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Micro Air Vehicle Project

Good afternoon. I'd like to introduce you today to Private Jones who is about to become one of the most important assets with U.S. forces in tomorrow's battlefield or peacekeeping operations.

Our enemies are no longer large armies and often use "hit and run" guerilla warfare to conduct their operations. We are moving into an age where response time and information are our best defense. Commanders with the most accurate, real-time knowledge of the battlefield will have an overwhelming advantage over their adversaries. The problem is getting that knowledge to the small unit level. Soldiers at that level need better situational awareness to put them and their mission at less risk.

That brings us to DARPA's Micro Air Vehicle Project—which we call the MAV project—an advanced concept technology demonstration program. Actually, around DARPA it's known more affectionately as "Private Jones."

The MAV project is being designed to give soldiers the ability to see first, decide first, and, most importantly, act first. Choosing which battles to fight and controlling the battlefield greatly reduces the operational and tactical risks involved in small unit operations. The MAV program aims to demonstrate a small, soldier portable, reconnaissance and surveillance system that has crucial battlefield benefits:

- MAV will be in a container roughly the size of the Javelin, which troops use today. The portability will allow the system to operate at the small-unit level. It will also be equipped with both a video and IR sensor to allow all-weather day and night operations. Other payloads could be biological, chemical, or acoustic sensors.

- "Private Jones" will also be independent. It will be capable of fully autonomous flight throughout its flight envelope, including hovering and conventional flight modes, and will operate in adverse weather.

- MAV's collision avoidance and precision landing systems will allow it to "perch and stare" and navigate under the canopy without a human manually flying it.

- The MAV will be able to operate in non-line-of-sight conditions and GPS limited environments typical of urban settings. The craft has its own control system that allows it to carry out its mission without human contact.

- "Private Jones" will operate under the canopy or inside buildings or caves for one-hour missions. This is a great capability for special operations forces. It will significantly reduce their exposure to hostile fire and/or booby traps. The "perch and stare" capability of the MAV will provide tactical reconnaissance and surveillance for extended periods of time with low risk to the user.

It is essential that the MAV system be easy to use. There's no point in having all this technology if you need two PhDs and a pilot's license to operate it. The system will be controlled by a device about the size of a Palm-pilot (hold up Palm-pilot) and have an extremely user-friendly interface. No extensive training will be needed to operate it

Let's look at a real world example. Remember the incident in Somalia depicted recently by Hollywood in the movie "Blackhawk Down." One of the problems in that incident was the lack of real-time intelligence to the U.S. troops on the ground. That is, they couldn't see what was around the corner or how they could join up with extraction teams. In the future, a small unit could use a MAV system to gain a tactical advantage.

Imagine a typical urban war scene with a group of troops on a corner wanting to see what's on the next block with out exposing themselves. While others cover him, a soldier pulls out his Palm-pilot device (click)

that has a map of the terrain built into it and a GPS locator (click). The soldier "draws" (click) the flight path and tells "Private Jones" (click) where to land and where to look.

MAV then goes to that location, perches, and stares down the street (click). If he wants a better view, the vehicle can move again or zoom in (click) to see the situation without wasting fuel. Also, the MAV will be fairly hard to spot.

Now the troops will be able to assess the situation and decide what actions to take with up-to-the-minute information. Let's say that they regroup with the troops shown in the bottom right frame and want to see what else might be coming down that road. They can leave the area and still monitor the transmissions, or they can recall "Private Jones" and save him for later.

These capabilities are all fine and dandy, but they aren't useful if they require a dedicated pilot. The goal of the MAV Advanced Concept Technology Demonstration (ACTD) program is to have "Launch and Learn" capabilities instead of a pilot manually flying the craft. We want it to fly on its own. Wouldn't that be a great toy for your son or daughter? (Wouldn't that be a great toy for you or me?)

We're getting a lot of support from this program outside of DARPA as well. US Army Pacific's 25th Infantry Division and PM-TUAV are significantly involved.

Here is the notional program schedule: We're in a planning phase right now and should be moving into a baseline systems build within the next couple of months. We're using a spiral development process with three major versions of the MAV. The first MAV will start off with an electric motor and batteries to isolate the vehicle from any problems with internal combustion engines and allow us to work out the tactics, training, and procedures. While flight time of the electric MAV is about 1/3 of a fixed-wing UAV with the same gross weight, it will be able to "perch and stare" for at least 24 hours.

The second step will be to use the D-STAR diesel engine to provide an energy source that costs one percent of the battery cost per flight. The diesel engine also will provide increased range for the vehicle, which will allow MAVs to demonstrate mission flight times twice that available from fixed-wing UAVs.

Finally, a hybrid system will be used to optimize the system. It will allow selected use of an internal combustion engine and the electric MAV system. For instance, while in "perch and stare" mode, the vehicle will run off electric power and recharge using the diesel engine driving a generator only when needed.

In flight the diesel engine will run at constant rpm, which will enable a low noise muffler and the variable electric motor torque, combined with the diesel engine "constant torque," to change total thrust from the fan. That will allow for longer mission times by conserving high density fuel. While flying, the diesel engine will keep the batteries charged so it can shut off once landed and still operate under electric power. After demonstrating the air vehicles, the final stage will be to develop an ability to produce the vehicles affordably—nominally $10,000 each. The low price will make them affordably expendable and allow wider, lower echelon use of them.

That's "Private Jones," ladies and gentlemen. I hope you enjoyed meeting him as much as our adversaries will some day on the battlefield.

Thank you.