Secretary of the Air Force Inspector General

Broad Area Review of the Enhanced Flight Screening Program

17 Mar 98

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PURPOSE

This review fulfills a Secretary of the Air Force (SECAF) tasking to conduct a Broad Area Review (BAR) of the Enhanced Flight Screening (EFS) program to reduce risk.

METHODOLOGY

After receiving the tasking from the SECAF on 15 Dec 97, the Secretary of the Air Force Inspector General (SAF/IG) appointed a team of functional experts from the Air Staff, Air Force Operational Test and Evaluation Center (AFOTEC), and the AF Inspection Agency to conduct the review. The team conducted the BAR from 15 Dec 97 to 30 Jan 98.

On 16 Dec 97, the team began reviewing data and identifying hazards. The data review included the draft Air Education and Training Command BAR on the EFS program, other program documentation, operations and maintenance manuals and procedures, and applicable Federal Aviation Administration (FAA) regulations. Initial hazard identification was performed through functional expert brainstorming, review of the draft AETC BAR, and use of the Air Force Safety Center’s 5-M (Mission, Man, Machine, Media, and Management) Risk Identification Model.

From 4-21 Jan 98, the team conducted interviews, reviewed data, and inspected facilities and equipment at locations involved with the EFS program:

- HQ AETC, Randolph AFB TX
- HQ 19 AF, Randolph AFB TX
- 12 FTW, Randolph AFB TX
- 3 FTS, Hondo Municipal Airport TX
- 557 FTS, United States Air Force Academy CO
- OC-ALC, Tinker AFB OK (T-3A Program Office)
- Lackland AFB TX (to evaluate 3 FTS student billeting)
- 47 FTW, Laughlin AFB (to interview previous EFS and non-EFS students and their instructors)
- Waco TX (to visit a contractor designing and testing major modifications to the T-3A aircraft)

The team also conducted telephone interviews with the Federal Aviation Administration (FAA) (in both Washington DC and at the Small Aircraft Directorate, Kansas City MO), and with personnel involved with the original T-3A acquisition and testing.

Next, the team assessed the current EFS program against established goals and standard Air Force practices. This assessment completed the hazard identification process and provided data necessary to determine risks to the EFS program's safety and screening effectiveness. This risk was determined by evaluating a hazard's probability of occurrence and severity. Once these risks were identified, the team evaluated methods to mitigate to levels considered acceptable.

Selected material from the briefing to CSAF and SECAF is included as appendices to this report.

BACKGROUND

History and Evolution of the EFS

Flight Screening dates from 1952 when the Air Force instituted centralized pre-flight training to reduce elimination during later phases of pilot training. The flying portion employed PA-18/L-21s and later the T-34. The program increased in importance in Jul 65, when the Air Force needed to offset the loss of 42 flight training hours in the T-37 syllabus. To facilitate the new program, the Air Force selected and procured the T-41 (Cessna 172F) to train pilot-qualified ROTC cadets.

Fiscal constraints caused by the Southeast Asia conflict delayed implementing the program at the United States Air Force Academy (USAFA) until Jan 68. At that time, USAFA implemented the T-41 Pilot Indoctrination Program (PIP) with the stated objective "to motivate…toward a rated career, to identify…those cadets who lack the basic aptitude to be an Air Force pilot, and to minimize attrition of Academy cadets who continue in Air Force pilot training." The program at USAFA remained virtually unchanged until 1990.

In Mar 72, the Chief of Staff of the United Stated Air Force approved T-41 training for flight-qualified Officer Training School (OTS) candidates at Hondo Municipal Airport TX. The program became a reality in May 73, when 80 students entered the contractor operated program.

ROTC flight screening underwent a drastic change from 1985 to 1988, when it reduced from 42 training sites to being consolidated with OTS training at Hondo.

The original concept of the EFS program was to enable "track selection" of pilot candidates prior to the primary phase of Specialized Undergraduate Pilot Training (SUPT). This concept was a result of CSAF (General Welch) direction in late 1987. Several inputs were to be used to determine which SUPT track a candidate would enter.

In 1989, Lieutenant General Oaks, Air Training Command (ATC) Commander, commissioned a Flying Training Broad Area Review (BAR). As part of their effort, the participants deliberated the merits of an enhanced flight screening program. The BAR concluded that such a program was needed, but that the T-41 was not suitable due its high-wing design and inherent limitations. To address, they voiced the need for an aerobatic aircraft able to expose pilot candidates to the rigors of follow-on pilot training environments. Their support of a more rigorous flight screening program and limitations of the T-41 to accomplish the mission led to the decision to purchase an aerobatic aircraft.

Acquisition of the T-3A Firefly

In Mar 90, ATC published a Statement of Need (SON) stipulating that the aircraft employed in the enhanced flight screening program must be aerobatic, capable of overhead traffic patterns, and able to accommodate low-to-moderate "g-loading." The aircraft would provide a means of evaluating a candidate's ability to react quickly and accurately while flying more complex maneuvers representative of follow-on trainers and operational USAF aircraft.

The initial preferred strategy was to lease a commercial aircraft; however, restructuring of Title 10, USC, discouraged aircraft service-lease contracts. The final decision was to purchase a flight screening aircraft from a commercial source. By Jul 90, the Air Staff Program Management Directive included direction to acquire an EFS aircraft at an estimated cost of $57 million.

Commercial candidate suitability demonstrations and operational evaluations were conducted for eight aircraft from Jul 90 to Jul 91. Areas evaluated were general aircraft performance, physical layout, adequacy of communication systems, handling characteristics, maintainability, and logistics. At that time, AF test pilots commented that the Firefly "appeared to have levels of redundancy, and normal and emergency procedures compatible with the skill levels of inexperienced student pilots."

Similar operational evaluations were conducted by Air Force Systems Command from 5-7 Aug 91. AF test pilots commented that the Firefly was suitable for the EFS mission, "capable of exposing pilot candidates to ground operations, takeoffs, stalls, slow flight, spins, aerobatics, overhead patterns, landings, and mission planning."

In Sep 91, the System Program Office released a Request for Proposal for the EFS program. Source selection activities completed on 29 Apr 92 when the Source Selection Authority (SSA) selected the Slingsby Firefly to be the EFS T-3A aircraft.

Qualification testing activities resulted in recommendations to provide additional analysis on high altitude operations, and on spin modes and recovery. The test community also recommended that "AFOTEC perform typical student training profiles prior to operational deployment to fine tune instructional techniques and evaluate flight manual procedures at high density altitude airfields."

In Dec 93, the T-3A was certified by the British Civil Aviation Authority (CAA) and the FAA as a FAR, Part 23, type-certified aerobatic aircraft. FAA certification was accomplished through bilateral agreement with the CAA. The CAA determined the aircraft met FAA requirements based primarily upon contractor supplied data. The first non-prototype aircraft was delivered to Hondo in Feb 94.

In Nov 94 and Jan 97, the final QOT&E and FOT&E reports were distributed by AFOTEC and AETC respectively. Overall, both found the T-3A was operationally effective but not suitable with respect to maintenance requirements. Suitability measures did not meet established mission completion success probabilities or fully mission capable rates.

The final T-3A was delivered to Hondo on 9 Jan 96.

Current Operations and Support Concept

The EFS program is executed at the 3 FTS, Hondo TX, and the 557 FTS, USAFA CO.

3rd Flying Training Squadron, Hondo TX. The 3 FTS has 57 aircraft and is primarily a contractor-manned operation. The squadron consists of 11 active-duty instructor pilots, 8 enlisted, and 2 Air Force civilians. These personnel perform quality assurance evaluator duties for the 40 contractor instructor pilots and 26 maintenance/support personnel. The 3 FTS primarily trains candidates from OTS, ROTC pre-commissioning programs, and those active-duty Air Force or Air Reserve Component personnel selected for pilot training.

557th Flying Training Squadron, USAF Academy CO. The 557 FTS has 53 aircraft and is composed of military pilots with civilian contract maintenance. The squadron is authorized 58 assigned and 55 attached pilots (primarily assigned to other USAFA duties but also function as instructor pilots). The squadron also has 3 enlisted quality assurance personnel to oversee 22 maintenance personnel. The 557 FTS primarily trains USAFA cadets.

ANALYSIS AND RECOMMENDATIONS

Chapter II contains detailed analysis of the EFS mission, aircraft, operating locations, instructor pilots, students, training, and support concept. Chapter III uses this analysis to identify and quantify risks (low, medium, or high) to the EFS program's safety and/or screening effectiveness. In Chapter IV, the team presents mitigating recommendations for those areas identified as having either medium or high risks.

Chapter IV contains 48 specific recommendations to improve the EFS program. From these, the BAR identified several actions that should be accomplished prior requalifying IPs, screening students at Hondo, or screening students at USAFA. These actions are summarized below with their corresponding specific recommendation number(s) from Chapter IV.

Prior to Requalifying IPs

- Complete FOT&E Phase I testing (Recommendation 10)
- Complete fuel system modifications on training aircraft (Recommendation 36)
- Define and establish measurable standards for engine stoppages (Recommendation 37)
- Publish flight manual and maintenance procedures for modified aircraft (Recommendation 4)
- Publish guidance on spins, aircraft departure characteristics, and common student errors (Recommendations 4, 11)
- Publish a standard instructor techniques manual (Recommendation 29)
- Reinstitute realistic Simulated Forced Landing (SFL) training (Recommendations 1, 24)

Prior to Resuming Student Flight Screening at Hondo

- Evaluate Doss Aviation, Inc., IP daily sortie requirements for safety and screening effectiveness (Recommendation 17)
- Implement new student syllabus (reinstating solo, reducing aerobatics, adding spin demonstration) (Recommendations 1, 5, 21)

Prior to Resuming Student Flight Screening at USAFA

- Complete FOT&E Phase III testing at USAFA (Recommendation 10)
- Convert the USAFA EFS program assigned military pilots to contractor pilots (Recommendation 15)
- Improve the Mission Qualification Training to emphasize high-altitude operations (Recommendations 26, 27)

CHAPTER I

HISTORY OF THE ENHANCED FLIGHT SCREENING PROGRAM AND ACQUISITION OF THE T-3A AIRCRAFT

INTRODUCTION

This chapter presents the history and evolution of the USAF Enhanced Flight Screening Program, the impact that evolution had on requirements for an aerobatic aircraft, and the acquisition of the Slingsby T-3A to meet those requirements.

HISTORY AND EVOLUTION

Flight Screening (FS) dates from 1952 when the Air Force instituted centralized pre-flight training and preliminary light plane flying to reduce elimination during pilot training. The flying portion, which varied from 16-65 hours, actually began in 1953, using Piper PA-18/L-21s and later the T-34. The original phase terminated in 1961, but flight screening resumed in July 1965 when the Air Force selected the T-41 (Cessna 172F) for the first phase of pilot training—a screening/training program of 30 hours—to offset the loss of 42 training hours in the T-37. Concurrent with the initial phase of FS, flight-qualified AF Reserve Officer Training Corps (ROTC) cadets received pre-commissioning training in the Flight Instruction Program (FIP), initiated in 1956. While analysis showed no significant benefit of this program in terms of motivation for flight training or a career in the Air Force, there was a marked decrease in attrition rates in flight training over non-FIP candidates.

The subject of flight training at the United States Air Force Academy was debated from the earliest years of planning, with the resolution on 1 Sep 48 that flying training would not be part of the academic curriculum but would follow graduation. While advantages of pilot training were recognized (interest of prospective students, pilots trained at an earlier age, Congressional interest, and increase in morale), General Harmon believed disadvantages outweighed advantages: efficiency of flying training would be impaired because of conflict with academic interests, cadets could not devote their best efforts to academic curriculum, danger to accreditation because of a necessity to reduce academic load, inefficiencies resulting in more expense than the present flying training program, problems scheduling and integration of flying students with non-flying students, and others.[1] After the Chairman of the House Committee on Armed Services voiced disapproval of an air academy without flying training, the Secretary of the Air Force decided "that the Air Force Academy curriculum should include appropriate phases of flying training."[2]

An accepted part of the curriculum by Jun 54, the flight training mission had as an important part "to instill and maintain in the cadet a strong desire to complete pilot training upon

[1] History of the United States Air Force Academy, 27 Jul 54-12 Jun 56, Vol 1, p.476ff.
[2] Ibid, p. 473.

graduation…to remain air-minded, and to seek a lifetime career with the United States Air Force."[3] Plans for a 25-hour Light Plane Pilot Training Phase grew to a proposal for a 171-flying hour program leading to a Navigator rating, with the intent that cadets would continue to pilot training after graduation.[4] The Academy continued to consider providing primary pilot training for cadets, but even "the President of the United States did not concur in the recommendations of the Board of Visitors (1958) with reference to incorporating a flying program in the Academy curriculum," and, he opposed construction of an airfield at the Academy.[5] Supporters for light plane flying at the Academy cited the successes of the 40-hour ROTC FIP in reducing Primary Pilot Training attrition from 25 to 6 percent. "Such a program screened out those whose aptitude for flying was low and headquarters felt there was a distinct possibility that ROTC graduates would have considerable advantage over Academy graduates in the formal Pilot Training Program."[6] In 1960, the Faculty Council agreed to a plan for a mandatory 10 hours of pilot indoctrination for all cadets and a voluntary program of 30 additional hours to screen those cadets physically qualified and desiring further pilot training.[7] Fiscal constraints caused by the Southeast Asian conflict, however, postponed establishment of the proposed T-41 Pilot Indoctrination Program (PIP) until Jan 68. The stated objectives were "to motivate…toward a rated career, to identify…those cadets who lack the basic aptitude to be an Air Force pilot, to minimize attrition of Academy cadets who continue in Air Force pilot training."[8]

Since the initiation of T-41 training as the first phase of Undergraduate Pilot Training (UPT) in 1965, flight screening has seen several changes; but, some form of light plane flying has been a continuous part of the Air Force pilot training culture. ROTC FIP/UPT continued throughout the T-41 years: those cadets completing the FIP flew only 14 hours in the T-41 phase of UPT compared to a 30-hour program for those with no previous flying experience. This initial phase of UPT came under scrutiny in the Summer/Fall of 1967 when HQ USAF suggested the program be deleted to save resources[9]. ATC disagreed with the concept, estimating that an additional 10 hours would be required in the T-37 phase to compensate for the loss of T-41 training. In an effort to enter all flying training candidates into UPT jet training with approximately equal flying experience, HQ USAF asked ATC one month later (Nov 67) to consider T-41 training for Officer Training School (OTS) candidates at Hondo as part of their curriculum. In Mar 72, the CSAF approved an ATC suggestion to consolidate T-41 flight screening at Hondo (Program Hasty Blue)--clearly supported by a need to decrease the higher attrition rates of OTS-graduate pilot training students.[10]

T-41 FS at Hondo became reality in Mar 73 with the arrival of two T-41s from Williams AFB, and flying began 17 May 73 with approximately 80 students in a contractor-operated program (Del Rio Flying Service). This revised approach put all candidates on a relatively equal footing to enter pilot training—ROTC cadets had the FIP, USAFA cadets underwent the

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[3] Ibid, p. 641.
[4] Ibid, Appendix Vol 7, Doc #83, p3-4.
[5] History of the USAFA, 12 Jun 1958-30 Jun 1959, Col II, p. 388.
[6] Ibid., p.389
[7] History of the USAFA, 1 Jul 1959-30 Jun 1960, p. 319.
[8] History of the USAFA, 1 July 1967-30 June 1968, Vol 1, SUPT-1, p. 99
[9] USAFA Pilot Indoctrination Program (PIP) began in Jan 68.
[10] OTS graduates accounted for about 81% of the Phase I UPT eliminations.

Academy's PIP, and OTS candidates received a comparable training/screening program at Hondo. Left out of this picture (at least for a while) were those active-duty pilot candidates who were already rated and those candidates who held a private (or higher) FAA pilot rating.

As T-41 screening continued at Hondo during the 70's and 80's for those pilot training candidates with no flying experience, the program was not without questions. In Jul 76, ATC/CC proposed a test of ground-based screening for USAF students at OTS in lieu of the "costly" T-41 screening. A combination of Air Force Officer Qualification Test (AFOQT) scores, general aviation trainer (GAT) performance, and a psychomotor test was suggested as a suitable substitute for the flying program. Though research was conducted on this proposition, T-41 screening was never suspended in favor of the non-flying regimen. Meanwhile, the ROTC FIP underwent several changes, decreasing to 42 sites by 1985 and further to 13 sites in 1986, with Embry Riddle Aeronautical University conducting a portion of the program at their Daytona Beach, Florida, campus. FIP in its original concept was terminated in 1987, and the Light Aircraft Training for ROTC (LATR) was offered by Embry Riddle and at Hondo, providing 14 hours of flight instruction for ROTC cadets. Finally, LATR terminated in 1988 when all screening for OTS and ROTC candidates was consolidated under contract at Hondo.

The concept of ground-based screening was not forgotten; not as a replacement for flight screening, but as an adjunct to assist in classification of pilot candidates prior to Specialized Undergraduate Pilot Training (SUPT) entry. Ground screening was to augment flight experience to assist the candidates in determining their personal preference (fighter, bomber, airlift, or tanker), and flight performance to determine their skills. Indeed, flight screening was a major topic of the Flying Training Broad Area Review commissioned by Lt Gen Oaks in 1989. Conferees deliberated the merits of an enhanced flight screening aircraft, resolving that the T-41 was not suitable because its high-wing design precluded overhead patterns and aerobatics, which they believed necessary to expose pilot candidates to the rigors of SUPT and follow-on Major Weapon System (MWS)-type environments. Development of this concept led to a decision to purchase an aerobatic aircraft, and a statement of need (SON) was published by ATC on 5 Mar 90. Recognizing the efficiencies of combining screening programs for USAFA cadets and ROTC/OTS candidates, ATC/CC and USAFA/CC signed a joint System Operational Requirements Document (SORD) for an aerobatic screening aircraft to be employed both at Hondo and the Academy. Commonality was limited to the aircraft and syllabus; but, there was clear recognition that the program at the Academy would not--as it never had--mirror the Hondo program.

PROGRAM REQUIREMENTS

The Enhanced Flight Screening (EFS) program was designed to essentially replace these two separate and distinct "pre-UPT" flight programs. The concept of *Specialized* UPT (SUPT) brought a change to PIP/FSP. ATC/CC, General Oaks, contended the transition to SUPT from UPT offered an optimum opportunity to determine if there were better ways to accomplish training goals and to identify and implement changes across the entire spectrum of USAF flight training. To this end, he directed a Broad Area Review (BAR) to examine all flying training programs within ATC. The BAR met in Jan, Apr, and Jul 89--the EFS concept was a result of their efforts.

BAR participants proposed a phased approach to implement EFS. The new course of instruction would be approximately 21.5 flight hours and provide centralized screening for all non-USAFA pilot candidates. In addition, the new EFS program would screen all candidates, even those with a Private Pilot's License (PPL). In Feb 90, USAFA/CC, Lt Gen Hamm, agreed to change the USAFA PIP to mirror EFS. He signed a memorandum of support that made provisions for the USAFA program to resemble AETC's EFS. However, the program would not be identical due to differences in climate, geography, USAFA cadet scheduling, and candidate experience levels. The memorandum also outlined the use of military IPs to conduct the flight program at USAFA.

The original concept of the EFS program was to enable "track selection" of pilot candidates prior to the primary phase of SUPT. This concept was a result of CSAF (General Welch) direction in late 1987. Several inputs would be used to determine which SUPT track a candidate would enter. The Pilot Selection and Classification System (PSACS) tested candidates' basic aptitude and motor skills, but the candidate's statement of preference and performance in flight screening would also weigh heavily in the classification process.[11]

In order to accomplish the goal of track selection, the screening aircraft would need to expose candidates to a sufficient range of flight regimes, so the candidate could make an informed choice for track preference and to facilitate evaluation of candidate performance potential. The Statement of Need (SON) in Mar 90 stipulated the aircraft must be aerobatic, capable of overhead traffic patterns, and be able to accommodate low-to-moderate (2-6) "g-loading" in order to expose candidates to the types of maneuvers military aircraft perform. This would also provide a way to evaluate a candidate's ability to quickly and accurately react while flying more complex maneuvers representative of follow-on trainers and operational USAF aircraft. Clearly, the T-41 was incapable of meeting these criteria, but, development of a new aircraft specifically for flight screening was cost prohibitive.

The initial preferred strategy was to lease a commercial aircraft for flight screening. However, previous AF-experience and business decisions discouraged such contracts. The final decision was to purchase a flight screening aircraft from a commercial source--a "commercial, off-the-shelf" (COTS) aircraft. Several candidate aircraft were available, and the initial plan called for

[11] In Feb 91, at CORONA, CSAF (General McPeak) overturned the previous decisions to track select prior to phase I of SUPT. However, the overall objective of the EFSP program remained the same: decrease attrition in SUPT.

125 total aircraft--69 at Hondo and 56 at USAFA.

ACQUISITION OF THE T-3A FIREFLY

Introduction

The T-3A Firefly was acquired under strategies and guidance which encouraged utilization of "Streamlined Acquisition Strategies," and Commercial Off-the-Shelf/Non-Developmental Items (COTS/NDI) to the maximum extent possible. The T-3A program was classified as an ACAT III/IV, non-OSD oversight program where major milestone events were waived to expedite and compress the buy and fielding decision.

COTS streamline strategies involve a highly-tailored acquisition process where major program milestones are often waived or compressed. The acquisition community recognizes potential benefits in this strategy through reduced fielding time (test and evaluation can be streamlined or even eliminated), and reduced R&D costs (major development work is already complete).

This accelerated fielding schedule often limits test opportunities which may be appropriate in some cases. When an item is procured without modification and used in the same environment for which designed, testing can often be streamlined or waived. Such was not the case for the T-3A (larger engine, slow taxi requirements, constant use of fuel pump, continuous high RPM operation, and high-altitude operations at USAFA); but, testing was still intentionally abbreviated. Acquisition decision makers believed that since the Firefly was a proven trainer used in other countries, such as the UK and Canada, "missionized" and operational environment testing requirements could be minimized or waived.

Chronology of Events

The following is a chronology of events that occurred during the EFS program:

TABLE 1.1. CHRONOLOGY OF EVENTS

Apr 90	AETC published a Statement of Need (SON) to acquire an aircraft that can perform aerobatics, overhead pattern, and spin maneuvers to screen students and track-select for the Specialized Undergraduate Pilot Training (SUPT) program
Jul 90	SAF/AQ published the first Program Management Directive (PMD) authorizing the purchase of an aircraft for the EFS program
Jul – Aug 90	Initial demonstration by competing manufacturers
Jan 91	AETC published EFS System Operational Requirements Document (SORD)
26 Jul – 7 Aug 91	Operational Evaluation fly-off of competing manufacturers
Sep 91	ASD/YT published the Request for Proposal (RFP)

18 Mar 92	Second PMD published to authorize purchase of 113 aircraft and conduct combined QT&E/QOT&E by Aeronautical Systems Division (ASD) and AETC. Identifies ASD/CC as the Designated Acquisition Commander (DAC) for the EFS program (A Program Executive Officer (PEO) was not appointed). Directs AFOTEC to conduct oversight of ATC's QOT&E
15 Apr 92	"AF Realignment of IOT&E and QOT&E Programs" by USAF/CV transferred dedicated QOT&E from AETC to AFOTEC
29 Apr 92	The Source Selection Authority (SSA) chose the CAA certified Slingsby Firefly
May – Aug 92	Stop work issued for contract protests; reviewed by GAO
22 Sep 92	Contract award to Slingsby for the Firefly
13 Jan 93	ASD/CC published an Acquisition Program Baseline (APB) that waives traditional acquisition milestone events
15 Jun 93	First delivery of T-3A prototype for testing
23 Sep – 1 Oct 93	"Combined" QT&E/QOT&E conducted by Slingsby and 4950th TW
Dec 93	Civil Aviation Authority (CAA) certified the T-3A aircraft with the AEIO-540 engine and FAA issues a bi-lateral agreement of certification under FAR Part 23
1 Feb 94	AFOTEC began dedicated QOT&E
18 Feb 94	4950 TW test report published--recommended further high-altitude testing
25 Apr 94	Final PMD by SAF/AQ directs AFOTEC to conduct combined QT&E/QOT&E to maximum extent possible
Mar 94	Initial IP training began at Hondo, concurrent with QOT&E
Mar – Aug 94	Fleet grounded for 50 days due to uncommanded engine stoppages on the ground
Jul 94	Student screening begins concurrent with QOT&E
31 Aug 94	AFOTEC dedicated QOT&E completed
6 Sep 94	Normal flying operations resumed after grounding of T-3A fleet
Oct 94	"Official" acceptance ceremony of T-3A at Hondo
Nov 94	QOT&E official test report published. Result--effective but not suitable
Jan 95	First delivery of T-3A to USAFA
25 Feb 95	First fatal mishap at USAFA
5 Jan 96	AETC started FOT&E at Hondo and USAFA
9 Jan 96	Final T-3A delivery and acceptance, and Final Operational Capability (FOC) declared
30 Sep 96	Second fatal mishap at USAFA
Sep 96	SAIC contracted to investigate engine stoppage problem
25 Oct 96	AETC-conducted FOT&E complete
Nov 96	FOT&E test report published. Result--effective but not suitable
25 Jun 97	Third fatal mishap at USAFA
24 Jul 97	T-3A fleet operations suspended. AETC/CC commissions Broad Area Review (BAR)
Aug 97	SAIC proposed modifications to reduce engine stoppages
Oct 97	IPT and TPWG formed to resolve engine stoppages and plan future

	AFOTEC conducted FOT&E
Dec 97	SAF/IG chartered to conduct BAR
Feb 98	SAF/IG report issued

Acquisition Strategy

Due to the nature of the COTS/NDI streamlined acquisition strategy of the T-3A program, the following milestone events were not required in the Acquisition Program Baseline (APB):

- Milestone I
- Milestone II
- Early Operational Assessment
- Developmental Test and Evaluation (DT&E)
- Initial Operational Test and Evaluation (IOT&E)
- Low Rate Initial Production (LRIP)
- Full-rate Production Contract Award

A traditional, non-COTS acquisition program requires all the above events take place IAW DODR 5000.2. Each milestone is a point in the program where a Milestone Decision Authority (MDA) authorizes the program office to continue the next corresponding phase of development. Since both Milestones I and II were not required for the T-3A acquisition, associated Phase activities which normally follow were also not conducted.

Normal activities during Phase I (period between Milestones I and II) include program definition and risk reduction with an Advanced Concept Demonstration, where manufacturers have the opportunity to demonstrate their prototype hardware and compete for source selection. Phase I is also used to conduct an Early Operational Assessment (EOA) to determine if the aircraft meets user requirements and reduces program risks by identifying operational deficiencies early. Eliminating the Milestone I decision helped streamline the process; however, it increased risk to the program by not requiring the EOA.

Phase II (period between Milestones II and III) activities are where the majority of DT&E and OT&E testing traditionally occurs. As Phase II progresses, a combined DT&E/OT&E is conducted to reduce program risks before the design is finalized. By combining these tests, the Air Force saves both time and money. Low Rate Initial Production activities are also conducted during Phase II to allow the manufacturer to test their production line and provide articles for dedicated OT&E. A dedicated OT&E, per Title 10 USC, is conducted at the end of Phase II to provide an independent assessment (without contractor or DT&E participation) of the aircraft's operational effectiveness and suitability. OT&E is the "final grade" given to the program and supports the MDA decision at Milestone III. Since the APB did not include Milestone II and associated Phase II activities, the opportunity to conduct "missionized" OT&E testing prior to the buy decision was eliminated.

In summary, both Milestone I and II decision points and associated Phase activities were waived to streamline the acquisition process. The program then proceeded to the Milestone III (production and fielding) decision authority, without the normal testing to support the buy and full production decisions. This was considered an acceptable risk at that time due to the COTS/NDI nature of the T-3A. Post Milestone III testing activities were also combined and tailored to reduce program costs and streamline production by minimizing test activities.

Source Selection

Immediately after the release of the Statement of Need (SON), a test demonstration program was conducted at Hondo in the Summer/Fall of 1990 to validate the program concept. The Program Management Directive (PMD) authorized the acquisition of 113 EFS aircraft at an estimated cost of $57 million, and required AETC publish an EFS System Operational Requirements Document (SORD).

The initial demonstration was conducted at USAFA from 23 Jul to 10 Aug 90, with multiple candidates competing for the contract. The following aircraft were flown and evaluated for general aircraft performance, physical layout, adequacy of communication system, handling characteristics, and maintainability and logistics:

- Aerospatiale Trinidad (8 sorties)
- Mooney M 20K/TLS (20 sorties)
- FFA Bravo (9 sorties)
- Siai Marchetti SF260 (9 sorties)
- Slingsby Firefly (9 sorties)
- Glasair IIS/III (15 sorties)
- LoPresti Piper Swift Thunder[12] (10 sorties)

Aircraft were evaluated by ATC, USAFA, and AFSC pilots in ambient temperatures ranging from 42-80°F, and density altitudes ranging 6,670-8,350 ft. The Firefly model evaluated was equipped with an AEIO 360 (200Hp) engine and comments included:

- Aircraft Performance: relatively slow rate of climb; lowest cruise speed; engine response good; deceleration good; overall stability very good
- Aircraft Physical Layout: no inertial reels; fixed seat–rudder pedal adjustment difficult; brake effectiveness poor; visibility over nose difficult; wing blocks view in pattern; good cockpit layout; visibility excellent
- Communications System: voice activated–pilots preferred “hot mike”
- Handling: slight yaw; trim responsive; stick forces good; good stall characteristics; energy maintenance poor if maneuver entry weak; spins easy to enter and recognize; rudder input breaks spin; flies well in pattern; very responsive to input; relatively easy to land

[12] Also known as the Swift Fury in its tail-dragger configuration.

- Maintainability and Logistics: logistically capable for EFS; proposed changes for improved maintainability; composites okay; mix of standard and metric measurements; lack of US support network

In Jul and Aug 91, AFMC conducted an Operational Evaluation (Ops Eval) of all competing aircraft. The Ops Eval was conducted at both USAFA and Wright-Patterson AFB by AFSC and USAFA pilots. This aircraft was now equipped with the Textron Lycoming AEIO 540 (260Hp) engine to provide increased power for high-altitude operations. These pilots commented that the Firefly had "levels of redundancy such that normal and emergency procedures are compatible with the skill levels of inexperienced student pilots." In addition, takeoff and landing performance exceeded requirements, climb capability and cruise performance were adequate, and stall characteristics were acceptable; but, the stall warning horn was too quiet. Spins were downgraded because established recovery procedures would require additional training for low-time pilots and to maintain instructor proficiency. The test pilots stated the flight manual spin recovery required accurate timing and correct application of opposite rudder, neutral aileron, and forward stick which could be difficult for a low-time pilot. In addition, pilots noted the brakes could not prevent the aircraft from creeping during static engine run-ups, and the engine sputtered when the throttle was reduced to a lower power setting. During one demonstration flight, a pilot had an uncommanded engine stoppage which was successfully restarted during a spin recovery.

The Ops Eval continued at Wright-Patterson AFB in Aug 91 by AFSC test pilots, and sorties were flown by USAFA and AETC pilots to a representative EFS syllabus and sortie lengths. Test pilots commented that the Firefly flown during the Ops Eval was suitable for the EFS mission, and "capable of exposing pilot candidates to ground operations, takeoffs, stalls, slow flight, spins, aerobatics, overhead patterns, landings, and mission planning." In addition, the Firefly "possessed handling characteristics compatible with a student training environment" and "had levels of redundancy, performance, normal and emergency procedures, and flight characteristics commensurate with the skill levels of inexperienced student pilots." There were minor downgrades noted in the final report, most notably in the area of ground handling because "the aircraft did not provide consistent [engine] starts and the starting methods were considered unsuitable for the EFS mission." The Firefly had an uncommanded engine shutdown during ground operations on three of seven sorties, all attributed to vapor locks in the fuel system.

After the Ops Eval, AFSC released the Request for Proposal (RFP) for the EFS Program in Sep 91. After proposals were received, a Source Selection Authority (SSA) convened from 6 Nov 91 to 22 Apr 92. On 29 Apr 92, the Slingsby Firefly was selected as the aircraft to meet EFS program requirements. The Firefly, with the Lycoming AEIO-540 (260 hp) engine configuration, was designated as the T-3A. Immediately following the award announcement, other bidding contractors filed protests. A stop work was declared and a 4-month GAO Review conducted in response. On 22 Sep 92, the contract award was confirmed and work resumed on T-3A production. The first prototype was delivered to the AF on 15 Jun 93.

Test Strategy

Per AFI 99-101, *Developmental Test and Evaluation*, "QT&E" is conducted in-lieu of "DT&E" to validate contractor specifications for COTS/NDI programs, and, "QOT&E" is conducted in-lieu of "IOT&E" to ensure the aircraft can meet mission requirements. The APB outlines the acquisition strategy for the T-3A program while the PMD defines participant roles, responsibilities, and testing strategy. In terms of test planning, PMD 1104 (12), 18 Mar 92, was issued by SAF/AQQU authorizing the purchase of the T-1A, T-3A, and JPATS for Specialized Undergraduate Pilot Training (SUPT). It directed acquisition of 113 FAA type-certified T-3A aircraft, determine the appropriate level of testing, conduct a combined QT&E/QOT&E, chair the Test Planning Working Group (TPWG), and prepare an integrated Test and Evaluation Master Plan (TEMP)[13]. The PMD also directed ATC develop the Operational Requirements Document (ORD), conduct the EFS QOT&E (combined with QT&E), and manage FOT&E. AFOTEC was directed to monitor the ATC-conducted QOT&E and FOT&E.

a. Combined QT&E/QOT&E

The PMD directed the use of a combined QT&E/QOT&E to the maximum extent possible to streamline the testing process. ASD and AETC were initially identified as the test agencies to conduct QT&E/QOT&E, and AFOTEC was not tasked to support the combined effort until after the QT&E/QOT&E test was completed (PMD 2331, 25 Apr 94). The effort was limited to AETC support personnel to collect maintenance data after each sortie.

From 23 Sep to 1 Oct 93, the combined QT&E/QOT&E was conducted at Hondo, TX, and Ruidoso, NM. Because this was a combined effort without AFOTEC involvement, both ASD and the contractor were responsible for the test. Slingsby primarily conducted the test with participation by the 4950th Test Wing. The Slingsby QT&E report was a deliverable item listed by contract, and the 4950th submitted an additional "informal test report." The majority of the QT&E/QOT&E flight tests were conducted at Hondo, with limited testing at Ruidoso, NM (elevation 6,811 MSL) to evaluate high-density altitude performance. During the test, extra emphasis was placed on spin-testing the T-3A with a total of 4 spin sorties capturing 39 spins. Slingsby's final report stated the T-3A demonstrated full compliance with system specifications.

The 4950 TW submitted their report documenting testing activities and recommendations on 18 Feb 94. Several recommendations from this report suggested Slingsby develop procedures for high-altitude operations. It also recommended Slingsby include additional range and endurance data in the flight manual and conduct an analysis of spin modes, spin recovery, and other data to provide a better description of aircraft systems and flight characteristics.

Other recommendations include the wear of parachutes during spins and aerobatics, and the initiation of spins no lower than 4,000 ft. AGL. Of particular interest was the recommendation that "AFOTEC perform typical student training profiles at USAFA prior to

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[13] Although a TEMP was directed, the draft TEMP dated 17 Apr 91, was waived in-lieu of a contractor supplied Systems Test Plan, dated 24 Sep 92 delivered by Slingsby.

operational deployment to fine tune instructional techniques and evaluate flight manual procedures at high density altitude airfields. Particular attention needs to be given to simulated forced landing procedures and energy management."

b. **Dedicated QOT&E**

From 1 Feb to 31 Aug 94, AFOTEC conducted the dedicated QOT&E in two phases with production aircraft at Hondo. Per AFI 99-102, *Operational Test and Evaluation*, AFOTEC conducts all QOT&E on commercial off-the-shelf (COTS) items in lieu of an IOT&E. The purpose of the test was to provide an independent "missionized" evaluation of T-3A operational effectiveness (How well does it perform its mission?) and suitability (Is it supportable at the operating location?). The test was designed to answer one Critical Operational Issue (COI): *Does the T-3A perform its screening mission?* The COI was answered by measuring attrition, aircraft availability, aircraft reliability, aircraft maintainability, and subjective instructor pilot surveys.

QOT&E Phase I, conducted during IP qualification training, was reduced from 14 to 5 weeks due to late aircraft delivery. QOT&E Phase II, conducted during student training, was shortened because of extended grounding of the fleet due to uncommanded engine stoppages during the test. Both events reduced the amount of planned test data collected; however, funding to expand QOT&E due to program slips was not made available from ASD.

AFOTEC published a final QOT&E test report in Nov 94 which indicated the T-3A was "operationally effective but not suitable." In other words, the T-3A was capable of performing its screening mission, but was not completely supportable within the established maintenance concept. This conclusion was drawn from pilot surveys which indicated the T-3A was effective at conducting all syllabus maneuvers; however, two suitability measures, Full Mission Capable (FMC) rate and qualitative maintainability, did not meet established test evaluation criteria. The observed FMC rate was 15.8%, well below the criteria of 81%. Maintenance personnel indicated (by survey) that the commercial maintenance manual lacked sufficient detail to troubleshoot and perform some repairs. Specifically, the manual lacked a step-by-step process to remove and install an engine (not uncommon in general aviation). The FMC rate was affected primarily by groundings due to engine stoppages.

c. **FOT&E**

AETC Studies and Analysis Flight (SAF) submitted a FOT&E test plan in Dec 95 to evaluate the T-3A to ensure it continued to meet mission requirements. The plan was approved in Jan 96, and FOT&E was accomplished by AETC in accordance with AFI 99-102, *Operational Test and Evaluation*. FOT&E was designed to resolve five Critical Operational Issues (COIs):

- Does the T-3A achieve its SUPT/UPT attrition goal?
- Is the T-3A effective in the Hondo operating conditions?
- Is the T-3A effective in the USAFA operating conditions?
- Is the T-3A suitable in the Hondo operating conditions?
- Is the T-3A suitable in the USAFA operating conditions?

The COIs measured operational effectiveness for winter and summer operations, and operational suitability through reliability, maintainability, availability, and technical manual usability. The FOT&E was accomplished at both Hondo and USAFA from 5 Jan to 25 Oct 96.

FOT&E was conducted by AETC to measure the effectiveness and suitability of T-3A operations at Hondo and USAFA. As with the QOT&E, no dedicated sorties were programmed for FOT&E to resolve new procedures or fine tune instructional techniques. During FOT&E, a new spin program and spin demonstration sortie were added to the PIT syllabus, but no additional testing was conducted to measure the operational effectiveness of the spin program. All data collected during FOT&E was in the form of approved questionnaires and personnel debriefs.

Overall, AETC also found that the T-3A was "operationally effective but not suitable with respect to maintenance requirements." Several suitability measurements did not meet established test evaluation criteria as indicated in the following table:

TABLE 1.2. SUITABILITY MEASUREMENTS

Measurement	Criteria	Reported
Mission Completion Success Probability (MCSP) at Hondo in the summer	≥ 98.5%	96.47%
MCSP at Hondo in the winter	≥ 98.5%	98.35%
MCSP at USAFA in the winter	≥ 98.5%	98.01%
In-Flight Engine Shutdown Rate (IFESDR) per 1,000 hours	≤ 0.05(unrecoverable) all w/no standard	zero 0.14 w/no standard
Fully Mission Capable (FMC) rate at Hondo in the summer	≥ 95%	92.52%
FMC rate at USAFA in the summer	≥ 95%	93.86%
FMC rate at USAFA in the winter	≥ 95%	80.52%

CHAPTER II

OPERATIONAL AND SUPPORT ASSESSMENT OF THE ENHANCED FLIGHT SCREENING PROGRAM

INTRODUCTION

This chapter provides a detailed assessment of the current operations and support systems of the Enhanced Flight Screening Program. The chapter is divided into operations and support sections, and is then further divided into major categories. These categories form the basis for the risk reduction tables in Chapter III and subsequent recommendations in Chapter IV.

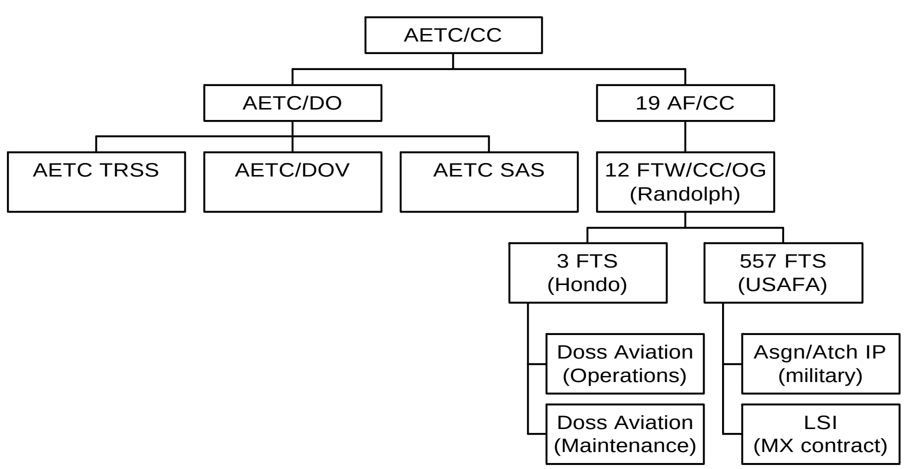
OPERATIONAL ASSESSMENT OF THE EFS PROGRAM

This operational assessment is discussed as it relates to the following areas: Mission, Aircraft, Operating Locations, Instructor Pilots, Students, and Training Programs.

MISSION

Operational Program Oversight

The Enhanced Flight Screening (EFS) Program command and control structure mirrors most existing flying training programs, with some unique differences. The EFS program consists of two Flying Training Squadrons (FTS), the 3 FTS and 557 FTS, located at Hondo Municipal Airport, TX, and the United States Air Force Academy, CO, respectively. They directly report to the 12th Flying Training Wing (FTW) located at Randolph AFB, TX. Both flying training squadrons are geographically separated from their parent wing headquarters; however, the 3 FTS has the advantage of close geographic proximity.



The 12 FTW reports to 19 AF, which in turn reports to HQ AETC. All suggested changes to the EFS Program must be approved by the 12 OG/CC prior to submission to 19 AF,

whose primary oversight to the EFS Program is through the standardization and evaluation function for this and all other AETC operational flying units. They conduct periodic Stan/Eval inspections, review proposed changes to flight manuals and command operational publications, and serve as the liaison between 19 AF and outside agencies.

The AETC Training Support Squadron (TRSS) and AETC Studies and Analysis Squadron (SAS) both serve support functions for AETC/DO. TRSS manages the EFS syllabus (including the T-3A PIT Program) and tracks attrition rates to measure effectiveness of the program. All syllabus changes are maintained by TRSS; however, 19 AF closely controls the final product. SAS serves to conduct Follow-On Test and Evaluation (FOT&E) and tracks the cost-benefit analysis of the program and identifies maintenance trends.

There is no core expertise in the command structure regarding the EFS Program, to include the T-3A aircraft, and very little throughout the subordinate command structure. This is partly due to the recent fielding of the T-3A in 1994, and very limited vertical progression from the squadron levels to the NAF and headquarters. Currently, HQ AETC/TRSS has only one individual assigned to fly the T-3A, 12 FTW has only one DOV pilot with T-3A experience, and 19 AF has two in the DOU function. None of the individuals assigned to the program are above the grade of Lieutenant Colonel.

Squadron Level

As mentioned earlier, the 3 and 557 FTSs have relatively typical Air Force flying squadron organizations. Each also has a contracted civilian workforce for aircraft maintenance, but most similarities end there. Each squadron has a different manning level and operating environment to accomplish their screening mission as described below.

a. 3rd Flying Training Squadron (Hondo)

The 3 FTS operates from two locations: Lackland AFB for orderly room administration and student billeting facilities, and Hondo Municipal Airport (approximately 40 miles west of Lackland AFB) for flying operations.[14]

The squadron is commanded by an active-duty Lieutenant Colonel, and the organization includes 11 active-duty AF instructor pilots who perform Quality Assurance Evaluator (QAE) duties. Eight enlisted personnel are also assigned (2 maintenance QAEs, 2 Life Support, 2 Parachute Riggers, and 2 commander support staff personnel), and 2 DAF civilian personnel (secretary and maintenance QAE), for a total of 21 non-contract personnel. Their responsibilities include student management, operations and maintenance contract surveillance, standardization/ evaluation, and cost center management.

The contractor, Doss Aviation, Inc., provides 40 instructor pilots and 26 maintenance/support personnel.[15] Contractor duties include flight and academic instruction,

[14] 3 FTS leases facilities at Hondo Municipal Airport from the city of Hondo.
[15] Personnel requirements are determined by programmed student load (as defined in the contract).

airspace management, standardization/evaluation,[16] daily flight and field operations to include Runway Supervisory Unit (RSU) operations, Supervisor of Flying (SOF) operations, aircraft security, on-equipment maintenance to include Functional Check Flights (FCF), Continuation Training (CT), and Pilot Instructor Training (PIT). The contractor personnel are organized in a military structure and are completely integrated into the squadron organization--with a general manager as the squadron commander counterpart. Below him are four divisions: Standardization/Evaluation, Maintenance, Quality Control, and Operations. Operations has four student pilot training flights, a pilot instructor training flight, and an academics flight.

Instructor experience varies widely among the IPs. The small number of military pilots (11 total) have various MWS backgrounds, and 3 have previous AETC (T-37/T-38) instructor experience. The contract civilian pilots all have previous instructor experience. The contract with Doss Aviation specifies all new hires have an FAA-Certified Flight Instructor (CFI) rating in fixed wing, single-engine land aircraft. The contract also stipulates that Doss pilots must have a minimum of 600 hours jet/turboprop time in US military aircraft to include a minimum of 250 hours instructor time in those aircraft. The AF pilots are not required to have a CFI rating.

EFS students come from a variety of backgrounds. Candidates come from Officer Training School (prior to enrolling), ROTC post-commissioning programs, or within the Air Force to include the Reserve Forces (both commissioned officers, rated and non-rated, and enlisted personnel selected for officer training).[17] The majority of the students have some flight experience varying from a few private hours to as much as 2,000 hours with multiple private/commercial/instructor ratings. Others have flying experience as navigators, flight engineers, or weapons controllers. The 4-week program operates continuously throughout the year with a constant level of student throughput.

The squadron plans to move their Lackland AFB operations to Randolph AFB in the near future, where students will initially be billeted to accomplish academics and medical screening. They will subsequently be billeted in or near Hondo for the flying training phase. This will eliminate the substandard accommodations which currently exist for male officers at Lackland AFB and the long daily commute to and from Hondo.

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[16] Military instructors fly "elimination" sorties and make the final determinations for students who have difficulties during training.

[17] 3 FTS processes those candidates not already accessed into the military upon arrival at Lackland AFB.

b. 557th Flying Training Squadron (USAFA)

The 557 FTS is located on the east side of the United States Air Force Academy Airfield, and is composed of military pilots and a civilian contract maintenance force. The squadron consists of nine flights: five student pilot training flights, a standardization/evaluation flight, a training flight which functions as the academics flight, an operations flight, and a maintenance flight which consists of three maintenance QAEs and four FCF-qualified instructor pilots.

The authorized manpower is 113 instructor pilots, 58 assigned to the squadron and 55 attached. Of these pilots, 26 have previous AETC instructor (T-37/T-38) experience. The majority have heavy aircraft backgrounds, with only a handful having fighter aircraft experience.[18] The attached pilots are primarily instructors at the Academy, with flying as their secondary duty.[19] A recurring comment from the attached pilots surveyed was that they did not receive sufficient support from their department heads to facilitate their flying commitments.

Lear Siegler Incorporated (LSI) performs aircraft maintenance under contract to the Academy. The $1.6M contract is managed by the 10 ABW, with the 557 FTS Commander acting as the Functional Area Chief (FAC) to oversee QAEs assigned to the squadron.[20] There are presently 22 maintenance/support personnel employed by LSI. The support section of this chapter provides a detailed discussion of maintenance concepts and practices.

EFS students are all Academy cadets, typically in their junior or senior year. Very few have any previous flying experience other than the USAFA Soaring Program. There are three periods in which a cadet can participate in flight screening: either in the fall or spring semester of the academic year, or in one of two 4-week summer sessions.[21] Most cadets interviewed said they preferred the summer sessions because flying was their entire focus, and did not compete with academic requirements. EFS training typically occurs as students are heavily immersed in completing demanding academic requirements in their major area of study. Where possible, students carry as light an academic load as possible when undergoing screening to compensate. Cadets receive four credit hours toward degree requirements for completing the EFS program.

As indicated in interviews, USAFA athletes have first priority to complete EFS during the summer session, and the majority of non-athletic team members must complete EFS during the school semester. In addition, EFS performance is a significant factor in determining if a cadet is selected for the Euro-Nato Joint Jet Pilot Training (ENJJPT) program. Most cadets interviewed strongly support a post-graduate program where ENJJPT selection is determined prior to completing EFS to match the ROTC and OTS selection process. They believe they could focus solely on the program to improve their chances for ENJJPT selection.

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[18] Current fighter pilot shortages dictate fewer pilots being released for T-3A instructor duty.
[19] An agreement between the AFA and the 557th stipulates that the 557th needs 55 instructor pilots drawn from the staff to complete their mission.
[20] The FAC is normally the Operations Group Commander in the wing, but in this case, the Operations Group Commander has delegated this responsibility to the Squadron Commander.
[21] See following section on Operations for further explanation of scheduling.
[9]During the academic year, flight screening is integrated into the cadet's academic/athletic schedule.

AIRCRAFT

The T-3A aircraft is a commercial off-the shelf aircraft designed and manufactured by Slingsby Aviation Limited, Kirkbymoorside, York, England. The aircraft is a Glass Reinforced Plastic (GRP) structure, low-wing monoplane with: a single Textron Lycoming, 6 cylinder, AEIO-540-D4A5 engine, rated at 260 hp; conventional low mounted tailplane and elevator; and fixed tricycle landing gear. The aircraft is fully aerobatic and is used as the primary flight screening aircraft by the Air Force. The AF has a fleet of 110 T-3A aircraft, 53 at USAFA , and 57 at Hondo.

As of Aug 97, Slingsby had produced 234 *Fireflies,* with variants possessing engines ranging from 160-260 horsepower (hp). The USAF is the single largest operator and flies the T67M260 (260 hp) version. Other operators include the Royal Air Force, Canadian Forces, KLM Airlines, and the Turkish Air League. All fly the aircraft in formal training programs for military and civil operations. Small numbers of *Fireflies* are also flown in Belize, Switzerland, Belgium, Holland, Germany, Norway, Japan, Hong Kong, and New Zealand. These aircraft have been involved in 16 fatal accidents, resulting in the loss of 26 lives, as summarized below:

Mishap Review

TABLE 2.1 T-67/T-3A FATAL MISHAPS

DATE	LOCATION	PHASE OF FLIGHT	FATALITIES	DESCRIPTION
1984	UK	Aerobatics	1	Aerial display; insufficient altitude for maneuver
1984	UK	Cross Country	1	On training flight, pilot became lost and attempted a bail-out too low
1985	UK	Spin	2	Failed to recover, no pre-impact defects
1987	UK	Aerobatics	2	Engine failure while inverted in loop. Probably pilot error, since placards warn against negative G flight
1987	Sweden	Aerobatics	1	Low level aerobatics
1987	UK	Aerobatics	2	Pilot initiated maneuver too low
1987	Switzerland	Spin	2	Spun too low to ground—no defects noted
1989	Japan	Aerobatics	2	Steep turn after takeoff, rolled inverted
1989	Turkey	SFL	2	Wing dropped near the ground
1989	Turkey	Formation	2	On inside of turn after takeoff, hit house
1990	UK	Aerobatics	1	Misjudged altitude during aerobatics
1990	New Zealand	Aerobatics	1	No information

1995	USAF	Spin	2	Failed to recover from planned spin
1996	UK	Aerobatics	1	Failed to recover from inverted spin during aerial display
1996	USAF	SFL	2	Engine failure low altitude. Aircraft impacted ground as a result of low altitude stall
1997	USAF	Traffic Pattern Ops	2	Departure from controlled flight--insufficient altitude for recovery

(Sources: Air Force Safety Center; Slingsby Aviation, Ltd.; Inspectorate of Flying Safety, Royal Air Force)

The Air Force conducted two separate investigations into each of the three fatal accidents; a safety investigation and an accident investigation. The Safety Investigation Boards (SIBs) were conducted under AFI 91-204, *Safety Investigations and Reports*. The SIB reports are "limited use" (which means they may be used only for accident prevention) and contain "privileged" information (meaning it is exempt by law from disclosure outside the Air Force safety community).

The Accident Investigation Board (AIB) reports were conducted under AFI 51-503, *Aircraft, Space, Missile, and Nuclear Accident Investigations,* and do not contain privileged information. The AIB reports are fully releasable and are used for all other purposes, to include answering the "next-of-kin" and the media on how and why the accident occurred. The AIB reports contain a factual summary and a "Statement of Opinion," which summarizes the AIB presidents' opinions regarding the cause of the accidents. These opinions were made in accordance with 10 USC 2254(d) and attribute the three fatal accidents to the following:

22 February 1995: The instructor pilot (IP) failed to apply anti-spin rudder as directed in flight manual. The IP's spin academic instruction, flying training, and error analysis experience did not adequately prepare him to recognize his improper rudder application.

30 September 1996: During a simulated forced landing, the engine quit for some unknown reason. After the engine quit, the aircraft entered a stall from which the IP was unable to recover prior to ground impact.

25 June 1997: The aircraft departed controlled flight for an unknown reason during the turn to downwind. The IP's failure to recognize this departure and take immediate positive corrective action was the primary cause of the accident. (The AIB President found no clear and convincing evidence of mechanical failure.)

These three fatal flight screening accidents all occurred since the T-3A was brought into the Air Force inventory in 1994. Since there were no T-41 fatal accidents for more than 20 years prior to converting to T-3As, the three fatal accidents have naturally raised questions with respect to the safety of the aircraft.

General aviation (GA) accident data yields mixed results when compared to the Air Force's T-3A operations. In 1993 (the most recent year for which general aviation statistical data was compiled), the US GA fleet flew approximately 24.3 million hours. The National Transportation Safety Board reported 2,022 accidents[22], which generates an accident rate of 8.31 accidents per 100,000 flying hours. By this measure, the T-3A's Class A flight mishap rate of 3.52 per 100,000 (as of 5 Jan 98) does not look at all unsatisfactory. However, if the focus is narrowed to general aviation fatal accidents only, there were only 385 such accidents in 1993, yielding a rate of 1.58 fatal accidents per 100,000 flying hours. Further, the Air Force definition of a "flight" mishap is far narrower than the civil aviation "accident" criteria in terms of the phase of operation during which the occurrence takes place--taxiing aircraft are encompassed by the civil definition, but not reflected in the Air Force "flight" category mishap rates. It is difficult to compare FAA and USAF mishap rates due to the difference in the way data is collected--the above comparison is only presented to gain a broad perspective.

Crew Protection

The T-3A is unpressurized, has no oxygen system, no ejection system, and aircrews do not wear flight helmets or anti-G garments. Pilots currently wear the Butler Parachute Systems Beta Emergency parachute, which is a 24-foot diameter, conical design with rapid opening characteristics and a 18 foot/second descent rate. The parachute was originally tested as part of a technology demonstration program to acquire a new backstyle parachute for AC-130 crew members. T-3A crews wear flight suits and flight boots since parachutes were required in Apr 96. The cockpit has a 5-point personnel restraint system with a negative-G strap. Noise levels have not been evaluated; however, aircrews wear a David-Clark headset which is designed for hearing protection (many wear additional ear protection as well).

Human Factors/Anthropometry

The T-3A System Operational Requirements Document (SORD) states the cockpit will accommodate the central 98% of the AF population, and "minimum (smallest) crew will be able to activate all controls and displays, perform all necessary functions for flight, and be able to see over the nose of the aircraft under all landing configurations and phases." The Systems Requirements Document (SRD), at Source Selection, indicated the human factors program would meet MIL-STD 1472, with the exception of paragraph 5.6, anthropometrics for the aircrew interface with the cockpit (which focuses on the design limits for the 5 percentile female to the 95 percentile male, theoretically fitting 90% of the user population). The 98% AF population specified in the SRD meant the cockpit must accommodate a larger cross section of pilot statures than required in MIL-STD 1472.

[22] An "aircraft accident" is defined as occurrences which take place between the time of boarding with intent for flight until all persons have disembarked after that flight, in which anyone suffers a fatal or serious injury or the aircraft receives "substantial damage." Dollar thresholds are not applied to civil aviation criteria; in terms of human injury, "serious injury" could technically be recorded by the Air Force as a relatively minor (Class C) mishap instead of a high-profile Class A or B mishap. Thus, it is extremely difficult to compare military to civil aviation mishaps, except in terms of fatalities or "hull loss" (destruction of the entire aircraft or damage beyond economical repair). Losses at the margins tend to drive up civil statistics, while the narrower window of vulnerability of military aircraft to loss under "aircraft accident" conditions makes such comparisons even more suspect.

Anthropometric analysis of the T-3A cockpit was completed in the summer of 1992 by Armstrong Laboratories (AL/CFHD), after the USAF contracted purchase of the aircraft (Apr 92). The analysis was conducted before any modifications were made and addressed overhead (canopy) clearance, leg clearance, external vision, internal vision, hand-reach to controls, minimum leg length for full rudder throw, and cockpit width. Except for internal vision, all were deemed unacceptable. The conclusions of the study were: (1) very few pilots will contact the canopy but there is very little clearance; (2) 4.5% of the male and 3% of the female pilots will contact the lower edge of the instrument panel with their shin, and 12% of the current flying population will pin their left leg between the stick and left throttle during full left stick input in the left seat; (3) during a no-flap landing, small pilots (5% of the males and 50% of the females) will not be able to see the touchdown zone over the nose unless additional seat cushions are used; (4) small pilots will not be able to reach some controls (starter, flaps, throttle) with the inertial reel locked; (5) small pilots will have difficulty achieving full rudder throw; and (6) two side-by-side flyers with 80th percentile shoulder breadth will contact.

The Enhanced Flight Screening Cockpit Working Group, composed of Slingsby, AL/CFHD, and others met at the Academy on 9 Dec 92 to discuss all major anthropometric concerns identified. Slingsby's proposal to rectify the accommodation problems for small pilots was to add pads under and behind the pilot to move him/her to a different position. Realizing that moving the pilot up and forward relative to the stick might influence the amount of aft stick throw available, additional anthropometric testing was proposed.

Evaluation conducted by AL/CFHD on the anthropometric accommodations proposed by Slingsby was published on 28 Jan 93. Various thicknesses of seat and back cushions were used successfully to correct reach and vision problems, but external vision was rated marginal. The SORD required all pilots see the touchdown zone (defined as the first 1,000 ft. of the landing runway) over the aircraft nose during a no-flap landing, but this was not met for small pilots without the use of additional seat cushions. The shape of the left throttle was changed to improve leg clearance. Overhead clearance was rated marginal, and leg clearance was rated unacceptable. Internal vision was rated acceptable, hand--reach to controls acceptable, reach to rudders acceptable, and cockpit width marginal.

During Critical Design Review (CDR), it was noted that the right side throttle protruded into the left cockpit space--corrected by reversing the knob. However, this move cramped the space between the throttle and the propeller control and "could result in inadvertent control movement." Though not all anthropometric requirements had been met at the time, AF/CFHD felt that only minor "tweaking" of the design was necessary to correct the problems and that no major redesign was necessary.

Future Tests

Future tests with AFOTEC, AFFTC, AETC, and OC-ALC/LK are being planned by the Test Planning Working Group (TPWG) to gather additional flight data. The plan involves four FOT&E phases.

Phase I would be conducted as a combined test force (CTF) with AFOTEC, AETC, and AFFTC, and start in Apr 98. The proposed tests would be flown in an unmodified T-3A to resolve performance data discrepancies, define departure characteristics as a result of flight control inputs from student error, evaluate proposed advanced handling characteristic maneuvers, and evaluate alternative spin recovery procedures. Current plans by OC-ALC do not include Slingsby involvement during Phase I; however, negotiations are in progress to have Slingsby participate and validate test results.

Phase II would be conducted in Jun 98 after the FAA Fuel System Modification Supplemental Type Certificate (STC) is issued in a modified T-3A. Phase II would be flown by AFOTEC and AETC at Hondo to evaluate the proposed PIT syllabus. The test would evaluate T-3A effectiveness to conduct the new proposed advanced handling characteristic and spin demonstration sortie maneuvers.

Phase III would evaluate T-3A effectiveness at USAFA operating altitudes. The proposed tests are planned for Jun and Jul 98 as a CTF with AETC, AFOTEC, AFFTC, and Slingsby to resolve AETC CONOPS, evaluate flight manual performance data and procedures, and define handling qualities for high altitude operations. Slingsby's participation in the test effort has not been secured; however, negotiations are in progress to obtain concurrence with test results and incorporate resulting data into the flight manual.

Phase IV would collect suitability data for a minimum of one year to determine if the modifications have reduced the number of engine stoppages to an acceptable rate and evaluate maintenance concepts of operations in terms of the CLS contract. Phase IV would evaluate and measure results against SORD requirements.

One item left unresolved is consensus on what constitutes an engine failure versus an engine stoppage. The Slingsby contract defines an in-flight engine failure as "the number of times the engine experiences *non-recoverable* failures (cannot be restarted) or experiences loss of power in flight, due to engine or engine-related malfunctions." The definition is unclear whether it captures in-flight engine shutdowns that can be recovered in flight by restarting the engine. If only non-recoverable engine failures are considered, the current aircraft design meets Slingsby's contract specification for a failure rate of less than 0.05 per 1,000 flight hours, since only one unrecoverable engine failure has been recorded in approximately 82,000 flight hours.

To ensure appropriate test criteria, AETC should define acceptable engine stoppage and failure rates before FOT&E Phase IV testing begins. Without a clear definition of an engine stoppage and a measurable criterion of acceptance, a single stoppage could be considered unacceptable, leading to potentially unnecessary program delays and costly modifications.

Flight Manual Guidance

Results of both the fuel system modifications and additional handling qualities flight tests may result in procedural changes to the mixture control, electrical fuel pump operation, in-flight engine restart checklist, and spin recovery procedure. This will require flight manual changes to current procedures.

The SAIC proposed fuel system modification and engineering analysis of component failure rates will require new flight procedures by pilots, who will have to change fuel mixture techniques as a result of removing the automatic mixture control. The manual mixture control will require a new description of both procedures and the fuel system in terms of manual mixture control. This is currently being addressed during SAIC's modification testing as updates to the flight manual are reviewed.

Flight manual guidance for an engine restart in flight requires the pilot to conduct 15 separate steps. Depending on the altitude, this procedure could be impossible to complete. Most pilots interviewed execute the accepted technique to engage the starter when a loss of power is detected in flight. This technique could easily be called an "Emergency Air Start," where the pilot simply checks his mixture and throttle position then engages the starter. If unsuccessful, and time permitting, they then continue with the current 15-step procedure.

In addition, AETC is requesting that spin recovery procedures be reviewed. During spin training, IPs enter a spin by applying rudder in the direction of the spin. Once the spin develops, the procedure is to check the throttle idle, neutralize the ailerons, and hold full aft stick. The rudder is not neutralized, which is unlike the T-37 or other aircraft spin recovery procedures. After confirming the direction of the spin, the pilot "swaps" the rudder opposite the direction of the spin. After waiting one second, the stick is placed full forward to break the stall and the rudder stops the rotation followed by recovery from the dive. If the pilot misses the first attempt, the "secondary drill" is executed. Instead of starting over (throttle neutral, ailerons and rudder neutral, stick full aft and hold), the pilot confirms direction of rotation, confirms opposite rudder, and selects full aft stick to "try again." Through repetitive habits of "swapping" the rudder during the spin recovery, pilots may inadvertently "swap" the rudder during the secondary drill in error, thus aggravating the spin recovery. It has been suggested the pilot start any spin recovery at a common starting point: throttle idle, rudder and ailerons neutral, stick full aft. If the pilot has an inadvertent spin with high spin rates, they (especially if inexperienced) could easily be disoriented. These and other flight procedures can only be resolved through flight tests by AFFTC.

Existing flight manual guidance regarding T-3A airborne emergency egress is inadequate, particularly on probable aircraft response to canopy opening and the best method to clear the canopy rail. For example, the flight manual does not contain lessons learned from the only attempted (and successful) bailout from a *Firefly* (two British pilots who bailed out of an aircraft which did not recover from a spin). Their experience suggests the slipstream will force the canopy open to its widest position. Once this has occurred, occupants may tend to be blown out of the aircraft once they rise above the level of the windshield. This data contradicts the current procedure, which calls for crews to dive over the wing and under the tail for bailout.

Flight Manual Update Process

Flight manual deficiencies or improvements are identified to OC-ALC from the 3 FTS and 557 FTS through AETC/DOVV using the AF form 847 process. OC-ALC dispositions potential changes by either using the annual flight manual review conference (FMRC) for administrative changes or in consult with the Original Equipment Manufacturer (OEM) for technical changes. The established process for changes to performance data is that OC-ALC will accept the change with AETC approval if it results in more conservative data or with the approval of the OEM (Slingsby and LSI in this case) if it results in less conservative data. If the OEM disapproves the change, AETC/DOVV is notified and the item is closed or redressed. All approved changes are made to the master copy by 19 AF/DOU per a memorandum of agreement with OC-ALC, who then prints and distributes changes.

Not all squadron-level generated 847s are forwarded to OC-ALC. The decision whether or not to approve an 847 is made at each of the 12 FTW, 19 AF, and HQ AETC levels. Inconsistent feedback on those not approved has created a negative perception in responsiveness to squadron concerns.

The flight manual formatting activities of 19 AF/DOU are unique among OC-ALC CLS programs. Nineteenth Air Force apparently believed responsiveness would increase by transferring this function to the highly motivated user; however, examples show that the opposite is true, and the plan is to return the function to OC-ALC.

In 1994, the USAF Test Pilot School validated the takeoff and landing data in the flight manual. Test data indicated Slingsby's runway length requirements were conservative at high altitudes in hot weather. Although adding a safety margin, it potentially limits flying operations at USAFA during hot, summer days. USAFA submitted an AF Form 847 to incorporate the new takeoff and landing data in the flight manual, but Slingsby did not concur because they did not participate in the testing, and could not validate the data collection process to meet CAA/FAA requirements.

The Air Force can now submit the data and methodology to the FAA for approval, or jeopardize its airworthiness certificate by changing the flight manual without Slingsby's approval. In the future, Slingsby should participate in performance testing to expedite flight manual updates.

OPERATING LOCATION FACTORS

Environment

Both locations offer generally favorable weather for flying training during much of the year. However, the Academy environment presents unique challenges due to its high altitude.

Hondo's field elevation is 930 ft. Mean Sea Level (MSL); the Academy Airfield is 6,572 ft. MSL. At extreme temperatures, the maximum density altitude at Hondo rarely exceeds 3,600 ft., but, the Academy's maximum density altitudes approach 10,000 ft. during summer months. This extreme density altitude translates into significant degradation of performance, most significantly in allowing only a maximum attainable power of 71% brake horsepower.[23]

TABLE 2.2 SORTIES LOST DUE TO WEATHER

	FY96	FY97 (Oct 96- Jun 97)
USAFA	26.3%	28.2%
Hondo	17.8%	27.8%[24]

Different weather conditions also exist at each location. Mission cancellations at Hondo are generally a result of low ceilings in the morning. For 9 months of the year, weather is less than 3,000 ft. ceilings and/or 3 miles visibility (VFR) more than 20% of the time, and in the winter such conditions are typically encountered more than 30% of the time. Hondo is also subject to sudden hailstorms primarily during the summer months.

At the Academy, summertime thunderstorms and strong, often unpredictable winds cause the majority of sortie cancellations. The Academy typically experiences thunderstorms at least 12 days each month in May, June, and July, and winter weather conditions frequently drive ceilings below student training minima. The Academy schedule allows 42 training days during the academic year and 20 flying days during the summer. During the fall and spring, cadets attend classes as well as military and athletic formations; they are available at the flight-line only every other academic day for a 3-hour-and-50-minute period. Therefore, during periods of bad weather, cadets can routinely go two weeks between sorties. During summer classes, cadets are available for 20 flying days and are not tasked with any other academic, military or athletic duties, and are available for the entire flying day.

There are no programmed weather days in the EFS syllabus, however, there is usually ample opportunity to complete training without downstream effects on the UPT pipeline. Weather attrition occasionally creates scheduling complications for individual Academy cadets, but rarely results in their late arrival at UPT. Weather attrition has resulted in late graduation for

[23] This reduced performance is the primary reason the aircraft contractor selected the 260Hp engine for the T-3A.
[24] The large increase in weather attrition at Hondo was not due to an increase in bad weather. Increased student loads reduced scheduling flexibility and resources available (aircraft and instructors) to compensate for weather.

Hondo students, but on-time delivery to UPT has not been affected due to current scheduling policies which do not directly link EFS completion with UPT class start dates.

Climatology data supports the proposition that both the Academy Airfield and Hondo Municipal Airport are well suited for their prevailing winds. The prevailing wind direction at the Academy is either due north or due south 11 months out of the year--essentially right down the runway with a mean speed of about 10 knots. Occasional downslope wind conditions create crosswinds which are typically well within the T-3A's 25-knot capability. At Hondo, prevailing winds vary month-by-month throughout the year; however, its multiple-oriented runways permit effective operations under virtually any conditions. Annual average wind speed at Hondo is approximately 8 knots. Both locations are subject to occasional high winds, but generally have minimal impact on student training unless accompanied by other adverse phenomena (thunderstorms, etc.).

An additional area evaluated is the lack of a requirement to maintain instrument currency for all T-3A IPs. This decision was made by 19 AF based on the fact the EFS syllabus does not include instrument maneuvers. Therefore, there is no requirement for T-3A IPs to maintain an instrument rating--though a current instrument rating is required for PIT candidates. The EFS mission does not require its use, nor do the number of weather cancellations justify establishing IMC ingress/egress and reporting procedures for the non-radar environment in which Hondo operates. However, a problem arises when an AF IP leaves the T-3A and returns to his/her MWS without an instrument rating. This problem is compounded if the pilot's T-3A tour is very early in his/her career when instrument skills are being developed. The IPs surveyed were split on the benefit to the program if the instrument rating were required. The team does not believe potential benefits outweigh risks and costs and does not recommend IPs be instrument qualified.

Airspace/Airfield Constraints

The team examined airspace constraints in terms of the air traffic environment, the density of aviation operations at each location, vertical airspace limitations and restrictions, and horizontal airspace limitations and restrictions.

a. Air Traffic Environment

Academy Airfield operations are controlled by two Air Traffic Control Towers, manned by a combination of military and civilian controllers. T-3A operations are conducted on the east runway only, as glider and parachute operations are conducted on the other two runways. Annual air traffic activity reports show that in FY 96, the Academy had a total of 173,078 movements with the east runway alone handling 87,039 movements. In comparison, Sheppard AFB and Laughlin AFB were 70,883 and 49,878 respectively for all runways.

There are no air traffic controllers at Hondo Municipal Airport, nor is there an elevated control tower. Class A RSUs control patterns at Hondo on parallel runways (crosswinds permitting). The RSUs are manned by contract IPs or 3 FTS personnel, with student recorders assisting. A total of 5 RSUs are available for use, providing good coverage of all possible landing directions. Arriving civilian aircraft which call inbound on UNICOM frequency (122.8) are given advisories regarding current student traffic. RSU personnel limit the information they provide to suggested landing direction and current winds only, and reroute student traffic as necessary when arriving and departing pilots elect to land on a runway other than that currently identified as active for student operations. In FY 96, 132,090 student movements were recorded at Hondo.

b. <u>Density of Operations</u>

As noted in the “Air Traffic Environment” discussion above, the Academy Airfield is an extraordinarily busy facility. This condition is exacerbated by the proximity of Colorado Springs Municipal Airport, 10 miles to the southeast, which has a high tempo of civil and military movements. Scheduled airline operations into and out of the airport are frequent, as are military movements associated with the Academy, North American Air Defense Command, HQ USSPACECOM, HQ Air Force Space Command, and the 301 Airlift Wing (Reserve).

In FY 93 (the most recent year for which comparative figures are available), Colorado Springs was the 48th busiest control tower (of 313 total) in the country, with 246,742 movements. Scheduled airline operations ranked it as the 85th busiest in the country, and 15th in general aviation operations [representing 70% of the airport’s movements (173,128)].

T-3A aircraft going to and from the Academy’s eastern and southeastern working areas must pass through Colorado Springs’ Class C airspace, which requires both an operable transponder and positive 2-way radio communication. The “Woodmen” and “East” departures are also in close proximity to both a popular uncontrolled general aviation airport (Meadow Lake) and a major highway (US 24) which is frequently used as a navigation reference. When the Colorado Springs Airport is in south operations, T-3As using the corridor must underfly an instrument arrival path. This could generate conflict alerts or resolution advisories for arriving Traffic Alert and Collision Avoidance System (TCAS)-equipped commercial airliners. Currently, radar monitoring for USAFA aircraft is only available through Colorado Springs approach control for departures and recoveries which pass through their airspace.

To mitigate these risks, the Academy has an aggressive midair collision avoidance (MACA) program designed to educate civilian pilots flying into and out of surrounding airfields about the tempo and hazards associated with Academy flying operations. Familiarization materials, which address parachute and soaring operations as well as those involving the T-3As, are available to local fixed base operators. The 557 FTS safety officer also has developed a plan for a briefing “blitz” to the Academy’s flying neighbors when EFS operations are resumed. In addition, local Academy publications including the T-3A Inflight Guide (557 FTS OI 11-206, Volume IA), contain prominent advisories about the hazards of specific portions of the local flying area.

Despite the air traffic density in the Colorado Springs area, many instructors feel the greatest midair collision potential exists at the Academy Airfield itself. All T-3A operations are limited to the east runway, meaning all arrivals must be funneled into a single pattern. Further, east and southeast arrivals converge on a single VFR entry point. When operating in south traffic (using runway 16L), potential exists for aircraft turning from crosswind to outside downwind to be "belly-up" and the same altitude as arriving aircraft.

By contrast, the level of non-military operations in the vicinity of Hondo is extremely low. There are no controlled airports within 50 nautical miles of Hondo in any direction, and transient traffic is rare. Aircraft without radios operate into and out of the southern part of the airfield, but local "no-radio" procedures are well known and reportedly adhered to extremely well by civilian operators. When T-3A operations resume at Hondo, these practices need to be re-emphasized to ensure "shortcuts" developed during the no-fly period are eliminated.

3 FTS personnel consider 20 aircraft (10 on each parallel runway) as the maximum safe number of aircraft they can operate in the pattern at any given time. While occasional "strangers" pass through their working areas, such conflicts are isolated and not considered a hazard by the instructor pilots. Military training route traffic occasionally becomes a factor during area airwork, but existing awareness programs are designed to maximize warning of such activity. The flatness of the surrounding terrain tends to ensure same altitude aircraft are "skylighted" instead of being obscured amid surface features.

Finally, a contract has recently been awarded between the Government and Alliant Technology Services, Inc., who will operate "Outrider" unmanned aerial vehicles (UAV) from the east side of the Hondo airport. A local agreement between the 3 FTS and contractor should deconflict operations such that UAV flying will only take place on weekends or other times when no student training is in progress. However, this raises a potential for conflict during weekends when functional check flights (FCF) or student make-up training are conducted.

c. Vertical Airspace

The Academy's vertical airspace is significantly constrained by geography and topography, and the proximity of other aviation activities. The Academy Airfield is at an elevation of 6,572 ft., and the surface elevation in the lowest working area (at the extreme southeastern edge of the designated training airspace) is about 4,700 ft. MSL. The closest working areas are 20 NM away, and the most distant 65 NM away.

To avoid environmental impact concerns, working airspace at the Academy is defined as starting at 3,000 ft. AGL. Therefore, 7,700 ft. MSL may be considered the absolute lowest altitude at which all maneuvers (except simulated forced landings must terminate). Terrain rises steadily from southeast to northwest.

The ceiling of the Academy's useful airspace is constrained in most areas by a lack of supplemental oxygen aboard the T-3A aircraft. While all flights are required to remain below 10,000 ft. MSL at Hondo, the Academy operates under a waiver to AFI 11-206 to operate up to 12,000 ft. MSL (not to exceed 30 minutes between 10,000 ft. and 12,000 ft.) without oxygen.

The absolute 12,000 ft. MSL ceiling on Academy operations is further constrained by two low-altitude airways: V81, running between the Jefferson County (Jeffco) Airport in Denver to the Colorado Springs Airport (eight miles north); and, V19, which comes into Colorado Springs from the northeast and exits to the south. The Academy identifies these working areas with lower than 12,000 ft. ceilings by assigning them numbers; “lettered” working areas have the full ceiling available. These conditions yield a “best-case” block of altitude of 4,300 ft. from floor to ceiling (in the most distant areas), and “worst case” airspace of just 700 ft. (in the closest area).

The working areas surrounding Hondo extend from 500 ft. AGL to 7,500 MSL. They are, on average, 15 miles closer than those at the Academy and require less transit time. The training syllabus for student pilots at Hondo varies from that at the Academy--providing just 20.7 flying hours at Hondo, versus 25.0 hours at the Academy to allow for the increased distances to the training areas.

d. Horizontal Airspace

The 557 FTS utilizes an auxiliary airfield (Bullseye) located 35 miles southeast of the Academy.

Hondo has two parallel runways which largely offsets the lack of a dedicated auxiliary field to support operations.

Infrastructure

The team reviewed four aspects of infrastructure at each operating location – airfield facilities, operations and training facilities, maintenance facilities, and student billeting.

a. Airfield Facilities

Both Hondo Municipal Airport and the Academy Airfield have paved runways, real-time weather observation equipment, and mission-capable RSU cabs. Ramp space at both locations is adequate based on the number of T-3As based at each facility. Taxiways and parking areas are well marked and defined at each location, and obstacle clearance appeared to be adequate (lack of aircraft movements precluded real-time observation of potential conflict areas). Hail sheds are provided at Hondo to protect aircraft from rapidly changing weather, and hangars are available at USAFA for all aircraft. Wind indicators are clearly visible and appropriately sited at both locations.

b. Operations and Training Facilities

The 557 FTS is an AETC tenant organization supported by the 34th Operations Group (USAFA). Their operation’s building contains staff offices, student briefing areas, a conference room, and operations/dispatch area. Facilities, though adequate, are space limited.

The 3 FTS operations and maintenance hangar is leased from the City of Hondo and modifications may only be made with the city’s permission. Four briefing rooms are available for the student training flights; physical separation between individual IP desks provides some degree of noise reduction and privacy. The squadron has obtained local permission and military funding to make structural modifications to the building to enhance its utility and provide additional restrooms for female personnel.

Neither facility has operational flight trainers, cockpit procedures trainers, nor training aids beyond wall charts--both students and instructors noted these absences. This is most acutely felt at the Academy, especially during the academic year when it is difficult for students to gain access to the aircraft themselves for individual familiarization training ("hangar flying").

c. Maintenance Facilities

At the Academy, the squadron interacts with LSI (which provides on-equipment maintenance), and Northrop (which operates the COMBS warehouse). Both organizations have work space in Government-owned hangars. Life support equipment is maintained in the 557 FTS operations building; parachutes are repacked in a separate facility.

At Hondo, maintenance is performed in the same hangar used for operations. Outbuildings are dedicated to life support equipment and flammable liquids storage. A parachute repack facility is not available at Hondo, so they are shipped to Randolph AFB for repacking.

d. Student Billeting

Air Force Academy cadets are housed in dormitories and eat in the cadet dining hall throughout the year. The quality of crew rest during the academic year is marginal for cadets on the 1st period flying schedule ("dawn patrol"), which requires them to retire not later than 2100 hours to obtain the mandatory eight hours of uninterrupted rest. Most cadets do not room with another on the same flying schedule, and both academic-related interactions and socializing tend to be at their peak during the "academic call to quarters" hours prior to taps. This increases noise and light, which prevents quality crew rest. This factor is largely alleviated during the summer months due to similar sleep schedules, and being located in an isolated part of Sijan Hall away from other summer program activities.

Hondo students are in TDY status with living conditions in marked contrast to the regimen at USAFA. Since the closure of the "Medina Base" Lackland Annex, the 3 FTS is forced to billet male and female students separately and officers apart from enlisted (officer-trainees) at Lackland AFB. The male officer barracks are substandard, and were waived by 12 FTW/CC and 37 TRW/CC (which expired 1 Apr 97).[25] These barracks have a communal latrine, inadequate heating, ventilation, and air condition (HVAC) systems, and thinly insulated walls which allows sound to transmit throughout the building. These conditions are not conducive to quality crew rest, and results in students competing for sanitary facilities at the start of each day.

In addition, the two-hour round trip commute is a significant strain on students. Serious concern over the safety of the bus travel has been voiced by 3 FTS leadership, which has detailed students to ensure drivers remain alert during the commute. Based on the inadequate housing conditions and daily bus-ride requirements, plans have been developed to billet students at Randolph AFB for in-processing and academics, and then in contract quarters at Hondo for the

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[25] In Oct 95, 37 FTW/CC notified 12 FTW/CC that OSD had canceled MILCON funding for new dorms. 37 TRW felt the 12 FTW should gain future funding, but AETC considered it the responsibility of the 37 TRW.

flying phase. City of Hondo officials are working with the 12 FTW to build a permanent facility in Hondo for housing EFS students, but funding has not been obtained to start construction.

External Influences on Operations

Local community encroachment on the USAF Academy reservation is becoming a significant consideration in daily operations at the Academy Airfield. The airfield is located at the extreme southeastern corner of the reservation, on the only suitable terrain available for runways. The Academy airfield segments its operations between the east and center/west runways. The west runway's pattern is used by sailplanes and towplanes, since these operations need to take advantage of lift associated with the mountains to the west. The center runway is used for parachute operations and towplane sequencing. T-3A operations are confined to the east runway only, which requires them to fly patterns that do not remain within the confines of the Academy reservation.

Land to the south and east of the USAFA reservation has been the scene of steady civilian housing growth for more than 20 years. This expansion has brought a steady increase in noise complaints against the Academy, as well as growing public concern about aviation operations which overfly neighborhoods--one arrival route has already been moved in response. Urban growth is also making it more difficult to fly south to Butts Army Airfield at Fort Carson, which previously served as an alternate field for contact operations on a noninterference basis. Routes to Fort Carson which in the past circumnavigated populated areas cross areas of recent expansion. While FAR 91.119 allows flight over congested areas at an altitude at least 1,000 ft. AGL, it also states that such flights are authorized only "if a power unit fails, an emergency landing [may be made] without undue hazard to persons or property on the surface." Even though corridor altitudes are between 2,500-3,000 feet AGL, some IPs believe the distance to viable emergency landing sites exceeds aircraft glide capabilities.

Summary

The following table summarizes differences/similarities between the 3 and 557 FTS.

TABLE 2.3 FLYING ENVIRONMENTS

	3 FTS	557 FTS
Primary Airfield	Hondo Municipal Airport	USAF Academy Airfield
Field Elevation	930’ MSL	6,572’ MSL
Runways	5 (17L/35R, 17R/35L, 08/26, 13/31, and 04/22)	16L/34R (only dedicated T-3A runway); 16C/34C, 16R/34L, and 08/26
	08/26: 150’ X 5,140’ 17R/35L: 150’ X 3,030	16L/34R: 75’ X 3,500’ (Note: 2 other runways are dedicated to other flight operations)
Auxiliary Airfields	N/A	Bullseye (BLS) 17/35: 75’ X 3,500’ Field Elevation: 6,036’ MSL
Airfield/Pattern Control	Uncontrolled airfield,-T-3As controlled by RSU	ATC controlled airfield -ATC controlled pattern at USAFA (Monitor in RSU) -AF-owned Aux field (USAFA T-3A use only) RSU controlled pattern
Working Areas	Top: 7,500’ MSL Base: 500’ AGL	Top: 12,000’ MSL Base: 3,000’ AGL (environmental considerations)
Vertical (Workable) Airspace Available	4,500’ to 6,000’	900’ to 4,300’
Distance to Areas	Closest entry: 6 NM Farthest entry: 36 NM	Closest entry: 15 NM Farthest entry: 65 NM
Number of Areas	36 Total (Six Northern areas unusable during low ceilings)	33 Total; 21 Special Use Airspace – full maneuver profiles, 11 numbered “VFR” areas – limited capability due to vertical airspace available
Airspace Classification	Areas: Special Use Airspace Class E throughout (Note 1).	Areas: Special Use Airspace transit Class C (Note 2).

Note 1: Class E airspace is essentially open for any aircraft.
Note 2: For an aircraft to operate in Class C airspace, the pilot must receive permission from ATC and have a transponder with Mode C capabilities.

INSTRUCTOR PILOTS

3 FTS, Hondo TX

a. Selection

Hondo EFS operations are conducted mostly by civilian contract IPs from Doss Aviation, Inc. The EFS contract states that the minimum experience requirement for a Doss IP is a total of 600 flying hours (250 as an instructor), a Certified Flight Instructor (CFI) rating, ability to pass an AF flight physical, and active flight experience in a military fixed wing aircraft within the last 4 years (6 years if the pilot has over 11 years experience). The contract allows the government to waive the military flying experience requirement on a case-by-case basis after the Squadron Commander or Operations Officer flies a sortie with the candidate to determine his/her aptitude for becoming an EFS instructor. In most cases, Doss hires pilots who exceed minimum requirements. They also screen applicants during PIT, and eliminate up to 40% before completing a flight evaluation. Recent airline hiring has reduced the number of desired applicants, and Doss anticipates attrition rates to decrease as a result of less stringent screening criteria.

Unlike Doss instructors, the military IP force is primarily hired for Quality Assurance Evaluator (QAE) duties and are not required to have previous IP experience in either AETC or a MWS. AETC requires non-fighter military IPs to be MWS Aircraft Commanders (AC); however, in many cases, pilots received an AC upgrade just prior to reporting for AETC duties or the requirement was waived. Most AF PIT trainees are assigned experienced Doss IPs in PIT. All AF PIT trainees take an end of course evaluation with an AF flight examiner while Doss trainees take their checkride with either a Doss or AF flight evaluator. The team noted that no AF IP has washed out of T-3A PIT since the beginning of the program.

In comparison, the Canadian Royal Air Force also contracts their T-67 IP force. The minimum requirements to be a T-67 IP are 400 IP hours if a previous military pilot, and 450 IP hours with no previous military experience. On average, they hire IPs with 700 military IP hours and 4,500 total hours. In addition, civilian instructors must be aerobatic instructor certified by the Canadian Government which is equivalent of the FAA certificate. The British also contract T-67 IPs with similar IP experience requirements.

b. Experience/Population

Approximately two-thirds of the Doss instructors have military flying experience and an average of 6,268 hours, of which 3,618 are in aircraft powered by reciprocating engines. In addition, the majority of Doss IPs have been with the flight screening program for over 10 years, with several over 15 years, and a high-timer with 22 years experience. The majority of the Doss IP force is stabilized, creating a high degree of continuity and a low turnover rate.

Seven of the ten AF IPs surveyed had previous IP experience, and eight of ten come from non-fighter backgrounds, in C-130s, B-52s, E-3, and KC-135. Only one AF IP had any previous reciprocating engine experience. The majority of AF IPs have obtained CFI and Air Transport

Pilot (ATP) certificates since the program was suspended. There are 11 authorized military IPs slots assigned to the squadron, including the Commander, of which 10 are filled. One-third of the AF IP force is replaced each year due to the normal reassignment process.

c. Roles and Responsibilities

Doss Aviation IPs are hired to screen students and perform only additional tasks that are either flying or directly flying related (e.g., RSU controller). Doss IPs are restricted to a maximum of three events per day.

The primary role of the military IPs is to conduct contract surveillance as certified QAEs, as well as to perform required additional duties. These duties are very time consuming, and the 3 FTS commander currently recommends a permanently assigned squadron adjutant be assigned to manage.

The 3 FTS Squadron Commander serves as the Functional Area Commander (FAC) for the $5.5 million contract and has direct local authority. QAE training is accomplished through a program approved by the 12 FTW Contracting Squadron. The plan includes continuation training for the QAEs through meetings, read files, and staff assistance visits from the 12th Contracting Squadron. Because of their small numbers, each can expect to be PIT IP and Flight Examiner (FE) qualified within the first year of assignment. Most student training issues are handled by Doss aviation; however, AF IPs are solely responsible for administering flying elimination checkrides for students.

d. Morale/Motivation

IP morale is suffering due to the extended suspension of operations. Both AF and Doss IPs overwhelmingly feel the suspension is unnecessary and the T-3A is safe to fly. They firmly believe the fuel system modifications will help reduce engine stoppages. However, Doss IPs are comfortable with the current fuel system configuration and rate of engine stoppages due to their experience in small, piston driven aircraft and their abilities to conduct forced landings. Their comfort level is due in part to their vast SFL training and a “mind-set” established during CFI certification where a pilot must prepare for an engine failure at anytime.

Doss IPs expressed dissatisfaction with AETC/DOV and 19 AF’s reaction to discontinue training events as a result of the three mishaps at USAFA. The first accident resulted in terminating spin training, and morale declined because they felt AETC/DOV and 19 AF should have increased not eliminated spin training. Eventually a formal spin training program for IPs was initiated; however, the IPs believe students need to demonstrate spins to a FAIR (Satisfactory) level of proficiency. They also argue that student spin training will help screen students with Manifestation of Apprehension (MOA), determine the student’s potential to complete SUPT (JSUPT in the future), and screen for possible airsickness.

AETC/DOV and 19 AF responded to the second accident by continuing flying operations, but discontinuing SFL training. This also affected morale of both AF and Doss IPs. The resulting lack of proficiency to conduct a forced landing, combined with a substantial number of engine stoppages, led them to lose faith in senior leadership. Most Doss IPs felt they could handle an actual forced landing situation; however, the inexperienced AF IPs had their doubts. In addition, when SFL training was reinstated shortly before the third accident, they were restricted to go-around at 500 ft. AGL which does not permit the pilots to roll out on final and properly assess field selection.

After the second mishap, concerns were raised with respect to the reliability of the aircraft brakes and possible consequences of brake failure during student solo flights. Again, the solution to this increased hazard--elimination of student solos vice increased training, was the implemented "fix." This further degraded the effectiveness of the overall program in the opinion of the IPs and the BAR.

After the third accident, AETC concluded they needed to emphasize quality IP training. Prior to the accident, significant improvements had already been made to the PIT syllabus, to include establishing a formal PIT flight with permanently assigned PIT IPs. The 3 FTS recognized that most USAFA IPs that receive PIT at Hondo are not experienced in small, piston-driven highly maneuverable aircraft. They believe the "scripted and canned" departure training, where each departure maneuver is briefed prior to execution, unrealistic. However, they are constrained by 12 FTW OI 11-1 to provide only "canned" student error scenarios.

IPs at both Hondo and USAFA unanimously express the need to bring the solo requirement back into the program. They believe benefits gained far outweigh arguments against. They believe the solo serves several purposes; as a motivator for the student, and a "test" for the student as well as the IP. They strongly recommend bringing solo back into the syllabus, which in turn requires student SFL training be reinstated.

One final note: The IP force, both Doss and AF, are motivated to resume flight screening at the earliest opportunity. The Doss contract has been extended for one year to October 1999; however, they are concerned that if flying does not resume soon, their jobs are at risk. If Doss IPs are laid off due to further delays to the program, the Air Force risks losing a valuable IP core of experience, especially when competing against increased airline hiring trends.

557 FTS, USAFA CO

a. Selection/Turnover

The 557 FTS IP force is set at 58 assigned and 55 attached instructors. All IPs are active-duty USAF pilots, with the exception of three attached IPs from Britain, Spain, and the US Navy. AETC does not have any special requirements for assigned IPs other than non-fighter MWS IPs must have completed AC upgrade. As in the case of the military Hondo assigned IPs, many completed AC upgrade just prior to reporting for T-3A PIT, or the requirement was waived. USAFA requires attached pilots to have met their second flying gate and completed a Master's Degree to qualify for an academic instructor position. All IPs typically serve a three-year tour prior to reassignment, a 30% turnover every year. The recent operational suspension and lack of back-fill assignments will result in an estimated 54% manning level by this summer.

If flight screening is restarted with active-duty IPs, the 557 FTS will be severely undermanned or have a large percentage of its force composed of new IPs--either produces an unacceptable risk. The BAR believes the planned change to contractor operations should be expedited to reduce this risk.

Of note is Air Force Audit Agency Report, *Air Force Academy Flight Screening Operations*, Project 97051029, 14 January 1998, which evaluated, " the potential to return pilots to operational assignments and save funds by outsourcing the flight screening operations at the Air Force Academy. Accordingly the audit determined whether the Air Force could perform the Air Force Academy flight screening more cost-effectively using contractor personnel. Specifically, they determined whether contractor personnel could replace the 57 part-time, attached and 58 full-time instructor pilots currently performing flight screening at the Academy."

The conclusion of the audit was that, "the Air Force could more cost-effectively accomplish flight screening at the Air force Academy using contractor personnel. Although we concluded there was no significant economic or operational advantage to eliminating the 57 part-time instructor pilots, the Air Force could replace the full-time flight screening instructor pilots with contractor personnel and avoid approximately $15.9 million of pilot training ands salary costs during the 6-year budget cycle and return 47 of the 58 full-time flight screening pilots to other rated billets."

b. <u>Experience/Population</u>

The majority of the assigned IPs (54 out of 58) are listed as captain positions on the UMD. The total USAFA IP force averages 272 T-3A hours and 250 other propeller-type aircraft time—small when compared to Doss contract instructors. The 557 FTS assigned IP force is largely second or third assignment captains with one weapon system experience--the majority not reaching IP qualification. Of the 106 IPs presently in the squadron (assigned and attached), only 26 have AETC Instructor backgrounds in the T-37 or T-38 (10 of 54 assigned, 16 of 52 attached). The majority rely totally on the instructor training provided through the T-3A program for their IP expertise. Although EFSP is committed and focused on screening, the instructor/teaching capability of the IPs is at least as important as for those IPs in SUPT.

c. <u>Roles and Responsibilities</u>

557 FTS IPs see their roles as similar to that of an IP in a typical UPT environment. Additional duties are assigned, however, they do not have to oversee a multi-million dollar contract and have limited supervisory positions. Job duty descriptions in OPRs and PRFs are lacking when compared to those of the IP force at Hondo. As a result, only one of eight IPZ/APZ assigned IPs were promoted on the most recent Majors board. The one individual promoted had a PRF generated by his losing unit.

Attached IPs have a greater degree of roles and responsibilities as USAFA academic course instructors, and have a greater opportunity to show progression and receive appropriate recognition. USAFA leadership relies on this "rated" presence to motivate cadets to become pilots. Attached IPs believe their role is to motivate cadets and use the EFS program for one-on-one contact with cadets to instill the desire to pursue an Air Force flying career.

d. <u>Morale/Motivation</u>

The combination of the six fatalities, poor promotion rates, and lengthy suspension from operational flying have greatly contributed to poor morale in the 557 FTS. These factors, in addition to increased media interest continue to weigh heavily on the squadron.

Even though morale is suffering, each IP is motivated to resume flying operations at the earliest opportunity. Like their Hondo counterparts, they do not believe it necessary to ground the fleet due to engine stoppage problems. They also strongly believe AETC's decision to prohibit spins and SFL training after the first two mishaps was an unwarranted reaction and created a loss of faith in leadership.

Other complaints cite the IP Continuation Training (CT) program as being constrained by the USAFA environment. Each IP must maintain currencies in landings, spins, and simulated forced landings (SFLs) through a minimum number of quarterly, semiannually, and annually flying "events" as required by 19 AFI 36-2211. There is also a requirement to fly a minimum number of student, navigation, and CT sorties. The inflexible cadet schedule results in an uneven distribution throughout the calendar to perform these requirements. During the beginning of new flying classes, the number of CT and navigation sorties are very small. At the end of the class, navigation and CT sorties make up the bulk of the schedule. This does not provide optimum IP proficiency in continuous student flying. This variance is best illustrated in the monthly flying hours, from a high of 2,400 hours (Jun 97) to a low of 500 hours (Dec of most years).

This "peaks and valleys" flying environment presents the 557 FTS a challenge in terms of maintaining an IP force at the leading edge of proficiency. Only through the judicious and frequent use of CT sorties is the squadron able to maintain its IP force at the desired proficiency level. Overwhelmingly, assigned IPs recommend divorcing the EFS program from the USAFA academic year and creating a post-graduate program. This will result in three favorable results: 1) Relieve the cadets from the stress of conducting EFS during the course year, 2) increase the 557 FTS capacity to meet future increased production rates, and 3) provide IPs adequate brief and debrief time without the time constraints imposed during the academic year. In addition, they recommend cadet class standing not have EFS factored in for competing for an ENJJPT training slot. ROTC selects ENJJPT students prior to completing EFS at Hondo, and the IPs believe USAFA cadets should be selected under the same criteria.

Most of the IPs interviewed did not have previous AETC IP experience, however many have obtained a Certified Flight Instructor (CFI) or Airline Transport Pilot (ATP) certificate since the fleet was suspended from operations. The attached instructors felt their supervisors often penalized them for taking time away from their teaching responsibilities to fly.[26] Many said they believe their career will suffer because this attitude will prevent them from progressing to the more desirable staff positions.

Finally, these IPs also criticized both AETC and USAFA senior leadership reactions to the mishaps which they believe hurt the program. The example most often cited was prohibiting SFLs to unprepared surfaces and the 500 ft. altitude restriction. The IPs believe the exact opposite course should have been taken to *increase* SFL training instead of limiting it. Both supervisors and line instructors voiced concern about maintaining proficiency in forced landings. This rationale also holds true for prohibiting spins with students, which decreased the IP's comfort with spins. All IPs said the solo sortie must remain in the syllabus. They believe the lack of the solo has resulted in relaxed standards for both IPs and students. For the most part, USAFA IPs voiced the same position on the lack of an instrument qualification requirement. The BAR team, as stated earlier, does not support this requirement.

[26] Some attached IPs noted a specific department head who was totally supportive of the program while others expressed opposing views stating USAFA is the "most hostile flying environment I have ever experienced" due to lack of department support from non-rated leadership.

EFS STUDENTS

Selection

USAFA applicants are selected to attend the Air Force Academy based on academic performance, citizenship, and physical health and fitness. Pilot candidate qualification is not an entry requirement, however, the Academy has a minimum number designed to meet annual projected pilot training requirements. Junior year cadets may volunteer for the EFS program if they are medically qualified to fly. Cadets medically qualified to fly are classified as Pilot Qualified (PQ).

EFS students attending Hondo come from a variety of backgrounds to include ROTC post-commissioning graduates, Officer Training School candidates prior to attending OTS, or active duty personnel within the Air Force. The Air Reserve Component (USAFR and ANG) also enroll commissioned officers--rated and non-rated--and enlisted personnel selected for officer training.

Population

Pilot qualified cadets enter flight screening as an additional part of their overall Academy curriculum, and have two periods in which they can complete flight screening. They can complete the program during their junior or senior year either during the academic year or in the summer program. Both programs use the same syllabus but are significantly different in execution because of the numerous demands placed on a cadet during the academic year. Few academy cadets have previous flying experience.

Hondo candidates enter the program according to an AETC schedule and have no other competing requirements. The majority of these candidates have some flight experience which varies from a few hours in a private aircraft, to as much as 2,000 hours with multiple private/commercial/instructor ratings. Some have previous active duty flying experience as navigators, flight engineers, or weapons controllers. For all Hondo students, flight screening is their only job for the 4-week period.

Motivation/Morale

Academy cadets are expected to enter EFS if they are pilot qualified, but there is a strong perception that they will have to personally explain to the Commandant of Cadets if they choose not to enter the program. As a result, some cadets enroll in EFS, just to SIE or wash out to avoid "face time" with the Commandant. When interviewed, the Commandant said it is his informal policy to interview selected PQ cadets who elect not to pursue a flying career to attempt to change their minds.

Hondo EFS candidates face tough competition for pilot slots. Although availability of slots varies with USAF pilot demand, there are historically fewer slots available than individuals competing. As a result, Hondo EFS candidates pursue other forms of flying to increase their chance to be selected for and successfully complete UPT. Hondo EFS students are motivated and focused toward completing the screening program, in part, by their personal investment in private flying.

Program Objectives & Differences

The overall objective of the EFS program is to provide a screening process to identify students who possess the potential to complete JSUPT or Euro-NATO Joint Jet Pilot Training (ENJJPT).[27] The purpose of the program is to reduce pilot training attrition by screening students early before an investment is committed.

The following table illustrates prior flying history and EFS completion rates for 1,161 students from Mar 94 to Apr 97. Also see the appendix 2 briefing chart on UPT attrition data.

TABLE 2.4 EFS STUDENT COMPLETION RATES

Population	
US Students with PPL (private pilots license)	665 (57%)
US Students w/ PPL and 100 hrs flying time	438 (38%)
Flying Training Deficiency Eliminees	
Total percent eliminated:	5.34% (62)
Percent of all entries, Non-PPL	10.5% (52)
Percent of all entries, PPL	1.5% (10)
Percent of all entries, PPL + 100 hrs	0.45% (3)
Self Initiated Elimination Eliminees	
Total percent eliminated:	3.1% (36)
Percent of all entries, Non-PPL	6.7% (33)
Percent of all entries, PPL	0.45% (3)
Percent of all entries, PPL + 100 hrs	0.15% (1)

The average number of students entering screening per class at Hondo is about 40-45 resulting in an average daily load of up to 90 students. The Academy begins its fall and spring semester classes with about 200 students and has the entire semester to screen them. The cadet's academic schedule is based on an alternating day system which allows them to fly every other

[27] The EFS syllabus identifies the course objectives: to provide "selection process to identify students possessing potential...includes flying training to teach principles and techniques...ground training to supplement and reinforce flying training."

academic day.[28] The two summer classes are scheduled for four-week periods where students are available every day, all day, with no other classes. The fall and spring semester class students are burdened with academic classes as well as other military and athletic requirements. EFS becomes just "another academic class" in the cadet's busy schedule. By contrast, the student load at Hondo is consistent year-round. Hondo's 3-week entry cycle (classes last six weeks but begin every three) for each of its 20 classes provides the opportunity for a relatively steady annual student load with smooth, predictable variations (24 programmed flying days). The 557th, by contrast, must accommodate the Academy schedule to include semester breaks and variations in student loads between the semester (42 training day) and summer (20 training day) schedules. According to all cadets interviewed, the summer schedule is highly preferred to conduct EFS over the academic semester.

Program objectives were discussed at the most recent EFS Syllabus Conference (25-26 Nov 96), which included representatives from HQ AETC/DO/SG, AL/AOC, USAFSAM/AF, 19 AF, TRSS, 12 OG, T-37 Squadrons, and T-3A Squadrons. The conference addressed the questions of "what *does* EFS screen for" and "what *should* EFS screen for?" The consensus of attendees was the EFS program should, and does, screen for airsickness, MOA/SIE, and aptitude. They further stated that aptitude includes the ability to deal with academics, testing, and application of knowledge both in flight and during stand-up situations. Performance in stressful situations is considered good measure of aptitude.

Currently, most JSUPT/ENJJPT candidates must attend EFS. The only exceptions are navigators/weapon systems officers with 300 hours in F-4, RF-4, F-15E, F-111, EF-111, FB-111 aircraft and current. In addition, former US military helicopter pilots with a minimum of 300 hours pilot-in-command are also waived. International students scheduled to attend the T-3A Security Assistance Training Program (SATP) who have successfully completed an equivalent course from their country may request a waiver.

Student Training Environment, Hondo TX

EFS program students report to Lackland AFB five to seven days prior to the course start date, to inprocess and complete medical screening at Brooks AFB. Immediately following, they receive three days of academics and physiological training.

The typical student duty day starts with a 0700 pickup for a 50-minute bus ride from Lackland AFB to Hondo for a 0800 briefing. Briefings are conducted like a standard UPT briefing, and are conducted by the flight commander covering general topics such as airfield status, ops notes, and Flight Crew Information File items. The unit stan/eval member (USEM) presents an aircraft emergency scenario to test selected student(s) knowledge, and the assistant flight commander briefs a safety topic. The flying day consists of three periods with the last bus departing at 1730 to return to Lackland at 1830--an 11+ hour day.

Student Training Environment, USAFA CO

[28] This schedule has resulted in a waiver allowing 10 days (versus the syllabus-directed 5 days) between flights without an review (Cxx87) sortie during the fall and spring semesters.

Flying periods during the academic year are scheduled for 3-hours-and-50-minutes in either a morning or afternoon session. Because of other competing requirements, the cadet can rarely extend beyond this window. A typical flying period consists of a 20-minute formal briefing, flight prebrief, sign out, parachute check out, walk to the aircraft, preflight inspection, taxi out, a 1.5 hour sortie, land and taxi back, return to Life Support, sign in, debrief, and catch the return bus. Any delay in the timetable places additional demands on the IP to expedite his/her instruction and cut short post-mission debriefings.

During the summer classes, the same 3-hour-50-minute flying periods are scheduled, however, students are available for almost the entire flying day (at least long enough to fly two local sorties or an out-and-back at a comfortable pace). When the cadet is not flying, he/she is available for study sessions, EP discussions with available IPs, monitoring pattern operations, observing other students' briefs and debriefs. The summer schedule closely simulates a UPT environment, affords reasonable IP continuity, and provides a motivational military aviation experience. Unfortunately, this opportunity is only available to about one third of the cadets.

TRAINING SECTION

Instructor Pilot Training

The 3 FTS conducts PIT for all T-3A instructor pilots. The course was designed by 619 TRSS (now AETC TRSS) and includes academic (8.5 hrs) and flying training (25.1 hrs). The formal academic course consists of the same aircraft systems portion of the course as given to students (designed for the "zero time" student). Training received during flight briefs and debriefs provides additional instruction on how the syllabus is executed, an advanced understanding of aircraft systems, and basic principles of instruction. Physiological training is conducted at Randolph AFB by the 12 AMDS/SGPT unit**.** The IP candidate must pass an open book, closed book, and emergency procedures exam as a requirement for the instructor qualification check administered by a military flight evaluator (FE). Unlike T-37, T-38, and T-1 PIT courses, candidates do not receive a separate proficiency flight evaluation. Graduation from PIT establishes the 17-month evaluation cycle—there are no further evaluations required until the next periodic evaluation.

After the completion of the initial instructor flight examination, the new IP completes a two-ride Mission Qualification Training (MQT) program as directed by 19 AFI 36-2211, *Aircrew Qualification and Training*. This program allows the new IP's supervisors to fly with him/her to gain insight into their capabilities. It also serves as a transition from "trainee" status to "mission qualified" status. The new IP does not fly with students until these sorties are completed and specific briefing items (e.g., instructor responsibilities, policies, grading practices, and others required by AETCI 36-2211) are covered. The 19 AF MQT program is supplemented by a Squadron MQT program whose goal is to provide additional training to the new IP to improve his/her teaching ability and technical knowledge with an emphasis on standardization, procedures, and discussion of techniques. This program requires two to four months to complete.

Continuation training, both ground and air, is conducted throughout the IP's assignment. Each attends a weekly CT meeting conducted by the flight commanders. This is augmented with bimonthly meetings covering all squadron flying functions to include Supervisor of Flying (SOF), Runway Supervisory Unit (RSU) controller and observer, Area Controller (AC), check pilot, PIT IP, safety, and standardization. Each IP must maintain 45-day landing currency and 30-day spin and simulated forced landing (SFL) currency. Since it is currently prohibited to perform spins and area SFLs with students, each IP can accomplish these maneuvers only during a CT sortie. This limits the IP's exposure to those maneuvers to the minimum required to be compliant with regulations. Finally, all IPs are required to fly three CT sorties each quarter. The military IPs must also fly four navigation sorties each half.

Maintaining a single PIT location to ensure standardization and continuity is an important requirement. There are concerns that the high altitude operations at the USAFA cannot be duplicated at Hondo, and could result in inadequate exposure to aircraft handling characteristics with inexperienced USAFA IPs. The team supports a special sortie in the PIT syllabus to fly maneuvers at USAFA operating altitudes while going through the program at Hondo. The 12

FTW could coordinate a suitable work area above Hondo in the Randolph MOA. This would expose all IPs to T-3A handling characteristics at high altitudes without moving PIT to USAFA.

<u>USAFA Instructor Pilots</u>

Formal instructor training begins with PIT at Hondo. PIT was initially conducted at both locations, but was consolidated at Hondo as recommended. Sending all attached IPs to Hondo is an inconvenience and disrupts academic scheduling, but several IPs favored training at Hondo because it enabled them to concentrate solely on their PIT training. In addition to semester commitments, attached IPs are assigned to summer cadet programs. Finally, attached IPs can only take leave during the summer or Christmas break, which further reduces their availability for EFS duties. AETC/DP has recently initiated the policy to address this situation by requiring all incoming T-3A IPs attend Hondo as a TDY enroute in conjunction with a PCS.

Following PIT, graduates enter the Aircrew Qualification Training (AQT) program defined by Squadron Operating Instruction (SOI) 36-2211, *Aircrew Qualification Training*. The program consists of Mission Qualification Training (MQT) and Squadron Certification Training (SCT).

MQT consists of a Familiarization (FAM) sortie, to acquaint the IP with the complexities of flying in the local environment, and a minimum of four sorties concentrating on instructor "fine-tuning." This training is accomplished by the Mission Qualification Training (MQT) Flight to ensure a standardized IP force. Each flight commander is also responsible to monitor his/her new IP's instructor development. The MQT program allows MQT Flight IPs, flight commanders and squadron supervisors to fly with new IPs. Besides local area sorties, the MQT program includes a minimum of two navigation sorties (usually flown as an out-and-back) and required ground training associated with flying and servicing the aircraft off-station. These sorties and associated ground training are described by the T-3A PIT Syllabus, but not flown at Hondo during PIT. To successfully complete the MQT program, the IP must fly with the squadron commander or operations officer, and be briefed by the squadron commander prior to flying with students. An IP appointment letter is filed in the IP's training folder.

New IPs enter their assigned flight and the squadron's certification program. Modeled on the previous AETC Buddy Instructor Program (BIP), SCT is designed to oversee the development of the new IP at the hands of the flight commander and an appointed Mentor Instructor Pilot (MIP). SCT consists of closely monitoring the new IP by observing his briefs and debriefs, flying with his students, and flying with the IP. The MIP is an experienced fellow flight member available to offer guidance as well as feedback to the new IP. Working with the flight commander, the MIP ensures the new IP receives a tailor-made program to provide the expertise required to be an effective instructor.

The certification program is not programmed for a definite time period. Its primary objective is to aid in the growth of the new IP from "inexperienced" to "experienced," defined in 19 AFI 36-2211, *Aircrew Qualification and Training*, as a minimum of 100 T-3A flying hours and squadron commander approval. The time period for reaching the experienced status ranges from two to six months, depending on the IP's availability (historically attached IPs, because of their more limited availability, take much longer than assigned IPs to become experienced). Until IPs become experienced, 19 AFI 36-2211 specifies that they attend a monthly CT-focused meeting covering grading scenarios, syllabus and instructor-oriented discussions, and general information relating to becoming more effective IPs. Squadron operating instructions dictate that all attached IPs also attend the monthly CT meeting. This offers important operational and instructional information to inexperienced and attached IPs, who have limited exposure to daily flying operations.

Once mission qualified, an IP must maintain currencies in landings, spins, and simulated forced landings (SFLs). A minimum number of flying "events" described in 19 AFI 36-2211 must be accomplished in a defined period (quarterly/semiannually/annually). There is also the requirement to fly a minimum number of sorties--student, navigation, and CT.

Training Improvements

Interviews with IPs, supervisors, and HQ AETC personnel unanimously indicated that the PIT syllabus needs improvement in both flight and ground training, especially for instructor development. AETC TRSS is developing a revised syllabus that should eliminate training deficiencies. In the new syllabus, an additional 23.5 hours of ground training will be added, and 11 hours will be added for instructor development. Increased ground training in aerodynamics, flight safety, spin, and SFL will also improve PIT ground training. The team recommends this syllabus be implemented prior to training new IPs. Also see the appendix 2 briefing charts on PIT syllabus changes.

In flying training, both SFL and spin training were restricted in order to limit risk encountered during these maneuvers by HQ AETC as a result of the USAFA Class A Mishaps. Unfortunately, instead of minimizing risk, the decrease of exposure actually reduced IP capabilities and confidence to handle these situations. The limitations were the most common complaints on the IP questionnaires. As noted above in the academic portion of this report, these concerns are already being addressed by HQ AETC and should be remedied by the changes described below.

An additional sortie is being added to the proficiency block of training and three sorties to the Advanced Aircraft Handling Characteristics (AAHC)/Spin block. Eliminating the Navigation training block (two sorties) from the PIT syllabus and including it in the MQT program at both locations offsets these increases. In order to help familiarize contractor pilots with military flying, the proposed syllabus allows for two additional sorties in the proficiency block. One of the sorties in the proficiency block will be a SFL demonstration sortie where trainees are introduced to various SFL scenarios. To add realism to SFL training, the minimum altitude during all SFL practice will be lowered to 200 ft. AGL. The AAHC/Spin block has been bolstered from a single spin demonstration sortie to four sorties. This block splits the spin sortie into two rides so the PIT trainee has more time to understand the dynamics of the different spin entries/characteristics. There are also two AAHC sorties added to concentrate on how to handle certain flight regimes and specific flight characteristics of the T-3A.

Although this new syllabus will improve the T-3A PIT program, time available for briefings and debriefings is seen as a continuing area of concern. Since PIT has implemented three sorties per day, time available for briefs has been significantly reduced. Both instructors and students see this as a very important part of the PIT program that should not be slighted.

Student Screening Syllabus

USAFA and Hondo conduct training under the same syllabus, 19 AF Syllabus S-V8A-E, dated May 95. Although USAFA Cadets receive 4.3 additional hours (20.7 hrs at Hondo vs. 25.0 hrs at USAFA) to compensate for longer transit times to the areas, academic training, syllabus sorties, and minimum performance requirements are the same for all students. The syllabus contains an orientation, 11 pre-solo, a solo, and 5 post-solo (including check ride) sorties. Students must perform all maneuvers, to include takeoffs, stalls, recoveries, spin prevention, aerobatics, SFLs, patterns and landings, to at least a fair level. The student solo sortie is a pattern only ride. Since 7 Mar 96, when HQ AETC identified brake problems in the T-3A, the solo sortie was suspended and the flying time for this sortie added to the previous sortie.

AETC's Training Support Squadron (TRSS) is coordinating a change to the syllabus to incorporate recommendations from the field as well as HQ AETC/IG's recent Broad Area Review to require students to show proficiency in spin prevention, and for IPs to demonstrate spin recoveries. Adding the spin recovery demonstration will help to screen students for problems in the T-37 program, and will also add opportunities for IPs to maintain proficiency in this maneuver. The number of aerobatic maneuvers in which a student must demonstrate proficiency will also be reduced, thereby reducing the number of post solo sorties. Instead of four post solo aerobatic sorties, the student will now receive a single refresher sortie between the solo and check ride.

This proposed student syllabus reduces the flying portion of the program from four to three weeks and would allow additional USAFA cadets to go through the summer program, thus reducing the number required to participate in the program during the academic year. Besides allowing more students to focus solely on flying during the summer, an added benefit would be to increased flexibility in the semester program because of reduced student numbers. See the appendix 2 briefing charts on the revised student syllabus.

A change supported at all levels of the program was reinstating the solo sortie when AETC determines the brake problem is resolved. This will eliminate the perception, voiced by IPs and students alike, that a student may be carried through the program since there is always an IP on board the aircraft to provide a safety margin. Besides being a powerful screening tool, the solo sortie also gives the student confidence in his/her flying ability.

During the SAF/IGI sponsored survey, students at the USAFA and Laughlin AFB who completed EFSP stated the training they received was valuable and the experience they gained extremely helpful when they entered SUPT. They did believe, however, that the same benefits could be achieved with a reduced syllabus as described above.

SUPPORT ASSESSMENT OF THE ENHANCED FLIGHT SCREENING PROGRAM

The support assessment begins with the T-3A Maintenance Concept section which offers a general description of the concept and specific circumstances at both Hondo and USAFA. This section also offers insight into possible conflicting guidance and engine overhaul schedule concerns. The next section evaluates the Airframe from a support point-of-view for reliability, certification, and configurations control. The team presents more detailed analysis on proposed or completed modifications in the third section, Subsystems. The final section looks at Operating Procedures that impact support.

T-3A MAINTENANCE CONCEPT

Overview

The maintenance concept for the T-3A is based on a combination of Contractor Logistics Support (CLS) for on-equipment maintenance, and Contract Operated Maintenance and Base Supply (COMBS) for off-equipment maintenance and supply support. CLS for on-equipment maintenance is performed by Lear Siegler, Inc. (LSI) at the USAF Academy and by Doss Aviation, Inc., at Hondo. COMBS support is provided at both locations by Northrop Grumman Technical Services, Inc., a subcontractor to Slingsby.

On-equipment maintenance is performed IAW the manufacturer's commercial maintenance manual, applicable AF/OSHA regulations, and Federal Aviation Regulation (FAR) Parts 43, 45, 91, and 145. The workforce consists of contractor Airframe and Powerplant (A&P) mechanics, many of whom have previous small aircraft maintenance experience. Off-equipment maintenance is performed by FAA-certified repair facilities via the COMBS contractor. This concept is basic to all weapon systems that use CLS/COMBS contracts. The premise of this concept is that the CLS mechanic troubleshoots a system, isolates the problem, removes the defective Line Replaceable Unit (LRU), and exchanges it for a serviceable LRU at the COMBS warehouse. Since the functional area commander at each location defines what are on- and off-equipment tasks, the distinction can vary between sites.

At the outset of the T-3A support contract, the FAA approved the maintenance contractors to follow modified rules for documentation and surveillance. The FAA awarded a repair station certificate to the on-equipment contractors after review of their repair station plan (which explains how they perform, document, and manage maintenance activities). The repair station plans for both contractors state they may use standard Air Force forms covered in the 00-20 series technical orders (T.O.) to document aircraft and maintenance history. Both contractors also use AFI 91-204, *Safety Investigation and Reports,* for mishap reporting; T.O. 00-35D-54, *USAF Deficiency Reporting and Investigating System*, for component deficiency reporting; T.O. 00-5-1, *AF Technical Order System*, for reporting technical data deficiencies; DODI 5000.2, *Acquisition Management Policies and Procedures*, for configuration changes; and AFI 21-107, *Maintenance Contract Surveillance*, for maintenance contract surveillance.

The FAA does not oversee their licensed mechanics and repair station facilities in the same manner or to the same level as the Air Force does. The FAA has no formal inspection program, while the Air Force requires the Quality Assurance Evaluators (QAEs) perform daily surveillance of the contractor's performance. The FAA inspects the sites at least once per year to ensure maintenance is performed according to the repair station plan.

LSI and Doss operate under different types of maintenance contracts for the same performance requirements. LSI performs on-equipment maintenance under a Performance Work Statement (PWS), with monetary rewards for exceeding standards and penalties for failing to meet them. Doss operates under a Statement of Work (SOW) and is rated yearly on their overall performance with no incentive or penalty clauses.

A shortcoming of the current on-equipment contract is that LSI and Doss are potential competitors and do not directly share innovative methods for aircraft servicing and maintenance activities. This leads to unique policy and guidance at each location. AETC and OC-ALC are working to award a single contract in FY 00 to one contractor for all on- and off-equipment services at both locations. OC-ALC will manage the contract, and one single contract should resolve many of the conflicts between the on-equipment contractors.

3 FTS, Hondo TX

Doss employs 26 people (17 A&P mechanics and 9 helpers) to support the T-3A aircraft at Hondo. The SOW states "The contractor shall provide only properly trained, qualified, and/or certified maintenance personnel. Personnel who perform maintenance supervisor or quality control duties must have at least five years of maintenance experience within the previous nine years. At least two of those five years of maintenance experience must be as an aircraft maintenance supervisor or quality control evaluator. The person listed as the chief inspector on the contractor's Repair Station Certificate will possess a current FAA Inspection Authorization (IA) Certificate. All contractor maintenance personnel, except aircraft workers, shall possess a current Airframe and Powerplant (A&P) mechanic certificate. Maintenance personnel who are not A&P certified must complete a general aircraft maintenance course designed by the contractor and accepted by the government. In addition, non-A&P certified maintenance personnel may not work without the direct supervision of an A&P certified mechanic."

Surveillance of the maintenance portion of the contract is accomplished by three government QAEs who ensure Doss meets requirements of the statement of work.

557 FTS, USAFA CO

LSI employs 22 people to support the T-3A, 16 A&P mechanics and 6 utility (helper) personnel. The PWS states "All aircraft mechanics shall possess a current FAA Airframe and Powerplant (A&P) certificate and/or an Inspection Authorization (IA) certificate. Repairmen shall possess a current FAA Certificated Repairman Certificate for the component or system they are listed on the Repair Station Certificate to maintain. All non-certificated employees shall be directly supervised (in the immediate work area) at all times by an appropriately certificated person while performing maintenance operations under this contract. The contract is monitored by three government QAEs who ensure LSI adheres to requirements of the performance work statement.

Guidance

The on-equipment maintenance contractor at USAFA is concerned that OC-ALC's maintenance guidance could conflict with the FAA's maintenance requirements. While OC-ALC has authority over configuration management and maintenance procedures, LSI believes that maintenance must be in accordance with the Original Equipment Manufacturer (OEM) or FAA procedures to maintain station certification. LSI fears the FAA may pull their repair station certificate if they comply with USAF maintenance policy that is contrary to the OEM maintenance manuals. This concern is not shared by Doss Aviation.

LSI's concern stems from an OC-ALC directed checklist for troubleshooting uncommanded engine stoppages which is different from the Lycoming (engine OEM) maintenance manual procedure. The OC-ALC checklist requires the fuel system components be disassembled and inspected for wear or damage before the engine is started. LSI wishes to return to Lycoming's troubleshooting procedures, directing an engine run before disassembly. OC-ALC says their procedure has discovered clogged lines and damaged components, whose condition might have been altered by an engine run before component inspection. After the fuel modifications have been proven, OC-ALC plans to authorize a return to the Lycoming's troubleshooting procedures.

The FAA permits the owner to supplement maintenance procedures as long as they are equal to (or more restrictive than) current procedures and meets the intent of the maintenance manual. However, the Air Force should minimize deviations from Slingsby's established maintenance as much as possible to avoid the perception that maintenance is not in accordance with FAA maintenance procedures. Furthermore, temporary deviations should normally be reviewed by Slingsby and the FAA and documented at OC-ALC.

Engine Overhaul Schedule Concerns

The COMBS contract with Northrop requires T-3A engines be overhauled at Lycoming every 1,800 flying hours. Lycoming has told Northrop each overhaul will take 6-8 weeks, including transportation time. To ensure the Air Force keeps possession of its low time engines (relative to the civil aviation fleet), Lycoming must overhaul and return the same engine to Northrop--it cannot trade a USAF engine for a newly overhauled engine.

Because all T-3As entered service between Mar 94 and Jan 96 and maintain similar flight hour profiles, the entire fleet may require engine overhaul within a relatively short period of time. The current distribution of hours for the engine fleet show between 8 and 19 engines due for overhaul each month from Dec 99 to Aug 01. The Air Force owns seven spare engines, not enough to prevent aircraft groundings during the overhaul period. The current COMBS contract allows the Air Force to buy up to 14 additional engines.

AIRFRAME

This section examines the T-3A aircraft from a systems perspective. It presents reliability data, rational and benefits for maintaining FAA airworthiness certification, and configuration control concerns (uncommonality between aircraft, maintenance manual change process, deficiency reporting, and modification process and funding).

Reliability

Standard maintenance indicators show the T-3A is a reliable aircraft. The mission capable rate averaged 93.5 percent in FY 95; 96.4 percent in FY96, and 91.2 percent while operational in FY97.

Certification

The T-3A is Type Certificated by the FAA, under Federal Aviation Regulation (FAR) Part 23 in the Aerobatic Category, and maintains FAA Standard Airworthiness Certificates. The USAF has decided to maintain the airworthiness certificates, and therefore, performs maintenance and alterations in accordance with FAA guidelines and carries valid registrations (N-numbers).

The FAA provides maintenance surveillance and modification oversight as necessary. OC-ALC asserts the FAA involvement in CLS programs allows for program sustainment with fewer AF personnel. In the T-3A case, FAA involvement also allows for less USAF engineering expertise, especially in piston engines and fiberglass structures.

Configuration Control

OC-ALC is the T-3A configuration control authority for the airframe, engine, subsystems, and technical orders (T.O.s) to operate and maintain the aircraft. Aircraft modifications and T.O. change processes are therefore managed by OC-ALC. The aircraft modification and T.O. change processes are intended to resolve deficiencies and incorporate improvements.

a. Uncommonality Between Aircraft

All USAF T-3As are not identical. All structural parts were manufactured by Slingsby, but most were assembled by Northrop at Hondo from “kits” shipped from Slingsby. The kits varied slightly in mounting bracket locations for various components. The fuel system modification was designed to accommodate these differences. An FAA Designated Engineering Representative (DER) is planned to be at each location during the fuel system modification installation to provide on-site analysis and approval of changes as required.

b. Maintenance Manual Change Process

To maintain the T-3A's FAA airworthiness certificate, Slingsby wrote and annually updates the maintenance manual. Out-of-cycle updates depend on the urgency and degree of change. If clarification or additional detail is required, the on-equipment contractor can request the COMBS contractor submit a User Experience Report (UER) directly to Slingsby. Typically, Slingsby will respond (with clarification or a maintenance procedure change) within 1-3 days and fax a copy to the OC-ALC engineer. OC-ALC's engineer must approve a new procedure and pass the approval through AETC/LGM before the on-equipment maintenance contractor is permitted to implement Slingsby's guidance. If the need is urgent, OC-ALC can authorize a change by fax or e-mail (through AETC/LGM) within hours. Suggestions can also be held for discussion during the annual maintenance manual conference, hosted by OC-ALC and attended by government and on- and off-equipment contractor representatives.

At the request of the government, Slingsby has rewritten the maintenance manuals in T.O. style format, adding figures, vendor information, and troubleshooting procedures. The users have reviewed the draft manual and expect a hands-on verification of the new/changed portions. The field is satisfied with the quality of the new maintenance manual and supports approval. Verification is required for approval to use the manual, but is not currently scheduled. The fuel and brake system modifications require updates to the maintenance manual. Information on new maintenance procedures should be available to the maintenance contractors prior to resuming flying operations.

c. <u>Deficiency Reporting</u>

The field reports technical problems through formal and informal channels. Deficiency Reports (DR) are intended to document critical failures (likely to result in hazardous or unsafe condition), recurring problems, and parts not meeting the specified Mean Time Between Failure (MTBF) in accordance with T.O. 00-35D-54. DRs flow from the field to AETC, OC-ALC, and Slingsby; however, not all DRs reach the responsible parts manufacturer. The decision whether or not to pursue is made at each of the AETC, OC-ALC, and Slingsby levels.

OC-ALC and AETC routinely screen "nuisance" deficiencies (e.g., a part fails but meets MTBF specifications) from going to the next level of review. Even if a DR passes the screening process, it can be disapproved if AETC decides the proposal is not cost-effective.

Because there are no supplemental guidelines on what kind of problems should be submitted, procedures for coordination, or responsibility for feedback, the DR program is not well understood or used. QAEs did not know how a DR was processed after submission to AETC/LGM or who had approval authority. None of the coordinating offices had suspenses for review, and no office was tracking the location and status of all DRs. As a result, many deficiencies were not being captured in the formal deficiency reporting process unless directed by government supervision.

QAEs stated inconsistent and insufficient feedback was the greatest deterrent to submitting Deficiency Reports. Written feedback was limited to a semi-annual list of DRs (generated by OC-ALC) showing the status as open, closed, or awaiting Slingsby input. OC-ALC provided periodic status and recommendations to AETC, but this detailed information was not always passed to the originator. The QAEs believed the lack of feedback indicated DRs were either not taken seriously or not acted upon.

d. Modification Process

Resolving technical problems is a dual track process--modifications must meet both USAF and FAA requirements.

To maintain a type certificate, all modifications must be reviewed, analyzed, tested, and approved by the FAA or Civil Aviation Authority (CAA), the British equivalent of the FAA. OC-ALC's preferred method is to contract Slingsby to perform an engineering analysis and propose a not-to-exceed cost to analyze the problem in depth, engineer and test a solution, and obtain the CAA's approval for the modification. The FAA may choose to observe, direct or perform its own tests/analysis, or (most likely) accept the CAA certification on a bilateral agreement. This method is usually the fastest since Slingsby has the engineering data and experience to make changes.

OC-ALC believes Slingsby has the expertise and capability to design future modifications and is confident the CAA and FAA are sensitized to performing a thorough review of proposed modifications. The FAA and CAA do test and analyze the modification's design to ensure it functions properly and is safe. However, evaluating the capability to meet the military's unique mission requirements, applications, or operating environments is not within the FAA's purview.

If Slingsby is not capable or responsive to the USAF's needs, a second option is to hire an experienced contractor to design, test, and coordinate FAA approval for a Supplemental Type Certificate (STC). This process still requires Slingsby's cooperation to endorse/approve the new design and make technical order changes.

If the Air Force chooses not to maintain the airworthiness certificate, a third option is to hire a contractor to design, analyze, and test a modification without FAA approval. This option could prove faster; however, any schedule reduction may be offset by the loss of the FAA's independent review of the design and testing process.

e. Modification Funding Shortfall

Beginning in FY 98, the T-3A program has $100K (approximately $1,000 per aircraft) in the Program Objective Memorandum for low cost safety modifications (3010). The OC-ALC program manager estimates three times that annual amount is actually required, based upon historical spending and future requirements. He states that the money is required to comply with service bulletins, airworthiness directives and other necessary safety modifications.

SUBSYSTEMS

Within this section, the BAR examines specific subsystem concerns and proposed corrective modifications. Specifically, the section evaluates the fuel delivery system, fumes in the cockpit, brakes, oil pressure indictors, emergency locator transmitter, and design features that may not comply with FAA requirements. The final sub-section describes completed modifications to the stall warning horn and rudder cables.

Fuel Delivery System

Engine start-up problems and uncommanded engine stoppages have been a problem since delivery of the first T-3A aircraft. The primary focus to resolve these problems has been on the fuel delivery system. This sub-section describes the problem identification and resolution history, including a review of the on-going modification.

In Jun 94 (after 8 ground engine stoppages), Slingsby was tasked to conduct a Failure Modes and Effects Analysis (FMEA). During the FMEA, aircraft deliveries were suspended and the fleet stood down. Slingsby's analysis identified four potential engine failure modes: fuel contamination, plug fouling, inadequate training on fuel servo adjustment, and operations/maintenance starting procedures. As a result, fuel servo maintenance and aircraft startup procedures were revised. Fuel contamination was addressed by the development of wing tank flushing procedures during production to remove "pickling" lubricants. Fuel vaporization was addressed by insulating several fuel lines in the engine compartment and modifying the fuel flow divider by replacing the 2 psi spring with a 4 psi spring.[29] Slingsby incorporated the changes into production aircraft and all other aircraft were retrofitted.

The fleet resumed flying in Sep 94, but uncommanded engine stoppages continued. Troubleshooting determined a wide range of suspected causes: fuel mixture, fuel servo, fouled plugs, plugged fuel lines, fuel contamination, improper idle adjustment and throttle technique, low oil temperature, and vapor lock. The Aeronautical Systems Center program office tasked Slingsby to perform an additional investigation at USAFA (where 11 of the 12 failures occurred in May-Jul 95). The investigation resulted in installation of a larger oil cooler and cowling louvers to reduce engine compartment temperatures. In addition, an upgraded regulator servo assembly (RSA) was introduced to facilitate fuel mixture settings.

In Sep 96, OC-ALC/LK contracted an independent engineering firm, Science Applications International Corporation (SAIC) to determine the root cause(s) of engine stoppages, and engineer and test a solution. SAIC instrumented two aircraft to record engine performance (e.g., fuel pressure between critical components, oil pressure, exhaust gas temperature, etc.).

SAIC flew the T-3A over 110 hours from Jan 97 to Jan 98, recording only one uncommanded engine stoppage (upon landing roll-out). A drop in fuel pressure with a corresponding drop in exhaust gas temperatures indicated fuel starvation. However, attempts to recreate the exact failure conditions were unsuccessful. Similar drops in fuel pressure and rises in fuel temperature were noted on other test flights, but did not result in engine stoppage.

[29] The fuel flow divider is a piston-controlled unit (resembling an automobile distributor) which distributes RSA-metered fuel to the injectors.

In Mar 97, SAIC reported that the automatic mixture control (AMC)[30] had no effect on fuel mixture at less than 20% power--a fact acknowledged by the manufacturer, but previously unknown in the operational community. Further, when the AMC was tested in laboratory conditions, it was determined that the AMC was sensitive to temperature differentials between the AMC case and the ram air, causing an out-of-calibration condition (as much as a 4,000 foot altitude-sensing error). However, the engineer did not consider the AMC to be a "single point failure" (i.e., not a sole cause of engine stoppage). Based on SAIC's testing of the AMC's operating range, 19 AF issued guidance mandating engine "clearing" while in a descent (increasing engine RPM to 2000 every 500 feet), and requiring the pilot to set the throttle ¼ inch above idle to remain in the AMC's operating range.

SAIC's analysis also showed the new 4-psi spring in the fuel flow divider appeared to restrict flow over a significant portion of the fuel servo range. Since the fuel flows from the servo into the fuel flow divider, the servo's low pressure fuel output results in possible interruption of the flow through the divider and to the cylinders. SAIC tested the old flow divider, with a 2-psi spring, and believe reverting back will result in slightly improved fuel flow.

On 23 Jul 97, a T-3A at USAFA experienced an engine stoppage during a landing approach. No defects were found and the engine restarted normally during maintenance troubleshooting. AETC/CC suspended T-3A flights pending resolution of the engine problem.

SAIC was directed to test their proposed modifications of the fuel system to determine the effect on engine performance. Flight testing began in Aug 97 and engine performance data (fuel pressure, temperature) and videotape of fuel flow showed marked improvement over the pre-modification system.

In Aug 97, the AFMC Propulsion Center of Excellence (COE) at Wright-Patterson AFB OH participated in analysis and independent testing to establish the range of operation of the fuel scheduling servo with the automatic mixture control and its input/effect on the engine stoppage problem. Their analysis did not pinpoint the engine stoppage problems to any single component. COE and SAIC agreed the problem is a cumulative effect of fuel vaporization, inadequate fuel pressure, and in some conditions, inadequate fuel mixture. Both agree SAIC's proposed fuel modifications should improve the fuel pressure and temperature while giving the pilot complete control to regulate the fuel-air mixture.

OC-ALC requested and received $6.2M to fund the fuel system modifications and tests on 5 Dec 97. Funding pays for parts and spares, installation labor, engineering services, travel, technical manual updates, and instructor cadre requalification flights. Most parts were ordered after the FAA fuel conformance inspection was completed on 20 Jan 98. The kit delivery schedule should be known by mid-Feb 98.

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[30] The AMC is an integral part of the RSA. Its purpose is to automatically schedule the fuel/air mixture to the fuel flow divider based on throttle position, atmospheric conditions, and other engine parameters. Its application is not widespread beyond the USAF and UK T-3As.

SAIC is tasked to gain FAA approval of the fuel system modification in a supplemental type certificate (STC). The STC approval process involves several steps. The parts conformity inspection, which matches the drawings to the disassembled parts, was performed in mid-Jan 98. The final engineering drawings should be delivered to the FAA by mid-Feb 98. The modification parts will be reinstalled and an aircraft instrumented for SAIC's ground and flight tests. In March, SAIC will retest and redesign pending the results of previous testing. The FAA has scheduled clear line ground tests and flight tests at SAIC in Apr 98[31]. After testing, SAIC will submit the STC package for FAA approval which is expected 23 May 98. Modification installation is to begin at both Hondo and USAFA on 26 May, and complete in Aug 98.

OC-ALC has categorized the fuel system modification into ten areas. The combined effect of these changes is expected to reduce the number of uncommanded engine stoppages.

1. Shorten and straighten fuel lines
2. Standardize fuel lines to ½ inch diameter
   - Install ½ inch diameter plumbing from the fuel tank outlet to the engine
   - Forward of the firewall, cover fuel lines with fire-sleeve and insulation
3. Relocate fuel selector valve to lower area
   - Relocate fuel selector valve handle to center console
   - Replace fuel selector valve (to fit with ½ inch diameter tubing)
   - Move parking brake control to accommodate above
   - Modify center console to accommodate above
4. Remove Automatic Mixing Control (AMC) from fuel servo system[32]
5. Replace fuel flow divider for another with 2 psi. spring
6. Replace and move electrical fuel pump to lower point and add gascolator
   - Modify electric fuel pump (a.k.a. boost pump) for ½ inch fittings and relocate to lower elevation under the cabin floor aft of the firewall
   - Replace fuel filter assembly with gascolator having quick-drain valve
   - Cut hole in cabin floor and lower right fuselage to install new fuel line and access gascolator and boost pump
7. Install larger diameter flop tube valve and move fuel tank vent outboard
   - Move, enlarge diameter, and add redundant fuel tank vent to outboard wing bays
   - Install dual pressure relieving vent check valves in the vent tube
   - Remove baffle from wing tank's hopper tank for flop tube's unrestricted movement
8. Redesign induction air box and air door latch, enlarged air box inlet
9. Change cowling louvers, add muffler shroud, vent oil cooler air overboard
   - Replace the fuel tank flop-tube and strainer screen with larger area items

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[31] Clear line fuel tests replaces fuel plumbing to critical engine components with a transparent line. The engine's fuel flow is videotaped while running at different throttle settings. Previous clear line testing demonstrated that bubbles were passing through the unmodified fuel system, causing uneven fuel flow to the cylinders.

[32] Removing the AMC requires the RSA to be replaced with another servo that does not contain an AMC. An RSA without an AMC does require calibration and can malfunction if an internal ball mechanism becomes stuck. OC-ALC is reviewing the maintenance and overhaul procedures to ensure maintainability and reliability.

Install a cooling air shroud around engine driven fuel pump
Replace two panels of louvers on lower cowling to increase open area
Add air baffle to inboard side of the oil cooler's cooling air exit to divert hot air
Add an insulation blanket to the muffler to reduce heat transfer
Lengthen exhaust tailpipe

10. Add audible warning of engine stoppage [33]

Engine Stoppage Performance Tracking

According to AETC, the T-3A program has documented 65 uncommanded engine stoppages[34] and one engine failure[35] from Feb 94 to Jul 97. Of the 65 stoppages, 8 occurred in flight (six were successfully restarted). The single engine failure was caused by in-flight oil starvation and engine seizure.

In AFR 127-4, *Investigating and Reporting of USAF Mishaps* (dated Jan 90 and replaced by AFI 91-204, *Safety Investigations and Reports*), an uncommanded engine stoppage after engine start in the T-41 was a Class-C reportable mishap. However, there is no similar policy for the T-3A. The Air Force Safety Center (AFSC) waived this reporting requirement because the field was reporting the incidents to OC-ALC (via AETC/LGM), and they saw no need to burden the field with an additional reporting process. As a result, AFSC does not have a complete list of engine stoppages.

OC-ALC and AETC/LGM learn of engine stoppages through the Operations Summary, an AETC product for commanders to report significant events to AETC/CC. There are no AETC guidelines on what types of maintenance incidents to report, resulting in inconsistent reporting. For example, OC-ALC has issued a checklist that excludes reporting an uncommanded engine stoppage if it occurred during the start sequence; however, there is confusion as to whether to report stoppages that occur in chocks prior to taxi. As a result, AETC counts eight more engine stoppages than OC-ALC.

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[33] The audible engine-stoppage warning is not part of the proposed STC. AETC added this requirement in Aug 97, and the design is in work. The modification will be approved by the FAA and installed separately.

[34] Engine stoppage is defined as an engine ceasing to run after starting and reaching stabilized RPM.

[35] Engine failure is defined as a stopped engine, unable to restart because of physical change.

Fumes in Cockpit

The 557 FTS reported fumes discrepancies as early as Jan 95. In Sep 96, OC-ALC tasked SAIC to determine the cause and develop a solution. SAIC determined that the fumes were a result of fuel overflow from the wing tank vents which are located immediately inboard of the wing root rib underneath the cockpit floor. The T-3A flight manual notes, "During servicing of the fuel tanks, it is possible to fill the tanks to a level that will flood the vent system with fuel. Fuel may flow overboard during ground operations or during takeoff and high angle of attack if the vent system is flooded. Vented fuel or fuel fumes may enter the cockpit through the water drain holes located next to the fuel vents." SAIC recommended relocating the fuel tank vent line outboard of its present location to prevent fuel fumes from entering the cockpit. In addition, a second fuel tank vent line will be added for redundancy in each wing tank. These changes will be accomplished as part of the fuel system modification.

Brakes

The T-3A began experiencing brake problems shortly after first delivery in Feb 94. Reported problems included sponginess, brake failure, and excessive pedal travel. In Mar 96, as a result of the continuing brake failures (53 by Feb 96), 19 AF/CC restricted students from solo flight until the brake problems were resolved. OC-ALC tasked Slingsby to investigate and resolve the recurring brake system problems. Slingsby identified that the problem stemmed from damaged flapper valves in the master cylinder. They determined that some master cylinders were manufactured with different springs which allowed the master cylinder to "bottom out" and damage the flapper valve. Once the flapper valve was damaged, the cylinder could not be properly supplied with fluid. This resulted in the crew experiencing spongy brakes or brake system failure depending on the level of the fluid remaining in the cylinder. Slingsby recommended changing the master cylinder spring to one with fewer coils and changing the stainless steel flapper plate to a phosphor bronze flapper plate.

Slingsby also discovered that improperly bleeding brake fluid could affect the amount of air in the system, and that a brake failure could be induced if the parking brake was engaged and released with pressure on the toe brakes. Slingsby recommended new procedures to bleed air from the brake system and to properly operate the parking brake.

In Apr 96, Slingsby issued Modification Bulletins which directed changes to the master cylinder, a stronger spring, and a new flapper plate. Modifications to the aircraft started in May 96 and were complete in Sep 96.

These modifications reduced but did not completely alleviate the problem. The brakes were still spongy and traveled, but returned to normal with pumping. OC-ALC determined the brake system was operating at the limits of its design capacity. The T-3A has an engine 500 pounds heavier than the original T-67 and operates in an environment that requires constant use of the brakes during taxi (students are required to taxi long distances at relatively slow speeds for safety). OC-ALC/LK tasked Slingsby to completely redesign the brake system. AETC authorized funding to redesign the brake system in Sep 96. During the interim, OC-ALC issued a new brake troubleshooting procedure to supplement the maintenance manual.

Slingsby proposed the master brake cylinder be totally redesigned, including higher capacity master cylinders, new low pressure lines with compression pipe fittings, new calipers, new brake pads, and an improved fluid reservoir system. AETC/LGM reviewed and concurred with the proposal in May 97. OC-ALC placed the modification on contract in Jun 97.

Since then, Slingsby has experienced quality problems with the vendor of a custom made part, delaying the delivery of brake modification kits until Feb 98. The estimated time to install the brake modification is 50 hours per aircraft. Since the brake modification requires significant cockpit disassembly that must also be done to facilitate the fuel system modification, OC-ALC prefers that the brake and fuel modifications be performed concurrently in May-Aug 98[36]. OC-ALC estimates the combined brake and fuel system modification will add only 20 hours per aircraft to the fuel modification installation timeline. The site services contractor has not determined if this will delay the fuel system modification schedule or require overtime. Ultimately, combining the modifications will save money and reduce potential damage from disassembly, since the components will be disassembled only once. The two modifications do not occupy the same space, so the risk of interference between the modifications should be minimal.

Oil Pressure Indication

The T-3A began having an unusual amount of oil pressure discrepancies during Jun/Jul 95. Problems included false high and low readings and movement of the indicator needle that made an accurate reading difficult. Initial investigation pointed to defective oil pressure sensors, and Slingsby was tasked to determine failure modes. They responded by developing a more comprehensive troubleshooting checklist, but this did not alleviate the problem. Slingsby stated that the oil pressure sending units were performing at less than expected mean time between failure, and was tasked to replace the oil pressure electrical sensor systems with a direct-reading pressure gauge.

Slingsby completed testing and submitted a proposal describing the direct reading pressure gauge in Mar 97. AETC/LGM reviewed the proposal and recommended the gauge be marked in psi versus “bars” and the pressure take-off line be moved to the rear of the engine. Although AETC recommended using the take off at the rear of the engine to reduce the distance of the oil line and number of clamps, Lycoming advised using the take-off at the front of the engine since it would indicate the lowest (worst case) pressure in the system--AETC/LGM concurred.

OC-ALC plans to use the existing Rochester gage indicator, since a new gage will not fit in the console. The oil pressure is transferred from the existing takeoff at the front of the engine via a 3/16 inch stainless steel pipe to the oil pressure indicator in the cockpit. A containment system consisting of a Tygon tubing sleeve installed over the stainless steel piping will prevent oil

[36] Disassembly that is common to both modification include removing the console center and side panels, seats, and rudder assembly.

from entering the cockpit in case of a leak in the piping. The new system has been tested on the ground and in flight, and the readings were steady with no undue oscillation. At engine startup, the oil pressure took approximately 20 seconds to indicate the correct oil pressure.

OC-ALC/LK placed the modification proposal on contract on 5 Aug 97. The gauge block is now being removed in lots of 9 and shipped to the gauge manufacturer for retrofit. The modification should be complete by Dec 98.

Emergency Locator Transmitter

The purpose of an Emergency Locator Transmitter (ELT) is to transmit a signal in the event of a crash to expedite rescue and recovery. If a pilot survives a controlled crash, otherwise survivable injuries can become fatal if rescue is not immediate. In civil aviation, many mishaps involve controlled flight into terrain--crashing with forward velocity into the ground or rising terrain. The T-3A uses a commercial ELT designed for civil aviation.

In the first mishap, the aircraft orientation was nose down, wings level on impact, but with little forward speed. In the second mishap, the aircraft was in a steep bank and its forward momentum was absorbed by the wing's impact to the ground. In the third mishap, the aircraft had almost no forward momentum, again impacting the ground in a wings-level attitude. Given the aerobatic mission and flight characteristics of the aircraft, a mishap can occur in almost any orientation and momentum axis.

Past accident investigations determined that the ELT activated only once in three mishaps. During the first mishap, the ELT activated but the antenna broke off during the crash. The ELT signal could only be received directly above the crash site. The antenna design was modified to improve the probability of surviving a crash.

The ELT did not activate during the second or third mishap because it is designed to activate only if the aircraft sustains a forward (x-axis) impact. The ELT will not activate if "g-forces" are sustained in any other dimension, as was the case in the final two mishaps. However, AETC/LGM asserts the ELT performs to specifications and will not fund a proposal for Slingsby to investigate alternative ELT systems, unless the operator (AETC/DO) establishes an "enhancement" requirement. To date, AETC has not determined if a new ELT is warranted.

Other Design Issues

At the request of OC-ALC, SAIC performed a detailed systems and structural examination of T-3A for compliance with FAR Part 23, Amendment 23-1 through 23-42. Results of their examination were provided to the FAA's Small Aircraft Directorate in mid-Oct 97.

Based upon the data provided, the FAA determined that 8 design features of the T-3A could be non-compliant and that 5 additional items may be non-compliant pending further evaluation. The FAA forwarded their concerns to the CAA on 27 Oct 97. The CAA worked with Slingsby to perform a detailed analysis, and on 12 Nov 97, sent a letter agreeing that 9 total items identified by the FAA may be non-compliant. The CAA further disagreed with one FAA non-compliant finding. All non-compliant items, including the item in disagreement, should be corrected by either the planned fuel system modification or by future Slingsby modification bulletins (see table below).

FAA representatives from the Small Aircraft Directorate indicate that issues requiring resolution prior to resumption of flying are addressed by the fuel system modifications. Timelines for future modifications should be adequate to allow necessary funding approval, procurement, and installation.

TABLE 2.5 POTENTIAL NON-COMPLIANCE ITEMS

Agreed Non-Compliant by FAA/CAA	Resolution:
1. Pressure drop in fuel system is beyond acceptable limits.	FAA believes the fuel system STC corrects the deficiency.
2. Present wing vent outlet allows fuel vapor to enter cockpit.	FAA believes the fuel system STC corrects the deficiency.
3. The engine mixture and throttle control cables are attached to the engines aluminum fuel injector control arm using steel clevis pins with a cotter pin to secure it.	FAA believes the fuel system STC corrects the deficiency.
4. The fuel selector valve placard does not have the word “OFF” printed in red color.	A future Slingsby modification bulletin should correct deficiency.
5. The fuel supply plumbing in the cockpit does not drain to a sump where contamination can be removed during a pre-flight inspection.	FAA believes the fuel system STC corrects the deficiency.
6. The electric boost pump is installed at the high point in the fuel system which may result in a loss of ‘prime’ when the engine is stopped.	FAA believes the fuel system STC corrects the deficiency.
7. A clevis pin and cotter pin is used in a moving joint at the pitch trim tab.	A future Slingsby modification bulletin should correct deficiency.
8. The elevator trim tab is not balanced and the reliability of the simple clevis pin joint does not meet the intent of FAR 24.667 and 23.689.	A future Slingsby modification bulletin should correct deficiency.
9. The circuit breaker for the fuel quantity indicators must be electrically isolated from the other instruments as it is an Essential Circuit.	A future Slingsby modification bulletin should correct deficiency.

Areas Where FAA and CAA Disagree	Resolution:
10. The fuel strainer does not have a sump drain.	FAA believes the fuel system STC corrects the deficiency.

The SAIC examination also identified several recommendations which could enhance service life or reduce cost. OC-ALC, AETC, and Slingsby are evaluating these recommendations for possible incorporation in future modifications or optional service bulletins.

Completed Modifications

The T-3A has compiled 61 Service Bulletins and 70 modification bulletins since it was fielded. Some of the more notable modifications completed were:

Stall warning horn: An inspection revealed the stall warning horn was prone to failure due to the difference between voltage generated by the aircraft (27.5V) and that used by the stall warning horn (24V). The problem was corrected by installing a resistor in line to the stall warning horn.

Rudder Cables: In Feb 95, maintenance personnel at Hondo discovered that the rudder cables bent and twisted when moving across the pulley. This situation created a sawing action which caused the cable to fray. Slingsby designed the T-67 with frictionless cable guide blocks for routing the rudder cables. During production of the T-3A, Slingsby complied with an FAA requirement that all aircraft using cables for rudder control be guided over pulleys. In 1995, Slingsby requested CAA approval to install the original design cable guide blocks. The CAA approved and issued the modification under reciprocal CAA/FAA agreement. The entire fleet was modified by Jun 97, and no further rudder cable problems have been noted.

OPERATING PROCEDURES THAT IMPACT SUPPORT

This section describes standard operating procedures on the T-3A which negatively impact reliability or support.

Electrical Fuel Pump

The T-3A flight manual states the electric fuel pump is normally used to prime the engine and during takeoff, landing, and aerobatics. Guidance in the flight manual is vague as to when to use the pump during cruise by stating "Electrical Fuel Pump – As required", but there is no guidance in the flight manual to determine "as required." AETCM 11-206, (*T-3A Mission Employment*), requires pilots turn on the fuel pump prior to spins and stalls. The flight manual does not provide any operating limits on the fuel pump leading pilots to believe it can be operated continuously. The 3 FTS has a verbal requirement to operate the fuel pump during the entire flight, and the 557 FTS has an Ops Note documenting the same requirement. Pilots have no cockpit indication if the electrical fuel pump fails. By operating the electrical fuel pump continuously, pilots risk not having the electrical fuel pump available in case the engine driven pump fails.

Constant operation causes excessive pump wear due to dead head pumping (pump operating in a no flow or near no flow condition) near idle conditions. As a result, the pump is failing more frequently than expected. The increasing failure rate could result in the electrical boost pump being inoperative for its designed purpose as a back-up to the engine driven fuel pump in case of an emergency. The fuel modification should reduce the dead head condition, but may not bring the failure rate up to specifications.

Engine Starting Procedures

The T-3A experiences frequent ground "non-starts" which lead to unnecessary maintenance troubleshooting. Current T-3A engine starting procedures differ from those recommended by Lycoming (engine manufacturer) and are a suspected cause. During flight testing for the fuel modification, SAIC experienced engine start problems and reverted to Lycoming's procedure with marked improvement. Both on-equipment maintenance contractors also recommended using Lycoming's procedures.

CHAPTER III

RISK ASSESSMENT

INTRODUCTION

This chapter presents the Broad Area Review Team's methodology to identify and assess risks associated with the USAF's Enhanced Flight Screening Program. It then presents a series of tables which identify specific hazards, their probability of occurrence and severity, and their resulting risk. The tables follow the general flow presented in Chapter II.

METHODOLOGY

The BAR team conducted a risk assessment to identify potential risk mitigation actions for the EFS program. The risk assessment methodology and risk values used are IAW AFP 91-215, *Operational Risk Management (ORM), Guidelines and Tools.* A summary of the methodology is included here.

The first step in the risk assessment process was to identify the hazards. Hazards are any real or potential condition that can cause mission degradation, injury, or death. Hazards for this report are separated into hazards to screening effectiveness (mission degradation) and hazards to safety (injury or death). Hazards were hypothesized by functional expert brainstorming, review of the draft AETC BAR of the EFS and numerous program documents, telephone and e-mail discussions with applicable organizations, and by use of the Air Force Safety Centers 5-M (Management, Mission, Man, Machine, Media) Risk Identification Model. Hazards were then validated by inspection, interview, and survey at appropriate locations.

Once the hazards were validated, two questions were asked for each hazard; what is the consequence or severity if the hazard occurs, and what is the likelihood of occurrence? Severity was subjectively assessed based on the collective experiences of the BAR team and expressed as one of the four categories presented in Table 3.1. The probability of occurrence was assessed based on quantitative data, interviews, organizational visits, surveys, and the BAR team's experience. Probability is expressed as one of the five terms presented in Table 3.1.

Risk is the product of the severity and the probability of a hazard occurring. Risk, determined from the Risk Assessment Matrix (Table 3.2), is expressed as one of three qualitative values; Low, Medium, or High.

TABLE 3.1 HAZARD PROBABILITY AND SEVERITY

HAZARD PROBABILITY	SEVERITY CATEGORIES
FREQUENT • Individual item - Occurs often • Fleet - Continuously experienced LIKELY • Individual item- Occurs several times • Fleet- Occurs frequently OCCASIONAL • Individual item- Will occur • Fleet- Occurs several times SELDOM • Individual item- Unlikely but could occur • Fleet- Unlikely but can expect to occur UNLIKELY • Individual item- So unlikely you assume it will not occur • Fleet- Unlikely but could occur	CATASTROPHIC • Complete mission failure, death, or loss of system CRITICAL • Major mission degradation, sever injury, or major system damage MARGINAL • Minor mission degradation, injury, or minor system damage NEGLIGIBLE • Less than minor mission degradation, injury, or minor system damage

TABLE 3.2 RISK ASSESSMENT MATRIX

	FREQUENT	LIKELY	OCCASIONAL	SELDOM	UNLIKELY
CATASTROPHIC	HIGH	HIGH	HIGH	MEDIUM	LOW
CRITICAL	HIGH	HIGH	MEDIUM	MEDIUM	LOW
MARGINAL	MEDIUM	MEDIUM	MEDIUM	LOW	LOW
NEGLIGIBLE	LOW	LOW	LOW	LOW	LOW

Risk can potentially be reduced by mitigating either the probability or severity of the hazard or both. The probability, in some cases, can be mitigated by a change in procedures or location. Example, change location to the Mojave Desert to reduce the probability of missed training days due to rain. Severity is often mitigated with additional safeguards or backup equipment, such as parachutes and SFL practice.

Tables 3.3 to 3.30 present the hazards, the probability and severity of each, and the assessed risks to the EFS program. These tables also show any current mitigation. Potential risk reduction actions for the medium and high risks shown in the tables form the basis of recommendations presented in Chapter IV.

TABLE 3.3 OPERATIONS (MISSION)

Management	Probability		Severity (consequence)	Risk to Screening Safety	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
Perceptions of Management					
• Poor Leadership	Unlikely	Unlikely	Critical	L	L
• Poor Guidance	Occasional	Occasional	Critical	M	M
• Low HHQ Responsiveness	Frequent	Frequent	Critical	H	H
Operational Management					
• Poor Policies	Unlikely	Unlikely	Critical	L	L
• Lack of HHQ responsiveness	Occasional	Occasional	Critical	M	M
• Lack HHQ T-3A expertise	Likely	Likely	Marginal	M	M
• Low IP Manning	Seldom	Occasional	Marginal	L	M
• High IP turnover	Unlikely	Likely	Marginal	L	M
Inadequate Ops Guidance					
• Dash 1	Occasional	Occasional	Critical	M	M
• Local Area Procedures	Unlikely	Unlikely	Critical	L	L
• Wing/Command OIs	Seldom	Seldom	Marginal	L	L
• Excessive FCIF/Read File	Seldom	Seldom	Marginal	L	L
Current Mitigation • Squadrons submit formal change requests through the AF Form 847 program					

TABLE 3.4 OPERATIONS (MISSION) CONTINUED

Management	Probability		Severity (consequence)	Risk to Screening Effectiveness	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
Perceptions of Management					
• Poor Leadership	Unlikely	Unlikely	Marginal	L	L
• Poor Guidance	Occasional	Occasional	Critical	M	M
• Low HHQ Responsiveness	Frequent	Frequent	Marginal	M	M
Operational Management					
• Poor Policies	Occasional	Occasional	Critical	M	M
• Lack of HHQ responsiveness	Likely	Likely	Marginal	M	M
• Lack HHQ T-3A expertise	Likely	Likely	Marginal	M	M
• Low IP Manning	Seldom	Occasional	Marginal	L	M
• High IP turnover	Unlikely	Likely	Marginal	L	M
Inadequate Ops Guidance					
• Dash 1	Occasional	Occasional	Marginal	M	M
• Local Area Procedures	Unlikely	Occasional	Negligible	L	L
• Wing/Command OIs	Seldom	Seldom	Marginal	L	L
• Excessive FCIF/Read File	Seldom	Seldom	Marginal	L	L
Current Mitigation None					

TABLE 3.5 OPERATIONS (MISSION) CONTINUED

Screening	Probability		Severity (consequence)	Risk to Screening Safety	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
Student Screening					
• No previous time	Seldom	Likely	Negligible	L	L
• Poor Syllabus quality	Unlikely	Unlikely	Critical	L	L
• Program capacity limitations	Occasional	Occasional	Marginal	M	M
Current Mitigation • The Student EFS Syllabus is currently being reviewed to include reducing the total number of sorties and bringing back the solo requirement					

TABLE 3.6 OPERATIONS (MISSION) CONTINUED

Screening	**Probability**		**Severity (consequence)**		**Risk to Screening Effectiveness**	
HAZARD	**Hondo**	**USAFA**			**Hondo**	**USAFA**
Student Screening • No previous time • Poor Syllabus quality • Program capacity limitations	 Seldom Unlikely Occasional	 Likely Unlikely Occasional	 Negligible Critical Critical		 L L M	 L L M
Current Mitigation • None						

TABLE 3.7 OPERATIONS (AIRCRAFT)

Cockpit	Probability		Severity (consequence)		Risk to Screening Safety	
HAZARD	**Hondo**	**USAFA**			**Hondo**	**USAFA**
Cockpit Deficiencies						
• Limited Size	Seldom	Seldom	Marginal		L	L
• Lacks Commonality	Seldom	Seldom	Marginal		L	L
• Anthropometrics	Occasional	Occasional	Critical		M	M
• Parachute Fit	Occasional	Seldom	Negligible		L	L
• Shoulder Harness	Seldom	Seldom	Marginal		L	L
Current Mitigation • AETC issues a waiver to students that cannot fit the T-3A cockpit due to anthropometric limitations.						

TABLE 3.8 OPERATIONS (AIRCRAFT) CONTINUED

Cockpit	Probability		Severity (consequence)		Risk to Screening Effectiveness	
HAZARD	**Hondo**	**USAFA**			**Hondo**	**USAFA**
Cockpit Deficiencies						
• Limited Size	Seldom	Seldom	Marginal		L	L
• Lacks Commonality	Seldom	Seldom	Negligible		L	L
• Anthropometrics	Occasional	Occasional	Critical		M	M
• Parachute Fit	Occasional	Seldom	Negligible		L	L
• Shoulder Harness	Seldom	Seldom	Negligible		L	L
Current Mitigation • None						

TABLE 3.9 OPERATIONS (AIRCRAFT) CONTINUED

Aircraft	Probability		Severity (consequence)	Risk to Screening Safety	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
Aircraft Performance					
• Inadvertent Spin/stall/departure	Occasional	Occasional	Critical	M	M
• Inability to recover from departure	Unlikely	Seldom	Catastrophic	L	M
• Rapid G onset	Frequent	Frequent	Marginal	M	M
Egress Equip/System					
• Poor Egress capability – High Altitude	Unlikely	Unlikely	Catastrophic	L	L
• Poor Egress capability – Low Altitude	Seldom	Seldom	Catastrophic	M	M
• Insufficient Egress guidance	Seldom	Seldom	Critical	M	M
Inadequate Testing					
• FAA	Unlikely	Occasional	Critical	L	M
• FOT&E	Occasional	Occasional	Critical	M	M
• Egress Equipment & Procedures	Occasional	Occasional	Critical	M	M
• Performance Data	Occasional	Occasional	Critical	M	M
• Handling Qualities	Seldom	Occasional	Catastrophic	M	H
• Engine Modifications	Unlikely	Occasional	Critical	L	M
• Brakes	Seldom	Seldom	Marginal	L	L
• Oil Pressure Sensor	Seldom	Seldom	Marginal	L	L
• Advanced Maneuvers	Seldom	Seldom	Marginal	L	L

Current Mitigation

- A proposed improvement to the PIT and CT training for IPs
- A proposed FOT&E with a combined effort between AFOTEC, AETC, and AFFTC—purpose is to resolve performance data, handling qualities, AETC concept of operations, and determine reliability of fuel system modifications to an acceptable confidence level

Note: "performance data" is considered a risk factor due to the significant differences between notional performance (as presented in the flight manual) and actual aircraft performance (as observed in service and through limited testing).

TABLE 3.10, OPERATIONS (AIRCRAFT) CONTINUED

Aircraft	Probability		Severity (consequence)	Risk to Screening Effectiveness	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
Aircraft Performance					
• Inadvertent Spin/stall/departure	Occasional	Occasional	Marginal	M	M
• Inability to recover from departure	Unlikely	Seldom	Marginal	L	L
• Rapid G Onset	Frequent	Frequent	Negligible	L	L
Egress Equip/System					
• Poor Egress capability – High Altitude	Unlikely	Unlikely	Negligible	L	L
• Poor Egress capability – Low Altitude	Seldom	Seldom	Negligible	L	L
• Insufficient Egress guidance	Seldom	Seldom	Negligible	L	L
Inadequate Testing					
• FAA	Unlikely	Occasional	Marginal	L	M
• FOT&E	Occasional	Occasional	Critical	M	M
• Egress Equipment & Procedures	Occasional	Occasional	Negligible	L	L
• Performance Data	Occasional	Occasional	Marginal	M	M
• Handling Qualities	Seldom	Occasional	Critical	M	M
• Engine Modifications	Unlikely	Occasional	Marginal	L	M
• Brakes	Seldom	Seldom	Marginal	L	L
• Oil Pressure Sensor	Seldom	Seldom	Marginal	L	L

Current Mitigation
- A proposed FOT&E with a combined effort between AFOTEC, AETC, and AFFTC—purpose is to resolve performance data, handling qualities, AETC concept of operations, and determine reliability of fuel system modifications to an acceptable confidence level

TABLE 3.11, OPERATIONS (LOCATION)

Location	Probability		Severity (consequence)	Risk to Screening Safety	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
Adverse Weather (after launch)					
• Crosswinds > 25 Kts	Unlikely	Occasional	Critical	L	M
• Crosswinds > 10 Kts	Seldom	Seldom	Marginal	L	L
• Turbulence	Unlikely	Seldom	Marginal	L	L
• Less than VFR	Unlikely	Unlikely	Critical	L	L
Airspace					
• Overall congestion	Unlikely	Occasional	Critical	L	M
• Limited Airspace	Unlikely	Seldom	Marginal	L	L
• ATC Restrictions	Unlikely	Seldom	Marginal	L	L
• Pattern congestion	Occasional	Occasional	Critical	M	M
• Mid-air collision	Unlikely	Unlikely	Catastrophic	L	L
• Birds strikes	Seldom	Seldom	Marginal	L	L
• Noise abatement restrictions	Unlikely	Seldom	Marginal	L	L
Atmosphere/Geography					
• High density-altitude	Unlikely	Occasional	Critical	L	M
• Poor terrain for FL	Seldom	Likely	Catastrophic	M	H
• Visual Illusions	Unlikely	Occasional	Critical	L	M
• Inadequate Runway Length	Unlikely	Unlikely	Critical	L	L

Current Mitigation

- Adverse Weather

- T-3A has higher crosswind limits than the T-41.
- Solo wind limits are conservative.
- Hondo has multiple direction runways.
- 19 AF has proposed lifting the non-instrument rating restriction

- Airspace

- Dedicated Runway Supervisor Unit (RSU) to control the pattern
- A mid-air collision avoidance safety program at USAFA

Atmosphere/Geography

- Proposed bringing SFL training back into both PIT and CT training without 500’ restriction
- Mountain flying checkout program for IPs stressing the effects of high altitude operations

TABLE 3.12, OPERATIONS (LOCATION) CONTINUED

Location	Probability		Severity (consequence)	Risk to Screening Effectiveness	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
Adverse Weather (sortie cancellation)					
• Crosswinds > 25 Kts	Unlikely	Occasional	Critical	L	M
• Crosswinds > 10 Kts	Seldom	Seldom	Marginal	L	L
• Turbulence	Unlikely	Seldom	Marginal	L	L
• Less than VFR	Occasional	Occasional	Critical	M	M
Airspace					
• Overall congestion	Unlikely	Occasional	Critical	L	M
• Limited Airspace	Unlikely	Seldom	Critical	L	M
• ATC Restrictions	Unlikely	Seldom	Marginal	L	L
• Pattern congestion	Occasional	Occasional	Critical	M	M
• Noise abatement restrictions	Unlikely	Seldom	Marginal	L	L
Atmosphere/Geography					
• High density-altitude	Unlikely	Occasional	Negligible	L	L
• Poor terrain for FL	Seldom	Likely	Marginal	L	M
• Visual Illusions	Unlikely	Occasional	Negligible	L	L
• Inadequate Runway Length	Unlikely	Unlikely	Marginal	L	L
Current Mitigation - Adverse Weather • T-3A has higher crosswind limits than the T-41. • Solo wind limits are conservative. • Hondo has multiple direction runways. • 19 AF has proposed lifting the non-instrument rating restriction					

TABLE 3.13, OPERATIONS (INSTRUCTOR PILOTS)

Instructor Pilots	Probability		Severity (consequence)	Risk to Screening Safety	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
IP Inexperience					
• Total Flight Time	Seldom	Seldom	Marginal	L	L
• Instructor Time	Unlikely	Occasional	Critical	L	M
• General Aviation	Seldom	Likely	Marginal	L	M
• Previous AETC IP	Seldom	Likely	Marginal	L	M
• Spin/Departure	Seldom	Likely	Marginal	L	M
• Aerobatics	Occasional	Occasional	Negligible	L	L
Personnel Influences					
• IP Distractions	Unlikely	Occasional	Critical	L	M
• IP Fatigue	Occasional	Unlikely	Critical	M	L
• Peer Pressure	Seldom	Seldom	Marginal	L	L
IP Personal Attributes					
• Low Motivation	Unlikely	Occasional	Negligible	L	L
• Low Confidence in Aircraft	Unlikely	Seldom	Marginal	L	L
• Lack of Discipline	Unlikely	Unlikely	Critical	L	L
• Low Confidence of Ability	Unlikely	Seldom	Marginal	L	L
• Complacency	Seldom	Seldom	Marginal	L	L

Current Mitigation
- Doss IP selection criteria more demanding than required by contract
- Proposed contract instructors at USAFA to begin Apr 98

TABLE 3.14, OPERATIONS (INSTRUCTOR PILOTS) CONTINUED

Instructor Pilots	**Probability**		**Severity (consequence)**		**Risk to Screening Effectiveness**	
HAZARD	**Hondo**	**USAFA**			**Hondo**	**USAFA**
IP Inexperience						
• Total Flight Time	Seldom	Seldom	Marginal		L	L
• Instructor Time	Unlikely	Occasional	Critical		L	M
• General Aviation	Seldom	Likely	Marginal		L	M
• Previous AETC IP	Seldom	Likely	Marginal		L	M
• Spin/Departure	Seldom	Likely	Marginal		L	M
• Aerobatics	Occasional	Occasional	Marginal		M	M
Personnel Influences						
• IP Distractions	Unlikely	Occasional	Critical		L	M
• IP Fatigue	Occasional	Unlikely	Critical		M	L
• Peer Pressure	Seldom	Seldom	Marginal		L	L
IP Personal Attributes						
• Low Motivation	Unlikely	Seldom	Marginal		L	L
• Low Confidence in Aircraft	Unlikely	Seldom	Marginal		L	L
• Lack of Discipline	Unlikely	Unlikely	Critical		L	L
• Low Confidence of Ability	Unlikely	Seldom	Critical		L	M
• Complacency	Seldom	Seldom	Critical		M	M
Current Mitigation: • Proposed contract instructors at USAFA to begin Apr 98						

TABLE 3.15, OPERATIONS (STUDENT PILOTS)

Students	Probability		Severity (consequence)		Risk to Screening Safety	
HAZARD	Hondo	USAFA			Hondo	USAFA
Personnel Influences						
• SP Distractions	Unlikely	Frequent	Marginal		L	M
• SP Fatigue	Seldom	Occasional	Marginal		L	M
• High Academic Load	Unlikely	Occasional	Marginal		L	M
• Poor Billeting	Frequent	Unlikely	Marginal		M	L
• Peer Pressure	Seldom	Seldom	Marginal		L	L
Current Mitigation • Current review of academic load at USAFA and academic scheduling to increase effectiveness of the program						

TABLE 3.16, OPERATIONS (STUDENT PILOTS) CONTINUED

Students	Probability		Severity (consequence)		Risk to Screening Effectiveness	
HAZARD	Hondo	USAFA			Hondo	USAFA
Personnel Influences						
• SP Distractions	Unlikely	Frequent	Critical		L	H
• SP Fatigue	Seldom	Occasional	Critical		M	M
• High Academic Load	Unlikely	Occasional	Critical		L	M
• Poor Billeting	Frequent	Unlikely	Critical		H	L
• Peer Pressure	Seldom	Seldom	Marginal		L	L
Current Mitigation None						

TABLE 3.17, OPERATIONS (STUDENT PILOTS) CONTINUED

Students	**Probability**		**Severity (consequence)**	**Risk to Screening Safety**	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
Inadequate Student Training					
• SFL	Frequent	Frequent	Negligible	L	L
• Inadvertent Departure/recovery	Frequent	Frequent	Negligible	L	L
• Stall recovery	Unlikely	Unlikely	Marginal	L	L
• Academics	Unlikely	Unlikely	Marginal	L	L
• TO/Landing Patterns	Unlikely	Unlikely	Critical	L	L
• Training Aids	Occasional	Occasional	Negligible	L	L
• Training Facilities	Occasional	Unlikely	Negligible	L	L
• Mass Brief	Unlikely	Unlikely	Critical	L	L
• Pre-brief	Seldom	Seldom	Marginal	L	L
• Debrief	Likely	Likely	Marginal	M	M
Current Mitigation • None NOTE: This table provides a risk assessment based on the current restriction of no solo requirement					

TABLE 3.18, OPERATIONS (STUDENT PILOTS) CONTINUED

Students	Probability		Severity (consequence)		Risk to Screening Effectiveness	
HAZARD	**Hondo**	**USAFA**			**Hondo**	**USAFA**
Inadequate Student Training						
• Solo	Frequent	Frequent	Critical		H	H
• SFL	Frequent	Frequent	Negligible		L	L
• Inadvertent Departure/recovery	Frequent	Frequent	Negligible		L	L
• Stall recovery	Unlikely	Unlikely	Critical		L	L
• Academics	Unlikely	Unlikely	Critical		L	L
• TO/Landing Patterns	Seldom	Seldom	Marginal		L	L
• Training Aids	Occasional	Occasional	Marginal		L	L
• Training Facilities	Occasional	Unlikely	Marginal		M	L
• Mass Brief	Unlikely	Unlikely	Negligible		L	L
• Pre-brief	Seldom	Seldom	Critical		M	M
• Debrief	Occasional	Occasional	Critical		M	M

Current Mitigation

- Proposed syllabus changes to allow for student solo requirement and increased briefing/debriefing time
- Hondo has physical plant modifications in progress aimed at optimizing existing facilities, but is approaching maximum student capacity.

TABLE 3.19, OPERATIONS (STUDENT PILOTS) CONTINUED

Students	Probability		Severity (consequence)		Risk to Screening Safety	
HAZARD	**Hondo**	**USAFA**			**Hondo**	**USAFA**
Inadequate Student Training						
• SFL	Occasional	Occasional	Critical		M	M
• Inadvertent Departure/recovery	Unlikely	Unlikely	Critical		L	L
• Stall recovery	Unlikely	Unlikely	Critical		L	L
• Academics	Unlikely	Unlikely	Critical		L	L
• TO/Landing Patterns	Unlikely	Unlikely	Critical		L	L
• Training Aids	Seldom	Seldom	Marginal		L	L
• Training Facilities	Seldom	Seldom	Marginal		L	L
• Mass Brief	Unlikely	Unlikely	Critical		L	L
• Pre-brief	Seldom	Seldom	Marginal		L	L
• Debrief	Occasional	Occasional	Critical		M	M
Current Mitigation • Proposed change to student syllabus to shorten length and reinstate solo NOTE: Probabilities in this table assume the solo requirement is reinstated						

TABLE 3.20, OPERATIONS (STUDENT PILOTS) CONTINUED

Students	Probability		Severity (consequence)		Risk to Screening Effectiveness	
HAZARD	**Hondo**	**USAFA**			**Hondo**	**USAFA**
Inadequate Student Training						
• SFL	Occasional	Occasional	Negligible		L	L
• Inadvertent Departure/recovery	Unlikely	Unlikely	Marginal		L	L
• Stall recovery	Unlikely	Unlikely	Critical		L	L
• Academics	Unlikely	Unlikely	Critical		L	L
• TO/Landing Patterns	Unlikely	Unlikely	Critical		L	L
• Training Aids	Seldom	Seldom	Marginal		L	L
• Training Facilities	Seldom	Seldom	Marginal		L	L
• Mass Brief	Unlikely	Unlikely	Critical		L	L
• Pre-brief	Seldom	Seldom	Marginal		L	L
• Debrief	Occasional	Occasional	Critical		M	M
Current Mitigation • Proposed change to student syllabus to shorten length and reinstate solo NOTE: Probabilities in this table assume the solo requirement is reinstated						

TABLE 3.21, OPERATIONS (TRAINING)

Instructor Pilots	Probability		Severity (consequence)	Risk to Screening Safety	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
Inadequate PIT Training					
• Spins	Seldom	Seldom	Catastrophic	M	M
• SFL	Seldom	Seldom	Catastrophic	M	M
• Aerobatics	Unlikely	Unlikely	Critical	L	L
• Inadvertent	Seldom	Occasional	Critical	L	M
Departure	Seldom	Seldom	Marginal	L	L
• Advanced Handling	Unlikely	Unlikely	Catastrophic	L	L
• Patterns	Unlikely	Unlikely	Catastrophic	L	L
• Stall	Unlikely	Unlikely	Critical	L	L
• A/C Knowledge	Occasional	Occasional	Critical	M	M
• Student errors	Occasional	Occasional	Marginal	M	M
• Instructor					
Development	Seldom	Seldom	Marginal	L	L
• Academics	Seldom	Seldom	Marginal	L	L
• Mass Brief	Seldom	Occasional	Marginal	L	M
• Pre-brief	Seldom	Occasional	Critical	M	M
• Debrief					
Inadequate CT Training	Likely	Likely	Catastrophic	H	H
• Spins	Frequent	Frequent	Catastrophic	H	H
• SFL	Unlikely	Unlikely	Critical	L	L
• Aerobatics	Occasional	Likely	Critical	M	H
• Inadvertent	Occasional	Likely	Critical	M	H
Departure	Unlikely	Unlikely	Catastrophic	L	L
• Advanced Handling	Unlikely	Unlikely	Catastrophic	L	L
• Patterns	Unlikely	Unlikely	Critical	L	L
• Stall	Seldom	Seldom	Critical	M	M
• A/C Knowledge	Seldom	Seldom	Critical	M	M
• Student errors					
• Instructor Proficiency					

Current Mitigation

- Inadequate PIT Training

- Proposed PIT Syllabus changes include Advanced Handling Characteristics and Instructor Development
- Proposed an additional Spin Demonstration sortie to split current sortie over two sorties
- Proposed lifting SFL restrictions of 500’ to 200’

- Inadequate CT Training

- Proposed lifting SFL and Spin training restrictions and adding increased training requirements
- Proposed adding realistic inadvertent departure training by lifting the “canned” profiles
- Proposed adding advanced handling characteristic maneuvers

TABLE 3.22, OPERATIONS (TRAINING) CONTINUED

Instructor Pilots	Probability		Severity (consequence)	Risk to Screening Effectiveness	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
Inadequate PIT Training					
• Spins	Seldom	Seldom	Marginal	L	L
• SFL	Seldom	Seldom	Marginal	L	L
• Aerobatics	Unlikely	Unlikely	Marginal	L	L
• Inadvertent	Seldom	Occasional	Marginal	L	M
Departure	Seldom	Seldom	Marginal	L	L
• Advanced Handling	Unlikely	Unlikely	Critical	L	L
• Patterns	Unlikely	Unlikely	Catastrophic	L	L
• Stall	Unlikely	Unlikely	Critical	L	L
• A/C Knowledge	Occasional	Occasional	Critical	M	M
• Student errors	Occasional	Occasional	Critical	M	M
• Instructor					
Development	Seldom	Seldom	Marginal	L	L
• Academics	Seldom	Seldom	Marginal	L	L
• Mass Brief	Seldom	Occasional	Marginal	L	M
• Pre-brief	Seldom	Occasional	Critical	M	M
• Debrief					
Inadequate CT Training	Likely	Likely	Negligible	L	L
• Spins	Frequent	Frequent	Marginal	M	M
• SFL	Unlikely	Unlikely	Marginal	L	L
• Aerobatics	Occasional	Likely	Negligible	L	L
• Inadvertent	Occasional	Likely	Negligible	L	L
Departure	Unlikely	Unlikely	Critical	L	L
• Advanced Handling	Unlikely	Unlikely	Critical	L	L
• Patterns	Unlikely	Unlikely	Critical	L	L
• Stall	Seldom	Seldom	Critical	M	M
• A/C Knowledge	Seldom	Seldom	Critical	M	M
• Student errors					
• Instructor Proficiency					

Current Mitigation

- Inadequate PIT Training

- Proposed PIT Syllabus changes include Advanced Handling Characteristics and Instructor Development
- Proposed to split the current Spin Demonstration sortie into two separate sorties for training effectiveness
- Proposed lifting SFL restrictions of 500’ to 200’

- Inadequate CT Training

- Proposed lifting SFL and Spin training restrictions and adding increased training requirements
- Proposed adding realistic inadvertent departure training by lifting the “canned” profiles

TABLE 3.23, OPERATIONS (TRAINING) CONTINUED

Physiological	**Probability**		**Severity (consequence)**		**Risk to Screening Safety**	
HAZARD	**Hondo**	**USAFA**			**Hondo**	**USAFA**
Physiological Training • Inadequate Physiological training • Hypoxia • Insufficient IP Alt Acclimation	 Unlikely Unlikely Unlikely	 Unlikely Unlikely Seldom	 Critical Critical Marginal		 L L L	 L L L
Current Mitigation None						

TABLE 3.24, OPERATIONS (TRAINING) CONTINUED

Physiological	**Probability**		**Severity (consequence)**		**Risk to Screening Effectiveness**	
HAZARD	**Hondo**	**USAFA**			**Hondo**	**USAFA**
Physiological Training • Inadequate Physiological training • Hypoxia • Insufficient IP Alt Acclimation	 Unlikely Unlikely Unlikely	 Unlikely Unlikely Seldom	 Marginal Marginal Marginal		 L L L	 L L L
Current Mitigation None						

TABLE 3.25, SUPPORT (T-3A MAINTENANCE CONCEPT)

T-3A Maintenance Concept	Probability		Severity (consequence)	Risk to Screening Safety	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
• Inadequate maintenance quality	Seldom	Seldom	Marginal	L	L
• Over reliance on FAA oversight	Seldom	Seldom	Marginal	L	L

Current Mitigation
- CLS contracts require A&P mechanics and supervisors
- AF QAE oversight of maintenance functions
- Contractor adherence to FAA standard practices

TABLE 3.26, SUPPORT (T-3A MAINTENANCE CONCEPT) CONTINUED

T-3A Maintenance Concept	Probability		Severity (consequence)	Risk to Screening Effectiveness	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
• Conflicting FAA and AF guidance	Seldom	Seldom	Negligible	L	L
• Unavailable due to scheduled overhaul	Occasional	Occasional	Marginal	M	M

Current Mitigation
- Conflicting FAA and AF guidance
  - OC-ALC only directs more stringent maintenance requirements which is compatible with FAA guidance
- Unavailable due to scheduled overhaul
  - Seven spare engines available to support overhaul activities

TABLE 3.27, SUPPORT (AIRFRAME)

Airframe	Probability		Severity (consequence)	Risk to Screening Effectiveness	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
• Uncommonality of T-3A Aircraft	Likely	Likely	Negligible	L	L
• Non-supportive Flt Manual process	Occasional	Occasional	Marginal	M	M
• Non-responsive Maintenance manual Process	Seldom	Seldom	Marginal	L	L
• Ineffective deficiency rpt of critical items	Occasional	Occasional	Critical	M	M
• Ineffective deficiency Rpt of routine items	Occasional	Occasional	Negligible	L	L
• Inadequate modification Process	Unlikely	Unlikely	Critical	L	L
• Modification funding shortfalls	Occasional	Occasional	Critical	M	M

Current Mitigation

- Uncommonality of T-3A Aircraft
  - Uncommonality of aircraft is understood and modifications are produced taking this into account
  - Designated Engineering Representatives are present during major modification installations for on-site support
- Non-responsive Flight Manual Process
  - Flight manuals updated by fully established 847 process
- Non-responsive Maintenance Manual Process
  - Deficiencies reported and corrected by established User Experience Report process
- Ineffective deficiency reporting of critical items
  - Deficiencies reported and corrected by established User Experience Report process
- Ineffective deficiency reporting of routine items
  - Deficiencies reported and corrected by established deficiency reporting process
- Inadequate Modification Process
  - Well established modification design (OC-ALC and Slingsby) and approval (FAA) process
- Modification funding shortfalls
  - Current POM contains $100,000 per year for low-cost modifications

TABLE 3.28, SUPPORT (SUBSYSTEMS)

Subsystem	Probability		Severity (consequence)	Risk to Screening Safety	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
Aircraft Subsystems					
• In-flight Engine Stoppage	Seldom	Seldom	Critical	M	M
• Fumes in Cockpit	Seldom	Seldom	Marginal	L	L
• Ineffective Brakes	Seldom	Seldom	Marginal	L	L
• Unreliable oil pressure indication	Seldom	Seldom	Marginal	L	L
• Non-activation of ELT	Likely	Likely	Critical	H	H

Current Mitigation
- In-flight Engine Stoppage
  - Planned Fuel System Modifications
  - IP practice of SFLs
- Fumes in Cockpit
  - Planned modifications in work
- Ineffective Brakes
  - Planned modifications in work
  - Student solos not permitted
- Unreliable oil pressure indication
  - Planned modifications in work
- Non-activation of ELT
  - New antenna improves probability of operation of ELT system

TABLE 3.29, SUPPORT (SUBSYSTEMS) CONTINUED

Subsystems	Probability		Severity (consequence)	Risk to Screening Effectiveness	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
• Non-compliance with FAA design requirements	Seldom	Seldom	Marginal	L	L

Current Mitigation
- FAA dedicated to maintaining oversight of design to ensure “airworthiness”
- Engineering analysis performed on entire system by SAIC and FAA is working identified issues
- Current fuel system modifications will address concerns with that system

TABLE 3.30, SUPPORT
(OPERATIONS PROCEDURES THAT IMPACT MAINTENANCE)

OPS Procedures that Impact Maintenance Procedures	**Probability**		**Severity (consequence)**	**Risk to Screening Effectiveness**	
HAZARD	**Hondo**	**USAFA**		**Hondo**	**USAFA**
• Unnecessary use of electric fuel pump	Likely	Likely	Negligible	L	L
• Engine starting procedures	Likely	Likely	Negligible	L	L
Current Mitigation • Planned fuel system modifications will reduce dead-head operating time and improve reliability					

CHAPTER IV

RECOMMENDATIONS

INTRODUCTION

Chapter II contains detailed analysis of the EFS mission, aircraft, operating locations, instructor pilots, students, training, and support concept. Chapter III uses this analysis to identify and quantify risks (low, medium, or high) to the EFS program's safety and/or screening effectiveness. In Chapter IV, the team presents mitigating recommendations for those areas identified as having either medium or high risk.

Risks to the program were identified throughout the Chapter II analyses and carried into the several applicable risk tables in Chapter III. In this chapter, the BAR "categorizes" the risks into areas which best present them for understanding and eventual resolution. For example, restricting spins and Simulated Forced Landings (SFLs) is discussed under instructor pilots, students, and training in Chapters II and III, but presented under mission in Chapter IV.

<u>OPERATIONS</u>

The following recommendations address both risks to safety and to screening effectiveness in the operations category, and are intended to reduce those medium or high risks to levels considered acceptable to the BAR.

MISSION

a. <u>Perceptions of Inadequate Management</u>

Data collected shows that IPs at both locations believe decisions by HQ AETC to restrict spin and SFL training may have increased rather than minimized risk.

1. Recommendation: HQ AETC revise spin and Simulated Forced Landing (SFL) training to include reinstating the student spin demonstration and SFL training to an altitude which allows realistic landing simulation.

Excessive delays in approving/implementing command guidance publication changes (i.e., Training Syllabi, AETC Operating Instructions, etc.) have created a perception among IPs that their recommendations are "lost in the system," and that those in charge are slow to react to correct known deficiencies and implement proposed enhancements.

2. Recommendation: HQ AETC control and track change requests until resolved, and provide feedback to the originator throughout the process.

b. Inadequate Operations Guidance

Flight manual technical information and associated publications are inadequate. For example, takeoff and landing data has been developed and tested but have not been published. Also, guidance on spins, aircraft departure characteristics, and common student errors is consistently identified as inadequate. This results in pilots operating with overly conservative data.

3. Recommendation: HQ AETC and OC-ALC improve the process to incorporate technical data into the Flight Manual in a timely manner.

4. Recommendation: HQ AETC publish comprehensive guidance on takeoff and landing data, spins, aircraft departure characteristics, and common student errors.

c. Screening Capacity Limitations

Screening requirements to support projected SUPT production cannot be met under the established program. Student proficiency requirements in advanced aerobatic maneuvers can be significantly reduced with minimal-to-no impact on screening effectiveness and would shorten the syllabus by four sorties. The BAR believes attrition data justifies approving waivers for students with previous experience, i.e., Private Pilot's License and 100 flying hours if required.

5. Recommendation: HQ AETC approve student syllabus which decreases EFS aerobatic sorties.

6. Recommendation: HQ AETC approve EFS waivers to candidates with a Private Pilot's License (PPL) and 100 flying hours as required.

AIRCRAFT

a. Cockpit Deficiencies

Several T-3A anthropometric factors (e.g., cockpit size and canopy height) are considered deficient. Although these problems cannot be economically changed in the T-3A, the lessons learned should be utilized in future COTS acquisitions.

7. Recommendation: SAF/AQ incorporate lessons learned from T-3A anthropometric deficiencies into future COTS acquisitions.

b. Inadequate Aircraft Performance Knowledge

A comprehensive academic course on spin aerodynamics, departures characteristics, propeller aerodynamics, reciprocating engines, and aircraft systems is necessary to prepare PIT trainees for safe and effective flight operations as instructors. AETC has developed a revised PIT syllabus to incorporate increased academics.

8. Recommendation: HQ AETC implement academic changes in the proposed T-3A PIT syllabus.

c. Inadequate Egress Equipment/Systems

T-3A airborne egress options are limited for aircrew, especially at low altitude. IPs state that current guidance is inadequate to provide confidence in bailout options and restrictions.

9. Recommendation: HQ AETC improve current egress guidance and explore the requirement for alternate egress systems.

d. Inadequate Aircraft Testing

HQ AETC and the test community (AFOTEC, AFFTC, and OC-ALC) have identified deficiencies in handling qualities and performance data. Current efforts are in progress to identify and evaluate areas requiring additional testing (e.g., spin recovery, takeoff and landing data, departure/recovery, weight and balance).

10. Recommendation: HQ AETC, AFOTEC, AFFTC, and OC-ALC perform planned FOT&E to review and evaluate T-3A performance data, handling qualities, and engine modifications.

11. Recommendation: OC-ALC integrate the aircraft manufacturer into the FOT&E testing effort to expedite changes to the flight manual.

e. International Cooperation Opportunities

Both the British and Canadian forces use the Firefly in training programs similar to our screening program. While not specifically addressed in the risk tables, the BAR recommends establishing an immediate dialogue--to include training demonstrations/orientation for select T-3A instructors.

12. Recommendation: HQ AETC open a dialogue/exchange with other Firefly users.

LOCATION

a. Adverse Weather

Although crosswinds at USAFA and ‘less than VFR’ conditions were seen as effectiveness risks, we believe current procedures provide an acceptable margin to safety concerns. The AETC review of this program recommended IPs reacquire and maintain instrument qualifications; however, the team believes added costs and safety risks outweigh benefits.

13. Recommendation: HQ AETC continue to NOT require EFS IPs obtain and maintain instrument qualification.

b. Airspace Congestion

Both USAFA and Hondo traffic patterns suffer from congestion. With training loads expected to increase, programs to address congestion must continue to be effectively managed.

14. Recommendation: 3 FTS and 557 FTS continue to emphasize safety concerns with airspace and pattern congestion through CT meetings, RSU programs, and community involvement.

c. Atmosphere/Geography at USAFA

Although the Academy has a Mission Qualification Training (MQT) program, many USAFA IPs believe training for high density altitude operations is insufficient. Specific syllabus recommendations are addressed in the training section. **See recommendation 29**.

INSTRUCTOR PILOTS

a. IP Inexperience

USAFA military IP's lack experience in light-weight, piston-driven aerobatic aircraft. This, coupled with the projected low IP manning makes retraining assigned 557 FTS personnel to conduct training for a short period (approximate 10-month) a risk to safe operations.

Contractor personnel are scheduled to assume EFS operations at USAFA in Jun 99. The BAR recommends the 557 FTS not resume flight operations until contractor personnel can be secured, which should reduce these risks.

15. Recommendation: USAFA convert the EFS program to contractor operations, and immediately reassign 557 FTS permanent party personnel to operational billets.

b. Personal Influences (Distractions)

Attached IPs at USAFA are distracted by competition between teaching duties and flying obligations. These distractions can be minimized if USAFA senior leadership (Commandant, Superintendent, Department Heads) approve policies supporting attached IP flying duties. This action will not only help attached IPs, but will also send a positive signal to cadets involved with the EFS program.

16. Recommendation: USAFA leadership implement policy supporting attached IP flying duties in the EFSP.

Hondo Doss IPs expressed concerns about the amount of activities they perform. They state a normal day routinely contains three flying activities, which leads to fatigue--especially on hot summer days.

17. Recommendation: HQ AETC evaluate current Doss IP flying event policies for safety and training effectiveness considerations.

STUDENT PILOTS

a. <u>Personal Influences (Distractions)</u>

USAFA academic, military, and athletic demands conflict with flying training conducted during the semester. In contrast, the summer EFS program allows cadets to focus solely on flying. Implementing recommendation 6 (to reduce the EFS student syllabus) would allow a third screening period be added during the summer.

18. Recommendation: USAFA investigate and implement methods to emphasize the importance of the EFS program while reducing competing Academy demands during the semester to an acceptable level.

19. Recommendation: USAFA add a third screening period during the summer.

The daily commute between Lackland AFB and Hondo, and inadequate crew rest due to substandard quarters necessitate acquisition of suitable quarters in the vicinity of Hondo.

20. Recommendation: HQ AETC pursue agreements to secure suitable quarters for 3 FTS students near Hondo without delay.

b. <u>Inadequate Student Training</u>

Solo flight has traditionally been the true "litmus test" in aviation training. It is a screening device for SIE and MOA attrition, and is likewise a standardization tool wherein the instructor must evaluate the student's abilities to perform unassisted safe flight. Remarks from both students and IPs indicate the solo challenge is a significant motivator for both performance and knowledge.

21. Recommendation: HQ AETC reinstate student solo sortie.

Student debriefs remain an important training tool, even in a screening environment. Former EFS students repeatedly told of rushed debriefs because of transportation requirements or IP commitments to other flying duties.

22. Recommendation: HQ AETC evaluate programmed sortie turn times to ensure adequate debrief time is available.

TRAINING

a. <u>Inadequate PIT Training</u>

IPs believe the current PIT syllabus is inadequate for USAF pilots inexperienced in light, piston-driven aircraft to achieve the level of flying and instructional capabilities required. HQ AETC has already drafted a revised syllabus to address risk areas identified in this report, which expands academics in instructor development, SFL, spin, and advanced aircraft handling capabilities (areas likely for unintentional departures). The team believes these changes, when combined with removing other identified training restrictions, will meet all desired requirements.

23. Recommendation: HQ AETC implement the revised PIT syllabus.

Pilots of single-engine aircraft must be proficient in forced landings. Proper training for PIT trainees, reinforced by realistic and frequent practice, will instill experience, confidence, and discipline to select a suitable field, judge the gliding distance, and put the aircraft in position to make a successful landing.[37] Key to determining a "successful" SFL is the ability to validate suitability of a selected field and accurately determine the touchdown point. Initiating a go-around from 500 feet AGL (IAW current procedures) does not allow the IP or student to fully evaluate forced landing terrain or touchdown point.

24. Recommendation: HQ AETC reinstate SFL training to realistic altitude.

PIT students and instructors noted there was frequently insufficient time for briefings and debriefings to cover instructor techniques, common student errors, and problem areas.

25. Recommendation: HQ AETC evaluate options to improve brief/debrief times during PIT.

IPs recommend moving the PIT program from Hondo to USAFA to better train in the more demanding environment (high density altitude); however, Hondo is a more suitable location in terms of a stabilized instructor force, throughput capacity, safer terrain, and less conflicting traffic. A high altitude handling characteristic's sortie added to the proposed PIT syllabus, and an improved MQT program at USAFA focusing on these characteristics, would emphasize operating limitations and differences of this restrictive environment.

26. Recommendation: HQ AETC keep PIT at Hondo, and add a syllabus sortie to IP training that emphasizes high altitude handling characteristics.

27. Recommendation: HQ AETC improve the MQT program at USAFA by focusing on high altitude operations.

b. Inadequate Continuation Training (CT) Training

Continuation training has been identified as inadequate. Removing SFL restrictions, emphasizing spin training (to include IPs demonstrating spins to students), and incorporating an advanced handling training program similar to the T-37 spin program would improve IP confidence and provide a safer program.

28. Recommendation: HQ AETC improve CT programs at both locations emphasizing realistic training.

Training inexperienced pilots in instructional techniques has already been identified as an area requiring modification. The BAR believes another way to address this problem is for HQ AETC/TRSS to publish a standardized Instructor Techniques Manual.

29. Recommendation: HQ AETC/TRSS publish a standardized T-3A Instructor Techniques Manual.

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[37] A "successful" FL is one which results in aircrew survival, with no serious concern about aircraft damage--an attitude which must be instilled in pilots.

<u>SUPPORT</u>

The following recommendations address both risks to safety and/or screening effectiveness in the support category, and are intended to reduce those medium or high risks to levels considered acceptable to the BAR.

T-3A MAINTENANCE CONCEPT

a. <u>Engines Unavailable Due to Scheduled Overhaul</u>

Because all T-3As entered service between Mar 94 and Jan 96 and maintain similar flight profiles, the entire fleet may require engine overhauls within a relatively short period of time. The current distribution of flying hours show between 8 and 19 engines will be required for overhaul each month between Dec 99 and 01. The Air Force owns only seven spares.

These scheduled engine overhauls could overwhelm existing available spares and reduce aircraft available for training. This would delay student sorties and reduce mission effectiveness.

30. Recommendation: HQ AETC and OC-ALC evaluate the need to exercise an option in the COMBS contract to purchase more spare engines before awarding a new maintenance contract in FY 00.

31. Recommendation: HQ AETC emphasize the need for squadron schedulers to widen the distribution of airframe flight hours when planning the daily flying schedule.

32. Recommendation: HQ AETC and OC-ALC review the engine management plan to evaluate possible efficiencies by placing engines into overhaul with less than the maximum 1,800 hours.

AIRFRAME

a. <u>Non-Supportive Flight Manual Process</u>

The current flight manual change process lacks sufficient controls to ensure timely updates, and pilots at both Hondo and USAFA believe the process unresponsive. In a situation unique to the T-3A, 19 AF performs update functions instead of OC-ALC and has had difficulty providing timely changes. **Also see recommendation 4**.

33. Recommendation: 19 AF return the Flight Manual update process to OC-ALC.

b. Ineffective Deficiency Reporting of Critical Items

The policy and guidance for reporting critical item deficiencies (e.g., engine stoppages) is unclear, and results in data not being captured in appropriate formats. Inconsistent reporting can result in inadequate technical or programmatic review and could lead to delayed resolution of technical problems.

The QAEs are also disappointed with the quality and frequency of feedback they receive on Deficiency Report (DR) submittals. They state difficulty in tracking DR status or understanding why DRs are approved or disapproved.

34. Recommendation: OC-ALC and HQ AETC review and update the DR process guidance to ensure it addresses deficiencies to be reported, responsibilities, timelines, and required feedback.

c. Modification Funding Shortfalls

The current POM is funded $200,000 below ($100,000 vs. $300,000) the program manager's projected requirements for complying with service bulletins, airworthiness directives, and other necessary safety modifications. Although dollar amounts are small, delays in obtaining required funding could result in downtime for affected aircraft or delay student training.

35. Recommendation: HQ AETC increase T-3A program low-cost safety modification funding (3010) to cover expected requirements.

SUBSYSTEMS

a. In-flight Engine Stoppage

Several low-probability events could result in an in-flight engine stoppage (e.g., mechanical failure, spin exit in certain attitudes, fuel system failures, etc.). While most engine stoppages will be recoverable (can be restarted), some could result in forced landings or even bail-out. Early warning of an engine-out condition maximizes pilot options. The T-3A currently has no engine out indicator.

36. Recommendation: OC-ALC continue implementing fuel system modifications.

37. Recommendation: HQ AETC define and establish a measurable standard for engine stoppages.

38. Recommendation: OC-ALC and HQ AETC ensure that the deficiency and safety reporting process tracks both recoverable and unrecoverable engine stoppages to increase visibility into possible endemic problems.

39. Recommendation: OC-ALC pursue an effective engine-out warning system.

b. Non-Activation of Emergency Locator Transmitter (ELT)

The T-3A ELT has failed on two of the three Class-A mishaps because of limitations of the single axis orientation of the activating sensor (activates only as a result of "g-forces" in the longitudinal axis). Failure of the ELT to properly activate during a future mishap could delay locating, recovering, or providing critical medical treatment to downed aircrew.

40. Recommendation: HQ AETC evaluate requirements for an ELT which activates when acceleration ("g-force") exceeds established thresholds in multiple axes.

c. Non-compliance with FAA Design Requirements

SAIC identified several design features of the T-3A which may not meet FAA requirements. The FAA, CAA, OC-ALC, and AETC are currently reviewing these findings and developing appropriate responses. Depending on the extent of required modifications, additional funding may be required to comply with future FAA airworthiness directives.

41. Recommendation: OC-ALC continue their efforts, in cooperation with the FAA, to address potential non-compliant items.

OPERATING PROCEDURES THAT IMPACT MAINTAINABILITY

a. Unnecessary Use of Electric Fuel Pump During Normal Flight Operations

3 FTS and 557 FTS standard instructions direct pilots operate the electric fuel pump continuously during ground and flight operations. The flight manual recommends operating only during engine start, take-off, aerobatics, and landing. Continuous use of the pump during low-demand conditions has resulted in higher than expected failure rates, and could result in the pump not being available as a back-up in case the engine-driven fuel pump fails.

42. Recommendation: OC-ALC clarify flight manual electrical fuel pump operating procedures and limitations.

43. Recommendation: 3 FTS and 557 FTS ensure their standard instructions adhere to new flight manual procedures for electrical fuel pump operation.

b. Suspect Engine Starting Procedures

Current engine starting procedures do not match the engine manufacturer's recommended procedures and may result in frequent "no-starts."

44. Recommendation: OC-ALC replace current flight manual engine starting procedures with those recommended by the engine manufacturer.

ADDITIONAL RECOMMENDATIONS IN THE SUPPORT AREA

a. Commercial Off-the-Shelf Acquisitions May Not be Adequately Tested

COTS strategies involve a highly-tailored acquisition process where major programmatic milestones are often waived or compressed. When an item is procured without modification and used in the same environment for which it was designed, testing can often be streamlined or waived. However, in many cases, COTS items are "missionized" by modification to original design, or used in environments different than originally intended. Such was the case for the T-3A (larger engine, continuous high-altitude operations at USAFA, slow-taxi requirements, constant use of fuel pump, continuous high RPM operation, etc.). Yet, because the T-3A was considered a COTS item, testing was intentionally abbreviated. The COTS strategy thus played a significant role in constraining time and resources available for government testing and may have precluded early identification and resolution of many of the problems that plague the T-3A program.

45. Recommendation: SAF/IG perform an acquisition management review of the Air Force's Commercial and Non-Developmental Item acquisition strategies and guidance to identify pitfalls and lessons learned which may be applied to future programs.

46. Recommendation: SAF/AQ and AF/TE establish COTS/NDI guidance to keep strategies focused on conducting realistic operational testing which reflects the mission environment. Conduct test and evaluation prior to buy or fielding decisions when possible.

b. Insufficient Documentation of Maintenance Procedure Deviations

At times, OC-ALC may issue maintenance direction which conflicts with original equipment manufacturer or FAA guidance. The FAA allows such deviations as long as they are the same or more restrictive than current procedures to meet the intent of the maintenance manual. There is currently no formal process to document deviations or to include the original equipment manufacturer (OEM) in their review. The team believes such a process is necessary to accommodate FAA oversight of maintenance activities.

47. Recommendation: AETC and OC-ALC establish a process to document deviations and include the OEM in their review.

c. Need to Validate the New T.O.-Style Maintenance Manual

Slingsby rewrote the maintenance manual into T.O.-style format. Proper validation requires hands-on verification for approval to use the new manual; but, none is currently planned.

48. Recommendation: AETC and OC-ALC schedule appropriate maintenance manual validation and approval before flying operations resume.

SUMMARY

This chapter presented 48 recommendations to improve the EFS program. From these, the BAR identified several actions that should be accomplished prior requalifying IPs, screening students at Hondo, or screening students at USAFA. These actions are summarized below with their corresponding specific recommendation number(s) from Chapter IV.

Prior to Requalifying IPs

- Complete FOT&E Phase I testing (Recommendation 10)
- Complete fuel system modifications on training aircraft (Recommendation 36)
- Define and establish measurable standards for engine stoppages (Recommendation 37)
- Publish flight manual and maintenance procedures for modified aircraft (Recommendation 4)
- Publish guidance on spins, aircraft departure characteristics, and common student errors (Recommendations 4, 11)
- Publish a standard instructor techniques manual (Recommendation 29)
- Reinstitute realistic Simulated Forced Landing (SFL) training (Recommendations 1, 24)

Prior to Resuming Student Flight Screening at Hondo

- Evaluate Doss Aviation, Inc., IP daily sortie requirements for safety and screening effectiveness (Recommendation 17)
- Implement new student syllabus (reinstating solo, reducing aerobatics, adding spin demonstration) (Recommendations 1, 5, 21)

Prior to Resuming Student Flight Screening at USAFA

- Complete FOT&E Phase III testing at USAFA (Recommendation 10)
- Convert the USAFA EFS program assigned military pilots to contractor pilots (Recommendation 15)
- Improve the Mission Qualification Training to emphasize high-altitude operations (Recommendations 26, 27)

APPENDIX 1

LIST OF ACRONYMS

A&P	Airframe And Powerplant
AAHC	Advanced Aircraft Handling Characteristics
AC	Aircraft Commander
ACAT	Acquisition Category
AETC	Air Education and Training Command
AFOQT	Air Force Officer Qualification Test
AFSC	Air Force Safety Center
AGL	Above Ground Level
AMC	Automatic Mixture Control
APB	Acquisition Program Baseline
ASD	Aeronautical Systems Division
ATP	Air Transport Pilot
BAR	Broad Area Review
BIP	Buddy Instructor Program
CAA	Civil Aviation Authority
CDR	Critical Design Review
CFI	Certified Flight Instructor
CG	Center Of Gravity
CLS	Contractor Logistics Support
COE	Center Of Excellence
COI	Critical Operational Issue
COMBS	Contractor Operated Maintenance and Base Supply
CONOPS	Concept Of Operations
COTS	Commercial, Off-The-Shelf
CT	Continuation Training
CTF	Combined Test Force
DAB	Defense Acquisition Board
DAC	Designated Acquisition Commander
DER	Designated Engineering Representative
DNIF	Duty Not To Include Flying
DR	Deficiency Report
DT&E	Developmental Test And Evaluation
EFS	Enhanced Flight Screening
EFSP	Enhanced Flight Screening Program
ELT	Emergency Locator Transmitter
ENJJPT	Euro-NATO Joint Jet Pilot Training
EOA	Early Operational Assessment
EP	Emergency Procedure
FAC	Functional Area Chief
FAR	Federal Aviation Regulation

FCF	Functional Check Flight
FE	Flight Examiner
FIP	Flight Instruction Program
FMC	Full Mission Capable
FMEA	Failure Modes And Effects Analysis
FOC	Final Operational Capability
FOT&E	Follow-on Test and Evaluation
FS	Flight Screening
FSS	Flight Screening Squadron
FTS	Flying Training Squadron
FTW	Flying Training Wing
GA	General Aviation
GAT	General Aviation Trainer
HVAC	Heating, Ventilation And Air Conditioning
IA	Inspection Authorization
IFESDR	In-Flight Engine Shutdown Rate
IFR	Instrument Flight Rules
IOT&E	Initial Operational Test and Evaluation
IP	Instructor Pilot
IPT	Integrated Process Team
JSUPT	Joint Specialized Undergraduate Pilot Training
LATR	Light Aircraft Training For ROTC
LRIP	Low Rate Initial Production
LRU	Line Replaceable Unit
LSI	Lear Seigler, Inc.
MACA	Midair Collision Avoidance
MCSP	Mission Completion Success Probability
MIP	Mentor Instructor Pilot
MOA	Manifestation Of Apprehension
MQT	Mission Qualification Training
MSL	Mean Sea Level
MTBF	Mean Time Between Failure
MWS	Major Weapon System
NAF	Numbered Air Force
NDI	Non Developmental Item
OA	Operational Assessment
OC-ALC	Oklahoma City, Air Logistics Center
OEM	Original Equipment Manufacturer
ORD	Operational Requirements Document
ORM	Operational Risk Management
OTS	Officer Training School
PIP	Pilot Indoctrination Program
PIT	Pilot Instructor Training
PMD	Program Management Directive
PPL	Private Pilot License

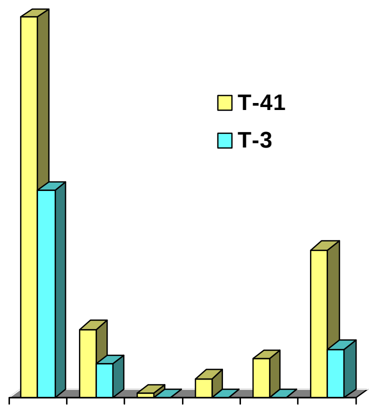
PQ	Pilot Qualified
PSACS	Pilot Selection And Classification System
PWS	Performance Work Statement
QAE	Quality Assurance Evaluator
QOT&E	Qualification Operational Test and Evaluation
QT&E	Qualification Test and Evaluation
RFP	Request For Proposal
RSA	Regulator Servo Assembly
RSU	Runway Supervisory Unit
SAF	Studies And Analysis Flight
SAIC	Science Applications International Corporation
SATP	Security Assistance Training Program
SFL	Simulated Forced Landing
SIE	Self-Initiated Elimination
SOF	Supervisor Of Flying
SON	Statement Of Need
SORD	System Operational Requirements Document
SOW	Statement Of Work
SP	Student Pilot
SRD	Systems Requirements Document
SSA	Source Selection Authority
STC	Supplemental Type Certificate
SUPT	Specialized Undergraduate Pilot Training
T.O.	Technical Order
TCAS	Traffic Alert And Collision Avoidance System
TEMP	Test And Evaluation Master Plan
TO	Take Off
TPS	Test Pilot School
TPWG	Test Plan Working Group
TRSS	Training Support Squadron
UAV	Unmanned Aerial Vehicle
UER	User Experience Report
UPT	Undergraduate Pilot Training
VFR	Visual Flight Rules

APPENDIX 2

SELECTED BRIEFING CHARTS

SAF/IG

T-37 Attrition 9501 - 9706



- T-41 Attrition Rate **13.4%**
- T-3 Attrition Rate **5.9%**
- **Bottom Line: T-3 trained students enjoy higher success rate in SUPT!**

SAF/IG

Current T-3A/T-37 PIT Academics

T-3 PIT Academics

Unit	Title	Hours
AA0201	Aerodynamics	1.0
SO0301/5	Systems Operation	3.5
ID0401	Instructor Development	2.0
EE0590	Written Qualification Examination	2.0
	8 blocks	8.5

T-37 PIT Academics

Unit	Title	Hours
AA-01/3	Aircraft Aerodynamics	6.0
AS-01/3	Aircraft Systems	9.0
ID-01/10	Instructor Development	13.0
AE-3790	Comprehensive Examination and Critique	4.0
FP-01/05	Flight Planning	13.5
CT-01/03	Centrifuge	8.0
FS-01/02	Flight Safety	1.0
C0101/08; C0190; I0101; F0101/2	Ground Training Units	24.5
	39 blocks	79.5

SAF/IG

Current T-3A/T-37 PIT Flight Program

T-3 PIT In-Aircraft

Unit	Title	Hours
C1101 - 08 (8 sorties)	Day Contact Training	10.4
C2101 - 07 (7 sorties)	Day Instruct. Training	9.1
C3101	Spin Training	1.3
N1101 - 02 (2 sorties)	Navigation Training	3.0
C4290 (checkride)	Instructor Pilot Evaluation	1.3
	19 sorties	25.1

T-37 PIT In-Aircraft

Unit	Title	Hours
T3001 - 10 (10 sorties)	Transition	14.0
T3390 (checkride)	Initial Aircraft Qualification	1.4
F3001 - 6 (6 sorties)	Formation Proficiency	7.8
C3101 - 11 (11 sorties)	Contact Instruction	14.3
I3101 - 12 (12 sorties)	Instrument/Nav Instruction	15.6
F3101 - 7 (7 sorties)	Formation Instruction	9.1
C4090 (checkride)	Instructor Qualification Evaluation	2.7
	48 sorties	64.9

SAF/IG

Proposed T-3A PIT Academics Revision

T-3 PIT Academics

Unit	Title	Hours
AA0201	Aerodynamics	1.0
SO0301/5	Systems Operation	3.5
ID0401	Instructor Development	2.0
EE0590	Written Qualification Examination	2.0
	8 blocks	8.5

T-3 Revised PIT Academics

Unit	Title	Hours
AA-01/2	Aircraft Aerodynamics	3.0
AS-01/3	Aircraft Systems	7.0
ID-01/10	Instructor Development	13.0
EE0590	Comprehensive Examination and Critique	2.0
FS-01/2	Flight Safety	1.0
C0201/07	Ground Training Units	13.0
	25 blocks	39.0

Proposed T-3A PIT Flight Revision

T-3 PIT In-Aircraft

Unit	Title	Hours
C1101 - 08 (8 sorties)	Day Contact Training	10.4
C2101 - 07 (7 sorties)	Day Instruct. Training	9.1
C3101	Spin Training	1.3
N1101 - 02 (2 sorties)	Navigation Training	3.0
C4290 (checkride)	Instructor Pilot Evaluation	1.3
	19 sorties	**25.1**

T-3 Revised In-Aircraft

Unit	Title	Hours
C11XX- 09 (9 sorties)	Contact Proficiency Training	11.7
C21XX - 07 (7 sorties)	Contact Instruction	9.1
C31XX - 04 (4 sorties)	Advanced Handling/Spin Training	5.2
C4290 (checkride)	Instructor Pilot Evaluation	1.3
	21 sorties	**27.3**