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Models of Operational Training in Fighter Squadrons

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Summary

Operational squadrons in the U.S. Air Force spend most of their time training to accomplish two objectives. The primary objective is to maintain readiness to deploy and operate in wartime, contingencies, and other engagements. The second objective is to prepare aircrew members for subsequent assignments at wings, major air commands, and the Air Staff. While it is generally agreed that some operational training is needed to achieve these objectives, historically it has been difficult to justify any specific amount of flying for this purpose. Moreover, operational training is expensive, and it is often targeted when there is pressure to cut the Air Force budget.

In response to these issues, this report describes a model of aircrew training in an operational fighter squadron.[1] Originally, we built the model to estimate how much operational training is needed. The Air Force was simultaneously developing the Ready Aircrew Program (RAP) for estimating operational training requirements for individual pilots. Our method goes beyond RAP in three respects: (1) It takes into account the need for flight leads or instructor pilots (IPs) to provide in-flight supervision of wingmen; (2) it reflects skills that underlie mission capabilities, and (3) it allows the user of the model to impose requirements on a squadron other than those for operational training (e.g., sorties for deployments).

The fundamental model is formulated as a linear program. The user specifies the number of pilots (or for the F-15E, pilots and weapon system officers [WSOs])[2] by qualification, and the model calculates the minimum number of sorties that must be flown in each half-year to provide all assigned crew members with the operational training they need.

Numerous skills underlie the ability of crew members to perform each type of mission. Crew members with different qualifications need different combinations of skills and different amounts of practice to maintain them. Different types of

[1]Operational fighter squadrons deploy and conduct combat missions during wartime, contingencies, and other engagements. They exclude squadrons dedicated to formal training or test-and-evaluation missions.

[2]The A/OA-10, F-15C, and F-16 fly combat missions as single-seat fighters, so the pilot is the whole aircrew. The F-15E flies combat missions with two aircrew members, a pilot and a WSO. Each operational F-15C and F-16 squadron has a few two-seat versions that are used for training. There is no two-seat version of the A/OA-10.

training sorties enable crew members to practice different skills at different levels of difficulty and realism.

With considerable input from experts in operational units and at the Air Combat Command (ACC), we have developed data and versions of the model to reflect these relationships for A/OA-10, F-15C, F-15E, F-16 HTS,[3] and F-16 LANTIRN[4] squadrons. We calibrate our models to a level of flying that experienced pilots say will provide "adequate training" for a highly experienced squadron. "Adequate training" means training that is good enough that the squadron will need no spin-up sorties before performing any of its assigned missions in combat.

Through interviews and surveys, we found a rough consensus among IPs and flight leads that 13 sorties per month provide adequate training for an inexperienced pilot, and about a sortie less than that was adequate for an experienced pilot (see pages 33–34). But this view was by no means unanimous. Moreover, we do not know why some IPs and flight leads thought 13 sorties per month was more than enough, or why others thought it was too little. We don't know what IPs and flight leads think pilots might gain if they flew more, or lose if they flew less.[5] Finally, we spent most of our effort calibrating the F-16 LANTIRN version of the model, less effort on A/OA-10 model calibration, and very little effort on F-16 HTS, F-15C, and F-15E model calibration. We think the models as they stand are suitable for analysis, but they should be more carefully calibrated before they are used for management purposes (e.g., to calculate formal Air Force requirements for flying hours).

Because optimization models tend to be somewhat cumbersome, we also developed so-called "repro" models, which are greatly simplified and more concise models whose fewer inputs and outputs nevertheless closely mirror selected inputs and outputs of the more detailed models (see Chapter 4). They can be implemented in straightforward spreadsheets (e.g., spreadsheets created in Microsoft Excel). In this form, they could supplement the Air Force RAP models for calculating squadron sortie requirements.

The RAP model is distributed in the form of a spreadsheet, with squadron manning as the basic input. It estimates squadron sortie requirements as the sum of the training requirements of individual crew members, plus a small allowance

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[3]HTS stands for HARM Targeting System, and HARM stands for high-speed anti-radiation missile.

[4]LANTIRN stands for Low Altitude Navigation and Targeting, Infrared for Night.

[5]Our current work may shed some light on this question.

for collateral sorties, attrition sorties, and "scheduling efficiency" sorties.[6] Supplementing this model with our repro model, possibly with adjusted coefficients, would improve estimated squadron sortie requirements by including the in-flight supervision requirement (see pages 36–39). To illustrate the importance of the supervision requirement, we compare the sortie requirement for a squadron with a 65-percent experience level to the requirement for a squadron with a 35-percent experience level.[7] While the RAP model estimates that the two squadrons need essentially the same number of sorties per month, our model estimates that the 35-percent-experience-level squadron needs about 20 percent more sorties than the 65-percent-experience-level squadron (see Table 3.4).

We have extended the repro models by constraining the number of sorties per month that can be flown by a fighter squadron (see Chapter 4 and Appendixes A through D). (The optimization models estimate only required sorties; they have not been configured to allocate a fixed number of sorties among categories of pilots.) In this form, the repro models enable one to examine how limitations in sortie availability, overmanning or undermanning, deployments, and production of new pilots from undergraduate flying training (UFT) and formal training units (FTUs) would affect newcomers' accumulation of experience and qualifications.

It would be useful to incorporate in the optimization models an ability to constrain sorties. We would need to develop good measures of the consequences of flying fewer sorties than are required. One measure (used in Taylor, Moore, and Roll, 2000, and in Taylor et al., 2002) is the rate at which inexperienced pilots accumulate flying hours—the so-called aging rate. This measure speaks to one of the objectives of operational squadrons: to provide pilots with the experience they need for subsequent assignments at wings, major air commands, and the Air Staff.

But we have no measure for the effect of a sortie constraint on the other, primary objective of an operational squadron: to maintain readiness to deploy and conduct combat missions during wartime, contingencies, and other engagements. We supposed that if a squadron flies the required number of

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[6]These are all sorties that must be flown as part of the price of operating a squadron, but which provide no training benefit. *Collateral sorties* include, e.g., ferry flights, deployments, orientation flights, and air shows. *Attrition sorties* are training sorties that are launched but are then aborted (e.g., due to weather or malfunction of the aircraft). *Scheduling efficiency sorties* are sorties flown in excess of an individual's training requirements (e.g., to fill a position in a four-ship flight).

[7]The Air Force uses a rather esoteric definition of experience level, but the squadrons in question are manned as follows: The squadron with a 65-percent experience level has 12 pilots out of 29 who need supervision, and the 35-percent-experience-level squadron has 17 of 29 pilots who need supervision. See Chapter 3 for more information.

sorties—i.e., the number estimated by our methodology—it will need no spin-up sorties to prepare for a deployment. So, it seems reasonable to measure a shortfall in training sorties in terms of the spin-up sorties that would be needed to counter it. At the time of this writing, we are engaged in research that may enable us to develop such a relationship.