UASs from a Human Factors Perspective

AUVSI North America
Washington, DC
August 11, 2009

Human Factors?

- The field of human factors and ergonomics goes beyond the design of chairs and keyboards; more than "knobology" or physical ergonomics

Human Factors Success Stories

CONSUMER PRODUCTS

- Stove tops
- Ergonomic chairs
- Electronics: VCR → Tivo

Human Factors Success Stories

BROADER IMPACT

- Aviation – WW II …; cockpit design, aviation safety, situation awareness
- Communications – Info. Age…; phone keypads; small displays, speech interfaces
- Computing – Info. Age…; command vs. GUI; web sites, menus, mice
- Energy – Three Mile Island 1979…; process control, control room design, decision aids, displays

Human Factors Success Stories

BROADER IMPACT

- Highway Safety – high accident rate…; high-mounted tail lights, seat belts, driver perception of passing distance
- Medicine/Health – patient safety issues…; medical devices (glucometers); anesthesia displays; drug barcodes; morphine pumps, hospital coordination
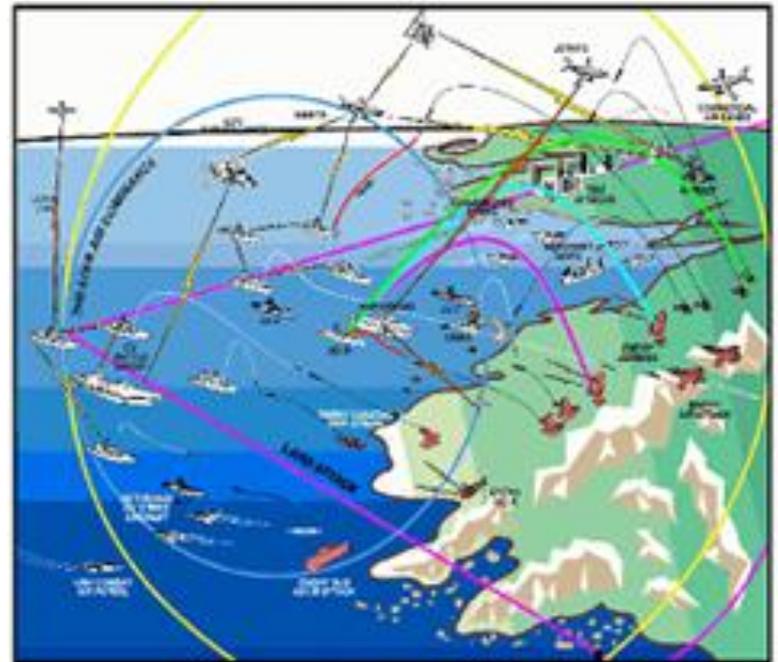- Military Systems – Vincennes 1988; command and control, training, decision aiding

Human Factors?

- The field of human factors and ergonomics goes beyond the design of chairs and keyboards; more than "knobology" or physical ergonomics
- The human, an integral part of the system, has physical and cognitive capabilities and limitations that need to guide technology design – the earlier the better!

UAS vs. UAV

- A system that includes the vehicle, the ground control station, and the payload which is typically part of a larger system

- And the human is an important part of that system

Human Factors?

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- The human, an integral part of the system, has physical and cognitive capabilities and limitations that need to guide technology design – the earlier the better!

- Technology or automation is not always the solution—very often it is the problem

When Automation is the Problem

- Tendency to throw automation/technology at the problem
  - Incident command centers in which technology gets in the way
  - Equipment too heavy for a soldier to carry & goes unused
  - Laptop UAV controllers without communications capability
  - VCR functions that are not apparent and manuals that are unreadable
  - Interoperable radios that were still in boxes and with no batteries

- Automation can lead to problems in UAS operations
  - Mode errors
  - Lack of situation awareness
  - Mistrust in automation

Human Factors Tends to be Ignored in "Unmanned Systems"

Some quotes…

<u>US Navy officer:</u> "They are unmanned. Therefore there are no humans and no need for human factors!"

<u>Industry program officer:</u> "It has been 10 years now since the Predator has been fielded and it might be time to start thinking about human factors."

Yet Mishaps Tell a Different Story...

FOX NEWS channel — NEAR TUBAC, AZ — S&P 8.82 — NVOY ESCAPED UNSCATHED [Fox] ANOTHER VEHICLE CARR

- UAVs have been reported to have a high mishap rate--by some counts 100 times higher than that of manned aircraft (Jackson, 2003)

- 33-43% of the mishaps attributed to human factors issues (Schmidt & Parker, 1995; Seagle, 1997).

Six Years of Human Factors of UAVs Workshops

Uniting the Research, Industrial, and Operational Communities

2004: Identify human factors issues
2005: Ground and underwater vehicles
2006: Civilian applications
2007: Border Security
2008: Imagery analysis using unmanned
        aerial vehicles
2009: AUVSI
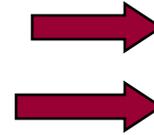
Cooke, N. J., Pringle, H., Pedersen, H., & Connor, O. (Eds., 2006). *Human Factors of Remotely Operated Vehicles.* Turpin.
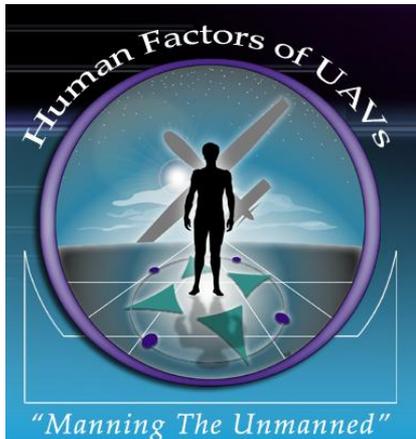
Human Factors of UAVs Issues Identified

- Terminology: *unmanned, vehicle*
- Human-Machine Interface
- Remote Sensing and Control
- Spatial Disorientation
- Automation and Multiple UAS Operation
- Fatigue
- Pilot Qualifications & Training
- Social Implications
- Crew Coordination and Communication

For effective, safe systems, it is essential that human capabilities and limitations be considered <u>early in system and training design.</u> Certification and air worthiness assessment needs to include ground control station. The technology is available; proper human systems integration is missing.

Signs of Progress

US GAO Report (May 2008)

UNMANNED AIRCRAFT SYSTEMS
Federal Actions Needed to Ensure Safety and Expand Their Potential Uses within the National Airspace System

"…accidents of varying degrees of severity have resulted from UAS reliability problems and human factors issues, i.e., equipment designs that did not fully account for human abilities, characteristics, and limitations. Our analysis of 4½ years of DOD's data indicates that UAS component failures caused about 65 percent of the accidents and human factors issues—a common challenge in new technology—caused about 17 percent of the accidents. "

Workshop Objectives

- Provide a forum for interaction between UAS users, designers, developers, industry experts and human factors researchers

- Educate AUVSI attendees on human systems integration issues that impact design, training, and safety of the systems

- Provide information on state-of-the-art technologies for UAS training, simulation, and human performance measurement

- Help to educate human factors researchers and practitioners on system issues, capabilities, and constraints

Workshop Agenda

1:10 – 2:00 pm   Human Factors Researchers Panel
2:00 – 3:00 pm   Question and Answer Period*
        3:00 - 3:15 pm   Break
3:15 – 4:00 pm   Operator Panel
4:00 – 5:00 pm   Question and Answer Period*

*Questions will be prepared ahead of time and solicited in writing from the audience.

Thank You!

- AUVSI & Kyle Snyder

- Sponsor: AFRL Human Effectiveness

- CERI Event Coordinator: Tonya Branaghan

- **Human Factors Researchers**
  - Missy Cummings
  - Mark Draper
  - Mike Goodrich
  - Bruce Hunn
  - Bill Kaliardos
  - Jay Shively

- **UAS Operators**
  - Jeff "Goldy" Goldfinger
  - James "Rainman" Hoffman
  - Jeff Huddleston
  - Chris Jella
  - Maj. Matt Martin
  - Robin Murphy
  - Stephen Rayleigh
  - Dave Silwa

Cognitive Engineering Research Institute for Collaborative Innovation