

CASE STUDY

UAV
NAVIGATION

Hydra Technologies Takes Flight

Hydra S45 medium-range UAV uses VN-200 GPS/INS for primary navigation

Since Hydra Technologies was founded in 2004 it has been producing medium-range Unmanned Aerial Vehicles (UAVs) with a focus on delivering platforms with extended range, payload and endurance capabilities. The latest evolution in Hydra's UAV portfolio is the S45 Balaam.

INTRODUCTION

The S45 Balaam (Jaguar) is a dual engine, gasoline piston driven UAV with a 5 m wingspan, an operational range of 120 km, endurance of 12 hours, 4500 m operational ceiling and payload capacity of up to 5 kg (10 lbs.). The S45 is designed for fast deployment, taking a two man crew less than 20 minutes to set up the ground control station and aircraft before being ready for flight.

Hydra have developed the in-house expertise to design and produce the airframe, control electronics and autopilot software, however they rely on outside industry experts to supply specialist sensors, such as the Inertial Navigation System (INS). Hydra's previous INS solution relied on outdated technology and struggled with both poor performance and reliability issues. "Our old INS suffered from low accuracy, provided only 0.4° dynamic pitch and roll, had a low measurement range of 300°/s gyros and 6 g accels, low frequency data output of 50 Hz and poor gyro angular walk performance" says Monica Rodriguez, R&D Communications Manager at Hydra Technologies. "We decided that a newer, higher performing INS solution was essential for the S45's primary flight control system."

CHALLENGES

The dual engine configuration of the S45 introduces high vibration from the two engines, which creates a challenging environment for inertial sensors. As an ISR platform, it was imperative that the INS provide accurate, low latency attitude data for the gimbal stabilization, which would result in a jitter free video feed for operators.

COMPANY PROFILE



With headquarters in Guadalajara, Mexico, Hydra Technologies is a specialist in the design and development of unmanned aerial vehicles (UAV) with a mission focus on intelligence, surveillance and reconnaissance (ISR) operations for the Mexican Armed Forces, Federal Police and the Civil Protection Agency.

APPLICATION

UAV Navigation

VECTORNAV PRODUCT

VN-200 GPS-Aided Inertial Navigation System

HYDRA TECHNOLOGIES PRODUCT

S45 BALAAM (Jaguar)



Hydra Technologies' S45 BALAAM



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+1-703-256-8900 • 800-628-0885 • info@navtechgps.com



CHALLENGES (continued)

To meet the more challenging operational requirements of some customers it was also important that the Hydra team evaluate the performance of the INS during GPS outages. The desired INS solution needed to satisfy two primary criteria: maintain accurate position and attitude estimates during a temporary GPS outage; and recover full performance in minimal time after GPS re-acquisition.

Size, weight and power consumption (SWaP) were also driving requirements when down selecting candidate INS solutions for evaluation. Even with a relatively large payload capacity of 5 kg on the S45, every gram saved on the INS would add a gram to the payload. After a comprehensive search, the Hydra team decided to evaluate two solutions, one from a European INS supplier and the VN-200 GPS/INS from VectorNav Technologies.

HOW VECTORNAV HELPED

"Evaluation of the VN-200 was quite straightforward. The simple interface and responsive support from the VectorNav Engineering team helped us get the VN-200 data integrated into our autopilot very quickly and we were able to conduct multiple flight tests to evaluate the unit in real operating conditions," says Rodriguez. "The VN-200 provided the best attitude performance and exceeded all expectations of what could be achieved in our high vibration environment, even outperforming larger, more expensive systems. There was simply no other solution that met the SWaP requirements and delivered that level of performance."

Hydra engineers extended the testing to evaluate the performance of the INS in conditions of GPS loss, again with the VN-200 coming out on top and providing the lowest position error propagation compared to the other sensors over the same period of time. "The performance of the VN-200 combined with the small size, weight and power of the sensor made the decision straightforward," says Rodriguez.

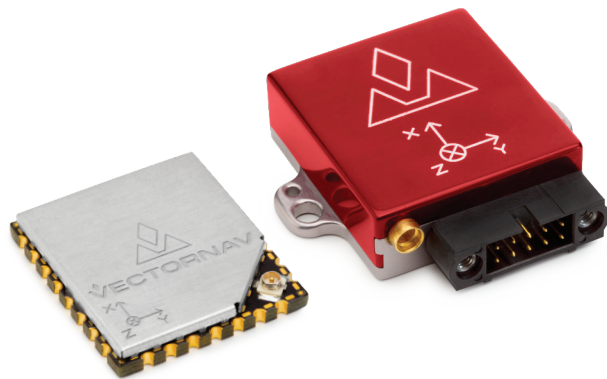
RESULTS, RETURN ON INVESTMENT AND FUTURE PLANS

Based on the success using the VN-200 Rugged module, Hydra are now planning to integrate the VN-200 Surface Mount Device (SMD) directly onto the control electronics. The Hydra team is also planning to integrate VectorNav's VN-300 Dual GNSS/INS as well as the Tactical Series VN-210 GNSS/INS to meet even more challenging requirements for upcoming applications. "VectorNav's full product offering shares a common software interface, which streamlines the integration process and enables us to offer a wider range of operational capabilities," says Rodriguez.

ABOUT VECTORNAV

VectorNav Technologies is a leading developer and manufacturer of high performance inertial navigation systems using the latest in MEMS sensor and GPS/GNSS technology. Since its founding in 2008, VectorNav has provided systems integrators in the Military, Aerospace, Marine, and Robotics industries with inertial navigation solutions with best-in-class price to performance ratios.

VN-200 GPS-Aided INS



KEY SPECIFICATIONS

NAVIGATION & IMU

Heading (INS)	0.3 ° RMS
Pitch/Roll (Dynamic)	0.1 ° RMS
Accelerometer Range	±16 g
Gyroscope Range	±2000 °/s
Gyro In-Run Bias Stability	5 °/hr typical
Accel In-Run Bias Stability	< 0.04 mg
Max Output Rate	800 Hz

PHYSICAL & ELECTRICAL

Dimensions (Rugged)	36 x 33 x 9.5 mm
Dimensions (SMD)	24 x 22 x 3 mm
Weight (Rugged)	16 g
Weight (SMD)	4 g
Max Power Usage (Rugged)	500 mW
Max Power Usage (SMD)	445 mW

INTERFACES

Interface (SMD)	Serial TTL, SPI
Interface (Rugged)	RS-232, Serial TTL

Contact us for product details and pricing



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info@NavtechGPS.com

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