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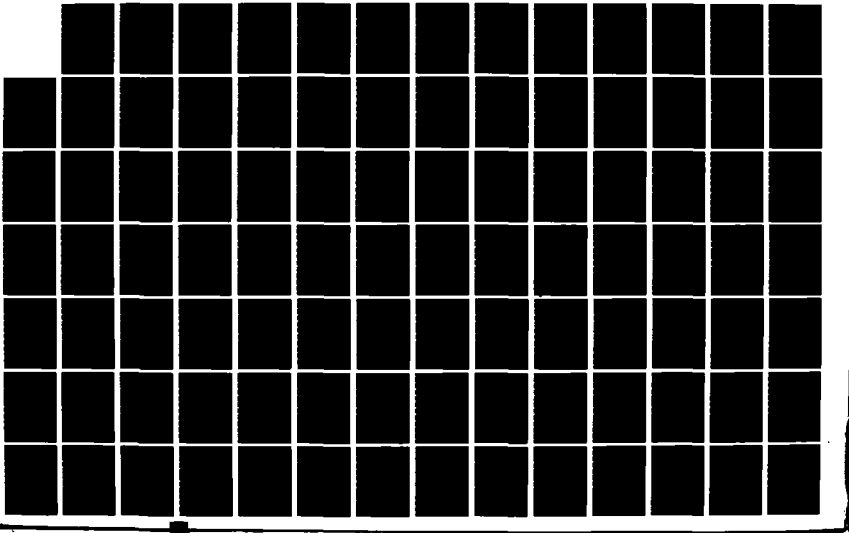

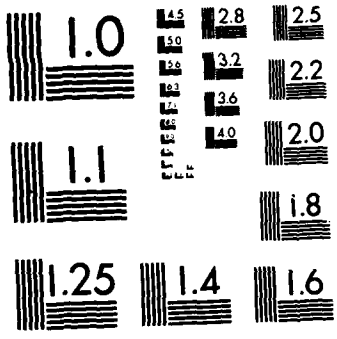

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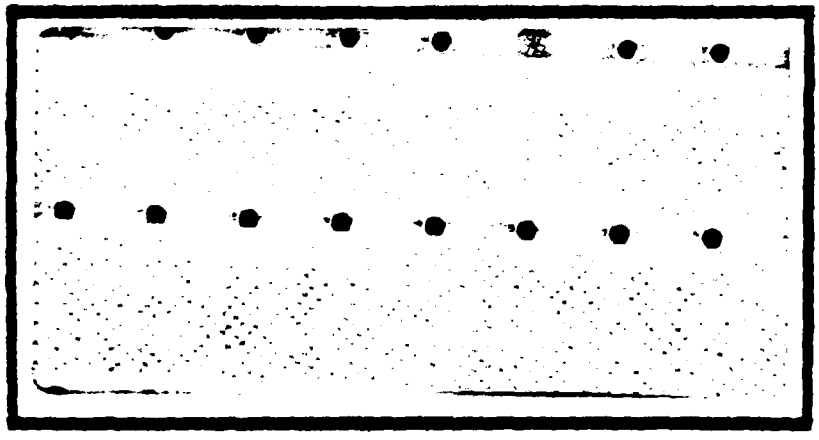

DEPARTMENT OF THE AIR FORCE

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Wright-Patterson Air Force Base, Ohio

ANALYSIS OF THE PILOT CONVERSION PROCESS FOR THE AIR FORCE T-46A JET TRAINER AIRCRAFT

V. Seth Jensen, Major, USAF

LSSR 51-83

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The objective of this research was to critically evaluate a portion of the Air Training Command T-46A Implementation Master Plan dated 1 March 1983. The process of converting students and instructor pilots from T-37 to T-46A was analyzed for feasibility and sensitivity to changes in certain resources and schedules. A simple analytical approach was used, calculating and comparing flying hours required versus available for various resource situations. The basic plan, as written for Laughlin AFB, is infeasible because of a shortage of flying hours during several months. The primary causes of this imbalance are: use of partial- and no-simulator syllabi; peak flying during the Operational Readiness Assessment (ORA); and the relatively low initial T-46A utilization rate. Some options for making the plan more workable are analyzed, as is a plan to convert without additional instructor pilots. Other approaches are suggested, without analysis. Besides the actual pilot conversion, there are brief analyses and comments on acquiring additional instructor pilots, manning the ORA, and conversion at subsequent bases. The findings are based on specific assumptions which must be clearly understood. The author concludes that the basic plan can be made feasible by applying suggested modifications.

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ANALYSIS OF THE PILOT CONVERSION PROCESS FOR THE AIR FORCE T-46A JET TRAINER AIRCRAFT

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Systems Management

By

V. Seth Jensen, BSEE
Major, USAF

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This thesis, written by

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has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

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But above all of these I owe a debt of gratitude to my wife, Jean, and our six children who have sacrificed greatly in order to allow me the time to complete this thesis and graduate degree.

V. Seth Jensen

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Background and Justification

The United States Air Force is currently in the early stages of procuring a replacement aircraft for the aging T-37 primary jet trainer. Formerly known as the Next Generation Trainer (NGT), the new aircraft has been designated the T-46A, or simply the T-46 (33:1). Fairchild Republic Corporation is on contract for Full Scale Development, production, and delivery of the first 54 aircraft by the Initial Operational Capability (IOC)[1] date, 30 September 1987 (13; 32; 33:2-3,8). The using command, Air Training Command (ATC), has selected Laughlin Air Force Base, Texas, to be the first to transition from the T-37 to the T-46.

Although numerous Air Force units over the years have made the transition from one aircraft to another, only very general guidelines are written which are applicable to all such transitions (1). The primary sources of guidance for planning an aircraft conversion appear to be records of recent conversions and the memories of those who were involved in them (24; 25).

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[1]IOC is defined as the date when the first student pilot training begins in the T-46A.

Two aspects of the T-37/T-46 conversion stand out as unique. First is the requirement to maintain normal student pilot production during transition; i.e., there should be no break or reduction in training (20; 21). This is quite different from the usual conversion process. For instance in the recent conversion from the RF-4C to the F-16 at Shaw Air Force Base (AFB), there was much less overlap between the two aircraft (19:26.6-26.7). In fact, the termination of RF-4C flying was accelerated by three months from the original plan (18:4.7). Moving out the previous aircraft system before arrival of the new aircraft greatly simplifies the conversion since there is no requirement to operate and maintain two different weapon systems simultaneously as there will be with the T-37/T-46 conversion. The second unique aspect is that ATC has not changed pilot training aircraft in about 20 years. Lack of recent experience is good reason to make an extra effort to ensure adequate planning.

Although planning for the transition is still in its early stages, ATC has developed an initial plan of action establishing their desired method and schedule for the transition (3). The plan is ATC Program Action Directive, PAD 1-83, T-46A Implementation Master Plan (17), hereafter referred to as the Master Plan. ATC expects to revise this document as planning progresses. Scheduled revisions are every six months (3; 17:3-4).

As in any project of this magnitude, planning progresses through many iterations. Planners at ATC as well as the T-46A System Program Office (SPO) are interested in identifying critical factors in the transition process and deficiencies in the plan which might adversely impact

the transition schedule (8). ATC operations planners are already aware of some potential problems in the current Plan (10). One of the primary ones relates to the need for additional instructor pilots during the conversion. Current planning is based on acquiring 30 additional IPs for Laughlin during their conversion. Part of this "bubble" of IPs will be moved from base to base as each transitions to the T-46 (17:B-3,C-2). No plans yet address options for the conversion with less, or no, additional manning.

Another potential problem has to do with the T-46 aircraft utilization rate. ATC planning is based on an initial rate of 45 flying hours per month for each aircraft, gradually increasing to 60 hours. Experience shows that few newly procured aircraft have achieved their target utilization rates. Some planners expect a T-46 rate closer to 30 (11). No plans yet address the impact of a utilization rate less than 45.

ATC and SPO planners are interested in options for resolving potential transition problems such as those mentioned above and have welcomed an independent review (8; 10; 20; 24). Efficient approaches to various aspects of transition may prevent delays in the process and could result in improved mission effectiveness.

Problem Statement

The problem is that the T-46A Implementation Master Plan has not been critically analyzed for feasibility or for sensitivity to changes in resources and schedules.

Research Objective

The objective of this thesis is to critically evaluate a portion of the Master Plan, specifically the pilot conversion process.

Scope and Limitations. Evaluation of the entire transition process as outlined in the Master Plan is beyond the scope of this research project. This study focuses strictly on conversion of the pilot force -- instructors and student pilots -- from the T-37 to the T-46. It concentrates on transition scheduling and sequencing. It examines in detail the conversion at Laughlin AFB, which will take approximately one year (17:C-10; 21); and in a more general sense it addresses the entire conversion throughout ATC, which will stretch over several years (17:C-10). Some of the specific lessons learned with Laughlin may be applicable to the remainder of the conversion.

The research investigates the impacts of these factors on the pilot conversion: additional IP requirements; IP transition training; T-46 aircraft delivery; the Operational Readiness Assessment; T-46 utilization rate; student pilot syllabus length; and T-46 simulator delivery.

This research does not consider the following factors except where they directly impact the pilot conversion process: maintenance and other technical training, supply, transportation, contracting, other logistics requirements, personnel functions, publicity, flight surgeon functions, civil engineering and services, inspector general functions, and retirement of the T-37 aircraft fleet. For purposes of this study, except as indicated otherwise, it is assumed that these functions will be carried

out in a manner that will avoid adverse impact on the pilot conversion process. In addition, this study does not consider the division of duties and responsibilities among various organizations.

Definition of Terms

Undergraduate Pilot Training (UPT) -- refers to United States Air Force initial pilot training as it is currently operated. It is a single-track training program where every student follows the same training plan (with minor variations) and flies the same aircraft, T-37 and T-38.

Specialized Undergraudate Pilot Training (SUPT) -- is a dual track training program planned for implementation in 1986. In SUPT all student pilots will fly the T-37 (or T-46 later) 85 hours in the "primary" phase. However, they will follow one of two tracks in the "basic" phase: Fighter-Attack-Reconnaissance (FAR) or Tanker-Transport-Bomber (TTB). FAR student pilots will train in the T-38. TTB students will fly in a new trainer, perhaps an "off-the-shelf" business jet (15:1,10-11).

Full Simulator Syllabus (Full Sim) -- The normal SUPT T-37/T-46 training syllabus with 85.0 hours of flying time and 35.1 hours simulator time (15:12).

Partial Simulator Syllabus (50% Sim) -- A T-37/T-46 syllabus with 107.1 hours flying and 15.6 simulator hours (17:C-11).

No Simulator Syllabus (No Sim) -- A T-37/T-46 syllabus with 118.0 flying hours but no simulator training (17:C-11).

Initial Operational Capability (IOC) -- means the date on which the first class of student pilots in UPT/SUPT begin training in the T-46 aircraft. Air Force's target IOC date is not later than 30 September 1987 (33:2-3,8).

Site Activation, System Activation or Deployment -- are synonymous.

> Activation is concerned with the overall process of effectively uniting facilities, prime and support hardware, personnel and publications and delivering a supportable and operational system to the operating command [31:para 1].

Transition or Conversion -- these two terms are synonymous and are used in a more limited sense than site activation. They refer to the process of changing the flying operation from T-37s to T-46s.

Initial IP Cadre -- means the small group of T-46 instructor pilots who will be trained in the T-46 at Edwards AFB and conduct the transition training of other IPs at Laughlin AFB (17:B-1).

Transition Training -- is the formal training course to convert fully qualified T-37 IPs to fully qualified T-46 IPs.

Flight or Student Pilot Flight -- is a group of normally 30-40 student pilots who proceed through pilot training as a class. A T-46 squadron will have six flights (16:II-10; 17:C-3).

Flight of IPs -- means the group of approximately 15 instructor pilots who train a student pilot flight (16:II-10).

IP Bubble -- Additional IPs acquired from outside ATC to help make the T-46 conversion. ATC plans on a total of 30 in this bubble including the nine initial IP cadre, six IPs for wing overhead, and 15 flight IPs. After completion of the Laughlin conversion the 15 flight IPs will flow through subsequent UPT/SUPT bases as each transitions. The other 15 will transfer to Randolph AFB to conduct all further transition training (11; 17:C-2; 21).

Utilization Rate or UT Rate -- is the mean number of hours flown per aircraft per month for a group of aircraft. Normally all the aircraft in the squadron are included in computing the UT rate.

Sortie -- A sortie is one flying mission or training mission, normally including just one initial takeoff and one full stop landing. A typical sortie, also commonly called a flight, might be 1.3 flying hours.

Note: The next five definitions apply to terms used in USAF Program Flying Training Volume 1, ATC (PFT). This document, which is printed three or four times a year, provides UPT class dates, student loads, production forecasts, and resource requirements (16:i).

Work Days -- Normal federal work days, five days a week less federal holidays and approximately a two week Christmas break. There are 246 work days annually.

Training Days or Flying Days -- There are 210 scheduled or expected flying days per year in SUPT. Work days minus expected weather losses (unscheduled days) equal flying days.

Flying Factor -- The mean number of flying hours required each scheduled flying day for each student pilot enrolled. These required hours account for not only student flying but also instructor proficiency flying.

Flying Training Hours -- Total student and instructor flying hours required for a given period of time. It is computed by multiplying mean student load, times the number of flying days, times the flying factor.

Additional Flying Hours -- Aircraft flying hours that are not directly associated with student pilot training. It includes flying hours other than the flying training hours listed above. For example, Laughlin currently forecasts 135 additional flying hours monthly.

Airfield Flying Hour Capacity -- The maximum number of T-37/T-46 daylight flying hours that can be expected on the normal work days for a given month. It assumes operation from the primary T-37/T-46 runway with one sortie launched every three minutes. It accounts for weather losses, operations and maintenance losses, and is limited by maximum number of IPs that can be gainfully employed year round.

Abbreviations

Abbreviations and acronyms used in this thesis and in the T-46 Master Plan are contained in Appendix A (17:iii-v) and in Appendix B.

CHAPTER II

REVIEW OF RELATED LITERATURE

This literature review has two main parts. The first is intended to give the reader a basic understanding of the Air Force's site activation process. The second provides an outline of the ATC transition plan as presented in the Master Plan.

During the literature search much data was located relating to Air Force weapon system site activations (18; 19; 25; 28; 29). These provide base-specific details on functions introduced in the next section. However, they are not reviewed here because they do not relate to the unique situation in this conversion. The only data found concerning the specific problem of converting aircraft while maintaining normal flying schedules was the Master Plan itself.

The Site Activation Process

Although much of the information presented in this section concerns functions which are outside the scope of this project, it is presented here to give the reader some appreciation for the complexity of the overall site activation effort and the organizations which are involved. ATC's responsibilities, with which this research is concerned, are mentioned near the end of the section.

The basic governing document, which provides only general guidelines for the site activation process, is a joint regulation of Air Force

Systems and Air Force Logistics Commands -- Site Activation/Alteration Task Force, AFSCR/AFLCR 800-11. It defines site activation in basically the same way as described in the definition section of Chapter 1. Air Force Systems Command (AFSC) has overall responsibility to manage site activation (1:1). Air Force Logistics Command (AFLC) as well as AFSC and the using command all have specific responsibilities. AFSC manages the process through its System Program Director (SPD) (31:para 2.2).

In managing the total effort, some of AFSC's specific responsibilities are (31:Atch 4.1, para 1-6):

-- Develop site activation schedules in coordination with the using command, ATC in this case

-- Appoint the commander of the Site Activation Task Force (SATAF)

-- Ensure thorough planning for "integrated logistics, training, operational support, technical orders, spares, support equipment, and facilities ... [31:Atch 4.1, para 2]"

-- Coordinate with the using command for schedules of SATAF conferences for each base to be activated

-- Provide engineering support to the SATAF commander as necessary

-- Participate in on-site systems and equipment tests of operational capability and supportability (31:Atch 4.1, para 2E)

-- Through the engine System Program Office (SPO) be responsible for activation of the aircraft engine and engine support facilities at each base

-- Coordinate with and provide management and technical support to the using command for all Military Construction Program (MCP) facilities

-- Through the SATAF Commander who serves under direction of the SPD, direct the on-site portion of the site activation through approved plans (31:Atch 4.1, para 6A)

-- Also through the SATAF Commander, ensure

> that the functional responsibilities for Logistics, Engineering, Communications, Program Control, Test and Evaluation, Administration, Military Construction, Safety Engineering, and Training are carried out I.A.W. [in accordance with] AFSCR/AFLCR 800-11 [31:Atch 4.1, para 6B]

AFLC's responsibilities include the following:

-- Establish detachments of personnel to carry out logistics functions supporting SATAF operations (31:Atch 4.1, para 7A)

-- Support the SATAF Commander with logistical expertise in

> maintenance, supply, test equipment, transportation, packaging, materials handling, calibration and metrology, and technical data ... and accomplish site inventories before turnover [31:Atch 4.1, para 7B]

-- Monitor receipt and accounting for all equipment and spares furnished to the operating command (31:Atch 4.1, para 7C).

The using command (ATC) provides a co-chairman for the SATAF conferences (31:Atch 4.1, para 8B) and is responsible for the Master Implementation Plan which includes:

-- Activation plans for each base

-- Construction or modification of facilities

-- Training of operations and maintenance personnel in the new aircraft system

-- Providing manpower and equipment needed for the activation process at each base (31:Atch 4.1, para 8; 33:7-8)

A portion of this Master Plan is the specific subject of this research.

The SATAF Commander and the nucleus of the Site Activation Task Force are physically located at the activation site during the final phases of the activation planning and implementation. Normally four SATAF conferences are held leading up to IOC, the first being approximately two years before IOC (31:para 3.5.2). The SATAF is a working team composed of personnel from AFSC, AFLC, and the using command. SATAF conferences are chaired by the SATAF Commander and co-chaired by the using command's plans office. Their mission is to develop and execute a Site Activation Management Plan for the base of concern to ensure that all necessary actions are taken to effect activation on time. Primary working groups in the SATAF are plans and programs, facilities, spares, support equipment, maintenance training, aircrew training/operations, technical orders, and systems safety (31:para 2-3).

The T-46A Implementation Master Plan

Air Training Command's general plan for guiding the transition process is the ATC Program Action Directive, PAD 1-83, T-46A Implementation Master Plan, dated 1 March 1983. This Master Plan will be revised periodically as planning progresses (17:3-4). This section explains applicable portions of the Master Plan as a broad basis on which research in this study was built. Parts of the plan were analyzed in detail during the study.

Assumptions. A number of assumptions in the Master Plan and other planning documents affect the pilot conversion process:

1. Funds will be provided as required for the projected aircraft and simulator delivery schedules (17:2). The most recent schedules are contained in the T-46A Program Schedule and the T-46A Aircrew Training Schedule (30; 32).

2. Only one pilot training base will transition at a time (17:2,C-1).

3. Laughlin AFB will be the first to transition (17:C-2,C-5).

4. The Specialized Undergraduate Pilot Training (SUPT) syllabus will be used for the T-46 (17:3).

5. Concurrent SUPT and T-46 implementation will not be attempted at the same base (17:2).

6. If for some reason SUPT is delayed, UPT will still convert to a three-week class entry cycle (from the current six-week cycle) with 14 classes of 37 students per year, prior to T-46 transition (17:3,C-3).

7. Aircraft and instrument flight simulator IOC will be simultaneous at Laughlin AFB and at each subsequent base as each transitions (17:2,C-1).

8. Each base's simulator facility is comprised of two complexes of four T-37 cockpits each. One of Laughlin's complexes will be converted, for T-46 training, before IOC. Downtime for this first conversion will not exceed six months. Subsequent simulator conversions should take no more than four months (17:3).

9. During the T-46 implementation, some classes will require extra flying time due to simulator downtime. They will fly a partial or no simulator syllabus (17:C-1).

10. Initial operations and logistics planning is based on a 45 hours/month T-46 utilization rate. The rate will gradually increase from 45 to 60 hours per month between the eighteenth and twenty-fourth months following completion of the Operational Readiness Assessment (ORA) (17:3,C-1).

11. Requested additional manpower resources will be approved by Headquarters, U.S. Air Force, and allocated to ATC at least 12 months before the effective date of the requirement (17:B-1,E-1).

12. Nine of the 12 pilots flying the Initial Operational Test and Evaluation (IOT&E) at Edwards AFB will become the initial IP cadre at Laughlin AFB. The other three will return to Randolph AFB as the initial cadre for Pilot Instructor Training and transition training there (17:B-1; 21; 24).

13. Instructor pilots will not be dual qualified; i.e., in both the T-37 and T-46. Therefore, when an IP begins transition training into the T-46, he can no longer fly the T-37. One exception to this policy may exist. A few key pilots such as the wing commander, safety, and standardization/evaluation pilots may be dual pilot qualified (not IP qualified) during the ORA (11; 17:C-1).

14. Pilot production through UPT/SUPT will be sustained during the T-46 implementation. Initial planning assumed a 2200 annual goal for the command (17:C-1).

15. Implementation is based on operational capability and class integrity and is not tied to the increased aircraft delivery rate possible under the current acquisition schedule (30 Aug 82) [17:C-1].

Concept of Operations. The first two T-46s produced will be test aircraft. They will be delivered to Edwards AFB, California, in the third quarter of Fiscal Year 1985 (FY 85), and will be used for Development Test and Evaluation (32). The first production aircraft will probably also go to Edwards in the second quarter of FY 86 (11; 32). These three aircraft will then be used for Initial Operational Test and Evaluation (IOT&E). Production aircraft deliveries will then begin at Laughlin AFB in April or May 1986. The production rate will increase gradually over the years from one to 12 per month. Deliveries will continue until May 1992 according to the current plan (17:3, C-1, C-5, 32). The production aircraft delivery schedule for the six year period is contained in Appendix A (17:C-5).

An outline of the entire command-wide implementation schedule is also contained in Appendix A (17:U-1 to U-3).

The first Air Force pilots to fly the T-46 will be test pilots at Edwards AFB and instructors from Pilot Instructor Training (PIT) at Randolph AFB, Texas. Three PIT instructors will be assigned to Edwards on a permanent change of station (PCS), while nine will go there on temporary duty (TDY). Upon completion of their training plus aircraft test and evaluation, probably nine of these original 12 will be assigned as the initial cadre at Laughlin. They will train experienced T-37 IPs into the T-46 (17:B-1, 21; 24).

ATC plans to acquire additional manning to assume the extra workload during transition. ATC has requested authority to acquire up to 10 additional IPs for PIT at Randolph and up to 30 IPs for Laughlin. Additional IPs may come from within the command or from outside ATC. If they come from within ATC, the vacancies they leave will then have to be filled from Air Force resources. Additional IPs who come from outside ATC will go through the normal series of training before assuming IP duties. Training includes Pilot Instructor Training (PIT) at Randolph, as well as pre-PIT and post-PIT local checkout at Laughlin. Half of the additional manning positions at Laughlin will be in the T-37/T-46 squadron. The other half will include the nine initial cadre plus six in wing overhead (17:3,B-3,C-6; 20; 21).

This "manning bubble" will be moved from Laughlin upon completion of the transition there. Approximately 15 will go to the T-37/T-46 squadron at the next transition base, Williams AFB, and then to each successive transition base. Transition training will also move from Laughlin, but it will go to Randolph where it will remain for the rest of the T-46 implementation. Therefore, about 15 of the manning bubble will move to Randolph to support transition training (11; 17:C-2).

As additional IPs from the manning bubble arrive at the squadron, experienced IPs may be released to transition to the T-46. Transition training will normally be done by flights. It is planned for either 15 or 30 training days and is expected to require 14 sorties and 21.0 flying hours per trainee (17:C-2,C-7).

The first IPs who transition to the T-46 will assist with flying during the Operational Readiness Assessment (ORA). Some IPs may be transitioning during the ORA. The ORA calls for 2400 hours to be flown in two months -- 20 aircraft at 60 hours per month per aircraft on the average. It is to start 30 days after delivery of the twentieth aircraft to Laughlin in January 1987 (17:C-1).

After completion of the ORA, the first flight of T-46 IPs will be available to return to the squadron and begin a student pilot class (flight) in the T-46. The IOC, defined as the initiation of student training, will occur not later than the fourth quarter of FY 87; i.e., September 1987. ATC's target date for IOC, however, is July 1987 (17:3, C-10,U-1).

One T-37 flight at a time will transition to the T-46. It is expected to take about a year to convert the whole T-37 squadron at each base to the T-46. The class which enters three weeks after IOC will probably fly the T-37 rather than the T-46 due to insufficient numbers of T-46 aircraft or IPs. Each new class will fly either the T-37 or T-46 depending on available resources. A class which starts in T-37 will fly it throughout the primary phase. Therefore, no student class will fly both T-37 and T-46 (17:C-9; 16).

A T-46 squadron will be organized into six flights, each consisting of approximately 15 instructor pilots (IPs). Each flight will train one class of student pilots (SPs) at a time. A class will consist of about 37 students and require about 90 training days or 18 weeks including 65 flying sorties (85 hours). Classes will enter three weeks apart, each

class being assigned to the flight which has just completed its previous class (15:12; 16:II-10; 21).

When the first flight of IPs returns from transition training, they will assume duties of another flight who will then go to transition training. This will occur at the beginning of a new student pilot class. This process will continue until all flights of IPs are transitioned and all students are flying the T-46 (11; 17:C-2,C-9). The student class transition schedule for the command is shown in Appendix A (17:C-10).

Although instrument flight simulator (IFS) procurement has not advanced as far as aircraft procurement, it is hoped that simulator IOC will occur simultaneously with aircraft IOC. The simulator is an integral part of the student pilot training program. Therefore, during conversion of each of the two IFS complexes, a partial simulator syllabus will be used for some classes. It will require more flying time to make up for less simulator time. A non-simulator syllabus might even be needed for some student classes (17:3). Appendix A describes these alternate syllabi (17:C-11). Laughlin's first IFS complex will be shut down and begin conversion six months before IOC in anticipation of being ready for use with the first T-46 class. The other complex will shut down six months after IOC and should be converted by the time the last student flight converts to the T-46 (17:C-3). Appendix A shows the complete simulator conversion schedule (17:C-12).

CHAPTER III

METHODOLOGY

Overview

A variety of techniques and approaches were considered for use in evaluating the planned pilot conversion process. Those that were seriously considered but not selected are a network planning and control technique, queueing theory, mathematical programming, and computer simulation. Reasons for their non-selection will be described in this chapter. The method used is a simple analytical approach which will be described later.

Methods Considered But Not Selected

Network Planning and Control Technique. Some interactions of factors and variables in the pilot conversion process can be studied by a technique such as PERT (Program Evaluation and Review Technique) or CPM (Critical Path Method) (2:128-140). In fact, a modified PERT was used to assist in gaining a greater understanding of sequences in the conversion process. Although this exercise was of some value, the activities overlap and interact in such a way as to make it very difficult to rigorously apply the technique. PERT appears more applicable to a "macro-view" of the site activiation than to this study's "micro-view" of the pilot conversion. The necessary sequence and times for activities are already fairly well understood. Therefore, PERT's usefulness for

further study of the pilot conversion process is questionable.

Queueing Theory. Some activities in the conversion involve a queueing, or waiting line, process. For instance, the required training sequence for new IPs and the transition training of IPs might be studied, in part, by a queueing model. However, some of the basic assumptions of analytical queueing models -- Poisson arrival and exponential inter-arrival distributions -- are violated. (9:438). Also, analytical queueing models get extremely complex when analyzing more than a simple structure (9:498). Such is the case here.

Mathematical Programming. It appeared that some type of mathematical programming might be applicable to certain aspects of the study. For instance, linear programming (9:95) might be used to determine the best schedule for IP transition training based on existing constraints and some predetermined decision criteria. However, given ATC's plan to transition each flight of IPs as a group and given other scheduling constraints in the system, the number of scheduling options is quite limited. Therefore, it seemed clear that enumeration of some potential options and analysis of each would be more appropriate than linear programming.

Computer Simulation. It appeared that perhaps computer simulation would provide a useful tool, overcoming some of the limitations of the previously mentioned approaches. A major effort and considerable time were spent developing a computer simulation model of a portion of the conversion up to the ORA.

The simulation language selected for use was Q-GERT. "GERT is an acronym for Graphical Evaluation and Review Technique. The Q is appended to indicate that queueing systems can be modeled in graphic form [26:vii]." Also, Q-GERT has been used to support evaluation of PERT networks (26:5,12). Therefore, Q-GERT appeared potentially applicable to this model, having elements of both PERT and queueing approaches.

The model became quite complex even for this relatively simple part of the conversion. Some simplifying assumptions were that IPs could enter transition training two at a time rather than as a whole flight, and that each cadre member would train exactly two IPs per class. Also empirical data was not available for some parameters, so reasonable values had to be assumed. These limitations led to serious doubts concerning the validity of the model in representing the actual conversion process (27:208-242).

It is also interesting to note that ATC has attempted to model the entire conversion and site activation process through simulation. They have encountered monumental complications due partially to continual changes, lack of documentation, and the sheer magnitude of the project. No documentation on this simulation was available from ATC (16). Bearing in mind the difficulties ATC has experienced and the constraints on this research project, it became evident that a simulation model is not the answer for this study. Indeed it is probably a more complex and expensive technique than is needed to evaluate the pilot conversion process.

In summary, the problem of this study is basically unstructured, and cannot be forced into any of these structured models or techniques.

A Simple Analytical Approach

A logical analytical and common sense approach was employed to study the pilot conversion process in the ATC Master Plan. It was

analyzed in segments and taken apart a piece at a time to see if the pieces fit together properly. The following kinds of questions were used to guide the analysis:

1. Is each segment of the plan feasible? Are any binding constraints violated? Are there conflicts in scheduling or sequencing of activities?

2. What are the critical factors, variables, or events which are most likely to delay the pilot conversion process?

3. How much variation in these factors can occur before an adverse effect is felt?

4. What are other feasible scheduling options for each segment of the conversion process?

5. If a segment of the plan is infeasible, what factors can be changed, and by how much, to make it more workable.

Segments of the Master Plan. The conversion process will be broken into the following segments:

1. Acquisition of the manning bubble of additional IPs

2. Transition training of the first group of IPs into the T-46

3. The Operational Readiness Assessment (ORA)

4. Student flight conversion and the remainder of transition training at Laughlin

5. Pilot conversion at the other UPT/SUPT bases

The first three of these segments are addressed in Part 1 of the analysis (Chapter IV) and are basically the pre-IOC portion. The second part of the analysis (Segments 4 and 5) is covered in Chapter V and

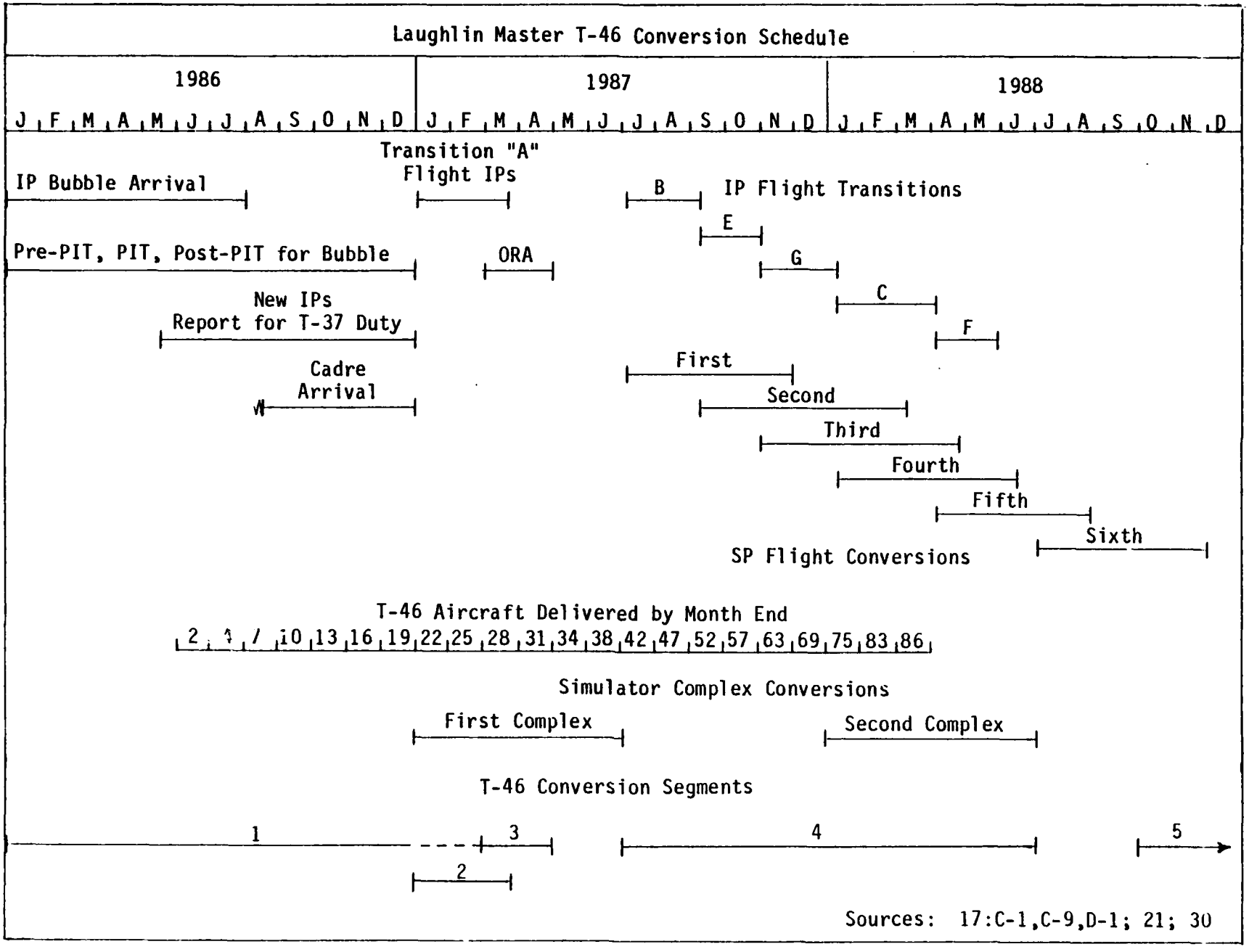
concerns primarily the post-IOC period.

Factors. The following factors will be considered in determining feasibility of the plan, sensitivity to change, and other scheduling options:

1. The size and arrival times of the additional IP manning bubble
2. The T-46 transition training syllabus length
3. T-46 aircraft delivery schedule
4. T-37 and T-46 utilization rates
5. Student pilot syllabus length
6. Instrument flight simulator (IFS) delivery schedule
7. Pilot manning options for the ORA
8. Sequencing of aircraft and simulator deliveries with overall conversion schedules at the later bases

Organization of the Analysis. The Laughlin Master T-46 Conversion Schedule (Figure 3-1) was developed to help visualize how the five segments fit together. Segment 1 will run approximately throughout 1986, perhaps into January or February 1987, and includes arrival and training of 21 of the IP bubble. These will provide for the 15 additional flight IP and six wing overhead positions. Also during Segment 1, the other nine of the bubble, the T-46 IP cadre, will report to Laughlin toward the end of the year. Aircraft deliveries to Laughlin begin in June 1986 and continue into Segment 4 (17:C-2; 21; 30).

Figure 3-1


Laughlin Master T-46 Conversion Schedule
1986
1987
1988
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
Transition "A" Flight IPs
IP Bubble Arrival
B
IP Flight Transitions
E
Pre-PIT, PIT, Post-PIT for Bubble
ORA
G
C
New IPs Report for T-37 Duty
F
Cadre Arrival
First
Second
Third
Fourth
Fifth
Sixth
SP Flight Conversions
T-46 Aircraft Delivered by Month End
2 4 7 10 13 16 19 22 25 28 31 34 38 42 47 52 57 63 69 75 83 86
Simulator Complex Conversions
First Complex
Second Complex
T-46 Conversion Segments
1
2
3
4
5
Sources: 17:C-1,C-9,D-1; 21; 30

Segments 1 and 2 may overlap slightly. Segment 2, training of the first 21 IP transition trainees into the T-46, can begin as soon as some of them are released from T-37 duties by the new IPs. A logical time is to transition them just before the ORA. Some could actually be transitioned during the ORA, overlapping Segment 3 as shown in Figure 3-1.

Segment 3, the Operational Readiness Assessment, is depicted in March and April 1987. It could occur earlier or later depending on actual delivery of the twentieth Laughlin aircraft. (Remember the ORA is to start thirty days after the twentieth aircraft arrives.) The first simulator complex is converted to T-46 during Segments 2 and 3 and is completed as Segment 4 begins (17:C-1 to C-3).

There is a break of about two months planned between the ORA and Segment 4, which begins at IOC. The remainder of the Laughlin transition training and the conversion of student flights to the T-46 (Segment 4) consume the next year, July 1987 to July 1988. The second simulator complex is converted during the last half of this period. Laughlin aircraft deliveries should be completed in March 1988 (17:C-10,C-12).

Segment 5, T-46 conversion at other UPT/SUPT bases, is not depicted in Figure 3-1, but would begin at Williams AFB in October 1988 (17:C-10).

As the analysis of the five segments proceeded, the master conversion schedule was useful in identifying activities and events which impact each other.

Plans for Segments 1,2, and 3 are not yet developed in detail. Therefore the analyses consisted mainly of developing feasible alternatives and checking the impacts of various factors. For Segment 3, equations

and worksheets were developed to assist in producing feasible pilot manning options for the Operational Readiness Assessment.

Segment 4 -- the actual instructor and student pilot conversion at Laughlin -- occupied the bulk of the analysis. It included developing tabular worksheets, summary tables, and figures as well as deriving formulas. These were used for computing and comparing required versus available resources by date in order to assess the feasibility of the Master Plan. Modifications to the plan and other options were evaluated to determine the effect of each factor listed earlier.

Segment 5 is planned only in general terms at this time. It was not analyzed in the same detail as Segment 4. However, similarities and differences between the Laughlin and subsequent conversions were listed, along with comments on the probable impacts of the differences.

Due to the fact that each segment required different analysis tools and techniques, details of the methods used will be explained along with each segment analysis. The next two chapters present these analyses. Chapter IV looks at the activities prior to IOC. Chapter V focuses on the post-IOC operations, particularly the actual student flight T-46 conversions.

CHAPTER IV

ANALYSIS OF THE ATC MASTER PLAN - PART 1

The Master Plan is analyzed in five segments, the first three of which are covered in this chapter:

1. Acquisition of the manning bubble of additional IPs.
2. T-46 transition training for the first group of IPs.
3. The Operational Readiness Assessment (ORA).

The Master Plan is very brief in its plans for these three segments; detailed procedures have not yet been developed. The general objective, therefore, became to develop feasible options for each segment. Factors which are of concern in these three segments are:

1. The size and arrival times of the IP bubble.
2. The T-46 transition training syllabus length.
3. T-46 aircraft delivery schedule.
4. T-46 utilization rate.
5. Pilot manning options for the ORA.

Segment 1, Acquisition of the Manning Bubble of Additional IPs

In this segment, since there are no detailed plans to be analyzed, comments are simply provided on a feasible approach for leading up to later segments of the conversion.

The Master Plan indicates that the bubble of 30 additional IPs will be authorized in FY 86, or as early as October 1985[1] (17:C-6).

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[1]A conflict exists between pages C-6 and B-3. Page B-3 says the 30 additional IPs become authorized in FY 87. This would be too late to meet the implementation schedule and is apparently in error (22).

Training these IPs will be spread approximately evenly throughout CY 1986 (21). Training a new IP requires approximately four and one-half months including four to six weeks of Pre-Pilot Instructor Training (PIT), 13 weeks of PIT, and one to two weeks of post PIT local checkout. According to ATC planners and operators, there is enough slack in all required training programs to accommodate the 30 additional IPs over one year without adversely affecting on-going programs (22; 35).

The 30 additional IPs will be used to replace the IPs who will go to T-46 transition. Nine will be distributed throughout the command to replace the nine cadre IPs. Twenty-one will go to Laughlin -- 15 to the T-37 squadron and six for wing overhead (17:C-6).

The 21 newly trained IPs for Laughlin must be performing T-37 instructor duties before experienced IPs can be released to T-46 transition[1] Pilot arrivals at Laughlin, ready for IP training, should be spread evenly from January to 1 August 1986. This will ensure meeting the earliest T-46 transition training required in Segment 2, which would begin January 1987. If there were a delay in arrival of trained IPs, the ORA could still begin 1 March as long as 12 IPs could begin transition 1 February and nine more 1 March.

Segment 2, Transition Training for the First Group of T-46 IPs

Analysis Objective. The objective of this segment analysis was to develop feasible options for the transition training. Effects of variations in the following factors were analyzed:

1. The size and arrival times of the IP manning bubble.

[1]Although Figure 3-1 shows T-46 arrivals during this period, the Segment 1 analysis is concerned only with T-37 training for new IPs.

2. The transition training course length.

3. T-46 aircraft delivery schedule.

4. T-46 utilization rate.

Assumptions. It is assumed initially that the following activities of Segment 1 have progressed as planned:

1. All nine T-46 cadre IPs will be at Laughlin before the beginning of transition training.

2. Enough of the bubble of IPs have been trained to release the required IPs for transition training.

3. Aircraft deliveries are on schedule.

T-46 Transition Training Options. The Master Plan does not specify a schedule for transitioning the first flight of IPs. Several alternatives are available however. The alternative selected depends on which approach is used for manning the ORA pilot requirements, which will be discussed in Segment 3.

The first ORA option requires that 30 pilots be fully qualified in the T-46 at the beginning of the ORA, which should occur approximately 1 March 1987. The 30 pilots would include the nine cadre (who are already current in the T-46) plus 21 others -- 6 wing overhead and the first flight of 15 IPs.

One alternative would be to train all 21 transition trainees as a class beginning early January 1987 using the 30 training day transition course (17:C-7). With 14 flying days expected both in January and in February, a few weekend flights may be required.[1] On the average

[1]See Appendix C for flying days per month (5).

each cadre IP would carry 2.33 trainees and fly 1.3 sorties per day.

Another alternative would be to fly two 15-day courses -- 9 trainees in January and 12 in February. The two courses would require 1.4 and 1.9 sorties per day per cadre IP for the two months respectively. Either of these alternatives is feasible. The advantage to the second approach is that 12 of the IPs can continue T-37 duties for an extra month, January.

The second ORA option requires, besides the cadre, just 12 more IPs to be transitioned by the beginning of the ORA. The other nine would transition during the first three weeks of the ORA. Transition for the 12 could be done on either a 30-day course (January and February) or the 15-day course (February only).

If there were no bubble of IPs, but only the nine-member cadre, little or no difference would be caused in this first transition training. The 21 other pilots for the ORA would still have to be trained; they would come from elsewhere in the SUPT wing but simply would not be replaced by new IPs. This situation is investigated in detail in Chapter V (Segment 4, Option 4).

More than adequate numbers of aircraft should be available (30; 32), requiring a UT rate of less than 13 hours per aircraft per month during this first transition. If aircraft deliveries fell behind schedule, the ORA would be postponed[1]; therefore, training would be postponed also.

Findings. The findings of the Segment 2 analysis are summed up as follows:

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[1]Remember that the ORA begins 30 days after the 20th aircraft delivery.

1. Transition training can proceed as scheduled whether or not the full IP bubble is acquired, as long as 12 transition trainees are available at least by 1 February 1987 and nine more are available a month later.

2. Either transition syllabus length would be usable depending on the transition option selected.

3. If aircraft deliveries fall behind schedule the ORA will be postponed. Transition training will also be postponed to begin not more than two months before the ORA.

4. The utilization rate is not a critical factor at this time. It could drop as low as 13 without affecting the transition training.

Segment 3, the ORA, is closely related to Segment 2 because of the potential overlap between the two. The option selected for transition training affects the approach required in the ORA.

Segment 3, Operational Readiness Assessment (ORA)

Analysis Objective. The objective of this segment analysis was to develop feasible options for manning the ORA with pilots.

The Master Plan contains only general requirements for the ORA. It is to begin 30 days after delivery of the twentieth aircraft to Laughlin in January 1987. It will last two months and involve 2400 aircraft flying hours -- 20 aircraft sustaining a mean UT rate of 60 hours per month (17:C-1,D-1). Assuming aircraft deliveries are on schedule, the ORA could run from 1 March to 30 April 1987.

The Master Plan does not specify how many pilots will be required for the ORA, nor what types of flying will be done. Because one purpose of the IP bubble is to provide extra pilots for the ORA, this analysis assumes 30 IPs will be used. It is not desirable to use the ORA to transition more IPs (more than these 30) because additional IPs will not be required for T-46 student training until after IOC, and they are needed in the T-37 until then. Delays in the arrival of the bubble would delay the ORA if the following minimums cannot be met:

-- 12 IPs enter transition training in February, or one month before the ORA.

-- Nine additional IPs transition as the ORA begins in March.

Several options were analyzed for manning the ORA pilot requirements. Two of these appear feasible and are presented here.

ORA Option 1. This option assumes that all 30 pilots are T-46 qualified beginning the ORA. If flying is spread evenly among all 30 pilots, and if all flying is dual (i.e., two T-46 pilots in an aircraft), each pilot would have to fly 80 hours per month. This may be excessive and would require a waiver to the ATC monthly limit of 75 hours per pilot. If all flying is done solo, only 40 hours per month would be required of each pilot. An approach somewhere between the dual and solo extremes is probably reasonable.

Pilots were divided into four groups depending on the number of flying hours they might be able to perform. The groups and flying hours per month are:

Group 1	1 Cadre Chief IP	30 Hours
Group 2	8 Cadre IPs	75 Hours
Group 3	6 Wing Overhead IPs	45 Hours
Group 4	15 Flight IPs	75 Hours

A worksheet was developed to tabulate types of flying by each group of pilots (Table 4-3). Table 4-1 defines the terms, and Table 4-2 shows the relationships between terms.

The next question was how much of each pilot's time could be dual proficiency time and how much would have to be solo in order to generate 2400 hours in two months. To answer these questions, two formulas were developed (See Appendix D for derivations.)

$$A = m(\Sigma\, n_i t_i - 1/2\, \Sigma\, p_i n_i t_i) = \text{total aircraft time} \qquad \text{(Eq. 1)}$$

$$p = 2 - \frac{2A}{m\Sigma n_i t_i} = \text{proportion of a pilot's time flown proficiency dual} \qquad \text{(Eq. 2)}$$

Solving Equation 2 for ORA Option 1,

$$p = .81$$

Also from Table 4-2,

$$s = 1 - d - p = 1 - 0 - .81$$

$$s = .19 = \text{proportion of a pilot's time flown solo}$$

Using these percentages, the rest of Table 4-3 was completed. Note that the total "p" hours under each group of IPs equals only half the sum of the pilots' "p" hours. Since two IPs are in the aircraft, this converts pilot time to aircraft time.

Table 4-1

Definition of Terms in ORA Worksheet

Term	Definition
i	Subscript to indicate pilot group: 1 = cadre chief, 2 = cadre, 3 = wing overhead, 4 = flight IPs
m	number of months
n	number of pilots of a particular group
t	flying time per month per pilot
d	proportion of a pilot's time flown dual, as instructor pilot
p	proportion of a pilot's time flown proficiency dual
s	proportion of a pilot's time flown solo or giving orientation
D	Aircraft time flown in dual instruction (T-46 cadre flying with a transitioning IP)
P	Aircraft time flown proficiency dual (two T-46 pilot's flying together)
S	Aircraft time flown solo (or for orientation flights)
A	Total aircraft time flown

Table 4-2

Relationships of Terms in ORA Worksheet

$$A = D + P + S$$

$$D = mntd \qquad d = \frac{D}{mnt}$$

$$P = mnt\frac{p}{2} \qquad p = \frac{2P}{mnt}$$

$$S = mnts \qquad s = \frac{S}{mnt}$$

$$d + p + s = 1$$

Table 4-3

ORA Worksheet - Option 1 (m=2)

	1		2		3		4		
	Cadre Chief		Cadre		Wing O/H		Flight IPs		Totals
Factor [1]	Ea.	Total	Ea.	Total	Ea.	Total	Ea.	Total	
n		1		8		6		15	30
t	30		75		45		75		
d									
D									
p		.81		.81		.81		.81	.81
P	48	24	122	486	73	219	121	911	1640
s		.19		.19		.19		.19	.19
S	11	11	29	228	17	103	29	428	770
A	69	35	151	714	90	322	150	1339	2410 [2]

Notes: [1]See Table 4-1 for definitions of factors.
[2]Small errors due to rounding.

Table 4-3 presents one feasible option for flying the 2400-hour ORA. To provide a better understanding column 4 is explained. There are 15 flight IPs who each fly 75 hours a month. No dual instruction time is flown. They fly 81% of their time proficiency dual, which totals to 121 hours for each IP over the two month period. The 15 IPs are credited with 911 aircraft hours flown proficiency dual [1/2(15)121]. (Note small discrepancy due to rounding.) Each pilot flies 19% of his time, or 29 hours, solo. All 15 fly 428 solo hours in two months. In total, each IP flies 150 hours while all 15 generate 1339 aircraft hours during the ORA.

Under this option pilots would be flying between 5.5 and 14.5 solo hours a month. These 770 solo hours might be used more productively to give orientation flights to T-37 and T-38 IPs and to maintenance personnel.

ORA Option 2. Option 2 is an approach that could be used to transition some of the 21 trainees during the ORA. Twelve would be trained before the ORA; and nine during about the first three weeks (m = 3/4 month). Two worksheets were used (Table 4-4). In the first worksheet m = 3/4, $n_3 = 0$, $n_4 = 12$; in the second, m = 5/4, $n_3 = 6$, $n_4 = 15$. To keep up the 1200 hour per month rate, 900 hours would need to be flown in the first period; 1500 in the second.

In Table 4-4a, the data in Columns 1 and 2 were determined by the requirement for nine cadre to transition nine new IPs at 21 hours each. Their remaining time was specified as solo. Then Equation 1 was

ORA Worksheet - Option 2

Table 4-4a (m=3/4)

	1 Cadre Chief		2 Cadre		3 Wing O/H		4 Flight IPs		Totals
Factor[1]	Ea.	Total	Ea.	Total	Ea.	Total	Ea.	Total	
n		1		8		0		12	21
t	30		75				75		
d		.93		.37					
D	21	21	21	168					189
p								.73	
P							21	246	246
s		.07		.63				.27	
S	2	2	35	282			15	182	466
A		23	56	450			36	428	901[2]

Table 4-4b (m=5/4)

	1 Cadre Chief		2 Cadre		3 Wing O/H		4 Flight IPs		Totals
Factor[1]	Ea.	Total	Ea.	Total	Ea.	Total	Ea.	Total	
n		1		8		6		15	30
t	30		75		45		75		
d									
D									
p		.81		.81		.81		.81	.81
P	30	15	76	304	46	137	76	570	1016
s		.19		.19		.19		.19	.19
S	7	7	18	142	11	64	18	267	480
A	37	22	94	446	57	201	94	837	1506[2]

Notes: [1]See Table 4-1 for definitions of factors.
[2]Small errors due to rounding.

used to calculate the necessary "p" factor for the 12 flight IPs. The results are shown in Table 4-4a. Data for the second period (Table 4-4b) were computed by the same procedures as used in Option 1.

Option 2 requires more solo time than Option 1, but it also requires fewer trained T-46 IPs to start with. Other than these differences, the two options are quite similar.

A third option was investigated to see what could be done if fewer IPs were available for early transition. It was discarded as infeasible. It would require four trained flight IPs beginning the ORA. Seventeen would be transitioned in the first three weeks, which is feasible. However, even with the four flight IPs flying all their time (56 hours each) solo, only 697 total hours could be generated in the first 3/4 month. This would then require 1703 hours or a UT rate of 68 during the remainder of the ORA. This exceeds the specified ORA UT rate of 60.

Findings. Findings of the Segment 3 analysis are:

1. To fly the ORA with 30 pilots will require a minimum of 770 hours solo flying (based on the options considered in this segment) or waivers to the 75-hour monthly limit. Solo time could be used instead for orientation flights.

2. It is feasible to fly the ORA starting with 21 qualified pilots and training nine more during the first three weeks.

3. It is not feasible to start the ORA with only 13 qualified pilots, and transition 17 more during the ORA.

This concludes the analysis of the Master Plan up to IOC. Below is a summary of what has been learned.

Summary of Findings

1. If the additional pilots arrive at Laughlin at an even rate from January to 1 August 1986, this should ensure meeting the earliest T-46 transition training.

2. Even if the full IP bubble is not acquired, transition training and the ORA can proceed on schedule as long as 12 transition trainees are available by 1 February and nine more by 1 March 1987.

3. The suitable transition training syllabus for the first class depends on the ORA manning option selected.

4. The utilization rate is not a critical factor for the pre-ORA transition training (unless it drops below 13).

5. If aircraft deliveries fall behind schedule, the ORA and therefore the pre-ORA transition training will be postponed.

6. To fly the ORA with 30 pilots or less will require either waivers to the 75-hour monthly limit or at least 770 solo hours(based on the Segment 3 options). Solo time could be used instead for orientation sorties.

There appear to be a number of feasible options for both the initial IP transition training and the ORA whether or not the bubble of additional IPs is acquired. In all cases, however, the initial IP cadre is essential.

The post-IOC analysis, presented in the next chapter, studies the student flight conversions including their impact on the earlier segments.

CHAPTER V

ANALYSIS OF THE ATC MASTER PLAN - PART 2

Overview

The analysis so far has concerned actions prior to IOC. This chapter analyzes primarily post-IOC activities. However, Segment 4, comparing flying hours required versus available, also looks back to the ORA and earlier. It expands the analysis to consider total flying hour constraints due to UT rate or airfield capacity. Segment 4 occupies the bulk of the chapter. Segment 5 takes a brief look at subsequent base conversions, particularly the similarities and differences from the Laughlin conversion.

Segment 4, Student Flight Conversion and Remaining IP Transition Training

Analysis Objectives. The first objective of this segment was to look at the feasibility of the Laughlin class conversions as presented in the Master Plan (17:C-9). Once that approach was identified as being infeasible due to flying hour constraints, the objective became to develop modifications to make the plan workable. The effects of the following factors were analyzed:

1. Student pilot syllabus length
2. T-46 and T-37 utilization rates
3. Instrument flight simulator delivery schedule and usage rate
4. T-46 aircraft delivery schedule

5. Airfield flying hour capacity

6. The size of the additional IP manning bubble

Several modifications to the Master Plan are included in the options that were analyzed. Among them are changes in simulator usage rate, simulator conversion schedules, use of various student pilot syllabi (Full Sim, 50% Sim, No Sim), and adjusting student class sizes. One option analyzes converting without the bubble of 30 additional IPs. Several other suggested improvements are made without detailed analysis.

Certain assumptions were made concerning each option that was analyzed. They are listed with the appropriate analysis. The following assumptions apply to the entire Segment 4 analysis:

1. The initial IP cadre will be nine T-46 pilots who will be on station at Laughlin ready to fly by 1 January 1987.

2. Student pilot attrition will be 16% for each class as forecast by ATC (5).

3. The rate of "additional" flying at Laughlin will remain constant at 135 hours per month.[1]

4. Sorties lost due to weather, plus operations and maintenance losses will remain at the present rates.

5. The ORA will be flown during March and April 1987.

Before proceeding with the various options, some basic data are presented -- tables, charts, formulas -- which served as tools throughout the analysis.

---

[1]See definitions, page 8.

Basic Data Compilation. The following tools are developed in this section:

1. Student pilot attrition/retention chart
2. Standard monthly flying data for Full Sim syllabus
3. Flying factors for each syllabus
4. Conversion formula for use with 50% and No Sim syllabi
5. Airfield flying hour capacity table
6. Table for flying hours available versus required in the long range steady state situation.

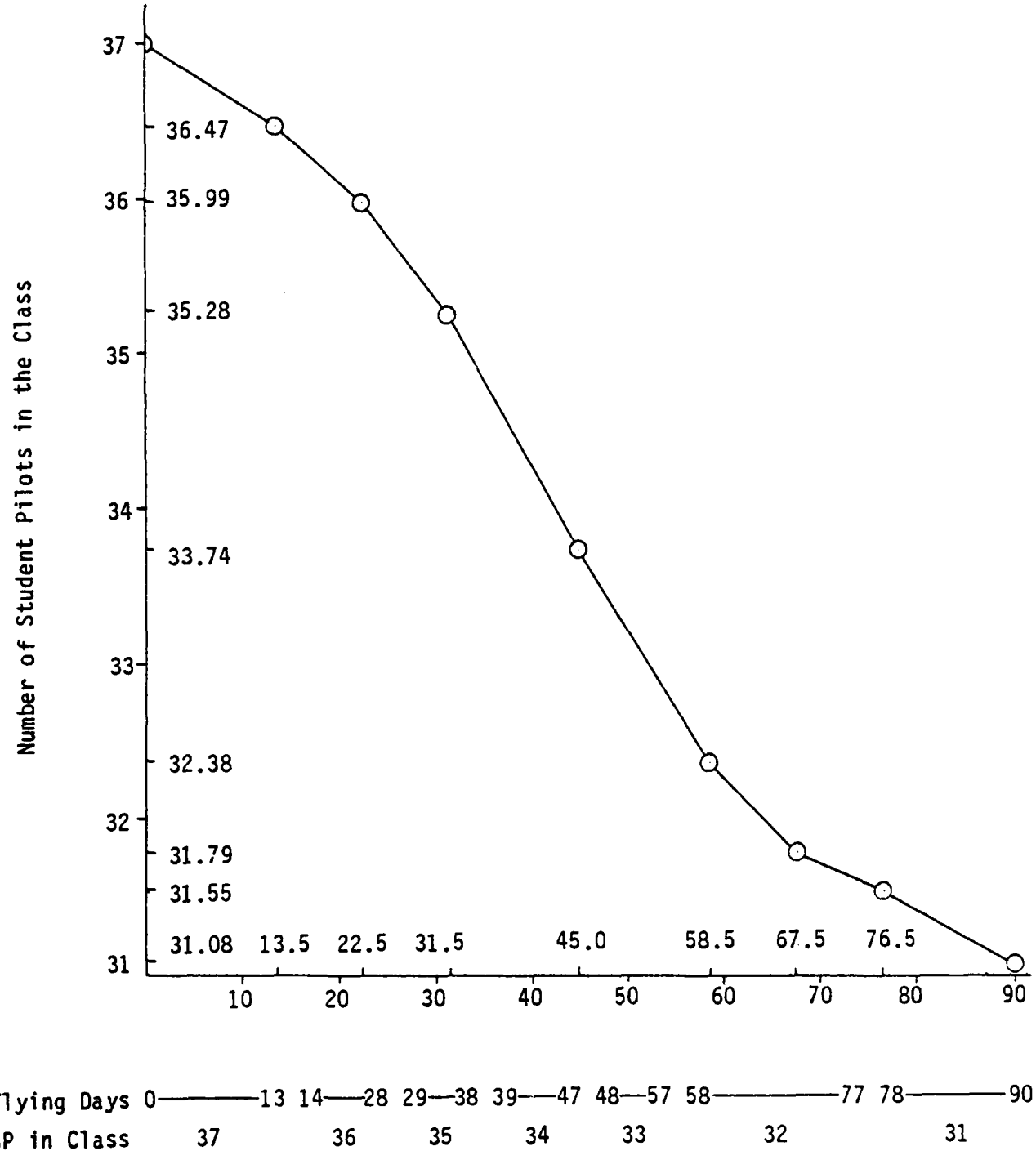
Forecast attrition in student pilot training is based on ATC estimates. There are critical points in the syllabus where attrition is most likely to occur. These are accounted for in ATC's attrition schedule shown below. Attrition between the data points is assumed to be linear since more detailed historical data is not available (5).

% of the Training Program Completed	% of the Total Attrition Occurred
15	9
25	17
35	29
50	55
65	78
75	88
85	92
100	100

From this data, a SP retention chart was derived for the 90-day SUPT with entering classes of 37 students. (See Figure 5-1) From this piecewise

Figure 5-1

T-37/T-46 Student Pilot Retention



linear function, these averages were computed:

Mean number of graduates per class = 31.08

Mean SP class load = 33.905

Mean SP load (6 classes) = 203.43

Standard monthly flying data are presented in Table 5-1. Flying hours in the table are valid only for a load of six classes on the full simulator (Full Sim) syllabus. The data were computed from classes 88-10 through 89-14 for November 1987 through October 1988. However, the data are also useful estimates for other years since class dates vary not more than two or three days from year to year. Class dates were based on the Master Plan (17:C-9). Flying training hours were computed in the same manner as in the PFT[1], and include all student flying and instructor proficiency flying associated with SUPT (16:II-10). Total flying hours include the 135 additional non-training hours, but not the T-46 ORA nor IP transition training.

The flying factor for the Full Sim syllabus was provided by the ATC Operational Plans and Programs Division (4). Flying factors for the other syllabi were computed[2]:

Syllabus	Flying Factor
Full Sim	1.0305
50% Sim	1.2760
No Sim	1.3972

[1]Flying training hours = (SP load)(flying factor)(monthly flying days).

[2]See Appendix E for explanation of flying factor computations.

Table 5-1

Standard Monthly Flying Data for Full Simulator Syllabus*

	1987																								
	Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		
Class	SP	Days	SP	Days	SP	Days	SP	Days	SP	Days	SP	Days	SP	Days	SP	Days	SP	Days	SP	Days	SP	Days	SP	Days	Totals
88-10	31	15																							
88-11	32	15	31	10	31	4																			
88-12	33	15	32	10	32	14	31	6																	
88-13	34	15	33	10	32	14	32	14	31	6															
88-14	36	15	35	10	33	14	32	14	31	18	31	3													
89-01	37	15	36	10	35	14	34	14	32	18	31	19													
89-02			37	10	36	14	35	14	34	18	32	21	31	13											
89-03					37	8	36	14	35	18	33	21	32	21	31	8									
89-04							37	8	36	18	35	21	32	21	32	18	31	4							
89-05									37	11	36	21	34	21	32	18	31	19							
89-06											37	17	36	21	34	18	32	22	31	12					
89-07											37	2	37	21	35	18	33	22	32	20	31	7			
89-08													37	8	36	18	35	22	32	20	32	18	31	4	
89-09															37	10	36	22	34	20	33	18	31	19	
89-10																	37	18	36	20	34	18	32	19	
89-11																	37	3	37	20	35	18	33	19	
89-12																			37	7	36	18	35	19	
89-13																					37	10	36	19	
89-14																							37	16	
Load [1]	201.00		204.00		198.00		203.43		200.94		201.95		204.29		203.33		203.73		202.55		202.61		204.68		203.43
Flying Training Hours [2]	3107		2102		2857		2935		3727		4370		4421		3772		4619		4175		3758		4008		43851
Total Flying Hours [3]	3242		2237		2992		3070		3862		4505		4556		3907		4754		4310		3893		4143		45471

*Flying factor = 1.0305

SP = Mean number of student pilots in the class based on 16% attrition (See Figure 5-1)

Days = Flying days based on 210 day annual calendar

[1] Mean student load, a weighted average of classes flying that month.

[2] (Load) x (Flying days for full month) x (Flying factor). Includes IP proficiency flying.

[3] Adds 135 hours for non-training flying (standard figure from PFT).

Since Table 5-1 is valid only when all six classes are on the Full Sim syllabus, Equation 3 was developed to estimate flying training hours for a mixture of the three syllabi.[1]

$$F_{k,m,n} = \frac{F_f}{6} (0.3558m + 0.2382n + k) \qquad \text{(Eq. 3)}$$

where

F_f = Monthly Flying Training Hours, Full Sim (Table 5-1)

k = Number of Classes Being Trained

m = Number of Classes on No Sim Syllabus

n = Number of Classes on 50% Sim Syllabus and

$F_{k,m,n}$ = Adjusted Flying Training Hour Estimate.

Equation 3 was not used for all estimates since it assumes the same class and syllabus composition throughout the month; i.e., k, m and n don't change. This assumption is violated during many months of the analysis, so for those months a different worksheet approach was used (explained in Appendix G). A second assumption is that all class sizes in a given month are equal. The equation was sometimes used even where this second assumption was violated since the error induced was small (on the order of 2% or less when compared with actual worksheet estimates by class by month).

In determining feasibility of a flying schedule, one necessary comparison is flying hours required versus available. Much of the remaining

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[1] See Appendix F for derivation of Equation 3.

analysis focuses on this comparison. But first, two factors which limit flying hours were considered -- aircraft utilization rate and airfield saturation.

The T-46 UT rate is expected to be 45 hours per month per aircraft until 18 months after IOC, then gradually increase to 60 hours by the 24th month (17:C-1). This limits flying hours to 3870 and 5160 per month for the 45 and 60 UT rates respectively, assuming all 86 aircraft are delivered.

Airfield flying hour capacity is not quite so easy to determine. ATC uses a computer program to determine the maximum number of student sorties that can be flown at a base in a given month. The data presented in Table 5-2 is based on that program; the numbers in columns 1 through 4 were received from ATC Operational Plans and Programs Division (5; 7). *Maximum student pilot day sorties* (column 2) are limited by daylight hours, one sortie launch every three minutes, a five-day work week less holidays, and the maximum number of IPs that can be gainfully employed year round. Effective sorties (column 4) adjusts column 2 for weather losses, which vary by month, plus operations and maintenance losses, which have totaled about 4.2% (5; 16:II-10). Columns 5 and 6 convert sorties to hours with the factor 85 hours/65 sorties. Column 7 corrects column 6 to account for IP proficiency and additional flying.

$$\text{Column 7} = (\text{Column 6}) \quad \frac{(\text{Flying Factor})}{\text{SP Flying Factor}} + 135 \text{ hr.}$$

The flying factors used are those for the *Full Sim syllabus* since that is the basis of the data. Column 8 multiplies column 7 by 65/60 because 5

Table 5-2

ATC Sortie and Flying Hour Capacity for Laughlin AFB

This table addresses airfield limitations; aircraft limitations are not considered.

Month*	1 Mean Daily Daylight Hours	2 Maximum Day SP Sorties Possible	3 Limiting Factor in Column 2	4 Effective Day SP Sortie Capacity	5 Maximum Day SP Flying Hour Possible	6 Effective Day SP Flying Hour Capacity	7 Effective Total Day Flying Hour Capacity	8 Airfield Flying Hour Capacity
Jan	10.6	3559	Daylight	2260	4654	2955	3359	3639
Feb	11.2	3279	Daylight	2052	4288	2683	3062	3317
Mar	12.0	3927	Daylight	2611	5135	3414	3860	4182
Apr	12.9	4470	Daylight	3026	5845	3957	4452	4823
May	13.6	4481	IPs	2846	5860	3722	4196	4546
Jun	14.0	4073	IPs	2806	5326	3669	4138	4483
Jul	13.8	4481	IPs	3536	5860	4624	5180	5612
Aug	13.2	4481	IPs	3769	5860	4929	5513	5972
Sep	12.3	3848	Daylight	2966	5032	3879	4367	4731
Oct	11.5	3916	Daylight	3122	5121	4083	4590	4972
Nov	10.7	3108	Daylight	2436	4064	3186	3611	3912
Dec	10.4	2373	Daylight	1770	3103	2315	2661	2883
May		4747	Daylight	3014	6208	3941	4435	4805
Jun		4460	Daylight	3073	5832	4019	4520	4897
Jul		4826	Daylight	3808	6311	4980	5569	6033
Aug		4589	Daylight	3859	6001	5046	5641	6111

*The first set of monthly data assume approximately 144 T-37/T-46 pilots on base. The second set shows the changes which occur with a bubble of 30 additional IPs on base (applicable only 1987 for most options).

Table 5-3

Flying Hours Required Versus Available

Long Range Steady State, UT Rate = 60, 86 Aircraft (T-46), Full Simulator Syllabus

Month	1 Total Flying Hours Required	2 Hours Available At 60 UT Rate	3 Column 2 Less Column 1	4 Airfield Flying Hour Capacity	5 Column 4 Less Column 1	6 Surplus Flying Hour Capacity
Jan	2992	5160	2168	3639	647	647
Feb	3070	5160	2090	3317	247	247
Mar	3862	5160	1298	4182	320	320
Apr	4505	5160	655	4823	318	318
May	4556	5160	604	4546	(10)	(10)
Jun	3907	5160	1253	4483	576	576
Jul	4754	5160	406	5612	858	406
Aug	4310	5160	850	5972	1662	850
Sep	3893	5160	1267	4731	838	838
Oct	4143	5160	1017	4972	829	829
Nov	3242	5160	1918	3912	670	670
Dec	2237	5160	2923	2883	646	646

Notes:
Column 1 from Table 5-1
Column 4 from Table 5-2, Column 8
Column 6 is the lessor of Column 3 and 5 for each month

of the 65 sorties are other than day local. It assumes that the syllabus ratios of weekday, weekend and night flying hold true and these ratios apply to IP proficiency flying also.

Table 5-3 consolidates available and required flying hours from Tables 5-1 and 5-2, as they will apply after the T-46 conversion is complete. As can be seen from column 6, there is typically a surplus flying hour capacity. Unfortunately, during the conversion this is not the case, as will be seen in the first conversion option.

Option 1, Laughlin Class Conversion Per the Master Plan (17:C-9). The objective of the first option analysis was to determine whether or not the Laughlin class conversion schedule is feasible as planned. Initially only the required T-46 UT rate was analyzed from IOC to completion of the conversion. Other factors of interest were the SP syllabus length, transition training syllabus length, simulator conversion schedule, and T-46 aircraft delivery schedule.

The analysis of this option was based on these assumptions:

1. Simulators will be used no more than the present rate. Two simulator complexes can support six classes; one can support three classes on Full Sim syllabus or six classes on 50% Sim syllabus.

2. The first T-46 simulator complex will be ready at IOC, 6 July 1987. The second complex will be ready when the last T-37 flight converts to T-46, 7 July 1988 (17:C-3).

3. A T-46 class will stay with the same syllabus throughout their training; i.e., Full Sim or 50% Sim.

The 30-day T-46 IP transition course will be used. There is enough slack in the schedule that there is no reason to rush IPs through a 15-day course. Six of the 30-day courses of 24 pilots each will be needed (See Appendix G). Twelve 15-day courses of 12 pilots would also be possible. The 30-day courses would require 1.49 events (aircraft or simulator sorties) daily per cadre IP. The 15-day course would require 1.87 events (17:C-7). Either alternative is possible, but the 30-day course appears preferable because of the additional preparation time available to IPs.

Although there are only six student flights in the squadron, there are seven flights of IPs during the conversion, one being in transition training. The flights of IPs are arbitrarily named A through G for simplicity in tracking them.

Table 5-4 repeats the conversion schedule from page C-9 of the Master Plan (17), adding the flights and other information. Several observations are made from analysis of the table. (a) There is considerably more time available for transition training than is necessary for most IP flights as shown in the "slack" column. (b) The last column specifies which syllabus has been selected for each class[1]. (c) The last flight to transition, D flight, would have to transition at Randolph (rather than Laughlin) in order to release the cadre to begin transition training there in June 1988 (17:C-10). In fact, the F flight transition training would need to be accelerated as much as possible to give the cadre more time to transfer before June. (d) The D flight transition course should include the 15 IPs who will be the IP bubble for Williams AFB.

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[1]The criteria for syllabus assignments was to make maximum use of simulators without exceeding current usage levels.

Table 5-4

Student Flight Conversion Schedule

Option 1 (Master Plan)

IP Flight Released to Transition	Flight	Aircraft	Date IPs Completed Prior Class	Weeks Slack	T-46 Transition	T-46 Class	T-37/T-46 Class Entry	T-37/T-46 Class Grad	Type of Sim. Syllabus
B	A	T-46			Before or during ORA	88-10	6 Jul 87	30 Nov 87	Full [2]
	C	T-37	24 Jul 87				27 Jul 87	13 Jan 88	
	D	T-37	17 Aug 87				18 Aug 87	16 Feb 88	
E	B	T-46	2 Jul 87	3	24 Jul-10 Sep	88-13	11 Sep 87	11 Mar 88	Full
	F	T-37	5 Oct 87				6 Oct 87	5 Apr 88	
G	E	T-46	10 Sep 87	0	11 Sep-30 Oct	89-01	2 Nov 87	27 Apr 88	Full
	A	T-46X [1]				89-02	1 Dec 87	19 May 88	50%
C	G	T-46	30 Oct 87	2	12 Nov-13 Jan	89-03	14 Jan 88	13 Jun 88	50%
	D	T-37					17 Feb 88	6 Jul 88	
	B	T-46X				89-05	14 Mar 88	27 Jul 88	50%
F	C	T-46	13 Jan 88	5	17 Feb-5 Apr	89-06	6 Apr 88	18 Aug 88	50%
	E	T-46X				89-07	28 Apr 88	13 Sep 88	Full
	A	T-46X				89-08	20 May 88	5 Oct 88	50%
	G	T-46X				89-09	14 Jun 88	1 Nov 88	50%
D*	F	T-46	5 Apr 88	6	6 Apr-24 May	89-10	7 Jul 88	30 Nov 88	Full [3]

*Transition at Randolph AFB

Notes: [1] X means flight of IPs already trained in T-46

[2] One Sim complex ready

[3] Two Sim complexes ready

A worksheet was developed to compute monthly flying time required.[1] Table 5-5a summarizes the work sheet results plus the required UT rates. Note that the planned UT rate of 45 is exceeded beginning in April 1988.

As shown in Table 5-4, there is considerable IP slack time in the transition training schedule. There are several alternatives to compress the transition schedule which would in turn accelerate the student flight conversion to T-46. However, in view of the T-46 UT rate being exceeded, converting to T-46 more rapidly would only aggravate this situation. Therefore, speeding up the conversion to reduce slack time is not recommended.

The use of the partial (50%) simulator syllabus has a major impact on flying requirements. Syllabus flying time increases from 85 to 107.1 hours (17:C-11). Total required flying time increases by nearly 25%. It obviously would be helpful to use more of the Full Sim syllabus. One apparent step is to drop the limitation of each class using the same syllabus throughout their training. By converting all on-going T-46 classes to a Full Sim syllabus when the second complex is ready in July 1988, the flying hour shortages thereafter would be decreased significantly (see Table 5-5b for changes.) However, a UT rate as high as 55 is still required, far exceeding the planned rate.

If aircraft deliveries fall behind schedule more flying hour shortages will occur. With deliveries two months behind, for example, a new flying hour shortage will occur in March 1988. Also the April and May shortages will become larger.

Findings of the Option 1 analysis are:

1. The planned UT rate of 45 is exceeded several months beginning

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[1]The worksheet, Table G-1, and explanation are included in Appendix G.

Table 5-5a

Feasibility Summary - Option 1 (Master Plan)

Month	Mean Number of T-46s Available	Flying Hours Required	Required UT Rate	Flying Hours Available at 45 UT Rate	Flying Hour Surplus or (Shortage)
Jul 87	40	800	20	1800	1000
Aug	44	1074	24	1980	906
Sep	49	1392	28	2205	813
Oct	54	1680	31	2430	750
Nov	60	1829	31	2700	871
Dec	66	1435	22*	2970	1535
Jan 88	72	2173	31	3240	1067
Feb	79	2410	31	3555	1145
Mar	85	3303	38	3825	522
Apr	86	4602	54	3870	(732)
May	86	4771	55	3870	(901)
Jun	86	3896	45	3870	(26)
Jul	86	5307	62	3870	(1437)
Aug	86	4727	55	3870	(857)
Sep	86	4181	49	3870	(311)

Table 5-5b**

Jul 88	86	4606	54	3807	(736)
Aug	86	4310	50	3807	(444)
Sep	86	3893	45	3807	(24)

* Unusually low due to Christmas break.

**This table assumes that when the last simulator complex is operational (July 1988), all T-46 classes convert to a Full Sim syllabus.

Note: Source of aircraft available information: Aircrew schedule (30); Master Plan (17:C-1).

April 1988. The maximum required rate is 62 in July 1988.

2. The necessity of using a 50% Sim syllabus for some classes has a major impact by increasing flying requirements.

3. Converting on-going T-46 classes to the Full Sim syllabus upon completion of the second simulator complex decreases shortages somewhat. However a UT rate as high as 55 is still required.

4. Either transition training syllabus is feasible; however, the 30-day syllabus appears preferable.

5. The last IP flight to transition to T-46 must do so at Randolph AFB.

6. There is considerable slack in the transition training schedule. However, speeding up the conversion would only aggravate the flying hour shortages.

7. If aircraft deliveries fall behind schedule, flying hour shortages will begin sooner and become larger.

Because the Master Plan is infeasible in some months, the sensitivity analysis has primarily concerned what needs to be changed (and how much) to make the plan work, rather than how much a particular factor can change before the plan becomes infeasible. The next option looks at a possible change to improve feasibility of the plan.

Option 2, Earlier Conversion of the Second Simulator Complex. The objective of this analysis was to determine the effect of converting the second complex during December 1987 through March 1988.

The Master Plan states that the second simulator complex converts during the period January to July 1988 (17:C-3,C-12), and yet,

it should take only four months (17:3). In order to have the second T-46 simulator complex ready by April (the first UT rate shortage), the conversion needs to begin 1 December 1987. Option 2 investigated the impact of this change.

In Option 2, all T-46 classes except 89-01 and 89-02 fly the Full Sim syllabus. Worksheets were produced for this option but are not included since significant improvements were realized only in April, May and June 1988. UT rates as high as 54 are still required. A summary is contained in Table 5-6.

Before making further attempts at reducing the flying hour shortage, we need to remember that we have so far considered only one of the two factors which limit flying hours available (UT rate). We have not yet included airfield capacity in the analysis of the Master Plan. In doing so, we must also consider T-37 flying.

Option 3 - Master Plan Modified. The primary objective of the Option 3 analysis was to analyze the conversion impact on airfield flying hour capacity. This option also evaluates T-37 UT rate requirements. Increased simulator usage is also incorporated. The second simulator complex is assumed to shut down 1 January 1988 per the Master Plan (17:C-3) and is complete by 1 May 1988, a four-month period (17:3). On 1 May 1988, all on-going T-46 classes will convert to the Full Sim syllabus.

Also simulator capacity was investigated. Simulators are presently used at about 80% capacity on the average (6). Therefore, it appears that one simulator complex could support a 50% Sim class in addition

Table 5-6

Feasibility Summary - Option 2

Month	Mean Number of T-46s Available	T-46 Flying Hours Required	Required UT Rate
Jul 87	40	800	20
Aug	44	1074	24
Sep	49	1392	28
Oct	54	1680	31
Nov	60	1965	33
Dec	66	1523	23
Jan 88	72	2293	32
Feb	79	2526	32
Mar	85	3189	38
Apr	86	3926	46
May	86	4073	47
Jun	86	3295	38
Jul	86	4605	54
Aug	86	4311	50
Sep	86	3894	45

to three Full Sim classes. Other combinations of classes could be supported -- two Full Sim and three 50% Sim, or one Full Sim and five 50% Sim. This increased usage is applied to both T-37 and T-46 simulators in Option 3, resulting in a flying time savings of approximately 3.5% in several months.

The general approach to the conversion of student flights is the same as Option 1, as shown in Table 5-7. However, an attempt was made to maximize simulator usage in order to reduce flying time. Where possible, the T-46 50% Sim classes were placed so as to minimize the time before they would convert to Full Sim (1 May 1988). Also T-37 Full Sim classes were used as much as possible before their last simulator shutdown (1 January 1988).

The worksheets for the conversion period are Table G-2 (Appendix G). Feasibility of this option is summarized in Table 5-8. Table 5-8a addresses the months when T-37 UT rate may be critical; Table 5-8b, when T-46 UT rate may be critical. Note the three month overlap between tables. Also both address airfield capacity. The T-37 UT rate of 50 hours per month was selected as a guide, not a hard limit. This is the figure ATC uses command-wide for general planning. However, a 50 UT rate may be exceeded at a particular base for a few months[1] (12). Laughlin is expected to have 83 T-37 aircraft for SUPT during our period of concern (16:I-7; 12). With the 50 UT rate and 83 aircraft, 4150 hours per month are available.

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[1]The current PFT requires as high as a 57 UT rate at Laughlin (August 1983)(16:I-7,II-10).

Table 5-7

Student Flight Conversion Schedule

Option 3

Flight Released to Transition	Flight	Aircraft	Weeks Slack	T-46 Transition	T-37/T-46 Class	Entry	Grad	Type of Sim. Syllabus
	B	T-37			88-04	14 Feb 87	2 Jul 87	50%
	C	T-37			88-05	13 Mar 87	24 Jul 87	50%
	D	T-37			88-06	3 Apr 87	17 Aug 87	50%
	E	T-37			88-07	27 Apr 87	10 Sep 87	50%
	F	T-37			88-08	19 May 87	5 Oct 87	50%
	G	T-37			88-09	11 Jun 87	30 Oct 87	Full
B	A	T-46		Before or during ORA	88-10	6 Jul 87	30 Nov 87	Full
	C	T-37			88-11	27 Jul 87	13 Jan 88	Full/No [1]
	D	T-37			88-12	18 Aug 87	16 Feb 88	50%/No [1]
E	B	T-46	3	24 Jul-10 Sep	88-13	11 Sep 87	11 Mar 88	Full
	F	T-37			88-14	6 Oct 87	5 Apr 88	Full/No [1]
G	E	T-46	0	11 Sep-30 Oct	89-01	2 Nov 87	27 Apr 88	Full
	A	T-46X			89-02	1 Dec 87	19 May 88	Full
C	G	T-46	2	12 Nov-13 Jan	89-03	14 Jan 88	13 Jun 88	50%/Full [2]
	D	T-37			89-04	17 Feb 88	6 Jul 88	No
	B	T-46X			89-05	14 Mar 88	27 Jul 88	50%/Full [2]
F	C	T-46	5	17 Feb-5 Apr	89-06	6 Apr 88	18 Aug 88	50%/Full [2]
	E	T-46X			89-07	28 Apr 88	13 Sep 88	50%/Full
	A	T-46X			89-08	20 May 88	5 Oct 88	Full
	G	T-46X			89-09	14 Jun 88	1 Nov 88	Full
D*	F	T-46	6	6 Apr-24 May	89-10	7 Jul 88	30 Nov 88	Full
			16					

*Transition training at Randolph AFB.

[1] On-going T-37 classes convert to No Sim syllabus when second simulator conversion begins 1 Jan 1988.

[2] On-going T-46 classes convert to Full Sim syllabus when second simulator complex is ready 1 May 1988.

Table 5-8a

Feasibility Summary - Option 3

Month	T-37s Available	T-37 Flying Hours Required	T-37 Required UT Rate	T-37 Hours Available at 50 UT Rate	Hours (over) or Under UT Constraint	Total Flying Hours Required	Airfield Flying Hour Capacity [5]	Hours (over) or Under Cap. Constraint
May 86	83	4556 [1]	55	4150	(406)	4556	4546	(10)
Jun	83	3907	47	4150	243	3907	4483	576
Jul	83	4754	57	4150	(604)	4754	5612	226
Aug	83	4310	52	4150	(160)	4310	5972	670
Sep	83	3893	47	4150	257	3893	4731	838
Oct	83	4143	50	4150	7	4143	4972	829
Nov	83	3242	39	4150	908	3242	3912	670
Dec 86	83	2237	27	4150	1913	2237	2883	646
Jan 87	83	3559 [2]	43	4150	591	3559	3639	80
Feb	83	3653	44	4150	497	3905 [3]	3317	(588)
Mar	83	4602	55	4150	(452)	5802	4182	(1620)
Apr	83	5372	65	4150	(1222)	6572	4823	(1749)
May	83	5434	65	4150	(1284)	5434 [4]	4805 [6]	(629)
Jun	83	4656	56	4150	(506)	4656	4897	241
Jul	83	4516	54	4150	(366)	5316	6033	717
Aug	83	4019	48	4150	131	5093	6111	1018
Sep	83	3203	39	4150	947	4595	4731	136

Notes:
[1] Flying hours are from Table 5-1 or Table G-2 as applicable.
[2] The Jan-Jun 87 T-37 hours are based on one class on a Full Sim and five classes on a 50% Sim syllabus. Estimates were made using Equation 1.
[3] Adding T-46 hours : Feb, 252 for transition; Mar, 1200 for ORA; Apr, 1200 for ORA.
[4] Although some T-46 flying will occur in May and Jun 87 and before Feb 87, it is assumed to be negligible on the T-37 runway.
[5] From Table 5-2.
[6] May-Aug capacity based on 30 additional IPs.

Table 5-8b

Feasibility Summary - Option 3

Month	Mean Number of T-46s Available	T-46 Flying Hours Required	T-46 Required UT Rate	T-46 Hours Available for the UT Rate	Hours Over or (Under) UT Constraint	Total Flying Hours Required	Airfield Flying Hour Capacity [3]	Hours (over) or under Cap. Constraint
Jul 87	40	800	20	1800	1000	5316	6033 [4]	717
Aug	44	1074	24	1980	906	5093	6111 [4]	1018
Sep	49	1392	28	2205	813	4595	4731	136
Oct	54	1680	31	2430	750	4646	4972	326
Nov	60	1829	30	2700	871	3620	3912	292
Dec 87	66	1344	20	2960	1616	2509	2883	374
Jan 88	72	2049	28	3240	1191	3560	3639	79
Feb	79	2166	27	3555	1389	3524	3317	(207)
Mar	85	3153	37	3825	672	4896	4182	(714)
Apr	86	4455	52	3870	(585)	5653	4823	(830)
May	86	4073	47	3870	(203)	5046	4805 [4]	(241)
Jun	86	3295	38	3870	575	4119	4483	364
Jul	86	4605	54	3870	(735)	4797	5612	815
Aug	86	4310 [1]	50	3870	(440)	4310	5972	1662
Sep	86	3893	45	3870	(23)	3893	4731	838
Oct	86	4143	48	3870	(273)	4143	4972	829
Nov	86	3242	38	4085 [2]	843	3242	3912	670
Dec 88	86	2237	26	4300	2063	2237	2883	646
Jan 89	86	2992	35	4515	1523	2992	3639	647
Feb	86	3070	36	4730	1660	3070	3317	247
Mar	86	3862	45	4945	1083	3862	4182	320
Apr 89	86	4505	52	5160	655	4505	4823	318

[1] T-46 hours after Aug 88 are from Table 5-1.
[2] T-46 UT rate increases from 45 to 60 during Nov 88 to Apr 89.
[3] From Table 5-2.
[4] Based on the capacity with the 30 additional IPs.

Findings of the Option 3 analysis are summarized as follows:

1. Conversion by this option appears to be infeasible without further modification.

2. Monthly flying time required versus available continues to be the critical factor. Either one or both of the flying hour constraints is exceeded in 17 of the 36 months.

3. The T-37 UT rate guideline of 50 is exceeded in eight months.

4. The required T-37 UT rates above 50 can probably be met in several months due to surge capacity. However, the months requiring UT rate of 65 are likely infeasible.

5. The planned T-46 UT rate of 45 is exceeded in six months.

6. Airfield capacity is exceeded nine months, the most critical time being during the ORA.

7. Using some of the excess simulator capacity results in a small saving of flying time.

Obviously not every possible adjustment has been evaluated that might lead toward a more workable conversion schedule. The next section lists several possible actions which might be used one or more at a time to improve the feasibility of Option 3 or other options.

Potential Solutions. A variety of actions could be tried to modify Option 3 into a workable plan, not all of which can be analyzed in detail here. Some are listed with brief comments; others have been investigated further. The first several actions concern primarily local commanders at Laughlin and would have little or no effect on other bases.

1. Many of the shortages are in the weekday sortie capacity of the T-37/T-46 primary runway. Some of the load could be shifted to other times and other runways. Certain sorties could be launched from the center runway. Cross country missions could be launched or recovered at night, on weekends, or on the center runway. Instrument sorties could be launched before sunrise, recovered after sunset, or flown as out-and-back missions to other bases (15:12). The ORA is a peak period. Many ORA sorties could be operated from the center runway. Also many ORA sorties could be out-and-backs. Since there are 30 extra IPs on base, local flying could be scheduled six or seven days a week and still allow each IP and SP one or two days off. Even with other corrective actions, weekend flying will probably be necessary during the ORA.

2. Flying in the surplus months could be accelerated in order to get ahead of the time line before a period of shortage months.

3. The T-37 UT rate could be boosted from 50 to 55 or 60 by additional maintenance effort. Similarly, emphasis should be on reducing operations sortie losses. If a UT rate of 60 could be achieved, it would solve the shortages (where T-37 UT rate is the critical factor) in all except one month.

4. The syllabus could be shortened for some classes. This would require ATC approval. If this were used as the single correction for February to May 1988, for example, every student in training the full month of February would have to give up 1.0 flying hour (207 hr/203.43 hr/SP). Those enrolled in March, April and May would lose respectively 3.5, 4.1 and 1.2. Some student pilots could lose as much as 9.8 hours.

If this is unreasonably high, this action could be implemented on a smaller scale along with other corrective actions.

5. Another approach that might be studied is to delay the first T-37 simulator shutdown until after the ORA. Also the ORA might be started a few weeks sooner than indicated in the options so far. Although this approach would mean the first two T-46 classes would begin with a No Sim syllabus, it would reduce the flying time required each month of the ORA by about 800 hours.

The next few actions have a greater effect on other bases and would require ATC approval.

6. Pilot production could be reduced during the conversion period. Smaller classes could be in training during the shortage months. This of course would require higher headquarters approval also. To illustrate, looking at April 1988, to reduce the requirement by 830 hours, we could reduce the entries in classes 89-01 through 89-06.

$$\frac{\text{SP Hours}}{\text{Approx. SP Load.}} = \frac{5202}{202} = 25.75 \text{ Hr/SP in April}$$

$$\frac{830 \text{ Hours}}{25.75 \text{ Hr/SP}} = \text{Approximately 32 SP}$$

That is, the student load for April would need to be reduced by 32. These 32 deletions could be taken from among the classes in such a way as to also relieve the shortages in the surrounding months.[1]

[1]It is interesting to note that some of the shortages may be relieved due to unrelated political or higher headquarters decisions. Currently, a 150-200 annual reduction is being considered for pilot production (12).

7. Some of the student load could be shifted to other SUPT bases during the conversion. Such a decision would have to consider excess capacity at each base.

8. Class sizes at Laughlin could be juggled to even out the monthly surpluses and shortages of flying time. This approach would cause fluctuations in the normal flow of SUPT graduates which would affect their follow-on training and flying assignments. Also it would shift flying hours across fiscal years, perhaps affecting budgets and other constraints. These factors would have to be considered. An example of this approach will be illustrated in the next option.

Option 4 - No IP Bubble. All options up to this point have assumed a bubble of 30 additional IPs acquired from outside ATC. A completely different problem exists if the additional pilots are not approved. The objective of this option analysis was to explore one approach to the conversion without the IP bubble. The IP cadre must still be available, but from within ATC. Also the analysis investigates the benefit of juggling SP class sizes to even out flying hour surpluses and shortages.

These assumptions apply to Option 4:

1. Nine cadre IPs will still be available at Laughlin to conduct transition training. They will be selected from PIT instructors, as planned. There will be no replacements for them except for adjustments that may be made within the command.

2. The 15 additional flight IPs and six for wing overhead will not be available.

3. The ORA will be manned basically the same as in previous options. There are about 144 IPs to transition in six classes (since there are now only six flights). For the ORA, 21 IPs will be transitioned. This leaves five classes of 24 or 25 each.

4. The second simulator complex will be converted between 1 December 1987 and 1 April 1988. The earlier conversion is justified by the smaller student loads and the more rapid conversion, which will be explained later. On 1 April 1988, all on-going T-46 classes will convert to the Full Sim syllabus.

5. Simulators will be used at the increased rate (approximately 1/6) as explained in Option 3.

6. The T-37 surge capability is a UT rate of 60, the same as the target T-46 UT rate (17:C-1,D-1). This would not be sustained for more than a month or two.

This option involves decreasing from six to five student flights at Laughlin during the conversion. There will still be six flights of IPs, but at any given time one will be in transition training. The analysis indicates that three classes of 37 student entries would be deleted (Table 5-9). These 111 students could be added to classes at other SUPT bases throughout the year. Distribution would be based on ATC base capacity data. Otherwise total ATC pilot production could be reduced by 111 for the year.

The first step was to develop a workable schedule for IP transition training and flight conversions. Three alternatives were studied, two of which are shown in Appendix H. The third schedule, shown in Table 5-9, was selected for a couple of reasons. It corresponds to the planned

Table 5-9

Student Flight Conversion Schedule - Option 4

SP Classes			Schedule 3			
Entry [1]	Grad [1]	Class	X-T [2]	Flight	Aircraft	Sim [3]
27 Jul 86	13 Jan 87	87-11		A	T-37	P
18 Aug 86	16 Feb 87	87-12		B	T-37	P
11 Sep 86	11 Mar 87	87-13		C	T-37	F
6 Oct 86	5 Apr 87	87-14		D	T-37	P
2 Nov 86	27 Apr 87	88-01		E	T-37	P
1 Dec 86	19 May 87	88-02		F	T-37	F
14 Jan 87	13 Jun 87	88-03	A		No Class	
17 Feb 87	6 Jul 87	88-04		B	T-37	P
14 Mar 87	27 Jul 87	88-05		C	T-37	F
6 Apr 87	18 Aug 87	88-06		D	T-37	P
28 Apr 87	13 Sep 87	88-07		E	T-37	P
20 May 87	5 Oct 87	88-08		F	T-37	F
14 Jun 87	1 Nov 87	88-09			No Class	
6 Jul 87	30 Nov 87	88-10	B	A	T-46	F
27 Jul 87	13 Jan 88	88-11		C	T-37	F/N [4]
18 Aug 87	16 Feb 88	88-12	D	B	T-46	F
11 Sep 87	11 Mar 88	88-13		E	T-37	F/N
6 Oct 87	5 Apr 88	88-14	F	D	T-46	F
2 Nov 87	27 Apr 88	89-01			No Class	
1 Dec 87	19 May 88	89-02		A	T-46	F
14 Jan 88	13 Jun 88	89-03	C	F	T-46	P/F [5]
17 Feb 88	6 Jul 88	89-04		B	T-46	P/F
14 Mar 88	27 Jul 88	89-05	E	C	T-46	P/F
6 Apr 88	18 Aug 88	89-06		D	T-46	F
28 Apr 88	13 Sep 88	89-07		E	T-46	F
20 May 88	5 Oct 88	89-08		A	T-46	F
14 Jun 88	1 Nov 88	89-09		F	T-46	F
6 Jul 88	30 Nov 88	89-10		B	T-46	F
27 Jul 88	13 Jan 89	89-11		C	T-46	F

Notes:
1. Approximate
2. Flight released to enter transition training
3. Type of simulator syllabus: F = Full; P = 50%; N = No Sim
4. Last T-37 Sim shutdown is 1 Dec. Convert from Full to No Sim.
5. Second T-46 Sim ready 1 Apr. Convert from 50% to Full Sim.

IOC date; the others do not. The last flight of IPs have T-46 students two classes earlier than the other two schedules, which have about 10 weeks when no IPs are in transition training. T-37 flying ends with the same class (88-13) under all three schedules.

The worksheets for the conversion period are shown in Table G-3 (Appendix G). Table 5-10 is the feasibility summary. Although some of the flying hour shortages have been alleviated, airfield capacity is still exceeded by large amounts during the ORA (March and April 1987). Also the T-46 UT rate is exceeded from April to October 1988. However, there are also many months with large surplus capacities. Some of the approaches mentioned earlier under "Potential Solutions" might be useful here.

One approach that was tried with this option was to juggle class sizes in order to even out the monthly shortages and surpluses. The worksheets and explanation of the procedure are contained in Appendix I. The process, although tedious, did provide estimates of the resulting changes in flying hours. Improvements are summarized in Table 5-11.

During the changes, class sizes were kept within what appeared to be reasonable limits. Entering class sizes varied from 30 to 45 (original size was 37). The size of each class is shown in Appendix I.

This whole approach to adjusting class sizes is not very sophisticated; it obviously has not produced the optimum solution on this attempt. However, significant improvements have been achieved. All of the shortages were reduced considerably or eliminated. One overcorrection has caused a small shortage in July 1986, however. In considering use of this procedure, the external impacts mentioned earlier under "Potential

Table 5-10a

Feasibility Summary - Option 4

Month	T-37s Available	T-37 Flying Hours Required	T-37 Required UT Rate	T-37 Hours Available at 60 UT Rate	Hours (over) or under UT Constraint	Total Flying Hours Required	Airfield Flying Hour Capacity[5]	Hours (over) or under Cap. Constraint
May 86	83	4556 [1]	55	4980	424	4556	4546	(10)
Jun	83	3907	47	4980	1073	3907	4483	576
Jul	83	4754	57	4980	226	4754	5612	858
Aug	83	4310	52	4980	670	4310	5972	1662
Sep	83	3893	47	4980	1087	3893	4731	838
Oct	83	4143	50	4980	837	4143	4972	829
Nov	83	3242	39	4980	1738	3242	3912	670
Dec 86	83	2237	27	4980	2743	2237	2883	646
Jan 87	83	3188 [2]	38	4980	1792	3188	3639	451
Feb	83	2930	35	4980	2050	3182 [3]	3317	135
Mar	83	3684	44	4980	1296	4884	4182	(702)
Apr	83	4297	52	4980	683	5497	4823	(674)
May	83	4345	52	4980	635	4345 [4]	4546	201
Jun 87	83	3727	45	4980	1253	3727	4483	756

Notes:
[1] Flying hours are from Table 5-1 or Table G-3 as applicable.
[2] The Jan-Jun 87 T-37 hours are based on two classes on a Full Sim and three on a 50% Sim Syllabus. Estimates were made using Equation 1. Jan 87 is a rough estimate due to the change from 6 to 5 classes mid-month.
[3] Adding T-46 hours: Feb, 252 for transition; Mar, 1200 for ORA; Apr, 1200 for ORA.
[4] Although some T-46 flying will occur in May and Jun 87 and before Feb, it is assumed to be negligible on the T-37 runway.
[5] From Table 5-2.

Table 5-10b

Feasibility Summary - Option 4

Month	T-46s Available (Mean)	T-46 Flying Hours Required	T-46 Required UT Rate	T-46 Hours Available at the UT Rate	Hours (over) or under UT Constraint	Total Flying Hours Required	Airfield Flying Hour Capacity	Hours (over) or under Cap. Constraint
Jul 87	40	1030	26	1800	770	4738	5612	874
Aug	44	1360	31	1980	620	4179	5972	1793
Sep	49	1664	34	2205	541	3732	4731	999
Oct	54	2208	41	2430	222	3758	4972	1214
Nov	60	1782	30	2700	918	2869	3912	1043
Dec 87	66	1252	19	2970	1718	2213	2883	670
Jan 88	72	2121	29	3240	1119	2974	3639	665
Feb	79	2511	32	3555	1044	3182	3317	135
Mar	85	3775	44	3825	50	4067	4182	115
Apr	86	4236 [1]	49	3870	(366)	4236	4823	587
May	86	4556	53	3870	(686)	4556	4546	(10)
Jun	86	3907	45	3870	(37)	3907	4483	576
Jul	86	4754	55	3870	(882)	4754	5612	860
Aug	86	4310	50	3870	(441)	4310	5972	1662
Sep	86	3893	45	3870	(24)	3893	4731	838
Oct	86	4143	48	3870	(273)	4143	4972	829
Nov	86	3242	38	4085 [2]	843	3242	3912	670
Dec 88	86	2273	26	4300	2063	2237	2883	646
Jan 89	86	2992	35	4515	1523	2992	3639	647
Feb	86	3070	36	4730	1660	3070	3317	247
Mar	86	3862	45	4945	1083	3862	4182	320
Apr	86	4505	52	5160	655	4505	4823	318
May	86	4556	53	5160	604	4556	4546	(10)
Jun	86	3907	45	5160	1253	3907	4483	576
Jul	86	4754	55	5160	406	4754	5612	858
Aug	86	4310	50	5160	850	4310	5972	1662
Sep	86	3893	45	5160	1267	3893	4731	838
Oct	86	4143	48	5160	1017	4143	4972	829

Notes: [1] T-46 hours after Apr 88 are from Table 5-1. [2] T-46 UT rate increases from 45 to 60 during Nov 88 to Apr 89 (12:C-1).

Table 5-11

Feasibility Improvement - Option 4

Month	Original Flying Hour Surplus or (Shortage)	Surplus or (Shortage) after Changes
May 86	(10)	(10)
Jun	576	518
Jul	226	(93)
Aug	670	156
Sep	838	320
Oct	829	276
Nov	670	425
Dec 86	646	646
Jan 87	451	541
Feb	135	349
Mar	(702)	(180)
Apr	(674)	(37)
May	201	473
Jun	756	840
Jul	770	594
Aug	620	290
Sep	541	310
Oct	222	101
Nov	918	842
Dec 87	670	670
Jan 88	665	665
Feb	135	135
Mar	50	136
Apr	(366)	(99)
May	(686)	(251)
Jun	(37)	465
Jul	(882)	(109)
Aug	(441)	114
Sep	(24)	365
Oct	(273)	(16)
Nov	670	670
Dec 88	646	584
Jan 89	647	563
Feb	247	160
Mar	320	210
Apr	318	210
May	(10)	(10)
Jun	576	520
Jul	406	178
Aug	850	542
Sep	838	560
Oct	829	533
Nov	670	517
Dec 89	646	594
Jan 90	647	619

Solutions" must also be kept in mind (see pages 62-65).

Further refinements could be made by going through this exercise again, but greater benefit could probably be realized by employing one of the other potential solutions. For example, one full day of weekend flying would probably make up for any of the remaining monthly flying hour shortages.

These findings sum up the Option 4 analysis:

1. Laughlin pilot production would be decreased by three classes (111 student entries) in order to develop a conversion schedule that might become feasible.

2. Flying hour shortages due to airfield limits are significantly fewer and smaller than in previous options. Large shortages occur only during the ORA.

3. T-46 UT rate continues to be a problem. April through October 1988 have shortages due to this constraint.

4. Juggling class sizes caused notable improvements toward eliminating constraint violations.

5. The remaining flying hour shortages can probably be eliminated by using one or more of the potential solutions mentioned on pages 62-65.

6. The conversion is complete two months earlier than under the Master Plan.

This concludes the analysis of selected options for the T-46 conversion at Laughlin AFB. Findings will be summarized at the end of this chapter. But first, comments are in order concerning subsequent base conversions.

Segment 5, Conversion of Other UPT/SUPT Bases

The Master Plan is currently still very general concerning conversions at the other bases, so the analysis will not be as detailed as with Segment 4. Some comments are appropriate however.

The conversions will be similar to that at Laughlin except for some simplifying factors. No ORA will occur causing a peak in flying hours. Because transition training will be done at Randolph, fewer flying hours will be required (nearly 3000 fewer during the entire conversion at Williams) (16:II-8). The size of the IP bubble at each base will be smaller, 15 instead of 30, causing a smaller need for IP proficiency flying (15 IP x 32.5 Hr/IP-Yr = 487.5 Hours/Year Savings). Simulator conversions will occur more quickly -- four months for each complex -- reducing the use of 50% and No Sim syllabi. With earlier and more rapid aircraft deliveries (17:C-5) relative to the implementation training (17:C-10), T-46 UT rate may be less of a constraint than for Laughlin. Lastly, more T-37s would be available, if needed, from previously transitioned bases.

There may be other problems, however. The planned aircraft delivery schedule (17:C-5) progresses more rapidly than does T-46 class implementation. In fact, at the later bases there is a considerable delay between the final aircraft delivery and the first student sortie in the T-46. Reese AFB has a 6-month delay; Vance, 11 months. Questions such as these arise:

Who will fly the 80 extra aircraft or will they just sit idle, some of them for 18 months?

Where will they be parked? Are there sufficient ramp space and tiedowns or would new facilities need to be constructed?

Cannot the conversion be sped up so it doesn't take a full year? It would involve, at least, accelerating the second Sim Complex and eliminating slack time during the IP transition courses.

Will the aircraft delivery be on schedule, or will slippage likely make them better aligned with the planned SP flight conversions?

Answers to these questions were not investigated in this research but should be of concern as implementation planning continues.

At this point, the post-IOC analysis is complete. A summary of what has been learned is in order.

Summary of Findings

1. The Laughlin AFB conversion schedule needs significant modification to make it feasible.

2. Flying time limitations dictated by aircraft utilization rates and airfield capacity are critical factors. Airfield flying hour capacity and planned T-46 UT rate were exceeded in every option that was evaluated.

3. The necessity of using 50% Sim and No Sim syllabi during the conversion is a major factor contributing to flying hour shortages.

4. The ORA is a peak flying period which causes flying hour shortages.

5. The conversion options can be made more workable by employing a number of modifications:

   a. Converting on-going T-46 classes to the Full-Sim syllabus as soon as the second simulator complex is ready.

b. Taking advantage of excess simulator capacity to decrease flying requirements.

c. Juggling student pilot class sizes to even out shortages and surpluses of flying time.

d. Implementing one or more of the potential solutions, listed on pages 62-65, which are available to the local commander.

6. If aircraft deliveries fall behind schedule, larger flying hour shortages will result.

7. Conversion without the IP bubble is possible if

a. The nine-member IP cadre is still acquired and

b. Laughlin student entries for the year can be decreased by three classes.

8. Either syllabus for IP transition training is feasible in each option; however, the 30-day syllabus is recommended.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this thesis has been to critically evaluate a portion of the T-46A Implementation Master Plan, specifically the pilot conversion process. The primary focus was to be the Laughlin AFB conversion plan -- its feasibility and sensitivity to change. Since the conversion process, as written, turned out to violate flying hour constraints, the focus shifted toward modifications that would make it feasible.

The analysis was done in five segments, with major emphasis on Segment 4 which included the actual student pilot flight conversions and most of the instructor pilot (IP) transition training at Laughlin. The first three segments concerned acquiring and training the bubble of additional IPs, transitioning the first group of IPs to the T-46, and flying the Operational Readiness Assessment. The final segment took a general look at subsequent pilot training base conversions.

Initially the Master Plan was analyzed as written. Then a variety of modifcations were made, with each option being evaluated for feasibility. Factors that were varied or whose impact was assessed include the IP bubble, transition training syllabus, aircraft delivery schedule, aircraft utilization rates, student pilot syllabus length,

simulator delivery schedule, pilot manning of the Operational Readiness Assessment (ORA), and conversion sequencing at later bases.

Conclusions

The conclusions reached are based on the estimates derived for options that were analyzed. No claim is made that these are the best possible options, since no criteria have been established for optimality.

Segments 1 and 2. The ORA is planned for 30 through 90 days after the 20th aircraft delivery, or approximately March and April 1987. In order for this to occur on schedule, at the very latest, 12 IPs must enter transition training 1 February and nine more 1 March as the ORA begins. The bubble of additional pilots should arrive to begin their IP training during January through July 1986. This could be delayed somewhat as long as the transition schedule listed above can be met. If there is no IP bubble, one student pilot class (starting in January) could be deleted in order to meet the transition schedule.

Segment 3. The ORA could be manned with 30 qualified pilots for the full two months. Another feasible approach is to start with 21 pilots and transition the other nine during the first three weeks. Both approaches will generate 2400 flying hours at an even rate over the two month period. In the first option pilots would fly 19% of their time solo or as orientation sorties. The second option would require as high as 27% solo flying for some IPs during the first month. If aircraft deliveries fell behind schedule, the ORA would simply be postposed until

30 days after the 20th aircraft arrival.

Segment 4, Master Plan. Without significant modification the Laughlin conversion schedule is not feasible due to the fact that flying hours required exceeds those available during several months. Shortages are the result of either an aircraft utilization constraint or an airfield capacity constraint.

Three factors appear to be causing the increased flying hour requirements. The primary one is the necessity of using partial and no simulator syllabi during the conversion. This factor alone causes significant shortages where there are none under the present T-37 program. Second, the ORA causes large shortages for its two month period. A third contributing factor is that the temporary 45 hour utilization rate (T-46) is less than is currently required of the T-37 in peak months. If either aircraft deliveries or simulator conversions fall behind schedule, the shortages will be further aggravated.

Several measures are available which may help decrease the shortages. Some were decreased by expanding use of the simulators by approximately one-sixth. Also, converting on-going classes to the Full Sim syllabus as soon as the second complex is ready causes some improvement. A number of other potential solutions are suggested in Chapter 5.[1] Using one or more of these may make the schedule completely workable.

Segment 4, No IP Bubble. T-46 conversion appears to be possible even without the additional IPs, and while still maintaining the required pilot production command-wide. It would require shifting some of the

[1]See pages 62-65.

student load to other SUPT bases which would increase the average IP flying time. It would also require juggling some class sizes, flying some weekends or using some of the other potential solutions.

Segment 5, Other Base Conversions. Flying hour constraints should be less restrictive than at Laughlin due to decreased flying associated with their conversions. Problems may result from the long lag between planned aircraft deliveries and class conversions particularly at Reese AFB and Vance AFB.

Recommendations

The results and conclusions concerning each segment and option should be considered only with a thorough understanding of the applicable assumptions. Also remember that all results are estimates based on these assumptions as well as forecast input data. The results and conclusions can be accurate only insofar as the assumptions and inputs are accurate. They should be used as a basis for further analysis and planning for the T-46 conversion.

Some of the procedures used in this effort were quite routine and tedious. Perhaps some more advanced, labor-saving techniques are or will become available for performing parts of the analysis and acquiring a more nearly optional solution. The following are possibilities:

1. A networking/goal programming approach might be used to equalize the monthly deviations from target constraints (flying hours available)

a. for the short run, by adjusting student pilot class loads, or

b. for the long run (steady state), by adjusting class entry and graduation dates to even out the monthly deviations from capacity.

2. Modify the ATC computer program which forecasts flying hours required. Adjust it to handle the variations used in Segment 4 such as using full, partial and no simulator classes at the same time. Data in this document might be used in validating such a program.

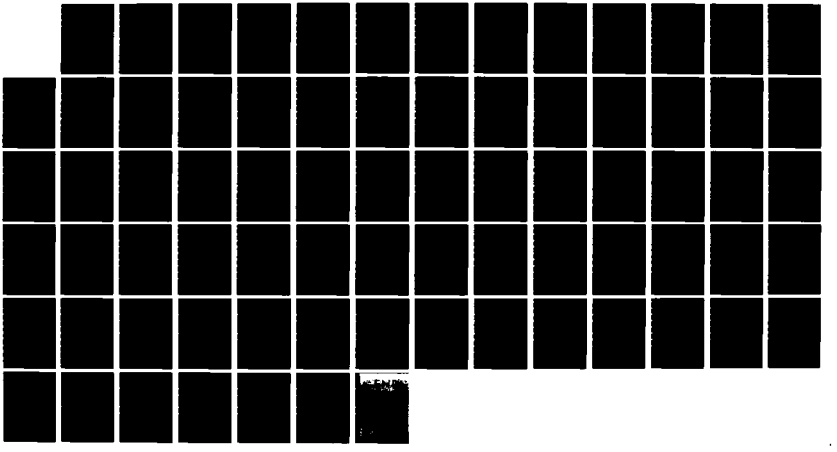
3. Use linear programming to select the optimum assignment of syllabi to classes during the simulator conversion.

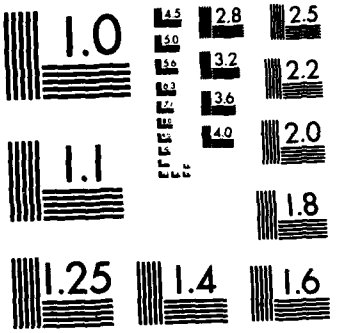
APPENDIX A

EXCERPT FROM THE T-46A IMPLEMENTATION MASTER PLAN

AD-A134 404 ANALYSIS OF THE PILOT CONVERSION PROCESS FOR THE AIR FORCE T-46A JET TRAI..(U) AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL OF SYST.. V S JENSEN 2/2

UNCLASSIFIED SEP 83 AFIT-LSSR-51-83 F/G 5/9 NL





HEADQUARTERS
AIR TRAINING COMMAND
UNITED STATES AIR FORCE

Randolph Air Force Base, Texas 78150

ATC PROGRAM ACTION DIRECTIVE

PAD 1-83

T-46A IMPLEMENTATION MASTER PLAN

Prepared by: XPXP
1 March 1983

HEADQUARTERS AIR TRAINING COMMAND
Randolph Air Force Base, Texas

TABLE OF CONTENTS

ABBREVIATIONS

3ABR Training	Resident training for airmen (basic AFSC awarding)
ACE	Accelerated Copilot Enrichment
AFLC	Air Force Logistics Command
AFMPC	Air Force Manpower and Personnel Center
AFSC	Air Force Systems Command
AFTEC	Air Force Test and Evaluation Center
AICUZ	Air Installation Compatible Use Zone
AIDS	Aircraft Incident Data System
ASD	Aeronautical Systems Division
ASP	Aerospace Physiology
ATC	Air Training Command
CTTC	Chanute Technical Training Center
DOPAA	Description of Proposed Action and Alternatives
DT&E	Development Test and Evaluation
EIAP	Environmental Impact Analysis Process
ENJJPT	Euro-NATO Joint Jet Pilot Training
FOT&E	Follow-on Operational Test and Evaluation
FSD	Full Scale Development
FTD	Field Training Detachment
FTW	Flying Training Wing
GOR	General Operating Requirement
HF	Human Factor
ICS	Interim Contractor Support
IFS	Instrument Flight Simulator
ILSP	Integrated Logistics Support Plan

IOC	Initial Operational Capability
IOS	Initial Operational Site
IOT&E	Initial Operational Test and Evaluation
IP	Instructor Pilot
MENS	Mission Element Need Statement
MTS	Mobile Training Set
MTT	Mobile Training Team
NGT	Next Generation Trainer
OL	Operating Location
ORA	Operational Readiness Assessment
PAD	Program Action Directive
PIT	Pilot Instructor Training
PMD	Program Management Directive
PMP	Program Management Plan
POM	Program Objective Memorandum
RFPP	Request for Purchase Package
R&M	Reliability and Maintainability
SAMP	Site Activation Management Plan
SATAF	Site Activation Task Force
SPO	System Program Office
STTS	Sheppard Technical Training Center
SUPT	Specialized Undergraduate Pilot Training
TEMP	Test and Evaluation Master Plan
TOT	Task Oriented Trained
Type 1 Training	Contractor
Type 2 Training	Resident (short-lived)

Type 3 Training	Resident
Type 4 Training	MTT or FTD
UMD	Unit Manning Document
UNT	Undergraduate Navigator Training
UPT	Undergraduate Pilot Training

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HEADQUARTERS AIR TRAINING COMMAND
Randolph Air Force Base, Texas

T-46 IMPLEMENTATION MASTER PLAN

1. References:

a. ATC GOR 01-78 "General Operating Requirement for Specialized Undergraduate Pilot Training."

b. HQ USAF Mission Element Need Statement (MENS), 26 Jun 79, for Primary Undergraduate Pilot Training System.

c. HQ USAF Program Management Directive for T-46A, PMD No R-Q 8067(9), 19 Nov 82.

d. Next Generation Trainer Test and Evaluation Master Plan (TEMP), Apr 82.

e. ASD Draft T-46 Master Deployment and Site Activation Plan.

2. Organizations:

a. HQ USAF, Washington, DC

b. HQ AFSC, Andrews AFB, MD

c. HQ AFTEC, Kirtland AFB, NM

d. HQ AFLC, Wright-Patterson AFB, OH

e. HQ ATC, Randolph AFB, TX

f. HQ AFMPC, Randolph AFB, TX

g. HQ ASD (AFSC), Wright-Patterson AFB, OH

h. CTTC, Chanute AFB, IL

i. STTC, Sheppard AFB, TX

j. 14 FTW, Columbus AFB, MS

k. 47 FTW, Laughlin AFB, TX

l. 323 FTW, Mather AFB, CA

m. 12 FTW, Randolph AFB, TX

n. 64 FTW, Reese AFB, TX

o. 71 FTW, Vance AFB, OK

p. 80 FTW, Sheppard AFB, TX

q. 82 FTW, Williams AFB, AZ

r. 3306 TES, Edwards AFB, CA

s. 3307 TEV, Wright-Patterson AFB, OH

3. General Instructions:

a. This Program Action Directive (PAD) was developed IAW ATCR 27-2 and is comprised of two major parts: the basic directive and staff annexes.

b. The basic directive contains general instructions, objective, program guidance, assumptions, concept of operations, specific staff guidance, command matters and coordination, and termination instructions.

c. The staff annexes contain specific guidance, individual tasks, and the schedule of completion of each task.

4. Objective: This directive provides a plan of action for the orderly implementation of the T-46A aircraft and instrument flight simulator into the Undergraduate Pilot Training (UPT) Program.

5. Program Guidance:

a. The requirement for the T-46A stems from the ATC GOR 01-78 and the HQ USAF MENS, dated 26 Jun 79. The T-46A will correct operational deficiencies present in the T-37 and address the impending T-37 end of design life and fleet insufficiency problem. The new system provides considerable fuel and maintenance savings. PMD R-Q 8067(9) directs full scale development (FSD).

b. HQ USAF/RDQL is the T-46A Program Element Monitor, HQ AFSC/SDTA is the Systems Command OPR, HQ ASD/AFG, Wright-Patterson AFB, OH is the Aeronautical Systems Division program manager, and HQ ASD/YWB is the simulator program office. HQ ATC OPR is XPQ acting as the T-46A single program manager.

c. Environmental Impact Analysis Process (EIAP) will be performed by HQ AFSC. HQ ATC/DEV will ensure that a site specific environmental impact analysis is performed for each operating location (OL) prior to implementation.

6. Assumptions:

a. Funds will be provided to ensure the projected aircraft and simulator delivery schedules are met (most recent aircraft delivery schedule dated 29 Oct 82; simulator schedule TBD).

b. Aircraft and simulator initial operational capability (IOC) will be simultaneous at the initial operation site (IOS).

c. Only one site will be implemented at a time.

d. Concurrent TTB and T-46 implementation will not be attempted at the same site.

e. The Specialized Undergraduate Pilot Training (SUPT) syllabus will be used for T-46A aircraft and simulator phase-in schedules, i.e., 85 aircraft hours in primary phase, based on the FY 86 IOC of the Tanker-Transport-Bomber (TTB) aircraft.

f. A three calendar week class entry cycle will be used.

g. An initial 45 hr/mo T-46A utilization rate will be used for operations and logistics planning.

h. The IOC simulator capability will be one complete complex of four T-46A cockpits. T-50 downtime for the initial simulator conversion will not exceed six months. Subsequent T-50 complexes will be converted from T-37 to T-46 cockpits in four months.

i. Periodic revisions to this plan will be made as required.

7. Concept of Operations:

a. The T-46A is scheduled to replace the T-37 in the primary phase of pilot training. Starting with aircraft deliveries at Laughlin AFB in Fiscal Year (FY) 3/86, the programmed aircraft conversion will continue through FY 2/92. Specific base phase-in dates are contained in Annex U.

b. The IOC defined as the initiation of student training, will occur not later than FY 4/87. Prior to the IOC, the following activities will be conducted at Laughlin AFB: technical order verification, follow-on test and evaluation (FOT&E), the Operational Readiness Assessment (ORA), and T-46A transition training for instructor pilots qualified in the T-37. Specific initiation dates for these activities and student class phase-in dates are contained in Annex U.

c. In addition to the replacement of the T-37 in primary training, the Pilot Instructor Training (PIT) Course at Randolph AFB and the Undergraduate Navigator Training (UNT) Course at Mather AFB will transition to the T-46A on the dates indicated in Annex U. Use of the T-46A in support of the Euro-NATO Joint Jet Pilot Training Program (ENJJPT) and the Accelerated Copilot Enrichment (ACE) Program is to be determined.

d. After implementation at the IOS, T-46A transition training, course number (TBD), will be located at Randolph AFB for all subsequent bases. PIT training in the T-46A will begin at Randolph in FY (TBD) in course number (TBD).

e. The T-50 instrument flight simulator (IFS) conversion to T-46 cockpits will be phased in simultaneously with the aircraft. The simulator IOC is programmed for Laughlin AFB NLT FY 4/87. During the transition period conversion of existing T-50 IFS facilities will require a partial and/or non-simulator syllabus be used for a portion of the student pilot population. Specific simulator phase-in dates are contained in Annex U.

f. Priority additive manning will be given to fill conversion authorizations for each base in succession. This provides necessary support to conduct T-46A transition training and continue programmed pilot production during the phase-in. An additional 30 IP and 70 maintenance authorizations are programmed for this purpose. Increases in authorizations are programmed for transition support

in PIT, technical training, and the 3305 School Squadron for syllabus development. Details are contained in Annex B, Plans, and Annex C, Operations.

g. This programming directive is for general planning purposes only. Periodic revisions will be made as required but at least every six months. HQ ATC/XP, in conjuction with the ASD Site Activation Task Force (SATAF), will develop a site specific implementation plan beginning NLT 24 months before implementation. The ATC site specific plan will augment the ASD Site Activation Management Plan (SAMP) and task each implementing wing to identify an implementation project officer and site activation working group. This group will develop a wing implementation plan based on the SAMP and the HQ ATC plan. A copy of the wing plan will be submitted to HQ ATC/XP for review and approval 120 days prior to scheduled receipt of that wing's first T-46A.

8. Specific Guidance:

a. Headquarters Air Training Command:

(1) DCS/Plans will:

(a) Be responsible for Annex B, Plans.

(b) Manage the preparation and revisions of this PAD.

(c) Participate in and manage, as necessary, all Command activities dealing with T-46A implementation to ensure achievement of the program objective.

(d) Provide a central point for all matters pertaining to T-46A implementation.

(e) Work directly with HQ ASD/AFG to develop a T-46 master deployment and site activation plan and subsequent site activation management plans.

(f) Act as the OPR for coordination of site activation plans with all HQ ATC offices of collateral responsibility (OCR), i.e., ATC/AC/DE/DC/DO/DP/IG/LG/SG/TT.

(g) Program required resources in cooperation with OCRs.

(h) Staff manpower requirements and actions.

(i) Conduct and/or support studies and analyses as needed.

(j) Manage T-46A Follow-on Test and Evaluation (FOT&E) IAW AFR 80-14 and the Test and Evaluation Master Plan (TEMP).

(k) Prepare FOT&E reports and submit them to AFTEC IAW AFR 80-14 and AFR 23-36.

(l) Prepare Description of Proposed Action and Alternatives (DOPAA) on AF Form 813. This initiates the Environmental Impact Analysis Process (EIAP) IAW AFR 19-2.

(2) DCS/Operations will:

(a) Be responsible for Annex C, Operations.

(b) Develop the operational portion of an implementation plan which will maintain programmed pilot production.

(c) Develop the T-46 syllabus (aircraft and simulator) using the ISD process.

(d) Develop course material and define associated training aids for the T-46A.

(e) Develop a standardization and evaluation program for the T-46A.

(f) Ensure concept of operations is compatible with existing ATC facilities and airspace.

(g) In conjunction with ATC/SG, insure the physiological training course for the T-46A is compatible with the forecast training flow.

(h) In conjunction with ATC/IG, develop safety of flight requirements specific for the T-46A.

(i) With AFMPC, plan and coordinate any student entry changes resulting from implementation.

(j) In conjunction with ATC/DP, ensure adequate instructor pilots are available during implementation.

(k) Assist the wings to develop an implementation plan for each base.

(l) Provide projected operational data for each OL to support site specific environmental impact analysis and update of Air Installation Compatible Use Zone (AICUZ) noise contour maps. Required data includes number of departures, arrivals, closed patterns, takeoffs, landings, and total operations per average busy days flight tracks and frequency of utilization of each.

(m) Participate as required in FOT&E.

(3) DCS Logistics will:

(a) Be responsible for Annex D, Logistics.

(b) Provide projected operational data for each OL to support site specific environmental impact analysis and update of AICUZ noise contour maps. Required data includes ground engine runups.

(c) Participate as required in FOT&E.

(4) DCS/Personnel will be responsible for Annex E, Personnel.

(5) Office of Public Affairs will be responsible for Annex F, Public Affairs.

(6) DCS/Comptroller will:

(a) Coordinate with ATC staff agencies for all funding requirements in support of this program.

(b) Coordinate with appropriate budget offices for funding requirements in conjunction with the relocation of T-37B and acquisition and implementation of T-46A aircraft.

(7) Surgeon will be responsible for Annex J, Surgeon.

(8) Communications/Electronics will provide guidance for and monitor provision of required communications.

(9) DCS/Engineering and Services will be responsible for Annex L, Engineering and Services.

(10) Inspector General will be responsible for Annex N, Inspector General.

(11) DCS/Technical Training will be responsible for Annex T, Technical Training.

(12) Directorate of Administration will publish this PAD and its revisions.

b. Headquarters Aeronautical Systems Division (AFSC) as tasked in the ASD/AFG draft T46A master deployment and site activation plan and PMD R-Q 8067 (9) will:

(1) Develop a T-46A master deployment and site activation plan.

(2) Conduct site surveys in conjunction with HQ ATC/XP/DE/LG and the T-46A system contractor's facility engineers to determine needed facility modifications or additions at each implementing base. Facility design criteria and requirements will be identified at least 40 months prior to operational need dates.

(3) Organize and manage the Site Activation Task Force (SATAF) under the T-46A special program office deployment manager.

(4) Develop and implement a Site Activation Management Plan (SAMP) for each base in conjunction with ATC, AFLC, and the implementing wing.

(5) Ensure that the SAMP identifies required resources to support initial and follow-on flying and simulator operations.

(6) Develop alternate temporary support programs to compensate for late delivery of resources.

(7) Update environmental assessment, Next Generation Trainer (NGT) prepared by HQ ASD/AFGM and DES 29 Apr 82 and revised 10 Jun 82. The update will include air emissions, ground noise, and flight noise measurements obtained during full scale development.

c. HQ Air Force Logistics Command, as tasked in PMD R-Q 8067(9), will:

(1) With AFSC, take the logistics actions necessary to achieve an efficient, operationally supportable system. Support AFSC in development, maintenance and implementation of the Integrated Logistics Support Plan (ILSP).

(2) Assist AFSC to develop and execute an R&M program as required by AFR 800-18, Air Force Reliability and Maintainability Program.

(3) With AFSC determine the need for interim contractor support (ICS) IAW AFR 800-21, Interim Contractor Support for Systems and Equipment. If required, plan and budget for ICS.

(4) With AFSC and ATC, determine the maintenance support concept IAW AFR 66-14, Equipment Maintenance Policies, Objectives and Responsibilities. Accomplish for the implementing command depot level maintenance source repair decision per the AF decision tree process. Accomplish generic logistics decision tree analysis for wholesale-level logistics support modules other than depot maintenance.

(5) Provide support to AFSC and ATC as required to include assistance in updating of the Systems Operational Concepts, Program Management Plan (PMP), ILSPs, and other logistical programs and concepts as appropriate.

(6) Provide the required support to AFSC and ATC for aircrew training devices programs.

(7) If appropriate, support AFSC in the development of a depot IOC commensurate with the operational IOC.

d. AFTEC, as tasked in PMD R-Q 8067(9) will monitor and support the ATC managed FOT&E IAW AFR 80-14, Test and Evaluation, and as agreed to in the T-46A Test and Evaluation Master Plan (TEMP).

e. Commander, each ATC Flying Training Wing, will:

(1) Assist HQ ATC in the implementation of the T-46A through the management of wing level activities.

(2) Develop a wing implementation plan to supplement the SAMP and HQ ATC plan. This plan will be submitted to HQ ATC/XP NLT 120 days prior to delivery of the first T-46A.

9. Command Matters, Coordination, and Reporting:

a. This PAD is directive on ATC organizations and is effective upon receipt. The PAD is provided for information/planning purposes for all other agencies. Reporting procedures are outlined in Annex V.

b. Annexes will contain specific information regarding assumptions, procedures, explanations, and task schedules (ATC Form 793) considered appropriate by the staff agency preparing the annex.

c. Direct coordination between staff agencies and units involved is authorized and required. HQ ATC/XPX/XPQ will be information addressee on all correspondence relating to this PAD. All policy matters, to include review of all programming documents relating to T-46A implementation, will be coordinated through DCS/Plans.

d. OPR/points of contact for T-46A implementation:

(1) HQ ATC/XPQ (Command Single Program Manager), Randolph AFB, TX, AUTOVON 487-4073

(2) HQ ATC/XPX (Command OPR for implementation), Randolph AFB, TX, AUTOVON 487-3735/4409/4411.

(3) HQ ASD/AFGM (Integration Branch), Wright-Patterson AFB, OH, AUTOVON 785-3227/5320.

(4) HQ ATC/DOX, Randolph AFB, TX, AUTOVON 487-4969.

(5) HQ ATC/LGY/LGX, Randolph AFB, TX, AUTOVON 487-4602.

(6) HQ ATC/DPX, Randolph AFB, TX, AUTOVON 487-4787.

(7) HQ ATC/PAX, Randolph AFB, TX, AUTOVON 487-3964.

(8) HQ ATC/ACX, Randolph AFB, TX, AUTOVON 487-6871.

(9) HQ ATC/SGPT, Randolph AFB, TX, AUTOVON 487-4869

(10) HQ ATC/DCX, Randolph AFB, TX, AUTOVON 487- 4531.

(11) HQ ATC/DEP, Randolph AFB, TX, AUTOVON 487-6200.

(12) HQ ATC/IGF, Randolph AFB, TX, AUTOVON 487-5817.

(13) HQ ATC/TTY, Randolph AFB, TX, AUTOVON 487-2707.

10. Termination: This PAD will be terminated upon written notification from DCS/Plans.

FOR THE COMMANDER

Monte D Montgomery

MONTE D MONTGOMERY
Brigadier General, USAF
Deputy Chief of Staff, Plans

ANNEXES

B - Plans
C - Operations
D - Logistics
E - Personnel
F - Public Affairs
J - Surgeon
L - Engineering & Services
N - Inspector General
T - Technical Training
U - Implementation Schedule/Flow
V - Reporting Requirements
W - Aircraft Dimensions
Z - Distribution

8

ANNEX B

PAD 1-83

PLANS

1. OBJECTIVE: This annex provides manpower, test, and organizational guidance for the orderly implementation of the T-46A.

2. ASSUMPTIONS:

a. That funds and manpower resources for conversion, as requested in ATC 85-89 Program Objective Memorandum (POM), will be approved by HQ USAF and allocated to HQ ATC.

b. Follow-on operational test and evaluation (FOT&E) will start at Laughlin AFB, TX and continue throughout implementation.

c. That pilots participating in the initial operational test and evaluation (IOT&E) at Edwards AFB CA will form the initial transition course IP cadre at Laughlin AFB TX.

d. That some IOT&E pilots will be available to HQ ATC to manage training system development.

3. CONCEPT OF OPERATIONS:

a. Planning documents:

(1) In addition to ATC PAD 1-83, the Aeronautical Systems Division (ASD) of AFSC is developing a Master Deployment and Site Activation Plan. The ASD plan establishes a Site Activation Task Force (SATAF) at each base which is responsible for developing and implementing plans and programs to insure the availability, delivery, and integration of the T-46A and all support resources. The SATAF is composed of functional working groups responsible for identifying and resolving problems associated with implementation. SATAF membership includes representatives from ASD, HQ ATC, SA-ALC, and the base being implemented.

(2) Future revisions to ATC PAD 1-83 will clarify HQ ATC and the implementing base responsibilities in site specific planning and activation. Duplication of effort and conflicting areas of responsibility between ATC and ASD will be avoided. When the ASD plan is finalized, it and all revisions thereto will be included as an attachment to this PAD.

b. Manpower:

(1) The attached manpower authorizations are required to support design, development, acquisition, and implementation. Delta's to the funded line were requested, as indicated, in the 85-89 POM process to achieve the

required manpower levels. HQ ATC/XPM will continue to pursue appropriate authorizations to insure adequate resources are available.

(2) HQ ATC/XPM will:

(a) Place all manpower spaces on the Unit Manning Documents (UMDs) immediately upon allocation of spaces to HQ ATC.

(b) Track manpower requirements and savings, as stated in para (1) above, to insure accurate and timely allocations/withdrawals.

(c) Work with HQ ATC/DP staff to insure specific categories, AFSCs, PASs, and other data elements are available to insure implementation of conversion.

(d). Initiate other manpower and organizational actions as required.

c. Follow-on Test and Evaluation (FOT&E):

(1) The T-46 FOT&E will be conducted in accordance with the ATC FOT&E test plan prepared by ATC/XPQ in accordance with ATCR 80-14.

(2) Data will be gathered during the operational readiness assessment (ORA) and during implementation.

(3) Specific tasking for participating organizations will be contained in the test plan.

(4) HQ ATC/XPQ will publish an FOT&E test report at the conclusion of testing.

4. RESPONSIBILITY: The DCS/Plans OPRs are listed below:

a. PAD OPR is XPXP - AUTOVON 487-4411 (Maj Jack Hannig).

b. Manpower OPR is XPMO - AUTOVON 487-4484 (Maj Greg Wilinski).

c. Command Focal Point is XPQC - AUTOVON 487-4073 (Lt Col Bill Ebert).

d. Command Test and Evaluation OPR is XPQC - AUTOVON 487-4073 (Maj Charles Anderson).

Monte D. Montgomery

MONTE D. MONTGOMERY
Brigadier General, USAF
Deputy Chief of Staff/Plans

1 Atch
1. T-46A Manpower Requirements

T-46A MANPOWER REQUIREMENTS

FUNCTION	PROGRAM ELEMENT	85				86				87				88				89			
		O	E	C	T	O	E	C	T	O	E	C	T	O	E	C	T	O	E	C	T
AFTEC	84771A	6	29	0	35	6	29	0	35												
3306 TEV + FTD	84772	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10
3307 TEV ACQUISITION MGT	84771A	1	13	0	14	1	13	0	14	3	13	0	16	3	13	0	16	3	13	0	16
TRANSITION TNG	84741A									30	0	0	30	30	0	0	30	30	0	0	30
MAINT TRANSITION	84741M									0	36	0	36	0	33	0	33	0	29	0	29
MAINT SAVINGS	84741M									0	4	0	4	0	(10)	0	(10)	0	(123)	0	(123)
12FTW (PIT) + O/H	84741A									10	0	0	10	10	0	0	10	10	0	0	10
12FTW (PIT) MAINT	84741M													0	(1)	0	(1)	0	(8)	0	(8)
SIMULATOR MAINT	84741M					1	4	0	5	1	4	0	5	1	4	0	5	1	4	0	5
3305 SCHOOL SQ	84771A	5	0	0	5	5	2	1	8	5	2	1	8	5	2	1	8	5	2	1	8
HQ ATC	85798A									4	0	0	4	4	0	0	4	4	0	0	4
MAINT TNG/CONV TEAM	84741M					2	68	0	70	2	68	0	70	4	136	0	140	4	136	0	140
TOTAL REQUIRED		12	52	0	64	15	126	1	142	55	137	1	193	57	187	1	245	57	63	1	121
FUNDED		7	51	0	58	60	18	0	78	60	18	0	78	60	18	0	78	60	18	0	78
FY 85 POM REQ		5	1	0	6	(45)	108	1	64	(5)	119	1	115	(3)	169	1	167	(3)	45	1	43
+BOS			0		0		6		6		12		12		17		17		4		4
TOTAL Deltas		5	1	0	6	(45)	114	1	70	(5)	131	1	127	(3)	186	1	184	(3)	49	1	47

NOTE: Based on 78.3 FH PRIMARY SYLLABUS

O (Officer) - E (Enlisted) - C (Civilian) - T (Total)

T-46A MANPOWER REQUIREMENTS (Cont)

FUNCTION	PROGRAM ELEMENT	90 O	90 E	90 C	90 T	91 O	91 E	91 C	91 T	92 O	92 E	92 C	92 T	93-EP O	93-EP E	93-EP C	93-EP T
AFTEC	84771A																
3306 TEV + FTD	84772	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10
3307 TEV ACQUISITION MGT	84771A	3	8	0	11	3	8	0	11	3	8	0	11				
TRANSITION TNG	84741A	30	0	0	30												
MAINT TRANSITION	84741M	0	26	0	26	0	13	0	13								
MAINT SAVINGS	84741M	0	(287)	0	(287)	0	(379)	0	(379)	0	(392)	0	(392)	0	(392)	0	(392)
12FTW (PIT) + O/H	84741A																
12FTW (PIT) MAINT	84741M	0	(22)	0	(22)	0	(33)	0	(33)	0	(42)	0	(42)	0	(49)	0	(49)
SIMULATOR MAINT	84741M	1	4	0	5	1	4	0	5	1	4	0	5				
3305 SCHOOL SQ	84771A	5	2	1	8	5	2	1	8	5	2	1	8				
HQ ATC	85798A	4	0	0	4	4	0	0	4	4	0	0	4				
MAINT TNG/CONV TEAM	84741M	4	136	0	140												
TOTAL REQUIRED		47	(123)	1	(75)	13	(375)	1	(361)	13	(410)	1	(396)	0	(431)	0	(431)
FUNDED		60	18	0	78	60	18	0	78	60	18	0	78	60	18	0	78
FY 85 POM REQ																	
+ BOS																	
TOTAL																	

ANNEX C

PAD 1-83

OPERATIONS

1. OBJECTIVE: This annex provides operational guidance for the integration of the T-46A aircraft and Instrument Flight Simulator (IFS) into the ATC Undergraduate Pilot Training (UPT) Program.

2. ASSUMPTIONS:

a. The T-46A utilization rate will be 45 hours/month until 18 months after the completion of the Operational Readiness Assessment (ORA). Thereafter, a 60-hour/month utilization rate will be attained by the 24th month.

b. The down time for a four cockpit IFS complex will not exceed six months during simulator conversion.

c. Implementation will be based on a three-week class entry cycle with 14 classes per year.

d. Instructor pilots will not be dual instructor pilot qualified in both the T-37 and T-46.

e. A higher flying time syllabus will be used for some classes during implementation due to simulator conversion down time.

f. Undergraduate Pilot Training (UPT)/Specialized Undergraduate Pilot Training (SUPT) production goals will be sustained during implementation (initial planning assumed 2200 production goal).

g. When concurrent implementation of the T-46 and TTB occurs, it must be at different bases.

h. T-46 implementation will be completed at one base prior to beginning at the next site.

i. Implementation is based on operational capability and class integrity and is not tied to the increased aircraft delivery rate possible under the current acquisition schedule (30 Aug 82).

j. A concurrent aircraft and simulator operational capability will be achieved with the initiation of student training at each implementing wing.

3. CONCEPT OF OPERATIONS:

a. T-46 Aircraft Delivery: The T-46 aircraft delivery will start at Laughlin AFB in Apr 86. The aircraft delivery will continue at a rate outlined in Atch 1. The aircraft will be flown initially for transition of a T-46 instructor cadre and to complete the operational readiness assessment (ORA) planned for 2400 hours in a two-month period. The ORA is scheduled to begin 30 days after the 20th aircraft is delivered in Jan 87. Additional

officer manpower has been programmed to conduct the ORA, T-46 transition training and form the original nucleus of instructors to start student training at Laughlin AFB (Atch 2).

b. T-46 Instructor Force: The instructor force will refine the syllabus training flow and course training material prior to the first student class. The 30 instructors will then be divided into the first flight of T-46 instructor pilots (15) and a transition training IP force (15) to train the remaining T-37 flight IPs at Laughlin. The additional instructors will allow normal student training to continue while each flight of T-37 IPs undergoes transition training. This bubble of extra instructors will move from wing to wing during implementation to maintain programmed production.

c. T-46 Transition Training: The transition course for the T-46 consists of 14 sorties and is four weeks long (Atch 3). As one flight of IPs (15) completes transition training and starts student training, another flight will start the transition course. This flow of training one flight of IPs at a time will allow for continual student training and match each subsequent class start date (Atch 4). The Squadron Commander will insure that he realigns his flight personnel to maintain an experienced balance between T-37 and T-46 IPs. As a policy, the experienced definition as outlined in ATCR 51-37 should be used during the IP transition phase to maintain this experienced balance. For those instructors not experienced, a minimum of six months ATC IP experience is desirable prior to T-46 transition training. For the initial cadre no new IPs directly from MAJCOMs or FAIPs will be transitioned until the formal PIT course is started at Randolph AFB in Jun 88. There will be an active duty service commitment for T-46 transition training based upon AFR 36-51 criteria. Individuals who do not desire T-46 transition and are approaching assignment may be reassigned early. It may be necessary to extend some instructors to maintain experience levels during the transition period.

d. T-46 Pilot Instructor Training (PIT): The initial Randolph AFB PIT cadre will consist of PCS members from the Laughlin transition cadre and 559th FTS instructors who have attended the transition course at Laughlin. The T-46 transition and T-46 PIT training will be maintained at Randolph AFB for the remainder of implementation. The T-46 PIT course will be conducted concurrently with T-37 PIT and build up as the T-37 IP requirement decreases during implementation. To maintain adequate experience levels, ATC career trainer personnel will be used when possible.

e. T-46 Student Training: Student training will begin at Laughlin AFB with Class 88-10 on 6 Jul 87. The remaining classes will begin training in accordance with the schedule at Atch 5. This inflow of student classes will insure a smooth transition of the T-46 into the primary phase matching simulator availability and instructor pilot transition training rate. The remaining wings will start student training as outlined in Atch 6. More detailed class starting dates will be defined in the site specific implementation plans for each wing.

f. T-46 Simulator Swap-out: During the T-46 transition, the T-50 simulator will be modified with a T-46 cockpit. To maintain maximum simulator availability, only one complex will be shut down at a time. The first complex at each base will be shut down six months prior to the wing's first T-46

student class start date. This complex will be complete and ready for training with the first T-46 class. The remaining complex will utilize the current T-50 for those students in T-37 training. Because there will be only half of the T-50 simulators available, a 50% simulator syllabus (Atch 7) will be available to insure that students receive adequate training. The initial T-46 simulator complex will build up to a maximum utilization rate near the end of each wing's implementation program. At this time, those students in the T-46 may be required to fly a 50% simulator syllabus. The last complex is scheduled for shut down six months after the first T-46 class starts and will be operational when the last T-46 class enters training. The down time for the simulator swap-out is an estimate only. The actual down time may be shorter or longer. Simulator swap-out schedule is at Atch 8.

g. Three-week Entry Cycle: Prior to the T-46 implementation, the five UPT wings will convert from the present six-week UPT class entry cycle to a new three-week SUPT class entry cycle. This new cycle will place all five wings on the same calendar with common class entry and graduation dates. The three-week common entry and graduation dates for all five wings will facilitate student PCS moves as necessary to TTB/FAR training bases, allow approximately three weeks for the PCS move, and stabilize the pipeline flow of students. Presently, three wings are on one calendar and two wings are on a different calendar. Even though these calendars are staggered three weeks apart, it results in an unequal number of entries and graduates every three weeks. The three-week entry cycle will also be used to smoothly convert the present 49-week UPT course to the 52-week SUPT course (Atch 9). The 52-week SUPT course will facilitate the additional flying time for the SUPT syllabus. The new cycle will result in 14 smaller classes (37 students) per year rather than eight larger classes (65 students) per year for each base (Atch 10). This will reduce the T-46 instructor pilot training requirements per class as well as the number of T-46 aircraft required to start the first class. The three-week entry cycle does not change the total time required to implement each base but facilitates a smoother more incremental rate rather than large pulses. The phase-in of the three-week entry cycle does not require all bases change to SUPT syllabus. Only those classes designated for the SUPT syllabus will receive the increased flying hours. The remaining bases will stay under the UPT syllabus but do so under an SUPT 52-week course length. As the delivery of the TTB aircraft increases, more and more primary classes will convert to the SUPT primary syllabus, but no adjustments will have to be made to the course length, or entry and graduation dates. The changeover to the three-week entry cycle will start in Mar 86 with Class 87-05 at Williams, Vance and Columbus AFBs, and in Apr 86 with Class 87-06 at Laughlin and Reese AFBs. All primary classes will be converted to the three-week entry cycle by Jul 86. This will match the proposed start of the first TTB/FAR track in accordance with the 1986 TTB Lease IOC. All basic phases will convert to the three-week entry cycle in Jul 86 and be complete by Feb 87 (Atch 11).

4. RESPONSIBILITY: The DCS/Operations OPR for this annex is DOXX, AUTOVON 487-4969 (Capt Ray Chapman).

11 Atch
1. Aircraft Delivery Schedule
2. Operations T-46 Implementation Officer Requirements
3. Proposed T-46A Transition Syllabus
4. T-46 IP Transition Entry/Grad Dates
5. T-46 Class Dates (Laughlin AFB)
6. T-46 Student Class Implementation
7. Options for Phase II Fly Hrs w/T-46 IFS Implementation
8. Desired Simulator Implementation Schedule
9. Calculations to Determine UPT/SUPT Course Length
10. Calculations of Tng Classes per Year
11. Three-week Entry Cycle Phase-in

EDWARD N. GIDDINGS
Brigadier General, USAF
Deputy Chief of Staff/Operations

AIRCRAFT DELIVERY SCHEDULE*

BASE	DELIVERY DATE	AIRCRAFT DELIVERY/CUMULATIVE TOTAL
LAUGHLIN AFB TX	APR 86 - MAR 88	86/86
RANDOLPH AFB TX	MAR 88 - JUL 88	36/122
WILLIAMS AFB AZ	JUL 88 - MAR 89	88/210
COLUMBUS AFB MS	MAR 89 - OCT 89	80/290
REESE AFB TX	OCT 89 - APR 90	80/370
VANCE AFB OK	APR 90 - NOV 90	80/450
MATHER AFB CA	NOV 90 - FEB 91	35/485
SHEPPARD AFB TX	FEB 91 - AUG 91	76/561
ACE Detachments	AUG 91 - MAY 92	89/650

* Based on production delivery schedule # 1, 30 Aug 82.

OPERATIONS T-46 IMPLEMENTATION OFFICER REQUIREMENTS

	85	86	87	88	89	90	91
Student Training		15	15	15	15	15	15
Wing IP Transition Training		9	9	9	9	9	9
Wing Overhead		6	6	6	6	6	6
3305th School Sq	5	8*	8	8	8	8	8
HQ ATC Staff			4	4	4	0	0
PIT Training			6	6	6	6	6
PIT Overhead			4	4	4	4	4
	5	35	35	49	49	45	45

Wing Overhead

1 FCF
1 Stan Eval
2 Academics
2 Supervisors
6

PIT Overhead

1 Stan Eval
1 Supervisor
2 Academics
4

HQ ATC Staff

2 DOT
2 DOV
4

* Includes 2 NCOs, 1 civilian

PROPOSED T46A TRANSITION SYLLABUS

Flying Mission	Category	Sorties/HOURS
	CONTACT	
C-01 thru 04	Fundamental/Advanced Maneuvers	4/6.0
C-05	Contact Check	1/1.5
C-06	Night Checkout	1/1.5
		6/9.0
	INSTRUMENTS	
I-01/02/03	Fundamental/Advanced Maneuvers	3/4.5
I-04	Instrument Check	1/1.5
		4/6.0
	FORMATION	
F-01 thru 04	Two-ship Formation Maneuvering	4/6.0
	TOTAL	14/21.0

Academics

Subject		Hours
AP	Aviation Physiology ("G" Suit, Pressurization, Egress, etc.)	2.0
IP	Instrument Procedures	6.0
AS	Aircraft Systems	12.0
FP	Flight Planning	3.0
AA	Applied Aero	8.0
	TOTAL	31.0

NOTE: Two training period alternatives are a 15 training day cycle or a 30 training day cycle. Front-loading the 31 academic hours in the first five training days for either alternative the required flying events/day are 1.4 events/day for alternative 1 and .56 events/day for alternative 2.

The present T-37 PIT syllabus (average student) allocates 48 training days to accomplish 25 simulator missions and 43 aircraft missions.

Simulator -	.52 events/day
Aircraft -	.90 events/day
Total	1.42 events/day

T-46 IP TRANSITION ENTRY/GRAD DATES*

LOCATION	CLASS #	ENTRY	GRAD
Laughlin	87-03	23 Jan 87	13 Mar 87
	87-04	16 Mar 87	28 Apr 87
	87-05	29 Apr 87	12 Jun 87
	87-06	15 Jun 87	27 Jul 87
	87-07	28 Jul 87	14 Sep 87
	88-01	15 Sep 87	5 Nov 87
	88-02	6 Nov 87	25 Jan 88
	88-03	26 Jan 88	15 Mar 88
	88-04	16 Mar 88	28 Apr 88
	88-05	29 Apr 88	14 Jun 88
Randolph	88-06	15 Jun 88	28 Jul 88
	88-07	29 Jul 88	14 Sep 88
	89-01	15 Sep 88	7 Nov 88
	89-02	8 Nov 88	24 Jan 89
	89-03	25 Jan 89	15 Mar 89
	89-04	16 Mar 89	28 Apr 89
	89-05	1 May 89	14 Jun 89
	89-06	15 Jun 89	28 Jul 89
	89-07	31 Jul 89	13 Sep 89

*Transition IP Load TBD

NOTE: After the IOS all T-46 Transition, Pre-PIT and PIT training will occur at Randolph to minimize airspace demands at the implementing base.

T-46 CLASS DATES

LAUGHLIN AFB (IOS)

		ENTRY	GRADUATION
88-10	T-46	6 Jul 87	30 Nov 87
88-11	T-37	27 Jul 87	13 Jan 88
88-12	T-37	18 Aug 87	16 Feb 88
88-13	T-46	11 Sep 87	11 Mar 88
88-14	T-37	6 Oct 87	5 Apr 88
89-01	T-46	2 Nov 87	27 Apr 88
89-02	T-46X	1 Dec 87	19 May 88
89-03	T-46	14 Jan 88	13 Jun 88
89-04	T-37	17 Feb 88	6 Jul 88
89-05	T-46X	14 Mar 88	27 Jul 88
89-06	T-46	6 Apr 88	18 Aug 88
89-07	T-46X	28 Apr 88	13 Sep 88
89-08	T-46X	20 May 88	5 Oct 88
89-09	T-46X	14 Jun 88	1 Nov 88
89-10	T-46	7 Jul 88	30 Nov 88

Assumes three week entry cycle.

X-flight already IP current in T-46.

BASE	T-46 STUDENT CLASS IMPLEMENTATION
Laughlin AFB TX	Jul 87 - Jul 88
Randolph AFB TX	Jun 88 - Sep 88
Williams AFB AZ	Oct 88 - Sep 89
Columbus AFB MS	Oct 89 - Sep 90
Reese AFB TX	Oct 90 - Sep 91
Vance AFB OK	Oct 91 - Sep 92
Mather AFB CA	Oct 92 - Jan 93
Sheppard AFB TX	TBD
ACE Detachments	TBD

Options for Phase II Flying Hours with T-46 IFS Implementation

Present Phase II (no sim)

	**T-4	A/C
Basic	3/3.0	7/ 9.1
Cont	2/2.6	36/ 45.9
Inst		23/ 29.9
Nav		6/ 9.0
Form		9/ 11.7
	5/5.6	81/105.6

**T-4 cockpits unpowered

Additional A/C Hours 31.2

Present Phase II (50% sim)

	T-4	Sim	A/C
Basic	3/3.0	2/ 2.6	5/ 6.5
Cont		3/ 3.9	35/44.6
Inst		6/ 7.8	16/20.8
Nav		1/ 1.3	6/ 9.0
Form			9/11.7
	3/3.0	12/15.6	71/92.6

Additional A/C Hours 18.2

SUPT Phase II (no sim)

	A/C
Basic	7/ 9.1
Cont	37/ 47.2
Inst	23/ 32.2
Nav	9/ 12.6
Form	13/ 16.9
	89/118.0

Additional A/C Hours 33.0

SUPT Phase II (50% sim)

	Sim	A/C
Basic	2/ 2.6	5/ 6.5
Cont	3/ 3.9	36/ 45.9
Inst	5/ 6.5	18/ 25.2
Nav	2/ 2.6	9/ 12.6
Form		13/ 16.9
	12/15.6	81/107.1

Additional A/C Hours 22.1

DESIRED SIMULATOR IMPLEMENTATION SCHEDULE

T-46 Simulator Completion Date (Ready For Training Date)

	COMPLEX 1 (CGI)	COMPLEX 2 (TMB)
Laughlin AFB	Jul 87	Jul 88
Williams AFB	Oct 88	Sep 89
Randolph AFB	Jan 89*	Jan 91*
Columbus AFB	Oct 89	Sep 90
Reese AFB	Oct 90	Sep 91
Vance AFB	Oct 91	Sep 92

T-37 Simulator (T-50) Shut Down

	COMPLEX 1 (CGI)	COMPLEX 2 (TMB)
Laughlin AFB	Jan 87	Jan 88
Williams AFB	Mar 88	Apr 89
Randolph AFB	Jul 88*	Jul 90*
Columbus AFB	Mar 89	Apr 90
Reese AFB	Mar 90	Apr 91
Vance AFB	Mar 91	Apr 92

*2 Cockpits

CALCULATIONS TO DETERMINE UPT/SUPT COURSE LENGTH

365 days minus holidays, weekends, and Christmas Break

= 246 work days

UPT presently on 216 training day calendar

17 days academic
81 Phase II flying training days
108 Phase III flying training days

$$\frac{17}{246} = \frac{X}{365} = 25 \quad 7 \;\; 49\;344$$

$$\frac{189}{216} = \frac{X}{365} = \frac{319}{344}$$

SUPT will have 210 training day calendar

15 days academic
90 Phase II flying training days
105 Phase III flying training days

$$\frac{15}{246} = \frac{X}{365} = 22 \quad 7 \;\; 361 \quad 51.5 \text{ weeks}$$

$$\frac{195}{210} = \frac{X}{365} = \frac{339}{361}$$

CALCULATION OF TRAINING CLASSES PER YEAR

UPT

$\frac{27 \text{ training day entry cycle}}{216 \text{ training day calendar}} = \frac{X}{365 \text{ calendar days}}$

$7 \overline{)45.6} = 6.5$ calendar week entry cycle

$\frac{52}{6.5} = 8$ classes per year

SUPT

$\frac{15 \text{ training day entry cycle}}{210 \text{ training day calendar}} = \frac{X}{365 \text{ calendar}}$

$7 \overline{)26} = 3.72$ calendar week entry cycle

$\frac{52}{3.72} = 14$ classes per year

3 WEEK ENTRY CYCLE PHASE-IN

PRIMARY

	CLASS #	START	GRAD
Last 6 Week Classes			
	86-08	9 Oct 85	18 Mar 86
A Bases	87-01	27 Nov 85	28 Apr 86
(Columbus, Williams, Vance)	87-02	31 Jan 86	6 Jun 86
	86-08	31 Oct 85	7 Apr 86
B Bases	87-01	20 Dec 85	15 May 86
(Laughlin, Reese)	87-02	24 Feb 86	25 Jun 86
First 3 Week Classes			
	87-05	12 Mar 86	25 Jul 86
	87-06	4 Apr 86	18 Aug 86
	87-07	28 Apr 86	11 Sep 86
A Bases	87-08	20 May 86	3 Oct 86
(Columbus, Williams, Vance)	87-09	12 Jun 86	30 Oct 86
	87-10	7 Jul 86	28 Nov 86
	87-06	4 Apr 86	18 Aug 86
	87-07	28 Apr 86	11 Sep 86
B Bases	87-08	20 May 86	3 Oct 86
(Laughlin, Reese)	87-09	12 Jun 86	30 Oct 86
	87-10	7 Jul 86	28 Nov 86
	87-11	28 Jul 86	12 Jun 87

3 WEEK ENTRY CYCLE PHASE-IN

BASIC

	CLASS #	START	GRAD
Last 6 Week Classes			
	86-07	31 Jan 86	17 Jul 86
A Bases	86-08	19 Mar 86	26 Aug 86
	87-01	29 Apr 86	8 Oct 86
(Columbus, Williams, Vance)	87-02	9 Jun 86	26 Nov 86
	86-07	25 Feb 86	5 Aug 86
B Bases	86-08	8 Apr 86	16 Sep 86
(Laughlin, Reese)	87-01	16 May 86	29 Oct 86
	87-02	26 Jun 86	19 Dec 86
First 3 Week Classes			
	87-05	28 Jul 86	12 Feb 87
	87-06	19 Aug 86	11 Mar 87
A Bases	87-07	12 Sep 86	3 Apr 87
(Columbus, Williams, Vance)	87-08	6 Oct 86	27 Apr 87
	87-09	31 Oct 86	19 May 87
	87-10	1 Dec 86	11 Jun 87
	87-11	13 Jan 87	3 Jul 87
	87-06	19 Aug 86	11 Mar 87
	87-07	12 Sep 86	3 Apr 87
B Bases	87-08	6 Oct 86	27 Apr 87
(Laughlin, Reese)	87-09	31 Oct 86	19 May 87
	87-10	1 Dec 87	11 Jun 87
	87-11	13 Jan 87	3 Jul 87
	87-12	13 Feb 87	24 Jul 87

ANNEX D
PAD 1-83
LOGISTICS

1. Objective: The objective of this annex is to provide a logistics plan of action for the orderly implementation of the T-46 aircraft and related flight simulator into the ATC Logistics system.

2. Assumptions:

a. Aircraft and simulator Initial Operating Capability (IOC) will be simultaneous at the Initial Operating Site (IOS).

b. Only one operating site will be implemented at one time.

c. Concurrent TTB and T-46 implementation will not occur.

d. No new MCP aircraft maintenance facility construction is anticipated for T-46 implementation. New flight line maintenance facilities will be needed at most affected bases. FY 86 and 87 O&M funding will be programmed for needed projects.

e. The IOS and Operational Readiness Assessment (ORA) site are synonymous; i.e., Laughlin AFB.

f. With the exception of ORA, an initial 45 hr/mo T-46A utilization rate will be maintained for the first 18 months of operation at each base, followed by a gradual increase to 60 hr/mo by the 24th month of operation.

g. ORA will commence 30 days after delivery of the 20th production aircraft to the IOS and will sustain an average utilization rate of 60 hr/mo for two months for a total of 2400 hours.

h. Delivery rate will not exceed 12 aircraft per month.

i. Initial spares and repair parts will be in place at the IOS 90 days prior to receipt of first operational aircraft.

j. Requisite support equipment. including validated technical orders, will be serviceable and in place at the IOS prior to the commencement of ORA.

k. All necessary training will have been accomplished for the T-46A cadre prior to ORA commencement. Training for follow-on maintenance (operational) personnel will be in progress during ORA and be completed prior to start of first UPT class.

l. Increased manning for the transitional phase (2 officers, 68 enlisted personnel per site) will be in place at each site prior to start of ORA and/or entry of first UPT class.

m. The T-46A aircraft will demonstrate the capability to sustain a 60 hr/mo utilization rate during ORA.

n. The T-37B aircraft will not exceed a maximum of 50 hr/mo utilization rate at any time during implementation of T-46 at each site.

o. ATC will not be responsible for disposition of the T-37B aircraft. No transfer inspections or any other maintenance manhour consuming actions will be assumed by ATC.

p. The IOC simulator capability will be one complete complex of four T-46A cockpits. Downtime during initial simulator conversion will not exceed one T-37B complex for more than 180 days. Subsequent complexes will be converted from T-37B to T-46A in 120 days.

3. Concept of Operations:

a. Contracting: ATC/LGC will insure that existing contracts which affect support of the T-46 aircraft (i.e., contracts which currently support the T-37) are amended/renegotiated as appropriate. Specific time phased tasks will be included in this annex at a later date.

b. Logistics Plans: ATC/LGX will:

(1) Participate in site surveys to determine required maintenance facility modifications/additions.

(2) Provide projected operational data for each activation site, to include specific environmental impact analysis and update of Air Installation Compatible Use Zones (AICUZ) noise contour maps.

(3) Manage the ATC/LG T-46 overall implementation effort.

c. Maintenance: ATC/LGM will be responsible for those actions identified in the appropriate time phase task schedules.

d. Supply: ATC/LGS will assure initial spares and required support equipment will be available within the ATC logistic infrastructure as detailed in the appropriate time phase task schedules.

e. Transportation: ATC/LGT will be responsible for increased vehicle requirements, packaging/crating/shipping, household goods, movements, and other transportation requirements as detailed in the appropriate time phase task schedules.

4. Responsibility: The DCS/LG OPR for this annex is LGXP, AUTOVON 487-4602.

WILLIAM J. BRECKNER, JR.
Brigadier General, USAF
Deputy Chief of Staff, Logistics

ANNEX U
PAD 1-83
IMPEMENTATION SCHEDULE

ACTIVITY	BASE	DATE (NLT)
Facility Survey	Laughlin	Mar 83
SATAF Activated	Laughlin	Jun 84
Facility Survey	Randolph	Dec 84
Facility Survey	Williams	Apr 85
T-46A Support/Training Equipment Delivery	Laughlin	TBD
Facility Survey	Columbus	Feb 86
Wing Implementation Plan	Laughlin	Feb 86
SATAF Activated	Randolph	Mar 86
T-46A Delivery	Laughlin	Apr 86
SATAF Activated	Williams	Jul 86
Facility Survey	Reese	Jul 86
T-46A Transition Course	Laughlin	Jan 87
Facility Survey	Vance	Jan 87
Operational Readiness Assessment (ORA)	Laughlin	Feb-Mar 87
SATAF Activated	Columbus	May 87
Student Training	Laughlin	Jul 87
T-46A Instrument Flight Simulator (IFS) Complex (R&D)	Laughlin	Jul 87
Facility Survey	Mather	Aug 87
SATAF Activated	Reese	Oct 87
Support/Training Equipment Delivery	Randolph	TBD
Wing Implementation Plan	Randolph	Dec 87
T-46A Delivery	Randolph	Mar 88
Wing Implementation Plan	Williams	Apr 88

ACTIVITY	BASE	DATE (NLT)
Transition/PIT Training	Randolph	Jun 88
2nd IFS Complex	Laughlin	Jul 88
T-46A Delivery	Williams	Jul 88
1st IFS Complex	Williams	Oct 88
Student Training	Williams	Oct 88
SATAF Activated	Mather	Nov 88
Wing Implementation Plan	Columbus	Dec 88
Support/Training Equipment Delivery	Columbus	TBD
1st IFS Complex*	Randolph	Jan 89
T-46A Delivery	Columbus	Mar 89
Wing Implementation Plan	Reese	Jul 89
2nd IFS Complex	Williams	Sep 89
1st IFS Complex	Columbus	Oct 89
Student Training	Columbus	Oct 89
Support/Training Equipment Delivery	Reese	TBD
T-46A Delivery	Reese	Oct 89
Support/Training Equipment Delivery	Vance	TDB
Wing Implementation Plan	Vance	Jan 90
T-46A Delivery	Vance	Apr 90
Wing Implementation Plan	Mather	Aug 90
2nd IFS Complex	Columbus	Sep 90
1st IFS Complex	Reese	Oct 90
Student Training	Reese	Oct 90
Support/Training Equipment Delivery	Mather	TBD

ACTIVITY	BASE	DATE (NLT)
T-46A Delivery	Mather	Nov 90
2nd IFS Complex*	Randolph	Jan 91
2nd IFS Complex	Reese	Sep 91
1st IFS Complex	Vance	Oct 91
Student Training	Vance	Oct 91
UNT Training	Mather	Oct 92
ENJJPT Training	Sheppard	TBD
ACE Training	ATC OLs	TBD

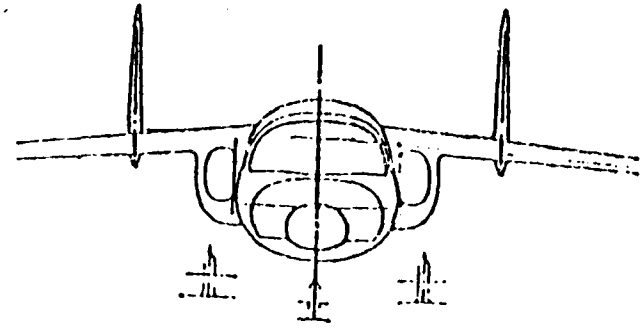
* 2 cockpits

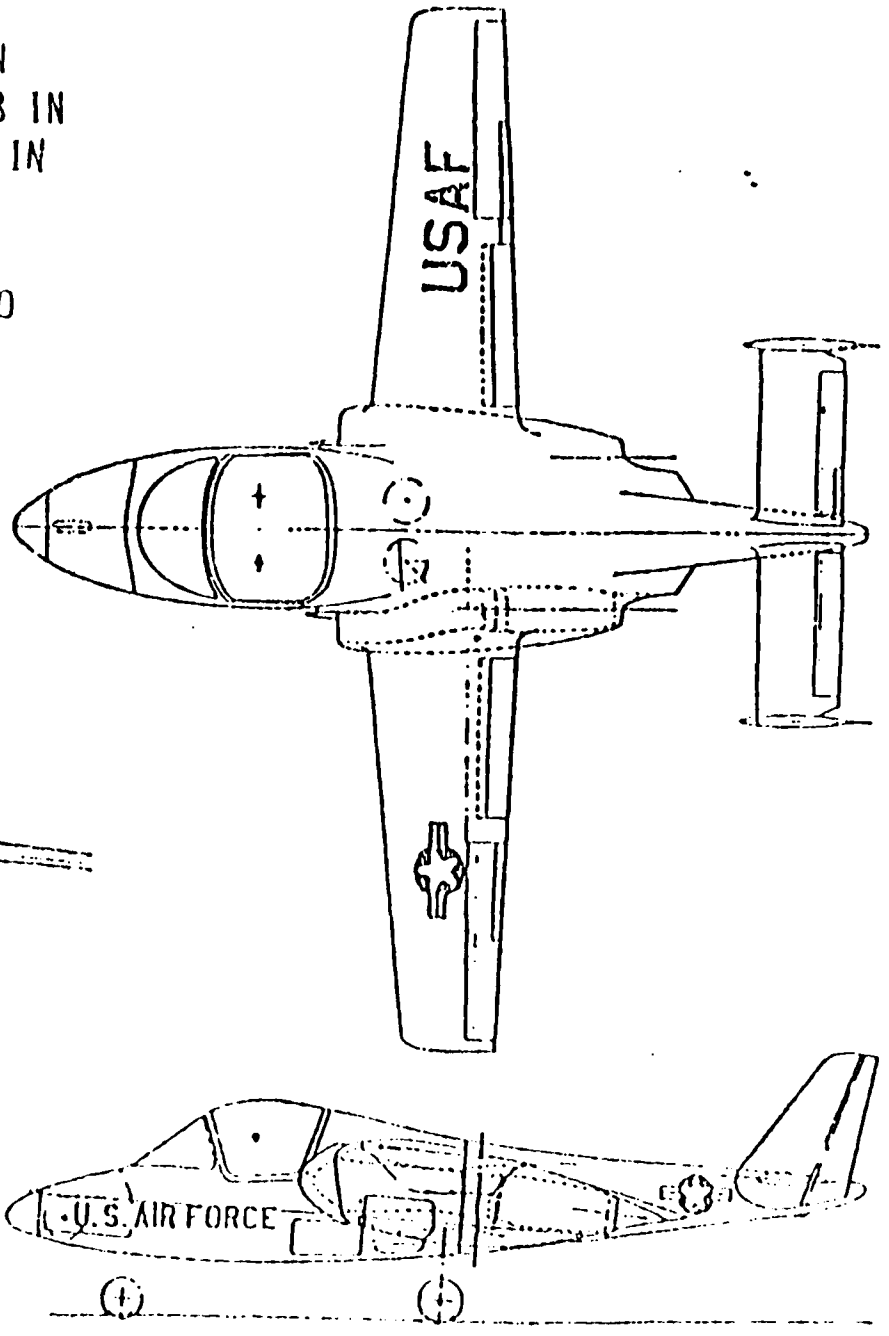
NOTE: Based on 30 Aug 82 aircraft delivery schedule.

ANNEX W

AIRCRAFT DIMENSIONS

LENGTH — 29 FT 6 IN
SPAN — 36 FT 11.8 IN
HEIGHT — 9 FT 11.8 IN
EMPTY WEIGHT — 5769 LBS
MAX T.O.G.W. — 6845 LBS
ENGINE — GARRETT F109-GA-100





APPENDIX B

ADDITIONAL ABBREVIATIONS

ACFT	Aircraft
PFT	USAF Program Flying Training, Volume 1, ATC
SIM	Instrument Flight Simulator
SP	Student Pilot
SPD	System Program Director

APPENDIX C

MONTHLY SCHEDULED FLYING DAYS (SUPT)

Month	Scheduled Flying Days
January	14
February	14
March	18
April	21
May	21
June	18
July	22
August	20
September	18
October	19
November	15
December	10
Annual Total	210

Source: Ref. 5

APPENDIX D

DERIVATION OF ORA FORMULAS

$$A = m(\Sigma n_i t_i - 1/2 \Sigma p_i n_i t_i) \qquad \text{Eq. 1}$$

Individual terms are defined in Table 4-1. In Equation 1, "m" is the number of months. The first compound term, $\Sigma n_i t_i$, would be the monthly hours flown if no two of the 30 T-46 IPs ever flew together. The second term subtracts out half of the IP hours to get aircraft hours when proficiency dual is being flown (two of the 30 qualified IPs in the same aircraft). Simplifying,

$$A = m \Sigma n_i t_i - \frac{m}{2} \Sigma p_i n_i t_i$$

If p_i is equal for all pilots,

$$A = m \Sigma n_i t_i - p\frac{m}{2} \Sigma n_i t_i$$

Solving for p and simplifying,

$$p = \frac{m \Sigma n_i t_i - A}{\frac{m}{2} \Sigma n_i t_i}$$

$$p = 2 - \frac{2A}{m \Sigma n_i t_i} \qquad \text{Eq. 2}$$

As an example, Equation 2 is solved for ORA Option 1 (Chapter 4):

$$p = 2 - \frac{2(2400)}{2[1(30) + 8(75) + 6(45) + 15(75)]}$$

$$p = .81$$

APPENDIX E

FLYING FACTORS BY SYLLABUS

The flying factor is the mean number of flying hours required each scheduled flying day for each student pilot enrolled. It is a total of the SP and IP flying factors and accounts for both student flying and instructor proficiency flying. The flying factor is different for each syllabus. For the Full Sim syllabus it was computed as follows:

Student Flying Factor:

$$\frac{\text{Flying Hours in SUPT}}{\text{Flying Days in SUPT}} = \frac{85}{90} = .9444$$

IP Flying Factor:

$$\frac{(\text{Student-IP Ratio})(\text{Proficiency Flying Per IP Per Year})}{\text{Flying Days Per Year}}$$

$$= \frac{(.5560)(32.5)}{210} = .0861$$

Total Flying Factor = .9444 + .0861 = 1.0305

The flying factors for the partial simulator (50% Sim) and no simulator (No Sim) syllabi were computed similarly.

Syllabus	Flying Factor
Full Sim	1.0305
50% Sim	1.2760
No Sim	1.3972

APPENDIX F

DERIVATION OF FORMULA FOR CONVERSION OF FLYING TRAINING HOURS

A formula was developed to convert the data of Table 5-1 to provide estimated flying training hours for a mixture of the three syllabi. Let

F_f = Monthly Flying Training Hours, Full Sim (Table 5-1)

k = Number of Classes Being Trained

m = Number of Classes on No Sim Syllabus

n = Number of Classes on 50% Sim Syllabus

$F_{k,m,n}$ = Adjusted Flying Training Hour Estimate

$$F_{k,m,n} = F_f \frac{k}{6} \frac{m}{k} \frac{1.3972}{1.0305} + F_f \frac{k}{6} \frac{n}{k} \frac{1.2760}{1.0305} + F_f \frac{k}{6} \frac{k-m-n}{k}$$

The three terms on the right side of the equation represent flying training hours for the classes with No Sim, 50% Sim, and Full Sim syllabi respectively. The factor, $\frac{k}{6}$, converts hours from six to "k" classes if there are not six in training. The $\frac{m}{k}$ and $\frac{n}{k}$ account for the proportion of total classes on the No Sim and 50% Sim syllabi respectively. The $\frac{1.3972}{1.0305}$ and $\frac{1.2760}{1.0305}$ increase flying hours proportionate to the applicable flying factor. The final term computes flying hours for classes still on the Full Sim syllabus.

Simplifying,

$$F_{k,m,n} = \frac{F_f}{6} (1.3558m + 1.2382n + k-m-n)$$

$$F_{k,m,n} = \frac{F_f}{6} (0.3558m + 0.2382n + k) \qquad \text{Eq. 3}$$

APPENDIX G

WORKSHEETS FOR FLYING TIME REQUIRED

This appendix contains worksheets for computing monthly required flying time for various conversion options. These worksheets were used when the standard data from Table 5-1 and Equation 3 were not appropriate.[1] The following explanations apply to tables in this appendix.

-- "SP and IP Flying" includes all flying directly associated with the training program as computed in the PFT (number of student pilots, times number of flying days scheduled, times the flying factor for the syllabus in use)(16:II-10).

-- "SP" is the mean number of student pilots in the class during the month (determined from Figure 5-1).

-- "Days" stands for scheduled flying days for the class.

-- "Hours" means flying hours required, computed as in the PFT.

-- For Tables G-1 and G-2, post-ORA transition training assumes 144 IPs are trained in six classes. They include 114 squadron IPs (16:II-10) and 30 attached IPs (23). Each transition class includes a flight of about 15 IPs plus nine others from the squadron and wing. A class flies 504 hours (24 IPs @ 21 hours) spread evenly over the transition course period, pro-rated by monthly SP flying days, not by training days in the transition course.

-- For Table G-3, post-ORA transition training assumes 123 IPs are trained in five classes (144 less 21 trained for ORA). Each class

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[1]Table 5-1 contains data for all six classes on the Full Sim syllabus. Equation 3 converts the Table 5-1 data for use with the other syllabi, but assumes that the numbers of classes on each syllabus do not change during the month.

is allotted 517 hours ($\frac{123}{5}$ times 21 hours) divided among months as above.

-- For Tables G-1 and G-2 the 135 hours additional flying (16:II-10) is divided between aircraft proportionate to the number of IPs flying each aircraft. (One-seventh of them in each T-46 transition class including the pre-ORA class).

-- For Table G-3 the additional hours are allocated the same as above except that there are only six transition classes including the pre-ORA class.

-- In Tables G-2 and G-3 the Sub-Total is the sum of the T-46 and T-37 Sub-Totals; i.e., all student and IP flying directly associated with SUPT. Total T-46 hours is the sum of the T-46 Sub-Total, T-46 Transition Training, and T-46 Additional Flying. The T-37 Sub-Total plus Additional T-37 Hours sum to Total T-37 Hours. Total Flying Hours sums Total T-46 Hours and Total T-37 Hours.

Table G-1

T-46 Flying Time Required - Option 1 (Master Plan)

SP & IP Flying		Jul 1987			Aug 1987			Sep 1987			Oct 1987		
T-46 Class	Flying Factor	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours
88-10	1.0305	37	18	686	36	20	741	33	18	612	32	19	627
88-13	1.0305			___			___	37	12	458	36	19	705
Sub-Total				686			741			1070			1332
T-46 Transition Training													
IP Flight													
B			6	95		20	314		6	95			
E									12	195		19	309
G													
C													
F													
D													
Additional Flying				19			19			32			39
Total T-46 Flying Hours				800			1074			1392			1680

Table G-1 Continued

SP & IP Flying		Nov 1987			Dec 1987			Jan 1988			Feb 1988		
T-46 Class	Flying Factor	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours
88-10	1.0305	31	15	479									
88-13	1.0305	34	15	526	33	10	340	32	14	462	32	14	462
89-01	1.0305	37	15	572	36	10	371	35	14	505	34	14	491
89-02	1.2760				37	10	472	36	14	643	35	14	625
89-03	1.2760			___			___	37	8	378	36	14	643
Sub-Total				1577			1183			1988			2221
T-46 Transition Training													
IP Flight													
B													
E													
G			10	194		10	194		6	116			
C												6	112
F													
D													
Additional Flying				58			58			69			77
Total T-46 Flying Hours				1829			1435			2173			2410

Table G-1 Continued

SP & IP Flying		Mar 1988			Apr 1988			May 1988			Jun 1988		
T-46 Class	Flying Factor	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours
88-13	1.0305	31	6	192									
89-01	1.0305	32	18	594	31	19	607						
89-02	1.2760	34	18	781	32	21	857	31	13	514			
89-03	1.2760	35	18	804	33	21	884	32	21	857	31	8	316
89-05	1.2760	37	11	519	36	21	965	34	21	911	32	18	735
89-06	1.2760				37	17	803	36	21	965	34	18	781
89-07	1.0305				37	2	76	37	21	801	35	18	649
89-08	1.2760							37	8	378	36	18	827
89-09	1.2760										37	10	472
Sub-Total				2890			4192			4426			3780
T-46 Transition Training													
IP Flight													
C			18	336		3	56						
F						17	260		16	244			
D													
Additional Flying				77			94			101			116
Total T-46 Flying Hours				3303			4602			4771			3896
Total hours if all on Full Sim Syllabus							3927			4073			3294

Table G-1 Continued

SP & IP Flying		Jul 1988			Aug 1988			Sep 1988		
T-46 Class	Flying Factor	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours
89-05	1.2760	31	19	752						
89-06	1.2760	32	22	898	31	12	475			
89-07	1.0305	33	22	748	32	20	660	31	7	224
89-08	1.2760	35	22	982	32	20	817	32	18	735
89-09	1.2760	36	22	1011	34	20	868	33	18	758
89-10	1.0305	37	18	686	36	20	742	34	18	631
89-11	1.0305	37	3	114	37	20	763	35	18	649
89-12	1.0305				37	7	267	36	18	668
89-13	1.0305							37	10	381
Sub-Total				5191			4592			4046
T-46 Transition Training										
IP Flight										
F										
D	Transition at Randolph									
Additional Flying				116			135			135
Total T-46 Flying Hours				5307			4727			4181
Total Hours if on Full Sim Syllabus				4606			4310			3893

Table G-2

T-37/T-46 Flying Time Required - Option 3

SP & IP Flying		Jul 1987			Aug 1987			Sep 1987			Oct 1987		
T-46 Class	Flying Factor	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours
88-10	1.0305	37	18	686	36	20	741	33	18	612	32	19	627
88-13	1.0305							37	12	458	36	19	705
T-46 Sub-Total				686			741			1070			1332
T-37 Class													
88-04	1.2760	31	1	40									
88-05	1.2760	31	17	672									
88-06	1.2760	32	22	898	31	12	475						
88-07	1.2760	33	22	926	32	20	817	31	7	277			
88-08	1.2760	35	22	983	32	20	817	32	18	735	31	4	158
88-09	1.0305	36	22	816	34	20	701	33	18	612	31	19	607
88-11	1.0305	37	22	114	37	20	763	35	18	649	33	19	646
88-12	1.2760				37	7	330	36	18	827	35	19	849
88-14	1.0305										37	16	610
T-37 Sub-Total				4400			3903			3100			2870
Sub-Total				5086			4644			4170			4202
T-46 Transition Training													
IP Flight													
B			6	95		20	314		6	95			
E									12	195		19	309
G													
C													
F													
D													
Additional Flying	T-46			19			19			32			39
	T-37			116			116			103			96
Total T-46 Hours				800			1074			1392			1680
Total T-37 Hours				4516			4019			3203			2966
Total Flying Hours				5316			5093			4595			4646

Table G-2 Continued

T-37/T-46 Flying Time Required - Option 3

SP & IP Flying		Nov 1987			Dec 1987			Jan 1988			Feb 1988		
T-46 Class	Flying Factor	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours
88-10	1.0305	31	15	479									
88-13	1.0305	34	15	526	33	10	340	32	14	462	32	14	462
89-01	1.0305	47	15	572	36	10	371	35	14	505	34	14	491
89-02	1.0305				37	10	381	36	14	519	35	14	505
89-03	1.2760							37	8	378	36	14	519
T-46 Sub-Total				1577			1092			1864			1977
T-37 Class													
88-09	1.0305	31	1	32									
88-11	1.0305/ 1.3972[1]	32	15	494	31	10	319	31	4	173			
88-12	1.2760/ 1.3972	33	15	632	32	10	408	32	14	626	31	6	260
88-14	1.0305/ 1.3972	36	15	556	35	10	361	33	14	646	32	14	626
89-04	1.3972										37	8	414
T-37 Sub-Total				1714			1088			1445			1300
Sub-Total				3291			2180			3309			3277
T-46 Transition Training													
IP Flight													
B													
E													
G			10	194		10	194		6	116			
C												6	112
F													
D													
Additional Flying	T-46			58			58			69			77
	T-37			77			77			66			58
Total T-46 Hours				1829			1344			2049			2166
Total T-37 Hours				1791			1165			1511			1358
Total Flying Hours				3620			2509			3560			3524

[1]Change in Flying Factor occurs 1 Jan 88, due to shutdown of last T-37 simulator.

Table G-2 Continued

T-37/T-46 Flying Time Required - Option 3

SP & IP Flying		Mar 1988			Apr 1988			May 1988			Jun 1988		
T-46 Class	Flying Factor	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours
88-13	1.0305	31	6	192									
89-01	1.0305	32	18	594	31	19	607						
89-02	1.0305	34	18	631	32	21	692	31	13	415			
89-03	1.2760/ 1.0305[2]	35	18	804	33	21	884	32	21	692	31	8	256
89-05	1.2760/ 1.0305	37	11	519	36	21	965	34	21	736	32	18	594
89-06	1.2760/ 1.0305				37	17	803	36	21	779	34	18	631
89-07	1.2760/ 1.0305				37	2	94	37	21	801	35	18	649
89-08	1.0305							37	8	305	36	18	668
89-09	1.0305										37	10	381
T-46 Sub-Total				2740			4045			3728			3179
T-37 Class													
88-14	1.3972	31	18	780	31	3	130						
89-04	1.3972	36	18	905	35	21	1027	32	21	939	32	18	805
T-37 Sub-Total				1685			1157			939			805
Sub-Total				4425			5202			4667			3984
T-46 Transition Training													
IP Flight													
C			18	336		3	56						
F						17	260		16	244			
D													
Additional Flying T-46				77			94			101			116
Additional Flying T-37				58			41			34			19
Total T-46 Hours				3153			4455			4073			3295
Total T-37 Hours				1743			1198			973			824
Total Flying Hours				4896			5653			5046			4119

[2]Change in flying factor occurs 1 May 88, when second T-46 simulator complex is ready.

Table G-2 Continued

T-37/T-46 Flying Time Required - Option 3

SP & IP Flying		Jul 88		
T-46 Class	Flying Factor	SP	Days	Hours
89-05	1.0305	31	19	607
89-06	1.0305	32	22	725
89-07	1.0305	33	22	748
89-08	1.0305	35	22	793
89-09	1.0305	36	22	816
89-10	1.0305	37	18	686
89-11	1.0305	37	3	114
T-46 Sub-Total				4489
T-37 Class				
89-04	1.3972	31	3	173
Sub-Total				4662
T-46 Transition Training				
IP Flight				
D		Transition at Randolph		
Additional Flying	T-46			116
	T-37			19
Total T-46 Hours				4605
Total T-37 Hours				192
Total Flying Hours				4797

Table G-3

T-37/T-46 Flying Time Required - Option 4

SP & IP Flying		Jul 1987			Aug 1987			Sep 1987			Oct 1987		
T-46 Class	Flying Factor	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours
88-10	1.0305	37	18	686	36	20	741	33	18	612	32	19	627
88-12	1.0305				37	7	267	36	18	668	35	19	685
88-14	1.0305										37	16	610
T-46 Sub-Total				686			1008			1280			1922
T-37 Class													
88-04	1.2760	31	4	158									
88-05	1.0305	31	19	607									
88-06	1.2760	32	22	898	31	12	475						
88-07	1.2760	33	22	926	32	20	817	31	7	277			
88-08	1.0305	35	22	793	32	20	660	32	18	594	31	4	128
88-11	1.0305	37	3	114	37	20	763	35	18	649	33	19	646
88-13	1.0305							37	12	458	36	19	705
T-37 Sub-Total				3596			2715			1978			1479
Sub-Total				4282			3723			3258			3401
T-46 Transiton Training													
IP Flight													
B			18	321		11	196						
D						7	125		19	339		3	53
F												15	169
C													
E													
Additional Flying T-46				23			31			45			64
Additional Flying T-37				112			104			90			71
Total T-46 Hours				1030			1360			1664			2208
Total T-37 Hours				3708			2819			2068			1550
Total Flying Hours				4738			4179			3732			3758

Table G-3 Continued

T-37/T-46 Flying Time Required - Option 4

SP & IP Flying		Nov 1987			Dec 1987			Jan 1988			Feb 1988		
T-46 Class	Flying Factor	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours	SP	Days	Hours
88-10	1.0305	31	15	479									
88-12	1.0305	33	15	510	32	10	330	32	14	462	31	6	192
88-14	1.0305	36	15	556	35	10	361	33	14	476	32	14	462
89-02	1.0305				37	10	381	36	14	519	35	14	505
89-03	1.2760							37	8	378	36	14	643
89-04	1.2760										37	8	378
T-46 Sub-Total				1545			1072			1835			2180
T-37 Class													
88-11	1.0305/ 1.3972[1]	32	15	494	31	10	433	31	4	173			
88-13	1.0305/ 1.3972	34	15	526	33	10	461	32	14	626	32	14	626
T-37 Sub-Total				1020			894			799			626
Sub-Total				2565			1966			2634			2806
T-46 Transition Training													
IP Flight													
B													
D													
F			15	169		10	112		6	67			
C									8	138		14	241
E													
Additional Flying	T-46			68			68			81			90
	T-37			67			67			54			45
Total T-46 Hours				1782			1252			2121			2511
Total T-37 Hours				1087			961			853			671
Total Flying Hours				2869			2213			2974			3182

[1]Flying Factor changes 1 Dec due to T-37 Sim. shutdown.

Table G-3 Continued

T-37/T-46 Flying Time Required - Option 4

SP & IP Flying		Mar 1988			Apr 1988		
T-46 Class	Flying Factor	SP	Days	Hours	SP	Days	Hours
88-14	1.0305	31	18	575	31	3	96
89-02	1.0305	32	18	631	32	21	692
89-03	1.2760/ 1.0305[1]	35	18	804	33	21	714
89-04	1.2760/ 1.0305	36	18	827	35	21	757
89-05	1.2760/ 1.0305	37	11	519	36	21	779
89-06	1.0305				37	17	648
89-07	1.0305				37	2	76
89-08	1.0305						
89-09	1.0305						
T-46 Sub-Total				3356			3762
T-37 Class							
88-13	1.3972	31	6	260			
Sub-Total				3616			3762
T-46 Transition Training							
IP Flight							
B							
D							
F							
C			8	138			
E			10	178		19	339
Additional Flying T-46				103			135
Additional Flying T-37				32			0
Total T-46 Hours				3775			4236
Total T-37 Hours				292			0
Total Flying Hours				4067			4236

[1]Flying factor changes 1 Apr due to second T-46 Sim being ready.

APPENDIX H

ALTERNATE FLIGHT CONVERSION SCHEDULES - OPTION 4

Table H-1

Alternate Flight Conversion Schedules - Option 4

SP Classes			Schedule 1			Schedule 2		
Entry [1]	Grad [1]	Class	X-T [2]	Flight	Acft [3]	X-T	Flight	Acft
27 Jul 86	13 Jan 87	87-11		A	T-37		A	T-37
18 Aug 86	16 Feb 87	87-12		B	T-37		B	T-37
11 Sep 86	11 Mar 87	87-13		C	T-37		C	T-37
6 Oct 86	5 Apr 87	87-14		D	T-37		D	T-37
2 Nov 86	27 Apr 87	88-01		E	T-37		E	T-37
1 Dec 86	19 May 87	88-02		F	T-37		F	T-37
14 Jan 87	13 Jun 87	88-03	A	No Class		A	No Class	
17 Feb 87	6 Jul 87	88-04		B	T-37		B	T-37
14 Mar 87	27 Jul 87	88-05		C	T-37		C	T-37
6 Apr 87	18 Aug 87	88-06		D	T-37		D	T-37
28 Apr 87	13 Sep 87	88-07		E	T-37		E	T-37
20 May 87	5 Oct 87	88-08	F	A	T-46		F	T-37
14 Jun 87	1 Nov 87	88-09		No Class			A	T-46
6 Jul 87	30 Nov 87	88-10	B	F	T-46	B	No Class	
27 Jul 87	13 Jan 88	88-11		C	T-37		C	T-37
18 Aug 87	16 Feb 88	88-12	D	B	T-46	D	B	T-46
11 Sep 87	11 Mar 88	88-13		E	T-37		E	T-37
6 Oct 87	5 Apr 88	88-14		A	T-46	F	D	T-46
2 Nov 87	27 Apr 88	89-01		D	T-46		A	T-46
1 Dec 87	19 May 88	89-02		F	T-46		F	T-46
14 Jan 88	13 Jun 88	89-03	C	No Class		C	No Class	
17 Feb 88	6 Jul 88	89-04		B	T-46		B	T-46
14 Mar 88	27 Jul 88	89-05	E	C	T-46	E	C	T-46
6 Apr 88	18 Aug 88	89-06		A	T-46		D	T-46
28 Apr 88	13 Sep 88	89-07		D	T-46		A	T-46
20 May 88	5 Oct 88	89-08		F	T-46		F	T-46
14 Jun 88	1 Nov 88	89-09		E	T-46		E	T-46
6 Jul 88	30 Nov 88	89-10		B	T-46		B	T-46
27 Jul 88	13 Jan 89	89-11		C	T-46		C	T-46

Notes: [1] Approximate

[2] Flight released to enter transition training

[3] Aircraft

APPENDIX I

JUGGLING CLASS SIZES

The following procedure was used for adjusting class sizes to even out surpluses and shortages of flying hours in Option 4.

To compute the number of students to remove from a class to reduce or eliminate a shortage, this approach was used.

July 1988 Shortage = 882 Hours

$$\frac{\text{Training Hours}}{\text{Student Load}} = \frac{4754\text{-}135}{203} = 22.8 \text{ Hr/SP}$$

$$\frac{882 \text{ Hr}}{22.8 \text{ Hr/SP}} = 38.7 \text{ SP to be moved}$$

July was used as a starting point because it has the largest shortage and is also in the center of the shortage period. Similarly, 31.5 students need to be removed from the May classes. After rough estimates were made concerning adjacent classes, it was decided to investigate the effect of removing six students from each of the six classes that would be flying most of July; i.e., 89-05 through 89-10.

By similar reasoning, period of surplus flying time were identified where extra students could be entered.

A worksheet was developed to record the estimates (Table I-1). Next to the month was listed the flying hour surplus or shortage -- the more restrictive of UT rate or airfield capacity. To help visualize the changes, approximate class entry and graduation dates were marked along with SP increases or decreases. The rest of the worksheet is explained by the notes. The process, although tedious, did provide estimates of the resulting changes in flying hours.

Table I-1

Worksheet for Juggling Class Sizes - Option 4

Month	1 Flying Hour Surplus or (Shortage)	2 Class Size Increases (+) and Decreases (-)	3 Approx. Net Change in Monthly SP Load	4 Flying Training Hours	5 Approx. SP Load	6 Estimated [1] Net Hour Change	7 Surplus or (Shortage) after Changes [3]
May 86	(10)						(10)
Jun 86	576	6	3	3772	203	58	518
Jul 86	226	14	14	4619	203	319	(93)
Aug 86	670	22	25	4175	203	514	156
Sep 86	838	28 (+)	28	3758	203	518	320
Oct 86	829		28	4008	203	553	276
Nov 86	670	22	16	3107	203	245	425
Dec 86	646	14	0	2102	203	0	646
Jan 87	451	6	-5	3053	170 [2]	-90	541
Feb 87	135	7	-13	2795	170	-214	349
Mar 87	(702)	14	-25	3549	170	-522	(180)
Apr 87	(674)	21 (-)	-26	4162	170	-637	(37)
May 87	201	28	-11	4210	170	-272	473
Jun 87	756	21	-4	3562	170	-84	840
Jul 87	770	14	7	4282	170	176	594
Aug 87	620	7	15	3723	170	330	290
Sep 87	541	5	12	3258	170	231	310
Oct 87	222	10	6	3401	170	121	101
Nov 87	918	15 (+)	5	2565	170	76	842
Dec 87	670	10					670
		5					

Note: [1] Column 6 = $\frac{\text{(Column 3)(Column 4)}}{\text{Column 5}}$

[2] 5/6 of 203 (for 5 classes)

[3] Column 7 = Column 1 minus Column 6

Table I-1 (Continued)

Month	Flying Hour Surplus or (Shortage)	Class Size Increases (+) and Decreases (-)	Approx. Net Change in Monthly SP Load	Flying Training Hours	Approx. SP Load	Estimated Net Hour Change	Surplus or (Shortage) after Changes
Jan 88	665						665
Feb 88	135						135
Mar 88	50	6	-4	3616	170	-86	136
Apr 88	(366)	12	-12	3762	170	-267	(99)
May 88	(686)	18	-20	4420	203	-435	(251)
Jun 88	(37)	24	-27	3773	203	-502	465
Jul 88	(882)	30 (-)	-34	4617	203	-773	(109)
Aug 88	(441)	36 (-)	-27	4176	203	-555	114
Sep 88	(24)	30 (-)	-21	3759	203	-389	365
Oct 88	(273)	24 (-)	-13	4008	203	-257	(16)
Nov 88	670	18 (-)	0	3107	203	0	670
Dec 88	646	12 (-)	6	2102	203	62	584
Jan 89	647	6 (-)	6	2857	203	84	563
Feb 89	247	6 (+)	6	2935	203	87	160
Mar 89	320	6 (+)	6	3727	203	110	210
Apr 89	318	6 (+)	5	4370	203	108	210
May 89	(10)						(10)
Jun 89	576	5 (+)	3	3772	203	56	520
Jul 89	406	10 (+)	10	4619	203	228	178
Aug 89	850	15 (+)	15	4175	203	308	542
Sep 89	838	15 (+)	15	3758	203	278	560
Oct 89	829	15 (+)	15	4008	203	296	533
Nov 89	670	10 (+)	10	3107	203	153	517
Dec 89	646	5 (+)	5	2102	203	52	594
Jan 90	647		2	2857	203	28	619

During the changes, class sizes were kept within what appeared to be reasonable limits. While other classes remained at 37, classes which changed were:

Class	Entering Size	Class	Entering Size
87-09	43	89-05	31
87-10	45	89-06	31
87-11	45	89-07	31
87-12	43	89-08	31
88-01	30	89-09	31
88-02	30	89-10	31
88-04	30	90-01	43
88-05	30	90-09	42
88-07	42	90-10	42
88-08	42	90-11	42
88-10	42		

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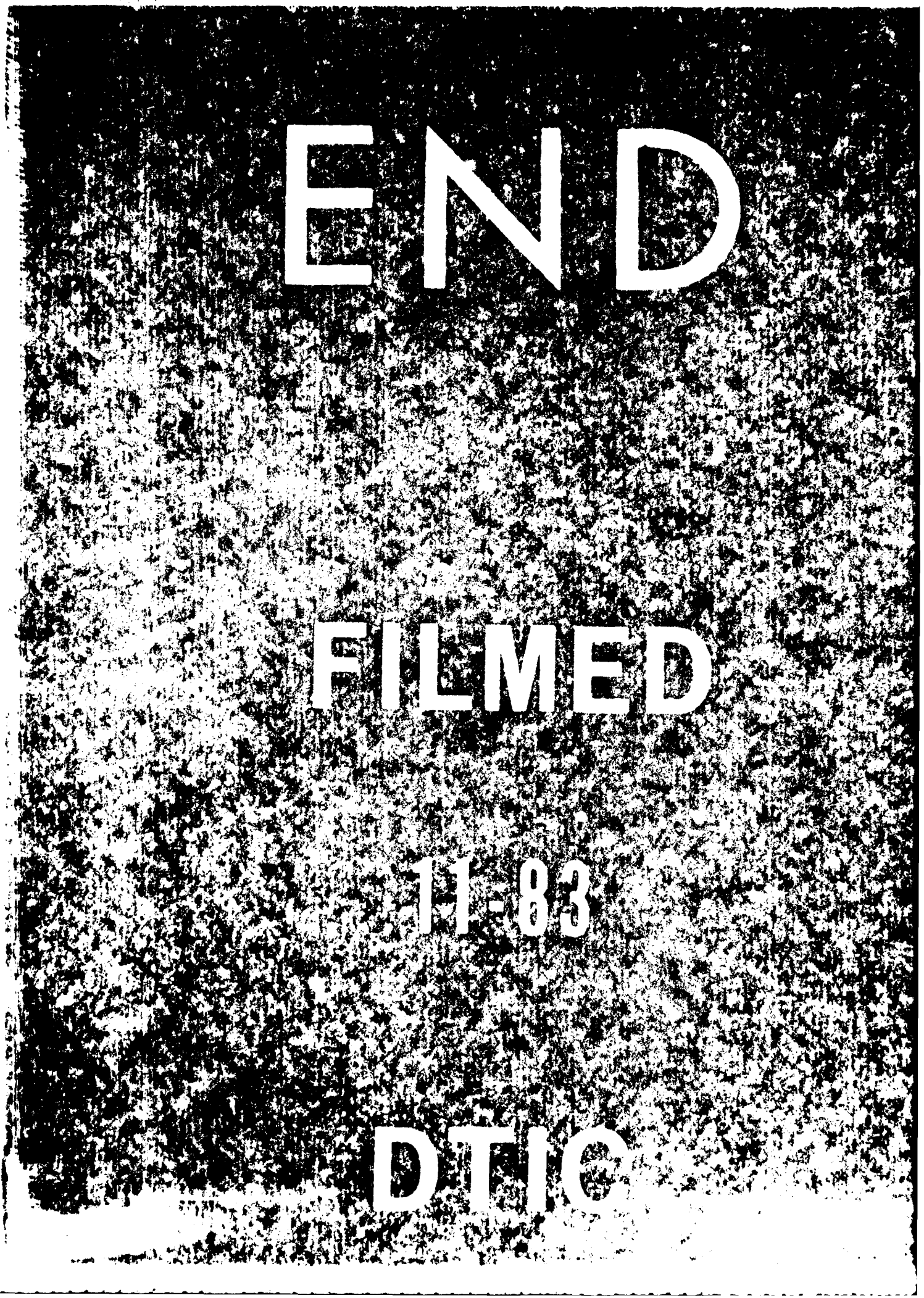
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