



TRIUMPH TECHNOLOGY

Javad Ashjaee

JAVAD GNSS

ICG

International Committee on Global Navigation Satellite Systems

December 9, 2008



TRIUMPH

**WE ARE BACK
TO LEAD AGAIN ...
With
TRIUMPH!**



TRIUMPH Technology

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





TRIUMPH Chip (GNSS DSP)

- 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



TRIUMPH Chip (GNSS DSP)

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.



TRIUMPH Chip (GNSS DSP)

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.



TRIUMPH Chip (GNSS DSP)

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/Beidou, etc.



TRIUMPH Chip (GNSS DSP)

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)



TRIUMPH Chip (GNSS DSP)

- 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



TRIUMPH Chip (Viterbi Decoder)

- 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.



TRIUMPH Chip (CPU/FPU/MEM/I-O)

- 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



OEM BOARDS

Features/Models	TR-G2	TR-G3	TR-G2T	TR-G3T	TRE-G2T	TRE-G3T	Duo-G2	Duo-G2D	Quat-G3D
GPS L1	16	16	16	16	16	16	2 x 14	2 x 14	4 x 14
GPS L2/L2C			16	16	16	16		2 x 14	4 x 14
GPS L5			16	16	16	16			
Galileo E1	16	16	16	16	16	16	2 x 14		4 x 14
Galileo E5A			16	16	16	16			
GLONASS L1		16		16		16	12	12	14
GLONASS L2				16		16	12	12	14
SBAS	4	4	4	4	4	4	4	4	4
Fast acquisition Channels	110K	110K	110K	110K	110K	110K	110K	110K	110K
Ethernet					Yes	Yes	Yes	Yes	Yes
Complete CAN	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Button/LED support	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IRIG timing system	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
On-board Flash	256 MB	256 MB	256 MB	256 MB	2 GB				
4.5-to-40V Power Sup.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hardware Viterbi	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size (mm)	40x55	57x66	57x66	57x88	100x80	100x80	100x80	100x80	100x120
Total channels	216	216	216	216	216	216	216	216	216
Base Price	\$750	\$1,500	\$2,250	\$3,000	2,250	\$3,000	\$3,000	\$4,500	\$7,500



TR BOARDS



TR-G2 16 each of GPS L1, Galileo E1.



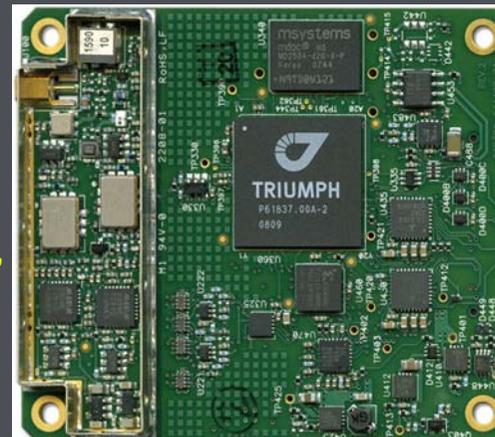
TR-G3T

16 each of GPS L1/L2/L2C/L5, Galileo E1/E5A, GLONASS L1/L2.



TR-G2T

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

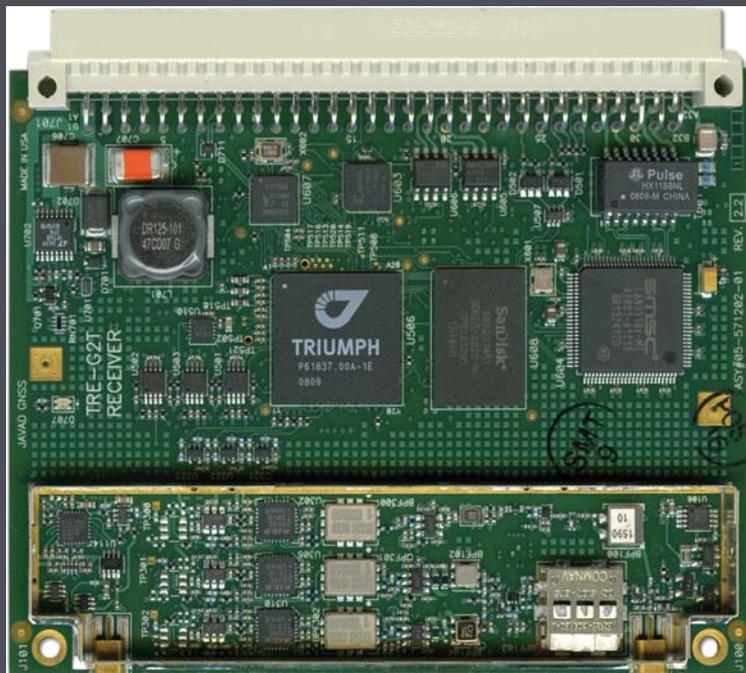


TR-G3

16 each of GPS L1, Galileo E1, GLONASS L1.

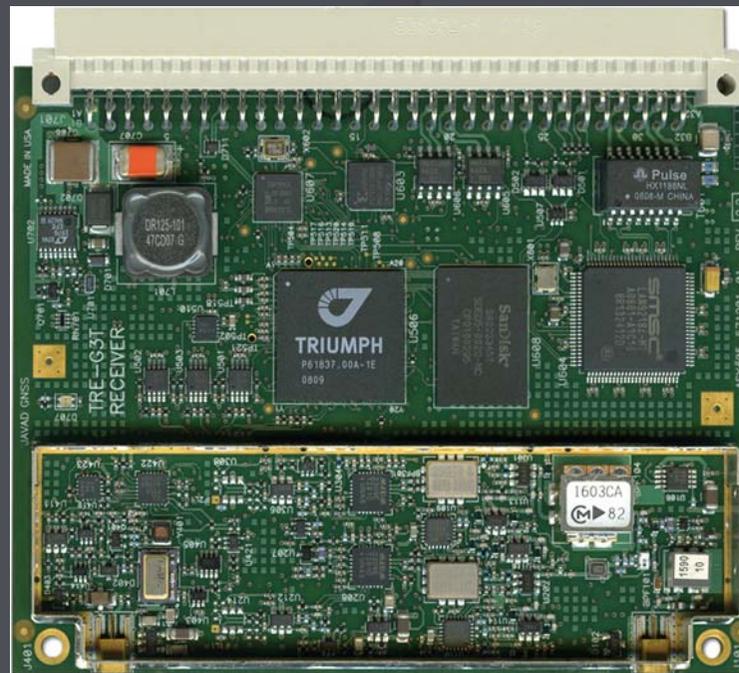


TRE BOARDS



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.

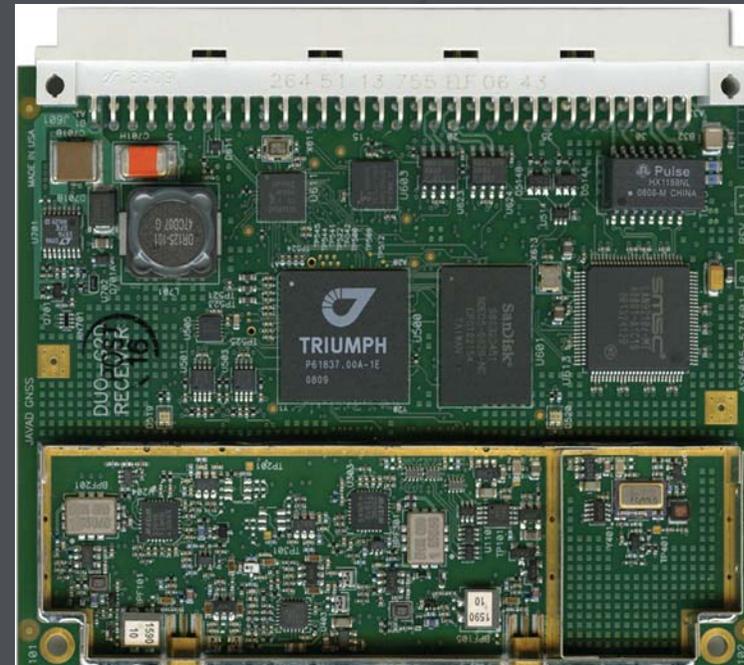


DUO BOARDS



DUO – G2

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



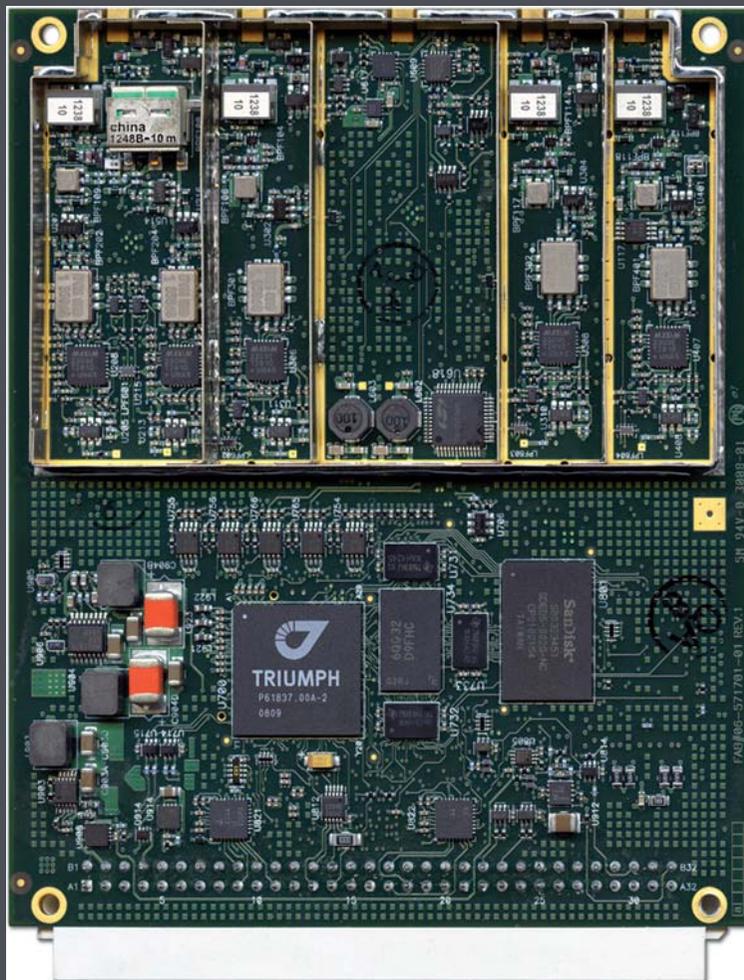
DUO – G2D

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

Heading and multi-antenna navigation



QUATTRO BOARD



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



GISmore... for GIS and more



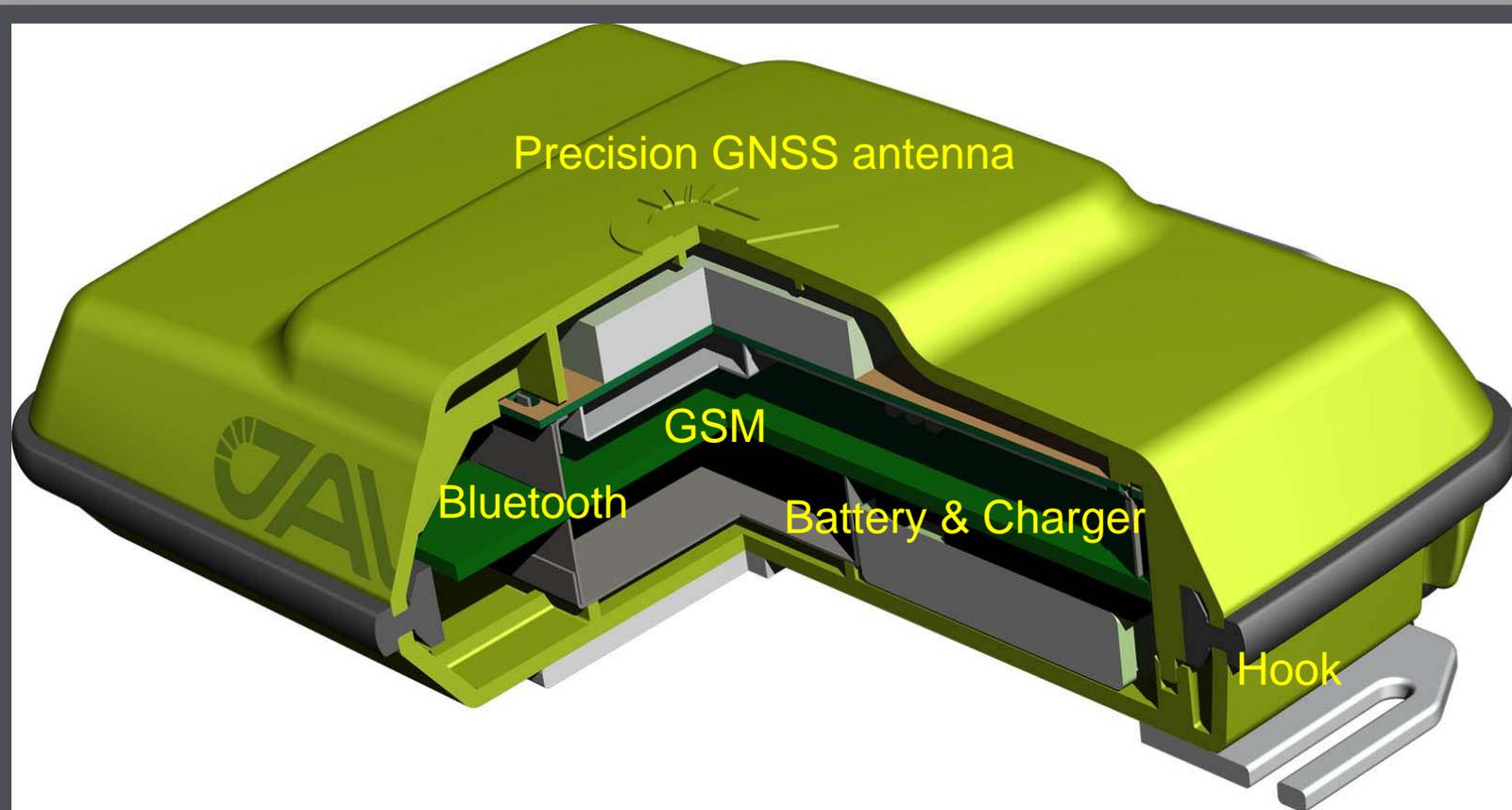
3 x 4.5 x 1 inches

Slightly bigger than a credit card.
Smaller than a passport.

A complete and compact unit for precision GIS and asset management.
Versatile mounting, wearing, attaching, carrying mechanisms.



GISmore



32 channels of GPS and GLONASS L1, code and carrier



GISmore at work

Better than 30 cm GIS... instantly
or 5 cm static



Actual size

GISmore stand-alone or
inside the hat

Bluetooth wireless
connection to GISmore

- GPS L1
- Galileo E1
- GLONASS L1
- 100 Hz update rate
- RAIM
- Rechargeable Li-Ion Battery
- GNSS Antenna
- GSM Module
- Bluetooth® Interface
- Bluetooth/GSM Antenna

Many
ways
to use





TRIUMPH-1



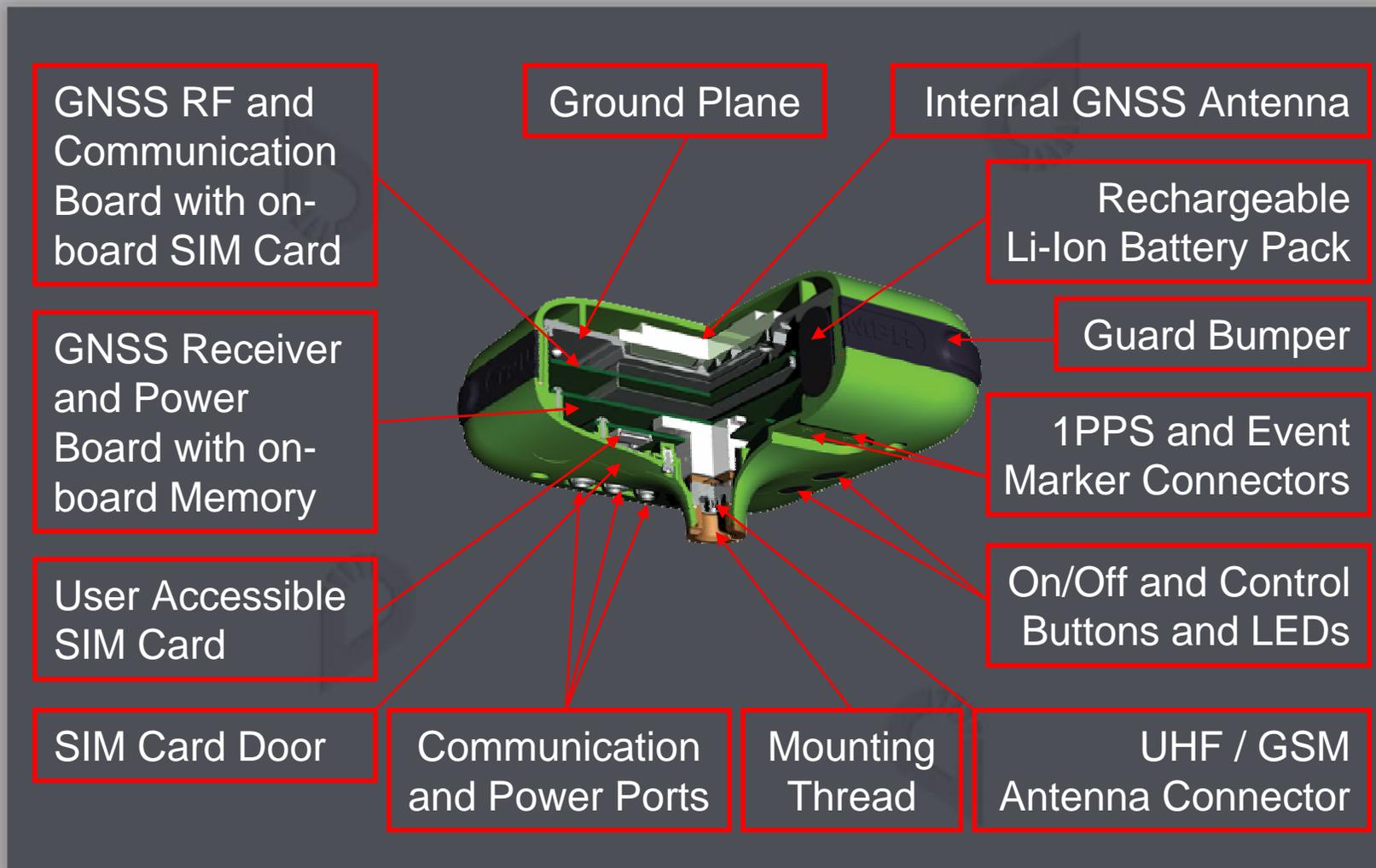


TRIUMPH-1

- All GNSS Electronics & data storage
- GNSS Antenna
- UHF Modem & Antenna
- WiFi & Antenna
- Ethernet
- Bluetooth & Antenna
- GSM (accessible SIM card) & Antenna
- Battery (20 hours) & Charger



TRIUMPH-1





CONNECTIVITY



POWER

SERIAL-A

SERIAL-B

ETHERNET

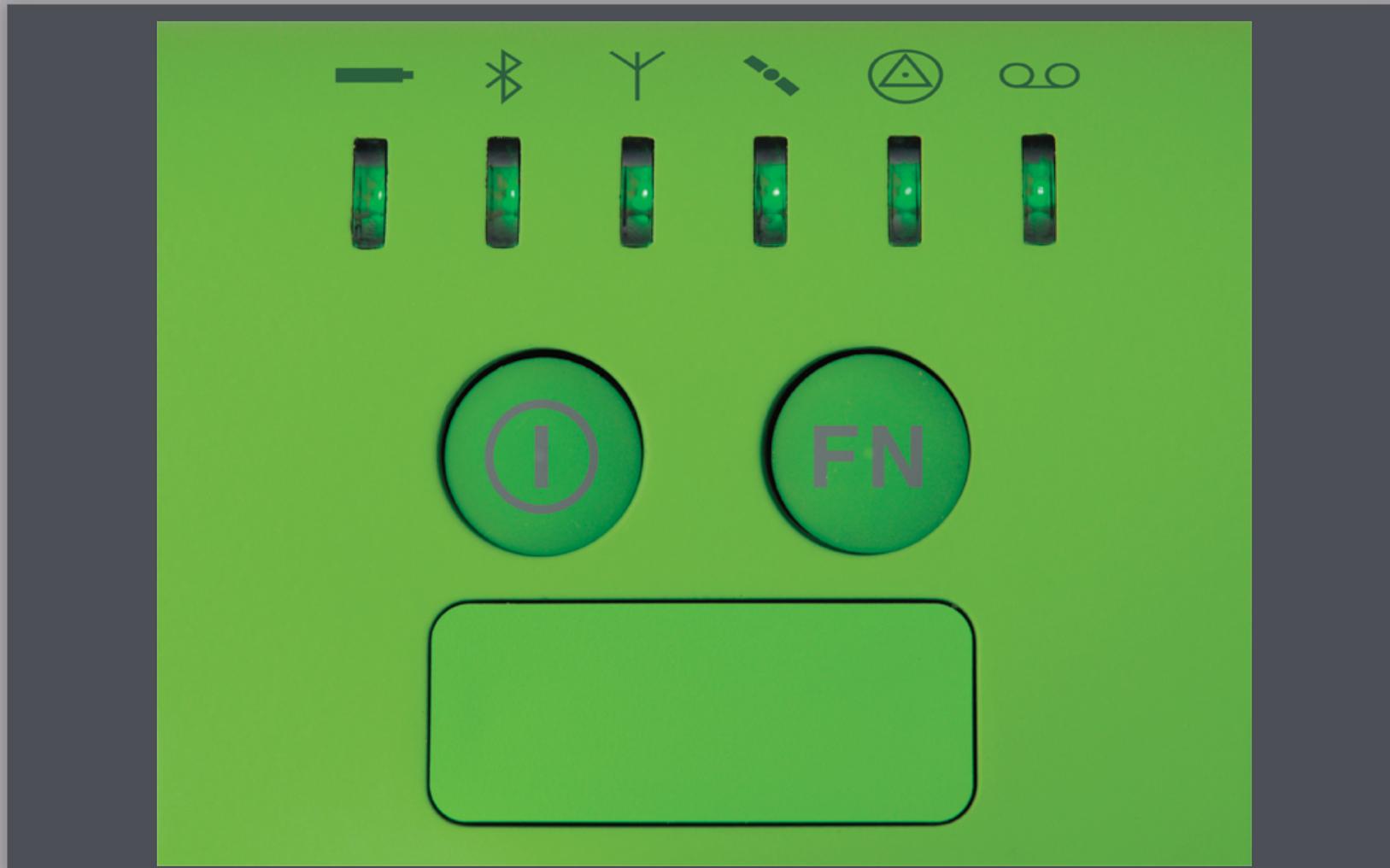
USB

plus

WiFi & BLETOOTH



FUNCTIONALITY





Rugged





TRIUMPH-4X

4 x 4

ALL WILL DRIVE

RTK!



TRIUMPH-4X





RTK Caddy & Umbrella



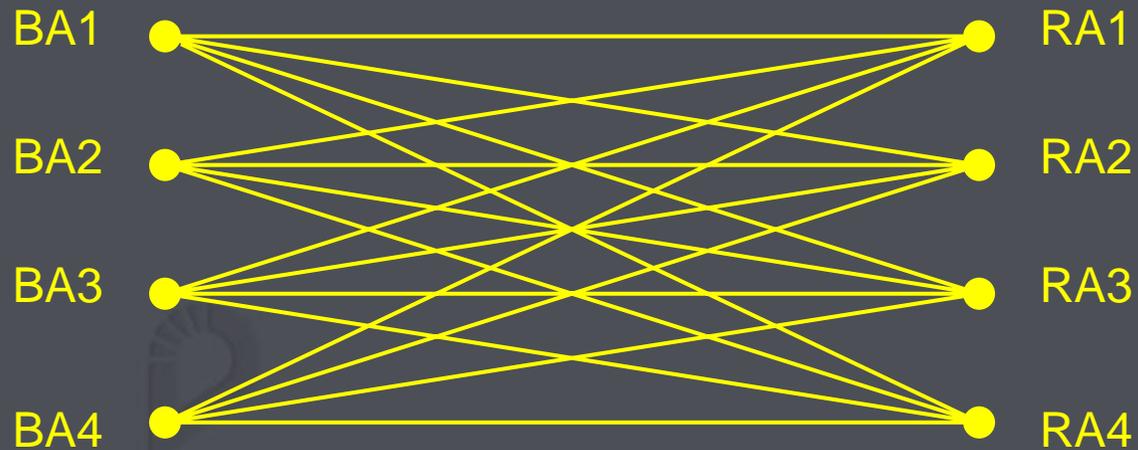
To make handling of the three additional antennas easy we have designed the RTK Umbrella. The receiver is mounted in the center and three small antennas on three folding arms. We took the hint from golfers and offer a modified golf caddy. The RTK Caddy is easy to store, transport and use in the field.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



4X4 RTK



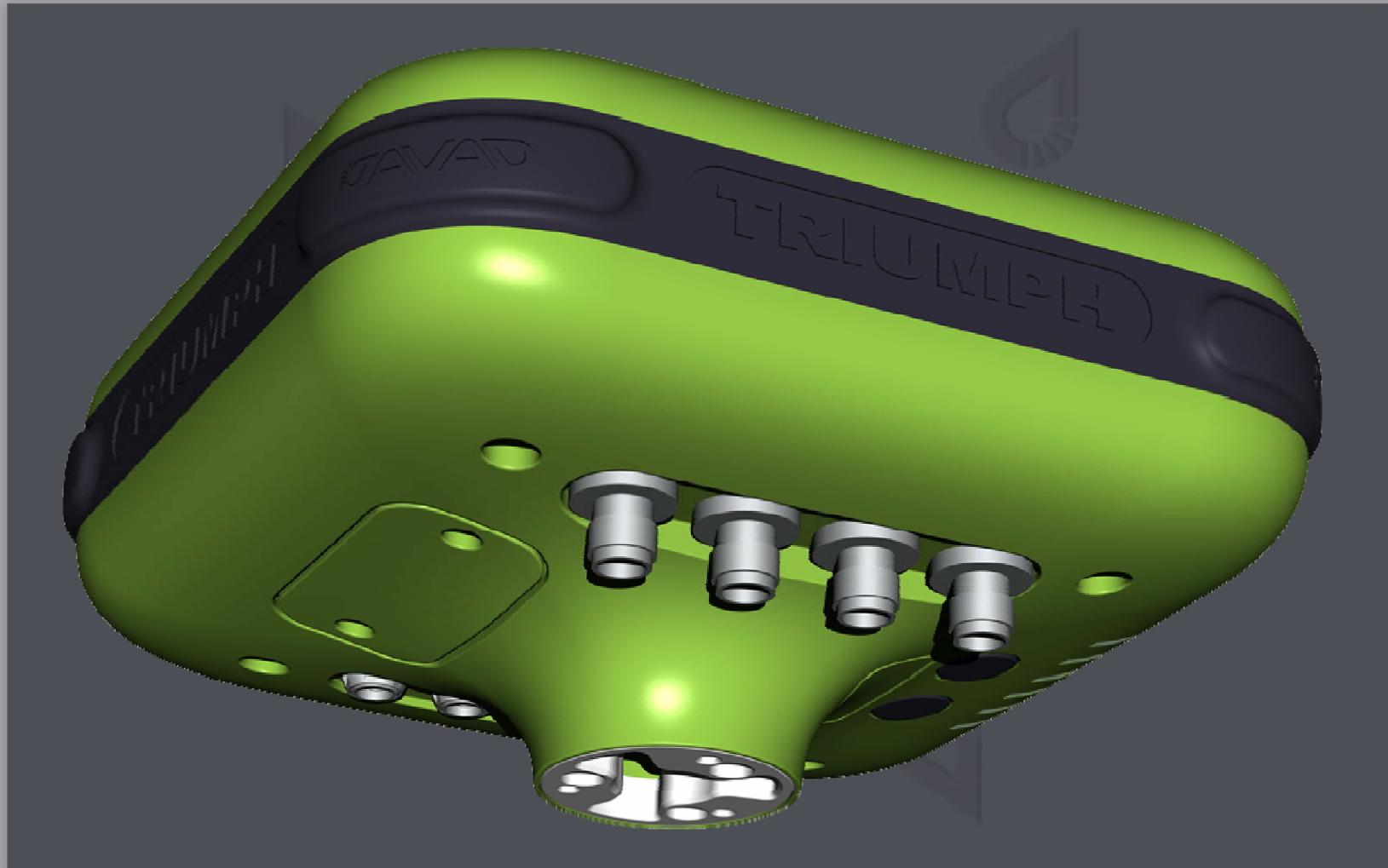
one base – one rover, one baseline



4 base – 4 rover, 16 baselines



TRIUMPH-4X



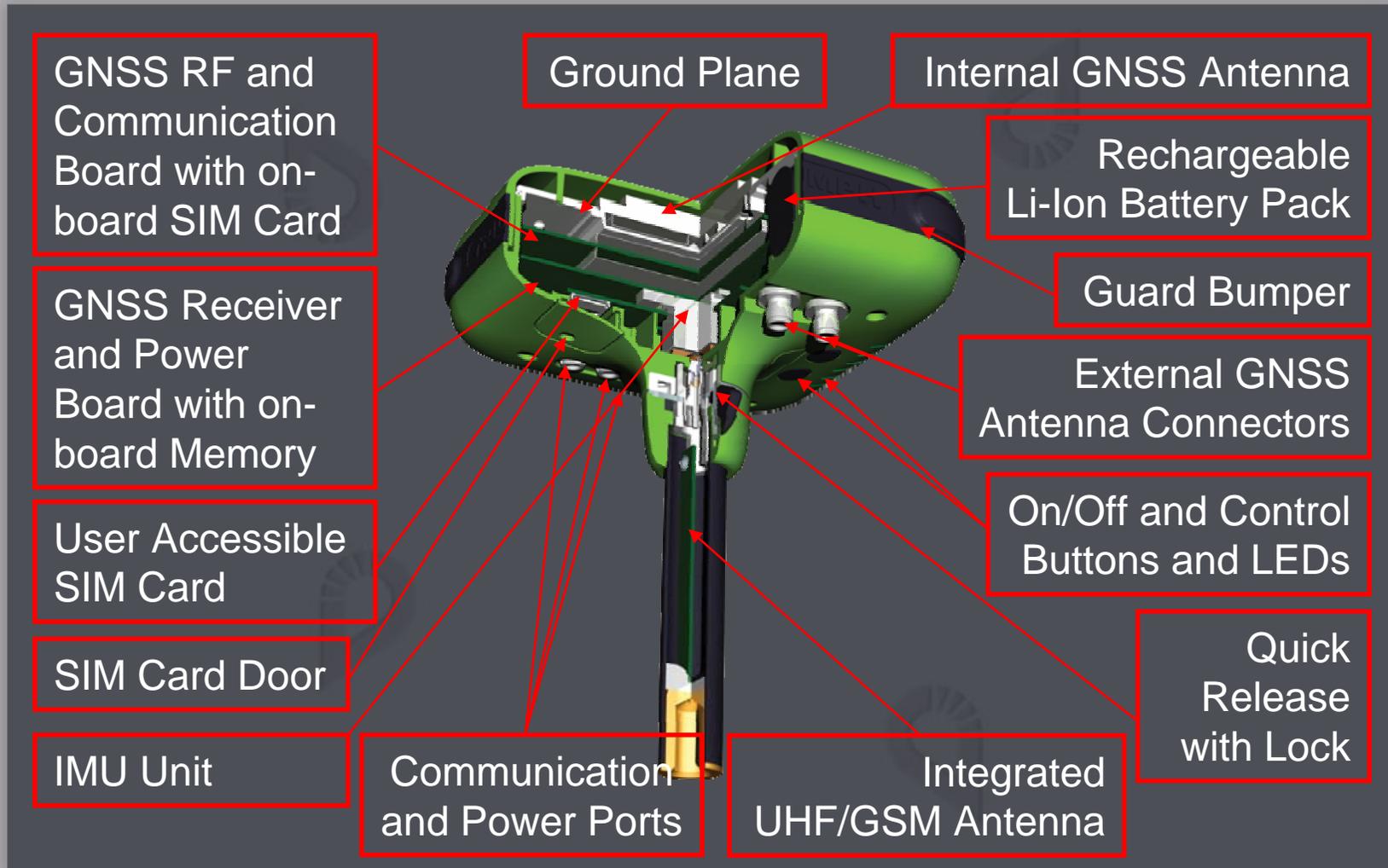


TRIUMPH-4X

- 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





RTK Caddy & Umbrella



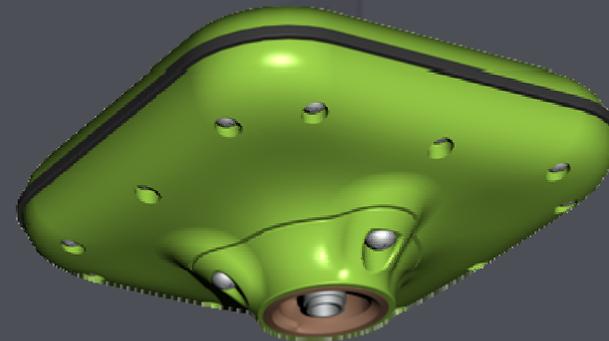
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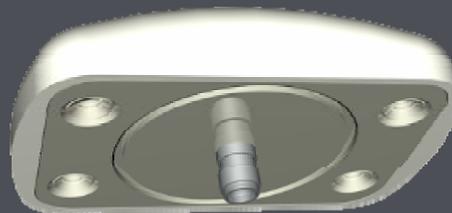
Antennas



GrAnt



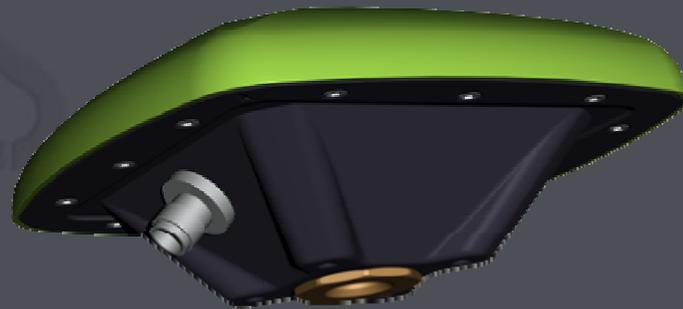
TriAnt



AirAnt



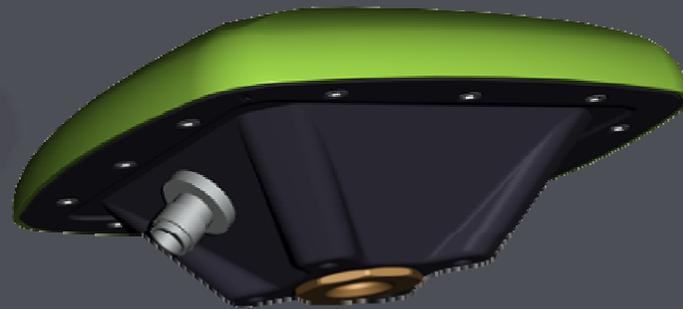
Antenna + IMU



GyrAnt



Antenna + GNSS



TyrAnt - G2

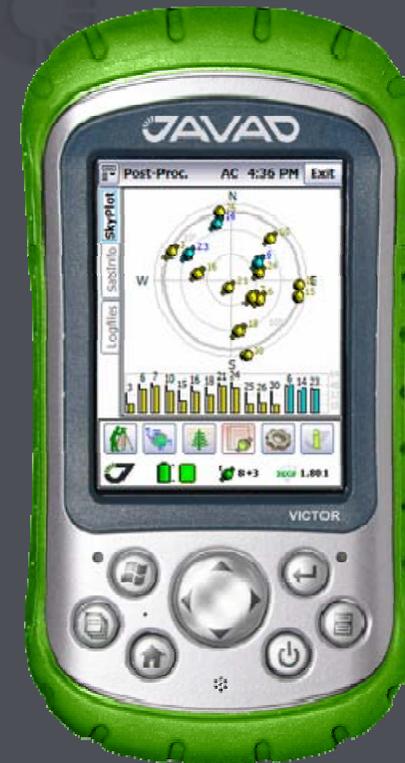
TyrAnt - G3

TyrAnt - G2T



VICTOR

Rugged Windows Mobile Hand-held controller



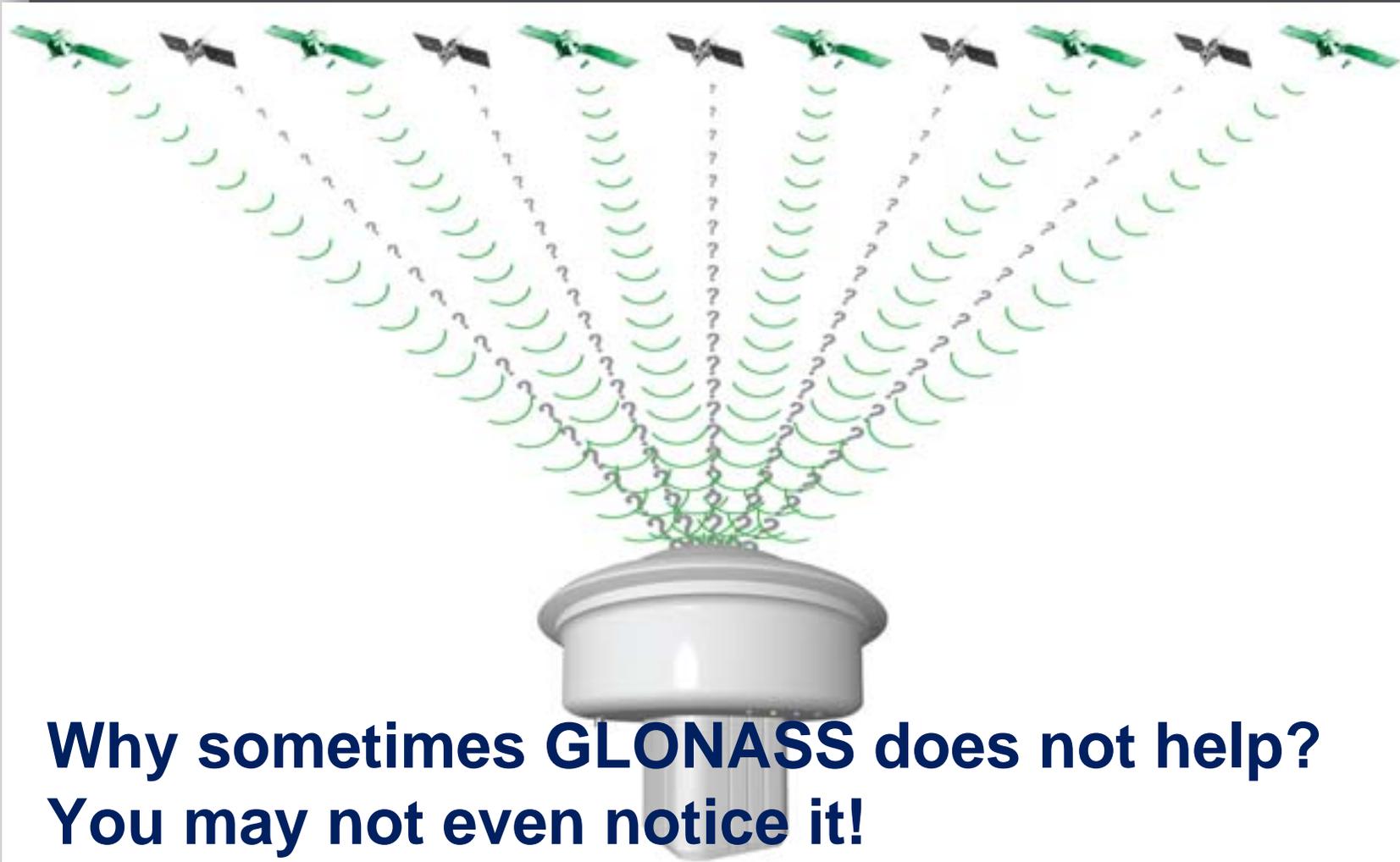


SOFTWARE

- **Justin:** A comprehensive Survey and GIS software.
- **Tracy:** A versatile and powerful field software.
- **Giodis:** Full-featured office post-processing software.



GLONASS ISSUES



**Why sometimes GLONASS does not help?
You may not even notice it!**



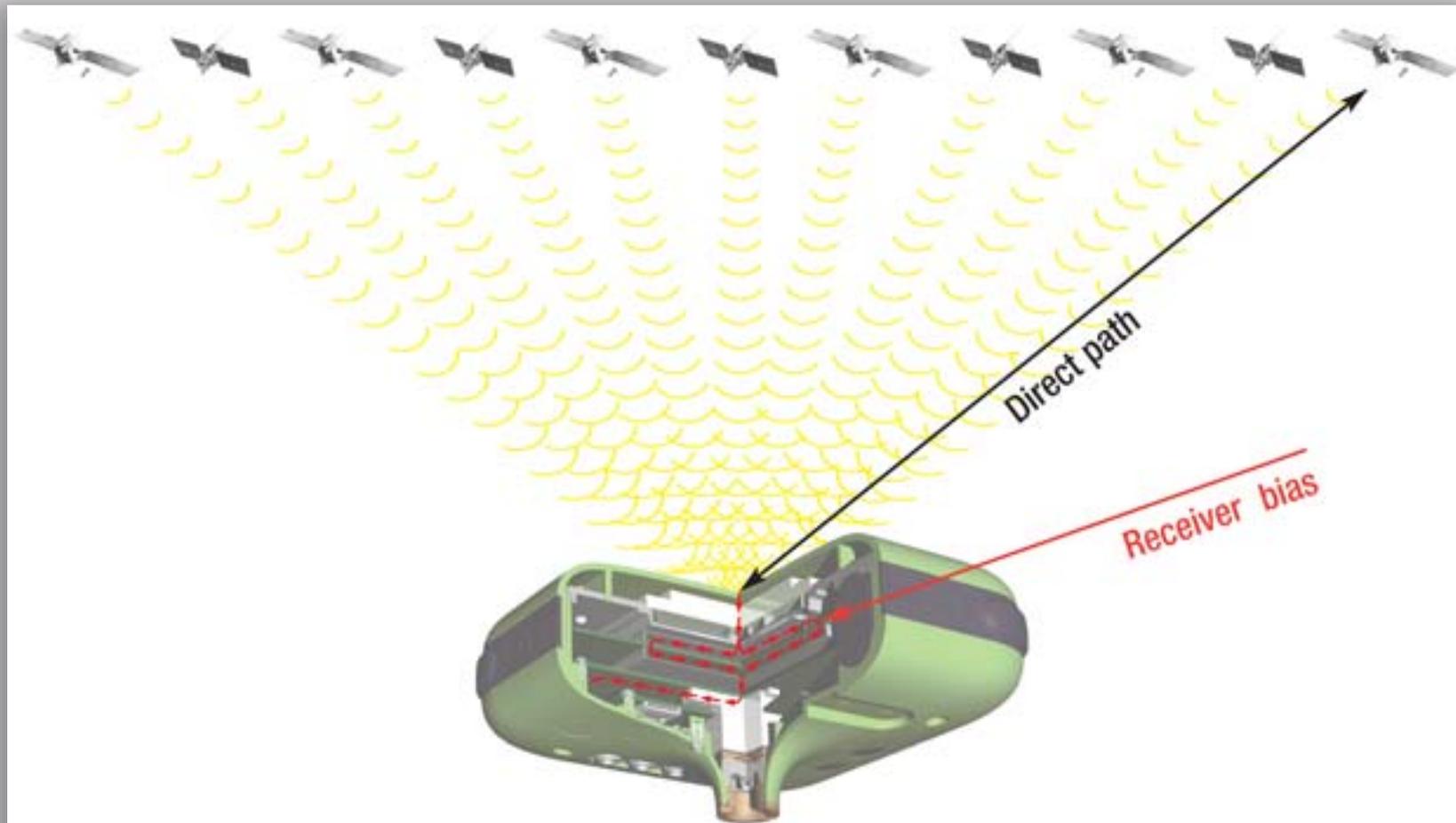
GLONASS ISSUES



**Why sometimes GLONASS hurts?
You may not even notice it!**



RECEIVER BIASES



Measuring distances to satellites



RECEIVER BIASES

Receiver biases cancel if they are the same for all satellites (single receiver)

OR

If they are the same in base and rover (differential)



RECEIVER BIASES

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



GLONASS

**We calibrate GLONASS biases
dynamically and continuously
with the accuracy of
0.2 millimeter.**





Triumph Palace

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.



Triumph Palace



THANK YOU