TRIUMPH TECHNOLOGY

Javad Ashjaee

JAVAD GNSS

www.javad.com

International SatelliteNavigation Forum

Moscow, April 7, 2008

WE ARE BACK TO LEAD …
With
TRIUMPH!

At the heart of our

TRIUMPH TECHNOLOGY

is our

TRIUMPH CHIP
0.09 Micron

TRIUMPH Chip

- GNSS signal processing section
- Viterbi decoder & CRC section
- CPU & FPU section
- Memory section
- PLL & I/O section

TRIUMPH

TRIUMPH Chip (GNSS DSP)

- 216 channels for GNSS signal tracking (5 correlators per each channel)
- advanced multipath mitigation technique
- 8-bit RF input
- 5 mm code measurement resolution
- 0.005 mm phase measurement resolution

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.

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.

TRIUMPH Chip (GNSS DSP)

Fast Acquisition module

- Equivalent of up to 110,000 regular correlators.
- 0.01 sec for complete frequency/delay 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

- 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)

- 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

BOARDS

- G2: GPS + Galileo
- G3: GPS + Galileo + GLONASS
- D: GPS L1/L2 + Galileo E1
- T: GPS L1/L2/L5, others dual frequency

Galileo is optional in all boards

BOARDS

Features/Models	TR-G2	TR-G3	TR-G2T	TR-G3T	TRE-G2T	TRE-G3T	*1	*2	*3
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	128 MB	128 MB	128 MB	256 MB	4 GB	4GB			
4.5-to-40V Power Sup.	Yes	Yes	Yes	Yes	Yes	Yes			
Hardware Viterbi	Yes	Yes	Yes	Yes	Yes	Yes			
Size (mm)	40x55	57x66	57x66	57x88	100x80	100x80	100x60	125x85	
Total channels	216	216	216	216	216	216	60	54	
Base Price	$600	$1,200	$1,800	$2,400	$1,800	$2,700			

Duo-G2D

- 2 G2D in 1 board
- All features of TRE-G2T
- Heading, multi antenna navigation, etc.

Quatro-G3D

- One G3D + 3x G2D in 1 board
- All features of TRE-G3T
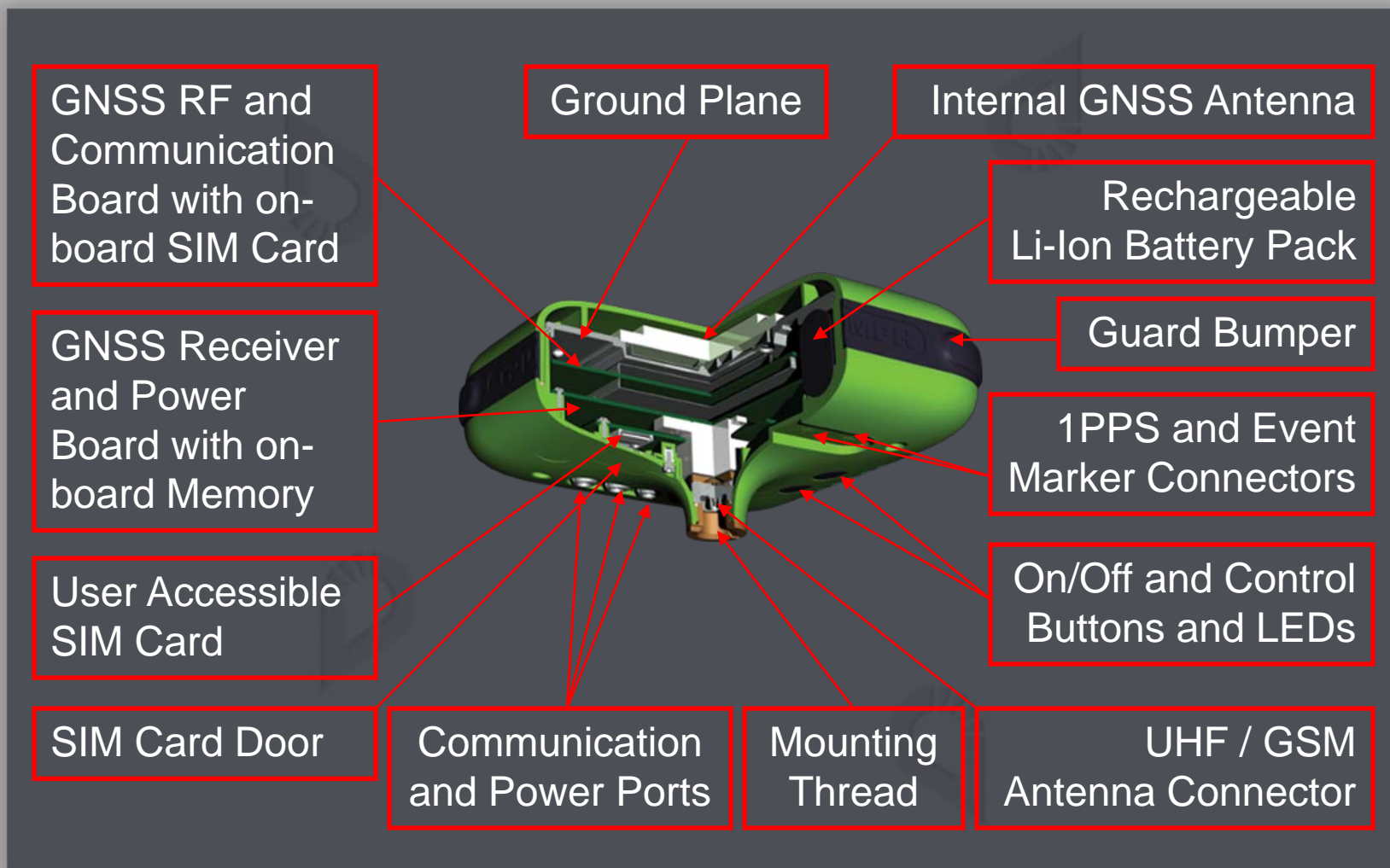- Attitude, multi antenna navigation, etc.

TRIUMPH-1

- Antenna
- UHF Modem (Javad's ArWest)
- WiFi
- Ethernet
- Bluetooth
- GSM (accessible SIM card)
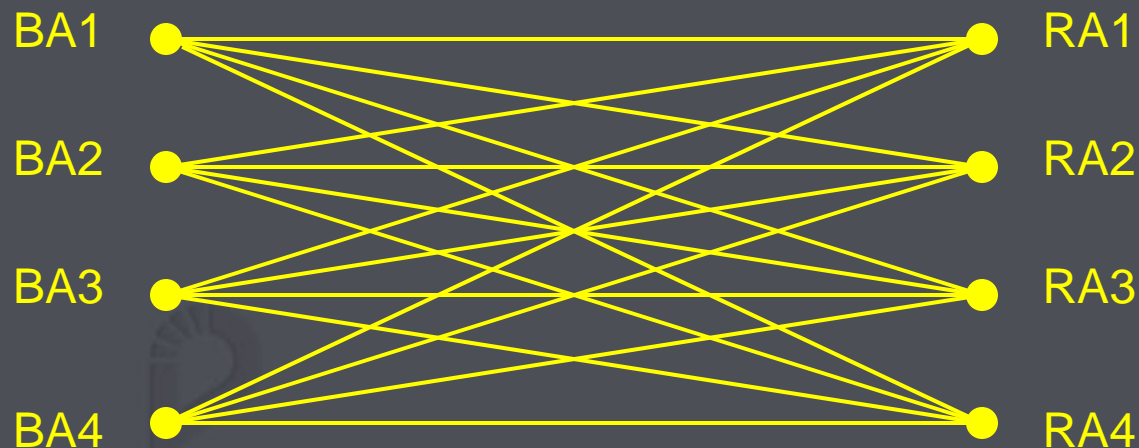- Battery (20 hours) & Charger

TRIUMPH-1

GNSS RF and Communication Board with on-board SIM Card

Ground Plane

Internal GNSS Antenna

Rechargeable Li-Ion Battery Pack

GNSS Receiver and Power Board with on-board Memory

Guard Bumper

1PPS and Event Marker Connectors

User Accessible SIM Card

On/Off and Control Buttons and LEDs

SIM Card Door

Communication and Power Ports

Mounting Thread

UHF / GSM Antenna Connector

4 x 4

ALL <u>WILL</u> DRIVE

RTK!

B ●————————————● R

one base – one rover, one baseline

BA1 ● ● RA1

BA2 ● ● RA2

BA3 ● ● RA3

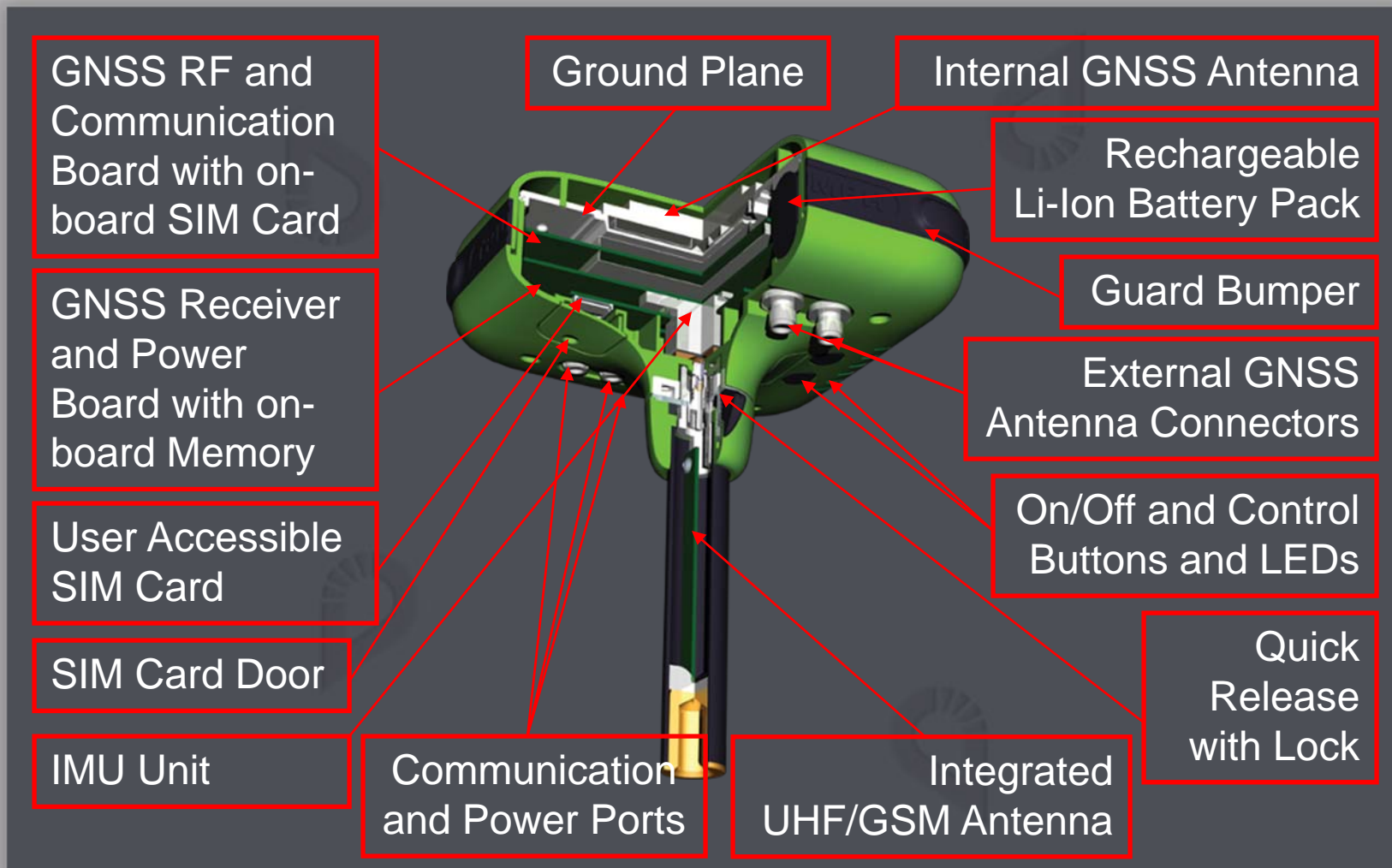BA4 ● ● RA4

4 base – 4 rover, 16 baselines
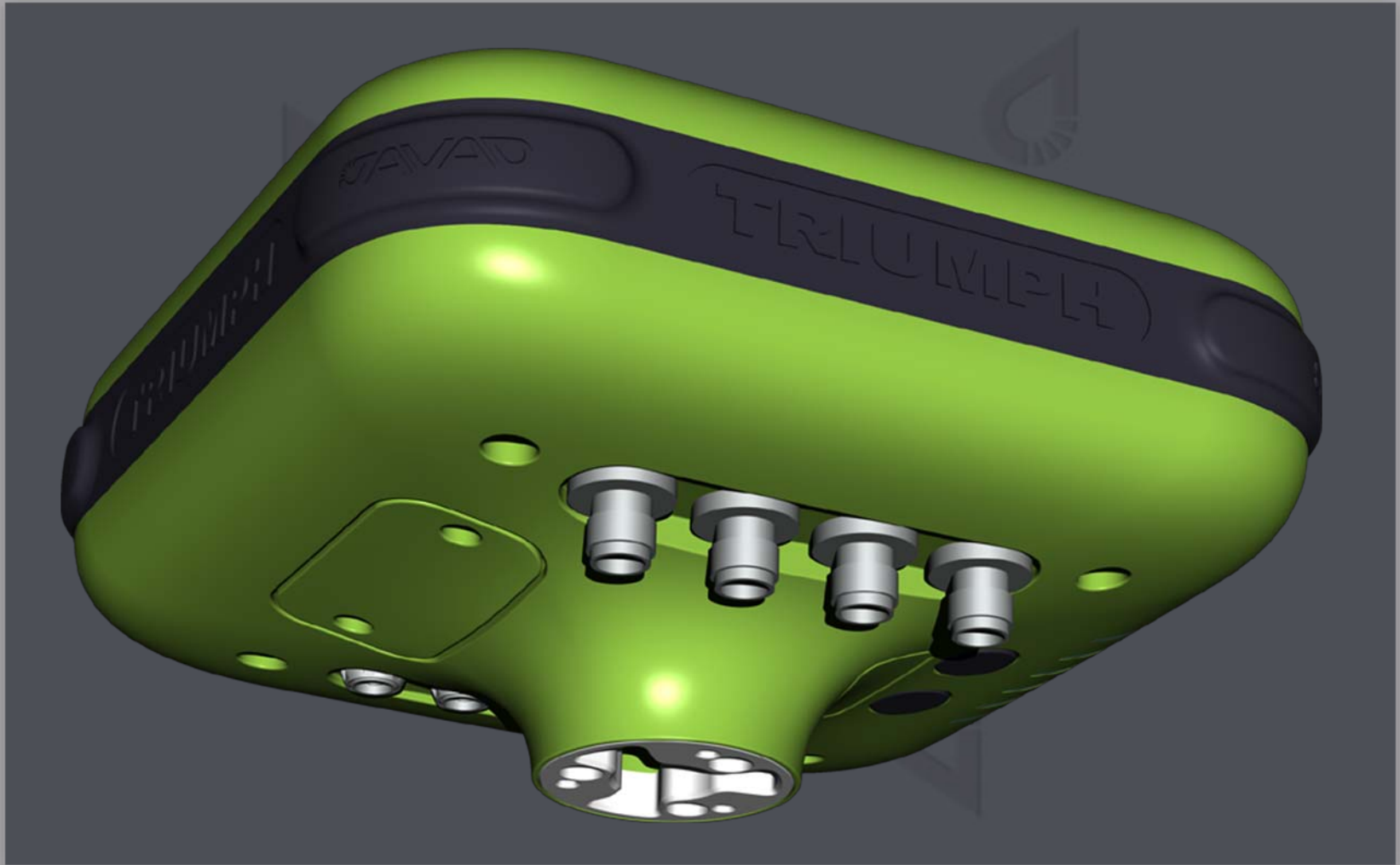
TRIUMPH-4X

- 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

GNSS RF and Communication Board with on-board SIM Card

Ground Plane

Internal GNSS Antenna

Rechargeable Li-Ion Battery Pack

GNSS Receiver and Power Board with on-board Memory

Guard Bumper

External GNSS Antenna Connectors

User Accessible SIM Card

On/Off and Control Buttons and LEDs

SIM Card Door

Quick Release with Lock

IMU Unit

Communication and Power Ports

Integrated UHF/GSM Antenna

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.
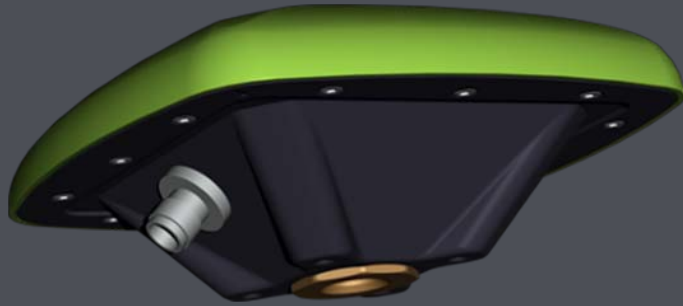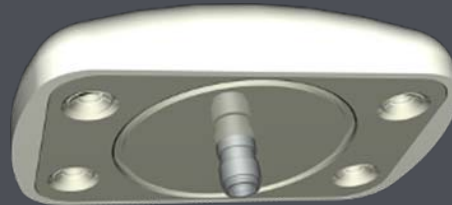
GrAnt
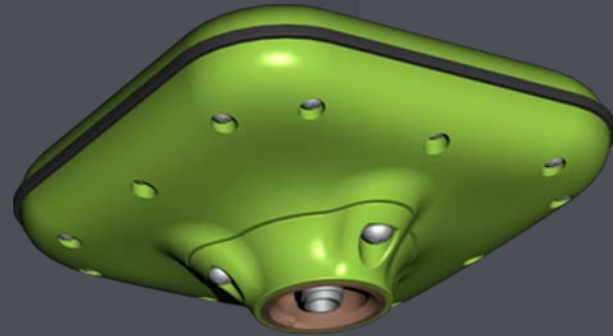
TriAnt

AirAnt

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.

The new generation of JAVAD GNSS products was named after Triumph Palace, a building in Moscow where company's Research and Development Center resides.

END