USCG Air Station Simulator

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Introduction

The United States Coast Guard (USCG) is world’s premier search and rescue, law enforcement and counter-drug organization.
Overview

- USCG needs the means to identify optimal assignment of its aircraft
- Require modeling capabilities that:
  - Analyze response and mission demand
  - Provide decision makers with alternative aircraft assignments optimized to operational and logistic capability and expected mission needs
Data

- Scheduled Missions (Mission Training)
- Scheduled Maintenance
- Unscheduled Missions (SAR, LE)
- Unscheduled Maintenance
Data

- Scheduled Missions (Mission Training)
- Scheduled Maintainence
- Unscheduled Missions (SAR, LE)
- Unscheduled Maintainence

- Unscheduled missions and unscheduled maintainence are a little harder to model
Queueing theory – the mathematical study of waiting lines or queues.

Queueing theory can answer questions like:
- Average waiting time in the queue
- Distribution of the number of customers in line
- Probability that the queue is empty or full
Background

- **Poisson distribution** - A statistical distribution showing the frequency probability of specific events when the average probability of a single occurrence is known.

- **Exponential distribution** - A family of continuous probability distributions. It describes the time between events in a Poisson process.
Flow Chart

Helicopter Attributes
1. YTD hours
2. Maint. cycle hours
3. Speed
4. Range
5. Duration
6. Resuce (0/1)
7. Availability (0/1)

Random Maintenance, Simulator
1. Downtime = fitted from data
2. State probabilities
3. Randomized digits file

SAR Attributes
1. Time of occurrence
2. Distance
3. Duration
4. Total mission time
5. Current mission: Travel time
6. Current mission: Elapsed time

Processing Routines
- Pulls SAR/Maintenance Data from formatted Excel files

Stochastic Generator Routine

Filter Routine

Score Routine

Availability Update
- Maintenance Downtime

Selection Routine

Dispatch Routine

Availability Update
- Service Time
The Problem Definition

- Currently there is a MatLab simulation, as described in the flow chart
- No graphical user interface
- Software isn’t end user friendly
My Project

- Build a Graphical User Interface (GUI) that addresses the main issue of usability
- Flexible GUI with ability to manipulate data input parameters as needed
- Output realistic statistical data such as:
  - Interarrival time of unscheduled maint.
  - Average length of service time
  - Interarrival time of SAR
  - Average length of SAR
Background

- **Human Factors**
  - Understanding of interactions among humans and other elements of a system

- **Usability**
  - Ease of use and learnability of a human-made object
My Project Approach

- Develop intuitive GUI while still considering
  - Human factor in computer interaction
  - Usability theory
  - Utilizing software engineering best practices
Potential Software

- MATLAB
  - Simulation coded in MATLAB
- HTML5
  - Potential choice for interface
Conclusion

Project Goal

- Overall, we are aiming to provide the USCG with a viable intuitive software package that can address their problems to assist in the maximum optimization of their unit.
References


- McGinity, Curtis. "ACCAM." Presentation to USCG, May 9, 2013

Thank You