

ATC Scenario Training Technology (ASTT)

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Aim

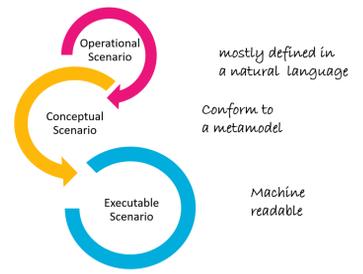
ASTT will provide an online environment allowing trainees to practice ATC concepts at their own pace without the need to utilize the Academy lab space and instructor's time.



The result of this project will significantly enhance ATC en route training at the Academy.

Motivation

- ATC simulation and training scenarios are the key in conducting human performance studies and delivering simulation part task training.
- Currently, training scenarios are generated manually from a subject-matter-expert's (i.e. controller's) oral or written briefing.
- This "operational scenario" is then verified and manually translated into the simulator's language, providing an executable scenario script for the target simulator technology.



Solution



- Proposed technology is built on top of an ATC domain-language.
- Domain information provided by subject-matter-experts.
- Researchers from Human Factors Department ensure detailed user-specific characteristics are used for human performance analysis.

Research Approach

- The project involves development of a training tool that emulates En Route Automation Modernization (ERAM) and en route lab interfaces.
- Selective en route scenarios will be programmed into the proposed technology.
- Human performance metrics will be implemented to conduct training analysis and effectiveness measures.

Goals and Objectives

- En route Scenario Specification:** Scenario implementation in ASTT.
- ASTT Design and Architecture:** Development of high-level and low-level architecture of ASTT.
- Human Factors Consideration:** Consideration of human performance measures into design and implementation of ASTT.
- Iterative ASTT Software Development:** Implement ASTT front-end and back-end through iterative phases.
- Tool Acceptance Test with Live Participants:** Conduct usability tests at ERAU en route lab.

Advantages

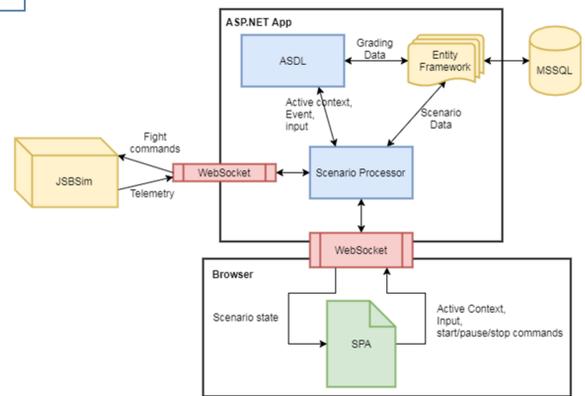
ASTT provides a web-based scenario-centric training platform that is:

- Portable:** Trainees log-in to a web-based environment
- Extendible:** New and alternative scenarios can be added easily
- Mimics full capabilities** of real ERAM
- Provides **feedback and evaluation** assessment to trainee

Architectural Design

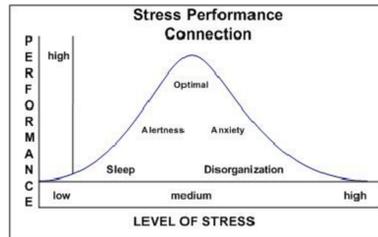
The ASTT application is comprised of four technologies:

- The **application** built in ASP.NET Core houses the ASTT logic.
- JSBSim** is instanced to provide a simulated flight environment for the aircraft.
- The **Single-Page-Application** provides the scenario simulation view, rendering scenario and telemetry data instances.
- As scenario attempts progress, simulation telemetry and user input are recorded in the **database** for future reporting and grading.



Human Performance Metrics

- Human factors approach to evaluating ASTT comprises of measuring subjective workload via the NASA-TLX survey.
- Designed to capture subjective workload measures and will be used for usability analysis.
- Iterative process employed in order to ensure that revisions are effective in reducing workload, increasing ease of use, and reducing latency in learning the software and completing tasks.



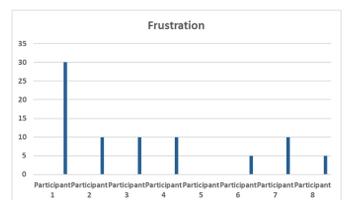
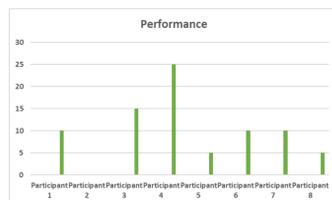
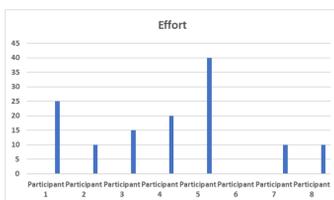
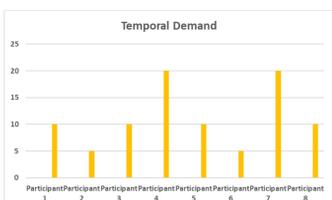
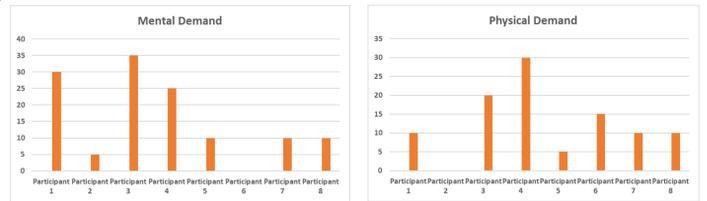
NASA Task Load Index

Hart and Staveland's NASA Task Load Index (TLX) method assesses work load on five 7-point scales. Increments of high, medium and low estimates for each point result in 21 gradations on the scales.

Name	Task	Date
Mental Demand: How mentally demanding was the task?		
Very Low ----- Very High		
Physical Demand: How physically demanding was the task?		
Very Low ----- Very High		
Temporal Demand: How hurried or rushed was the pace of the task?		
Very Low ----- Very High		
Performance: How successful were you in accomplishing what you were asked to do?		
Perfect ----- Failure		
Effort: How hard did you have to work to accomplish your level of performance?		
Very Low ----- Very High		
Frustration: How insecure, discouraged, irritated, stressed, and annoyed were you?		
Very Low ----- Very High		

Human Factors Experiments and User Acceptance Test

- 8 en route ATC students from ERAU participated at an HF experiment to comment on the acceptance of the tool and its usability
- One hour experiment was conducted while measuring each participant's perceived workload on performing 9 tasks
- NASA TLX metrics were collected and the results demonstrated the expected result of minimal workload pressure for the first task
- Similar data was obtained for the remaining tasks



Value

ASTT development aims to benefit the FAA in manifold ways:

- Improving training efficiency
- Reducing training time
- Increasing trainee knowledge retention
- Reducing training cost
- Improving learner engagement
- Decreasing trainee washout rates

Timeline

