Mar 4th, 10:45 AM - 12:15 PM

# Application of a Skill Taxonomy in Aviation

Marisa D. Aguiar M.S.
*Embry-Riddle Aeronautical University*, aguiarm@my.erau.edu

Haydee M. Cuevas Ph.D.
*Embry-Riddle Aeronautical University - Daytona Beach*, cuevash1@erau.edu

Christopher Piccone M.S.
*Embry-Riddle Aeronautical University*, piccoc9b@erau.edu

# Application of a Skill Taxonomy in Aviation

MARISA D. AGUIAR, M.S.

HAYDEE M. CUEVAS, PH.D. &

CHRISTOPHER PICCONE, M.S.

# Introduction

**Purpose**: Propose a taxonomy for defining the construct ‘skill’ utilizing a human-information processing approach

Useful for developing guidance and training, as well as system design applications

# Skill Taxonomy Dimensions

| | |
|---|---|
| 1. Automaticity | The result of a smooth, continuous act requiring little conscious thought |
| 2. Goal-Oriented | Enacted to achieve a specific end-state and is not merely a random act |
| 3. Permanence | Behavior should be of a relatively permanent nature, as opposed to transitory |
| 4. Generalizability | Should transfer to novel, though related, situations |
| 5. Proficiency | Must meet a specified, predetermined level of proficiency |
| 6. Origin | The knowledge is acquired through training and practice |

# Methodology

Approach: Two separate Cognitive Task Analyses (CTA) were used to identify the key knowledge, skills, and abilities in the domains of:

- Unmanned Systems Maintenance Operations
- Virtual Reality Flight Training

Skills elicited from CTAs evaluated by Subject Matter Experts (SMEs)

SME feedback used to refine the preliminary taxonomy

# Results

## UNMANNED SYSTEMS MAINTENANCE OPERATIONS

# Subject Matter Experts

*UASMx-SME_01.*

- U.S. Army UAS electronics technician and crew chief for five years
- General knowledge of several UAS platforms, both consumer and tactical
- UAS maintenance instructor

*UASMx-SME_02.*

- Trained with Textron as an aircraft operator, crew chief, and mission coordinator
- Practical and general knowledgebase of half a dozen UAS

*UASMx-SME_03*.

- Six year career with Textron as a mechanic and crew chief
- General knowledge of several UAS systems

# CTA Results: Airframe Task Subject Area

Subtask: Performing a repair to a damaged fiberglass wing as part of an impact damage inspection.

Drawn from the CTA, the skills needed to implement the repair effectively are:

- Knowledge of basic machining processes
- Proper cleaning of the damage
- Skill-based techniques
  - core filling
  - fiber wet out
  - fiber placement
  - epoxy mixing

# Taxonomy Validation Skill: Repair damaged fiberglass wing as part of an impact damage inspection

| Dimension | SME Evaluations |
|---|---|
| 1. Automaticity | ***UASMX_SME_01***: Agreed; there may not be a procedure to follow, as many UAS lack a structural repair manual<br>***UASMX_SME_02***: Agreed<br>***UASMX_SME_03***: A mix of controlled and automatic behaviors |
| 2. Goal-Oriented | ***UASMX_SME_01***: Agreed<br>***UASMX_SME_02***: Agreed<br>***UASMX_SME_03***: Agreed |
| 3. Permanence | ***UASMX_SME_01***: Agreed<br>***UASMX_SME_02***: Agreed<br>***UASMX_SME_03***: Agreed |
| 4. Generalizability | ***UASMX_SME_01***: Agreed<br>***UASMX_SME_02***: Agreed<br>***UASMX_SME_03***: Agreed |
| 5. Proficiency | ***UASMX_SME_01***: Agreed<br>***UASMX_SME_02***: Agreed<br>***UASMX_SME_03***: Agreed |
| 6. Origin | ***UASMX_SME_01***: Agreed<br>***UASMX_SME_02***: Agreed<br>***UASMX_SME_03***: Agreed |

# CTA Results: Powerplant Task Subject Area

Subtask: Removing and replacing a UAS engine due to a manufacturer life limit

Drawn from the CTA, the skills needed to implement the repair effectively are:

- Installing a small two-stroke gas engine
  - Knowledge and skills required:
    - Tooling identification
    - Tooling use
    - Engine systems
    - The ability to adequately comprehend given instructions and follow steps for proper installation
    - Basic understanding of torque and how it relates to fainters

# Taxonomy Validation Subtask: Small two-stroke gas engine installation

| Dimension | SME Evaluations |
|---|---|
| 1. Automaticity | ***UASMX_SME_01***: Agreed<br>***UASMX_SME_02***: Agreed; mix of automatic and controlled based on the difficulty of the task<br>***UASMX_SME_03***: Agreed; mix of automatic and controlled processes |
| 2. Goal-Oriented | ***UASMX_SME_01***: Agreed, but the standard should be to always follow the manual<br>***UASMX_SME_02***: Agreed<br>***UASMX_SME_03***: Agreed |
| 3. Permanence | ***UASMX_SME_01***: Agreed<br>***UASMX_SME_02***: Agreed<br>***UASMX_SME_03***: Agreed |
| 4. Generalizability | ***UASMX_SME_01***: Agreed<br>***UASMX_SME_02***: Agreed<br>***UASMX_SME_03***: Agreed |
| 5. Proficiency | ***UASMX_SME_01***: Agreed<br>***UASMX_SME_02***: Agreed<br>***UASMX_SME_03***: Agreed |
| 6. Origin | ***UASMX_SME_01***: Agreed<br>***UASMX_SME_02***: Agreed<br>***UASMX_SME_03***: Agreed |

# Results

VIRTUAL REALITY PART TASK TRAINER FOR AIRBORNE REFUELING

# Subject Matter Expert

Retired from the United States Marine Corps

Eight years of flight experience

Five years spent flying F-18 Hornets

750 hours of tactical flight time

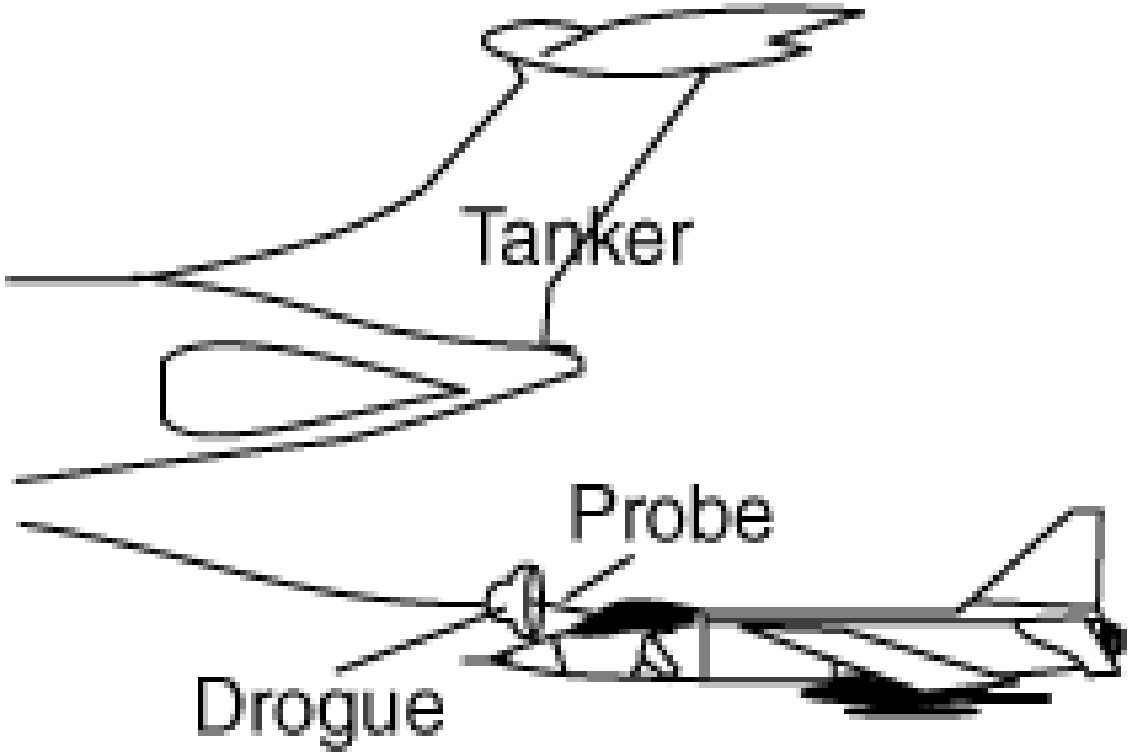
Performed the F-18 Virtual Reality Validation Trial for Embry-Riddle Aeronautical University

# CTA Results: Virtual Reality Part Task Trainer for Airborne Refueling

Subtask: F18 pilot guides probe into drogue to refuel

Knowledge, skills, and abilities required to complete the subtask:

- "Dancing on the controls"
- Formation flying




Aviation Dictionary. (2014). Probe and Drogue. *Academic Dictionaries and Encyclopedias*. Retrieved from http://aviation_dictionary.enacademic.com /5339/probe_and_drogue

# Taxonomy Validation
## Skill: “Dancing on the Controls”

| Dimension | SME Evaluation |
|---|---|
| 1. Automaticity | Agreed |
| 2. Goal-Oriented | Agreed |
| 3. Permanence | Agreed |
| 4. Generalizability | Agreed |
| 5. Proficiency | Agreed |
| 6. Origin | Agreed; transferred skill from formation flight training |

# Taxonomy Validation
## Skill: Formation Flying

| Dimension | SME Evaluation |
|---|---|
| 1. Automaticity | Agreed |
| 2. Goal-Oriented | Agreed |
| 3. Permanence | Agreed |
| 4. Generalizability | Agreed |
| 5. Proficiency | Agreed |
| 6. Origin | Agreed |

# Discussion

- SMEs confirmed that skills met all six dimensions in both domains
- Results from this initial study show promise for the skill taxonomy
- Taxonomy was able to capture targeted skills of the six dimensions

# Next Steps

- Additional domain: Commercial Aviation

# Questions?