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The Use of Videotape during Post-Flight Debriefing of Simulator Flights to Improve Student Learning and Reduce Instructional Time

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THE USE OF VIDEOTAPE DURING POST-FLIGHT DEBRIEFING OF SIMULATOR FLIGHTS TO IMPROVE STUDENT LEARNING AND REDUCE INSTRUCTIONAL TIME

by

Stanley Paul Rowe

A thesis submitted to the Office of Graduate Programs in partial fulfillment of the requirements for the degree of Master of Aeronautical Science

Embry-Riddle Aeronautical University
Daytona Beach, Florida
December 1993
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Stanley Paul Rowe

This thesis was prepared under the direction of the candidates' thesis committee chairman, Dr. Charles Richardson, Department of Aeronautical Science, and has been approved by the members of his thesis committee. It was submitted to the Office of Graduate Programs and was accepted in partial fulfillment of the requirements for the degree of Master of Aeronautical Science.

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ACKNOWLEDGEMENTS

The author wishes to express special thanks to the Thesis Chairman, Dr. Richardson, whose constant encouragement, helpful counsel, and practical suggestions were crucial to the successful outcome of this thesis. Appreciation is also due to Dr. Connolly and Mr. Ray Rutt, Thesis Committee Members, for their assistance in preparing this manuscript.

This statement of acknowledgement would be incomplete without formal expression of sincere appreciation and gratitude to both the author's friends and family for providing the assistance and encouragement needed to complete the task.
ABSTRACT

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Title: The use of videotape during post-flight debriefing of simulator flights to improve student learning and reduce instructional time

Institution: Embry-Riddle Aeronautical University
Degree: Master of Aeronautical Science
Year: 1993

The purpose of this study was to determine if videotaping students during simulator flights and using the results as a teaching tool would improve student learning and require less instructional time. Thirty subjects were randomly selected from students enrolled in an instrument rating flight course at Embry-Riddle Aeronautical University. A Frasca 141 simulator and a Panasonic video camera were used as the data gathering instruments. The treatment group reviewed the instructional lesson on videotape during their post-flight debriefing. At the end of the experiment, both groups received a posttest. The results of the posttest and the amount of instructional hours given was used to evaluate the experiment. The treatment group required less instruction, scored higher on the posttest, and accomplished the learning in less time.
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INTRODUCTION

The cost of aviation training for the students, flight schools, and universities has risen sharply over the years. There are no indications that this trend will change in the near future. In order for the schools and universities to maintain affordable flight training for their students, the most innovative and cost-effective teaching techniques must be utilized. The intent of this research was to study a method to lower flight costs for students by reducing the instructional hours required to gain an instrument flight rating.

Costs are very important to the students and flight schools alike. If training costs are not minimized, few students will be able to afford the cost of learning how to fly. Therefore, without a high level of cost consciousness, the very existence of flight schools is in jeopardy. The economics of supply and demand indicates that the number of students able to afford flight training is directly affected by increased costs in training. If the training costs continue to escalate, fewer students will be able to pursue careers in aviation. By using innovative techniques in training, which will reduce training time without reducing learning, the costs of that training may be reduced and the effectiveness of the training enhanced.
The aviation industry depends on civil aviation students that are being trained today for the professional pilots needed tomorrow. Historically, the military has supplied most of the pilots needed by the airlines. However, the military pilot base has been shrinking in the recent years and the airlines are now relying on the civilian pilot base for many of their pilot needs. The truth is that the government in the form of the military has been training a majority of the aviation industry pilots at public expense.

If the cost of training continues to increase, the civilian pilot base will also be reduced in size. Therefore, something must be done to ensure there will be a sufficient number of pilots trained to meet future demand.

One solution is the extensive use of flight simulators. The flight simulator is a device that provides a suitable training environment for a pilot to learn various maneuvers and procedures with more efficiency and greater safety than the aircraft (Smith & Simpson, 1971). By adding additional training devices, such as video cameras, the flight simulator may become a more effective learning tool than it is presently.

It is anticipated that videotaping each dual simulator session can help reinforce the learning objectives for the student. During intense training, the student is unable to absorb all the available information that is presented
during a simulator flight period. Even when the instructor points out specific problems during the flight activity, the student may be unable to fully understand the instructions due to task overload. Often, only when the student is out of the cockpit and no longer in the task overload situation, is he/she able to analyze the problem. Unfortunately, the student is often unable to recall all of the information concerning the activity after the lesson is completed.

The advantage of videotaping will be realized by replaying the training activity. The student and instructor can replay critical portions of the activity to allow the student to review his/her actions and decisions during the flight. In addition, if the students can take the videotape home, they are able to review the activity repeatedly or in full at their leisure.

This type of instruction should help reinforce the instruction received and give the students time to better comprehend their actions and decisions during the activity. Due to task overload, students are often unable to comprehend their true actions during the flight activity. For example, a student might have thought he/she turned left during a flight activity when in actuality they turned right.

By videotaping each flight activity, the student will experience each flight activity at least twice. If the student so desires, he/she could watch the tape as often as
wished. This allows time to digest actions and better understand them during the next flight. This should increase the student's general knowledge and reduce the flight time required. Since most simulators are equipped with plotters, the student could also use the plotted track to further review the activity. By using multiple aids, the student should be able to comprehend the information more easily than if a single source were to be used.

The instructor is still the key to the learning process. Videotaping is not a "stand alone" technique. The instructor must use the videotape as a training aid and point out the highlights of the flight to the student. This should include the areas that were unsatisfactory and the areas in which the student performed well. The time spent reviewing the videotape may vary from lesson to lesson depending on the problems encountered during the flight.

Statement of the Problem

The study investigates a new and innovative way of instructing students to increase their learning of a flight task in reduced instructional time. The study is based on training time in the flight simulator and the learning achieved by the students. For the purpose of the study, flight time refers to the actual time in hours spent maneuvering the simulator or airplane during a training activity. A flight simulator is a ground-based device used
to imitate the cockpit environment and flying characteristics of an airplane, and a plotter is a device that records the ground track of the flight. Dual refers to a training activity where the student receives instruction from a qualified flight instructor.

Review of Related Literature

The literature of this subject area as it pertains to aviation is lacking in quantity. However, by utilizing the published documents of both corporate video departments and airline training operations, the review was developed into two major sections: Videotaping and Feedback and Benefits of Flight Simulators.

Videotaping and Feedback. Many corporations are currently using video to train their employees because the training received is consistent from individual to individual and saves the corporation money. Video training can be given at times that were not previously feasible, since an instructor does not need to be present at the time of viewing.

Corporate video departments produce more television programs than the three major networks for any given year (Cartwright, 1986). Airlines are also using videotape to make their training more effective. The primary example of videotape usage is in teaching the skills necessary for
effective Cockpit Resource Management (CRM). CRM refers to the use of all resources available to the crew and the efficient management of the cockpit. Airlines have found that crewmembers have benefitted by replaying the video and observing their actions in a simulated training activity. (Sams, 1987).

United Airlines incorporated a major innovation to their CRM program when they added the use of a video camera to the Line Oriented Flight Training (LOFT), in order to record the crewmember's interactions. By reviewing the tapes, the crews were able to analyze their actions and decisions, obtaining insights into their behavior (Helmreich & Foushee, in press).

LOFT involves the recreation of one of the airlines' scheduled routes. The procedures, route, and time are traced from the time of engine start to engine shutdown and can last as long as three hours. The instructor sits outside the simulator and can duplicate situations that actually occurred on a scheduled flight. The pilots are given the opportunity to experience situations that could not be safely reproduced in the airplane. After the flight, the pilots are given the opportunity to evaluate their decisions and learn how and why errors are made (Richmond, 1983).

A National Aeronautics and Space Administration (NASA) study reported LOFT was enhanced when the session was
videotaped and the crews were allowed to review their actions. This helped to reinforce what was learned and to make the crewmembers aware of problem areas in communication and decision making skills (Helmreich, Chidester, Foushee, Gregorich, & Wilhelm, 1989).

The Federal Aviation Administration (FAA) indicated that videotape is a very effective communication evaluation technique. The FAA praised this technique because of the success video feedback has had in LOFT simulations and CRM classrooms (Jensen, 1989).

USAir uses video in their training to provide feedback to pilots in Phase II of their CRM training program. The program was designed to provide crewmembers with self and peer critiques to improve communication and management skills in the cockpit (USAir, 1991).

Mr. Tom Leahy (personal communication, March 3, 1993) explained Phase II is a review of CRM concepts introduced in Phase I of USAir’s CRM training. Phase II deals with human factors and crew relations during a recreation of an incident that occurred on an actual flight where communication had broken down. The recreation of the flight points out the deficiencies in the communication. After the flight, the video is played back for the crewmembers. After viewing the videotape, the instructor seeks the crew’s opinions and suggestions on how to better communicate in the cockpit to avoid similar situations on future flights.
Cryer (1988) conducted research on lecturers' reactions to staff development. This process involved giving practice lectures which were videotaped, reviewed, and analyzed. The goal of the study was to improve attendance at optional sessions which would be beneficial to the students. Approximately 100 lecturers, who attended an annual course on teaching and learning, which included video feedback on lectures, were sent questionnaires. The questionnaire consisted of 10 questions asking the participants about their feelings, reactions, and any benefits of being videotaped during their practice lectures. The response rate of the questionnaire was 77 out of 102. Fifty-five of the 77 respondents, felt their lecturing had improved as a result of the use of video feedback. Comments showed that videotaping and reviewing their lectures improved confidence, pointed out distracting mannerisms, and emphasized the need for greater eye contact. The conclusions indicated that videotaping was a very beneficial technique in improving the effectiveness of the lecturers' presentations.

Mulac (1974) gathered data to support the value of video feedback as an aid in teaching a basic speech course. Many speech instructors had hypothesized that video feedback improved the speech skills of students, but there was no empirical evidence that had been published to support the hypothesis. The study consisted of 108 randomly chosen
subjects that were videotaped and provided video feedback of their speeches. Mulac (1974) found that the students demonstrated significantly greater skill in oral communication as a result of viewing themselves during the replay. He found the most significant improvements were in the areas of body action, personality, language, and voice.

Using Mulac's research as a foundation, Miles conducted further research to investigate whether there was any improvement after being videotaped (Miles, 1981). The study was based on 52 subjects, who were videotaped and provided feedback of their speeches for self-critique. Miles concluded that using video replay enhanced a student's ability to identify and improve language and delivery techniques. These results supported Mulac's earlier studies of video feedback.

Colleges and universities have often utilized video feedback to improve the performance of their students in oral presentations. Jurma and Froelich (1984) conducted video feedback research to improve performance of the students speech skills. They found that: "evidence also exists to suggest that immediate evaluative feedback can improve performance skills; Nyquist and Wulff discovered that immediate auditory feedback could improve the teaching behavior of university instructors" (p. 179-180). The intent was to focus on the immediate feedback and determine whether the students would improve their performance
significantly or not. Jurma and Froelich (1984) felt the immediate feedback would reduce the chances of the students developing the bad habits of repeating erratic behaviors. The results of the study confirmed the hypothesis that immediate feedback was advantageous for the students. Students who received video feedback participated in higher quality discussions than individuals who did not receive immediate feedback. Jurma and Froelich (1984) stated "video feedback is the most effective and least disruptive of the methods for providing immediate evaluative information because material can be transmitted and read quickly and silently" (p. 185).

Goldhaber and Kline (1972) investigated how videotaping would affect attendance and student attitudes toward both the course and the instructor when videotape was used in the classroom. Four hypotheses were tested:

1) Classes that used videotape on assignments would have better attendance.

2) Classes that used videotape on assignments will have a more favorable attitude towards its use than those that do not.

3) Classes which do assignments on videotape will have more favorable evaluations than those that do not use videotape.
4) Classes that do assignments on videotape will have more favorable instructor evaluations than those classes that do not use videotape.

One hundred students enrolled in one of four sections of Speech 101 were used in the study. A questionnaire was administered to all four sections of Speech 101 during the first and last week of the course to test their attitudes toward the use of videotape in the classroom. Two of the four sections were videotaped and were allowed to record and playback the speech several times prior to presenting it at the next class meeting. The other two sections were controlled groups and presented their speeches in front of the class without being videotaped at all. Oral and written critiques were provided by fellow students and the instructors for all four sections. The conclusions indicated that attendance was significantly higher in classes that used video versus those classes without video. The students in the classes using videotape had better attitudes towards the class, which was probably why the attendance was better. The students had positive responses to the classes that were videotaped, and they felt it was an effective way to improve their speech skills.

Videotaping has also been used effectively in other academic environments. The Association of Dental Schools recommended that students should review presentations given by other students to help them properly inform patients on
the type of treatment to be used. These presentations were usually given by students without prior experience in student-patient relationships. In a 1987 report, Powell, Rice, and Leonard noted "Hocott recommended that 'selected case presentations should be recorded on TV tape and be reviewed with the student by the faculty'" (p. 720).

Videotapes were used to provide feedback for the students to identify quality student-patient interactions. The students were able to observe, analyze, and evaluate their own performance of their presentations (Powell et al., 1987).

During their 1987 study, Powell et al. conducted a survey of students that had been videotaped. Questionnaires were given to the subjects asking their opinion on the class. Ninety-eight percent of the questionnaires were returned. Results indicated that videotaping of small group instruction of treatment plan presentations was well-accepted by the students. Seventy-two percent of the students indicated that the videotaped treatment plan presentations helped to improve their communication skills with patients.

Raborn, Plecash, and Perio (1986) also conducted research dealing with student-patient interviews. Their study involved trying to improve and teach the techniques necessary to properly discuss patients' dental history. The student-patient interviews were videotaped and then played
back for analysis by the students. This allowed the students to see themselves as their patients saw them during the interview process. Students felt this was a productive process and, when they had the opportunity to be taped for a second time, their skills showed remarkable improvements.

As part of the study, a survey was made of the 42 graduating seniors, 31 questionnaires were returned for a response rate of 73.8 percent. Sixty-one percent of the 31 felt that the videotaping helped to improve their interview skills.

McCallum and Dickerson (1985) used video equipment to tape 62 students (at the University of Texas at Arlington) in three speech communication courses. The purpose was to try to improve the communication skills of the students.

The first taping illustrated the nervousness of the students. During the second session, the students were more relaxed. One hundred percent of the students felt the feedback improved their communications skills and had helped them gain confidence in presenting speeches.

Barbee (1972) conducted a study with disadvantaged people, selected from three large metropolitan manpower agencies, to improve both their interview skills and their chances for suitable employment. He videotaped the subjects during simulated job interviews, which allowed each subject to review their performance. Each subject was assigned one of three experimental training interview conditions.
Most disadvantaged people presented a passive self-image in the interview situation. Barbee was able to produce a positive change in interviewing behavior, which lead to suitable employment for many of the participants.

In continued research, Barbee and Keil (1973) used video feedback to improve job interviewing skills of a group of culturally disadvantaged people. A total of 64 subjects from three manpower agencies in the Denver area were randomly assigned to one of three treatment conditions. The first treatment consisted of 24 subjects that received a combined treatment program. This included videotape feedback and behavior modification techniques. The second group of 21 subjects were given video feedback only. The third group consisted of 19 subjects who were in a no treatment (control) group. Findings indicated that there were no significant differences between the second and third treatment groups. The first group showed significant improvement on their interviewing techniques compared to the other two groups. However, the experiment was not designed to use videotaping as an independent training program. The videotaping provided the applicant and trainer with an accurate representation of the initial job interview. The videotaping helped subjects become more self-confident, assertive, and to present themselves more effectively to an interviewer.
Some researchers feel that media is not an effective learning tool and, if any additional learning did occur, it was only from the effects of the instructional technique or the novelty of the situation. This was the view expressed by Clark (1983) in an article entitled "Reconsidering Research on Learning From Media." Clark felt that the instructional method is the crucial factor in determining student achievement.

Petkovich and Tennyson (1984) disagreed with Clark's conclusion on the use of media as a learning tool. They felt media was an effective learning tool and should be explored further to extract the maximum possible benefits. They felt that researchers should be more careful in their studies to ensure that results showed the true effects of the media in the learning process. Petkovich and Tennyson (1984) found evidence in their research that media was a valuable instructional tool, and the studies they reviewed did not support Clark's theory that media did not influence learning.

The military has used several forms of video to enhance training for student pilots. One of these techniques was to tape training flights, with audio, and to have the students watch selected parts of the resultant tapes. The flexibility of the multi-media system worked well in this environment. Students were able to return to portions of the tape they did not fully understand, or advance past
information that was fully understood (Anderson & Hagin, 1971). This study stated, "multi-media instructional systems have been developed largely on the basis of potential and are being sustained on judged rather then measured effectiveness" (p. 2).

Through the use of video, the United States Air Force realized substantial benefits in student flight training in the T-37. These benefits included improved mid-phase contact check scores, improvement of instrument check ride scores, improvement of maneuver performance on check rides, less time required to learn procedures, and a faster rate of learning as observed through mid-phase and formal check rides (Anderson & Hagin, 1971).

The instructors also noticed benefits of using video equipment in the training of the students. The instructors found they were able to improve their own instructional techniques by evaluating their in-flight instructional techniques, and using this information during the debriefings with the students. Another benefit realized by instructors was the videotape's ability to refresh their memory prior to grading student performance (Anderson & Hagin, 1971).

The United States Air Force conducted another study utilizing video equipment. This study used 31 subjects for pretraining that had no formal undergraduate flight training. The subjects participated in testing and
evaluation of the pretraining materials and data collection process. This study attempted to improve the cognitive skills of student pilots prior to beginning their flight training. One of the methods used was videotaped instruction. The instruction consisted of demonstrating the procedures and concepts involved with aircraft movements, instrument changes during the maneuvers, and instrument cross-check techniques. The videotape could be reviewed at the students' convenience, and gave the instructors the assurance that identical information was viewed each time. The videotape was also used to review the basic concepts of airmanship and instrument reading skills, backed up with written information (McFadden, Edwards, & Tyler, 1976).

McFadden, Edwards, and Tyler (1976) found their study indicated that cognitive skills were improved by making use of several media formats. They found that the videotape proved to be flexible, convenient for the administrators, and improved the control over the pre-training of subjects.

Other United States Air Force studies found that mediated cognitive pretraining proved to have beneficial results. The benefits were "reduction of negative effective responses acting within the individual through a decrease of task load effects, reduction of actual flying time required to gain proficiency in complex perceptual motor skills, and increased student motivation through individualized, self-paced instruction" (McFadden, Edwards, & Tyler, 1976, p. 6).
The University of North Dakota utilized a Cessna integrated flight program developed by Cessna Pilot Center (CPC) videotaped flight instruction. The program was designed to integrate material and skills necessary for a new pilot by introducing the material in an orderly effective, fashion. Four basic events occurred to maximize the learning effectiveness: a stimulus, a response, a reinforcement, and an association. Another key to success was the repetition of information through various media applications. The repetition helped to reinforce the stimulus-response association (Odegard, 1978).

**Benefits of Flight Simulators.** For many years, pilots had to practice flight training maneuvers in the actual aircraft, in order to develop the skills needed to obtain a pilot certificate. This limited the flight training to certain times of the day under favorable weather conditions. As a result of the ingenuity of the people involved in flight training problems, ground training devices were developed for introduction into pilot training programs.

Ground training devices have gone through several evolutions. With each evolution, the training devices increased their capabilities and provided a more suitable training environment for pilots. Managers of pilot training programs realized the benefits offered by the ground training devices, which could provide for greater safety
than an actual airplane and, at the same time, could increase the efficiency of flight training. Flight simulators are used by the airlines with virtually little or no aircraft time when upgrading pilots to new equipment (Smith & Simpson, 1971).

Wooden and Cowell (1973) stated that flight simulators attempt to perform like aircraft, but provide a safer environment in which to operate. The effectiveness of a simulator is based on two factors:

1. The best instructor cannot provide quality instruction to offset the adverse effects of a poor simulator.

2. A poor instructor can impair the training value of the best simulator.

Therefore, the flight instructor is a key element in the effectiveness and the value of the training conducted in a simulator.

Gibino (1983) noted that simulators are able to operate 20 hours per day and operating costs, as compared to the actual aircraft, were significantly lower. The simulator lends itself to rehearsal of maneuvers more productively than the airplane. For example, failure of an engine on takeoff can be practiced several times in a shorter period of time in a simulator compared with an airplane.

Technological advancements in the computer field have provided for sophisticated computerized simulators. These
simulators can imitate a wide range of aircraft operations, including start, taxi, takeoff, flight, and landing (Richmond, 1983).

Richmond (1983) noted "the advantages of simulators are numerous, and economy is one important factor" (p. 41). The simulator can also provide a safe environment to practice emergencies that would otherwise be impossible to perform in the airplane.

Using the proper training techniques combined with the use of a proper simulator, can result in a reduction of aircraft time required to obtain the course objectives. The United States Army was able to reduce the amount of aircraft time in an undergraduate helicopter instrument-pilot training program, from 60 hours to 6½ hours, using a realistic simulator combined with an effective training program (Caro, 1973).

American Airlines received a FAA "Grant of Exemption" for training 40 Captains transitioning to the B-727 aircraft. The flight training times, in 1966, averaged 18 to 20 hours per Captain to only 2.1 to 5.3 hours when simulators were used. The use of the simulator reduced exposure to accident prone situations that could be experienced while training in the actual airplane (Morgan, 1971). Morgan (1971) stated that "American Airlines is convinced that the greatest contribution to the unmatched
jet safety record of the B-747 was achieved through the use of simulators" (p. 169).

**Statement of the Hypothesis**

It is expected that instruction given with the aid of the videotape will enhance the student’s learning by reducing the actual instruction time required to perform oral, simulator, and flight activities. Therefore, it is hypothesized that videotaping the student’s simulator activity and reviewing it with the student will decrease the total amount of oral, simulator, and flight time required in the training sessions without reducing the learning skills needed to attain an instrument flight rating by successfully completing the phase checks.
METHOD

Subjects

The subjects for this study were randomly selected from a unique population of the Embry-Riddle Aeronautical University (E-RAU) student body. The population was made up of students who were enrolled in the FAA approved flight program and had completed the prerequisite courses for the Commercial Pilot Flight Operations III Course (FA 250). Each student was assigned a distinctive number to conceal his/her identity and limit any bias in the selection process. Each number representing the student was placed on a piece of paper and placed into a container. Two faculty members selected the subjects, while the researcher observed, by pulling their names from the container. The researcher was only present to observe the process of selection and did not select the students. After the numbers were selected, the names were matched to the numbers drawn. The randomly selected students were then assigned to their flight instructors.

The backgrounds of the subjects were virtually identical with little variation with respect to aviation (See Appendix A). To meet the prerequisites for FA 250, the students must have already completed two previous flight courses at E-RAU. The first flight course is Commercial Pilot Flight Operations I (FA 110) or (FA 109). FA 109 is
taken in the place of FA 110, if the students have already received their FAA Private Pilot certificate when they enrolled at the university. At the completion of FA 110, students receive their FAA Private Pilot Certificate for a single-engine land airplane. The next flight course after FA 110 is Commercial Pilot Flight Operations II (FA 200). In FA 200, students are introduced to flying by reference to the flight instruments without using outside visual references. The instruction for Basic Attitude Instrument (BAI) flight techniques is limited to the simulator. At the completion of the progress check, students are eligible to enroll in FA 250.

Ninety percent of the students completed most of their aviation training at E-RAU. Ten percent of the students have flown a minimum number of hours outside the university for their personal pleasure.

The population of the university is appropriately represented, since only about five percent of the students enrolled in the flight curriculum have their private pilot certificate prior to entering the flight courses. An even smaller percentage (approximately two percent) have advanced ratings, such as the instrument rating, when they enrolled.

The ages of the students varied slightly. However, this gave an excellent sample of the population for the study. The ages of the subjects ranged from 19 to 23 years old. This is also representative of the population of the
students in the flight courses, as the majority of the flight student population is in the range of 18 to 28 years of age.

A total of 27 students were sampled, 14 received the treatment and 13 were in the control group. Approximately 72 students made up the population of FA 250 students that were enrolled at the time the study was conducted. There was some bias in the study due to the fact the subjects could talk among themselves, but this should not alter the test results. The percentage of subjects selected helped to reduce the bias.

**Instruments**

For this study, the instruments used were a Frasca 141 flight simulator, the Piper Cadet aircraft (PA28), the Mooney M20J aircraft, and a Panasonic VHS camcorder. The simulator was used as the training device and the video camera was used to record the training sessions. The airplanes were used as a vehicle to demonstrate the students competency in the actual National Airspace System (NAS). The PA28 was used in the first phase of the flight course to help enhance the information learned in the simulator. There were only four flights pertaining to instrument flight skills in the PA28 which gave the students limited exposure to the airplane. This helped the students transfer in the procedures learned in the simulator to the actual flying
environment. The Mooney M20J was used in Phase II of the flight course. Phase II of the flight course concentrated on the actual flying environment rather than the simulator. The simulator had very limited use in Phase II of the flight course.

The simulator model was a Frasca 141 and was manufactured by Frasca International, Incorporated. This particular model was designed for only one person to be in the cockpit at a time. The flight controls were designed to reflect the flight controls of a generic airplane, but closely matched the controls of the actual airplanes used in the study.

There is a control console located just behind the simulator for the instructor. This simulator is capable of simulating the flight characteristics of several different single-engine airplanes.

In this study, the simulator was in the PA28 mode during Phase I and the Mooney M20J mode in Phase II of the flight course. The Frasca 141 uses a computer to give the instructor the capability of simulating various flight situations. Some of the features included the ability to fail or incorporate various systems and navigational aids, vary environmental conditions, or simply freeze the simulator. While on freeze, the instructor can talk to the student without the student having to concentrate on flying the simulator.
Any airport or navigational aid can be loaded into the simulator to simulate flying in various areas of the country. For the study, the subjects conducted the majority of instrument approaches in the Florida area. The instructors selected various approaches on their own, in the Florida area, that would best benefit each particular student.

The Frasca simulator model used did not have a visual system. This did not precipitate any problems for the study since the students were flying solely by use of their flight instruments to control the simulator. There was no need for the students to use outside visual clues in this particular type of training.

The PA28 was manufactured by the Piper Aircraft Corporation. The model used was designed and equipped for pilot training with seating for four persons. The airplane is a fixed gear monoplane of all-metal construction with low semi-tapered wings (Piper Aircraft Corporation, 1988).

The airplane was equipped with dual flight controls which are connected to the control surfaces by cables. The elevator was equipped with a trim tab used to relieve the pitch control forces. The trim wheel was located between the pilots and instructors seats on the floor.

The airplane was also equipped with conventional rudder pedals. The rudder incorporated a rudder trim which was a spring-loaded recentering device. The trim control
was located on the right side of the pedestal below the throttle quadrant.

The instrument panel was designed to accommodate instruments and avionics equipment for Visual Flight Rules (VFR) and Instrument Flight Rules (IFR). The radios are located to the right of the flight instruments, which are located in front of the pilot. The flight and engine instruments include an altimeter, airspeed indicator, heading indicator, magnetic compass, attitude indicator, turn coordinator, vertical speed indicator, tachometer, and various gauges to monitor the engine’s operation. The attitude and heading indicators are driven by an engine driven vacuum pump. A standby vacuum pump is part of the airplane’s system. The altimeter, airspeed indicator, and vertical speed indicator use air pressure provided by the pitot/static system located on the left wing. The turn coordinator is electrically driven.

The navigation instruments included in the PA28 are two communication radios and two Very-high frequency Omnidirectional Range (VOR) receivers. One of the receivers is equipped with a glide slope indicator, Automatic Directional Finder (ADF) receiver, and Distant Measuring Equipment (DME).

The Mooney M20J was manufactured by the Mooney Aircraft Corporation. The model used was designed and equipped for pilot training with seating for four persons. The airplane
has retractable landing gear and a variable pitch constant speed propeller. The Mooney M20J is an all-metal, low wing, high performance airplane (Mooney Aircraft Corporation, 1989).

The airplane is equipped with dual flight controls which are connected to the control surfaces by push-pull tubes. A spring-loaded interconnect device indirectly joins the aileron and rudder control systems to assist in lateral stability during flight maneuvers (Mooney Aircraft Corporation, 1988). The Mooney’s whole empennage was designed to move when the trim is used to relieve the pitch control forces. The trim wheel was located between the pilot and instructor seats on the floor. The airplane is equipped with conventional type rudder pedals.

The instrument panel was designed to accommodate instruments and avionics equipment for VFR and IFR. The radios are located to the right of the flight instruments which are located in front of the pilot. The flight and engine instruments included an altimeter, airspeed indicator, heading indicator, magnetic compass, attitude indicator, turn coordinator, vertical speed indicator, tachometer, and various gauges to monitor the engine’s operation. The attitude indicator is driven by an engine-driven vacuum pump. A standby vacuum pump is also included. The altimeter, airspeed, and vertical speed indicator were supported by the pitot/static system located on the left
wing. The turn coordinator and the slaved Horizontal Situation Indicator (HSI) are electrically driven.

The navigation instruments included in the Mooney M20J are two communications radios, two VOR receivers. One of the receivers is a HSI which has guidance information for both vertical and horizontal navigation, Remote Indicating Compass (RIC) receiver, and DME.

The VHS Camcorder was manufactured by Panasonic Industrial Company, which is a Division of Matsushita Electric Corporation of America. The model was a Pro Line AG-180, and featured a tape counter, lap time counter, auto focus, built-in microphone, black and white view-finder, auto iris, and a minimum lighting of seven lux. The Camcorder could be operated by its own battery power or plugged into an AC outlet. The Camcorder was mounted on a tripod which was located behind and to the right of the subject. The main purpose of the Camcorder was to record the training session. Both audio and visual was used to assist the instructor during the post-flight debriefing. In addition, the plotter was used to record the track flown by the subject during the training activity.

Prior to starting the main study, a pilot study was conducted with six subjects. The subjects were selected from the population of FA 250. The method for selection was the next six students who were in line to be assigned to a flight instructor. Two subjects were assigned to a flight
instructor. The pretest objectives were to decide on the placement of the camera and how to best utilize the equipment for its maximum potential.

There were problems identified by the pilot study that had to be corrected prior to the main experiment. One of the problems dealt with the inability to read the flight instruments when replaying the simulator activity on the television. By trying to get a full field of vision with the video camera, fine details were lost. Therefore, the zoom was used to increase the size of the instruments on the television. The instructor had to align the image so that the airspeed indicator was on the left side of the view finder and ADF was on the right side of the view finder. This would limit the instruments viewed to the airspeed indicator, attitude indicator, altimeter, turn coordinator, vertical speed indicator, HSI, and ADF. The navigation instruments were not in the field of view of the video camera. In order to view the navigation instruments, the flight instructor would have to pan the camera to include those instruments. The pretest illustrated that this technique seemed more valuable than trying to include all the instruments at once. The instructor panned the camera anytime there was beneficial information for the student to view.

The physical location of the camera was placed in several areas to locate the most beneficial location. The
height of the camera was varied to avoid obstacles from being in the field of view of the camera. The best location was found to be to the right of the student just behind the physical structure of the simulator. The camera was raised to a height of approximately three and one half feet above the floor. In this configuration there were no obstacles directly in front of the camera. Also, the student did not block the view of the camera, in this location, when the camera was panned from left to right.

The counter on the video camera and the VCR were calibrated with one another. The findings showed the two counters varied very little with each other. The only procedure the instructor had to do with both the camera and VCR was make sure the videotape was fully rewound and the counters were set to zero prior to starting the session. The instructors were able to use the counters to indicate pertinent locations on the tape to review with the subject. When the instructors wanted to indicate a location on the tape to be reviewed, they would write down the counter number. In this manner, they could advance to the precise spot on the videotape during the debriefing. This saved debriefing time for both the student and the instructor.

The students reviewed portions of the videotape with their instructor, but were also given the videotape to take home for further reviewing. The pilot study showed that
further reviewing by the student of the videotape on their own was beneficial.

The pilot study indicated a need for a central location of the video cameras, television, and VCR. This also helped with the security of the equipment. Several areas were identified as safe locations for the cameras. However, due to unforeseen circumstances, some of the areas proved to be unsuitable. The final location was the maintenance office, which was manned during normal business hours. This was inconvenient at times, but proved to be the best overall solution. The television and VCR were located in a room located inside the simulator room. This location provided security and privacy for the student and instructor.

Design

The design approach to this study was the experimental method. This design was chosen because the independent variable was manipulated to show the results on the dependent variable. The experimental design corresponds best to this type of research.

The experiment design was the only research method that actually tested the hypothesis as it related to the cause and effect relationship. The educational problems were addressed with more validity, since the researcher had better control over the study. The researcher manipulated one variable while the others remained constant. In this
way, the researcher was better able to evaluate the effects of that particular variable on the other dependent variables. The researcher determined which subjects received the treatment and which ones did not. This manipulation is one of the characteristics that sets the experimental design apart from other types of designs. The independent variable was the variable that the researcher believed would make the difference in the results. The independent variable was manipulated in various ways; such as, method of instruction, type of reinforcement, frequency of reinforcement, arrangement of learning environment, type of learning materials, and the size of the learning group.

The experimental design is the most demanding type of research. However, it also provides the soundest results when conducted properly. The cause and effect relationship supported the evidence to prove or disprove the hypothesis.

The basic steps followed were the selection and definition of a problem, selection of the subjects and measuring instruments, execution of procedures, analysis of data, and formulation of conclusions. The researcher was guided by the hypothesis that stated the expected results of the cause and effect relationship of the two variables. The reason for the experiment was to either accept or reject the hypothesis. From the beginning of the experiment, the researcher randomly selected the groups that received the treatment. The researcher tried to control the experiment
so other factors did not affect the independent variable. The researcher observed and measured the behavioral changes of the groups at the conclusion of the study.

The subjects were split into two groups, the control group and the treatment group. Both groups received the same information and received a pre and post-flight briefing. However, only the treatment group was videotaped. The videotape was used as an integral part of the post-flight debriefing with the treatment group. In this experiment, the dependent variable was the change or difference in the groups that occurred as a result of the manipulation of the independent variable. The dependent variable was measured by a test, changes in attitudes or actions of the subjects, or a behavioral change.

The students were assigned to 11 pre-selected instructors familiar with the flight course. There was a possibility of bias in the study due to the students and instructors talking amongst themselves. To help reduce this bias, instructors worked with subjects from both the control and the treatment groups. This helped to offset the bias and properly represent the total population.

To further benefit the student, the treatment group was allowed to take the videotape home. The students were able to review the session further at their convenience. This extra contact time, helped reinforce topics previously learned. By allowing the students to review the videotapes
at home, they could watch the tapes as much as needed to better understand the material for the next unit in the simulator.

**Procedures**

In FA 250, the student learns how to safely and accurately operate an airplane under instrument flight rules within the National Airspace System. The prerequisite courses provide the student with Private Pilot ratings single-engine land and the introduction to BAI flying. For this study, BAI refers to flying the airplane by use of the aircraft instruments without any additional outside visual references.

During the first phase of FA 250, the subjects were split into two groups, control and experimental. The control group was not videotaped. The experimental group was videotaped and reviewed selected portions of their videotape with the instructor after each flight. In addition, the experimental group was allowed to take the tape home for further review on their own and complete the review of the activity form (See Appendix B).

In the second phase of FA 250, the subjects transferred their knowledge from the simulator phase to the actual airplane (Mooney M20J). However, the experimental group was not videotaped in the airplane. The training was
essentially the same between the control and experimental groups in the second phase.

All students followed the curriculum for FA 250, as prescribed in the training course outline approved by the FAA (See Appendix C). There was no deviation from the course as written.

Lesson One consisted of a checkout in the PA28 in order for the student to be allowed to fly their solo cross-country flights required by the FAA. This training was not part of the study.

Lesson Two consisted of two simulator units which review BAI basics previously learned in FA 200. The first unit, Number 4, was used as a pretest to determine the skills of each flight student. The test was conducted by appropriately rated instructors who would give the mid-phase and final progress checks. The second simulator activity would be conducted by the subject’s instructor. This would be the first activity during which the subject in the experimental group would be videotaped.

Lesson Three consisted of three simulator sessions and one flight in the actual airplane (PA28). The flight was the last unit of the lesson. This allowed the student to apply the knowledge learned in the simulator and apply it to the actual environment. This lesson focused on learning how to obtain and follow an Air Traffic Control (ATC) clearance. The subjects learned how to enter a holding pattern over
various fixes and intersections using a VOR as the primary navigational aid. The subjects learned the proper departure and arrival procedures as they pertain to IFR. The subjects also learned how to fly an instrument approach using a VOR as the primary navigational aid. In addition, the subjects learned the correct time to begin and execute an appropriate missed approach procedure.

Lesson Four taught the subjects how to navigate an instrument approach and a holding pattern using an ADF as the primary navigational aid. The lesson consisted of four units, the first three were simulator units and the last activity was a flight in the PA28. This allowed the subject to apply the information learned in the lesson to the real environment. The subjects review arrival and departure procedures and are introduced to the Non-Directional Beacon (NDB) approaches.

Lesson Five consisted of training the subjects to fly precision approaches utilizing the Instrument Landing System (ILS). In addition, the subjects were introduced to DME arcs and localizer back course approaches. The lesson consisted of two simulator flights and one training flight in the PA28.

Lesson Six consisted of two simulator units and one flight unit. The intent of this lesson was to review the previous lessons and to prepare the subject for the progress check.
Lesson Seven was the progress check and consisted of an oral and a unit in the simulator. The student had to perform the following maneuvers: instrument cockpit check, ATC clearance, IFR departure procedures, holding procedures, non-precision approaches, precision approaches, missed approach procedures, IFR arrival procedures, emergency procedures, timed turns to magnetic compass headings, and radar vectors.

After successful completion of the progress check, the student continued on to Lesson Eight. If the student failed the progress check, the student had to return to his/her previous instructor and receive additional training. When the student was again considered competent in the maneuvers, he/she returned and completed the progress check on the previously failed items only.

After Lesson Seven had been completed, the students were no longer videotaped. From this point on, there was no difference in the training between the control and treatment groups.

Lesson Eight was a transition to the M20J. The student received a high performance signoff so that the student could act as pilot in command in the M20J.

Lesson Nine and Ten introduced the subjects to IFR cross-country operations. This developed the subjects skill in cross-country operations in the NAS.
Lesson Eleven was a total review of the flight course and prepared the subjects for the final progress check. This lesson consisted of both local and cross-country operations in the M20J.

Lesson Twelve was the progress check in accordance with the Practical Test Standards (PTS) for the instrument pilot rating. The subjects were evaluated on their ability to navigate in the NAS in an IFR environment.

The instructors received instructions from the researcher on how to record the information for each flight activity (See Appendix D). The procedures for obtaining the video camera and its use were also discussed and demonstrated (See Appendix E). The instructors were briefed on how to videotape the flight activities and grade the treatment groups using the performance evaluation form (See Appendix F). The instructors were advised to use their best judgement when deciding what portions of the videotape to review with the student. It was emphasized that each debriefing would use the videotape only as an addition to the debriefing and not as a substitute.

The instructors were issued the required supplies to conduct the experiment. The performance evaluation sheets that were to be filled out for both the control and treatment groups were included as part of the instructor's supplies (Appendix E). Each activity used the plotter to
aid the student in following the flight while they reviewed the videotape.
ANALYSIS

The flight course was divided into two levels, Phase I and Phase II. Phase I consisted of units 1-25, while Phase II included units from 28-43. The control group, consisting of those subjects not videotaped, contained 13 students at the start of the study. However, prior to the end of Phase I, two of the 13 students (numbers 10 and 11) withdrew due to financial problems, and one student withdrew (number 13) because of unsatisfactory performance on the initial lessons.

Based on 13 students, the control group received an average of 5.9 hours of flight time in the PA28 (see Table 1). Subtracting the hours flown by students 10, 11, and 13 yields an average of 6.5 hours of flight time for the remaining 10 students. This is a better representation of the true hours flown since students 10, 11, and 13 did not complete the training.

Instruction in the simulator was divided between oral and hands on instruction. The control group received an average of 8.1 hours of oral instruction based on 13 subjects. The average for the ten subjects who completed Phase I was 9.0 hours which is a better representation of the oral time. The average of the simulator instruction was 15.7 for all 13 students, and an average of 16.7 hours based
Table 1

Results of Phase I of the Control Group Students 1-13

<table>
<thead>
<tr>
<th>Student</th>
<th>Flight Time (Hrs)</th>
<th>Instruction (Hrs)</th>
<th>Phase Check Results</th>
<th>Grade Sim*a</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Oral</td>
<td>Simulator</td>
<td>Oral</td>
<td>Grade</td>
</tr>
<tr>
<td>1</td>
<td>7.4</td>
<td>16.5</td>
<td>19.9</td>
<td>2.1</td>
<td>Pass</td>
</tr>
<tr>
<td>2</td>
<td>2.8</td>
<td>10.9</td>
<td>21.1</td>
<td>1.7</td>
<td>Pass</td>
</tr>
<tr>
<td>3</td>
<td>6.6</td>
<td>12.0</td>
<td>22.9</td>
<td>1.8</td>
<td>Pass</td>
</tr>
<tr>
<td>4</td>
<td>7.5</td>
<td>7.4</td>
<td>17.6</td>
<td>1.7</td>
<td>Pass</td>
</tr>
<tr>
<td>5</td>
<td>4.6</td>
<td>8.2</td>
<td>18.4</td>
<td>1.5</td>
<td>Pass</td>
</tr>
<tr>
<td>6</td>
<td>6.4</td>
<td>5.5</td>
<td>11.9</td>
<td>1.7</td>
<td>Pass</td>
</tr>
<tr>
<td>7</td>
<td>7.1</td>
<td>9.7</td>
<td>15.6</td>
<td>1.8</td>
<td>Pass</td>
</tr>
<tr>
<td>8</td>
<td>7.8</td>
<td>6.4</td>
<td>12.4</td>
<td>1.7</td>
<td>Pass</td>
</tr>
<tr>
<td>9</td>
<td>6.5</td>
<td>5.0</td>
<td>15.1</td>
<td>1.9</td>
<td>Pass</td>
</tr>
<tr>
<td>10</td>
<td>8.3</td>
<td>8.9</td>
<td>25.2</td>
<td>0.0</td>
<td>fail</td>
</tr>
<tr>
<td>11</td>
<td>2.0</td>
<td>0.5</td>
<td>0.8</td>
<td>0.0</td>
<td>fail</td>
</tr>
<tr>
<td>12</td>
<td>8.5</td>
<td>8.7</td>
<td>12.2</td>
<td>1.4</td>
<td>Pass</td>
</tr>
<tr>
<td>13</td>
<td>1.1</td>
<td>6.0</td>
<td>11.2</td>
<td>0.0</td>
<td>fail</td>
</tr>
<tr>
<td>Totals</td>
<td>76.6</td>
<td>105.7</td>
<td>204.3</td>
<td>17.3</td>
<td>13</td>
</tr>
</tbody>
</table>

Averages 5.9 8.1 15.7 1.3 76.9% 1.1 46.2%

*aSimulator.

bIncomplete.
on the 10 subjects who completed Phase I. Subject number 10 received approximately 10 hours more instruction than the average for the other subjects, but did not complete Phase I.

The Phase Check results indicated the performance of the subjects at the completion of Phase I. The subjects were given a pass or fail grade at the completion of the phase check. This is the current grading policy of the university. The hours are not necessarily a direct indication of students' performance, but there were some similarities between the subjects that did not pass the phase check on the first attempt. Subjects 1, 7, and 9 had taken more time to complete the phase as compared to the other subjects. The researcher believes there is a correlation between the additional hours required by those subjects and their comprehension of the material. All of the subjects that attempted the phase check passed the oral portion on their first attempt. If the other subjects, 10, 11, and 13, had been included in the results, the pass rate would drop to 76.9%, since only 10 of the 13 actually passed the phase check on the first attempt. The results for the simulator portion of the phase check indicates a pass rate of 60% based on 6 of the 10 subjects passing on their first attempt. If all 13 subjects had been included in the results, the pass rate would be 46.2% based on 6 subjects out of 13 passing on the first attempt.
The treatment group, consisting of those subjects that were videotaped, contained 14 subjects. These subjects were assigned numbers 14 and 27. All of the subjects in the treatment group completed the training in Phase I. The average hours of flight time for the treatment group consisted of 6.9 hours (see Table 2).

The instruction hours received in Phase I was broken down between oral and simulator instruction. These students received an average of 8.6 hours of oral time and 15.0 hours of simulator instruction. Subject number 18 received 4.3 hours more oral instruction and 7.3 hours more simulator instruction than the average of the other subjects. The researcher feels this may be an indication of poor comprehension by that subject. However, the subject was able to complete the phase check on the first attempt with a passing grade. Subject number 19 received less hours of instruction compared to the average of the other subjects, but was unable to complete the phase check on the first attempt.

The phase check results for the treatment group in Phase I indicated a 100% pass rate on the oral portion of the phase check. Whereas, the simulator portion was 92.9% based on 13 of the 14 subjects passing on their first attempt.

Phase II of the flight course consisted of units 28-43. Phase II had very few simulator units in comparison to
<table>
<thead>
<tr>
<th>Student</th>
<th>Flight Time (Hrs)</th>
<th>Instruction (Hrs)</th>
<th>Phase Check Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flight Time (Hrs)</td>
<td>Oral Simulator</td>
<td>Oral Grade</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sim* Grade</td>
</tr>
<tr>
<td>14</td>
<td>8.4</td>
<td>7.0</td>
<td>1.4 Pass</td>
</tr>
<tr>
<td>15</td>
<td>7.2</td>
<td>9.8</td>
<td>1.5 Pass</td>
</tr>
<tr>
<td>16</td>
<td>4.9</td>
<td>8.4</td>
<td>1.7 Pass</td>
</tr>
<tr>
<td>17</td>
<td>6.0</td>
<td>10.1</td>
<td>1.7 Pass</td>
</tr>
<tr>
<td>18</td>
<td>6.8</td>
<td>12.9</td>
<td>2.0 Pass</td>
</tr>
<tr>
<td>19</td>
<td>6.5</td>
<td>8.2</td>
<td>1.9 Pass</td>
</tr>
<tr>
<td>20</td>
<td>7.0</td>
<td>8.2</td>
<td>1.8 Pass</td>
</tr>
<tr>
<td>21</td>
<td>7.6</td>
<td>7.2</td>
<td>1.7 Pass</td>
</tr>
<tr>
<td>22</td>
<td>8.6</td>
<td>7.1</td>
<td>1.7 Pass</td>
</tr>
<tr>
<td>23</td>
<td>4.7</td>
<td>5.6</td>
<td>1.2 Pass</td>
</tr>
<tr>
<td>24</td>
<td>8.2</td>
<td>10.4</td>
<td>1.5 Pass</td>
</tr>
<tr>
<td>25</td>
<td>5.7</td>
<td>8.4</td>
<td>1.8 Pass</td>
</tr>
<tr>
<td>26</td>
<td>7.2</td>
<td>10.1</td>
<td>1.7 Pass</td>
</tr>
<tr>
<td>27</td>
<td>7.5</td>
<td>6.5</td>
<td>1.5 Pass</td>
</tr>
<tr>
<td>Totals</td>
<td>96.3</td>
<td>119.9</td>
<td>23.1</td>
</tr>
<tr>
<td>Averages</td>
<td>6.9</td>
<td>8.6</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15.0</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>92.9%</td>
</tr>
</tbody>
</table>

*Simulator.
Phase I. The subjects performed most of the Phase II activities in the airplane. However, none of the subjects were videotaped in the airplane.

When comparing the two groups in Phase I of the study, there were discernable differences in the length of time taken and the overall pass rates. The control group used slightly less time in the airplane when compared to the treatment group. However, the average difference was only 0.4 hours or 24 minutes. The researcher believes this difference is insignificant as delays from outside forces could have easily accounted for such a minimal difference.

The oral time received averaged 9.0 hours for the control group (based on 13 subjects) and 8.6 hours for the treatment group. The researcher also considers this time difference to be insignificant since there is also only 0.4 or 24 minutes hours variance between the two groups.

The simulator time indicated a more significant difference between the two groups. The control group, based on 13 subjects, used an average of 16.7 hours of simulator instruction, while the treatment group used an average of 15.0 hours. This is a difference of 1.7 hours of instruction. The extra time required by the control group may indicate a lack of understanding of the material.

The pass rates for the two groups differed slightly on the oral portion, but were significantly different on the simulator portion. The control and treatment groups
averaged 76.9% and 100% for passing on the first attempt, respectively. The results for the simulator portion for the control and treatment groups was 46.2% and 92.9%, respectively. The results for the simulator portion indicated a substantial difference between the two groups.

The control group, subjects 1-13, received an average of 13.8 hours of flight time in Phase II (see Table 3). However, a total of only nine subjects actually completed Phase II. These nine subjects averaged 20 hours of flight time per student. Subject number 12 was unable to satisfactorily complete the Phase I stage check and was withdrawn from the flight course. Flight time varied between subjects depending on the amount of cross-country flight time needed by each individual to meet the requirements of the Federal Aviation Regulations (FAR). Some of the subjects were able to obtain more hours of cross-country flight in previous flight courses which reduced the number of cross-country hours in FA 250, Commercial Pilot Flight Operations III Course. The fact that the flight time between the subjects varied did not appear to influence the results of the study.

The control group received an average of 8.4 hours of oral and 2.4 hours of simulator instruction based on 13 subjects. When the averages were calculated using only the nine subjects who completed Phase II, the oral instruction
Table 3

Results of Phase II of the Control Group Students 1-13

<table>
<thead>
<tr>
<th>Student</th>
<th>Flight Time (Hrs)</th>
<th>Instruction (Hrs)</th>
<th>Phase Check Results (Hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flight Time (Hrs)</td>
<td>Oral Simulator</td>
<td>Oral Grade M20J* Grade</td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>19.0</td>
<td>12.9 10.9</td>
<td>2.0 Pass 1.4 Fail</td>
</tr>
<tr>
<td>2</td>
<td>21.5</td>
<td>15.2 1.6</td>
<td>2.9 Pass 2.4 Fail</td>
</tr>
<tr>
<td>3</td>
<td>19.4</td>
<td>16.5 4.8</td>
<td>2.5 Pass 1.7 Pass</td>
</tr>
<tr>
<td>4</td>
<td>24.5</td>
<td>9.6 2.2</td>
<td>2.0 Pass 1.7 Pass</td>
</tr>
<tr>
<td>5</td>
<td>15.2</td>
<td>11.8 1.3</td>
<td>3.3 Pass 1.6 Pass</td>
</tr>
<tr>
<td>6</td>
<td>18.7</td>
<td>11.4 2.7</td>
<td>1.9 Pass 1.6 Pass</td>
</tr>
<tr>
<td>7</td>
<td>20.8</td>
<td>12.3 2.0</td>
<td>2.4 Pass 1.8 Fail</td>
</tr>
<tr>
<td>8</td>
<td>17.9</td>
<td>9.6 2.3</td>
<td>1.5 Pass 1.2 Pass</td>
</tr>
<tr>
<td>9</td>
<td>22.7</td>
<td>9.7 4.0</td>
<td>2.4 Pass 2.5 Fail</td>
</tr>
<tr>
<td>10</td>
<td>0.0</td>
<td>0.0 0.0</td>
<td>0.0 lb 0.0 lb</td>
</tr>
<tr>
<td>11</td>
<td>0.0</td>
<td>0.0 0.0</td>
<td>0.0 lb 0.0 lb</td>
</tr>
<tr>
<td>12</td>
<td>0.0</td>
<td>0.0 0.0</td>
<td>0.0 lb 0.0 lb</td>
</tr>
<tr>
<td>13</td>
<td>0.0</td>
<td>0.0 0.0</td>
<td>0.0 lb 0.0 lb</td>
</tr>
<tr>
<td>Totals</td>
<td>179.7</td>
<td>109.0 31.8</td>
<td>20.9 13 15.9 13</td>
</tr>
<tr>
<td>Averages</td>
<td>13.8</td>
<td>8.4 2.4</td>
<td>1.6 69.2% 1.2 38.5%</td>
</tr>
</tbody>
</table>

*Mooney M20J.

bIncomplete.
averaged 12.1 hours and the simulator instruction averaged 3.5 hours per subject.

The phase check results based on a total of 13 control subjects indicated a pass rate for the oral portion of 69.2%, and a pass rate of 38.5% for the simulator portion. The subjects who received an incomplete were counted as failures since these subjects did not pass the phase check on the first attempt. If the four subjects that did not complete Phase II of the flight course were excluded from the computation of the results, the oral portion would have been 100% and the flight portion would have been 55.6% for the subjects that passed on their first attempt. The average number of hours taken to complete the oral portion of the phase check was 1.6 hours, with 1.2 hours of flight time in the simulator, based on 13 subjects. When using nine subjects as a base, the oral time averaged 2.3 hours and the flight time averaged 1.8 hours. The times for nine subjects more accurately represents the data since only nine of the subjects participated in Phase II of the flight course. The flight hours received during Phase II were higher for the subjects that failed than for those subjects that passed. However, there were two exceptions. Subject number 1 received .4 hours less time than the average of the other eight subjects, but received a failing grade on the phase check. Another exception was subject number 5 who received
1.0 hour more oral time during the oral portion than the other subjects, but failed the oral on the first attempt.

The treatment group was not videotaped in the airplane during Phase I or Phase II of the flight course. In addition, none of the simulator sessions were videotaped in Phase II since the subjects had minimum exposure to the simulator in Phase II. The researcher was more concerned whether or not the subjects would be able to retain the information learned in Phase I of the flight course.

The average flight time received by the treatment group in Phase II consisted of 21.4 hours (see Table 4). The number of hours received did not necessarily indicate a need of extra training, since the subjects required different amounts of cross-country time depending on how many hours were obtained in previous flight courses. The researcher did not feel this would bias the results since both the treatment and control groups were similarly affected by this.

The oral instruction received by the subjects in the treatment group averaged 11.9 hours, and the simulator time averaged 2.5 hours. Subject number 25 received 3.5 hours of oral instruction more than the average, but received 1.4 hours less time, based on the average, in the simulator than the other subjects. The additional hours of oral would seem to indicate a weakness on the part of the subject, requiring additional hours of instruction in the simulator by that
Table 4

Results of Phase II of the Treatment Group Students 14-27

<table>
<thead>
<tr>
<th>Student</th>
<th>Flight Time (Hrs)</th>
<th>Instruction (Hrs)</th>
<th>Oral Grade M20J* Grade</th>
<th>Phase Check Results Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Oral</td>
<td>Simulator</td>
<td>(Hrs)</td>
</tr>
<tr>
<td>14</td>
<td>19.6</td>
<td>10.6</td>
<td>2.7</td>
<td>2.0</td>
</tr>
<tr>
<td>15</td>
<td>21.6</td>
<td>15.6</td>
<td>1.6</td>
<td>2.6</td>
</tr>
<tr>
<td>16</td>
<td>19.9</td>
<td>12.5</td>
<td>1.8</td>
<td>2.3</td>
</tr>
<tr>
<td>17</td>
<td>17.6</td>
<td>13.1</td>
<td>3.8</td>
<td>2.0</td>
</tr>
<tr>
<td>18</td>
<td>22.6</td>
<td>12.4</td>
<td>5.6</td>
<td>2.3</td>
</tr>
<tr>
<td>19</td>
<td>24.7</td>
<td>10.0</td>
<td>2.3</td>
<td>2.5</td>
</tr>
<tr>
<td>20</td>
<td>25.5</td>
<td>14.2</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>21</td>
<td>18.7</td>
<td>12.9</td>
<td>1.9</td>
<td>2.5</td>
</tr>
<tr>
<td>22</td>
<td>26.6</td>
<td>9.1</td>
<td>2.4</td>
<td>2.4</td>
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<tr>
<td>23</td>
<td>13.4</td>
<td>9.7</td>
<td>1.8</td>
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<td>24</td>
<td>16.4</td>
<td>11.0</td>
<td>2.2</td>
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<td>10.7</td>
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<td>2.1</td>
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<td>27</td>
<td>29.9</td>
<td>10.0</td>
<td>3.5</td>
<td>2.3</td>
</tr>
<tr>
<td>Totals</td>
<td>300.2</td>
<td>167.2</td>
<td>34.9</td>
<td>32.1</td>
</tr>
<tr>
<td>Averages</td>
<td>21.4</td>
<td>11.9</td>
<td>2.5</td>
<td>2.3</td>
</tr>
</tbody>
</table>

*Mooney M20J.
subject. However, the data indicates less time was used in the simulator. The extra oral time may have offset the time needed in the simulator.

The pass rate of the treatment group on the oral portion was 100% for all 14 subjects. The pass rate for the airplane portion of Phase II was 71.4% on the first attempt. There was a direct correlation between the hours received in the airplane, and those subjects who failed their phase check on their first attempt. Those subjects had from 0.5 to 1.1 hours more than the average. The increased number of hours may indicate a lack of understanding by the subject, causing the subject to require more time to complete the tasks. This may not be the exclusive reason though, as there may have been traffic delays during the phase check. The same subjects that failed the flight phase check required 0.4 to 0.5 more hours than the average subject on the oral portion.

After comparing the two groups' performance in Phase II of the course, there appear to be some differences. The flight time for the control and treatment groups were 20.0 and 21.4 hours, respectively. This is a difference of 1.4 hours of flight time. This may or may not be significant depending on the amount of cross-country flight time each individual student may have needed.

The instruction time received for the oral time was 12.1 hours for the control group and 11.9 hours for the
treatment group. The researcher considered an average of 0.2 or 12 minutes hours of instruction an insignificant difference.

There was a significant difference between the two groups in the simulator instruction. The control and treatment groups received 3.5 and 2.5 hours of instruction, respectively.

The major differences between the two groups was on the phase check results. The oral and simulator portions of the phase check had a difference of 30.8% and 32.9%, respectively. The control group did not retain information from Phase I as compared to the treatment group. The exposure time to the material was less for the control group since they could not review the videotape after each training session. The information may not have been reinforced as well. The researcher believes this is a significant difference between the two groups.
CONCLUSIONS

The results of the mid-phase check supported the research hypothesis that videotaping the subjects would reduce the simulator and oral time required to successfully complete the phase check. However, the results did not support a reduction in flight time. The results of the second phase supported a portion of the research hypothesis as it relates to simulator and oral time, since the treatment group had an overall better pass rate than the control group with a reduction in time required, but the results did not support a reduction in flight time.

The control group received 0.5 hours less oral instruction than the treatment group on units 1-25. The four students who withdrew from the flight course were included when the average hours were calculated. Three of the four students withdrew prior to completing the first phase check. The other student completed the first phase check and then withdrew from the course. Since their total oral instruction hours were less than the average of the other 10 students, this caused the averages to indicate less hours of instruction received as compared to the treatment group.

During the first phase, the control group received an average of 0.1 hours more simulator time and 0.5 hours more of oral instruction than the treatment group. The treatment
group received 0.4 more hours of flight time than the control group. Therefore, the control group had 0.2 hours more instruction time than the treatment group. The overall results supported the research hypothesis that the actual instruction time required was reduced.

During the second phase, the control group received an average of 0.2 hours more oral time and 1.0 hours more of simulator instruction than the treatment group. The treatment group received 1.4 hours more of flight instruction in the airplane than the control group. Therefore, the treatment group received 0.2 hours more instruction time than the control group. This did not support the hypothesis that videotaping would reduce the amount of oral, simulator, and flight time required to obtain an instrument rating.

A limitation was identified, during the second phase of the flight course, when six of the students were assigned to new instructors that were not part of the original study without the permission of the researcher. Most of the students that received instructor changes were in the treatment group. This had a possible influence on the outcome of the experiment. An additional limitation occurred when combined with phase check pilots that were well qualified, but not part of the original study administered the final phase check. The loss of positive
control was due to flight department requirements that took precedence over the experiment.

The first part of the flight course resulted in more valid data since there were no instructor changes and the same two phase check pilots conducted the evaluations. This provided more consistent results from the data collected.

The original plan was to have the same two instructors administer the phase checks for all the subjects. This was accomplished on the mid-phase check, units 1-25, but was not possible on the final phase check. Due to circumstances beyond the control of the researcher, instructors that were not initially part of the study gave four of the phase checks. These instructors were qualified to administer the check, but the research plan was to use the same instructors for both sets of phase checks for consistency. The additional instructors had not been briefed on the procedures and forms needed to supply data results for the study. Since there were various instructors administering the phase checks, the results may have been biased to a small degree, but only on the final phase check.

The researcher concludes that the experimental data indicates that videotaping did not reduce the overall time for the entire course. However, some of the students that the researcher interviewed indicated they benefitted from being videotaped and by watching the tapes during the debriefing. In the students' opinions, they felt more
comfortable with the material after reviewing the lesson on videotape. Since they had an improved understanding of the procedures previously learned on the preceding unit.

The study contained limitations since the general population was not considered in the study. The only subjects tested were from ERAU which makes up a small segment of the overall population of people that add an instrument rating to their certificate. The results of this study would only pertain to ERAU students.

Although the results of the experiment did not fully support the research hypothesis that videotaping will reduce the actual instruction time required to perform the oral, simulator, and flight activities, the researcher accepts the results of the experiment and concludes that the data did not support the hypothesis. The only portions supported were the oral and simulator activities.
RECOMMENDATIONS

Further research should be conducted in this area to investigate how long term retention is impacted by videotaping. The researcher should limit the amount of units to be covered in the course to reduce the overall time involved to collect the data. One to two months is a more appropriate length of time to collect data on the students. The longer a course continues, the greater difficulties the researcher will have collecting data.

Future researchers should strive to have total control of the study. This would include selection of instructors, management of students, and scheduling of the students for phase checks. The number of instructors involved in the study should be limited to provide better standardization between the instructors, decreased workload on the researcher, and allow for better management of the study on a daily basis. A large span of control makes the daily operation of data collection difficult to maintain. Without having the instructors reporting directly to the researcher, the researcher is out of the loop on daily operations concerning the study.

For ease of operation, the video camera should be mounted directly to the simulator to avoid set-up and security problems. Depending on the equipment available and the amount of subjects involved, the researcher may want to
have a video camera, VCR, and television for each simulator. This would solve equipment problems between individual instructors. The VCRs and televisions should be located in close proximity to the simulators with dividers for privacy. If possible, the VCR and television should be located in separate rooms when the space is available.

Additional research should be conducted with the use of videotape to improve the students cognitive ability to solve problems. The instructors should have the students explain the good and bad points of the unit during the debriefing. The instructor can replay the areas of concern back to the student to help them remember the details of the unit. This will provide the student with a third persons perspective of their flight. This could possibly help the student to better understand their actions and reduce the chance of the same mistakes occurring again.
REFERENCES


APPENDIX A

DEMOGRAPHIC INFORMATION FOR FA 250 STUDENTS
Demographic Information for FA 250 Students

Please answer the follow questions to determine the experience of the students participating in the experiment.

1. Fill in your total flight time in the following spaces.

   Total Time: _______ PIC: _______
   Instrument: _______ Simulator: _______

2. Do you have any flying experience other than E-RAU?
   □ Yes
   □ No

3. If the answer to question 2 is yes, outline your flight experience prior to E-RAU.

   Total Time: _______ PIC: _______
   Instrument: _______ Simulator: _______

4. Have you previously taken FA250 and had to withdraw for any reason?
   □ Yes
   □ No

5. If the answer to question 4 is yes, what was the last lesson completed successfully?

   _______ Last lesson completed
APPENDIX B

REVIEW OF THE ACTIVITY
Review of the Activity

Take a few minutes to answer the following questions while you review your last activity on the video tape. Also write down any questions that you may have for your instructor as you think of them.

1) List areas in your last simulator unit that your performance met the standards for the lesson.
   1) 
   2) 
   3) 
   4) 

2) List the areas that you did not meet lesson standards in the last simulator unit.
   1) 
   2) 
   3) 
   4) 

3) Analyze the actions necessary to correct the errors you observed on the video review.
   1) 
   2) 
   3) 
   4) 

4) Questions for my instructor.
   1) 
   2) 
   3) 
   4)
FA-250
COMMERCIAL PILOT OPERATIONS

PHASE III
(Flight Training Record)

FOREWORD

This flight training record contains the complete outline of subject areas to be covered during this phase. It is designed to be used for unit preparation and for documenting each completed activity.

REVISIONS

Hundreds of staff and students use the Flight Department publications constantly. Since these publications govern all our training efforts, they must remain as accurate, current, and professionally written as possible. Accordingly, a procedure has been established to methodically harness the creative energies of the entire user population.

Recommended changes to publications may be submitted to the Department Chairman by anyone. The recommendation must be submitted in writing, including a complete example of how the item should be written and justification for the change. Forms may be obtained from the Training Managers or the Department Chairman.

----------------------------------------------------------------------------------

PHASE

OBJECTIVE: To develop the aeronautical knowledge, skill, competence and experience necessary for the student to meet the requirements for the addition of an instrument rating to his/her pilot certificate.

PHASE

STANDARDS: This phase will be complete when the student has demonstrated through a final phase check, written examination, and school records that he/she has the required aeronautical knowledge and skill, as outlined in the current FAA Instrument Pilot Practical Test Standards. In addition, the student must have obtained the cross-country experience required by Appendix D, 3(c)(2) of FAR Part 141 as well as the flight experience required by FAR Part 61.65(e)(1).

NOTE: For those lessons which provide for instruction in both ground trainer and aircraft, the student must demonstrate that he or she meets lesson proficiency standards in the ground trainer before progressing to the aircraft.

----------------------------------------------------------------------------------
LESSON 1 ADVANCED SOLO CROSS-COUNTRY

OBJECTIVE: To further develop the student's confidence and proficiency during the conduct of extended solo cross-country flight operations and to make further progress toward the total cross-country requirements specified in Appendix D, 3(C)(2) of FAR Part 141.

STANDARDS: This lesson will be complete when the student has successfully completed two separate solo cross-country flights each of which has a landing at an airport more than 50 nautical miles from the point of departure.

NOTE: This lesson may, at the instructor's discretion, be completed at any point during this phase.

UNIT 1 DUAL/FIG DATE A/C#_______

PROFICIENCY REVIEW:
(1) Preflight Preparation
(2) Normal and Crosswind Takeoffs and Climbs
(3) Normal and Crosswind Approaches and Landings
(4) Maneuvering at Critically Slow Airspeed
(5) Imminent and Full Stalls - Power On
(6) Imminent and Full Stalls - Power Off
(7) Constant Altitude Turns
(8) Emergency Approach and Landing
(9) Go-Around
(10) As directed by the instructor

COMMENTS: ________________________________________________________________

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__________________________________________________________
UNIT 2  SOLO CROSS-COUNTRY       DATE_____       A/C#_____

PREFLIGHT BRIEFING:
   (1) Preflight Preparation
   (2) Flight Planning
   (3) Weather Analysis

PRACTICE:
   (4) Flight Plan
   (5) Flight Log Use
   (6) Pilotage
   (7) Dead Reckoning
   (8) Radio Navigation

ROUTE:__________________________

UNIT 3  SOLO CROSS-COUNTRY       DATE_____       A/C#_____

PREFLIGHT BRIEFING
   (1) Preflight Preparation
   (2) Flight Planning
   (3) Weather Analysis

PRACTICE:
   (4) Flight Plan
   (5) Flight Log Use
   (6) Pilotage
   (7) Dead Reckoning
   (8) Radio Navigation

ROUTE:__________________________
ATTACH LESSON 1
PINK SLIPS AND EXTRA TRAINING FORMS
HERE
LESSON 2 BASIC ATTITUDE INSTRUMENT REVIEW

OBJECTIVE: To further develop the student's ability to perform basic attitude instrument and radio navigation maneuvers.

STANDARDS: This lesson will be complete when the student has demonstrated the ability to safely and accurately perform basic attitude instrument and radio navigation maneuvers while maintaining altitude +/- 100 feet, airspeed +/- 10 knots, and heading +/- 10 degrees.

UNIT 4 GROUND TRAINER DATE A/C

INTRODUCE:
(1) Instrument Cockpit Check
(2) Instrument Takeoff
(3) Basic Attitude Instrument Flying - Four Fundamentals, FP/PP
(4) Change of Airspeed, FP/PP
(5) Maneuvering at Critically Slow Airspeed, FP/PP
(6) Stalls FP/PP
(7) Steep Turns
(8) Unusual Flight Attitudes, FP/PP
(9) Timed Turns to Magnetic Compass Headings
(10) VOR Tracking/Intercepts
(11) NDB Tracking/Intercepts
(12) Radar Vectors

COMMENTS: ____________________________

_____________________________________

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6
UNIT 5  OBSERVER  DATE  A/C#__

The student will be assigned to a flight that relates to his/her appropriate level in this course.

UNIT 6  DUAL/PIC  DATE  A/C#__

REVIEW:
(1) Instrument Cockpit Check
(2) Instrument Takeoff
(3) Basic Attitude Instrument Flying, FP/PP
(4) Change of Airspeed, FP/PP
(5) Maneuvering at Critically Slow Airspeed, FP/PP
(6) Stalls, FP/PP
(7) Steep Turns
(8) Unusual Flight Attitudes, FP/PP
(9) Timed Turns to Magnetic Compass Headings
(10) Magnetic Compass Turns
(11) VOR Tracking/Intercepts
(12) NDB Tracking/Intercepts
(13) Radar Vectors

COMMENTS:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
ATTACH LESSON 2
PINK SLIPS AND EXTRA TRAINING FORMS
HERE
LESSON 3  VOR APPROACHES AND HOLDING

OBJECTIVE: To develop the student's ability to perform VOR approach and holding procedures.

STANDARDS: This lesson will be complete when the student has demonstrated the ability to safely and accurately perform VOR approaches and VOR holding within the IFR environment. Proper departure, arrival, and missed approach procedures must be used while maintaining altitude +/- 100 feet, airspeed +/- 10 knots, and heading +/- 10 degrees with no descent below minimum approach altitudes. Orientation shall be maintained at all times.

UNIT 7  GROUND TRAINER

REVIEW:

____ (1) Instrument Cockpit Check

INTRODUCE:

____ (2) Preflight Preparation
____ (3) Radio Communications
____ (4) ATC Clearance
____ (5) IFR Departure Procedures
____ (6) VOR Holding
____ (7) VOR Approach
____ (8) Missed Approach Procedures
____ (9) IFR Arrival Procedures

COMMENTS:________________________________________
________________________________________
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________________________________________

10
UNIT 8 GROUND TRAINER

REVIEW:

(1) Preflight Preparation
(2) Instrument Cockpit Check
(3) Radio Communications
(4) ATC Clearance
(5) IFR Departure Procedures
(6) IFR Arrival Procedures
(7) Missed Approach Procedures

INTRODUCE:

(8) VOR Intersection Holding
(9) Terminal VOR Approach
(10) Partial Panel Flight

COMMENTS:

UNIT 9 GROUND TRAINER

REVIEW:

(1) Preflight Preparation
(2) Instrument Cockpit Check
(3) Radio Communications
(4) ATC Clearance
(5) IFR Departure Procedures
(6) IFR Arrival Procedures

INTRODUCE:

(7) VOR Holding, FP/PP
(8) VOR Approach, FP/PP
(9) Missed Approach Procedures, FP/PP

COMMENTS:
UNIT 10 OBSERVER DATE A/C#_________

The student will be assigned to a flight that relates to his/her appropriate level in this course.

UNIT 11 DUAL/PIC DATE A/C#_________

**REVIEW:**

1. Preflight Preparation
2. Instrument Cockpit Check
3. ATC Clearance
4. VOR Holding, FP/PP
5. VOR Approach, FP/PP
6. Terminal VOR Approach, FP/PP
7. Missed Approach Procedures, FP/PP
8. Landing From a Straight-In Approach

**INTRODUCE:**

9. Circling Maneuvers

**COMMENTS:**

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
ATTACH LESSON 3
PINK SLIPS AND EXTRA TRAINING FORMS
HERE
LESSON 4  NDB APPROACHES AND HOLDING

OBJECTIVE: To develop the student's ability to perform NDB approach and holding procedures.

STANDARDS: This lesson will be complete when the student has demonstrated the ability to safely and accurately perform NDB approaches and NDB holding within the IFR environment. Proper departure, arrival, and missed approach procedures must be used while maintaining altitudes +/- 100 feet, airspeed +/- 10 knots and headings +/- 10 degrees with no descent below minimum approach altitudes. Orientation shall be maintained at all times.

UNIT 12 GROUND TRAINER

REVIEW:
(1) ATC Clearance
(2) IFR Departure Procedures
(3) Missed Approach Procedures
(4) IFR Arrival Procedures

INTRODUCE:
(5) NDB Holding
(6) NDB Approach

COMMENTS:________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
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________________________________________________________________________

14
UNIT 13 GROUND TRAINER

REVIEW:
(1) ATC Clearance
(2) IFR Departure Procedures
(3) NDB Holding
(4) NDB Approach
(5) Missed Approach Procedures
(6) IFR Arrival Procedures

INTRODUCE:
(7) Terminal NDB Approach
(8) Partial Panel Flight
(9) Lost Radio Communications
(10) ASR Approach

COMMENTS:

UNIT 14 GROUND TRAINER

REVIEW:
(1) ATC Clearance
(2) Magnetic Compass Turns
(3) Timed Turns to Magnetic Compass Headings

INTRODUCE:
(4) NDB Holding, FP/PP
(5) NDB Approach, FP/PP
(6) Missed Approach Procedures, FP/PP

COMMENTS:
UNIT 15 OBSERVER DATE A/C$_______

The student will be assigned to a flight that relates to his/her appropriate level in this course.

UNIT 16 DUAL/PIC DATE A/C$_______

REVIEW:

____(1) ATC Clearance
____(2) NDB Approach FP/PP
____(3) NDB Holding FP/PP
____(4) Timed Turns to Magnetic Compass Headings
____(5) Missed Approach Procedures
____(6) Circling Approach Procedures
____(7) Terminal NDB Approach
____(8) Lost Radio Communications

INTRODUCE:

____(9) Landing From a Straight-In or Circling Approach

COMMENTS:________________________________________________________________________
________________________________________________________________________
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________________________________________________________________________
ATTACH LESSON 4
PINK SLIPS AND EXTRA TRAINING FORMS
HERE
LESSON 5  ILS APPROACHES AND LOCALIZER HOLDING

OBJECTIVE: To develop the student's ability to perform ILS, Localizer, and Localizer B.C. approaches, including their associated holding and missed approach procedures.

STANDARDS: This lesson will be complete when the student can safely and accurately perform ILS, Localizer, and Localizer B.C. approaches, including their associated holding and missed approach procedures while complying with ATC instructions. Altitudes shall be maintained +/- 100 feet, airspeed +/- knots and heading +/- 10 degrees with no descent below minimum approach altitudes. Orientation shall be maintained at all times.

UNIT 17 GROUND TRAINER DATE A/C# ________

REVIEW:
   (1) ATC Clearance
   (2) IFR Departure Procedures
   (3) Missed Approach Procedures
   (4) IFR Arrival Procedures

INTRODUCE:
   (5) Localizer Holding, FP/PP
   (6) ILS Approach, FP/PP
   (7) Localizer Approach, FP/PP
   (8) Localizer Back Course Approach
   (9) Emergency Procedures
   (10) No-Gyro Approach
   (11) DME Arc Approach

COMMENTS: ____________________________
__________________________________
__________________________________
__________________________________
__________________________________
__________________________________

18
UNIT 18 GROUND TRAINER

DATE_________ A/C#_________

REVIEW:

(1) ATC Clearance
(2) IFR Departure Procedures
(3) Timed Turns to Magnetic Compass Headings
(4) ILS Approach, FP/PP
(5) Localizer/Localizer B.C. Approach, FP/PP
(6) Localizer Holding, FP/PP
(7) Missed Approach Procedures, FP/PP
(8) IFR Arrival Procedures
(9) DME Arc Approach

COMMENTS:_________________________________________

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UNIT 19 OBSERVER  DATE________  A/C#________

The student will be assigned to a flight that relates to his/her appropriate level in this course.

UNIT 20 DUAL/PIC  DATE________  A/C#________

REVIEW:

(1) ATC Clearance
(2) IFR Departure Procedures
(3) Localizer Holding, FP/PP
(4) ILS/Localizer Approach, FP/PP
(5) Missed Approach Procedures, FP/PP
(6) Emergency Procedures
(7) IFR Arrival Procedures
(8) Landing from a Straight-In or Circling Approach

COMMENTS:__________________________________________________________
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_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
ATTACH LESSON 5
PINK SLIPS AND EXTRA TRAINING FORMS
HERE
LESSON 6  RADAR APPROACHES AND INSTRUMENT PILOT OPERATIONS

REVIEW

OBJECTIVE: To introduce radar approaches, to review all IFR pilot operations previously covered, and to identify and further develop competency in individual student weak areas.

STANDARDS: This lesson will be complete when the student can safely and accurately perform each required IFR procedure while maintaining altitude +/- 100 feet, airspeed +/- 10 knots and heading +/- 10 degrees with no descent below minimum approach altitudes. Orientation shall be maintained at all times.

UNIT 21 ORAL DATE__________

DISCUSS:

(1) Emergency Procedures
(2) FAR's Pertinent to Instrument Flight
(3) Those areas in which the student has demonstrated a weakness or lack of complete understanding

(4) __________________________________________
(5) __________________________________________
(6) __________________________________________
(7) __________________________________________
(8) __________________________________________

COMMENTS:_______________________________________

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## UNIT 22 GROUND TRAINER

### REVIEW:

1. Instrument Cockpit Check  
2. ATC Clearance  
3. IFR Departure Procedures  
4. Holding Procedures  
5. VOR Approach  
6. NDB Approach  
7. ILS Approach  
8. Missed Approach Procedures  
9. IFR Arrival Procedures  
10. Emergency Procedures  
11. Partial Panel Approach  
12. Timed Turns to Magnetic Compass Headings  
13. Radar Vectors

### COMMENTS:

23

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### UNIT 23 GROUND TRAINER

### REVIEW:

1. Instrument Approaches  
2. Holding  
3. Emergency Procedures  
4. Radar Approaches  
5. Those areas in which the student has demonstrated minimum satisfactory performance or as determined necessary by the instructor.

### COMMENTS:

23
The student will be assigned to a flight that relates to his/her appropriate level in this course.

REVIEW:
Those areas in which the student has demonstrated minimum satisfactory performance or as determined necessary by the instructor.

(1) 
(2) 
(3) 
(4) 
(5) 
(6) 

COMMENTS:
ATTACH LESSON 6
PINK SLIPS AND EXTRA TRAINING FORMS
HERE
LESSON 7  IFR OPERATIONS PHASE CHECK

OBJECTIVE: To determine through an oral and flight check that the student has the knowledge and skill required to safely and accurately conduct IFR operations within the National Airspace System.

STANDARDS: This lesson will be complete when the student has demonstrated the ability to safely and accurately comply with ATC instructions, follow departure and arrival procedures, enter and depart holding patterns, execute precision and non-precision instrument approach procedures, and properly respond to all unanticipated emergency situations. Altitude shall be maintained +/- 100 feet, airspeed +/- 10 knots and heading +/- 10 degrees with no descent below minimum approach altitudes. Orientation shall be maintained at all times.

UNIT 26  ORAL PHASE CHECK

EVALUATE:
(1) Preflight Preparation
(2) Instrument Cockpit Check
(3) ATC Clearances
(4) IFR Departure Procedures
(5) IFR Arrival Procedures
(6) Radio Communications
(7) Holding Procedures
(8) Instrument Approach Procedures
(9) Missed Approach Procedures
(10) Emergency Procedures
(11) FAR’s Pertinent to Instrument Flight
(12) ERAU Flight Operations Manual

UNIT 27  GROUND TRAINER PHASE CHECK

EVALUATE:
(1) Instrument Cockpit Check
(2) ATC Clearance
(3) IFR Departure Procedures
(4) Holding Procedures
(5) Non-Precision Approach
(6) Precision Approach
(7) Missed Approach Procedures
(8) IFR Arrival Procedures
(9) Emergency Procedures
(10) Timed Turns to Magnetic Compass Headings
(11) Radar Vectors
ATTACH PHASE CHECK FORMS
AND PINK SLIPS HERE
LESSON 8  COMPLEX AIRPLANE FAMILIARIZATION

OBJECTIVE: To familiarize the student with the operation of an aircraft equipped with at least a 180 H.P engine, retractable landing gear system, flaps, and a controllable propeller. Also, to develop the student's competency and understanding in those knowledge areas pertaining to complex aircraft.

STANDARDS: This lesson will be complete when the student has demonstrated his/her familiarity with the systems and operation of a complex aircraft and has received a logbook endorsement attesting to his/her competency to pilot such aircraft as required by FAR Part 61.31(e).

UNIT 28 ORAL DATE_______

DISCUSS:
(1) Pilot's Information Manual
(2) Operation of Airplane Systems
(3) Systems and Equipment Malfunctions
(4) Determining Performance and Limitations
(5) Emergency Procedures
(6) Complex Airplane Operations and Procedures
(7) Complex Airplane Questionnaire

COMMENTS: __________________________

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28
UNIT 29 GROUND TRAINER

DATE_______ A/C#________

DISCUSS:
(1) Cockpit Familiarization
(2) Airplane Servicing

INTRODUCE:
(3) Cockpit Management
(4) Use of Checklist
(5) Ground Safety Precautions
(6) Starting Engine
(7) Taxiing
(8) Pretakeoff Check(s)
(9) Four Fundamentals, VR/IR
(10) Operation of Airplane Equipment
(11) Power Changes
(12) Airspeed Changes
(13) Maneuvering at Critically Slow Airspeed
(14) Imminent Stalls - Power On
(15) Imminent Stalls - Power Off
(16) Constant Altitude Turns
(17) Emergency Procedures
(18) Prelanding Check(s)
(19) After Landing Procedures
(20) Collision Avoidance Precautions
(21) Shutdown Procedures

COMMENTS: ____________________________________________

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UNIT 30 OBSERVER

DATE_______ A/C#________

The student will be assigned to a flight that relates to his/her appropriate level in this course.

_________________________________________________________________
UNIT 31 DUAL
DATE_______ A/C#________

REVIEW:
(1) Four Fundamentals, VR/IR
(2) Maneuvering at Critically Slow Airspeed
(3) Constant Altitude Turns
(4) Imminent and Full Stalls - Power On
(5) Imminent and Full Stalls - Power Off

INTRODUCE:
(6) Normal and Crosswind Takeoffs and Climbs
(7) Emergency Approach and Landing (Simulated)
(8) Normal and Crosswind Approaches and Landings
(9) Wake Turbulence Avoidance
(10) System and Equipment Malfunctions
(11) Traffic Pattern Operations

COMMENTS:

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UNIT 32 DUAL
DATE_______ A/C#________

REVIEW:
(1) Traffic Pattern Operations
(2) Normal and Crosswind Takeoffs and Climbs
(3) Normal and Crosswind Approaches and Landings
(4) Equipment Malfunctions

INTRODUCE:
(5) Maximum Performance Takeoffs and Landings
(6) Soft Field Takeoffs and Landings
(7) Forward Slips to Landing
(8) Go-Around From Rejected Landing
(9) Adverse Landing Conditions
(10) Aborted Takeoff

COMMENTS:_____________________________________________________

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30
ATTACH LESSON 8
PINK SLIPS AND EXTRA TRAINING FORMS
HERE
LESSON 9 BASIC IFR CROSS-COUNTRY OPERATIONS

OBJECTIVE: To develop the student's ability to perform IFR cross-country operations within the National Airspace System in a complex aircraft.

STANDARDS: This lesson will be complete when the student has demonstrated his/her ability to plan and perform an IFR cross-country flight within the National Airspace System while maintaining altitudes +/- 100 feet, headings +/- 20 degrees, airspeeds +/- 10 knots, and with no loss of orientation. The student must also adhere to ATC instructions and effectively handle emergency situations. The cross-country flight flown in the airplane must include a landing at an airport at least 50 nautical miles from the point of departure.

UNIT 33 ORAL DATE

DISCUSS:
(1) Preflight Preparation
(2) IFR Cross-Country Planning
(3) Aeronautical Publications
(4) IFR Flight Plans
(5) IFR Flight Logs
(6) Obtaining Weather Information
(7) Low Altitude Enroute and Area Charts
(8) Enroute IFR Procedures
(9) Emergency Procedures

COMMENTS:
UNIT 34  GROUND TRAINER CROSS-COUNTRY  DATE____ A/C#____

REVIEW:
(1) Preflight Preparation
(2) Instrument Cockpit Check
(3) ATC Clearance
(4) Emergency Procedures

INTRODUCE:
(5) IFR Arrival/Departure Procedures
(6) Enroute IFR Procedures
(7) Instrument Approach Procedures

COMMENTS:

The student will be assigned a flight that relates to his/her appropriate level in this course.
UNIT 16  DUAL/PIC  CROSS-COUNTRY  DATE  A/C$

REVIEW:
(1) Preflight Preparation
(2) Instrument Cockpit Check
(3) ATC Clearance
(4) Emergency Procedures
(5) IFR Arrival/Departure Procedures
(6) Enroute IFR Procedures
(7) Instrument Approach Procedures

COMMENTS: ________________________________________________________________

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ATTACH LESSON 9
PINK SLIPS AND EXTRA TRAINING FORMS
HERE
LESSON 10  ADVANCED IFR CROSS-COUNTRY OPERATIONS

OBJECTIVE: To further develop the student's ability to perform IFR cross-country operations within the National Airspace System and to meet the dual IFR cross-country flight requirements of Appendix C, 3 (d) of FAR Part 141.

STANDARDS: This lesson will be complete when the student has safely and accurately flown in simulated or actual instrument conditions, on Federal Airways or as routed by ATC, two IFR cross-country flights. Each flight must include a landing at an airport at least 50 nautical miles from the point of departure, and one flight must cover at least 250 nautical miles and include a VOR, an NDB and an ILS approach at three different airports.

UNIT 37 OBSERVER  DATE  A/C#

The student will be assigned to a flight that relates to his/her appropriate level in this course.

UNIT 38 DUAL/PIC CROSS-COUNTRY  DATE  A/C#

REVIEW:
(1) Preflight Preparation
(2) Instrument Cockpit Check
(3) ATC Clearance
(4) IFR Arrival/Departure Procedures
(5) Enroute IFR Procedures
(6) VOR Approach
(7) NDB Approach
(8) ILS Approach
(9) Emergency Procedures

COMMENTS: _______________________________________________________
______________________________________________________________
______________________________________________________________
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______________________________________________________________

36
### REVIEW:

1. Preflight Preparation
2. Instrument Cockpit Check
3. ATC Clearance
4. IFR Arrival/Departure Procedures
5. Enroute IFR Procedures
6. VOR Approach
7. NDB Approach
8. ILS Approach
9. Emergency Procedures

### COMMENTS:

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ATTACH LESSON 10
PINK SLIPS AND EXTRA TRAINING FORMS
HERE
LESSON 11 INSTRUMENT PILOT OPERATIONS REVIEW

OBJECTIVE: To review and further develop the student's knowledge of and ability to perform all required instrument pilot operations and procedures for the addition of an instrument rating to his/her existing Private Pilot certificate. In addition the student will complete the flight experience requirement specified in FAR 61.65(e)(1).

STANDARDS: This lesson will be complete when the student has demonstrated a working knowledge of all required instrument procedures and pilot operations and can safely and accurately perform them while maintaining at least the minimum standards specified in the FAA Instrument Pilot Practical Test Standards. At the completion of this lesson the student will have logged a total of 125 hours of pilot flight time, of which 50 hours are as PIC in cross-country flight, each flight having a landing at a point more than 50 nautical miles from the point of departure.

UNIT 40 ORAL DATE

DISCUSS:

(1) ATC Clearances
(2) Instrument Departure and Arrival Procedures
(3) Instrument Approach Procedures
(4) FAR's Pertinent to Instrument Flight
(5) Obtaining Weather Information
(6) Cross Country Flight Planning
(7) IFR Emergency Procedures
(8) Instrument/Equipment Malfunctions
(9) Aircraft Flight Instruments and Navigation Equipment
(10) Aircraft Systems Related to IFR Operations

COMMENTS: ____________________________________________
<table>
<thead>
<tr>
<th>UNIT 41 DUAL/PIC CROSS-COUNTRY</th>
<th>DATE</th>
<th>A/C#</th>
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<tr>
<td>REVIEW:</td>
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<tr>
<td>____(1) Preflight Preparation</td>
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<td>____(2) Instrument Cockpit Check</td>
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<td>____(3) ATC Clearances</td>
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<td>____(4) Compliance with Departure, Enroute, and Arrival Procedures and Clearances</td>
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<td>____(5) Holding, FP/PP</td>
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<td>____(6) VOR Approach, FP/PP</td>
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<td>____(7) NDB Approach, FP/PP</td>
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<td>____(8) ILS Approach</td>
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<td>____(9) Circling Approach Procedures</td>
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<td>____(10) Missed Approach Procedures</td>
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<td>____(11) Emergency Procedures</td>
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<td>____(12) Recovery From Unusual Flight Attitudes</td>
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<td>____(13) Timed Turns to Magnetic Compass Headings</td>
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<tr>
<td>____(14) Landing From a Straight-In or Circling Approach</td>
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COMMENTS: __________________________________________________________

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41
UNIT 42 ORAL

REVIEW:
As directed by the instructor, those knowledge areas required to demonstrate competency as an instrument rated pilot.

(1)

(2)

(3)

(4)

(5)

(6)

COMMENTS:

UNIT 43 DUAL/PIC CROSS-COUNTRY

REVIEW:
As directed by the instructor, those pilot tasks required to demonstrate competency as an instrument rated pilot.

(1)

(2)

(3)

(4)

(5)

(6)

COMMENTS:
ATTACH LESSON 11
PINK SLIPS AND EXTRA TRAINING FORMS
HERE
LESSON 12 INSTRUMENT PILOT CERTIFICATION PHASE CHECK

OBJECTIVE: To determine, through an oral examination and flight check that the student has the aeronautical knowledge and skill necessary for the addition of an instrument rating to his/her existing Private Pilot certificate.

STANDARDS: This lesson will be complete when the student has demonstrated the required aeronautical knowledge and skill for each pilot operation contained in the current FAA Instrument Pilot Practical Test Standards.

UNIT 44 ORAL PHASE CHECK

EVALUATE:
(1) Obtaining Weather Information
(2) Cross-Country Flight Planning
(3) Aircraft Systems Related to IFR Operations
(4) Aircraft Flight Instruments and Navigation Equipment

UNIT 45 DUAL/PIC CROSS-COUNTRY PHASE CHECK

EVALUATE:
(1) GROUND OPERATIONS
   a. Instrument Cockpit Check
(2) AIR TRAFFIC CONTROL CLEARANCES AND PROCEDURES
   a. Air Traffic Control Clearances
   b. Compliance with Departure, En-route, and Arrival Procedures
   c. Holding Procedures
(3) FLIGHT BY REFERENCE TO INSTRUMENTS
   a. Straight-and-Level Flight
   b. Change of Airspeed
   c. Constant Airspeed Climbs and Descents
   d. Rate Climbs and Descents
   e. Timed Turns to Magnetic Compass Headings
   f. Steep Turns
   g. Recovery from Unusual Flight Attitudes
(4) NAVIGATION AIDS
   a. Intercepting and Tracking VOR/VORTAC Radials and DME Arcs
   b. Intercepting and Tracking NDB Bearings
(5) INSTRUMENT APPROACH PROCEDURES
   a. VOR/VORTAC Instrument Approach Procedure
   b. NDB Instrument Approach Procedure
   c. ILS Instrument Approach Procedure
   d. Missed Approach Procedure
   e. Circling Approach Procedure
   f. Landing from Straight-In or Circling Approach Procedure
Instructor Standardization

Students

Each instructor will be given no more than six students made up of an experimental group and a control group. The instructor may not receive all six students at the same time. The experimental group will be video taped and the control group will not. There should be no differences in the instruction or the pre and post-briefings with the two groups. The control group may not under any circumstances watch the student as they are video taped or review the tape in any way. The instruction and briefing times should be of the same approximate length.

Grading

Use performance measurement forms for each maneuver on the control and experiment groups. To further the aid the instructor key elements of the maneuver are listed to aid in the grading process. Circle the appropriate outcome of each element. At the bottom of the page, an overall performance grade for the unit will be given to each student. Circle the proper criteria that meets the objective.

Video Camera

The video camera will be used on all simulator flights to record the full activity. If the simulator freeze option is
utilized continue to record the activity. The camera will be placed to the right of the pilot's seat just outside of the simulator. Set up the viewfinder to include the flight instruments and the navigation instruments. The camera can be panned to pick up the radios when deemed appropriate.

Plotter

The plotter must be utilized on all flights to provide the student with visual representation to accompany the video recording. Plotter pens will be given to all instructors.

Debriefing

A debriefing consisting of at least fifteen minutes will be required to cover the weak and strong areas. The strong areas must be brought to the student's attention to instill motivation. At the end of the debriefing, the student will be given the video tape to review at home. In addition, the student will be given a questionnaire to fill out as he/she reviews the tape on their own.

The instructor will mark the tape in some manner to insure the student did indeed review the tape. How the instructor marks the tape is left to the individual instructor.
APPENDIX E

OPERATIONAL GUIDE FOR THE VIDEO CAMERA
Operational Guide for the Video Camera

The majority of operating buttons and switches are located on the top left of the camera. The ON switch is located on the top of the camera on the left side. This switch is moved forward to turn the camera on and then released. The red indicator light on the top of the power switch (ON switch) will illuminate indicating there is power to the camera. There are some buttons located on the left side of the camera which will only have to be checked prior to start. These will usually be set in the auto position for this project. These buttons are the focus and white balance switches.

The camera can be operated by battery power if needed. There is really no need to rely on this as a power source since there are outlets located on the simulator. When setting up the camera, use the power supply. Plug the AC adapter cable into the back of the camera located part way down on the back left side of the camera. Plug the power supply into the six outlet surge protector on the back of the instructor's control panel of the simulator.

To install the Video Cassette, press the eject button on the top left side of the camera. The power does not have to be on at this time, but it is recommended. Insert the cassette into the camera with the window (on the cassette)
facing towards you. Close the cover by pushing gently on it until you hear a click.

To record, turn the power on, if you have not already done so, by moving the switch forward and releasing it. Set the White Balance Mode Selector and the Focus Mode Selector to AUTO. These switches are located on the left side of the camera under the view finder. Press the start/stop button and the recording indication will be displayed in the view finder. The camera will be recording at this time. To visually verify this "rec" will be displayed in the electronic viewfinder (EVF).

At the beginning of session, the tape counter will automatically reset to 0000. To verify this, look inside of the EVF and the counter will be displayed. If it indicates something other than 0000, you can reset it by pressing the counter reset button located just aft of the power switch on the left top side of the camera.

To remove the Video Cassette, press the eject button on the top left side of the camera. Verify that the camera has been stopped prior to ejecting the video tape. The stop button is located on the top left side of the camera. Pull out the cassette, and close the cover by pushing gently on it until it clicks.

At your discretion, you can have the camera rewind the tape of wait until you get to the VCR. The VCR is the recommended method because it is much faster that the
camera. You can start discussing the flight as you are waiting for the tape to rewind. Remember prior to review the tape to reset the counter on the VCR to 0000. This can be accomplished with the remote controller.

The EVF is adjustable, so you can position to suit your needs. The eye piece can be raised to make the EVF is to see from a distance. In most cases, it will be easier to have the eye piece in this position. This way you will not have to get close to the camera to check viewing position or progress.

There is a operational manual available for the video camera, if additional information on the camera is needed. Please advise me if you need to see that document.

During all instructing, the plotter should be used to further add the student in the debrief. Both groups should make use of the plotter. This makes it easier for the student to follow along as the review the tape.
APPENDIX F

PERFORMANCE EVALUATION
Performance Evaluation

Preflight

Unit #: ___________  Name: ___________

Date: __/__/__

Circle One

1. Preflight Preparation  S  U
2. Cockpit Management  S  U
3. ATC Clearance  S  U
4. Instrument/Cockpit Check  S  U

Departure Procedures

1. Instrument Takeoff  Hdg ±____°, A/S ±____Kts.
   Drift:  Left  None  Right
2. IFR Departure Procedures  Hdg ±____°, A/S ±____Kts.
   Complied with ATC:  YES  NO
   Complied with Dep. Proc.:  YES  NO
   Orientation:  Good  Poor  Confused

Enroute Procedures

1. Holding Procedures:
   Entry:  Correct  Incorrect
   Timing:  Correct  Incorrect
   Tracking:  Correct  Incorrect
   Orientation:  Good  Poor  Confused
2. Tracking:  Good  Poor  Erratic
3. Orientation:  Good  Poor  Confused
4. Complied with ATC Clearance:  YES  NO
   Hdg ±____°, A/S ±____Kts, Alt. ±____'

Arrival Procedures

1. Planning for Approach:  Good  Poor  Confused
2. Complied with ATC:  Yes  NO
3. Orientation:  Good  Poor  Confused
4. Approach Procedures:
   Arrival Planning:  Good  Poor  Confused
   Tracking:  Good  Poor  Erratic
   Started Descents:  Early  Late  Unsure
   Complied with Minimums:  Correct  Low  High
5. Missed Approach:
   Complied with ATC:  YES  NO
   Planning:  Good  Poor  Confused
   Hdg ±____°, A/S ±____Kts, Alt. ±____'

Grade

Unsatisfactory  Fair  Good  Excellent

☐  ☐  ☐  ☐