KVH

Case Study

Churchill Navigation Selects KVH's CNS-5000 for Dynamic Mapping Application in Augmented Reality System (ARS)

Summary

It sounds like something out of a summer action movie – a late night pursuit of a criminal, law enforcement helicopters streaking overhead to keep him in sight and guide officers on the ground right to the perpetrator using high-tech video systems, real-time tracking, and precision navigation. But this is no special effect on the big screen; this is reality thanks to a next-generation mapping system called Augmented Reality System (ARS) developed by Churchill Navigation and integrated by Paravion Technology, Inc. ARS enables airborne law enforcement teams to pursue and track suspects by overlaying street names and property addresses directly over the live video from their infrared cameras. With high-resolution geographic, address and property owner databases from communities throughout the nation, plus street information, satellite imagery and topographic maps, there is no place left to hide. But for this solution to work, Churchill Navigation and Paravion needed to ensure that their navigation and positioning information was precise, reliable, and rock-steady. That's why they turned to KVH Industries, Inc., and its CNS-5000 inertial navigation system (INS).

Churchill Navigation and Paravion Technology's ARS provides a next-generation solution to moving map technology with precision positioning and navigation provided by KVH's CNS-5000.

Challenges

According to Scott Holst, Paravion sales and marketing director, the ARS system includes a touchscreen monitor, the CNS-5000 INS, a computer system with a minimum of a half terabyte of solid state storage, and Churchill Navigation's augmented reality mapping solution. To make the system viable for installation in helicopters, the ARS unit's weight was a serious consideration, as was ease of integration with other hardware. In addition to needing a continuous navigation system capable of delivering reliable, accurate data while being small and light enough to fit in the helicopter's limited space, the INS had to offer easy installation.

The Solution: KVH's CNS-5000 Continuous Navigation System

"The KVH CNS-5000 met the demanding specifications of our airborne application but was still a compact size," said Tom Churchill, CEO of Churchill Navigation. "We considered many other inertial measurement systems for the ARS, but most were too large or too expensive for our applications. KVH's CNS-5000 stood out for its performance, physical size, and cost. And KVH has been very supportive and responsive."

The CNS-5000 combines two complementary technologies – highly accurate GPS via NovAtel's OEMV® GPS and a KVH fiber optic gyro (FOG)-based INS – within a single, small form enclosure. With KVH's patented Digital Signal Processing (DSP) technology, the CNS-5000 provides a groundbreaking low-cost, compact solution for 3D positioning, velocity, and attitude measurement. *(continued)*

Company Info

CHURCHILL NAVIGATION

Churchill Navigation is a world leader in advanced mapping technology and the recognized authority in augmented reality mapping. A privately held company founded in 2005, Churchill is dedicated to building fast and elegant mapping products that make a difference in the world.

Paravion® Technology Inc.

Paravion Technology, Inc., is a leading supplier of aircraft accessories to the general aviation marketplace. Established in 1986 with the development and sales of the Pneumatic Door Opener System for Bell 206 Series helicopters, Paravion, a FAA approved manufacturer, is well known for its innovative yet easily installed and maintained products.

Additional Resources

About Churchill Navigation:
www.churchillnavigation.com

About Paravion Technologies, Inc.:
www.paravion.com

About KVH's fiber optic gyros:
www.fiberopticgyro.com

See demonstration video at:
www.tinyurl.com/YouTubeARS

Churchill Relies on CNS-5000 for Real-time Mapping

The Solution: KVH's CNS-5000 Continuous Navigation System (continued)

The CNS-5000's deeply coupled design offers exceptional performance and superior bridging capability when GPS reception is obstructed or unavailable. In dealing with environments where GPS can be blocked, KVH's CNS-5000 continues to deliver accurate and precise position, velocity, and attitude information with dramatically faster GPS signal reacquisition while maintaining precise inertial navigation, exactly as required by the ARS.

KVH's CNS-5000's reliable performance, easy integration and small size met the unique needs of the ARS.

Unlike most GPS/IMU systems that use GPS data to control errors in data from the IMU, the CNS-5000 relies on the inertial data to support the GPS by aiding in satellite reacquisition. By blending these two powerful technologies, the rugged CNS-5000 delivers superior GPS-tracking and performance for applications in the air, on land and sea, as well as underground and underwater.

Critical Attributes

The ARS airborne real-time mapping system relies on the KVH CNS-5000 to provide reliable and accurate data for the direct overlay of map data on live daylight and IR airborne video. The CNS-5000's ease of integration, its insensitivity to helicopter vibration and movement, and its ability to provide continuous robust positioning in challenging conditions make it especially ideal for the ARS.

Results/Impact

KVH's CNS-5000 provides a complete position, velocity and attitude solution in a compact, light-weight single enclosure, enabling the ARS to offer law enforcement agencies a better and safer way to pursue and track suspects. Easily installed into the small form factor ARS unit – which weighs less than 23 lbs., the CNS-5000 never compromised performance or overextended Paravion's production budget. According to Tom Churchill, the comments from customers are positive, "Law enforcement agencies are shocked that they can watch a person on live video walk into a house and see the address displayed on their screen directly above the roof – thanks to the KVH CNS-5000."

About KVH Industries, Inc.

KVH Industries is a premier manufacturer of high performance sensors and integrated inertial systems for defense and commercial guidance and stabilization applications. KVH is also a leading manufacturer of solutions that provide global high-speed Internet, television and voice services via satellite to mobile users at sea, on land, and in the air. The company is located in Middletown, RI, with facilities in Illinois, Denmark, Norway, and Singapore.

CNS-5000

IMU Specification

Gyro Technology	FOG
Gyro Bias (deg/hr, 1σ)	±1
Gyro Bias Repeatability (deg/hr, 1σ)	±3
Gyro Angle Random Walk (deg/√hr)	0.0667 Max
Accel Technology	MEMS
Accel Bias Offset (total, mg)	±50
Accel Bias Stability (mg)	±.75
Accel Velocity Random Walk (m/s/√hr)	0.0053 Max

System Accuracy

Position Accuracy (CEP)	RTK (2 cm + 1 PPM) DGPS (0.5 m) Single Point (1.8 m)
Velocity Accuracy (m/s, CEP)	0.02
Heading Accuracy (Yaw) (degrees, RMS)	0.1
Roll & Pitch Accuracy (degrees, RMS)	0.05

For CNS-5000 sales and technical inquiries, contact:

Mr. Sean McCormack
FOG/OEM Sales Manager
KVH Industries, Inc.
smccormack@kvh.com
+1 401.845.2413

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