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Assessing the Impact of Future Operations on Trainer Aircraft Requirements

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Developing the requirements and securing the funding for modern military aircraft can take a significant amount of time. Given emerging operational demands and the age of some current Air Force trainer aircraft, it is time to examine how the skills needed to perform future military missions might affect the capabilities required of new aircraft and ground-based systems used in pilot training.

From 1962 until 1992, Air Force pilots learned to fly in an Undergraduate Pilot Training (UPT) program in which all students first flew the subsonic T-37 jet aircraft and then the supersonic T-38. In 1992 the Air Force began a transition to Specialized Undergraduate Pilot Training (SUPT), which tracked students after the T-37 phase of training. Students selected to fly fighters or bombers now train in the T-38, while those selected to fly tanker or transport aircraft train in the T-1A, a military derivative of a commercial business jet. The Air Force began replacing the T-37 with a new aircraft in 2001, but in the next few years, it must make decisions to replace or extend the lives of the aging T-38 and the newer, but tiring, T-1A.

The timing of these decisions is important because the inventory of Air Force aircraft will change dramatically in the next 25 years. Two new fighter aircraft, the F/A-22 and the F-35, will be introduced, with the F/A-22 replacing the F-15 and F-117 and the F-35 replacing F-16s and A-10s. While there are no plans to develop new
transport, tanker, or bomber aircraft over the next two decades,\(^1\) pilots of these aircraft, like fighter pilots, will face a future that is characterized by the following:

- operations conducted around the clock and in all weather and geographical conditions (pp. 30–31)
- operations requiring near real-time implementation of airpower against an enemy (pp. 31–32)
- incorporation of precision weapons to increase mission effectiveness while minimizing the exposure of manned aircraft to threats (pp. 32–33)
- mobility missions taking place in closer proximity to the enemy (pp. 34–35)
- integration of large amounts of information from disparate sources (land, air, and space based) in real-time conditions (pp. 35–36)
- flight profiles involving greater physiological demands (pp. 41–43).

More complicated missions, new aircraft capabilities, and new information management demands require new pilot skills. The question is, which of these skills, if any, should be taught in undergraduate flying training, and which, if any, are so different that they cannot be taught in current training aircraft? If required future skills are beyond the capabilities of current training aircraft, the decision to replace them is obvious. If not, a service life extension program (SLEP)\(^2\) of the aircraft might be acceptable.

The RAND Corporation was asked by Air Education and Training Command (AETC) to examine the replacement decision for

\(^1\) The Air Force has been examining the possibility of replacing its tanker fleet, but the potential replacements are derivatives of existing commercial aircraft. The C-130J can be considered a new transport aircraft, but it is a modification of an airframe already in the inventory.

\(^2\) A SLEP is a modification to an aircraft that is made to extend the life of the aircraft beyond what was originally planned.
the T-38C and the T-1A, and to do so we reviewed Air Force planning documents related to future approaches to combat, attended an international conference on pilot training, and discussed future aircraft inventories with officers in the planning business. More important, we interviewed 230 Air Force pilots involved in every stage of the pilot training pipeline and representing experience in virtually all current Air Force aircraft to hear their opinions about current pilot training and their predictions about the skills pilots will need in the future. Despite the diverse backgrounds of those we interviewed, we saw a convergence of themes that indicated to us that pilots perceived the same types of challenges and recommendations for flying training across the organization. Among these are the following:

- The collection, synthesis, and prioritization of information in the cockpit will become increasingly difficult in future operations as we look out toward 2025 (pp. 37–38).
- Flying the aircraft is currently and must continue to be second nature for pilots, given the many information management tasks that are prevalent in the operational environment (pp. 43–48).
- Pilots will continue to be challenged with more responsibilities in the cockpit that are focused on the management of information, sensors, and weapons (pp. 43–48).
- Even with the changes in technology and the impact of such changes in the operational flying environment, SUPT should continue to focus on teaching flying fundamentals to new pilots (pp. 43–48).
- Pilots will be required to become more proficient at layering technological solutions in the cockpit, that is, knowing when, and when not, to make use of (or depend on) a given technology (pp. 43–48).

Recognizing these training themes, the almost unanimous conclusion of the pilots we interviewed was that the aircraft currently
used in SUPT are capable of providing the skills required of pilots who will be flying Air Force missions over the next several decades.

Thus, our first conclusion in this study is that in the context of SUPT, the decision to replace, or extend the life of, the T-38 and the T-1A can be reduced to an economic analysis based on cost alone: do whichever is cheaper.

Our discussions with pilots showed, however, that the replacement decision must be based on an analysis of the entire training pipeline, and not just SUPT. For example, SUPT graduates who are assigned to the F-15 and F-16, both single-seat fighters, first gain some experience in two-seat versions of the aircraft at their Formal Training Units (FTUs), but there are no plans to develop two-seat versions of the F/A-22 or the F-35. G-induced loss of consciousness (GLOC) is not unusual during training in the F-15 and F-16, but new students are protected by the presence of an instructor. Pilots we interviewed were concerned about the potential dangers of exposing inexperienced SUPT graduates to the high-g capabilities of the F/A-22 and the F-35 when their first flight in those aircraft will be solo. Some suggested the use of an intermediate training aircraft to ease the transition from the Introduction to Fighter Fundamentals (IFF) course (taken by SUPT graduates assigned to fighter aircraft) to the F/A-22 or the F-35. Implementing that suggestion could have a ripple effect on what is taught in SUPT, the demands on aircraft, and the decision to replace the T-38.

Several categories of issues could increase or decrease the demands on current training airframes or affect the type of training pi-

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3 Current SUPT aircraft are the T-6, which is replacing the T-37, the T-1A, the T-38A, and the T-38C. The T-38C is currently flown in SUPT at Vance AFB, Oklahoma, and Columbus AFB, Mississippi, and in Introduction to Fighter Fundamentals (IFF) training at Moody AFB, Georgia. Eventually all T-38 aircraft used in SUPT will be upgraded to the T-38C.

4 FTUs are where pilots first learn to fly their assigned aircraft.

5 G-forces are the forces of acceleration experienced by a pilot while maneuvering in flight. A force of nine positive g’s makes a pilot feel nine times as heavy as when the aircraft is in unaccelerated flight. High positive g-forces can reduce the flow of blood to the brain, which can lead to loss of consciousness.
lots need, and thus influence decisions on the feasibility of retaining current aircraft:

- **Strategy**: The demand for pilots could change as a result of the increased use of Unmanned Aerial Vehicles (UAVs) or other decisions that affect the number of aircraft needed to perform Air Force missions. If fewer pilots are needed, fewer will need to be trained, and the demands on current trainer aircraft will be reduced. UAV operators may need new approaches to training.

- **Policy**: A desire for increased flexibility in the assignment of Air Force pilots could lead to the requirement that all pilots receive the same training. In addition, moves to increase joint operations with other services may affect the amount of training required.

- **Training**: More advanced simulators and other improved approaches to ground-based training could affect the number of flying training hours required. Any changes in the timing of the tracking decision will also affect the demands on the T-38. Changes in the requirements for FTUs could also affect the decision to retain or replace current training aircraft.

- **Budget**: Better understanding of the economics of aging aircraft will affect the decision, since in the case of the T-38, retaining the aircraft will mean that the Air Force could eventually be training student pilots in jets close to 80 years old. In addition, any decision about a follow-on trainer aircraft must take into account the costs associated with classroom instruction, computer-based training, simulators, and other ground-based training necessary to augment what is taught in the aircraft.
Therefore, while the T-1A and the T-38 are adequate for future training in the context of SUPT, AETC should consider using the following approach to finalizing its replacement decision:

1. As a baseline, determine the cost of continuing SUPT and IFF in their current forms by SLEPing the T-38C and the T-1A. At the same time, determine the cost of retaining trainer versions of the F-16 in order to use them in a pre-F/A-22 FTU program that will expose new pilots to high sustained g-forces in the presence of an instructor before they fly solo in the F/A-22 (pp. 51–52, 54).

2. Compare this to the cost of continuing SUPT in its current form but with replacement aircraft for the T-1A and the T-38C. For T-38C replacement aircraft, it makes sense to consider some version of the BAE Hawk (already used in training by other air forces) or the T-50 (recently developed for training in the Korean Air Force). This comparison should also include the cost of using the replacement for the T-38C in IFF and in a pre–F/A-22 FTU program (pp. 61–62).

3. As a first excursion from current SUPT, consider the possibility of extending T-6 training before the tracking decision is made (pp. 21–25). This would decrease the demands on both the T-38C and the T-1A in SUPT, which could mean they would last longer even without a SLEP.

4. As a second excursion from current SUPT, the effect of allowing all students to fly the T-38C (in order to expose them to a higher performance aircraft before tracking) should be analyzed (pp. 21–25).6

5. Finally, examine the costs of returning to single-track UPT, first in a version using a SLEPed T-38C,7 and then with a replacement

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6 Lt Gen Baker, Vice Commander of Air Mobility Command (AMC), and others have suggested that all students have as many as eight sorties in the T-38C before tracking is done.

7 Chocolaad (2001) considered this case in an excursion of his study, and determined that the Air Force would have to purchase T-38s from other U.S. (and perhaps foreign) organizations in order to meet the expanded sortie requirements. Because of attrition, he concluded that the T-38 would not be able to meet sortie requirements after 2020. The study took into
for the T-38C. In the second case, the replacement aircraft would
be used for both the advanced training phase and IFF, and possibly for a pre–F/A-22 version of FTU. The single-track option
would also introduce a tanker/transport version of IFF: after sin-
gle-track UPT, graduates could attend a short course in the T-1A
before going on to FTU (many people we interviewed think that
current T-1 training is too long). This option will be interesting
to consider, because it would replace only one aircraft (instead of
replacing or SLEPing two), and might provide an option for in-
terim training for new pilots who have been assigned to the
F/A-22. Thus, while there is no compelling training reason to re-
turn to single-track UPT, cost considerations or increased flexi-
bility in making pilot assignments might make doing so an
attractive option (pp. 61–62).

account the costs of some upgrades to the T-38 (including those for the T-38C), but it did
not consider a more extensive SLEP that might make the aircraft more reliable or sustainable.