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## SUMMARY

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The U.S. Air Force is currently confronting unprecedented problems in managing fighter aircrews. There are too few pilots in the active component, yet so many new pilots are entering the force that operational units cannot absorb them without jeopardizing readiness and safety. The 1990s saw sizable cuts in force structure, increased tasking, and fewer training sorties in all remaining active operational units. These factors are the genesis of today's absorption problems.

During site visits, we observed the adverse training environment that can result when the number of new pilots arriving at operational units exceeds the units' capacity to absorb them. At an active A/OA-10 combat unit located at Pope Air Force Base, North Carolina, for example, we found the following:

- Sixty percent (47 of 78) of assigned primary mission pilots were decertified from combat mission-ready (CMR) status.
- Pilots averaged too few sorties monthly, exhibited degraded performance in primary bombing events, and performed poorly on check rides.
- All instructor pilot (IP) and supervisor survey respondents cited problems with both the quantity and the quality of training available to inexperienced pilots. Many also expressed concern that wingmen in their units were flying advanced missions without a fundamental foundation in certain basic skills.
- Manning and experience levels exacerbated these problems. Available training sorties had to be distributed among an aircrew position indicator-1 (API-1) pilot population that was 16.7

percent overmanned and only 36.9 percent experienced even though the reported experience level was 48.6 percent.<sup>1</sup>

This training environment compromised both safety and readiness and compelled us to analyze its causes to see how these circumstances can be avoided. The primary cause was an excessive inflow of newly assigned pilots that overwhelmed the unit's capacity to train and absorb pilots effectively. Our research confirmed that these circumstances will continue until either training resources are increased or the flow of incoming pilots is reduced. Indeed, this unit and other affected A/OA-10 units have recovered in the period since our field visit—primarily because the flow of incoming pilots has been reduced considerably.<sup>2</sup>

The Air Force needs to *increase* the flow and absorption of incoming pilots, however, because pilots are in short supply. Air Force figures indicate a current shortage of 538 fighter pilots (12.2 percent of authorized positions). The current objective is to produce 330 new fighter pilots per year, but recent production (FY 2000 and FY 2001) has been about 280 pilots per year. Since the post-Cold War force reductions, the 330-pilot goal was reached only during FY 1997–FY 1999, the period that produced the new-pilot flows that overwhelmed the A/OA-10 units. These events are related because A-10 formal training units (FTUs) had greater capacity to increase production during that period than did those of other fighters.

Despite the fact that producing 330 new fighter pilots per year has been problematic, the Air Force needs to produce and absorb more than 380 new fighter pilots per year (unless pilot retention behavior can show marked improvement) in order to fill its requirements for experienced pilots. These factors make it essential to calculate the operational units' actual capacity to absorb new fighter pilots.

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<sup>1</sup>The cause of this disparity was the confusing method specified to calculate experience levels; there was no deliberate deception. A unit's primary mission pilots are designated *API-1 pilots*, while supervisory pilots and attached overhead staff pilots are designated *API-6 pilots*.

<sup>2</sup>The observed conditions were representatives of all operational A/OA-10 units, but the recovery at another A/OA-10 unit we visited at Davis-Monthan Air Force Base, Arizona, was accelerated considerably by simultaneous increases in its primary mission aircraft inventory (PMAI).

## KEY PARAMETERS

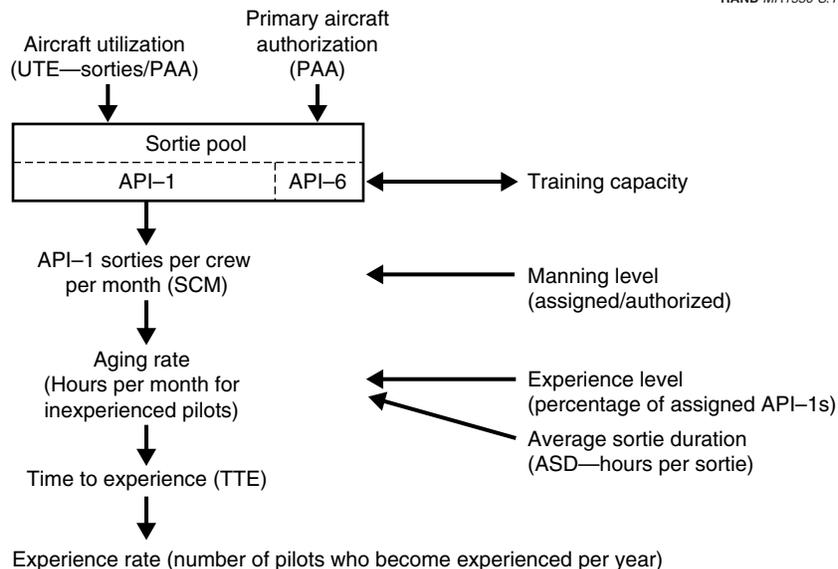
The first step in this process is to determine the precise meaning of the term *absorption capacity*. Although the long-term relationships among many of the relevant parameters have been known to aircrew managers since the rated distribution and training management (RDTM) system was first implemented in the 1970s, these relationships remain complex, making it difficult to accurately calculate the effects of reduced experience and overmanning on absorption capacity. Our models are the first to achieve this goal.

Absorption capacity is determined by the number of pilots each year who successfully complete the requirements to become newly experienced.<sup>3</sup> Its value can be determined in stages. The factors that influence absorption capacity are shown in Figure S.1.

The first step is to determine the *training capacity* of the collection of operational units, which is essentially the pool of sorties that those units can generate and devote to training. This, in turn, depends on other parameters, such as force structure and aircraft utilization (UTE) rates. The sorties must be distributed among the pilots to determine how many are available for inexperienced pilots to fly. We must determine how many sorties can be flown by API-1 pilots because API-6 pilots should not include any inexperienced pilots among them. The API-1 sortie average, which depends on the unit's *manning level*, must be adjusted once again because supervisory requirements limit the sorties a unit's inexperienced pilots can fly on average—especially as that unit's *experience level* decreases. Another important factor is the *aging rate* of new pilots, or the rate at which new pilots accumulate experience, defined in terms of flying hours rather than sorties. This is calculated by multiplying (1) the number of the available sorties that can actually be flown on average by individual inexperienced pilots by (2) the *average sortie duration* (ASD) of

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<sup>3</sup>Fighter pilots normally require 500 flying hours in their PMAI to become experienced pilots, although there are provisions that enable pilots with flying experience in non-PMAI aircraft to qualify with fewer PMAI hours. Pilots with 1000 total flying hours (logged as first pilot or IP time), for example, become experienced with 300 PMAI hours.



**Figure S.1—A Sequence of Factors Influences the Number of Pilots Who Become Experienced Each Year**

these sorties. Aging rates are derived from training capacity by adjusting for the conditions that can reduce inexperienced pilots’ sortie averages and are used in turn to calculate the times to experience (TTEs) for new pilots and then the associated *experience rate*.<sup>4</sup>

When fighter units take in more new pilots each year than their training capacity and aging rates allow them to turn into experienced pilots, the system will begin a degradation process that will eventually drive the units to an unacceptable steady-state condition. This will further invalidate the traditional methods used to analyze the system’s behavior. The rate at which new pilots can become experienced changes with time as the other parameters vary. For example,

<sup>4</sup>Aging rates are measured in flying hours per month. TTEs in calendar years (or months) needed to meet the *experienced pilot* definition, and experience rate in numbers of pilots who become experienced each year.

the aging rate of new pilots starts to decrease as soon as the absorption capacity is exceeded.

The RDTM system is based on setting compatible objectives that can be achieved simultaneously for a major weapon system in a viable steady state. When overall objectives become unachievable, however, the analysis must be extended to identify other conditions that might be acceptable for limited periods of time. This process introduces more changes that need to be analyzed because lower aging rates increase the time required for individual pilots to become experienced. Both of these factors exhibit dynamics that must be analyzed as well.

To illustrate the problems associated with incompatible objectives, we established a best-case scenario (BCS) on which to base our calculation of the current capacity to absorb new fighter pilots. This scenario is considered a best case for *absorption capacity* because the underlying assumptions that influence training capacity and aging rates are deliberately optimistic. They include the following:

- Flying hour programs for FY 2002 and beyond are fully funded and flown.
- UTE rate objectives are met unit by unit on the basis of FY 2002 aircraft authorizations rather than actual numbers of aircraft possessed. That is, we assume that any reductions in effective force structure that result from aircraft modernization and conversion programs can be offset either by increasing utilization of the remaining available aircraft or by another means.
- Enough experienced pilots are available to provide units with 100 percent of API-6 and 50 percent of API-1 authorizations, and the units' only source of inexperienced pilots is the FTU basic course for the appropriate weapon system. Any other entering pilots are experienced.
- API-6 sortie allocations set by current Air Combat Command (ACC) planning methods apply throughout.

On the basis of these assumptions, the absorption capacity is 302 new fighter pilots each year. This figure falls well short of the current

production objective of 330 pilots and far short of the 382 needed to fill existing requirements, assuming recent retention rates.

## KEY FINDINGS

Our numerical excursions indicate that an annual production rate of 330 fighter pilots per year will take operational units into training circumstances that are very similar to those we observed at Pope Air Force Base, *even when the BCS assumptions are maintained*. That level of inflow, following historical aircrew management priorities, would push squadron manning over 140 percent in the F-15 community and almost that high in F-16s. Such levels are probably unacceptable because it would take new pilots more than three and one-half years to become experienced. That is, most fighter pilots would neither meet current experience standards nor fly enough to upgrade as IPs until late in their flying careers, if at all.

Eventually, fewer than 36 percent of the assigned line pilots would be experienced under these conditions. Thus, the question is not whether conditions such as those we observed at Pope Air Force Base would occur, but when. We need more sophisticated analytic tools to answer this question, but our preliminary results indicate that F-16 units could exceed the manning levels observed at Pope within two years. It takes a little longer to reach low experience levels because the BCS's training capacity is slightly higher than Pope could generate when we visited.

Using our models, we examined the effects of possible policy options in a search for more acceptable equilibrium conditions. One such option requires that experienced pilots be deliberately removed from operational units in order to prevent overmanning, but it is not certain that the equilibrium conditions would be viable. Indeed, the conditions are so fragile that they can be destroyed by adding more than one pilot per squadron. The proportion of experienced line pilots in this case would also drop below 36 percent.<sup>5</sup> Average TTEs would remain below three years, but it is questionable whether the

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<sup>5</sup>It is a mathematical consequence of the equilibrium equation that experience will continue to drop until the system reaches equilibrium conditions at a fixed experience level that is independent of manning level.

units would have enough instructors to ensure training effectiveness and combat capability.

It remains important to estimate how quickly these conditions would occur. Our preliminary results indicate that experience levels in F-16 units will be below 40 percent within 18 months when the increased pilot flow associated with the 330-pilot production levels begins arriving in the units. Exceeding targeted manning levels by even two extra pilots per squadron would destroy the precarious equilibrium conditions. Unit manning would need to be managed nearly perfectly.

Precise management might use this option to bring fighter absorption capacities to 330 pilots per year for brief periods, but it would allow little flexibility for real-world deviations. Instabilities associated with deviations will surely become problematic if units face reductions in the sorties and flying hours available for training API-1 pilots—e.g., because of contingency tasking or aircraft modernization or conversion programs. Also recall that, unfortunately, absorbing 330 new pilots per year is inadequate to fill future requirements for fighter pilots.

Two further calculations examine the UTE rate and force structure increases, respectively, that would be needed to absorb 330 new fighter pilots per year and still meet manning and experience objectives. The results help define the magnitude of the current imbalance between planned fighter pilot production rates and absorption capacity. Beyond the best-case-assumption values, either an 8.9 percent UTE increase or an 11.1 percent force structure increase is required to absorb 330 new fighter pilots annually. The latter represents an additional 1.43 fighter-wing equivalents (FWEs).

The five numerical cases are summarized in Table S.1.

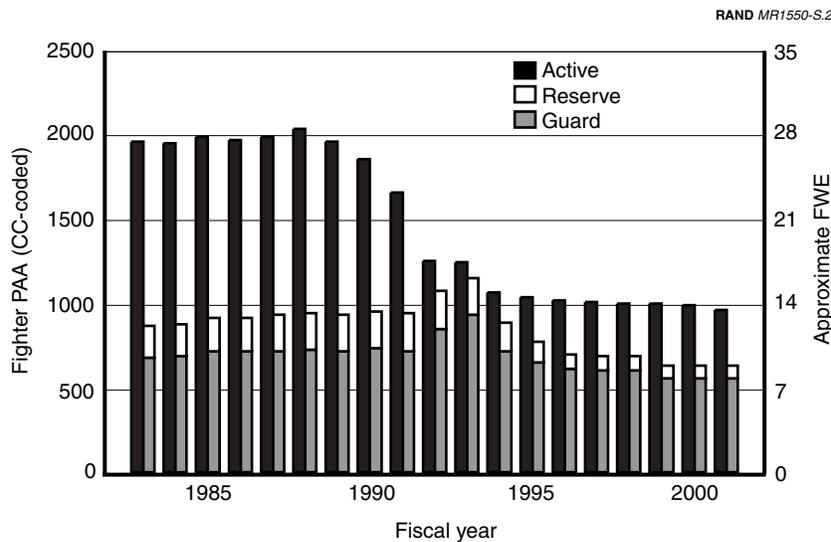
## **RECOMMENDATIONS**

In short, the Air Force may be facing the most challenging aircrew management problem in its history. No single policy alternative can resolve all of the absorption issues in fighters. Initiatives are already under way to improve retention, use alternative manning sources,

**Table S.1**  
**Summary of Numerical Cases**

Variable	BCS	Historical Default	Fixed Manning Excursion	UTE Excursion	Force Structure Excursion
Pilots absorbed	302	330	330	330	330
Manning level (%)	100	>125	100	100	100
Experience level objective (%)	50	50	Not specified	50	50
Actual experience level (%)	50	~40, 36 for F-15 and F-16	~40, 36 for F-15 and F-16	50	50
Inexperienced SCM aggregate, F-15/F-16	11 10.5/11.5	7.5 6/7	9.5 9/10	12 12/13	11 10.5/11.5
TTE (years)	<2.5	>3.5	<3.0	<2.5	<2.5
PMAI hours aggregate; F-15/F-16	570 525/575	430 350/400	525 475/520	620 585/635	570 525/575
Parameter/ amount of change	NA	Manning level: >25 percent higher	Experience level: same value as default	UTE: 8.9 percent, 1.65 sorties/PAA	PAA: 11.1 percent, or 1.43 FWEs
Viable steady state	Yes	No	No; preferred?	Yes	Yes

and further improve UTE rates, and continued efforts in these areas will be critical. However, any advantages these efforts bring may simply help achieve the BCS's assumption values. Indeed, the force-structure reductions depicted in Figure S.2, expressed in terms of primary aircraft authorizations (PAA), are the primary cause of the absorption crisis in fighters.



NOTE: All aircraft authorizations for operational units are combat coded (CC-coded). An approximation of the corresponding changes in FWEs is given on the right-hand axis. These numbers are approximate because they include small numbers of aircraft (such as OA-10s or air defense force [ADF]-tasked units) that are not usually included in FWE calculations. Small numbers of aircraft (such as F-117s) that do not help absorb new pilots are also included. Data are from the Air Staff (AF/XPPE).

**Figure S.2—Active Fighter PAA Reductions Are Central to Current Absorption Problems**

Our analyses indicate that although force structure must be addressed, it is unlikely that any approach can succeed without at least offsetting the losses in effective force structure that will come with aircraft modernization and conversion programs. Moreover, as we have noted, producing and absorbing 330 new fighter pilots per year is not enough. Unless retention improves, the actual requirement could be as high as 382 pilots per year. It could take up to four additional FWEs to absorb this many new pilots in active units, and the associated costs could prove prohibitive.

PAA increases need not, however, be achieved directly through net increases in active force structure. They can also be achieved indi-

rectly by restructuring the available force structure to increase absorption capacity. Wings containing 18-PAA squadrons, for example, need the same number of API-6 pilots as do wings with 24-PAA squadrons, so the latter can distribute more of their sorties to API-1 pilots, thereby raising aging rates and increasing absorption capacity. Moreover, the component PAA breakdown in Figure S.2 reveals a significant potential for options that use guard and reserve aircraft assets to help absorb active pilots. Thus, there are three fundamental options that can address PAA shortfalls:

1. *Direct* active PAA increases, achieved by adding new units or increasing PAA in existing units.
2. *Indirect* active PAA increases, achieved by reorganizing active units to improve absorption capacity. For example, the existing active PAA could be redistributed so that more wings contain at least three 24-PAA squadrons. This implies that some units would be closed in order to make others more robust.
3. *Effective* PAA increases, achieved by making more creative use of the force structure available in all three components. Active associate or blended units, for example, could enable the existing PAA to absorb new pilots much more efficiently than the options we evaluated using active assets only.

These options have significant budgetary implications, and their indirect costs must be evaluated as well. The second and third options, for example, may arouse serious political concerns, and the third option must also overcome cultural differences that have thus far precluded multicomponent cooperation to improve absorption. The Air Force's Future Total Force (FTF) initiative is considering active associate units and blended units—alternatives that mix assets across the components. These options seem promising for increasing absorption. Yet a number of obstacles make it unlikely that any of these options alone can resolve the absorption crisis. The Air Force must therefore examine policies that incorporate multiple options in order to resolve the crisis.

At the same time, the Air Force must find a way to grow the inventory to match requirements while simultaneously ensuring training environments that do not exhibit manning levels greater than 100 per-

cent or experience levels less than 50 percent. Other options are unacceptable for the long term.

Once an acceptable long-term solution has been identified, an implementation policy must be developed to take the units from their current circumstances to the targeted equilibrium conditions in a logical and sensible manner. This will require a better understanding of the dynamic processes that are involved, especially those associated with ongoing conversion and modernization initiatives. The problem calls for a comprehensive analytic framework that reflects a system complexity that is often difficult to grasp and communicate. A dynamic modeling framework coupled with a comprehensive longitudinal database could provide the near-real-time indicators that decisionmakers need.

If policy alternatives that enable the system to operate in viable steady-state conditions are not implemented, the Air Force will enter uncharted aircrew management territory wherein the entire active fighter community will be indefinitely exposed to the corrosive conditions that have already been observed in A/OA-10 units. Leaders will have to considerably revise their expectations regarding the knowledge and capabilities of “experienced” pilots serving in line, staff, and supervisory billets. This should not be allowed to happen by default.