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Does this robotic form factor make me look fat?

The form factors of unmanned systems vary wildly, from the behemoth 512 kg General Atomics MQ-1 Predator to the tiny IAI's Mosquito micro UAV, which barely weighs 500 grams. Critical subsystems, such as Operator Control Units (OCU) also differ in shape, and size.

Just as missions dictate whether an unmanned system has wings, tractors or wheels, the specific display and control needs of a given task will determine the configuration of an OCU. Field operators need to travel light, so small portable handheld OCUs are preferable, while stationary personnel, such as those who control long-range UAVs, may enjoy the luxury of a work console with tremendous computational capacity and a correspondingly larger form factor. Vehicle mounted OCUs offer a compromise between power and mobility.

Whether the unmanned system's operator should be deployed in the front lines or safely in the rear has been rigorously debated. For tactical robots, there seems to be an emerging consensus that the danger posed to the operator by combat is outweighed by the increased situational awareness, real-time control & information processing, as well as the enhanced coordination with other field personnel. Since the pack weight of an infantry soldier can easily exceed 100 pounds, the attention of developers have focused on lighter, smaller form factors.

Several intriguing experiments have been conducted using iPhones as OCUs. Not only is the iPhone familiar to many soldiers, but it is also known for its advanced interface, which includes multi-touch controls and gyroscopic sensors. However, an iPhone OCU needs a server-side network. Unless the DOD plans to install 3G towers throughout all combat theaters, it is unlikely that field personnel will be controlling OCUs on the same interface that they download music videos and text their girlfriends.

Much more likely are "wearable" OCUs, made possible by continuous miniaturization of increasingly powerful computers as well as progress in smart/embedded electronics (also known as electronic textiles and printable electronics). In addition to their lightweight form factor, wearable computers hold out the promise of allowing the operator to access information and control without interrupting their other activities. Since "other activities" for a soldier may mean targeting an enemy or dodging automatic weapons fire, multi-tasking is a valuable asset.

The Human Machine Interface (HMI) of an OCU typically includes display, joystick, and keyboard. Proposed innovations include speech-based interfaces as well as gesture-mediated controls, which would exploit the motion-sensor capabilities of devices such as Nintendo Wii Remote Controllers (Wiimote).

Obviously, integrating speech and gesture would significantly impact the OCUs form-factor. Speech would allow hands-free control, while motion control would have the opposite effect. Both need to deliver commands through a battlefield full of competing motions and noise. These control methods have been compared to delivering commands to a dog, which juxtaposes nicely with the advocates of semi-autonomy, who often describe the ideal combat robot in canine terms.

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As stated previously, the unmanned system's mission can greatly influence the form factor of the OCU. What happens when the OCU has to control multiple robots, each with its own battlefield task? This is a real world problem, since maximizing the force multiplication benefit offered by robots requires that one soldier control many systems.

The development of a Common Operator Control Unit (COCU) will be difficult. In the robot population explosion that followed the American invasion of Iraq, unmanned systems were deployed with little thought to integration and interoperability. With the current level of technology and the ubiquity of "stovepipe" engineering, a true COCU would have a form factor so large and complicated, that it would be impractical.

Nevertheless, a true COCU is coming. It will be man-wearable, probably allow some degree of hands-free input, and interact with the soldier through vibratory and heat alarms. Several developers have taken up the COCU challenge, but none, so far, have produced any meaningful results.

In the meantime, AMREL has devised a modular one-box solution that delivers common control capability (see Modular Kit Solution). This brand-new form factor demonstrates that common control does not have to wait for the future.