User Accessible SIM Card

SIM Card Door

IMU Unit

Communication and Power Ports

Integrated UHF/GSM Antenna
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. We took the hint from golfers and offer a modified golf caddy. The RTK Caddy is easy to store, transport and use in the field. It is especially helpful when roving with TRIUMPH-4X.
Antennas

GrAnt

TriAnt

AirAnt
Antenna + IMU

GyrAnt
Rugged Windows Mobile Hand-held controller
• **Justin**: A comprehensive Survey and GIS software.

• **Tracy**: A versatile and powerful field software.

• **Giodis**: Full-featured office post-processing software.
First GPS L5 signal

Signal-to-noise ratios for GPS PRN 1 [L5]
First GPS L5 signal
GLONASS ISSUES

Why sometimes GLONASS does not help? You may not even notice it!
Why sometimes GLONASS hurts? You may not even notice it!
Measuring distances to satellites
Receiver biases cancel if they are the same for all satellites (single receiver)

OR

If they are the same in base and rover (differential)
Biases depend on:

- Frequency (GLONASS ISSUE)
- Temperature (GLONASS ISSUE)
- Electronic components (GLONASS)
- Age (GLONASS ISSUE)
GLONASS BIASES

• Some manufacturers ignore GLONASS biases and hope for the same at both ends to cancel. Not good!

• Some calibrate a sample and then code in all receivers. Not good enough!
  • Component differences
  • Temperature changes
  • Age
We calibrate GLONASS biases dynamically and continuously with the accuracy of 0.2 millimeter.
The new generation of JAVAD GNSS products was named after Triumph Palace, a building in Moscow where the company’s Research and Development Center resides.
THANK YOU

TRIUMPH
More than success
THANK YOU