

# WELCOME TO THE Third Annual Human Factors of UAVs: "Manning the Unmanned"



*May 24-26, 2006*

*AZ Golf Resort, Mesa, AZ*

# Opening Session Overview

- Welcome & Logistics (0830-0845)
- A word from our sponsors (Research Integrations, AFRL/AFOSR; 8:45-8:55)
- Robin Murphy, USF (8:55-9:35)
- Steve Swartz, FAA (9:35-10:15)

# UAV

→ U = Unmanned

***But there are no women in them either...***

→ A = Aerial

***But there are also ground, water, and space vehicles...***

→ V = Vehicle

***But it is a system, not a vehicle...***

# WHY?

## Human Factors of UAVs: "Manning the Unmanned"





Figure 2 - Ground Control Station

# *Manning the Unmanned OR Inhabiting the Uninhabited*



*"There are no  
humans...therefore,  
no Human Factors..."*



# Unmanned Vehicles May be Unpiloted, But They are NOT “Unmanned.”

- 70 people involved by some counts
- The human is an integral and critical component of unmanned aerial vehicle systems in jobs ranging from air vehicle operator and sensor operator to weather experts and maintenance personnel
- But high mishap rate (100 x higher than manned aircraft)
- Many mishaps (33-43%) point to human factors issues
- Understanding of human capabilities and limitations needs to be integrated into system design and training – the earlier the better!

# Some Human Causes of Mishaps

- Loss of situation awareness
- Operational tempo/fatigue/workload
- Poor teamwork/handoffs/lack of communication
- C2 chain inefficient
- Remote control with poor feedback
- Crew selection & training
- Aeromedical readiness
- Pilot proficiency/currency
- Personnel shortages



# Broadening our Scope



Figure 7-1. Team Retarius UGCV

## Ground and Underwater Vehicles



## Civilian Applications



# PROGRESS?

## Human Factors of UAVs: “Manning the Unmanned”



# UAS Myths



# *"Unmanned" Means no Humans*



- **Unmanned does not mean uncontrolled**
- **Operators are remote, not absent**
- **Ground personnel are numerous (1-5 Global Hawks require 28 maintenance personnel in theater; Army estimates staffing at 70 per vehicle)**
- **Cost savings on the vehicle currently exceeded by costs on the ground (ground equipment, net increase in people, training)**

# *The Human Has Been Automated "Out of the Loop"*


- **Thirty years of research demonstrates that automation changes the human's task and not always for the better.**
- **Many mishaps are attributed to the human being "out of the loop."**
- **The true beauty of the UAS is the ability for humans to override the automation to do dynamic re-tasking.**



# *Just Like Air Traffic Control*

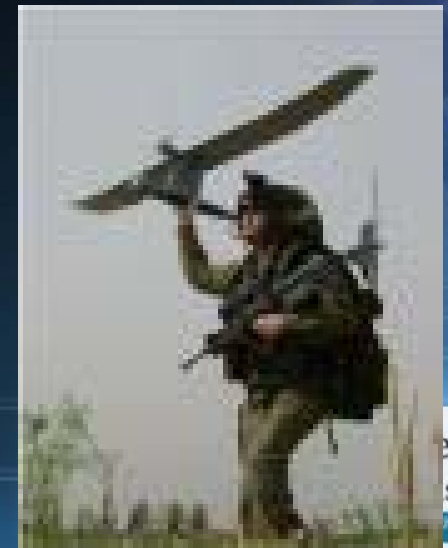
- **The UAS control task involves much more than monitoring and control of aircraft position**
- **Dynamic re-tasking and re-planning maximally exploits the UAS**
- **State of practice is 2:1**
- **Research suggests that 1:4 is not currently feasible**



 NASA Dryden Flight Research Center Photo Collection  
<http://www.dfrc.nasa.gov/Gallery/Photo/index.html>  
NASA Photo: EC04-0347-06 Date: November 20, 2004 Photo By: Tom Tschida  
Two identical RnR Products APV-3 aircraft validated cooperative flight control software in the Networked UAV Teaming Experiment at NASA Dryden in early 2005.

# *Just Like Manned Flight*

- It is not a vehicle, but a system that includes vehicles, ground control, air operations, operators, intelligence, weather personnel, maintainers...
- Piloting analogy ignores years of studies on time lag, loss of visual cues, depth perception, etc.
- Piloting analogy ignores the system functions beyond flight (i.e., re-tasking, replanning, sensor operations)
- It may be more like robotics or video gaming



# Some Human Factors of UAS Issues



## PERCEPTUAL

- Soda straw views
- Spatial disorientation
- Target detection
- Vigilance

## MULTIPLE UAS CONTROL

- Control of multiple UASs
- Optimal operators : vehicles
- Effective use of automation

## INTERFACE

- Control design
- Effective feedback
- Geographical displays
- Multimodal displays
- Information overlays
- Decluttering

## Command & Control

- Communications
- Reachback capabilities
- Coordination
- Teamwork

## TRAINING & SELECTION

- Appropriate training/KSAs
- Crew selection
- Certification

## NATIONAL AIRSPACE

- Standardization & multiple platforms
- Integration with national airspace

## OTHER HF ISSUES

- Fatigue during lengthy missions
- Safety & error analysis
- Checklists & procedures
- Social/psychological implications of remote battlefield
- Situation awareness

# HUMAN FACTORS OF REMOTELY OPERATED VEHICLES

EDITORS: NANCY J. COOKE, HEATHER PRINGLE, HARRY PEDERSEN, & OLENA CONNOR

2006

## Topics Covered

- Errors, mishaps, & accidents
- The ROV interface
- Control of multiple ROVs
- Team control of ROVs
- ROVs on the ground



ADVANCES IN HUMAN PERFORMANCE AND  
COGNITIVE ENGINEERING RESEARCH  
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HUMAN FACTORS OF  
REMOTELY OPERATED VEHICLES

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OLENA CONNOR  
Editors

# Hosted by the Cognitive Engineering Research Institute



**5810 S. Sossaman, Suite 106  
Mesa, AZ**



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# Workshop Organizing Team



***Dr. Nancy Cooke***  
***CERI & ASU***



***Pat Fitzgerald***  
***AFRL-Mesa***



***Harry Pedersen***  
***CERI & NMSU***



***Jennifer Winner***  
***CERI & ASU***



***Ben Schaub***  
***CERI & ASU***



***Dr. Steven Shope***  
***Executive Director***  
***CERI***

# Breakout Sessions

*sign up now...*

- 1. Automation Issues in UVs**
- 2. Human Factors Implications of Armed UAV Employment**
- 3. Human Factors in Operator Selection and Training**
- 4. Decluttering of UAV Displays**

# Logistics

- **Posters & demos**
- **Meals & special needs**
- **Bus departs 6pm tonight for dinner**
- **CERTT & Dessert...in the desert...  
7:30-9 Friday (please sign up)**
- **Surveys**
- **Other?**



# CERI Would Like to Thank the Sponsors of the 3rd Annual Human Factors of UAVs Workshop



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Factors  
and  
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**RESEARCH INTEGRATIONS**

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Their Support Makes this Workshop Possible