APX-20 UAV

High Performance GNSS-Inertial Solution with Dual IMU's

The Trimble® APX-20 UAV is a GNSS-Inertial OEM solution designed to reduce the cost and improve the efficiency of mapping from small Unmanned Aerial Vehicles (UAVs). Comprised of small, low power, precision GNSS and inertial hardware components and POSPac UAV™ post-mission Differential GNSS-Inertial office software, the APX-20 UAV eliminates the need to survey extensive Ground Control Points (GCP's), and reduces the amount of sidelap required to be flown per flight. The innovative APX-20 UAV features a precision, survey grade GNSS receiver and dual inertial measurement units; one embedded onto the GNSS-inertial board and one as an external unit mounted on the sensor to be georeferenced. With this feature the APX-20 UAV automatically supports integration on gimballed platforms without requiring an external interface to an autopilot or the mount itself.

High Accuracy, Extremely Small Package

Weighing only 90 grams, and measuring just 60 x 67 x 34 mm for the GNSS-Inertial board, with different types of external IMU sensors, the APX-20 UAV provides unparalleled performance in an extremely small and lightweight package. The APX-20 UAV computes a real-time navigation solution at 100 Hz using its embedded IMU while simultaneously logging the raw IMU data from both the internal and external IMU at 200 Hz for post-processing in POSPac UAV. The highly accurate post-processed position and orientation solutions are used for direct georeferencing of cameras, LiDARs and other sensors.

The APX-20 UAV brings all the benefits of Direct Georeferencing to UAV platforms:

- Turn your UAV into a professional mapping solution
- Ultra-fast image georeferencing for faster map production and delivery
- Reduced number of ground control points, saving time and money
- Consistent, reliable, highly accurate results
- Increased collection area per flight for greater productivity
- Redundant navigation solution to autopilot for enhanced safety

Key Features

- High-performance Direct Georeferencing solution for improved efficiency and accuracy of mapping from small Unmanned Aerial Vehicles
  - Reduce/eliminate GCP's
  - Reduce sidelap
  - Accurate LiDAR/Camera georeferencing
  - Seamless workflow with gimballed platforms
- Compact OEM module complete with survey-grade multi-frequency GNSS receiver and embedded and external IMU's
- Applanix IN-Fusion™ GNSS-Inertial and SmartCal™ compensation technology for superior position and orientation performance
- POSPac UAV Differential GNSS Inertial post-processing software for highest accuracy georeferencing
- RTK real-time position for precision landing and real-time mapping applications
- Supports all common RTK corrections
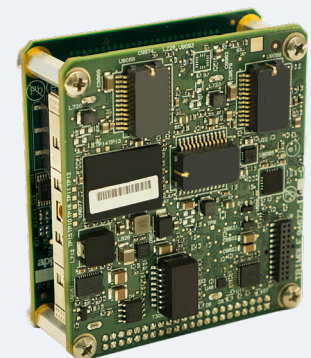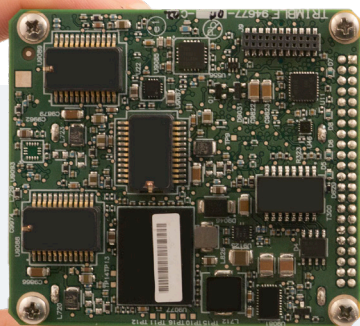
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TECHNICAL SPECIFICATIONS
System Summary

- Advanced Applanix IN-Fusion GNSS-Inertial integration technology
- Dual IMU with solid-state MEMS inertial sensors with Applanix SmartCal compensation technology
- Advanced Trimble Maxwell™ Custom GNSS survey technology
- 336 Channels
  - GPS: L1 C/A, L2C, L2E, L5
  - GLONASS: L1 C/A, L2 C/A, L3 CDMA[7]
  - BeiDou: B1, B2
  - Galileo: E1, E5A, E5B, E5AltBOC
  - QZSS: L1 C/A, L1S, L1C, L2C, L5, LEX
  - SBAS: L1 C/A, L5
  - MSS L-band: Trimble® RTX, OmniSTAR®
- High precision multiple correlator for GNSS pseudorange measurements
- Unfiltered, unsmoothed pseudorange measurements data for low noise, low multipath error, low time domain correlation and high dynamic response
- Very low noise GNSS carrier phase measurements with <1 mm precision in a 1 Hz bandwidth
- Proven Trimble low elevation tracking technology
- 100 Hz position, roll, pitch and heading output
- IMU data rate 200 Hz for both Internal and external IMU
- Navigation output format: ASCII (NMEA-0183), Binary (Trimble GSOF)
- Supported Reference input: CMR, CMR+, sCMRx, RTCM 2.1, 2.2, 2.3, 3.0, 3.1
- Support for POSPac UAV post-processing software (included)
- No export permit required

LAN INPUT/OUTPUT

ALL ETHERNET FUNCTIONS ARE SUPPORTED THROUGH DEDICATED IP ADDRESS (STATIC OR DNS) SIMULTANEOUSLY.	
TCP/IP and UDP	ASCII and Binary data streaming (Time tag, PPS sync, status, position, attitude, velocity, track and speed, dynamics, performance metrics, GNSS data)
HTTP	Web based Control software (GUI) for easy system configuration and low rate display. Support for all common browsers (IE, Safari, Mozilla, Google Chrome, Firefox)

SERIAL INPUT/OUTPUT

RS232 LEVEL PORT	
TTL level (3.3 V) port Parameters	ASCII and Binary data streaming (Time tag, PPS sync, status, position, attitude, velocity, track and speed, dynamics, performance metrics, GNSS data), reference input (CMR, CMR+, sCMRx, RTCM), configuration messages

OTHER I/O	
PPS (pulse-per-second)	Time Sync Pulse output
Event Input (2)	Two time mark of external events TTL 3.3 V pulses, max rate 50 Hz
Digital I/O (3)	LED drivers with dedicated functionality for systems integrators

LOGGING

Internal Logging ....6 GByte Flash memory
External Logging .... USB 2.0 Device port
Parameters .... Time tag, status, position, attitude, velocity, track and speed, dynamics, performance metrics, raw IMU data (200 Hz), raw GNSS data

INERTIAL MEASUREMENT UNITS (IMU)

AIRBORNE					
IMU TYPE	RANGE[5]	TEMP (°C)	POWER	SIZE (mm) [L x W x H]	WEIGHT (KG)
Internal onboard IMU59	+/-6g, +/-350dps	-40 °C - +75 °C	n/a	n/a	n/a
External IMU82	+/-10g, +/-490dps	-40 °C - +85 °C	4.75 to 36 VDC (4W max)	61 x 68 x 65	0.330
External IMU90	+/-10g, +/-490dps	-40 °C - +85 °C	4.75 to 36 VDC (1.8W max)	39 x 42 x 22	0.070
External IMU93	+/-10g, +/-490dps	-40 °C - +85 °C	4.75 to 28 VDC (3W max)	50 x 50 x 50	0.180

PERFORMANCE SPECIFICATIONS[2] (RMS ERROR)
Unmanned Airborne Vehicle Applications

AIRBORNE				
	SPS[9]	RTK[3, 9]	PP-RTX[10]	POST-PROCESSED[4,9]
Position (m)	1.5 - 3.0	0.02 - 0.05	0.03 - 0.06	0.02 - 0.05
Velocity (m/s)	0.05	0.15	0.01	0.010
Roll & Pitch (deg)	0.03	0.025	0.015	0.015
True Heading[2] (deg)	0.10	0.08	0.035	0.035

PHYSICAL CHARACTERISTICS
Board Set

Size[8] .... 67 L x 60 W x 34 H mm
Weight[8] .... 90 grams
Power[8] .... Wide range input 9-30 V DC, typical power consumption of 4W at room temperature
Connectors .... I/O: 44 Pin Header Samtec TMM-122-03-S-S-MW (mating part FCI 90311-044LF) IMU Connector: Mlolex 503148 (mating part Molex 503149)
Antenna Port ....Connector: MMCX receptacle Output Voltage: 3.3 V DC to 5 V DC Maximum Current: 400 mA Minimum Input Signal Strength: 32 dB (>35 dB Recommended)

ENVIRONMENTAL CHARACTERISTICS

Temperature .... -40 °C to +75 °C (Operational), -55 °C to +85 °C (Storage)
Mechanical Shock .... +/- 75g Survival
Operating Humidity .... 5% to 95% R.H. non-condensing at +60 °C
Maximum Operating Limits .... 515 m/sec, 18,000 m

ADDITIONAL ACCESSORIES[6]

- Evaluation Kit (Development Board)

POSPAC UAV OFFICE SOFTWARE

- Post-processed Differential GNSS-Inertial SW for APX-20
- 200 Hz Navigation solution (Position, Velocity, Orientation, Rates, Accelerations)
- Applanix IN-Fusion GNSS-Integration technology
- Full support for UAV dynamic models
- Single Base Differential GNSS-Inertial processing
- Forward and reverse processing with optimal Smoother with support for Applanix SmartBase virtual reference station module[6]
- Support for PP-RTX[10]

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1 Typical performance. Actual results are dependent upon satellite configuration, atmospheric conditions and other environmental effects
2 Typical survey mission profile, max RMS error. Heading error will increase for low speed rotor applications and when hovering.
3 Requires base station and radio link, sold separately
4 POSPac UAV, short base line operation
5 Sensor bandwidth (-3 dB amplitude) ~ 50 Hz

6 Sold separately
7 There is no official GLONASS L3CDMA or Galileo E6 ICD. The current tracking capability is based on publicly available information. Full receiver compatibility cannot be guaranteed.
8 Not including external IMU
9 Performance based upon external IMU
10 POSPac UAV/MMS, Post-processed CenterPoint® RTX, typical mission performance subscription sold separately. The accuracy is subject to quality of GNSS, durational data set, and regional coverage.

Specifications subject to change without notice.

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