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EVALUATION OF T-37 IFS SYLLABI IN THE ASPT.(U)

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EVALUATION OF T-37 IFS SYLLABI IN THE ASPT

By

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AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235

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Two syllabi were developed for potential use in the T-37 phase of undergraduate pilot training (UPT), when the Air Training Command's (ATC) Instrument Flight Simulator (IFS) become operational. These syllabi were designed to maximize the use of proven instructional strategies with state-of-the-art simulators; the goal was to demonstrate that such a program would permit using only one aircraft check ride for validation of instrument skill learning. Four UPT students from Class 77-03 were trained using the first syllabus; and four students from Class 77-05 were trained using the second syllabus. The remaining students in each of the respective classes, trained using the current ATC syllabus, were used as control groups. The Advanced Simulator for Pilot Training (ASPT), modified to simulate IFS capabilities as closely as possible, was used as the test vehicle. → (over)

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Comparisons were made between average training times required by the experimental groups (progressed on a proficiency basis) and average training times required by the remainder of the UPT classes, using the conventional syllabus. Average check ride scores were compared for all groups. Training effectiveness ratios were computed by training category for each of the two syllabi tested.

Using these syllabi, which maximized the use of available devices (T-4 trainers and the ASPT as modified to approximate the IFS), it was demonstrated that most of the instrument training currently accomplished using T-37 aircraft can be accomplished in the IFS with no degradation in pilot output quality; an average of 2.4 aircraft hours was required for experimental subjects, as compared with 15.8 aircraft hours currently used.

Since experience indicates that some number of students (estimated at 13%) will fail their first aircraft instrument check ride, a goal of one check ride per student is unattainable (except administratively); however, this study indicates ATC has a high probability of coming very close to their goal.

Student instructor and simulator operator interviews provided several suggestions which will be helpful in implementing the selected syllabus with the IFS.

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PREFACE

This study was conducted in support of project 1123, Flying Training Development, Mr. James F. Smith, Project Scientist; task 112303, The Exploitation of Simulation in Flying Training, Mr. Robert R. Woodruff, Task Scientist; and work unit 11230324, Evaluation of T-37 IFS Syllabus in the ASPT, Captain Douglas C. Weyer, Principal Investigator, assisted by Captain John H. Fuller.

This study was conducted by the Flying Training Division of the Air Force Human Resources Laboratory (AFSC) and supported by the 82d Flying Training Wing (ATC) and 82d Flying Training Wing/Deputy for Operational Research commanded by Lt Col Gerald L. Floyd.

Special appreciation is expressed to Lt Col Floyd and his staff who conducted the student training phase of this study. These people were: Captains James H. Gormley, Lee A. Lesher, Peter Drechsler, Lucian A. Dade, III, and Thomas Grayson.

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EVALUATION OF T-37 IFS SYLLABI IN THE ASPT

I. INTRODUCTION

Background

From 1969 through 1972, the United States Air Force sponsored three studies which had as their objective the identification of future concepts for use in undergraduate pilot training (UPT). One of the more significant findings reflected in each of these studies was a need for integration of advanced flight simulators into the flying training program (USAF Mission Analysis Study Group, 1972). As a result, procurement of an Instrument Flight Simulator (IFS) for UPT was initiated. The IFS is a state-of-the-art flight simulator equipped with: a six-degree-of-freedom synergistic platform motion system; a camera model visual system; and selected advanced instructional features. (The first operational IFS complex, consisting of eight T-37 and eight T-38 cockpits, is scheduled for installation and acceptance at Reese AFB, Texas in 1977.)

Also as a result of the studies noted above and *to obtain an objective estimate of the increase in* training effectiveness that could be achieved through the use of flight simulators with visual systems in UPT, the Flying Training Division (FT) of the Air Force Human Resources Laboratory (AFHRL) conducted a series of research studies. Preliminary studies were conducted using the T-4G, a T-37 simulator with limited motion and visual systems (Woodruff & Smith, 1974), and more recently, using the Advanced Simulator for Pilot Training (ASPT) (Weyer & Fuller, 1976; Woodruff, Smith, Fuller, & Weyer, 1976). (The ASPT is an advanced full mission T-37 simulator with a six-degree-of-freedom platform motion system, a full field of view visual system and numerous advanced instructional training features. A more detailed description of the ASPT may be found in Appendix A (Hagin & Smith, 1974)). Each of these studies involved using ground training devices in basic instrument training and required development of new syllabi for integrating these devices into the total basic phase of UPT. As a result of these efforts, both Air Training Command (ATC) and AFHRL/FT personnel obtained considerable experience in training program development.

To capitalize on this syllabus development experience, ATC requested that FT participate in the development and evaluation of two separate syllabi for use with the IFS. This report provides a description of both phases of that study.

The syllabus developed for use in the first phase (hereafter referred to as IFS I) involved conducting *all* ground instrument training in the ASPT and *all* procedures training in the existing T-4 Instrument and Procedures Trainer. The syllabus developed for the second phase (hereafter referred to as IFS II) involved conducting *most* of the ground instrument training in the ASPT and the *remainder* of the instrument training and *all* procedures training in the T-4. Thus, the major difference between the syllabi used was scheduling for the distribution of training between the two ground training devices; specifics of these differences are discussed in later sections. Since the treatment of subjects in IFS I and IFS II were the same except as noted previously, descriptions of the procedures used for both phases are combined.

The evaluations were designed to meet the following objectives:

1. *Evaluate two T-37 IFS Test Syllabi to determine if a desired criteria of one aircraft validation/check ride for each UPT student could be achieved.*

2. *Develop instructional procedures, techniques, and guidelines for using the IFS training features effectively.*

3. *Develop procedures for terrain model board (TMB) time sharing and scheduling.*

4. *Determine and recommend operator training requirements.*

II. METHOD

Apparatus

While both the ASPT and the IFS simulate T-37 aircraft, they have different visual systems, platform motion systems, advanced instructional features, and console operator station locations. To minimize the effects of these differences on the study results, it was necessary to reduce the ASPT capabilities to approximate those available with the IFS. A description of the differences and limitations follows.

Visual. The major difference between the ASPT and the IFS is the visual system. ASPT has a wide wraparound field of view (FOV), computer image generated (CIG) visual system displaying a contінous scene through large optical windows. This scene extends 300 degrees in azimuth, 110 degrees up and 40 degrees down. The visual images are composed by a computer with mathematically generated objects monochromatically displayed using 63 color shades ranging from white to black. No films, pictures, or physical models are used.

The IFS visual system is a color presentation generated by means of a TV probe scanning a terrain model board depicting a runway environment and a 5- by 10-mile area in the vicinity of the runway. A special effects unit also permits display of an above-the-clouds effect; blue sky above and adjustable white to dark gray clouds below. The FOV for this system is approximately 48 degrees in azimuth with ± 18 degrees vertical.

The ASPT visual system was electronically masked for this project so that images would not appear outside of the IFS FOV. In addition, a visual scene was modeled, which approximated the terrain model board with a parallel runway configuration; buildings, runway markings, and surface texturing. Special effects such as ceiling conditions and above-the-clouds scenes with light gray sky and dark clouds were available.

The difference in training value of the modified ASPT visual system and the IFS system is difficult to quantify. The above-the-clouds effect is very similar between the two systems and little difference in training effectiveness is expected. The difference between the runway scenes, however, is readily apparent. The IFS color system appears to improve realism in the scene, but preliminary research on other devices indicates that color does not significantly improve the training effectiveness of the display system. Although the CIG imagery is more stylized and contains less detail than model probe imagery, instructor pilots believe that the visual cues provided by the ASPT are sufficient to conduct all training required by the syllabus.

Motion. Both the ASPT and the IFS have six-degree of freedom (DOF) motion systems, each having six identical hydraulic actuators arranged in three bipod pairs. The maximum actuator excursion on the ASPT system is 60 inches, while maximum excursion on the IFS is 48 inches. Table 1 compares the maximum platform motion excursion for each system.

Table 1. **A Comparison of Maximum Motion Platform Excursions**

Degree of Freedom	ASPT	IFS
Pitch	+30°, −20°	±25°
Roll	±22°	±20°
Yaw	±32°	±20°
Vertical	+38″, −30″	±34″
Lateral	+48″	±34″
Longitudinal	+49″, −48″	±34″

The actual platform motion cues delivered to the pilot are based on the motion drive program. Since the final configuration for the IFS motion system program was not available at the time of the study, the motion drive program developed for the ASPT was used. It is expected, however, that the final IFS motion program will not be significantly different than that used during this study.

Advanced Instructional Features. Although the ASPT has several additional features not available on the IFS, only those features available on the IFS were used. These include: automatic demonstrations, initialization of aircraft location and parameters, playback, automatic/manual malfunction insertion, and parameter freeze. While the ASPT and IFS instructional features are nearly identical, the IFS initialization capability is somewhat more flexible; initial condition parameters and location can be readily modified by the console operator. In addition, the playback feature on the IFS allows playback of the last five minutes of flight at any time; the ASPT configuration requires the instructor to manually start and stop recording before activating playback. While the ASPT configuration requires slightly different activation procedures by the instructor, the final playback to the student is identical to that provided in the IFS.

Console Operator Stations. The ASPT has three console operator stations–advanced, conventional, and in-cockpit. Each cockpit has a conventional station equipped with repeater instruments, digiwheel switches, and pushbuttons for activating various training features. Both cockpits can be operated from the advanced station which is also equipped with cathode ray tubes (CRT) for displaying alphanumeric and graphic information. Operational control at the advanced station is by means of a keyboard, which is very similar to the IFS console.

Whenever possible, the console operators used the advanced station to control each mission; however, it was necessary occasionally to use the conventional station. If two different missions (normally requiring two operators) were being conducted, one operator worked at the conventional station and the other at the advanced station.

Subjects

Four subjects were selected from UPT Class 77-03 to participate in IFS I and four subjects from Class 77-05 for IFS II. Criteria for selection were: no subjects with over 50 hours of civilian aircraft time, and no navigators with prior Air Force flying experience. The remainder of the students in each class (26 in Class 77-03 and 32 in Class 77-05) served as control groups to provide for comparisons in performance data.

Instructor Pilots

Two 82d Flying Training Wing/DOR instructor pilots (IP) were assigned to the experimental group in Class 77-03 and three DOR IPs to Class 77-05. One additional instructor was available on a part-time basis for both groups. These instructors functioned as training managers in all flight-line related activities for the experimental subjects.

All IPs were given instruction and practice in operating the ASPT instructor stations and in flying the simulator from the right seat. IPs were present in the cockpit during all training, except for team sorties in emergency procedures and navigation.

Syllabi

Original drafts of the two syllabi were prepared by Air Training Command, Curriculum Development, Randolph AFB, with consultation provided by AFHRL/FT. The syllabi were designed to eliminate all instrument category training in the aircraft, with the exception of one validation sortie, an instrument check ride. In the IFS I syllabus, all instrument training was accomplished in the ASPT; the T-4 was used only as a procedural trainer. In the IFS II syllabus, most of the instrument training was conducted in the ASPT with the remainder being completed in the T-4; the T-4 was also used for procedures training.

The content of both syllabi was based on experience gained from T-4G studies referenced earlier, ATC's Quality Improvement Program (QIP) Syllabus implemented in July 1975 (Air Training Command, 1975), and results of the ASPT Operational Utilization Test (Woodruff *et al.*, 1976). For purposes of comparison, Tables 2 and 3 show projected aircraft and simulator hours, respectively, for all three syllabi.

Table 2. **A Comparison of Scheduled T-37 Aircraft Sorties-Hours for Three Syllabi Used in this Study**

Category of Training	Syllabi		
	ATC QIP	IFS I	IFS II
Basic	8 – 10.4	8 – 10.4	2 – 2.6
Instruments	11 – 14.3	1 – 1.3	1 – 1.3
Contact	32 – 40.7	32 – 40.7	34 – 43.3
Navigation	6 – 9.0	6 – 9.0	6 – 9.0
Formation	12 – 15.6	12 – 15.6	12 – 15.6
Totals	69 – 90.0	59 – 77.0	55 – 71.8

Table 3. **A Comparison of Scheduled Simulator Sorties-Hours for Three Syllabi Used in this Study**

Category of Training	Syllabi				
	ATC QIP	IFS I		IFS II	
	T-4	T-4	T-50	T-4	T-50
Basic	10–10.4		16–15.2	7– 5.6	10–10.4
Instruments	17–16.8		23–24.0	13–11.2	14–16.8
Navigation	3– 3.2		5– 5.6	3– 3.2	4– 5.6
Procedures	7– 6.4	5–4.0	1– 0.8	5– 4.0	3– 2.4
Totals	37–36.8	5–4.0	45–45.6	28–24.0	31–35.2

The primary differences among the three syllabi in terms of aircraft hours appear in the *basic* and *instrument* categories. Since the *basic* phase of IFS I was completed prior to beginning IFS II, it was possible to change the IFS II syllabus based on findings of the previous phase. As a result of the IFS I findings and an ATC request, aircraft hours scheduled for *basic* in IFS II were reduced from 10.4 to 2.6; also at ATC's request, some of these hours were added in *contact*.

In the *instrument* category, conventionally trained students received 14.3 hours, whereas IFS subjects received only one aircraft sortie; the T-37 instrument check ride. As a result of the projected reduction in aircraft hours in the IFS I and II syllabi, additional simulator training hours were included in the *basic, instrument*, and *navigation* categories (see Table 3).

Mission Guides

Special mission guides were developed for use in the study. Previous experience in the Operational Utilization Test (OUT) study indicated that IPs need certain information in a convenient-to-use format to assist them in conducting ASPT training more efficiently from inside the cockpit. The guide was printed on 8 by 5-inch cards and assembled in booklet form. It contained the following information relating to ASPT operations: (a) initial condition index, (b) malfunction index, (c) phase training standards, (d) specific information for each maneuver, and (e) special instructions for each training block, including personal equipment to be worn. In the IFS II mission guide, specific information was also provided for T-4 sorties, including: (a) proficiency items, (b) practice items, (c) initial conditions, and (d) other pertinent instructions as required. Samples of the mission guides used in IFS II are contained in Appendix A.

Student Study Guides

Student study guides were designed to help students prepare for simulator training and reinforce student learning after training was accomplished. This type of guide had been used quite effectively by students during an earlier study using the ASPT (Weyer & Fuller, 1976).

The systems approach to training was utilized in designing the Student Study Guide. Desired behavioral objectives for each task trained in the simulator were listed. All other items in the guide were intended to assist the student in accomplishing these task objectives.

Student activities were listed for preflight, in-cockpit, and post flight. References directed the student to all relevant source materials, including learning center programs pertaining to each specific task. Probable errors, based on the judgements of experienced IPs, were also included to alert students to common pitfalls normally encountered while performing each maneuver. A sample of the Student Study Guide is contained in Appendix B.

IP-Student-Console Operator/Interviews

Interview sessions were held with all instructor pilots, students, and console operators concerning their opinions of the overall program effectiveness, the simulator, and simulator training features. This material was summarized and appears in Appendix C.

Procedures

All experimental and control students were trained to phase training standards as specified in the ATC July 1975 Syllabus for both the simulator and the aircraft. (For ease of description, research terminology is used throughout this report; however, all readers should be aware that the study really consisted of two demonstration studies in an operational situation, using small numbers of subjects and did not possess the rigor of an experiment.) Students were given an instrument check ride in the simulator in addition to required ATC check rides; all check rides were administered by the 96th Flying Training Squadron Check Section. Academic training for all was completed on the same schedule as conventionally trained ATC students.

Data collected for both experimental groups included simulator and aircraft hours used in all categories of training and check ride scores from the T-37 aircraft. In addition, student performance in the T-38 phase of UPT was examined to obtain information concerning the long range effects of the special treatment.

Of the original experimental sample from Class 77-03, one student was eliminated from the group due to problems during presolo contact. The subject was washed back to Class 77-04 and eventually eliminated from training.

In Class 77-05, one subject was washed back to Class 77-06 because of (a) an extended period of illness, and (b) failure of a final progress check in the contact phase, which resulted in a requirement for extra aircraft training sorties.

III. FINDINGS AND DISCUSSION

Simulator Hours

Table 4 provides a summary of simulator hours used by both control and experimental groups for IFS I and IFS II. Due to reduced aircraft flying hours in both syllabi, a proportionately greater amount of simulator time was spent in the *basic*, *instrument*, and *navigation* categories. The IFS I experimental group used a total of 53.5 hours in the simulator; IFS II experimental group used a total of 61.5 hours. The increase in simulator hours from IFS I to IFS II resulted from an ATC decision to reduce aircraft time in the *basic* category and from a subjective opinion regarding the expected reduction of training transfer from the simulator to the aircraft due to training received in the T-4. (Individual summaries showing simulator

Table 4. **A Comparison of Average (Group X) Simulator Hours Used (by Category of Training) Between the Experimental Groups and Their Respective Control Groups**

Category of Training	IFS I		IFS II	
	Control (N=26)	Test N=3)	Control N=32)	Test (N=4)
Basic	10.3	15.4	10.4	16.7
Instruments	15.9	26.4	18.6	29.6
Navigation	3.3	5.6	3.3	8.8
Procedures	6.6	6.1	6.4	6.4
Total	36.1	53.5	38.7	61.5

hours used by each experimental subject are provided in Appendix D.)

A Lindquist (1953) Type I Design Analysis, using time spent in ASPT, the T-4, and the aircraft, in addition to T-37 instrument check ride scores, indicates the optimal ratio of time spent in the T-4 to time spent in the IFS to be 60% (T-4) to 40% (IFS). This is based on training to proficiency in the T-4 before going to the IFS.

Aircraft Flying Hours

Table 5 provides a summary of T-37 aircraft hours used by the control and experimental groups. IFS I experimental subjects used a total of 77.5 aircraft hours, 12.5 fewer hours (13.9%) than the control group: IFS II experimental subjects used 75.5 hours, 11.6 fewer hours (13.4%) than the control group. Students in all four groups could proficiency advance in the basic category, thereby finishing with fewer sorties/hours than called for by the syllabus. In the *contact, navigation,* and *formation* categories of training, the number of sorties for all groups was fixed by the syllabus.

Relatively large savings were demonstrated by both experimental groups in the *basic* and *instrument* categories of training. The increased savings in basic achieved by the IFS II experimental group was due in part to syllabus redesign as a result of ATC's decision to further reduce aircraft hours in that category; increased savings in *instruments* by the IFS II experimental group was due entirely to their superior performance. Both experimental groups required more hours in the *contact* category than their respective control groups due to failed contact check rides. In both experimental groups, one individual required considerably more time than his peers due to failure of a final progress check in *contact*. This negative factor is believed to be the result of a combination of syllabus flow and student scheduling. In both evaluations, the syllabus required that students be given the instrument check ride first. This resulted in less than optimal contact training continuity during the time when subjects were concentrating heavily on instrument flying in the simulator. In other cases, subjects had too few sorties remaining following instrument training to adequately prepare them for the contact check ride. This resulted from flightline schedulers using contact sorties to keep subjects flying in the aircraft during peak periods of simulator utilization. It is expected that this problem can be solved, however, by eliminating the instrument check ride as a prerequisite for the contact check and by briefing flight-line schedulers on possible scheduling pitfalls. (Individual summaries showing aircraft hours used by each experimental subject are available in Appendix E.)

Table 5. **A Comparison of Average (Group X) Aircraft Hours Used (by Category of Training) Between the Experimental Groups and Their Respective Control Groups**

Category of Training	IFS I				IFS II			
	Control (N=26)	Test (N=3)	Saved %	TER[a]	Control (N=32)	Test (N=4)	Saved %	TER[a]
Basic	12.2	8.6	29.5	.71	8.4	2.4	71.4	.95
Instruments	15.9	3.0	81.1	1.23	15.7	2.0	87.3	1.24
Contact	40.4	43.7	−8.2		41.4	49.9	−20.5	
Navigation	8.6	9.4			7.7	8.3		
Formation	13.0	12.7			13.7	12.9		
Total	90.1	77.4	13.9	.72	87.1	75.5	13.4	.51

[a]See text for definition of Training Effectiveness Ratio.

Training Effectiveness Ratios (TER)

While hours (and percentages) saved are interesting, a more meaningful measure of simulator effectiveness is the TER. This ratio (Roscoe, 1971) provides an estimate of transfer efficiency by the ratio of practice hours saved to practice hours spent in a prior device; the higher the ratio value, the greater the transfer efficiency. In its purest form, the TER is computed as follows:

$$\frac{\text{original flight hours} - \text{new flight hours}}{\text{simulator hours}}$$

In this study, this form was not applicable since performance data for a non-simulator-trained group was not available. As a result, a TER was computed using the following formula (Diehl & Ryan, 1977):

$$\frac{\text{original flt hrs (control)} - \text{new flt hrs (experimental)}}{\text{new simu. hrs (experimental)} - \text{original simu. hrs (control)}}$$

Using either formula presented above, a higher obtained value represents more effective training. It should also be understood that the ratios obtained in this study cannot be attributed entirely to the use of a new simulator since effective use of the capabilities of the new device required development of a revised syllabus; therefore, the TERs provided in Table 5 resulted from the use of a new device and revised syllabi.

The IFS II trained group achieved a higher TER than that achieved by the IFS I studies in the *basic* category (.95 vs. .71). This is provocative remembering that the IFS II group received less training in the ASPT due to utilization of the T-4 device; however, part of the improvement in the IFS II TER, although it cannot be quantified, is due to syllabus design. TERs in *instruments* reveal little difference between the two groups.

Check Ride Scores

Average check ride scores are provided in Table 6 for both experimental and control groups. Although the group mean scores for the T-37 phase vary somewhat from control to experimental, none of the differences are statistically significant at even the 10 percent level of confidence (and these likely occur by chance). These findings attain more significance, when considered in terms of treatment differences among the groups; i.e., both control groups received 11 instrument training sorties in the aircraft as opposed to an average of 2.3 sorties per subject in IFS I and 1.5 sorties per subject in IFS II. (Review sorties required as a results of failed check rides, as well as rechecks, are included in these averages.) Both experimental groups required more total aircraft hours in *contact* training. These data indicate that the reduction of aircraft hours in both the *basic* and *instrument* categories may require some amount of additional aircraft hours in *contact* training to retain an equivalent overall level of quality. (A summary of items failed on instrument and contact check rides appears in Appendix F; no trends were noted.)

The progress of both experimental groups in T-38 training was monitored; *contact* and *navigation* check ride scores were obtained. These scores are also provided in Table 6. As in the T-37 phase, none of the differences in group means are statistically significant at the 10 percent level of confidence.

Table 6. **A Comparison of Average (Group X) Aircraft Checkride Scores Between the Experimental Groups and Their Respective Control Groups**

Type of Check ride	IFS I Control (N=26)	IFS I Test N=3)	IFS II Control (N=32)	IFS II Test (N=4)
T-38 Phase				
Instruments	90.43	86.49	90.60	88.14
Contact	86.47	86.45	88.14	86.57
T-38 Phase				
	(N=23)	(N=3)	(N=31)	(N=3)
Navigation	91.02	92.88	93.27	96.32
Contact	83.66	86.77	88.11	86.77

IV. CONCLUSIONS/RECOMMENDATIONS

This evaluation was conducted to provide Air Training Command information concerning the implementation of the Instrument Flight Simulator into undergraduate pilot training. Following is a summary of conclusions and recommendations relative to each objective:

Objective 1 – Evaluate the T-37 IFS Test Syllabi using the ASPT configured like the IFS. Based on results of this study, use of the IFS II syllabus is recommended for implementation into UPT. The IFS II syllabus appears to be more effective, since it required less aircraft time, while the experimental subjects completed the training and achieved check ride scores (equal to or better than) those achieved by the IFS I subjects.

Assuming that the T-4 trainer remains operational, it is more cost effective to use it in combination with the IFS rather than conducting all training in the IFS. Training effectiveness ratios indicate that use of the T-4 trainer in IFS II did not reduce training transfer to the aircraft. This could conceivably free the IFS for use in accomplishing part of instructor pilot annual requirements now accomplished in the aircraft, thus realizing additional savings.

Followup data on IFS subjects indicate that experimental subjects performed as well as their peers in terms of T-38 check ride scores, suggesting that reduced flying time in the T-37 did not negatively affect students' performance in the T-38.

Objective 2 – Develop instructional procedures, techniques, and guidelines for using the IFS training features effectively. It was concluded by instructor pilots and console operators, that the mission guides used with the IFS II syllabus should be implemented into UPT with the operational IFS. Minor changes may be necessary to accommodate the slight differences between the two systems.

Objective 3 – Develop procedures for terrain model board (TMB) time sharing and scheduling. Prior to a training period beginning, instructor pilots and console operators should discuss which cockpit will begin using the visual system.

With reference to part-task sorties, time sharing can best be accomplished by letting one cockpit use the visual system while the other cockpit does nonvisual maneuvers. When the first cockpit has completed use of the visual system, it will be available for the second cockpit. During mission profile sorties where both cockpits will require the visual system at the beginning and end of the mission, staggered start times are appropriate; as little as three minutes may be allowed between takeoffs for the two cockpits. In the case of a typical instrument sorties, the staggered start times will allow the visual system to be available on a noninterference basis for both cockpits for takeoff, and again at the end of the mission for the visual flight rules (VFR) transition to landing from the ground controlled approach (GCA).

Objective 4 – Determine and recommend operator training requirements. In addition to a recommended listing of job responsibilities and a training program, it is suggested that use of enlisted personnel as IFS instructors be given every consideration for purposes of cost effectiveness and lightening the instructor pilot workload. Job responsibilities of the IFS console operator should include:

1. Setting up the simulator for the sortie to be flown, including all advanced training features to be used.

2. Acting as Air Traffic Controller providing voice communications for departure approach control, air route traffic control center (ARTCC), GCA, tower, and Runway Supervisory Unit (RSU) controllers.

3. Managing the sharing of the terrain model board between cockpits within the simulator complex.

4. Coordinating the training effort with the instructor during the student sortie.

5. Acting as safety observer, relaying instructions to cockpit crewmembers during an actual emergency and supervising egress as necessary.

6. Notifying maintenance personnel of system problems as they occur. (Also keeping cockpit crewmembers informed of expected duration of downtime.)

Suggested training requirements for IFS console operators are as follows:

1. Hardware Orientation – Extensive training in the areas of equipment familiarization and console operation; training time is estimated at eight hours.

2. Air Traffic Controller Operations – Initial training should include extensive familiarization with pilot and instrument procedures to include related publications (an annual review should also be employed) and orientation visits to the local control tower, RSU, GCA, and radar approach control center (RAC) facilities. These orientation visits should include briefings by each agency. Recurring training should include briefings by the local Standardization and Evaluation (Stan-Eval) section on all Wing Manual publications governing local flying procedures. All changes to these manuals should be briefed as they occur. Each operator will be responsible for keeping current the portion of the Wing Manuals (primarily radio procedures) relating to his function as an air traffic controller.

3. Cockpit Checkout – Recurring training for each operator should include familiarization instruction with an instructor pilot in the simulator cockpit to observe typical mission (including voice communications) in each category of instruction for which he will serve as an operator. This training should include observance of a typical emergency procedures sortie.

4. Practical Checkout – Initial training for each operator should include at least one period of on-the-job training, wherein he receives instruction while he performs duties as an operator/controller in the conduct of a typical sortie from the ATC syllabus (both part-task and mission profile). He should receive one of these instructional periods in each category of training.

5. Quality Control – On a semiannual basis, each console operator should be monitored by his supervisor to ensure his currency in console operations and by a representative of local Stan-Eval to monitor air traffic control procedures and voice communications. Comments should be documented and made a part of each operator's permanent record to be retained by local Stan-Eval.

Interviews with students and instructor pilots also provide a basis for some recommendations. The more significant of these are as follows:

1. With the exception of team and emergency procedures training sorties, instructor pilots are more effective when located in the simulator cockpit.

2. A standard instrument hood should be used during mission profile sorties in the simulator.

3. Spatial disorientation demonstrations should be provided in simulator instrument training.

4. When GCA proficiency is achieved in the simulator, additional training with varying levels of turbulence should be provided.

5. Proficiency in simulator landings should be reviewed, and perhaps eliminated, unless the IFS visual system provides better transfer than achieved in this study.

6. Aircraft cross-country flights should be planned to provide maximum instrument training; i.e., short hops and multiple approaches at each destination.

7. The mix of 4 dual/3 solo sorties in the C31XX unit of instruction should be changed to 5 dual/2 solo sorties and additional instruction provided in advanced aerobatics.

8. To provide for increased scheduling flexibility and continuity of training, the requirement for the aircraft instrument check ride as a prerequisite for the contact check ride should be deleted.

9. Sortie length in the I15XX unit of instruction should be increased to 1.0 hours to accommodate the large number of tasks involved.

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APPENDIX A: SAMPLE MISSION GUIDES DEVELOPED FOR USE IN THE IFS II SYLLABUS OF DESTRUCTION

Following are samples of information provided in the Mission Guides developed for use in IFS I and IFS II studies. As shown, the document included some instructions to the IPs and specified phase training standards, as well as Sortie guides.

INITIAL CONDITIONS INDEX

01	TAKEOFF	- WAFB, R/W 30C
03	TAKEOFF LEG, 1900', 196K	
06	PHX 045R, INBOUND, 9 DME, FL180	
32	15M', 160K, 360 DEG (BARTLETT)	
36	3/4 MILE FINAL, 1700'	- WAFB, R/W 30C
37	5 MILE FINAL, 1900'	- WAFB, R/W 30C

IFS MALFUNCTIONS

	A	B		A	B
02 ELECTRICAL					
01	Battery Weak/Fail	41	04	Main Inverter	44
02	Generator (Left)	42	05	Spare Inverter	45
03	Generator (Right)	43			
05 ENGINE					
06	High Oil Pressure(L)	46	12	Engine Overheat(L)	52
27	High Oil Pressure(R)	61	27	Engine Overheat(R)	67
09	Engine Seizure(L)	49	13	Engine Fire(L)	53
24	Engine Seizure(R)	64	23	Engine Fire(R)	68
10	Engine Flameout(L)	50			
25	Engine Flameout(R)	65			
06 FLIGHT					
01	Aileron Trim, Insp	41	12	Attitude Indicator	52
02	Aileron Trim, Runaway	42			
03	Elevator Trim, Insp	43			
04	Elevator Trim, Runaway	44			

07 NAVIGATION

02	UHF Receiver	42	21	DME Fail	61
09	VOR System	49	25	Compass Error	65

BASIC PHASE TRAINING STANDARDS

	MANEUVERS	STANDARDS
1.	Climbs, descents, levels off, level flight, normal turns	ALTITUDE: ±150 feet AIRSPEED: ±10 KIAS HEADING: ±10° VERT. VEL: ±20% BANK: ±5° PITCH: ±6°
3.	60° Bank turns	ALTITUDE: ±250 feet BANK: ±10°
5.	Takeoff	R/W ALIGNMENT: ±15 feet LIFT OFF AIRSPEED: -5+10 KIAS

INSTRUMENT PHASE TRAINING STANDARDS

	MANEUVERS	STANDARDS
1.	Aircraft control	Same as BASIC
3.	Holding	COURSE: ±5° INBOUND COURSE DME: ±1 mile
5.	GCA	AIRSPEED: -5+10 KIAS HEADING: ±5° assigned ALTITUDE: -0+100 feet MDA if ASR
6.	Missed Approach	DME: +1/2 NM or TIME: +15 secs

Reference: ATC Syllabus P-V4A, III-24.

11201-04 (T-4) INSTRUMENTS - PART TASK (0.8 HOURS)

1. Proficiency Items:

   a. Items from I11XX as required for proficiency.
   b. Tech Order climb.
   c. Rate climb and decent.
   d. Vertical S (A and D required).

e. Aileron Roll.
f. Wingover.
g. Unusual attitude recoveries.
h. Instrument slow flight.
i. Enroute descent.

2. Practice Items:

a. Rate and timed turns.
b. Magnetic compass turns.

3. Initial Conditions:

a. 140 KIAS; S & L; 15M'.
b. 160 KIAS; S & L; 15M'.
c. 190 KIAS; S & L; 15M'.

4. The student should demonstrate proficiency in rate climbs and descents, using different rates of climb.

5. Minimum repetitions for Vertical-S maneuvers - one satisfactory climb and descent. Vertical-S bravo and charlie may be used as transition teaching steps to the Vertical-S delta.

6. Instrument slow flight - Begin from an initial condition of 160 KIAS, 15,000 feet, clean configuration.

7. Practice rate and timed turns and mag compass turns on I1203.

I1501-06 INSTRUMENTS (PART TASK) (0.8 Hours) (Mission Profile) (1.6 Hours)

SPECIAL INSTRUCTIONS:

1. Personal Equipment - Gloves, parachute harness, helmet (I1505-06).

2. Perform maneuvers under conditions of "IMC."

3. I1501-3 Norton Penetrations to missed approach.

I1504 1 Norton Penetration to missed approach.

2 Hi Vortac RW30C Williams to landing, IC058 (500-1).

I1505-6 Mission Profile.

VISUAL	INITIAL CONDITION	MANEUVER/ PROFICIENCY	LEVEL	I1501	I1502	I1503	I1504	I1506
IMC	06,05	HOLDING	(3+)	D R/P 8				
IMC	06,07,08 58	VOR/VORTAC APPROACH	(3+)	D R/P 8				
TMB	36	LANDING	(3+)	R/P				
IMC		MISSED APPROACH	(3+)	R/P				

DEMONSTRATIONS: 007 - Holding (Norton)

008 - Penetration (Norton)

Low Approach (Norton)

INSTRUCTOR GUIDE TO IFS MALFUNCTION SET 04

1. The first malfunction is a right engine fire during start. It will occur when the right engine RPM reaches 25%. It will clear by pulling the right fuel shutoff T-handle. Make sure that you wait 15 sec after the handle is pulled before restarting the engine to ensure that the malfunction has cleared.

2. Malfunction 2 is a dual engine flameout occurring at 2,000' MSL. The student should eject. You might want to freeze the simulator after he ejects. When he has ejected or crashed, initialize to 001. Check gear down, half flaps, and speed brake up.

3. Malfunction 3 is a left engine overheat occurring at 95 knots. The desired student response is to abort. Regardless of what he does, initialize to 003 when he completes the EP. Check gear up, flaps up, and speed brake up.

4. Malfunction 4 is high oil pressure on the right engine occurring as the aircraft passes 13,000' MSL. The oil pressure will reach 65 PSI, but will drop to 45 PSI when the throttle is retarded to idle. When the student has completed the EP, initialize to 038, Tango, for a Sabre Recovery to a straight-in.

5. Malfunction 5 occurs on the Sabre Recovery at 5,000' MSL. At this altitude, total hydraulic failure will occur. The student will most likely have to fly a no-flap straight-in to a full stop landing.

The Emergency Gear Extension will lower the gear with the gear handle down. At completion, initialize to 037 for another straight-in. Check gear, flaps, and speed brake up.

6. Malfunction 6 is a dual engine flameout at 11,000' MSL on the Sabre recovery. Most likely, the student will try an airstart on both engines. The left engine will start, but the right will not. The right engine will start, however, when the right engine ignition switch is used in proper sequence for a restart.

7. The last malfunction (split flaps) will occur, when the aircraft passes 3,000' MSL. After the student lands, initialize to 001 and the mission is complete.

N1202-4 NAVIGATION (MISSION PROFILE) (1.6 HOURS)

SPECIAL INSTRUCTIONS:

1. Students will accomplish profiles, using any of the following:

   a. March AFB to Nellis AFB.
   b. Williams AFB to March AFB.
   c. El Paso Airport to Kirtland AFB.

2. Special instructions will be provided in the mission profile to include route of flight, altitude, weather conditions, radio calls, and other details concerning the mission.

3. Students will accomplish all phases of flight planning, under IP supervision, to include Form 70 and Form 175 preparation.

4. IPs will ensure a practice Form 175-1 is completed for each sortie.

5. To introduce the crew concept, each student will fly one sortie acting as co-pilot. His function will include, but need not be limited to, changing radio frequencies, updating flight logs, recomputing time and fuel estimates, using the MB-6 computer and chart reading.

6. Personal Equipment - Gloves, parachute harness, helmet (both students during team rides).

7. IPs will include mission context emergency procedures training during each lesson.

VISUAL	INITIAL CONDITION	MANEUVER/PROFICIENCY LEVEL		N1202	N1203
		FLIGHT PLANNING	(4+)		
		PERFORMANCE DATA COMPUTATION	(4+)		
		FORMS 70/175 PREPARATION	(3+)		
	TMB	GROUND OPERATIONS	(4+)		
		CLEARANCE COPY/READ BACK	(4+)		
	TMB	TAKEOFF	(4+)		
	IMC/VOT	INSTRUMENT DEPARTURE	(3+)		
	IMC/VOT	CLIMB AND LEVEL OFF	(4+)		
	AS REQD	AIRSPEED & ALTITUDE CONTROL	(4+)		
	AS REQD	USE OF TRIM	(4+)		
	IMC/VOT	ENROUTE PROCEDURES	(4+)		
	IMC/VOT	INFLIGHT CHECKS	(4+)		
	IMC/VOT	ENROUTE ETE/FUEL COMPUTATIONS	(4+)		
	IMC/VOT	GROUND SPEED CHECK	(4+)		
	IMC/VOT	POSITION REPORT	(4+)		
	IMC/VOT	COURSE INTERCEPTION/MAINT	(4+)		
	IMC/VOT	FIX-TO-FIX NAVIGATION	(4+)		
	AS REQD	EMERGENCY PROCEDURES	(4+)		

DEMONSTRATIONS: +PMSV, PIREP (4+)

PART-TASK/MISSION PROFILE

Part-Task Sorties. These sorties are designed to gain proficiency in individual maneuvers. The instructor should make extensive use of initialization and problem freeze to set up the simulator, rather than have the student fly to the starting conditions for each maneuver. The .8 sortie length has been selected, since it has been shown to be an ideal amount of time for a typical training period. It is very important that the instructor and student be thoroughly prepared for the part-task sortie. A minimum amount of time in the simulator should be spent discussing procedures and techniques that can be discussed during the mission briefing.

Mission Profile Sortie. These sorties are designed to prepare the student for training in the aircraft. Initialization and problem freeze may be used occasionally; however, the student should be gaining experience in setting up for maneuvers and in flying the aircraft for the duration of a typical aircraft mission. The instructor should also consider adjusting his instructional approach to more closely match the approach he will use in the aircraft. For example, the instructor may allow the student to make deviations in learning a straight-in and landing in the simulator that he would not allow in the aircraft. During the mission profile, the IP should start setting the same standards he expects the student to meet in the aircraft.

ADVANCED INSTRUCTIONAL FEATURES

Problem Freeze. This feature should be used primarily during part-task training. It allows the instructor to freeze the simulator, so that the student can concentrate on the briefing or debriefing for individual maneuvers. It also allows the instructor to freeze the simulator during a maneuver to point out references or corrective action the student should take to complete the maneuver successfully. Problem freeze can be used during mission profiles to debrief malfunctions or emergency procedures that occur during flight.

Initialization. The initialization feature should be used regularly during part-task training to set up for each maneuver. In addition, this feature can be used during mission profiles to eliminate non-productive time flying from one point to another. For example, it would normally be more effective to initialize for a second VOR approach than to fly back to altitude to start the approach again.

Auto Demonstration (D). Demonstrations are often comprised of several maneuvers. The instructor may stop the demonstration after the desired maneuver has been played. If the desired maneuver is the second or third maneuver in the demonstration, the student will have to see the first maneuvers again. This should reinforce the student on the proper performance of those maneuvers, and it gives the instructor a chance to interject more advanced techniques for the student.

Record/Playback (R/P). This feature will normally be used in two ways. First, it allows the student to more effectively analyze the instructor's comments on his performance. He does not have to interpret these comments while he is trying to fly, and he does not have to visualize his performance, if the instructor debriefs him after the maneuver is complete. Second, it is a unique opportunity to have the student verbally critique his own performance. In this way, the instructor can determine how well the student understands the maneuver and his errors.

Malfunction Insertion: Malfunctions may be inserted manually or automatically. During part-task training, malfunctions will be inserted manually, such as, inserting an engine fire to set up for a single-engine approach. Certain malfunctions will be inserted automatically during the sortie. This does not preclude the instructor from manually inserting additional malfunctions. It should be emphasized that the point at which malfunctions are inserted should be commensurate with the student's proficiency level. For example, an inflight engine fire should probably first be introduced during straight and level flight. During later flights, it may be introduced in the middle of an approach or other critical phases of flight. This gives the student an opportunity to develop judgment in the application of emergency procedures, rather than simply following the Bold Face or checklist procedures.

Parameter Freeze. This feature can be activated only by the console operator. It will normally be used in part—task sorties to simplify teaching certain maneuvers. Listed below are several examples of how to use this feature:

1. During basic altitude control practice, freeze heading and bank, so that the student can concentrate on proper pitch and power inputs.

2. If the student is having difficulty establishing the proper aim point on final, freeze position, and altitude on final, while he practices adjusting the pitch and power to achieve the proper aimpoint and airspeed.

3. Position freeze may be used to allow the student to get configured, if he is "getting behind the aircraft" on a normal straight-in or GCA.

4. Position freeze may be used during a mission profile sortie, once the student is established in a working area. Then he may be taken off freeze, when it is time to start the recovery.

Ceiling/Visibility Control. The visual conditions for the TMB are controlled by the console operator. The ceiling/visibility listed in the mission guide are the minimums at which the student must meet the specified proficiency. These values should be varied during training, so that the student can practice acquiring the runway from different ranges and from different portions of the approach.

APPENDIX B: SAMPLE STUDENT STUDY GUIDES FOR TASKS INCLUDED IN THE IFS II SYLLABUS OF INSTRUCTION[a]

TASK: CHANGE OF AIRSPEED, (STRAIGHT AND LEVEL), (TURNING)

OBJECTIVES: Student can accomplish changes of airspeed during straight-and-level and turning flight.

STUDENT ACTIVITY:

PREFLIGHT: What is the recommended RPM setting for 190 KIAS at 15M feet MSL? 160 KIAS? 140 KIAS? Why must angle of attack be increased as airspeed decreases?

IN-FLIGHT: The student will practice making changes of airspeed.

PROBABLE ERRORS:

1. Gains or loses altitude resulting from lack of cross-checking VVI, stares at altitude and airspeed indicator.

2. Poor trim.

3. Failure to readjust attitude indicator/pitch, once the airspeed is attained.

4. Failure to use power settings recommended by ATCM 51-4.

REFERENCES: Learning Center S71303, ATCM 51-4, p. 86-87, "Airspeed Changes." To "Constant Airspeed Climbs and Descents."

TASK: CONFIDENCE MANEUVERS, (AILERON ROLL), (WINGOVER)

OBJECTIVE: Student can perform confidence maneuvers.

STUDENT ACTIVITY:

PREFLIGHT: What is the correct power setting and entry airspeed for performing confidence maneuvers?

[a]Note to Reader - These Student Study Guides are typical of 41 such guides (20 for basic, 19 for instrument and 2 for navigation) developed for use with the IFS syllabi.

PROBABLE ERRORS:

1. Aileron Roll:

a. Insufficient pause at 25° pitch.

b. Jerky roll rates.

c. Back pressure before wings are leveled.

d. Failure to use rudder.

2. Wingover:

a. Wing tip below horizon prior to 60° bank (insufficient increase in roll rate, see "b" below).

b. Erratic roll rates; that is, back pressure and aileron deflection not sufficiently adjusted for changing airspeed.

REFERENCES: ATCM 51-4, p. 89, "Confidence Maneuvers," AFM 51-37, p. 8-20 to 8-21, "Confidence Maneuvers."

TASK: COURSE INTERCEPTS (INBOUND), (OUTBOUND), (RMI) AND (RMI-CI)

OBJECTIVE: The student will perform course intercepts (RMI) only, and (RMI/CI).

STUDENT ACTIVITY:

PREFLIGHT: What are the correct procedures for CDI and RMI, RMI only, and CDI only intercepts inbound and outbound? How does the wind affect these intercepts? What is an intercept angle? How is the intercept completed? How do you intercept a radial inbound?

INFLIGHT: The student will practice CDI and RMI, RMI only, and CDI only intercepts.

PROBABLE ERRORS:

1. Poor basic aircraft control - weak basic instrument cross-check and poor use of trim.

2. Chases CDI when aircraft position is close to the station.

3. Failure to precompute lead points.

4. Failure to consider "turn factor" in leading intercepts.

5. Setting the radial in the CDI for an inbound intercept, rather than the inbound course.

REFERENCES: AFM 51-37, p. 11-1, Ch 11, through p. 11-34, "Holding Procedures." Learning Center, S71 309, 310, 311, 901.

TASK: ARC INTERCEPTION AND MAINTENANCE

OBJECTIVE: The student can intercept an arc from a radial, maintain an arc, and intercept a radial from an arc.

STUDENT ACTIVITY:

PREFLIGHT: What are the procedures for intercepting an arc from a radial? Maintaining an arc? Intercepting a radial from an arc? Once on the arc, how many degrees correction should be used for each half-mile inside the arc? Each 1/2-mile outside the arc?

INFLIGHT: The student will practice the objectives.

PROBABLE ERRORS:

1. Poor basic aircraft control; weak basic instrument cross-check and poor use of trim.

2. Failure to compute corrections for maintaining the arc.

3. Failure to compensate for winds.

4. Failure to correctly compute leadpoints for intercepting g an arc from a radial, and intercepting a radial from an arc.

REFERENCES: AFM 51-37, p. 12-11, "Arc Procedures," to p. 12-19, Proceeding Direct to a TACAN Fix."

APPENDIX C: SUMMARY OF INSTRUCTOR PILOT-STUDENT-CONSOLE OPERATOR INTERVIEWS

1. Instructors felt IFS students were better at the completion of training than those trained in the Operational Utilization Test. Most students felt the training they received was better than that presently being conducted under the conventional ATC syllabus.

2. Key factors in the success of the study were training with the IP in the simulator cockpit during all but the team and emergency procedures sorties, and utilizing the cross-country in the aircraft so as to accomplish maximum instrument training. This was done by flying short hops, so as to be able to fly multiple instrument approaches at each destination. Students also spent maximum time en route under the hood.

3. It was found that students should use a regular instrument hood during instrument training, rather than a map or a Form 70, since the hood is generally used during the instrument checkride and cuts out all reference with the outside horizon. (Several students mentioned that they had experienced vertigo, when using the hood for the first time.) Mission profile sorties prior to the instrument check in the simulator should also be conducted, with students wearing the instrument hood.

4. It is recommended that all personal equipment be worn during mission profile sorties and only the gloves and parachute harness, during part-task sorties. IPs need not wear personal equipment in the simulator, during student training.

5. Both IPs and students felt the motion system added both realism and task loading to training; however, they felt that the better the quality of the visual system, the less motion was required.

6. A spatial disorientation demonstration in the simulator should be added to the syllabus to be conducted during instrument training.

7. Once students obtain proficiency in the GCA, different levels of turbulence should be introduced to approximate turbulence which might occur in the aircraft.

8. Both IPs and students liked the automatic demonstration capability of the simulator. They felt the training value of the record/playback system was greatest during the early stages of training for maneuvers that did not require a great deal of time. The use of both the automatic demonstration and the record/playback system should be based on student progress/proficiency. Use of the record/playback system proved to be of less value, if the student was already aware of his errors.

9. The IFS visual system appears to be adequate for conducting training in all basic and instrument maneuvers except for the instrument circling approach. Some students felt that training in emergency procedures was somewhat limited by the narrow FOV.

10. The automated malfunction system is excellent. Training in emergency procedures is far superior to that received in the T-4 trainer.

11. Experience gained through the IFS studies suggests that the requirement for landing proficiency in the simulator should be reviewed, due to low transfer of training to the aircraft. In recent Operational Test and Evaluation Reports on the UPT-IFS visual system, pilots have reported similar problems with depth perception, as well as the quality and resolution of the picture.

12. Most students thought that the night contact training was of little value, due to lack of visual cues causing poor depth perception in the traffic pattern. It could be beneficial, if sufficient cues were made available.

13. Instructors recommended that in the C30XX unit, the number of dual/solo rides be changed from 4dual/3solo to 5dual/2solo. They felt the student would benefit more from the additional dual sortie than the solo sortie. This block corresponds to the C31XX unit in the IFS 2 Syllabus.

14. Regarding checkrides, IPs felt that either check ride should be allowed to occur first, and that one should not be prerequisite for the other.

15. In order to provide the most efficient training, the possibility of accomplishing navigation training with a series of two out and backs, or a three-leg cross-country flight, in addition to one local sortie where the student flys an instrument check ride profile, should be explored.

16. Both instructors and students liked the concept of team training used during emergency procedures and navigation training.

17. Students felt key factors in the success of their training to be: (1) IP continuity; (2) good procedural training; (3) navigation training, including the number of strange field approaches flown; and (4) team sorties.

18. Students felt they had received enough instrument training in ASPT prior to their check ride and that further training was not required.

19. Students stated the instrument check in ASPT had tended to lower their level of anxiety concerning the aircraft check ride. They also felt the simulator check to be a good learning experience.

20. Students felt that one to two instrument sorties in the aircraft prior to the checkride would have enhanced their check ride performance.

21. Students and IPs felt an 0.8-hour sortie in the simulator was insufficient time to accomplish required items, during the advanced instrument part-task sorties. A sortie length of one hour was recommended as being more optimal. (This proved to be a problem in IFS 2 in the I15XX unit of training.)

22. Students pointed out several areas where the characteristics of the aircraft differed significantly from the simulator: (1) more turbulence in the aircraft; (2) the aircraft tended to decelerate more quickly than the simulator; (3) the characteristics of the aircraft's VOR system were different when in the cone of confusion than were the simulator's; (4) the aircraft was slower to accelerate at altitude than was the simulator. Students also stated that background radio chatter and the VFR transition to landing from GCA were quite different in the aircraft. (IPs should brief students on these differences, prior to the aircraft instrument check ride.)

23. Check pilots stated that all three students were procedurally better than those under the conventional ATC syllabus, and had established good habit patterns.

24. Check pilots pointed out that the three subjects made many of the same errors typically seen on student instrument checks, including: (1) Poor heading control on GCA final; and (2) improper VFR transition to landing. None of these errors can be regarded as having been caused by the additional simulator training received by the IFS groups.

APPENDIX D: SUMMARY OF SIMULATOR HOURS USED BY EXPERIMENTAL SUBJECTS FOR TRAINING CATEGORIES, INCLUDING AVERAGES FOR BOTH GROUPS

Category of Training	Subject #1	#2	#3	#4	Test $\overline{X}$	Control $\overline{X}$
			IFS-I - UPT CLASS 77-03			
Basic	15.2	15.2	15.7	----	15.4[a]	10.3[b]
Intruments	24.0	24.8	30.4	----	26.4	15.9
Navigation	5.6	5.6	5.6	----	5.6	3.3
Procedures	5.6	6.4	6.4	----	6.1	6.6
(Total)	(50.4)	(52.0)	(58.1)	----	(53.5)	(36.1)
			IFS II - UPT CLASS 77-05			
Basic	17.0	16.8	17.0	16.0	16.7[c]	10.4[d]
Instruments	32.2	29.0	28.8	28.5	24.6	18.6
Navigation	8.8	8.8	8.8	8.8	8.8	3.3
Procedures	6.4	6.4	6.4	6.4	6.4	6.4
(Total)	(64.4)	(61.0)	(61.0)	(59.7)	(56.5)	(38.7)

[a]N = 3. [b]N = 26. [c]N = 4. [d]N = 32.

APPENDIX E: SUMMARY OF AIRCRAFT HOURS USED BY EXPERIMENTAL SUBJECTS FOR TRAINING CATEGORIES, INCLUDING AVERAGES FOR BOTH GROUPS

Category of Training	Subject #1	#2	#3	#4	Test $\bar{X}$	Control $\bar{X}$
			IFS-I - UPT CLASS 77-03			
Basic	9.0	8.0	8.9	----	8.6[a]	12.2[b]
Intruments	1.2	6.4	1.5	----	3.0	15.9
Contact	39.8	51.2	40.2	----	43.7	40.3
Navigation	9.0	9.3	9.8	----	9.4	8.6
Formation	13.3	12.3	12.4	----	12.7	13.0
(Total)	(72.3)	(87.2)	(72.8)	----	(77.4)	(90.0)
			IFS II - UPT CLASS 77-05			
Basic	2.3	2.4	2.2	2.5	2.4[c]	8.4[d]
Instruments	2.3	1.4	1.9	2.2	2.0	15.7
Contact	48.4	46.5	60.9	43.8	49.9	41.4
Navigation	8.2	8.5	8.5	8.1	8.3	7.7
Formation	11.1	13.4	14.3	12.6	12.9	13.7
(Total)	(72.3)	(72.2)	(87.8)	(69.2)	(75.5)	(86.9)

[a]N = 3. [b]N = 26. [c]N = 4. [d]N = 32.

APPENDIX F: SUMMARY OF ITEMS FAILED ON INSTRUMENT AND CONTACT CHECKRIDES

INSTRUMENTS - ASPT CHECKS

MANEUVER	GRADE	REASON FOR LOW GRADE
DEPARTURE	U	Failed to adhere to altitude restrictions.
JUDGMENT	U	Returned from training area to VOR at other than assigned altitude.
FIX-TO-FIX NAVIGATION	U	Missed fix by 4.5 OME miles.

(Following failed ASPT check, subject (IFS 1, #2) flew two review sorties in ASPT, followed by a recheck, which he passed.)

MANEUVER	GRADE	REASON FOR LOW GRADE
RMI ONLY COURSE INTERCEPTS	F	Used improper procedures for intercepting a radial inbound.

(Subject (IFS II, #2) flew one review sortie with supervisor. His overall performance was satisfactory, and the check was complete.)

MANEUVER	GRADE	REASON FOR LOW GRADE
ALTITUDE CONTROL	F	Poor altitude control.
TRIM	F	Aircraft not adequately trimmed.

(Subject (IFS II, #3) flew review sortie with supervisor. His overall performance was satisfactory, and the check complete.)

INSTRUMENTS - T-37 AIRCRAFT CHECKS

MANEUVER	GRADE	REASON FOR LOW GRADE
HEADING CONTROL IN PENETRATION	U	Large deviations, with no corrective action.
CROSS-CHECK	U	Slow to notice aircraft deviations.

(Subject (IFS 1, #3) flew one review in ASPT and two in aircraft; received a grade of G on his aircraft recheck.)

MANEUVER	GRADE	REASON FOR LOW GRADE
INSTRUMENT DEPARTURE	F	Course deviations on departure too large.
FIX-TO-FIX	F	Missed desired fix too far.

(Student (IFS II, #3) flew additional sortie with a supervisor, and received an overall grade of G; check complete.)

MANEUVER	GRADE	REASON FOR LOW GRADE
GROUND OPERATIONS	F	Failed to stow loose items prior to start.
LOW APPROACH	F	Descended and remained below MDA on VOR LA.

(Student flew sortie with supervisor and received an overall G; check complete.)

CONTACT - T-37 AIRCRAFT CHECKS

GO-AROUND	U	Forgot flaps on a single-engine pattern.
LANDING	F	Inconsistent; late retarding power.
TOUCH-AND-GO LANDING	F	No written comment.

(Subject (IFS I, #3) flew two review sorties and a recheck; recheck scores follow.)

TAKEOFF	F	Improper crosswind control.
LANDING	F	Abrupt flair - late retarding throttle.
TOUCH-AND-GO LANDING	F	No written comment.

(Subject flew two practice sorties and an FPC, receiving a grade of G.)

POWER-ON STALLS	F	Premature stall recovery.
TRAFFIC PAT STALLS	F	Premature stall recovery.

(Subject (IFS I, #1) flew sortie with supervision, graded as G.)

TAKEOFF AND LANDING DATA	F	Used velocity during takeoff roll chart in checklist improperly.
VERTICAL RECOVERY	F	Lost excessive altitude in recovery.
CLEARING	U	Weak on technique during flight.
EMERGENCY PROCEDURES	U	Incorrect response to boldface emergency.

(Subject (IFS II, #2) flew two sorties and passed recheck.)

MANEUVER	GRADE	REASON FOR LOW GRADE
NORMAL PATTERN	F	Failed to handle crosswind properly.
SIM SNGL ENG PATTERN	F	Failed to plan for crosswind.

(Student IFS II, #3) flew sortie with supervisor; received grade of G.)

POWER-ON STALLS	F	Failed to recognize secondary stall.
JUDGMENT	F	Hesitated to make decisions without help.
CLEARING	F	Pulled excessive G's at bottom.
MISSION PLANNING	U	Failed to maintain VFR.

(Student (IFS II, #4) flew two more sorties prior to prolonged period of non-flying duty. Upon return to flight status, flew one more sortie and received check ride as shown following.)

LANDING	F	Steep final, abrupt flair, hot.
VERTICAL RECOVERY	U	Entered inadvertent spin-diving recovery.
CLOVERLEAF	U	Pulled excessive G's at bottom.

(Student flew two review sorties prior to Flight Progress Check; received an overall grade of G on the check ride.)

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