Unmanned Platforms Are Smaller But Sensor-Rich

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Just as computer users have gravitated from desktops to notebooks, notebooks to tablets and tablets to smartphones, armed forces and government security agencies are finding more uses for small unmanned aerial systems (UAS) of under 150 lb. all-up weight.

In fact, the market is diverging, as truck-mounted UAS, with large and unwieldy catapults, are replaced by higher-performance runway-launched systems or smaller versions. One stark example: Sagem is proposing its motor glider-based Patroller to replace the French army's aging 750-lb.-class Sperwer, while the Dutch armed forces have replaced Sperwer with Insitu ScanEagles.

While Israel continues to lead the small unmanned aerial vehicle (UAV) market, Boeing's Insitu unit has, up to now, earned a good deal of business and been able to fund rapid development programs on the back of fee-for-service contracts. Most of the 700,000 combat hours logged by ScanEagle, —now being joined by the larger Integrator and its U.S. military sibling, the RQ-21A Small Tactical UAS—including 29,000 ship-based hours in 2,700 sorties, have been under contracts where company employees maintain, launch and recover Insitu-owned assets and the military user pays for sensor-on hours over target areas.

The Insitu model generates profits, but also means that new capabilities are provided to the user as part of the service contract. The system can be upgraded outside military acquisition and training channels. In the case of the Integrator/Small Tactical UAS, the U.S. Marine Corps was able to operate it before the RQ-21 completed developmental testing. The USMC Air-Ground Combat Center has been flying the Integrator since 2011, and the UAS became operational aboard the amphibious landing ship USS Mesa Verde in February. The RQ-21A is expected to be operational in the first quarter of 2014.

New to ScanEagle—already in the field, but announced in May—is the EO-900 high-magnification daylight sensor, with 170 X zoom lens. Shrinking such a lens into an envelope “half the size of a breadbox” was not easy, but it provides a high level of detail from a great distance without requiring much communication bandwidth. The system incorporates a second wide-angle imager, and provides the operator with a “picture-in-picture” display to maintain situational awareness.

Also under test is what Insitu calls its Mid-Wave Infrared (MWIR) 3.0 sensor. After shrinking MWIR technology, the company combined MWIR and daytime electro-optical (EO) capability in a single sensor “with the same form factor, and virtually the same price” as the current MWIR 2.0. That permits an operator to keep aircraft on station without being constrained to switch between EO and IR.side: the potential for rapid shrinkage as major combat operations draw down. Consequently, the company has moved resources into the Asia-Pacific market. ScanEagle is operational with users as diverse as the Singapore navy and Australian Agriculture, Fisheries and Forestry Department. The latter has used the UAS over land, to monitor the growth of invasive Siam weed, and over water, to patrol for illegal fishing. The organization pioneered mixed-airspace operations, often at night when fish poachers work. Some plants can be detected by their IR signature, and other nighttime airspace users do not operate in the low-altitude bands used by a small UAS.

Insitu has new competition in the shape of ThunderB from Israel's BlueBird Aero Systems. Unveiled in June at the Paris air show, ThunderB is available with gasoline or electric power–the former offers 24-hr. endurance, and has retractable wheeled landing gear rather than Insitu's trademark catapult and SkyHook recovery system.

Israel, meanwhile, continues to apply advances in sensor technology to military UAVs. One of the latest developments is from Rafael, which unveiled part of a self-sufficient tactical terrain analysis system enabling land forces at brigade and battalion levels to map, analyze and digitize the terrain they are in and prepare tactical aids for operational planning, coordination and targeting independent of higher echelons.

The program conforms to the new priority set by ground forces command to enhance independence and operational capabilities at battalion level and below. As part of five-year plan under discussion, the Israel Defense Forces seeks to improve the battalion command and control process, by increasing the speed with which tactical units identify, acquire,

designate and destroy targets, conduct operational planning and coordinate complex operations while supporting tactical forces in rapidly changing scenarios.

The new system was unveiled at the Israel International C5I (command and control, computers, communications, cyber and intelligence) convention in May. It includes a lightweight terrain-mapping payload carried by a small UAV. The payload, called HDLite, weighs 1.2 kg (2.6 lb.) and carries a 24-megapixel high-definition imaging camera with 17-deg. field of view. By rapidly scanning a wide area at high resolution and from different angles, it provides 3-D images in near-real time. HDLite stores images and mission data on board and operates independently of its platform. This means it can be integrated with mini-UAVs, helicopters, small airplanes and other airborne vehicles, and operated independently at battalion or brigade levels.

After a short mission (typically 20 min.), recorded data is processed on a computer running Rafael's 3DLite terrain-modeling application. Using an automated process, the system rapidly generates a detailed 3-D geographical database accurate enough to support target-quality locations, annotated with metadata, intelligence layers and known targets for use by combat units in planning, pre-mission rehearsal and operations. .

The system converts HDLite images into digital terrain models and orthophotos (corrected photos of uniform scale). It creates detailed 3-D reconstructions of urban elements, with buildings and vegetation accurately represented, enabling rapid and efficient orientation of users viewing the area from different angles and heights. The system also implements a geographical information engine, for efficient terrain analysis and line-of-sight calculation for mission planning.

The output of 3DLite is a compressed 3-D view of an area that can be distributed to all participants as the basic terrain model (i.e., map) for the tactical situational display used for planning, intelligence briefings, reporting and targeting. According to Rafael, the model is precise enough to “target a pixel,” thereby providing accurate coordinates for weapon guidance.

To acquire targets, forward observers can employ Rafael's Pointer target-acquisition system, or Mini-Pointer, a lightweight system enabling intelligence observations and target-acquisition teams to investigate, locate and update targets, feeding them into a unit's database. Future applications may employ “augmented reality” interfaces, permitting operators to explore the area around them assisted by system images and databases.

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