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## Examination of the Impact of Various Training Approaches on Different UAS Operator Populations

Summer Rebensky M.S.  
*Florida Institute of Technology, slindsey2013@my.fit.edu*

Meredith Carroll Ph.D.  
*Florida Institute of Technology, mcarroll@fit.edu*

Maria Chaparro M.S.  
*Florida Institute of Technology, mchaparro2016@my.fit.edu*

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# Drone Uses



## Drone Uses Include:

- Film and Entertainment
- Industrial
- Environmental Purposes
- Construction
- Real Estate
- Emergency Services
- Search and Rescue
- Incident Imaging
- Flooding inspection

*FAA Forecasts 2019*

## Drone industry by 2021 expected to grow to

- 1.6 million drones for commercial use
- 3.5 million drones for recreational use

*FAA Forecasts Growth (2017)*

# Importance of Training



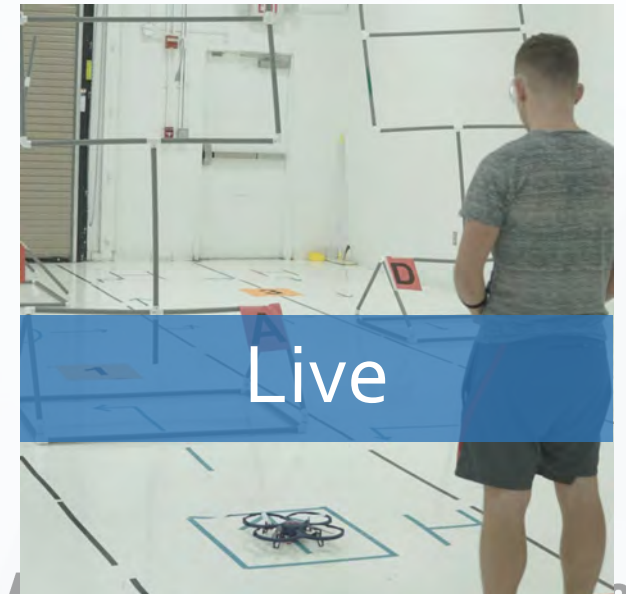
- The FAA is currently focused on training regulations and operating standards
  - Currently there is no requirement for flight training to operate drones recreationally or commercially
- Those looking to utilize drones in industry must learn on their own or utilize commercial vendors to train operators
  - However after a short 10-hour training course, practice opportunities are slim, due to regulatory and fiscal limitations related to live flight.
- What are effective and engaging training methods for UAS?

# Study Goals

- Evaluate the effect of training task on engagement
- Determine which training tasks are best for recreational versus commercial operators
- Explore the influencing factors of engagement based on operator type

# Task

- Participants completed 3 training tasks
  - Video: Watching UAS videos while following along with controller in hand
  - Simulation: Obstacle courses completed in RealFlight 7.5
  - Live: Flying similar obstacle courses with a sUAS in a high bay



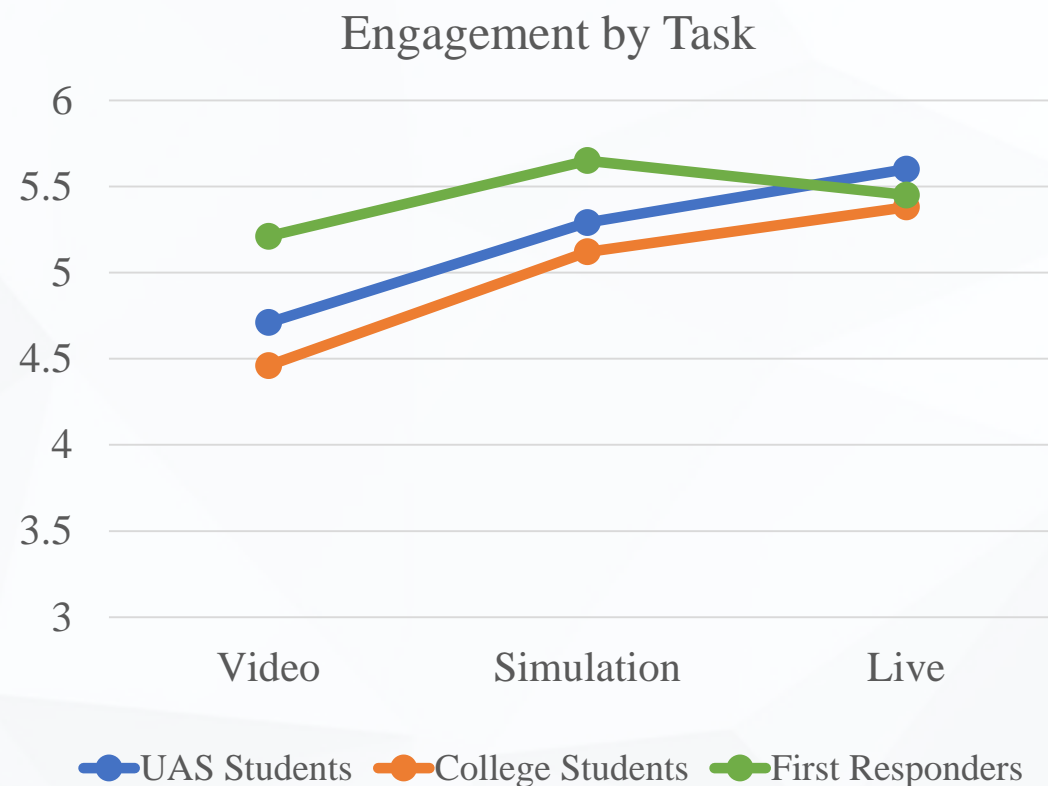
# Methods

- 49 people participated in the study
  - 33 undergraduate students enrolled in UAS applications course
  - 8 general college students with UAS interest
  - 8 first responders with UAS experience
- Measures
  - Outcome Measures: Flow Short Scale & Performance
    - Engagement – A state of deep concentration, control, with loss of awareness and time.
    - Performance – 10 points per completed trial
  - Qualifying Measures: Intrinsic Motivation Inventory
    - Interest – Pleasure and interest when completing the task
    - Importance (Value) – Perception of value and usefulness of the task
    - Competence – Perception of effectiveness in completing the task



# Results

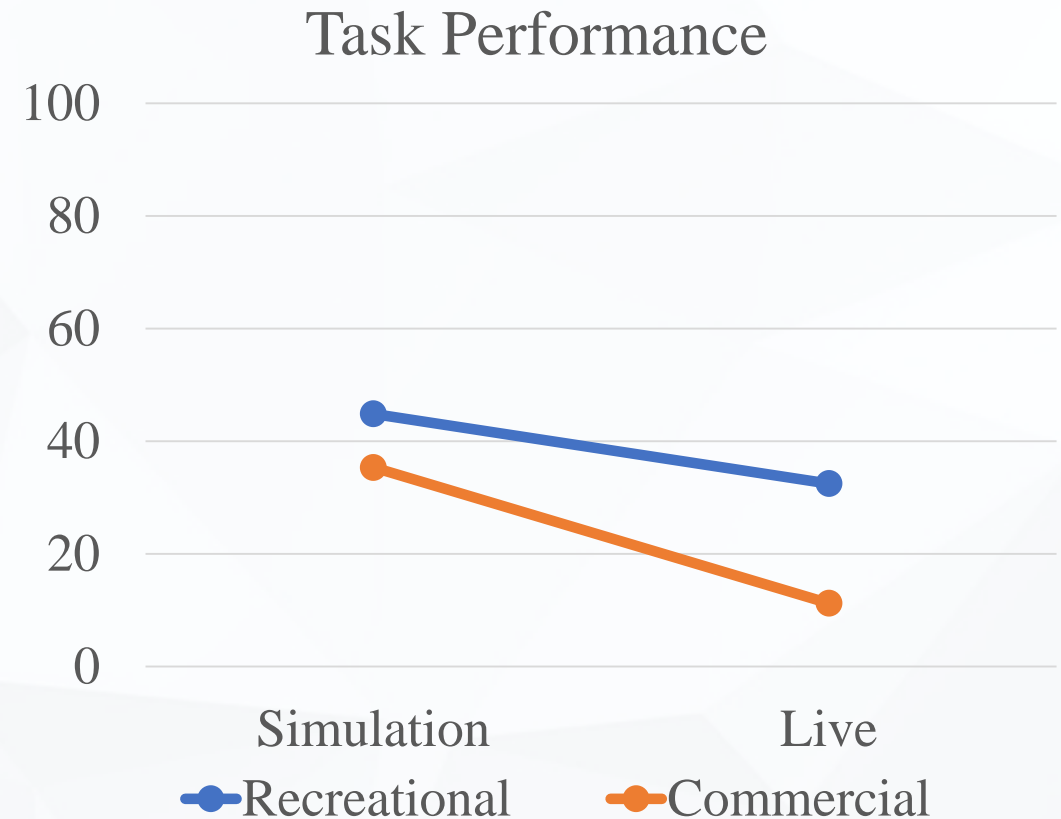
- Sim and Live training was significantly more engaging than video
  - $F(1,46)=13.03, p = .001$
- UAS students and general college students had similar engagement levels throughout
- First responders slightly different (not statistically significant)
- To evaluate differences
  - We merged UAS students and College Students to represent recreational UAS Operators
  - First Responders represented Commercial UAS Operators





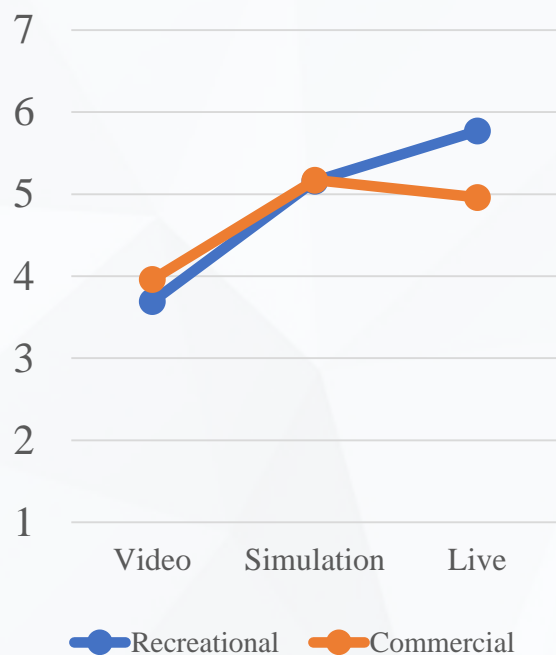
# Performance

- Significant interaction between operator type and task
  - $F=(1,47)=8.2, p=.006$
- Commercial operators had significantly worse performance
  - $p \leq .004$
- Commercial operators mentioned only having experience with self-leveling/auto-hovering drones

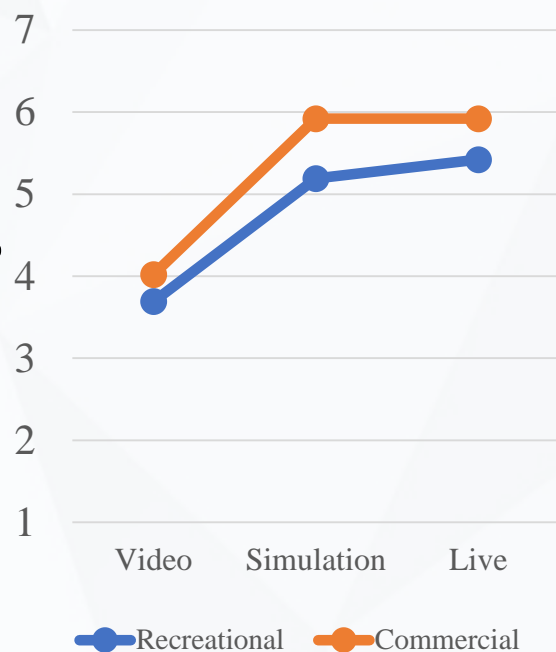


# Results

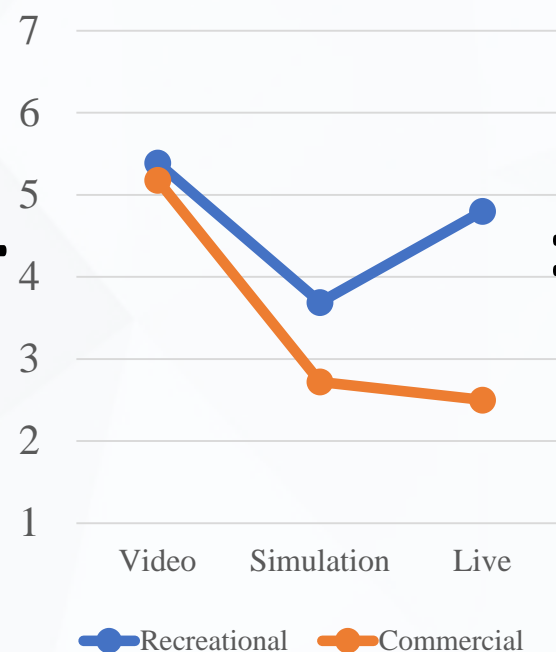
### Interest by Task



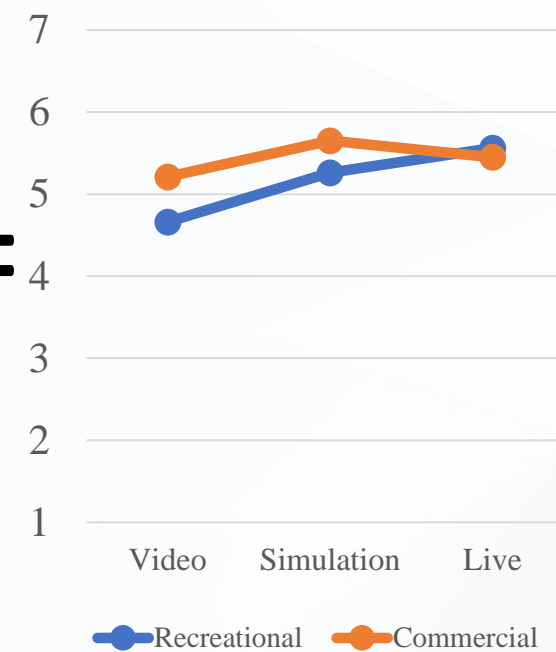
### Importance by Task



### Competence by Task



### Engagement by Task



Interaction of task and operator type  
 $F=(1.68,79.05)=3.15, p = .057$

No significant interactions or main effects

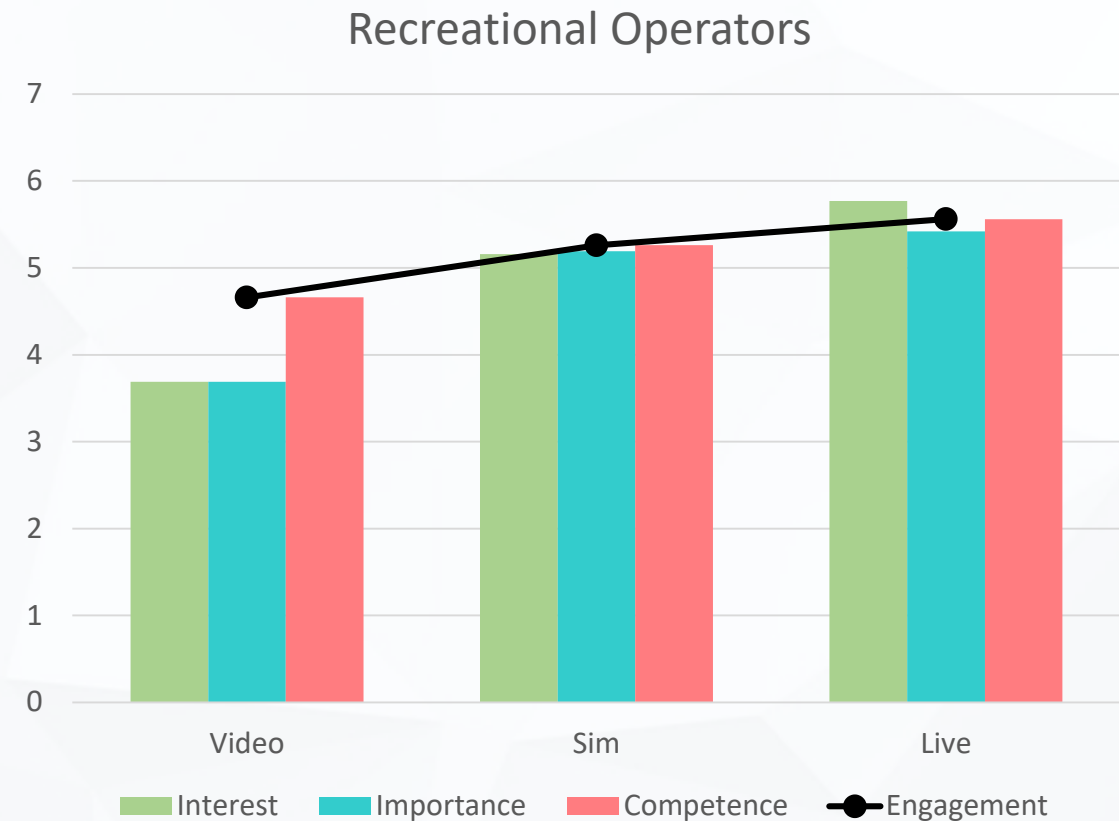
Main effect of operator type  
 $F(1,47)=6.68, p = .013$   
 Interaction of task and operator type  
 $F=(2,94)=7.49, p=.001$

Main effect of task  
 $F=(1.7, 81.74)=6.20, p<.005$



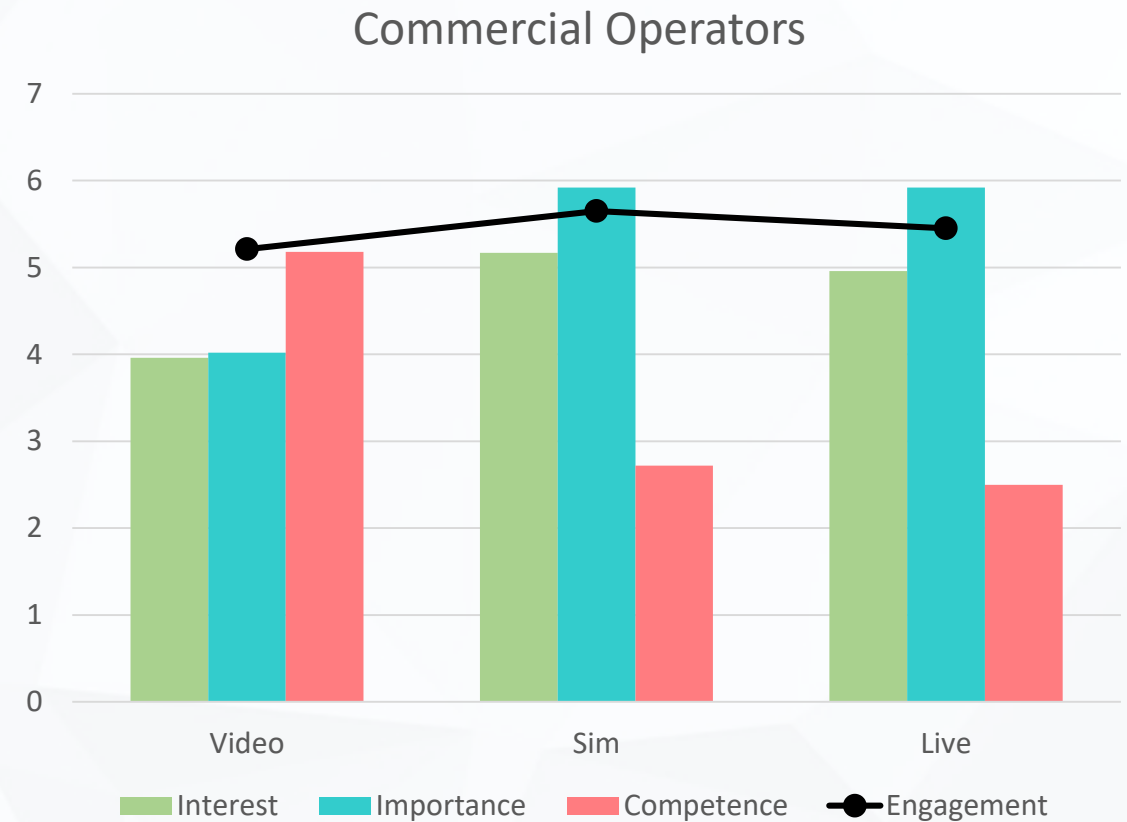
# Recreational UAS Operator Results

- Slightly lower engagement in video condition than commercial operators
  - Likely due to lower interest and importance related to task
- Increased engagement in sim
  - Likely due to improved interest and importance and sustained competence
- Highest engagement in live
  - Likely due to improved interest and importance and sustained competence



# Commercial UAS Operator Results

- Slightly higher engagement in video compared to recreational
  - Likely due to higher interest and importance related to task
- Increased engagement in sim
  - Likely due to improved interest and importance. Slightly less increase compared to recreational likely due to lower competence.
- Decreased engagement in live
  - Likely due to lower competence



# What does this mean for UAS Training?

- Issue: Competence can decrease engagement during training
  - Mitigation: Allow operators to move at their own pace
- Issue: Many commercial operators lack the resources and approval for UAS live training in regulated areas
  - Mitigation: Commercial operators commented that they valued the chance to practice in simulation and live environments
- Issue: Commercial operators did not have experience with non- self-leveling or auto-hovering UAS. Likely this impacted competence and ultimately trainee engagement
  - Mitigation: Match training equipment to real-world equipment



# Takeaways for Training



Utilize simulated training, which can be equally as engaging, to increase accessibility and reduce training costs



Training is not one size fits all – offer different paces and environments



Ensure training fosters interest and is designed to be viewed as important to operational needs

# Future Research



Evaluate more immersive learning technology such as AR/VR with more applied learning tasks



Explore more individual and task factors that influence learner engagement and outcomes



Evaluate the transfer of training to operational performance

# Questions?

Summer Rebensky, [slindsey2013@my.fit.edu](mailto:slindsey2013@my.fit.edu)

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