Decision Framework for Dynamic Manpower Reallocation

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Introduction

As the Air Force continues to play a dominant role in the Global War on Terrorism, airmen worldwide are challenged with grueling schedules and longer duty hours. With some career fields and units tapped more heavily than others, leaders find themselves having to consider temporarily realigning resources to meet short- and long-term objectives. This article presents a systematic way to consider reallocation decisions and should be of interest to readers responsible for managing and leading units that contain shift workers. Presented below are comparative techniques to determine relative burden levels and conceptual triggers for augmenting distressed agencies.

Example

During her first month as a newly-assigned group commander, Colonel Smith was notified by one of her squadron commanders that an airman had dozed off while driving on the flightline and struck a parked airplane. The accident occurred during the last few hours of the airman's shift and his last day before a two-day break. The squadron commander explained that his unit had been working 12-hour shifts for the past 3 months, and was planning to continue the schedule into the foreseeable future. The squadron is working a *4 days on and 2 days off* cycle, and this is the third mishap attributable to long duty hours. Colonel Smith wonders if she can temporarily reallocate manpower from some of her other squadrons to get the unit back into 8-hour shifts. She knows that her other squadrons are working 10-hour days, 5 days a week. She is having difficulty comparing each unit's *level of effort* because of the dissimilar duty hours and duty cycles. Even if one of her squadrons were underutilized, would it make sense to reallocate manpower?

Article Acronyms

D - Duration
MI - Mission Impact
PFD - Present for Duty
R_L - Risk Leveling
R_{NL} - Risk Not Leveling
TB - Transition Burden

Discussion

As the Air Force evolves to meet the increasing demands of a post-9/11 environment, leaders will continue to be challenged by manpower allocation decisions. Many competent managers are forced to rely on intuitive techniques without a systematic way to frame the issues surrounding augmentation. The purpose of this article is to present a framework that helps military commanders make dynamic resource allocation decisions that ultimately contribute to short term mission accomplishment and long-term organizational well-being. Grounded in the academic disciplines of operations management and decision analysis, this decision framework consists of two dimensions—a *utilization factor* and a *utility function*. The utilization factor is used to develop a burden index, useful in comparative analysis and answering the question, "Are some of my units working disproportionately longer hours than others?" The utility function then provides the commander the tools to decide, "Should I temporarily augment an overused unit with manpower from an underused unit?"

Utilization Calculations

Utilization calculations are fundamental to understanding various output rates across units with dissimilar resources and duty requirements. We have identified three input variables that influence the output rate—*manpower available*, the *situation*, and the *schedule*. The first input defines the number of personnel present for duty (PFD). An alternative input could be using the number of personnel assigned, but this figure tends to mask the reality of manning situation. The second variable, *situation*, helps commanders account for the context of the decision and for our purposes, is limited to three categories—contingency, surge, and normal. *Contingencies* include environments that require higher utilization rates without the penalties and full implications associated with normal operations. *Surge* accounts for a temporary increase in required output—examples include a change in aircraft alert posture or increased threat conditions.

Normal is defined as routine operations and is typical of many permanent bases. The third variable is *schedule*, and has significant bearing on utilization. The schedule has four dimensions—*duration*, *days on*, *days off*, and *setup time*. *Duration* includes breaks and meals and is usually expressed in hours. $Days_{on}$ and $Days_{off}$ are then converted to *Cycles per Time Period* for normalization. *Time Period* is the length of the analysis period. In this article, we use a 28-day time period. *Setup time* needs to be considered to create an accurate picture of the complete duty day. For aircrew, the duty day often begins with reporting in for a premission brief, followed by a mission brief, aircraft departure and return, equipment turn-in, and debrief. Twelve hours of flying easily translates to a duty day of 16 hours when setup time is included. In another example, an immunization technician may have customer hours of 0700-1500. His customer facing time is 8 hours, but he has to arrive at work 30 minutes prior to set up the crash cart, unlock cabinets, prepare certain types of shots, power on computers, and so forth. At the end of the day he has to spend 30 minutes doing the reverse. The distinction between *customer facing time* and *duty time* is important in understanding different burden levels across units—we call these $Output_{customer}$ and $Output_{duty\ time}$ respectively.

Before leaving the burden index, a discussion of mission required activities not related to customer output or setup time is warranted. Airmen are required to attend to a variety of training events and personal appointments related to deployment readiness. Career field specific training also occurs outside of customer facing activity. For example, an air traffic controller cannot leave her post to attend a dental appointment. She has little flexibility relative to other airmen who can leave their duty station without substantial negative customer service impairment. The amount of flexibility to attend required events away from the place of work is a matter of degrees. To simplify the issue and incorporate it into the burden index model, we have to classify units as *flexible*, *constrained*, or *inflexible*. A *flexible* unit can conduct training and allow people to meet personal readiness appointments with minimal impact to the customers they service. A *constrained* unit has the ability to let people leave the duty section but with some type impairment to customer service—customers may have to wait in line for 10 minutes rather than 5 minutes. An *inflexible* unit is one in which people can only attend training events or appointments outside of normal customer facing time. Squadrons generally have a mix along this scale. Management in the *back office* may be flexible, but airmen facing customers may be either constrained or inflexible. The category a unit falls into is subjective, but the overall classification should reflect the overwhelming majority of unit personnel. To quantify this concept, we have weighted each category and used the weight as a multiplier to the index. To go further than this simple method would encroach on manpower authorization and manning standard multipliers—out of scope for our proposed decision tool. If people in a unit are faced with tough schedules and cannot leave the duty section to attend appointments, the burden is higher and augmentation is desirable.

Figure 1 provides baseline utilization rates given 100 people present for duty (PFD) for contingency, surge, and normal and provides examples of different units and their burden indices. Note that the *normal* situation tends to describe a Monday through Friday work schedule where people report at 0700 and leave at 1600. Normal shows a utilization of 46 percent—that is 46 percent of the people working 7 days a week, 8 hours a day, with an hour of setup in the morning and an hour of setup in the evening. The 7 day a week scenario is a maximum output rate

Unit Name	PFD	Situation	Schedule Definition(hrs)	Days On / Days Off	Cycles per TP	Output Customer (hours)	Setup (hours)	Output Duty (hours)	Maximum (PFD * 7/0/12/2)	"Degree of Flexibility"	Utilization	Burden Index
BASELINE	100	Max	12	7 / 0	4.00	33,600	2	39,200	39,200	Inflexible	100%	**100**
BASELINE	100	Contingency	12	6 / 1	4.00	28,800	2	33,600	39,200	Inflexible	86%	**84**
BASELINE	100	Normal	8	5 / 2	4.00	16,000	1	18,000	39,200	Inflexible	46%	**2**
Sqn A	25		12	5 / 2	4.00	6,000	0	6,000	9,800	Inflexible	61%	**18**
Sqn A	25		8	5 / 2	4.00	4,000	0	4,000	9,800	Constrained	41%	**0.375**
Sqn A	25		8	5 / 2	4.00	4,000	0	4,000	9,800	Flexible	41%	**0.25**
Sqn B	72		8	5 / 2	4.00	11,520	2.5	15,120	28,224	Constrained	54%	**6**
Sqn C	321		12	6 / 3	3.11	71,904	2	83,888	125,832	Inflexible	67%	**28**
Sqn D	268		12	1 / 1	14.00	45,024	4	60,032	105,056	Flexible	57%	**6**
Sqn E	111		10	6 / 1	4.00	26,640	4	37,296	43,512	Inflexible	86%	**80**

Figure 1. Output and Utilization Rates for Various Schedules

and can only be sustained for very limited durations. It serves as an uppermost limit of output. The burden index for normal is a 2. The index number is nonlinear—the closer the utilization rate approaches 100 percent, the higher the index number (achieved by squaring difference between the utilization rate minus a minimum utilization level of 40 percent). The longer hours worked and the shorter the recovery time, the greater the burden.

The indices and $Output_{Duty}$ can be graphically depicted for comparison and are plotted in Figure 2. When a unit's schedule falls within the area shaded in dark gray, leaders should consider a temporary reallocation. This figure was developed by holding the number of personnel assigned and the degree of flexibility constant (*inflexible* in this case) across ten popular scheduling options. Further, we constructed an array (model) of 10 different on/off day combinations and 6 different shift durations (8-hour shifts with no setup all the way up to 12-hour shifts with 2 hours of setup) and plugged in the variables into a table similar to Figure 1 to determine the 60 possible indices. Figure 2 yields several interesting observations. First, according to the model, a 4 and 2 has the same burden level as a 6 and 3 schedule. This occurs because the ratio of time on to time off is the same for both shifts. Second, leaders can more readily weigh the merits of different schedules—4 and 2 12- hour shifts fall within the same burden range as certain 8-hour shifts. The final and most important benefit of this type of graph is plotting actual data from various squadrons, seeing if some units are headed for trouble, and being prompted to consider reallocation.

Understanding that one unit is running closer to capacity than another is only one aspect of the reallocation decision. The next step in the process considers more subjective factors. Applying a utility function is the next step of the process and allows leaders to weigh the mission impact (MI) of their decision. MI has four components, expressed as MI=($risk_{leveling}$, $risk_{not\ leveling}$, duration, and transition burden). $Risk_{leveling}$ (R_L) accounts for the opportunity cost of not having reallocated personnel performing their primary role because of a decision to level the overall burden of the group. For example, suppose you are a commander responsible for transportation and messing. You notice there is a shortage of truck drivers (they are overutilized and working long shifts) and cooks appear to be underutilized. You are considering leveling the burden by tasking cooks to drive trucks, but having fewer cooks available for meal preparation could result in improperly prepared meals (a health risk) or longer wait times at the dining facility for customers. In this example R_L equals a decrease in food service and the probability of illness due to improperly prepared meals. If R_L is predisposed to quantification it should be quantified, but laborious measures should be avoided. R_L can be expressed and understood qualitatively. $Risk_{not\ leveling}$ (R_{NL}) accounts for the cost of not reallocating resources. To continue with our previous illustration, a shortage of truck drivers could have catastrophic effects if the group's primary mission is transportation. The shortage could also impact jobs that depend on trucking. For example, meal preparation is dependent on receiving timely food shipments delivered by trucks. Dependent and independent relationships between functions must be weighed, and the decision matrix allows for annotation of dependencies and hierarchical relationships. Reallocations are temporary for the scope of this framework and are defined as 5 to 180 days. Duration (D) of the assignment also influences the decision. If cooks only need to drive trucks for a 5-day surge period, the decision is appreciably different than tasking them to drive trucks for 6 months. The level of effort required to augment an overutilized function is the last decision variable and can be called the transition burden (TB). TB considers the level of training required, the periodicity of the training, the physical resources required to perform the task, and the retransition burden when the temporary duty is complete. Hypothetically, the TB of tasking a cook to drive a large truck includes an 8-hour truck driving class and a recertification class every 6 months that lasts 4 hours. Driving a truck requires no unusual resource requirements other than a truck. If the cook drives a truck for less than 90 days, he or she is not required to conduct recertification or training upon return to the mess hall. If it is greater than 90 days, he or she is required to be recertified on oven use, a 4-hour process. The TB of tasking a cook to backfill a loadmaster is an altogether different scenario—performing the

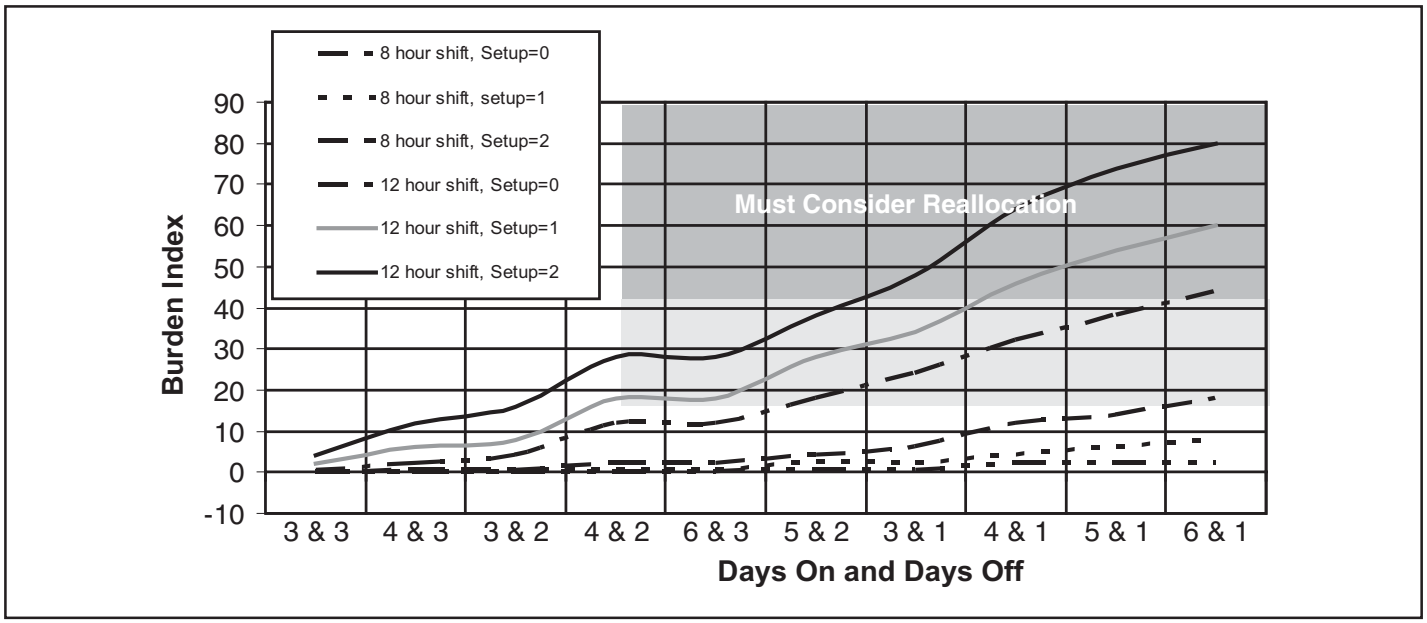

Figure 2. Plot of Relative Burden Indices

most basic loadmaster functions requires a significant amount of training. The rest of the TB calculation is irrelevant for a temporary reallocation decision. The TB of asking a cook to backfill security forces would require 24 hours of annual recurring training, and is gated by the resource requirements of a rifle and a radio. Each aspect of the TB should be analyzed for constraints that govern the utility function.

The overall decision framework can be graphically represented as is seen in Figure 3.

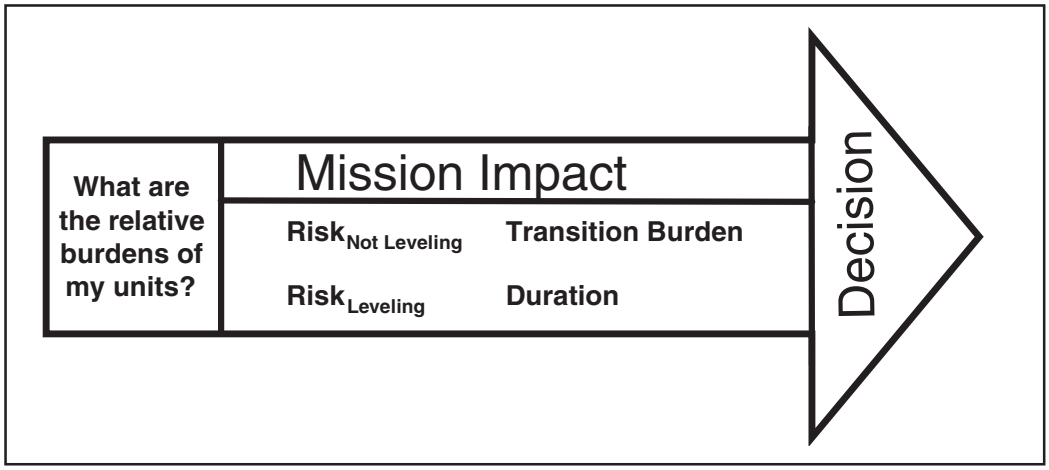

Figure 3. Decision Framework

It is worth noting that this conceptual framework is unable to account for all the variables relevant to the decision. There are political considerations to be weighed, relevant aspects of unit history to consider, and anticipated burdens beyond the scope of the analysis time period that factor into the overall decision. Despite the shortcomings of this model, it should be an improvement on wholly intuitive models. With proper application, leaders may be able to dynamically respond to upward trending manpower demands with better short- and long-term results.

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Historical Perspective

The battle is fought and decided by the quartermasters before the shooting begins.

—Field Marshal Erwin Rommel

No matter their nationality or specific service, military logisticians throughout history have understood the absolute truth represented in the above quote. Whether they were charged with supplying food for soldiers, fodder for horses or the sinews of modern war—petroleum, oil, and lubricants (POL), they have understood that victory is impossible without them—even if, sometimes, it seemed their vital contributions were forgotten or ignored. None of the great military captains of history were ignorant of logistics. From Frederick the Great to Napoleon to Patton, they all understood the link between their operations and logistics. The great captains also have all understood that history had much to teach them about the nature of the military profession. Yet, military logisticians do not often spend time studying the history of military logistics.

There are at least three general lessons from history that might prove of some use in understanding how best to prepare for the future. The first of these is the best case operationally is often the worst case logistically. The second is promises to eliminate friction and uncertainty have never come to fruition. And the third is technological change must be accompanied by organizational and intellectual change to take full advantage of new capabilities. While these lessons are not exclusive to logistics, when applied to the understanding and practice of military logistics, they provide a framework for understanding the past and planning for the future.

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Concentration and Logistics

To win in battle we must concentrate combat power in time and space. Strategy and tactics are concerned with the questions of what time and what place; these are the ends, not the means. The means of victory is concentration and that process is our focus here. There are only four key factors to think about if we seek success in concentration. This is not a simple task. Although few in number, their impact, dynamics and interdependencies are hard to grasp. This is a problem as much of perspective as of substance. It concerns the way we think, as much as what we are looking at. The factors are not functions, objects or even processes. They are best regarded as conditions representing the nature of what we are dealing with in seeking concentration. They are as follows. Logistics is not independent. It exists only as one half of a partnership needed to achieve concentration. Why is understanding this so important? Logistics governs the tempo and power of operations. For us, and for our enemy. We have to think about the partnership of operations and logistics because it is a target. A target for us, and for our enemy. Like any target, we need to fully understand its importance, vulnerabilities and critical elements to make sure we know what to defend and what to attack. All military commanders, at all levels of command, rely on the success of this partnership. How well they understand it will make a big difference concerning how well it works for them and how well they work for it.

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