Topic areas for the PEGASAS COE Summer Experience for 2018

1) Terminal Area Safety, Software and Systems Branch

Overview:

Seeking an engineer or mathematician to assist with research for the Terminal Area Safety (TAS) Program. Research projects in the TAS program focus on developing training solutions and identifying effective technologies to mitigate the key causes of fatal accidents in the terminal area, such as loss of control and runway excursions. Researchers in the TAS program use a combination of simulation, data analysis, and input from subject-matter-experts to improve the safety of operations at or near an airport.

Research Opportunity:

This summer experience position will offer the candidate the opportunity to work with a TAS researcher on ongoing projects in the TAS program. Primarily the candidate will be assisting with research pertaining to the evaluation of the effectiveness of angle-of-attack (AOA) displays for commercial transports and the development of more effective go-around training.

The objective of the AOA display research is to determine the effectiveness of various AOA displays for upset avoidance/recovery and for diagnosing an air data system failure. The candidate will support this research effort by assisting with the analysis of data from human-in-the-loop simulation experiments, and, if needed, support the development of follow-on simulation experiments. Possible tasks include analyzing simulation data, documenting findings of the human-in-the-loop experiment, and performing a design of experiments for potential future AOA display research.

The purpose of the go-around safety research is to develop specific guidance for more effective go-around training. The candidate will assist the TAS research team with the development of a comprehensive research plan. The primary tasks for the candidate will include documenting recommendations for go-around safety based on literature and industry input and assisting the TAS team with developing a test plan to evaluate a technology to improve go-around safety. At the end of the program, the candidate will provide documentation of his/her analysis and findings.

Mentor: Angela Campbell, Ph.D. Manager, Hossein Eghbali

Specific COE Fellow requirements:

- Masters or PhD candidate
- Engineering or mathematics degree with Design of Experiments (DOE) experience. Aerospace or piloting experience would be beneficial.
- Experience with statistical data analysis tools such as JMP
- Experience with MATLAB
2) Rotorcraft Systems Safety Management & Terminal Area

Overview:

The research done this summer by the COE fellow will be on the Rotorcraft Systems Safety Management & Terminal Area safety projects at the FAA William J. Hughes Tech Center. The following work plan will outline participation in active projects working in data collection and data monitoring for terminal area safety, as well as further analysis with new experimental safety equipment and sensor technology for rotorcraft systems.

Research Opportunity:

This Summer Experience student position will be working to perform data analysis and experimental design on two main projects contained within Rotorcraft Safety. The opportunities which this COE student will be able to participate in will be within the Helicopter Flight Data Monitoring (HFDM) within Terminal Area Safety (TAS) and Enhanced/Synthetic Vision Systems (EHVS) for helicopter instrument approaches. These two areas evaluate impacts of experimental technology and safety equipment on the safety and maneuvering of rotorcraft flight.

During rotorcraft flight, Terminal Area Safety (TAS) is important primarily for Instrument Flight Rules (IFR) conditions during takeoff, landing, and maneuvering where risk is highest. Elevated risk for these operations comes from different navigational maneuvers within off-nominal conditions such as a missed approach and the pilot having to use unaided vision to land instead of assistance from cockpit for navigational support. The intent of this research is to increase situational awareness during reduced visibility conditions with new vision technology through outside visual information provided to the pilot who is unable to perceive out of the windows.

The research that will be done includes sensor flight testing and human-in-the-loop (HITL) flight data collection for off-nominal conditions and equipment failure modes. Some of these tests will be to determine performance benefit and visual cues provided to the pilots using EHVS, for both sensors and displays. The importance of human factor analysis is key when implementing new technology into a system. From flight testing, the data can be used to determine performance as well as intermediate effects included with usefulness and quality improvement due to given factors. A series experimental design space exploration methods can be used to model trends for the TAS metrics. Similarly, through flight data monitoring research, important statistical analysis can be used to identify trends and define outliers in different rotorcraft operations.

Mentor: Charles C. Johnson. Manager: Hossein Eghbali

Specific COE Fellow requirements:

- Masters or PhD candidate
• Engineering or mathematics degree with Design of Experiments (DOE) experience. Aerospace or piloting experience or experience with statistical data analysis tools such as JMP and/or Matlab would be beneficial.

3) National Airspace System (NAS) Animated Storyboard

Project Description:

The NAS Animated Storyboard is a way of communicating and understanding how our National Airspace System works using animation. More specifically, storyboarding shows how complex functions, data flows, and operational concepts work by using motion graphics. The application and benefits of Storyboarding allows the Federal Aviation Administration (FAA) the mechanism to communicate NAS operational improvements as well as our new technologies to a variety of stakeholders. This facilitates a common understanding of new concepts and technologies across the agency, and helps verify and validate requirements, designs, and architectures throughout the program lifecycle. Animated Storyboards are being developed for all new agency technologies (e.g. Satellite Navigation, Trajectory Based Operations, Data Communications), as well as future concepts for Unmanned Aerial Systems, Commercial Space Travel, and Cyber Security.

Technical areas:
• Perform Analysis of complex systems
• Understand System Architectures to develop data flows and use cases

Skill set
• Ability to conduct interviews with Subject Matter Experts
• Ability to write technical requirements for storyboards
• Ability to present ideas to team members and upper level management
• Experience with Adobe products preferred (e.g. Illustrator, After Effects)
• Web design experience preferred (e.g. Java, JavaScript, HTML)

US Citizen status
• Required

Mentor: Cuong Nguyen (Cuong.Nguyen01@faa.gov). Manager: Harry Bilicki

4) Fuels - Historical Detonation data analyses on data gathered at the FAA WJHTC and methods used by other entities.

1) Process historical FAA WJHTC engine detonation test data using various algorithms, digital filters, and comparing numerical analyses methods

2) Mentor would be Jon Doyle, manager is Dave Atwood

3) Request US citizen, because that keeps the door open for potential hiring in the future and eliminates any issues with admin access
Skillset: Experience in labview programming and vi setup, MATLAB. This project involves a lot of BIG data mining; computer science background a plus.

5) Fuels - Continue support in areas of electrical and electric hybrid aircraft propulsion potential test work.
1) Further refinement of safety areas and testing R&D needs
2) mentor would be Jon Doyle, manager is Dave Atwood
3) Request US citizen, because that keeps the door open for potential hiring in the future and eliminates any issues with admin access

Skillset: Knowledge of Safety Risk Management practices and applications to aviation, electric and hybrid propulsion system failure modes, electrical, mechanical or aerospace engineer.

6) Airport Safety
The research area is with the development of the FAA Wildlife Strike Database, and analysis of wildlife strikes data.
Work includes requirements development, Agile software and testing oversight, Software/Database Response Time Analysis, and Web application profiling.
Specific skill: system engineering, agile software development, COTS system profiler tools.
Mike Talotta will be the mentor. Jim Patterson, manager.
US Citizen is not required.

7) Human Factors- Computer Scientist / Software Engineer
The Human Factors Branch conducts research in many aviation domains, including air traffic control, unmanned aircraft systems, and traffic flow management. These projects generate large amounts of data, including physiological, cognitive neuroscience, human performance, and human-technology interaction data. We seek a summer experience student (graduate student level) in computer science or software engineering to help the branch’s efforts to build an integrated data management, reduction, analysis, and visualization platform for human factors data. The summer student will work under the branch’s lead computer scientist and will work closely with human factors scientists, engineers, and domain experts. The summer student should have research interests and experience with topics such as machine learning, voice recognition and natural language processing. The summer student must have programming skills, and familiarity with software engineering methods, architectural patterns, and tools (e.g., distributed version control, issue tracking).

Mentor- Nelson Brown. Manager - - Kenneth Allendoerfer
8) Human Factors Engineer / Cognitive or Experimental Psychologist / Human-Computer Interaction Specialist

The Human Factors Branch conducts human-centered research in many aviation domains, including air traffic control, unmanned aircraft systems, and traffic flow management. We seek a summer experience student (graduate student level) in human factors engineering, cognitive or experimental psychology, or human-computer interaction to assist with the design, conduct, and analysis of human factors research projects, including human-in-the-loop simulations, laboratory studies, and field observation studies. The summer student will work under a principal engineering research psychologist in the Branch, and will work closely with other scientists, engineers, and subject-matter experts on these projects. The summer student should have research interests and experience with current topics in the field, such as humans + highly automated systems, human perception and attention, or user interface design and evaluation. Experience with basic data analysis and visualization tools (e.g., Excel) is required; familiarity with advanced data analysis tools (e.g., R, SPSS, Statistica, MatLab) is a plus. Education or job experience in an aviation domain (e.g., pilot license) is desirable but not required.

Mentor- TBD. Manager - Kenneth Allendoerfer