Air Force Operations Center Scheduling (AFOCS)

OR 680 / SYST 798
Capstone Project System Requirements Document

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1. Introduction

U.S. Air Force operations require staffing numerous operation centers with trained and certified personnel. Scheduling the staffing of these operation centers is a time consuming manual process. Scheduling includes not only staffing the operation centers, but also scheduling the training events, training resources, and trainers necessary to maintain current certification. The goal is to develop an optimization scheduling model that will enable the automation of the scheduling tasks for a USAF group-level organization (Group).

1.1 Background

Currently the scheduling process is a manual process using the TimePiece software tool from Kepler Research, Inc.

The Group provides staffing to 15 operation centers (op centers). Each op center requires two functional positions: Crew Commander (CDR) and Deputy Crew Commander (DEP). The shifts are 24 hours long (7 a.m. to 7 a.m.). Shifts are referred to as "Alerts," however, in this document the term shift will be used.

1.2 Scope

The emphasis of this project will be to develop a model that includes an optimization algorithm to improve the efficiency and performance of the existing scheduling process. The project will follow a hybrid development approach that blends the conventional systems engineering vee approach with a spiral development. The standard vee approach will be used for requirements development at the front of the project as well as testing and deployment at the end of the project. The spiral development will be used during model development to add new optimization and new constraints with each development. During the final phase of the project, the AFOCS team will test and analyze the optimization algorithm.

1.3 Assumptions

The optimization algorithm will have, at minimum, the following data for input:

- Calendar month/year to be scheduled
- Pre-scheduled days for training classes
- Training resources including classrooms availability for trainees
- Number of instructors required for the simulation training event (TR)
- Number of slots per day available for TR and Evaluations
- Number of personnel and their job titles and roles
- Unavailable days for personnel due to Leave, Duty Not Including Alert (DNIA), Temporary Duty (TDY), etc.

2. Applicable Documents

The following documents are referenced to support this System Requirements Document.

Air Force Operations Center Scheduling Project Proposal, February 17, 2011

Emails

Handout from sponsors

3. System Requirements

3.1 System Definition

3.1.1 System Description

The AFOCS is an optimization model that automates the current manually intensive scheduling process that is performed monthly.

3.1.2 System Users

The system users are the schedulers at the squadron and group level.

3.2 Requirements

3.2.1 Functional Requirements (Op Center Staffing)

3.2.1.1 The model shall schedule 15 op centers plus one standby crew.
3.2.1.2 The model shall schedule each op center to be staffed by one Crew Commander and one Deputy Crew Commander.
3.2.1.3 The model shall schedule 24 hour shifts (7 a.m. to 7 a.m.) for each op center.
3.2.1.4 The model shall schedule an off day (O Day) after each alert.
3.2.1.5 The model shall schedule the Crew Commander positions with qualified crew members.
3.2.1.6 The model shall schedule the Deputy Crew Commander positions with qualified crew members. Personnel qualified as Crew Commander are able to staff the Deputy Crew Commander position.
3.2.1.7 The model shall verify that each crew member have completed required mandatory training in the previous calendar month. See section 3.2.2 Functional Requirements (Mandatory Training).
3.2.1.8 Each squadron has one Squadron Command Post (SCP). The model shall schedule the staffing of the SCP by SCP qualified crew members. SCP qualification is an additional qualification beyond the Crew Commander/Deputy Crew Commander position.
3.2.1.9 The model shall verify that SCP qualified crew members accomplish one SCP alert at a minimum of every 60 days to maintain certification.

3.2.1.10 The model shall schedule each crew member at minimum of one alert every 45 days to maintain certification.

3.2.1.11 The model shall schedule Instructors, Evaluators, and Flight Commanders for at most two alerts per calendar month.

3.2.1.12 The model shall schedule Crew Members for no more than eight alerts per calendar month.

3.2.1.13 Pairing the same CDR with the same DEP is referred to as "crew integrity", one of the organization's goals is to maximize crew integrity. The model shall schedule crew members paired together 80% of the time. In other words, 80% of the time each person is assigned to a shift or training they are paired with the same partner.

3.2.2 Functional Requirements (Mandatory Training)

3.2.2.1 The model shall schedule monthly and annual required training. Monthly mandatory training consists of TR, T1, T3 and T4. Annual required training consists of a four-hour Annual Evaluation in the simulator.

Table 1: Summary of Required Training

Training Event	Frequency	Type	Duration (hrs)	Trainer	Comments
TR	Monthly	Simulator	4	INST – 2 ea	
T1	Monthly	Classroom	8	INST – 2 ea	
T3	Monthly	Classroom	4	INST – 2 ea	Often paired with T4
T4	Monthly	Classroom	4	INST – 2 ea	Often paired with T3
Annual Evaluation	Annually	Simulator	4	EVAL – 3 ea	

3.2.2.2 The model shall schedule one or two instructors for each monthly training event.

3.2.2.3 The model shall schedule three evaluators for each annual evaluation.

3.2.3 Functional Requirements (General)

3.2.3.1 The model shall be able to rebuild the schedule anytime during the calendar month due to an unforeseen absence of an individual.

3.2.3.2 While rebuilding the schedule, the model shall minimize rescheduling of future events due to an unforeseen absence of an individual.

3.2.4 Technical Requirements

3.2.4.1 The model shall be able to run on a server.

3.2.4.2 The model that runs on a server shall be accessible from a client workstation

3.2.4.3 The model shall be able to import and export data in XML, CSV, and XLSL formats in order to input to TimePiece.

3.2.5 Project Requirements

3.2.5.1 Team AFOCS shall develop an optimization algorithm/model.

3.2.5.2 Team AFOCS shall compare performance of different algorithms/approaches.

3.2.5.3 Team AFOCS shall develop a Requirements Document.

3.2.6 Constraints

3.2.6.1 TBD

4. Requirements Verification Matrix

Verification methods: inspection, demonstration, test

Number	Requirement	Method	Comments
3.2.1.1	The model shall schedule 15 op centers plus one standby crew.	Test	
3.2.1.2	The model shall schedule each op center to be staffed by one Crew Commander and one Deputy Crew Commander.	Test	
3.2.1.3	The model shall schedule 24 hour shifts (7 a.m. to 7 a.m.) for each op center.	Test	
3.2.1.4	The model shall schedule an off day (O Day) after each alert.	Test	
3.2.1.5	The model shall schedule the Crew Commander positions with qualified crew members.	Test	
3.2.1.6	The model shall schedule the Deputy Crew Commander positions with qualified crew members. Personnel qualified as Crew Commander are able to staff the Deputy Crew Commander position.	Test	
3.2.1.7	The model shall verify that each crew member have completed required mandatory training in the previous calendar month. See section 3.2.2 Functional Requirements (Mandatory Training).	Test	
3.2.1.8	Each squadron has one Squadron Command Post (SCP). The model shall schedule the staffing of the SCP by SCP qualified crew members. SCP qualification is an additional qualification beyond the Crew Commander/Deputy Crew Commander position.	Test	
3.2.1.9	The model shall verify that SCP qualified crew members accomplish one SCP alert at a minimum of every 60 days to maintain certification.	Test	
3.2.1.10	The model shall schedule each crew member at minimum of one alert every 45 days to maintain certification.	Test	
3.2.1.11	The model shall schedule Instructors, Evaluators, and Flight Commanders for two alerts per calendar month.	Test	
3.2.1.12	The model shall schedule Crew Members for no more than eight alerts per calendar month.	Test	
3.2.1.13	The model shall schedule crew members paired together 80% of the time	Test	
3.2.2.1	The model shall schedule monthly and annual required training. Monthly mandatory training consists of TR, T1, T3 and T4. Annual required training consists of a four-hour Annual Evaluation in the simulator.	Test	
3.2.2.2	The model shall schedule one or two instructors for each monthly training event.	Test	
3.2.2.3	The model shall schedule three evaluators for each annual evaluation.	Test	

Number	Requirement	Method	Comments
3.2.3.1	The model shall be able to rebuild the schedule anytime during the calendar month due to an unforeseen absence of an individual.	Test	
3.2.3.2	While rebuilding the schedule, the model shall minimize rescheduling of future events due to an unforeseen absence of an individual.	Test	
3.2.4.1	The model shall be able to run on a server.	Inspection	
3.2.4.2	The model that runs on a server shall be accessible from a client workstation	Inspection	
3.2.4.3	The model shall be able to import and export data in XML, CSV, and XLSL formats in order to input to TimePiece.	Inspection	
3.2.5.1	Team AFOCS shall develop an optimization algorithm/model	Inspection	
3.2.5.2	Team AFOCS shall compare performance of different algorithms/approaches	Inspection	
3.2.5.3	Team AFOCS shall develop a Requirements Document	Inspection	