Chapter 12
Optimization of NAS Lemoore Scheduling to Support a Growing Aircraft Population

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ABSTRACT

The manual process for flight scheduling at Naval Air Station Lemoore accommodates the needs of 16 fighter resident squadrons as well as constraints imposed by limited military operating area availability. Given the complexity of this problem, attempting to additionally avoid periods of high activity and resultant congestion would challenge the manual process. However, congestion leads to long wait times for flight-line services. Refueling operations are particularly costly when operational time is lost, and resources are backlogged. The problem of avoiding inefficient periods of high demand is complicated by the two types of refueling available: hot refueling, which occurs when the aircraft's engine is running, and cold refueling, which occurs when the aircraft is shut down. Achieving a balance between the two refueling methods is key to maximizing operational effectiveness. The authors discuss an optimization model designed to determine the best daily flight schedules based on the squadrons' flying and training requirements, the refueling infrastructure, and range availability.

INTRODUCTION

Background

Refueling is a critical and costly part of aircraft operation and maintenance. There are two methods to conduct land-based aircraft refueling: hot and cold. In hot refueling, the aircraft's engines are still operating, which means that the aircraft must be equipped with a closed-circuit refueling receiver and single-point pressure refueling receiver that incorporates an automatic fuel shutoff capability. In cold

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refueling, the aircraft must shut down its engines, turn off all switches, and conduct a turnaround inspection prior to the refueling. The Naval Air Systems Command (NAVAIR) aircraft refueling manual 00-80T-109 provides definitions and guidelines for hot and cold refueling (NAVAIR, 2002). Although cold refueling is more fuel efficient, it is also more time consuming; hot refueling provides a much quicker turnaround. It would be easy to assume that the preferred method is hot refueling because it is faster than cold refueling; however, because fuel is consumed while refueling or waiting to refuel, hot refueling is costly. A squadron requests and schedules an aircraft to receive hot refueling if the aircraft needs to immediately fly another mission. Thus, achieving a balance between these two refueling methods and avoiding unmanageable peak demands are keys to maximizing the effectiveness of a refueling facility.

Naval Air Station (NAS) Lemoore is the home base of 16 fighter squadrons. A number of squadrons are deployed away from NAS Lemoore at any given time. Each of the remaining at-home squadron generates a flight schedule with its respective events a day prior to the actual flying date. Each event includes, among other information, the takeoff and landing times, the number of aircraft, the range where the aircraft will go, and the estimated fuel that will be burned in that event. The events of all squadrons are independently scheduled with the exception of joint missions in which multiple events from one or more squadrons will fly to the same range at the same time.

Because the squadrons do not communicate their schedules among themselves, and because the times when aircraft take off and land are not taken into account as a whole, there are times when the number of aircraft landing exceeds the capacity of the refueling system. The large number of aircraft coinciding in their landing time, in addition to the first-come, first-served distribution of the refueling resources, creates a backlog during some peak hours while leaving refueling resources underused in other times.

Additionally, NAS Lemoore's aircraft population will grow in the coming years, particularly in 2017 and 2018. This growth will be due to the introduction of the Joint Strike Fighters (JSF) F-35 and relocation of one or more F/A-18 E/F squadrons. Given the current bottleneck experienced by the aircraft waiting to be refueled during peak operational periods, the additional future demand will likely increase wait times for refueling if a new approach to scheduling is not developed. Optimizing the flying and refueling schedules in order to operate the refueling system more efficiently will improve the available flying time of the aircraft.

Current Flight Scheduling Process at NAS Lemoore

Every Tuesday, the training officer (TRAINO) of each of NAS Lemoore's homebased fighter squadrons meets with Command Strike Fighter Wing Pacific (CSFWP) staff to request and allocate Lemoore's military operating area (MOA) and field carrier landing practice (FCLP) hours for the following week. Additionally, each squadron's TRAINO requests hours at MOAs and ranges from other bases from the respective base MOA/range coordinators; this occurs a week prior to flight. Figure 1 shows a small example of a report indicating when a particular MOA/range is assigned to squadrons during one week. The numbers in the cells represent the squadrons assigned each day and time, indicated by column and row respectively. Actual reports are more complex than this example, as each location usually includes many MOA/ranges, and it also covers more hours during the day.

The following week, each day, each TRAINO utilizes the MOAs assigned to his or her squadron along with the squadron's training requirements, and, without knowing the other squadrons' flight plans, creates his or her squadron's flight schedule. Figure 2 illustrates the process each squadron's TRAINO follows in order to create a daily flight schedule. Although these squadrons are geographically located at