Interface for Non-pilot UAV Control

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Our design goal is to create a display that enables tactical control of UAVs to be passed to on-site special warfare operators. In this scenario, the aircraft arrives over the area of interest and control is passed to the special warfare operators in that area. Following local action, aircraft control is returned to base for recovery. To this end, a small unit transportable interface is required that allows non-pilot operators to : 1) control different aircraft, 2) maintain situational awareness/orientation of the aircraft and sensor imagery, and 3) mark, study, and track multiple items of interest.

The basis for this display is the control interface designed by Drs. David Still (Institute for Human and Machine Cognition) and Leonard Temme (Naval Aerospace Medical Research Laboratory), called OZ. OZ has several qualities that make it well suited for this task. It is easy to learn. Its direct depiction of flight capability facilitates transition between aircraft by making power and aerodynamic relationships transparent to the user. Its melding of aircraft orientation and world coordinate systems works well on a small screen and facilitates orientation with external objects and locations. It has very modest computer and display requirements (size, weight, and power) facilitating transportability.

OZ consists of abstract metaphorical objects that convey multiple data streams of aircraft state parameters by the scale of the objects' component parts, and that indicate the underlying controlling algorithms by the objects' configurations. The overall result is that OZ shifts the workload requirements for flight from one of visual scanning of separate instruments and displays, requiring intensive integration/computation, to nearly instantaneous or 'direct' perception of an integrated picture. In essence, a glance at OZ lasting 200 ms conveys most of the information contained in the entire panel of conventional instruments that may take several seconds to scan. Although OZ presents the operator with processed flight data, the processing does not obscure information nor does it make decisions for the operator.

OZ's adaptation to the UAV environment was both theoretically and pragmatically driven. Theoretical constructs were evaluated using commercially available simulators and the Air Force Research Laboratory/HEA Synthetic Task Environment, which models the General Atomics' Predator. The incorporated OZ modifications included the depiction of aircraft performance, the location of external objects, and sensor integration.

We encourage the evaluation of OZ by other laboratories. To this end, we created several tools. OZ design to date is documented in a software implementation/User's Guide. OZ software was modified to work with the flight simulation program of the Navy's Microsim project, Microsoft Flight Simulator 2002. Data Collection/analysis/storage software was created to work with all the flight simulation programs we use.

The presentation will give a live demonstration of the interface, discuss its design principles, software issues, and hardware requirements. A review of research findings on learning, flight performance, and the effects of operator physiological stress will be included in the presentation.