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A Comparative Analysis of Scenario Based Training and Maneuver Based Training in a 14 CFR part 141 Private Pilot Certification Course

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A Comparative Analysis of Scenario Based Training and Maneuver Based Training in a 14 CFR part 141 Private Pilot Certification Course

by

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This thesis, submitted by Jered C. Lease in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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This thesis meets the standards for appearance, conforms to the style and format requirements of the Graduate School of the University of North Dakota, and is hereby approved.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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To my wife Tara and our soon to be born child

ABSTRACT

In order to help combat a recent increase in the number of General Aviation accidents, the Federal Aviation Administration has endorsed a new pilot training curriculum known as FAA/Industry Training Standards. This new training program incorporates Scenario Based Training (SBT) which differs from traditional pilot training, known as Maneuver Based Training (MBT), by utilizing scripted "real world" scenarios to introduce maneuvers and provide pilots in training with more decision making opportunities.

Although variations of SBT have been used extensively in other fields such as the education, law enforcement, and medical industries, there is no definitive research in the aviation field that compares traditional MBT to SBT in a Private Pilot Certification Course. This study seeks to pilot that research.

The study compared two groups of students – one taught using MBT the other SBT – in the Title 14 CFR Part 141 Private Pilot Certification Course on the campus of the University of North Dakota. The mean performance of the two groups was compared in the following areas by using an independent group *t* test: flight, ground and simulator training times, scores on a pilot judgment questionnaire, and basic navigation skills using navigation tracks recorded on the final check-ride. There were no significant differences found in any of the measures.

CHAPTER I

INTRODUCTION

Recent technological advancements in the General Aviation (GA) industry have led to the realization that traditional flight training methods may inadequately prepare pilots for today's complex flight environment. According to Robertson, Petros, and Schumacher (2005), the "previous training philosophy assumed that newly certificated pilots would generally remain in the local area until recently acquired aviation skills are refined;" however, "this is no longer true with the advent of Technically Advanced Aircraft (TAA)" (p. 3).

A 2003 *General Aviation Technically Advanced Aircraft FAA – Industry Safety Study* found the root cause of recent increases in the number of accidents involving pilots operating TAA's to be the overall inadequacies of the traditional GA training system (FAA, 2003). As Tom Glista (2003) – an Aviation Safety Inspector in the Flight Standards' GA and Commercial Division at the Federal Aviation Administration (FAA) – explains:

> A one-size-fits-all training approach best describes the current general aviation training paradigm. The aircraft may be single engine or twin engine, but the technological systems (better known as cockpit instruments) were mostly standardized. However, new developments in technology have changed these generic systems, which in turn change the way pilots need to be trained (p. 1).

The new training philosophy Glista (2003) proposes is known as the FAA/Industry Training Standards or FITS program. FITS is essentially one part of a larger movement by the FAA to help make GA flying safer. It relies on a combination of partnerships between the FAA, academic institutions, and the GA industry to help address the challenges presented to pilots operating in the National Airspace System (NAS) by developing a new training philosophy and subsequent curriculum materials (Robertson et al., 2005). The FITS curriculum differs from traditional GA training – commonly referred to as Maneuver Based Training (MBT) – in that it incorporates Scenario Based Training (SBT), Learner Centered Grading, and Single Pilot Resource Management (SRM).

Statement of Problem

Scenario Based Training (SBT) is the backbone of the FITS program. According to multiple sources which discuss the FITS philosophy and the implementation of its curriculum, SBT incorporates real world scenarios to develop better Aeronautical Decision Making (ADM) and SRM skills in less time while maintaining the same or higher level of basic aircraft control skills (FAA, 2006; Robertson et al., 2005; DOT, 2004; Glista, 2003; FAA, 2003; and Wright, 2002). However, there is no definitive research to support the benefits SBT is expected to afford. In other words, the FAA has incorporated SBT as a major component of its FITS curriculum without adequately examining if SBT is superior to traditional training methods. A Department of Transportation (2004) report found that:

> despite the ubiquity of SBT and the vast amount of research pertaining to its implementation and use, we have not found empirical research demonstrating that SBT is a more effective or efficient means of training. A study showing improved transfer of training, reductions in cost- or improved safety would seem appropriate given the changes and investments necessary to implement a successful SBT program (p. 10).

Purpose of the Study

The purpose of this study is two fold: 1) to add to the area of research that compares the FITS model of SBT against traditional MBT in a Title 14 CFR Part 141

Private Pilot Certification Course and 2) develop a SBT syllabus supplement for the University of North Dakota's AVIT 102 Edition 9 Private Pilot Certification Course (refer to Appendix A) that could be used in the execution of future studies and/or the development of SBT private pilot certification syllabi. This study will seek to compare multiple differences between two groups of student pilots – one taught using SBT the other taught using MBT – completing a private pilot or initial certification course at the University of North Dakota (UND).

The study will compare these two groups of student pilots in the following areas: (a) Aeronautical Decision Making (ADM) skills using a Pilot Judgment Test (PJT) developed by David Hunter (2003) of the FAA; (b) basic navigation (pilotage and dead reckoning) skills using Global Position System (GPS) tracks recorded during the cross-country task of the final stage check; (c) flight, simulator, and ground training times, repeat lessons, and completion rates for each group in each of the three blocks of training that comprise UND's Part 141 Private Pilot Certification Course and for the entire course; (d) performance of the two pilot groups for each task on the three stage checks (or check-rides) that comprise UND's Part 141 Private Pilot Certification Course. The purpose of these comparisons is to add data to the area of SBT research which is currently lacking in the GA industry.

Significance of the Study

The FITS curriculum – and the SBT model it proposes – could have a significant impact on the GA training industry. Although the FITS literature maintains that the focus of its training is for pilots operating light TAAs, it is suggested in multiple sources that the SBT model and similar FITS curriculum could be used to train all GA pilots at all levels regardless of equipment type (Robertson et al., 2006; FAA, 2006; & Craig et al., 2005). However, as previously mentioned, there is no empirical data in the aviation field that evaluates the benefits of SBT as compared to traditional MBT. Therefore, the results of this study could be used to help support or refute the application of SBT to the entire GA training industry.

Also, this study incorporates the use of a SBT private pilot syllabus supplement that could be used as guide in the development of future FITS curriculum involving the initial certification of pilots. As identified in a 2004 Department of Transportation (DOT) report, the literature currently developed by the FITS team fails to provide instructors with complete guidance on how to develop or manage an SBT lesson and whether or not SBT training should be used for all levels of pilot training. The SBT supplement designed for this study could be used to provide guidance, and the results of this study could be used to help determine whether SBT should be used for private pilot certification.

Conceptual Framework

This study will be evaluating SBT based on the FITS model. Therefore, the *Scenario Based Training, Training Module for Inspectors-Version 1.0* developed by Robertson et al. (2005) will serve as a guide for constructing the SBT supplement that will be used by the flight instructor group in this study.

The FITS model of SBT uses the same individual tasks as MBT except it organizes individual tasks into scenarios that are designed to mimic real-life cross-country travel. MBT differs in that it puts an emphasis on the mastery of specific skills or tasks to determine competence and flight ability. In other words, a person involved in traditional flight training or MBT spends hours practicing individual tasks that he or she will have to perform within a pre-determined standard on their check-ride. Robertson et al. (2005) explains, because of this practice and drill approach, “only limited emphasis is placed on decision making, and as a result, when the newly trained pilot goes on to fly in the real-world environment, he or she may be inadequately prepared to make crucial decisions unassisted” (p. 4). Scenario Based Training serves to correct the inadequacies of MBT by presenting the student with more realistic decision making opportunities inside an established scenario.

A 2004 DOT report argues that the FITS description of SBT “may be more accurately described as structured cross-country flight training (SCFT)” (p.13). This term stems from the fact that each flight lesson incorporates “pre-scripted flight plans similar to a typical dual cross-country flight;” therefore, “a name change is in order to reduce confusion and emphasize what is actually being done” (DOT, 2004, p. 13). For the purpose of this study, SBT will mean SCFT or any variation in name thereof. Also, in keeping with the FITS model of SBT, all lessons identified as SBT will be designed in a cross-country format which introduces all new tasks in that particular scenario.

According to Robertson et al. (2005), going from point A to point B on each lesson is simply not enough to satisfy the FITS model of SBT. Instead, flight instructors should incorporate effective questioning of the student in order to spur the development of ADM and SRM skills and guide the student through the decision making process. This use of questioning forces students to focus on the ADM process, and therefore accelerates the acquisition of judgment and decision making skills (Robertson et al., 2005). The FITS model of SBT requires an instructor to lead a flight student all the way through a particular scenario. This is where the FITS’ SBT model differs greatly from the previous incorporation of scenarios in flight training (Robertson et al., 2006).

The previous uses of scenarios in flight training were not really scenarios at all but rather canned responses to specific problems. Robertson et al. (2005) identifies this practice as a stimulus/response learning approach. For example, if the situation is a system malfunction or failure, then the canned response is the completion of the appropriate checklist procedure. At the completion of the "scenario," the instructor acknowledges whether or not the student acted correctly. It is important in the FITS approach to SBT that instructors avoid emphasizing one solution to a problem (Robertson et al., 2005).

Giving only one solution to a problem immediately leads a learner to believe there is only one resolution to all problems which in most circumstances is never the case. Therefore, an instructor should try to have his/her student derive multiple solutions to any problems presented in the scenario and choose what they think is the best action (Robertson et al., 2006). In keeping with the FITS model of SBT, all lessons in this study designated as SBT will incorporate questions that instructors can use as guidance for the effective means of developing ADM and SRM skills.

Definitions

Aviation Information Management System (AIMS). A computerized record keeping system used by UND Aerospace to conduct many functions including the management of student flight records and schedules, instructor certifications and schedules, and aircraft maintenance histories and schedules (UNDAF, 2006).

Block of Training. An area of training within a course syllabus that has its own specific set of lessons and completion standards.

Cross Country. A flight conducted in an aircraft by a person who holds a pilot certificate where a landing is conducted at a point other than the original point of departure during which dead reckoning, pilotage, electronic navigation aids, radio aids, or other navigation systems were used to navigate to the landing point (GPO, 2006).

Dead Reckoning. A navigation technique used to determine position by advancing a previous known position's courses and distances through the use of calculations based on compass heading, speed, effects of wind, and direction from known position (Kumar, DeRemer, & Marshall, 2004).

FAA/Industry Training Standards. A partnership between industry, academia, and the FAA in order to create curriculum materials for TAAs that incorporate SBT and learner centered grading in order to better prepare pilots for operating TAAs in today's national airspace system (FAA, 2006).

Flight Lab. A pre-determined two-and-a-half-hour block-of-time established by the university during which students are suppose to conduct their flight training in order to ensure aircraft availability and help limit local airspace saturation. One instructor is assigned to each flight-lab, and flight labs allow students to pick an instructor and time to train at the same time.

Flight Training Device (FTD). A device that is a full size replica of the instrument, equipment, or set of aircraft, in an open flight deck area or in an enclosed cockpit, including the hardware and software for the systems installed, that is necessary to simulate the aircraft in ground and flight operations (GPO, 2006).

Flight Training Time. The official time logged either solo or with a CFI in an aircraft for the purpose of obtaining a private pilot certificate.

Ground Training Time. The time logged with a CFI other than flight training or simulator time (GPO, 2006).

General Aviation. "All aviation operations, excluding airlines and military. It includes, but is not limited to, business flying, agricultural aviation, personal flying for pleasure or sports, and flying by flight training institutions" (Kumar et al., 2004 p. 308).

Maneuver Based Training (MBT). The flight and ground training that involves the teaching of specific maneuver tasks, traditional GA training method (Robertson et al., 2006).

Pilotage. A method of navigating from point to point with a visual reference to objects on the ground as opposed to navigating by means of electronic navigation aids (Kumar et al., 2004).

Scenario Based Training (SBT). The flight and ground training that uses scripted real world scenarios for the introduction of new material and the construction of each lesson. All flight training is conducted in a cross-country format (FAA, 2006).

Simulator Time. The official time logged in a Flight Training Device (FTD) with a CFI for the purpose of obtaining a private pilot certificate. There are two lessons in UND's Private Pilot Certification Course that utilize the FTD.

Stage Check. A lesson designated in a UND course syllabus where the evaluation of a student is conducted by another randomly appointed instructor who has been trained to evaluate whether or not a student meets the required predetermined standards for a block of training or the entire course.

Student Pilot. A person who holds a student pilot certificate and has five or less hours of previous flight training before their enrollment in UND's Part 141 Private Pilot Certification Course.

Technically Advanced Aircraft (TAA). A general aviation aircraft that has the following features: a GPS with a moving map display, automated systems and engine management, and an integrated autopilot system, see figure 1 (FAA, 2006).

Training Time. The training received from a flight instructor in flight, on the ground, or in a flight simulator or flight training device (GPO, 2006).

Figure 1: Cirrus SR-22 Cockpit, example of a TAA (Glista, 2006)

Assumptions

1. This study makes the assumption that the teaching abilities between the two flight instructor groups – MBT and SBT – is equal and every member of each instructor group conducted their assigned type of training as they were instructed.
2. This study makes the assumption that the teaching abilities and information offered in the two ground school classes are identical.
3. This study makes the assumption that there was no cross-over training between the subjects receiving MBT and SBT. In other words, subjects receiving MBT only received MBT and subjects receiving SBT only received SBT.
4. This study also makes the assumption that all subjects are fully competent and capable of learning the material that was presented to them, and do not have any learning disabilities that would interfere with the findings of this study.

Research Questions

In an effort to evaluate the possible incorporation of the FITS' SBT philosophy into all GA training curriculums, this study will seek to compare SBT versus traditional MBT methods in a Title 14 CFR Part 141 Private Pilot Certification course on the campus of the University of North Dakota. The two groups of student pilots will complete the private pilot training course – one trained using MBT and the other using SBT – in an effort to answer the following research questions:

1) How do the flight and ground training times of student pilots taught using SBT differ from those taught using MBT in UND's Private Pilot Certification Course?

a) How does the flight training time of student pilots taught using SBT differ from those taught using MBT in block one (lessons one through 13) of UND's Private Pilot Certification Course?

b) How does the ground training time of student pilots taught using SBT differ from those taught using MBT in block one (lessons one through 13) of UND's Private Pilot Certification Course?

c) How does the simulator time of student pilots taught using SBT differ from those taught using MBT in block one (lesson one through 13) of UND's Private Pilot Certification Course?

d) How does the flight training time of student pilots taught using SBT differ from those taught using MBT in block two (lessons 15 through 25) of UND's Private Pilot Certification Course?

e) How does the ground training time of student pilots taught using SBT differ from those taught using MBT in block two (lessons 15 through 25) of UND's Private Pilot Certification Course?

f) How does the simulator time of student pilots taught using SBT differ from those taught using MBT in UND's Private Pilot Certification Course?

f) How does the flight training time of student pilots taught using SBT opposed to those taught using MBT in block three (lessons 27 through 29) of UND's Private Pilot Certification Course?

g) How does the ground training time of student pilots taught using SBT differ from those taught using MBT in block three (lessons 27 through 29) of UND's Private Pilot Certification Course?

h) How does the flight training time of student pilots taught using SBT differ from those taught using MBT at the completion of UND's Private Pilot Certification Course?

i) How does the ground training time of student pilots taught using SBT differ from those taught using MBT at the completion of UND's Private Pilot Certification Course?

2) How does the number of repeat lessons for student pilots taught using SBT differ from student pilots taught using MBT in UND's Private Pilot Certification Course?

a) How does the number of repeat lessons for student pilots taught using SBT differ from those taught using MBT in each of the three blocks of UND's Private Pilot Certification Course?

3) How does the number of unsatisfactory tasks for each of the three stage checks attempted by each student pilot taught using SBT differ from those taught using MBT during UND's Private Pilot Certification Course?

4) How do the scores of student pilots taking a Pilot Judgment Test taught using SBT differ from MBT at the completion of UND's Private Pilot Certification Course?

5) How does the amount of time spent at deviation from a desired course differ between student pilots taught using SBT opposed to those taught using MBT during the simulated cross country task of the final stage check (lesson 30) of UND's Private Pilot Certification Course?

Limitations

1. Students involved in SBT will do every lesson in a SBT format except lesson 12 and the three stage checks.[1] This makes for a total of four lessons which traditional training or MBT will be conducted in the SBT group.
2. The FITS model of SBT was designed for a TAA. By definition the aircraft used in the Private Pilot Certification Course at UND are not TAA. However, multiple sources suggest that SBT could be applied in all aircraft types.

Literature Review

The purpose of this literature review is to examine the origins of SBT, identify other studies where SBT has proven to be effective, and examine how SBT can be used to teach Aeronautical Decision Making and Single Pilot Resource Management skills.

Discovery Learning

It is clear that the SBT approach is strongly grounded in educational theory – specifically discovery learning – a major component of the constructivist approach to education (DOT, 2006). Teachers who use this technique have students take an active role in the learning process by creating experiences that allow them to discover the information on their own (Slavin, 2006). Discovery learning has several advantages in that it arouses a student's curiosity and motivates them to continue to work to find an

[1] Lesson 12 is the first solo, UND Policies and Procedures require all initial Student Pilot Solo operations to be conducted at the Grand Forks International Airport on runway 17R-35L for safety purposes. In order to maintain the validity of the UND Stage Check System all stage check operations/destinations are left to the discretion of the individual assigned to administer the stage check

answer to a problem. A major advantage of discovery learning is students learn independent problem-solving and critical thinking skills because they have to analyze and manipulate information (Slavin, 2006). According to Bruner (1966), one of the founders of the discovery learning concept:

> We teach a subject not to produce little living libraries on that subject, but rather to get a student to think…for himself, to consider what matters as an historian does, to take part in the process of knowledge getting. Knowing is a process, not a product (p. 72)

Discovery learning's influence on the FITS model of SBT can be seen by examining the *Scenario Based Training, Training Module for Inspectors – Version 1.0*. The guide informs persons wishing to utilize the FITS model of SBT to let the student determine solutions as much as possible, and to guide them through the process with effective questioning (Robertson et al., 2005).

Problem-Based Learning in the Medical Field

As Silbart (2006) points out, Problem-based learning (PBL) has become a common approach for teaching tomorrow's health professionals. Problem-based learning's origins date back over thirty years when instructors at McMaster University in Canada started to incorporate problems or scenarios based on actual cases into their curriculums in an effort to better prepare medical students for their clinical experiences. Since that time PBL curriculums have been implemented at health training institutions and universities across the world (Problem Based, 2003).

Problem-based learning spawned from the idea that the starting point of learning should be a problem that the learner wishes to solve. It seeks to counteract the idea "that learning is nothing more than the transmission of information from active teacher to passive learner" (Hung, 2002, p. 393). This same concept is rooted in the FAA's (1999) Fundamental's of Instruction which identifies learning as an active process and states that learners must have a purpose in order to learn.

Case Study-Based Instruction

The most common form of PBL in the medical industry is case-based instruction. In this method instructors carefully select several medical cases that coincide with the learning objectives of the course. The intention is "to allow students to learn basic sciences in a manner that integrates science with its clinical applications" (Hemlo, 1995, p. 403). This model of case study-based instruction is not limited to the medical industry.

Robertson et al. (2006) suggests utilizing this method as part of the FITS SBT model of instruction by having students review recent accidents in order to further develop their problem solving skills. The SBT supplement developed for this study utilizes case study-based instruction on two lessons. One lesson involves the introduction of basic attitude instrument flying and asks students to find three accidents on the National Transportation Safety Board (NTSB) website where VFR flight into low visibility or ceilings resulted in an accident. The other lesson introduces the use of performance charts in cross-country planning and requires students to find three accidents on the NTSB website where performance calculations were a factor.

Research Evaluating Problem Based Learning

Hemlo (1995) conducted a study on PBL that compared the case-based instruction method to a traditional lecture based medical curriculum. The study was conducted on the campus of two schools where both forms of instruction were provided. At the completion of their courses students were asked to generate conclusions for one of six medical cases that were randomly assigned. Hemlo (1995) found that the PBL students used hypothesis-driven reasoning more than the traditional students, PBL students made more justified assertions, PBL students were more apt to correctly apply their knowledge to clinical cases over-time, and PBL students were more likely to use science concepts in their responses. At the end of the study, Hemlo (1995) concluded that PBL appeared to have powerful cognitive benefits for learners.

Another study involving PBL was conducted in the Netherlands in the spring and fall semesters of 2000 to evaluate whether or not PBL led to deficiencies in basic science knowledge (Prince et al., 2003). The study sampled 424 four-year students from all eight medical schools in the country. Three of those schools used the traditional lecture curriculum, one had a fully integrated PBL program (since 1970), and the others were currently converting their curriculum to incorporate PBL. All participants were asked to take a survey which measured their perceived knowledge of anatomy and a test which measured their actual knowledge. The researchers found that students at PBL schools have the same perceived level of anatomy knowledge as students at non-PBL schools and that no difference in actual knowledge of anatomy existed between students at PBL and non-PBL schools. Therefore, the study concluded that PBL does not result in a lower level of anatomy knowledge than traditional curriculums (Prince et al., 2003).

SBT in Law Enforcement

A form of SBT is beginning to emerge as a more effective way of training law enforcement officers. The first class of Federal Bureau of Investigation (FBI) agents trained using an integrated case scenario graduated in February of 1998 (Whitcomb, 1999). The FBI began transitioning to a scenario based curriculum under the guidance of Academy Director Joseph Wolfinger shortly after his appointment to that position in the fall of 1996. Wolfinger realized that officers graduating from the sixteen week course had all the necessary skills but lacked the ability to apply those skills to the actual cases they would encounter on the job (Whitcomb, 1999).

At the time, scenario based training was not new to the FBI, but unlike the current model used at the academy today – which utilizes one integrated case with vivid sets, lighting, props and characters that contribute to the realism of the training experience – scenarios were limited to specific objectives of the course (Whitcomb, 1996).

The old state of affairs at the FBI is similar to the current condition of instructional techniques used in GA. Robertson et al. (2006) explains that scenarios incorporated by instructors today are often limited to teaching very specific emergency situations. The FITS model of SBT differs by incorporating one scenario which flight instructors incorporate throughout the entire flight in order to emphasize how each task contributes to the overall mission of completing the scenario that requires the student to travel from point A to point B.

The SBT model of instruction utilized at the FBI has begun to find its way into other law enforcement training curriculums across the country. The process for developing such a program is described by Sergeant Michael Lynch (2005) who is the curriculum coordinator and an instructor at the West Virginia State Police Academy. In order to develop such a training program, Lynch (2005) recommends starting at the course objectives. "Defining training objectives at the beginning actually will lay the foundation of a scenario-based training program" (Lynch, 2005 p. 3).

Lynch (2005) also highlights the importance of safety. Like aviation, officer training can be dangerous; therefore, special consideration should be given to this particular area in course development. During the development of the scenarios for the SBT supplement used in this study, safety was at the forefront. For example, the introduction of a power off stall – a maneuver that requires a pilot to slow an aircraft to a point where the wing fails to provide enough lift to support the aircraft – under the SBT model of FITS might be construed as introducing the maneuver on final approach at a low altitude. This practice would be inherently unsafe; therefore, the SBT supplement calls for the introduction of this maneuver in a simulated approach and landing format at an altitude where a safe recovery is assured.

The law-enforcement model of SBT, as explained by Lynch (2005), relies heavily upon the realism of a scenario. Characters in the scenario dress-up and take on personas that would be equivalent to an actor in a Hollywood movie. Lighting, elaborate sets, and props are incorporated to add to the realism. Therefore, the impact of transition to the real world of law enforcement is minimized on trainees (Lynch, 2005). This component of SBT in law enforcement is similar to the FITS model of SBT, which requires flight instructors to keep experiences as real as possible (Robertson et al., 2006).

A survey of United States Probation and Pretrial Officers highlighted the benefits of SBT. The survey found that respondents who had received scenario training were three times more likely than respondents who had not to rate their training as excellent. Also, respondents who received SBT were over 20 percent more likely than the respondents who had not to indicate they were satisfied with their district's training and practices (Lowry, 2000).

Scenario Based Training in Aviation

It should be clear that the concept of SBT is not new; it has been applied in several industries for many years. In fact, SBT is not new to aviation. Models of SBT have been applied in other genres of aviation for several years – specifically military and commercial aviation (Fowlkes et al., 1998). This section will seek to examine the models of SBT in the three genres of aviation – military, commercial, and general aviation – and some of the recent research that has been completed on the FITS model of SBT.

Military Aviation

Although the exact origins of the modern approach to SBT in aviation are obscure, the concepts most likely stem from the Navy's response to low kill ratios in air-to-air engagements in Southeast Asia in the mid-fifties (DOT, 2004). In an effort to increase pilots' air combat maneuvering and weapons systems employment ability, the United States Navy created a graduate level flight school where students went up against instructors in a series of simulated combat scenarios. The military adage "train like you fight, fight like you train," has since spread to the rest of the military, thus making SBT a major component of any military complex systems training program (DOT, 2004, p. 9).

Since SBT is the adopted form of training for the military, the majority of literature produced in this genre of aviation involves the explanation of scenario development and the use of simulation devices. Fowlkes, Dwyer, Oser, and Salas (1998) of the Naval Air Warfare Center Training Systems Division explain how scenarios should be developed when taking an SBT or Event-Based Approach to Training (EBAT). "Event-based techniques do not depend upon the chance interactions among trainees and other elements of the scenario for training; rather, they create the requirement to act" (Fowlkes et al., 1998 p. 211). In other words, the scenarios should be designed in such a way that requires trainees to respond with a solution. This requirement is similar to the explanation of the FITS model of SBT by Robertson et al. (2006) which was used to develop the SBT supplement for this study.

Scenarios should also be very specific, organized, and controlled in order to adequately satisfy the requirements of the training objectives (Fowlkes et. al, 1998). This requirement was given due consideration in the development of the scenarios in this study. Each scenario for every lesson in the SBT supplement provides the instructor with a detailed explanation of the incorporation of that scenario in a manner that would satisfy the requirements of the completion standards listed in UND's Title 14 CFR part 141 approved Private Pilot Certification Course.

Randall Oser (1999) of the Naval Air Warfare Center Training Systems Division warn that although SBT has been demonstrated to be an effective means of teaching, the introduction of scenarios alone will not guarantee learning. "Careful design and planning of how the simulations are to be used are two essential characteristics that are necessary to maximize the effectiveness of training" (Oser, 1999).

Commercial Aviation

The most common form of SBT in commercial aviation training is Line-Orientated Flight Training (LOFT). This type of training was first implemented by Northwest Airlines in 1975 in an effort to enhance Crew Resource Management (CRM) (Taylor & Emanuel, 2000). Before that time, it was commonly accepted that a pilot's individual skills was the greatest determination of their ability to perform their duties. However, a close examination of 20-years worth of air carrier data revealed that at least 65% of accidents and incidents "were due to inadequate leadership qualities, communication skills, crew coordination, and decision making" (Taylor & Emanuel, 2000 p. 29). Thus, the concepts of CRM and LOFT were created.

Line-orientated flight training provides aircrews with the opportunity to practice and develop their CRM skills in a simulated and controlled flight training environment (Taylor & Emanuel, 2000). Like the FITS model of SBT, LOFT calls for the use of scenarios that simulate real-world operations. Taylor and Emanuel (2000) explain that a LOFT scenario should not be designed to overload the crew but rather to present a realistic scenario that allows for completion. This concept is rooted into the FITS model of SBT and the supplement designed for this study.

Since LOFT's focus is on the development of CRM skills or the interaction of individuals in a crew environment, its direct application to the FITS model of SBT – which focuses on the development of SRM skills – and this study is somewhat limited. However, many of the underlying concepts in LOFT are rooted in the FITS model of SBT, and it should be noted that U.S. Airlines operating under Title 14 CFR Part 121 have one of the lowest accident rates of any genre of aviation.

For the year 2005, the National Transportation Safety Board (2006) recorded only 32 accidents and 20 fatalities for Part 121 scheduled airline carriers. In the same year, general aviation operators experienced 1,669 accidents which resulted in 321 fatalities. The accident rate per 100,000 flight hours for U.S. scheduled airline carriers was 0.171 in 2005, while the rate of general aviation accidents increased from the pervious year to 6.83 per 100,000 flight hours (NTSB 2006). However, these statistics alone are not enough to support the application of SBT or LOFT concepts to the entire GA training industry because of the vast differences in pilot experience and operating rules that exist between the two genres.

General Aviation

As Robertson et al. (2006) explains, the traditional training method used in the industry today is known as Maneuver Based Training (MBT). Although the FAA has done its best to facilitate the incorporation of SBT with its FITS program, SBT is still relatively new to GA, and the transition to SBT is expected to be a long one.

Dr. Paul Craig – one of the first advocates for SBT in GA –discusses the use of SBT to teach decision making in student pilots in his book *Pilot in Command*. Craig (2000) explains that initial pilot training, the type conducted in this study, relies on the building blocks method. In other words, "a simpler skill is taught so that it can be used to facilitate the learning of a more complex skill" (Craig, 2000 p. 101). Refer to figure 2 for the building blocks of training for a private pilot course as identified by Craig (2000). According to Craig (2000), the traditional training method allows a person to advance to the next block of training once they can manipulate the aircraft to particular skill level. However, this method of training fails to prepare someone to be a safe and effective pilot in command. As Craig (2000) explains:

> We need a new method that will keep the best from the past but incorporate what teaches people to be decision makers not just manipulators…The real-world offers the pilot an unlimited number of decision circumstances where decisions are required and let them practice making them. This real-world element can be injected into any flight training situation if the student and instructor use a little creativity (p. 102).

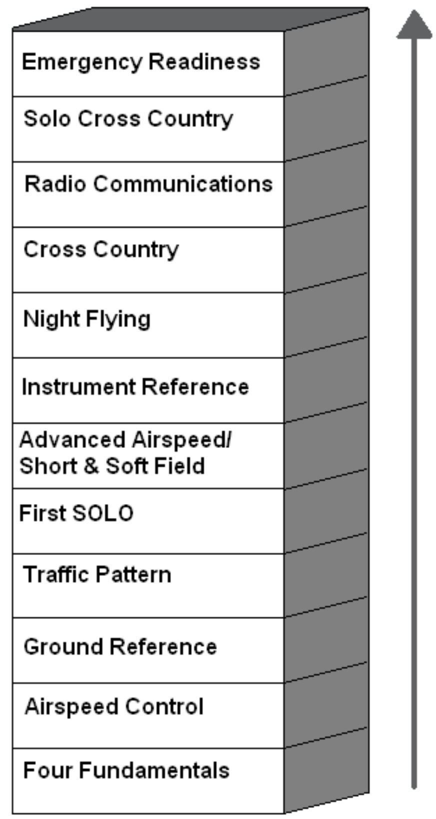

Figure 2: Building Blocks of Private Pilot Training (Craig, 2000)

The suggestions Craig (2000) makes for the incorporation of scenarios in a private pilot training curriculum are similar to the scenarios in the SBT supplement produced for this study. Craig (2000) stresses the importance of introducing maneuvers where they will actually occur in the flight environment in order to give the student pilot an understanding of the decisions that would lead to the use of that maneuver in the real-world. This SBT model he proposes is identical to the model that is incorporated into the FITS philosophy and this study.

Craig et al. (2006) and his team are in the process of evaluating the FITS model of SBT in the SATS Aerospace Flight Education Research (SAFER) project currently taking place in Middle Tennessee State University's (MTSU) Aviation Program . The research project is one component of NASA's Small Aircraft Transportation System (SATS) initiative which proposes and analyzes the feasibility of a future air transportation environment that would use a series of small TAA type aircraft and underutilized airports to move people and cargo from point to point. The SAFER project at MTSU is training two groups of students – one group which started in September 2004 and the second group which started in January of 2005 – in a combined private and instrument FITS endorsed syllabus. The students involved in the program had to meet the following criteria in order to participate: acceptance into MTSU's aerospace training program and less than five hours of previous flight training experience. The SAFER project subjects are training in a TAA - the Diamond DA 40 aircraft equipped with a Garmin G-1000 glass cockpit (Craig et. al, 2006).

Craig et al. (2006) and his team completed a preliminary descriptive analysis of the advantages of SBT utilizing nine of the 14 students which made up the first group of students in the SAFER project with a qualitative design. After receiving their private pilot's license with an instrument rating, the SAFER students' flight skills were compared against the skills of a set of traditionally trained students on a cross country flight scenario. The flight scenario addressed a number of real-world issues "that include changing destinations and clearances, failed equipment, stick and rudder skills, and maintaining safe attitudes while engaged in a number of distracting activities" (Craig et al., 2006, p. 19). The preliminary results of this study only addressed stick and rudder skills and found those skills of the SAFER students were as good as or better than traditionally trained students. The study concluded:

> the evidence at this point tends to support the claim that all the time and money spent on formal maneuver training in traditional syllabi appears to

> be immaterial when applied to scenario training in TAA (Craig et. al, 2006 p. 21).

An obvious limitation of these findings is that the number of subjects involved is drastically limited and the conclusions being made are generalized to a potentially large population of pilots. Also, a qualitative design for this type of research may be inadequate in that it fails to objectively measure how the skills of the two groups of students varied.

Craig et al. (2005) and his team also conducted a preliminary descriptive analysis on the training times of the first group of SAFER project students. The team compared the number of bottlenecks or areas of training that require a student to receive additional training to master that component of flight between the SAFER students and traditionally trained students. The bottlenecks of the SAFER students in the combined FITS private and instrument syllabus were compared to the bottlenecks of traditionally trained students in the Jeppesen Private Pilot and Jeppesen Instrument and Commercial Syllabi which have a lot of commonality in the GA training industry.

The study found that SAFER students have more bottlenecks or repeated lessons in the pre-solo phase than do traditional or MBT students. However, SAFER students have a reduction in the number of bottlenecks in the rest of their training while traditional students continue to have setbacks. Craig et al. (2005) and his research team concluded the number of bottlenecks in the pre-solo phase of flight training for the SAFER students was due to the additional number of tasks taught during this phase. Unlike a traditional private pilot syllabus, "SAFER students are being taught cross-country flight planning, navigation, and instrument flight principles all before the first solo" (Craig et al., 2005 p. 121). However, the SAFER students reap the benefits of this delay in later lessons where they only experience 0.76 setbacks per student between solo and the SAFER stage 2 –

which is essentially the cross country phase in the traditional syllabus. During this phase the traditionally trained students experienced an average of 9.73 bottlenecks. SAFER students finished the combined FITS syllabus in an average of 88.66 flight hours while the traditionally trained students complete the same training in 134.3 flight hours. Craig et al. (2005) and his team point out that this difference is approximately 45 hours which equates to a flight training savings of more than $6000 dollars. However, Craig et al. (2005) recognizes that the number of subjects compared in the study is drastically limited and the conclusions being made are thereby not definitive. Therefore, one of the study's recommendations was for more research in this particular area (Craig et al. 2005).

Although MTSU's SAFER project's preliminary analysis seeks to identify the difference between training times of SBT versus MBT, it only does so indirectly. It appears that SBT takes less time than MBT by examining the results of the study. However, the subjects involved in the study were trained in two completely different syllabi, so it appears impossible to make any direct comparisons. The study described in this paper serves to add to this area of research and correct the inadequacies of the MTSU SAFER project's study by requiring subjects to accomplish the same material on each lesson whether or not they are SBT or MBT students – thereby making a direct comparison between the two methods of training possible.

Two other recently completed studies were done in laboratory type conditions by researchers at Embry-Riddle Aeronautical University (ERAU) and UND in order to validate the effectiveness of FITS in TAA transition training.

The first study was published by Jon French et al. (2005) of ERAU. The study utilized a population of pilots from the University who were instrument current, had less than 500 total flight hours, and had little or no previous flight experience in a glass cockpit. Two groups of 15 subjects were given eight hours of training using either MBT or SBT, while a third group of 12 subjects received no training at all. Due to a problem with the test equipment, the subjects who received no training at all were left out of the data analysis. The MBT and SBT subjects involved in the study were given a total of eight hours of training by one of three FAA certified instrument instructors from ERAU's flight program. The three certificated instrument flight instructors used for the study had little or no previous training experience in a TAA or glass cockpit. These instructors were trained in a classroom setting by subject matter experts before they began subject training. After training all MBT subjects, the three "instructors quickly learned SBT training," in order to reduce or eliminate any differences created by instructor quality (French et al., 2005 p. 13).

The performances of the MBT and SBT subjects were compared in a pretest and posttest design utilizing a flight training device with standardized raters who evaluated subjects flying one of two similar prefabricated scenarios with the following eight phases of flight similarity: flight planning, pre-flight preparation, pre-take-off, take-off and departure, re-route, en-route, approach, and missed approach. Subjects were evaluated by one of two standardized raters who were kept experimentally blind to the fact whether or not a subject received SBT or MBT. Both raters evaluated the same five participants near the beginning of the experiment in order to determine inter rater agreement. "This check on inter rater agreement established 100% compatibility" (French et al., 2005 p. 15).

French et al. (2005) and his research team found that subjects trained using SBT performed better in the following areas than the MBT subjects: autopilot use, pre-flight preparation, re-route, approach, and missed approach. The two groups of subjects showed no significant difference in abilities in the following areas: GPS use, takeoff and departure MFD use, flight planning, pre-take-off, en-route, and video tape analysis (French et. al, 2005).

The second study was led by Charles Robertson et al. (2006) of UND Aerospace. This study evaluated three groups of subjects – one trained using the FITS model of SBT, another MBT, and the third self study – in a pre/posttest design in order to determine the effectiveness of each type of training when transitioning from a traditional steam gauge cockpit to a new TAA or glass cockpit. Thirty-three subjects with little or no previous glass cockpit experience were recruited for the study from the University's undergraduate aviation program. After being randomly assigned to one of the three groups, subjects in the MBT and SBT group received approximately ten hours of flight instruction in an Advanced Training Device (ATD) – which simulated a Cirrus SR22 glass cockpit – from one of six flight instructors. The MBT instructors utilized in the study were trained in Cirrus aircraft systems by the lead instructor for extension programs at UND using traditional training methods or MBT. The SBT instructors were trained at the Cirrus Design factory training facility in Duluth, MN in a FITS approved syllabus (Robertson et al., 2005).

The experimental or SBT subject group's training utilized a five lesson FITS approved Cirrus SR22 syllabus that placed an emphasis on ADM and SRM skills with specific considerations given to resource, risk, automation, and information management. The MBT subject group was trained using a pre-FITS five lesson Cirrus SR22 syllabus, which relied on oral quizzing of factual information during ground briefings and traditional flight training in the ATD. The control or self-study group was provided with a CD-ROM and aircraft manual materials that they were required to review, and up to ten hours of access to the ATD during which they were allowed ask an assigned instructor specific questions on aeronautical knowledge and aircraft systems (Robertson et al., 2005).

Before training began, each subject was asked to fly one of two similar instrument flight scenarios in the ATD – configured to simulate a traditional cockpit – during which deviations of altitude, airspeed, and heading were recorded by the device. During this flight, blind observers also recorded subject responses to radio calls and flight situations in order to determine pilot performance and ADM skills. In order to determine situational awareness, the blind observers would periodically freeze the ATD and ask a subject a series of questions about aircraft position. In addition to the flight test, subjects were asked to complete the following three measures: Wechsler Adult Intelligence Scale III – vocabulary subtest, Mental Rotation Test, and Higher Order Thinking Awareness Test. The pretest results of the study found no differences between the three subject groups (Robertson et al., 2005). After a subject's training was completed they were asked to conduct the posttest.

The post test consisted of having a subject fly the second instrument flight scenario, during which the ATD again recorded deviations in altitude, airspeed, and heading. During the flight, blind observers recorded subject responses to radio calls and flight situations. Like the pretest flight, the observers would periodically freeze the ATD and ask the subjects questions about aircraft position in order to determine situational awareness (Robertson et al., 2005).

The posttest results of the study showed significant improvement in pilot performance and ADM in the SBT group "when difficult situations and challenges were interjected during the flight" (Robertson et. al, 2006 p. 60). SBT subjects showed significant differences from the other subject groups in the following areas: percentage of correct responses to flight clearances, situational awareness, higher order thinking skill awareness, and in ADM in percentage of good judgments. A severe limitation identified by the study was the limited sample size which prevented the findings from being generalized to the large population of active pilots. At the conclusion of the study Robertson et al. (2006) and his team recommended that the FITS model of SBT used in the study be tested in other non-TAA training programs in order to facilitate its adoption as a standardized method of training.

The research proposed by this paper addresses Robertson's recommendation by comparing MBT and SBT in a Part 141 Private Pilot training program on the campus of the UND. The Piper Warrior III aircraft used for this study are by definition non-TAA, and it involves a sample of subjects with very limited previous flight training experience.

The last study addressed in this literature review was the result of a thesis designed and implemented by Shayna Strally (2005), a graduate student at ERAU. Strally's (2005) research evaluated the teaching of Single Pilot Resource Management (SRM) as it relates to the use of emergency parachutes that are designed into new production aircraft, such as the Cirrus SR20 and SR22.

Thirty-six subjects recruited from the University's pilot population were randomly assigned to either a SBT or traditional training group. The SBT group's training consisted of in depth discussions and four scenario flights in a simulation device during which subjects had to make time critical decisions about parachute deployment. At the end of each flight scenario, SBT subjects received feedback from a flight instructor based on the previous assessment of how a pilot should act in particular scenario by subject matter experts (SME). The traditional training group received information about how to use the parachute and some possible situations during which its use might be warranted. According to Strally (2005), this is equivalent to the industry standard of training today. Subjects in the traditional group were allowed to practice the deployment procedure in a computer based simulation as well as the simulation device. In addition to this, the subjects in the group flew the same scenarios in the simulation device as the SBT group, but without emergency events and instructor feedback. Total training time for both groups was about three hours (Strally, 2005).

Two SMEs blind to the condition evaluated each subject in the simulation device in a pre and posttest scenario flight. The SMEs looked for and rated subject behaviors and actions on a five point Likert scale. A score of five represented a very appropriate behavior, a score of three represented a somewhat inappropriate behavior, and a score of one represented a completely inappropriate behavior. “For example, if the appropriate behavior was pulling the parachute, a participant received a five if he or she uses the correct procedure to release the parachute” (Strally, 2005 p. 37). In the posttest flight scenario, each performance measure was repeated at least twice in order to enhance assessment reliability. In addition to this, SMEs would meet and discuss their independent ratings to come up with one score for each subject after each flight scenario. Strally (2005) found SBT to be more effective than traditional training in ten of the 16 performance measures, supporting the conclusion that SBT is a more effective means of training.

In conclusion, the study proposed by this paper differs from previous research on the FITS model of SBT by directly comparing MBT and SBT in a private pilot certification course. Unlike the study done at MTSU, which was described previously, this study will allow for a direct comparison of flight and ground training times between MBT and SBT subjects, because the material covered on each lesson by every subject will be the same. Title 14 CFR part 141 requires the subject matter on each lesson in an approved syllabus to be completed to the standards prescribed for that lesson in that syllabus. Because the proposed research will take place in UND’s AVIT 102 edition 9 Title 14 CFR Part 141 approved syllabus the lesson content experienced by SBT and MBT subjects is required by law to be the same. This makes a direct comparison of flight and ground training times of the two training methods possible.

Also, this is the first study to evaluate SBT against MBT in a Private Pilot or initial pilot certification curriculum. The previous research in GA compared SBT’s effectiveness to traditional training methods in a combined private and instrument syllabus, in transition training from steam gauge to glass cockpit, and in decision making and proper use of an aircraft parachute deployment system. Therefore, the results of this study could be used to help support or refute SBT’s future application to this particular level of pilot training.

CHAPTER II

METHODOLOGY

This study seeks to add research in the aviation field that compares the FITS model of SBT to the traditional model of MBT. The study recruited subjects from the University of North Dakota's Title 14 CFR Part 141 approved Private Pilot Certification Course. Subjects were assigned to either a traditional MBT group – which used the University's Edition 9 Aviation 102 Title 14 CFR Part 141 approved syllabus – or the FITS SBT group – which used a syllabus supplement (see appendix A) developed by the research team in addition to the approved syllabus. Therefore, the content of each lesson remained the same whether a subject was assigned to the experimental or SBT group or the control or MBT group. The only difference was the manner in which maneuvers were introduced and practiced.

Population

Since it is the eventual desire of the FAA and many industry professionals to apply the principles of FITS, and therefore SBT, to the entire GA training industry, the targeted population of this study could include the nearly 610,000 individuals who hold civil airman certificates in the United States (FAA, 2006).

On the other hand, this study will only examined the use of SBT in a Private Pilot Certification Course, therefore a more limited and realistic population could be 87,213 active student pilots and the over 90,000 instructors who are qualified to teach them. This equates to a total target population of 177,768 individuals (FAA, 2006).

However, since the sample sizes were limited, and the study involved the implementation of SBT in the University of North Dakota's Private Pilot Certification Course, the proposed target population for this study was limited to the approximately 300 students that enroll each year in University's AVIT 102 Part 141 Private Pilot Certification Course offered through the John D. Odegard School of Aerospace Sciences (D. Thureen, personal communication, June 15 2006).

Sample

The sample for this study is a convenience sample. Thirty subjects – 16 in the MBT group and 14 in the SBT group – were recruited from the John D. Odegard School of Aerospace Sciences AVIT 102 14 CFR part 141 Private Pilot Certification Course. The participants' ages ranged from 18 years to 26 years old. Individuals who participated in the study were given an extra-credit incentive in the ground school portion of their course. Anyone starting flight training in the AVIT 102 course during the nine week summer session which this study took place was able to participate, but individuals with less than five hours of previous flight training experience were preferred.

The five hour limitation was adopted from the SAFER project at MTSU in order to maintain consistency in this area of research (Craig et al., 2005). In addition to this, previous training experience has shown to be one of the best predictors of pilot performance (Martinussen, 1996). Therefore without the five hour limitation, previous training experience could skew the results of this study.

A total of 27 individuals met the (less than five flight hour) operational definition of student pilot for this study. The one individual who did not meet this requirement in the SBT group had 36 logged hours, while the other two individuals in the MBT group had 20 and 17 hours respectively.

Design

This study incorporated an independent groups design to compare the FITS model of SBT against the traditional model of GA flight training, known as MBT. The study utilized individuals enrolled in the summer session of the University of North Dakota's John D. Odegard School of Aerospace Sciences Title 14 CFR part 141 approved Private Pilot Certification Course. Subjects completed training in either a MBT or SBT format depending upon the flight lab they choose prior to flight training. At the completions of all the subjects' flight training, the mean performance of the two groups was compared in the following areas: (a) flight, simulator, and ground training times, (b) number of repeat lessons, (c) task performance on the three stage checks, (d) scores on a Pilot Judgment Test (PJT) developed by Hunter (2003) of the FAA, and (e) GPS tracks recorded on the cross-country task of their final stage check.

Assignment of Subjects

Because this study could not interfere with the University's normal enrollment process, assignment of the subjects to either group was determined by subjects' individual flight lab time choices. Before the recruitment of subjects began, the flight labs that were to be made available for student selection were separated into a maneuver or a scenario group based on flight lab launch time and instructor. The goal of the flight lab partition was twofold: 1) to have an equal of distribution of MBT and SBT flight labs throughout the day, and, 2) to have two groups of instructors who would either teach SBT or MBT in order to eliminate any confusion caused by conducting more than one type of training. The distribution of the flight labs was essential to the study in order to make sure any differences were not due to confounding variables to include but not limited to: traffic density, general weather patterns, or ground school classes.

During the first three weeks of classes, subjects involved in the study were required to complete a brief survey that determined previous flight experience (see Appendix B for a copy of survey) and two tests which would help determine the equality of groups during data analysis. The first test was the Vandenberg Test of Mental Rotation which required subjects to match three dimensional depictions of different figures on a sheet of paper (Vandenberg & Kuse, 1978). Subjects were given three minutes to complete two problem sets of twelve. Each problem set presents a subject with a figure and four choices, and asks them to find two of the four figures that are the original figure from a different or rotated viewpoint. Subjects received a score of 0, 1, or 2 on each problem set depending upon which figures they selected.

The second test was the vocabulary subtest of the Weschler Adult Intelligence Scale-Revised (WAIS-R) developed by Weschler (1981). This test presented subjects with 35 words which they were asked to verbally define. Subjects' definition of each word was recorded by a member of the research team. Depending upon the accuracy of their response, subjects received a score of 0, 1, or 2.

Traffic Density as a Confounding Variable

Grand Forks International Airport is one of the 50th busiest air traffic control towers in the country with over 244,000 operations for 2005 (FAA, 2006). Like all busy airports, the amount of traffic varies with time of day and when the airspace becomes saturated this causes delays. Students and instructors with mid-day launches can often spend upwards of fifteen minutes waiting for departure. Therefore, if the SBT and MBT flight labs were not equally distributed throughout the day, the findings of this study would possibly be skewed.

Weather as a Confounding Variable

Typical weather patterns in the Grand Forks area can also have a significant impact on repeat lessons and lesson times depending upon the choice of launch time. The typical weather pattern for Grand Forks in the summer consists of generally calmer cooler weather in the morning followed by heating throughout the day which leads to higher winds and more turbulent air into the afternoon and early evening hours. Convective activity or thunderstorms usually occur in the late afternoon and early evening hours. This type of weather pattern means afternoon and evening launches could be cut-short due to inclement weather, thereby affecting the results of the study. However, the impact of weather was reduced or virtually eliminated by distributing the flight labs equally throughout the day.

Ground School as a Confounding Variable

Students involved in flight training at the University take a five credit academic or ground school class titled Introduction to Aviation, in conjunction with their flight lab. Two such classes – an early morning and mid-afternoon class – were offered during the nine week summer session in which this study will take place. To de-emphasize the impact of the assumption that the teaching ability and lesson content of the two ground school classes were the same, it was necessary to get an equal sample of students from both ground school classes. This was achieved by distributing the MBT and SBT flight labs equally throughout the day, because students are unable to fly during their ground school class times. Therefore students in the early morning class were more likely to choose an afternoon flight lab or visa versa, and since their choices of SBT and MBT flight labs were equivalent the study was more likely to get an equal distribution of SBT and MBT student pilots from each ground school class.

The early morning class ended up with five subjects involved in SBT and eight subjects involved in MBT. The afternoon class contained ten subjects involved in SBT and seven subjects involved in MBT.

Management of Instructor Groups

This study utilized line instructors from the John D. Odegard School of Aerospace Sciences flight operations department. The instructors that were assigned to flight labs reserved for students enrolling in the AVIT 102 Private Pilot Certification Course were divided into two groups: a MBT group consisting of 18 instructors and a SBT group consisting of 15 instructors. The division of instructors was based on lab times for the reasons stated in the previous section.

Each instructor group received a one-hour training session that was designed to help define and explain the methodologies of each type of training. The SBT instructor group's training session consisted of explaining the industries incorporation of FITS, basic study design, the FITS mentality of SBT, and detailed explanations and examples of how to incorporate the training supplement into their daily teaching activities. The MBT instructor group's training session explained the industries transition towards FITS, basic study design, SBT versus MBT, and the importance of continuing with a maneuver based training format with their students during this study. During the time of this study, the training provided at UND was maneuver based. Therefore, the transition or impact on the training style of the MBT instructor group is believed to be less than the one on the SBT instructor group. Therefore, no additional supplement or materials were developed to be used by the MBT instructor group.

For the purpose of maintaining the internal validity of the study, instructors in each group were prohibited from allowing instructors outside of their associated groups to provide training to their students. A common practice amongst the over two-hundred members that encompass the flight instructor group at the University is to temporarily transfer or cover students with another instructor when situations conflict with their own availability. Therefore a website, email, and phone list was developed in order to better accommodate both instructor groups taking part in this study.

AVIT 102 SBT Study Supplement

The SBT supplement utilized by the SBT flight instructor group was developed by the research team prior to the start of the study. See Appendix A for a copy of the supplement. The supplement was necessary for two reasons: 1) to help facilitate SBT instructors' transition to what is a new type of training for them, and, 2) to convert the maneuver based Title 14 CFR part 141 approved AVIT 102 edition 9 syllabus into a scenario format. Because this study is conducted in a Title 14 CFR Part 141 approved training program with an approved syllabus, the syllabus supplement had to contain the same content on each lesson as the original syllabus – a requirement by the regulations that govern the operation of UND's flight training program.[2] Also, the supplement could not serve as a primary guide, but instead, had to work in addition to edition 9 of the AVIT 102 approved syllabus. Therefore, the supplement made reference to the original edition 9 syllabus for maneuvers or material which was previously introduced on each lesson.

The *Scenario Based Training, Training Module for Inspectors - Version 1.0* developed by Robertson et al. (2005) served as a guide in the development of the supplement used in this study. Dr. Charlie Robertson, Dr. Thomas Petros, and Professor Peter Schumacher of the University of North Dakota all personally provided guidance during the construction of the SBT syllabus supplement used in this study. In addition to

[2] This regulatory requirement ensures that the lesson content in each subject group is the same and allows for a direct comparison of flight and ground training times between SBT and MBT subjects.

this, the supplement was reviewed by Tom Glista – manager of the FITS program at the FAA – who identified it as meeting the FITS model of SBT.

Every lesson – excluding the three stage checks and lesson 12, the first solo – had a developed scenario which incorporated the same material as the approved Edition 9 Title 14 CFR Part 141 Private Pilot Certification syllabus used in the University's flight training program. These lessons in the SBT supplement have a scenario with suggested destinations[3] in addition to a detailed step-by-step explanation on how to incorporate the required maneuvers into the scenario. The syllabus is designed in such a way as to always provide students with a mission or goal, which requires them on each lesson to land at another airport, and to always introduce new maneuvers in a realistic context. Since subjects involved in the training will be evaluated as per the existing maneuver based Practical Test Standards (PTS) established by the FAA, the syllabus supplement allows for the drill and practice of previously introduced maneuvers in order to prepare them for the three stage checks or checkrides that comprise the course.

Data Collection Methods/Procedures

This study incorporated an independent groups design that compared 30 subjects in two groups – MBT and SBT – in a Title 14 CFR Part 141 Private Pilot Certification Course at the University of North Dakota. The purpose of the study was to evaluate the differences between SBT and traditional MBT in the following areas: (a) ground, simulator, and flight training times, (b) repeat lessons, (c) performance on stage checks, (d) scores on a PJT, and (e) GPS tracks recorded on the cross-country task of their final stage check.

[3] Instructors involved in the SBT group were not allowed to alter the scenarios but were allowed to change the destinations to which the scenarios suggested they go. This flexibility was a requirement in order to conduct the study in UND's normal flight training environment, because normal flight operational practices include assigning practice areas to each training flight for safety (i.e. destinations).

Ground, Flight, and Simulator Training Times

The University's flight training program utilizes a computer based record keeping system called the Aviation Information Management System (AIMS) that allowed the research team to access and analyze the necessary data to compare the ground, simulator, and flight training times of the SBT and MBT student pilot groups. This system is used by the University to record and manage student flight records and schedules, instructor records and schedules, and aircraft maintenance records and schedules (UNDAF, 2006).

The system requires instructors to "task" or record each component of training flights and ground briefings within 72 hours of an invoiced or billed lesson. At the completion of the course, the flight operation's records center located at the airport reviews the logbook, certificates, and other flight training records of students wishing to graduate from a course to those recorded in AIMS. The general rule is that AIMS must match the content of the student's flight logbook. Therefore the flight training records for each student in AIMS can be considered to be very accurate and valid. Since all students are billed for aircraft and instructor time based on tenths-of-an-hour, this study used that same level of measure.

After each student pilot involved in the study completed their required training their flight training records in AIMS were used to determine the following for each subject: (a) ground, simulator, and flight training times for block one or lesson one through 13 of UND's Private Pilot Certification Course, (b) ground, simulator, and flight training times for block two or lesson 15 through 25 of UND's Private Pilot Certification Course, (c) ground and flight training times for block three or lesson 27 through 29 of UND's Private Pilot Certification, and (d) total flight and ground training times for UND's Private Pilot Certification Course. The flight and ground training times recorded for the three stage checks – stage 14, stage 26, and stage 30 – were excluded in the analysis because these are not actual training lessons but rather lessons where subjects were required to demonstrate they met or exceed the applicable standards.

Repeat Lessons

The University's AIMS system records all lessons for all students in all courses based on the following statuses: complete, incomplete, or review. A lesson is identified as complete in AIMS when all tasks for a particular lesson, as recorded by the instructor through a web based interface, have been tasked as satisfactory indicating that all tasks for that lesson have been completed to the standards listed in the applicable course syllabus – for the purpose of this study the AVIT 102 edition 9 FAR Part 141 Private Pilot Certification Course syllabus. A lesson will be marked as incomplete if one of the tasks fails to comply with the listed completion standards, and thereby tasked by the instructor as unsatisfactory, or if one of the required tasks is unable to be completed, thereby tasked by the instructor as incomplete. Finally, a lesson is identified as review when the lesson is attempted again after all required tasks were previously marked as satisfactory. For the purpose of this study, all lessons recorded in AIMS as incomplete or review was counted as a repeat lesson. The three stage checks – stage 14, stage 26, and stage 30 – were excluded in the analysis because these are not actual training lessons but rather lessons where subjects were required to demonstrate they met or exceeded the applicable standards.

Performance on Stage Checks

This study compared the performance of the two student pilot groups, SBT and MBT, on three stage checks which comprised the approved Title 14 CFR Part 141 Private Pilot Certification Course. The three stage checks or practical exams – stage 14, stage

26, and stage 30 – were administered by a pre-determined group of qualified instructors who were appointed to administer these stage checks. Each stage check consisted of an oral and a flight portion each with its own applicable tasks. After the stage check each required task – as listed in the applicable syllabus – was marked by the designated stage check pilot or examiner as not attempted, unsatisfactory, or satisfactory in AIMS. All required tasks must be marked as satisfactory before a student is allowed to proceed to the next block of training and tasks marked as not attempted were either previously demonstrated as satisfactorily or are not required to be demonstrated on the particular stage check. Therefore, for the purpose of this study, only tasks marked as unsatisfactory or satisfactory in AIMS were compared between the two student pilot groups.

Aeronautical Decision Making PJT

A 51-item Pilot Judgment Test (PJT) developed by Hunter (2003) of the FAA was used in the study to measure subjects' Aeronautical Decision Making (ADM) skills. The test was administered to subjects after the completion of Lesson 29, the last lesson before the final stage check of the FAR Part 141 Private Pilot Certification Course. Each test question presents subjects with a problem or flight scenario that establishes the "motivational dimension, the context in which the flight was taking place, the locale, if pertinent, and the situation that demanded a decision" (Hunter, 2003 p. 377). Subjects are then presented with four plausible solutions and are asked to rank order the answers. Subjects' answers were then compared to the answers of an expert group of 31 flight instructors and senior pilots with a mean flight time of 4,995 hours who were asked by Hunter (2003) to rank-order each of the alternatives based upon what they would recommend a private pilot with 500 hours total time and no instrument rating should do.

Subjects received one point for each question for which their first rank order choice matched the subject matter expert group's first rank order choice.

GPS Tracks on Final Stage

In an effort to compare and evaluate the pilotage and dead-reckoning skills of subjects in each group, the paths or tracks of subjects were observed and recorded by an independent hand-held GPS receiver on the final stage check or lesson 30 of UND's Private Pilot Course. Subjects attempting Stage 30, the final stage, were asked to plan a cross-country involving a direct route – approximately 250 nautical miles – from Grand Forks, North Dakota to St Paul, Minnesota by their assigned stage check pilot. Subjects then flew the first 25 miles of the route.

By definition, pilotage and dead reckoning do not involve the use of radio navigation aids, but the stage check does involve the evaluation of a pilot's ability to use those aids. Therefore, subjects were allowed to use any radio navigation aid they desired up until one-minute after the course indicator for the navigation aid they were using became alive or began to indicate course deviation. At the one-minute point the stage check pilot administering the stage took away all navigation aids and asked the subject to navigate using pilotage and dead reckoning. Subject's tracks were saved in the GPS for later uploading and analysis utilizing the MapSource™ PC software developed by Garmin Corporation – a respected manufacture of aviation based GPS technologies. MapSource™ allowed the subject's recorded tracks to be compared to the desired course based on time spent at a deviation of more than two and three nautical miles. These distances were incorporated from the FAA's Practical Test Standards for Commercial and Private Pilot applicants.

The FAA's (2006) Practical Test Standards for pilots seeking a commercial pilot certificate with a single engine airplane class rating require an applicant "verifies the airplane's position within two (2) nautical miles of flight planned route" (p. 1-26). The PTS for a private pilot seeking a single engine airplane class rating require an applicant "verifies the airplane's position within three (3) nautical miles of flight planned route" (FAA, 2006, p. 1-24). Therefore, measuring time spent at deviations of two and three nautical miles for the participants of this study ensures external validity.

Instrument Reliability and Validity

This study makes use of the following instruments: the Mental Rotate Test developed by Vandenberg and Kuse (1978), the Wechsler (1981) Vocabulary subtest of the WAIS-R, the Pilot Judgment Test (PJT) developed by David Hunter (2003) of the FAA, and the handheld GPS 76 manufactured by the Garmin Corporation.

The mental rotation test developed by Vandenberg and Kuse (1978) has been used extensively since its creation. It has been shown to have a high degree of validity, reliability, and correlation with general overall flying aptitude and has been used in a similar form in previous studies where piloting skills were a factor (Petros et al., 2003; Bartholomew et al., 1999; Petros et al., 1993; & Gordon & Leighty, 1988). The Vocabulary subtest of the WAIS-R has also been used extensively and has a high degree of validity and reliability (Wechsler, 1981). Therefore, the reliability and validity of these two measures is not in question.

Situational judgment test models, that the PJT measure is a based on, are commonly used in other research fields; however, the PJT developed by Hunter (2003) is relatively new. Therefore, the reliability and validity of the test was determined by Hunter (2003) in two separate studies.

In the first study, Hunter (2003) had a small group of approximately 20 senior pilots and flight instructors edit each item of the test for clarity and realism. The test was then administered to a group of 31 subject matter experts (SMEs) with a mean flight time of 4,995 hours who were asked to rank order each of the answers based upon what they thought a private pilot with 500 hours and no instrument rating should do. The inter rater reliability of the subject matter experts rank ordering was determined to be .44. The test was then administered to a random sample of 1,000 private pilots from the Eastern, Southwest, and Northwest Mountain FAA regions (Hunter, 2003). The 246 responses received from the sample were then correlated to the SMEs rankings, and the test was found to have a very high correlation of .914. The test was found to have an acceptable reliability as measured by a coefficient alpha of .753 and a normal distribution of scores with the mean centered on approximately 50% correct responses (Hunter, 2003).

In the second study, the construct validity of PJT was sought to be determined. For this study, Hunter (2003) presented the PJT to a convenience sample of 246 pilots recruited online from an FAA website. In order to determine the construct validity of the PJT, the answers of this sample were correlated to the scores measured by a Hazardous Event Scale (HES) test that is designed to measure the number of times a pilot has experienced an accident or hazardous in-flight event in the preceding 24 months. Avoiding accidents or hazardous events such as running low on fuel or entering hazardous weather is considered as an indicator of good judgment. 115 subjects completed both tests and a correlation of -.215 ($p = 0.21$) was determined. Therefore the PJT developed by Hunter (2003) is determined to have acceptable psychometric properties and construct validity. “These results support the use of the PJT as a measure of pilot judgment, although additional research is certainly needed to further explore the divergent and convergent construct validity of the scale" (Hunter, 2003 p. 383).

The GPS measure utilized in this study is more of an instrument than an actual measure, but the accuracy of the GPS device needs to be addressed. This study will utilize the independent handheld GPS 76S developed by Garmin Industries. This particular model GPS has a reported lateral accuracy of less than three meters or 9.8 feet 95% of the time and a vertical accuracy of 10 feet (Garmin). This degree of accuracy is arguably very high, making this device an appropriate instrument for this study.

Data Analysis

This study compares the mean performance of two independent groups of students taught using SBT or MBT in the following areas of a Title 14 CFR Part 141 Private Pilot Certification Course at the University of the North Dakota: flight, ground, and simulator training times, repeat lessons, task performance on the three stage checks, scores on a PJT, and GPS tracks recorded on the final stage check. Since the means of two independent groups will be tested, the data analysis for this particular study lends itself to an independent group *t* test – one of the most common uses for this statistical test (Howell, 2002).

The *t* test is a robust test in that it is more or less unaffected by moderate departures from its underlying assumptions. Howell (2002) states that when using a *t* test for two independent sample means, like this study proposes to do, the following has to be considered: normality of the sampling distribution of differences between means, homogeneity of variance, and the condition of equal sample sizes versus unequal sample sizes.

Since sample sizes are limited in each group for this study, it is possible that there will be a difference – as detected by an independent groups *t* test – in the mean scores of each group on the Vandenberg and Kuse (1978) Mental Rotation Test. Since this test has a high correlation with overall flying aptitude and has been shown to be an adequate predictor of pilot performance, it can be used to determine if any significant amount of skill or aptitude for flying exists between the two groups – a possible confounding variable that could skew the results of this study (Petros et al., 1993; & Gordon & Leighty, 1988). Therefore, if a significant difference in the mean scores of each group taking the mental rotation test is determined by an independent groups *t* test, a statistical analysis of covariance as described by Howell (2002), will be used to adjust for the covariance between the means of the two groups in the remaining measures.

Protection of Human Subjects

Approval for this study was received from the University's Institutional Review Board in March of 2006. All subjects in the study signed a consent form that indicated their willingness to take part in the study, and granted the research team's access to their educational records in AIMS that are protected by the Federal Education Rights and Privacy Act. Subjects were able to withdraw from the study at any time and continue with the University's normal training program without penalty. All subjects involved in the study received a random six digit identification number that was used during analysis to conceal their identity. All personal data and the consent forms are being stored in a locked cabinet in the University's Aviation Department for a period of three years from the date which the study began.

CHAPTER III

RESULTS

This study compared two groups – one taught using SBT the other taught using MBT – of 29 subjects in UND's Title14 CFR Part 141 approved Private Pilot Certification Course. An independent group t-test was used to compare the mean performance of each subject group in the following measures: (a) Student Survey, (b) Vandenburg and Kuse Mental Rotation Test, (c) WAIS III Vocabulary subtest, (d) flight, ground, and simulator training times for each block of training and for the entire course, (e) number of unsatisfactory tasks for each of the three stage checks, (f) number for repeat lessons for each block of training and for the entire course, (g) scores on a PJT, and (h) GPS ground tracks recorded on stage 30.

Exclusion of an Outlier

According to Howell (2002), an outlier is a subject who's score(s), "is widely separated from the rest of the data" (p. 21). This data is often the result of a recording error, but sometimes it is just an extreme value that occurs naturally in the population. Howell (2002) suggests using a stem and leaf plot before proceeding with data analysis to detect and possibly eliminate potential outliers that would skew the mean.

See figure 3 on the following page for three stem and leaf plots that were used to identify subject MBT5 as an outlier. The subject was a member of the MBT group and differed from the mean on several measures by two or more standard deviations. Since sample sizes were limited in both groups for this study any outlier would skew the mean in a direction not representative of the population mean. Therefore subject MBT-5 was excluded from the analysis.

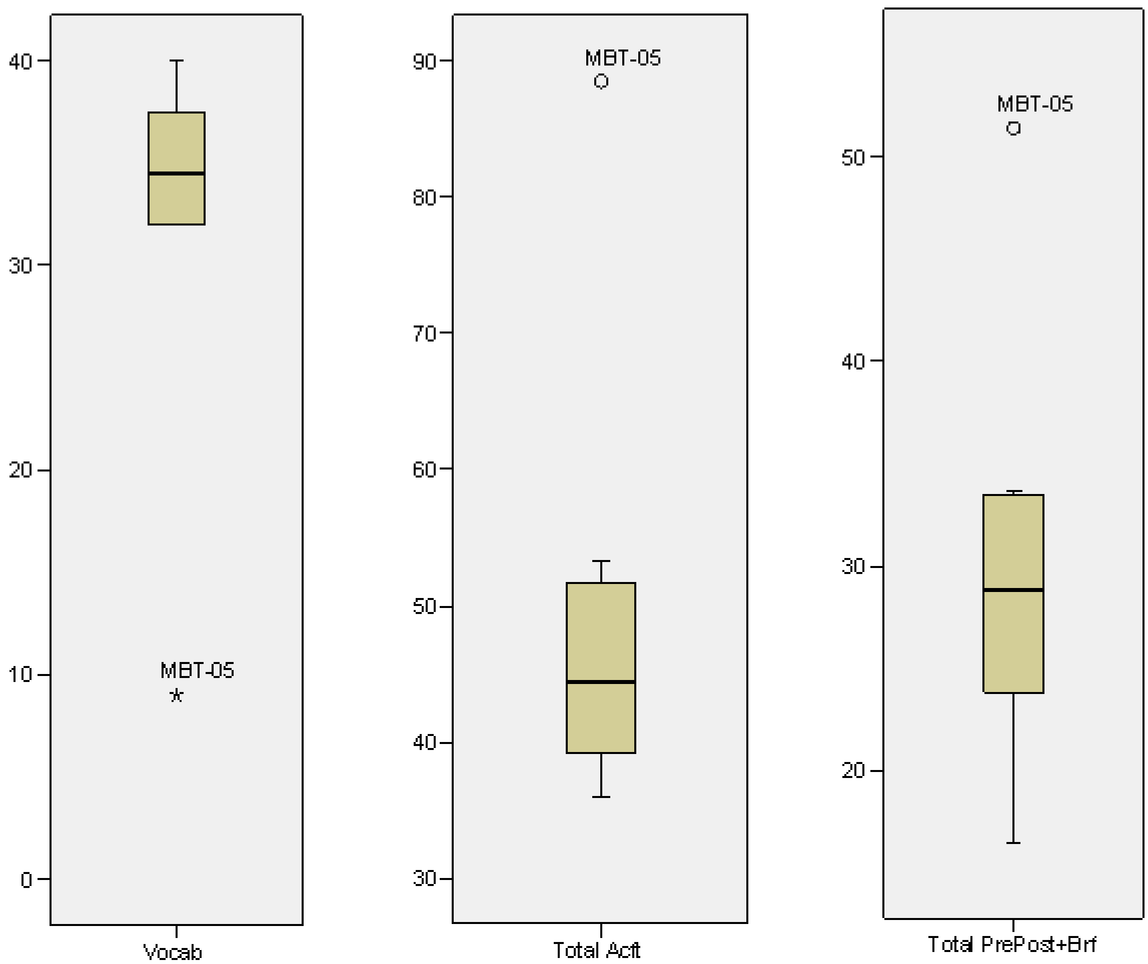

Figure 3: Stem and leaf plots for MBT group data used to identify subject MBT 5 as an outlier. Plots from left to right are for WAIS III Vocabulary subtest, Total Aircraft Time, and total ground training time.

Student Survey

Previous flight training has been shown to be one of the greatest predictor's of pilot performance; therefore, past studies evaluating SBT and MBT with respects to initial pilot certification adopted a five hour previous flight training limitation for subjects enrolling in these studies (Martinussen, 1996 & Craig et al. 2005). Due to low enrollment numbers and subsequent power of the experiment, this study chose to include three subjects that did not meet the adopted five hour limitation. The one individual who did not meet this requirement in the SBT group had 36 logged hours, while the other two individuals in the MBT group had 20 and 17 hours. However the student survey (see appendix B) was used to determine whether or not the aviation experience levels between the two group means were significantly different from each other.

An independent group *t* test for each measure of the survey (as shown in table 1) did not detect any significant differences between the two groups of students. The mean logged flight time for the two groups of students was 2.81 hours (SD = 6.558) for the

Table 1

Table 1
Means, Standard Deviations, and *t* value for Student Survey

Measure	N	*M*	SD	*T*
Age				
MBT	15	19.13	1.506	-1.986
SBT	14	20.64	2.499	
Logged Flight Time				
MBT	15	2.81	6.558	0.912
SBT	14	2.57	9.621	
Unlogged Flight Time				
MBT	15	4.55	7.722	0.221
SBT	14	3.71	12.206	
Aviation Experience Level				
MBT	15	2.20	0.862	0.151
SBT	14	2.14	1.167	
Exposure to Flight Environment				
MBT	15	2.00	0.926	0.344
SBT	14	1.86	1.292	

***p>0.05**

MBT group and 2.57 hours (SD = 9.621) for the SBT group. The survey also revealed, the mean unlogged flight time for the MBT group (M = 4.55, SD = 7.722) and the SBT group (M = 3.71, SD = 12.206). These means were not shown to be significantly different from each other. An independent group *t* test also did not detect any significant differences between the SBT and MBT group means with respects to: (a) age, (b) aviation experience level, and (c) exposure to the flight environment. Aviation experience level and exposure to the flight environment were determined by a student rating on a 5 point likert scale.

Pretests

In order to ensure equality with respect to flight aptitude between the two student groups – MBT and SBT – subjects in each group underwent two pretests: Vandenburg and Kuse mental rotation test and WAIS III vocabulary subtest. The means, standard deviations, and *t* values for these measures are displayed in table 2. The means for the

Table 2

Table
Means, Standard Deviations, and *t* value for Mental Rotation and Vocabulary Test

Measure	*n*	*M*	SD	*T*
Mental Rotation Test				
MBT	14	34.79	8.294	0.280
SBT	14	33.93	7.908	
WAIS III Vocabulary Subtest				
MBT	14	37.00	6.656	-0.639
SBT	14	38.57	6.345	

***p>0.05**

vocabulary subtest of the WAIS III were 34.79 (SD = 8.294) for the MBT group and 38.57 (SD = 6.345) for the SBT group. An independent group *t* test revealed no significant difference between these two means. The means for the mental rotation test were 37.00 (SD = 6.656) for the MBT group and 33.93 for the SBT group. An independent group *t* test did not detect any significant difference between these two means. Also, one student from the MBT group did not complete the two initial pretests but was included in the analysis of remaining measures.

Training Times

The mean training times were compared between the SBT and MBT student groups in each of the three blocks of training that comprise UND's Private Pilot Course. Training times were obtained from the University's AIMS computer software which is used to track every student's flight progress. Training time analysis was delayed until January 15, 2007 to allow all subjects ample time to finish the course.

Block One Training Times

Block one of UND's Private Pilot Course is designed to prepare a student for initial solo. The block consists of fourteen lessons with the fourteenth lesson being a stage check. Only lessons one through thirteen were included in the training time analysis because stage checks are not training lessons but rather lessons which require a student to demonstrate whether or not they meet the applicable standards. Two students from the SBT group and one student from the MBT group did not finish block one of the course and were excluded from the analysis. For the mean training times, standards deviations, and *t* values for block one refer to table 3.

An independent group *t* test comparing the flight training times for the MBT group (M = 18.636) and SBT group (M = 19.250) group revealed no significant differences (see table 3).

The mean simulator training times for each group were also compared using an independent group *t* test. In block one of UND's Private Pilot Certification course there were two lessons which utilized a flight training device. The mean simulator time for the MBT group (M = 2.171) and the SBT group (M = 2.308) mean were not significantly different from each other.

Table 3

Table 3
Means, Standard Deviations, and *t* value for Block 1 Training Times

Measure	*n*	*M*	SD	*t*
Flight Training Time				
MBT	14	18.636	5.3068	-0.332
SBT	12	19.250	3.8787	
Simulator Training Time				
MBT	14	2.171	0.2091	-1.485
SBT	12	2.308	0.2610	
Ground Training Time				
MBT	14	13.586	4.5561	-0.086
SBT	12	13.725	3.4934	

$^*p>0.05$

The ground training time means for each group – which include pre and post briefings before each flight and simulator lessons and the three ground lessons in block one – were compared using an independent group *t* test. An independent group *t* test did not find the MBT (M = 13.586) and SBT (M = 13.725) means to be significantly different from each other (see table 3).

Block Two Training Times

Block two of UND's Private Pilot Course is designed to introduce and have students master advanced skills – such as soft and short field takeoff and landings – and cross country procedures. This block consists of lessons fifteen through 26, with lesson 26 being a stage check. Stage 26 was excluded in the flight training analysis because it is not a lesson but rather an evaluation where students were required to demonstrate they met or exceeded the applicable standards. One subject from the SBT group did not finish block 2 by the January 15, 2007 date and was excluded from the block 2 training time analysis. Means, standard deviations, and *t* values for block two can be found in table 4.

In block two the flight training times for the fourteen MBT subjects (M = 21.300, SD = 5.0992) were compared to the training times for the eleven SBT subjects (M = 20.345, SD = 6.78) using an independent group *t* test. These two means were not found to be significantly different from each other (see table 4).

Table 4

Table 4
Means, Standard Deviations, and *t* value for Block 2 Training Times

Measure	*n*	*M*	SD	*t*
Flight Training Time				
MBT	14	21.300	5.0992	0.402
SBT	11	20.345	6.7791	
Simulator Training Time				
MBT	14	1.157	0.2623	0.028
SBT	11	1.155	0.1695	
Ground Training Time				
MBT	14	14.186	5.2489	0.792
SBT	11	12.809	2.6334	

***p>0.05**

An independent group *t* test did not detect any significant differences between the SBT (M = 1.147, SD = 0.256) and MBT (M = 1.157, SD = 0.2623) mean simulator training times for block two. In block 2 there was one lesson, lesson 16, which utilized a flight training device to introduce students to instrument flight and radio navigation equipment.

The ground training times for block two included the pre and post briefings for all the flight and simulator lessons and the two ground lessons which comprised the block. An independent group *t* test comparing the ground training time for the MBT and SBT groups revealed no significant differences (see table 4).

Block Three Training Times

Block three of UND's Private Pilot Course is the shortest block of the entire course and is designed to have the student acquire the necessary solo cross country time for course completion and hone their flight skills for the final stage check. It is a review block that does not incorporate any lessons which utilize a FTD. The block consists of lessons 27 through 30 with lesson 30 being the final stage check. Twelve subjects from the MBT group and ten subjects from the MBT group finished this block of training by the analysis date of January 15, 2007. Refer to table 5 for the training times of block three.

The mean flight training times for block three were 7.133 hours for the MBT group and 7.08 hours for the SBT group. An independent group *t* test did not detect any significant difference between these two means.

Table 5

Table 5
Means, Standard Deviations, and *t* value for Block 3 Training Times

Measure	*n*	*M*	SD	*t*
Flight Training Time				
MBT	12	7.133	1.7875	0.071
SBT	10	7.080	1.7313	
Ground Training Time				
MBT	12	3.208	1.3823	0.576
SBT	10	2.900	0.9787	

$*p>0.05$

The group training time means – which include the pre and post briefings for each flight lesson and the one ground lesson – for block three were also compared using an independent group *t* test. The MBT group mean of 3.208 (SD = 1.3823) hours was not found to be significantly different from the SBT group mean of 2.9 (SD = 0.9787) hours.

Total Training Times

Total flight and ground training times were compared for the twelve MBT subjects and ten SBT subjects who completed UND's Private Pilot Course before the January 15, 2007 analysis date. The simulator training times for the fourteen MBT and eleven SBT subjects were compared because the last lesson utilizing a simulator is lesson 16 in block two of UND's Private Pilot Course. These means, standard deviations, and *t* values for these times are shown in table 6 on the next page.

The total flight training means for the thirteen MBT subjects was 44.358 hours (SD = 6.1266) and for the ten SBT subjects of 47.160 hours (SD = 8.94). The flight training times for the three stage checks were excluded from these mean values because stage checks are not flight lessons but rather flight evaluations. An independent group *t* test did not find these means to be significantly different from each other.

Table 6

Table 6
Means, Standard Deviations, and *t* values for Total Flight, Simulator, and Ground Training Times

Measure	*n*	*M*	SD	*T*
Flight Training Time				
MBT	12	44.358	6.1266	-0.869
SBT	10	47.160	8.9480	
Simulator Training Time				
MBT	14	3.329	0.3811	-0.681
SBT	11	3.436	0.4081	
Ground Training Time				
MBT	12	27.850	5.4050	-1.135
SBT	10	30.200	4.0368	

$*p>0.05$

There are three lessons – lesson 2, lesson 8, and lesson 16 – in UND's Private Pilot Course that utilize a flight training device. The mean MBT simulator time was 3.329 hours (SD = 0.3811) and the mean SBT simulator time was 3.43 hours (SD = 0.4081). An independent group *t* test did not detect any significant difference between these two means.

The ground training times – which include pre and post briefings for each flight and simulator lesson and the five ground lessons of UND's Private Pilot Course – were also compared using an independent group *t* test. The mean ground training time for the MBT group was 27.85 hours (SD = 5.4050) and 30.2 hours for the SBT group (SD = 4.0368). These two means were not found to be significantly different from each other.

Repeat Lessons

The number of repeat lessons was compared in each block of UND's Private Pilot Course and for the entire course. A repeat lesson was determined by accessing students' flight records in the University's AIMS software program. All lessons tasked by an instructor as incomplete or review were counted as a repeat lesson. The three stage checks were not included in the analysis because they are not lessons but rather evaluations where subjects' are required to demonstrate whether or not they meet the applicable standards. The repeat lessons for each block of training can be found in table 7 on the next page.

The mean number for repeat lessons for the MBT group was 4.86, 6.64, and 1.92 lessons for block one, two, and three of UND's Private Pilot Course. The mean number of repeat lessons for the SBT group was 5.25, 4.73, and 1.30 lessons for block one, two, and three. An independent group *t* test did not detect any significant differences between any of these block means.

In order to increase the power of the *t* test by adding more subjects for mean comparison, a ratio of repeat lessons to lessons complete was used. This ratio allowed all subjects who attempted flight training, except for subject MBT5, to be compared no matter their progress through the course. The mean value for this ratio in the MBT group – consisting of 15 subjects – was 0.56248 (SD = 0.3763) and 0.42059 (SD = 0.2025) for the SBT group – consisting of twelve subjects. An independent group *t* test did not find these two means to be significantly different from each other.

Table 7

Table 7
Means, Standard Deviations, and *t* values for Repeat Lessons

Measure	*n*	*M*	SD	*t*
Block 1 Repeat Lessons				
MBT	14	4.86	4.092	-0.293
SBT	12	5.25	5.25	
Block 2 Repeat Lessons				
MBT	14	6.64	4.500	1.055
SBT	11	4.73	4.519	
Block 3 Repeat Lessons				
MBT	12	1.92	1.311	1.196
SBT	10	1.30	1.059	
Ratio of Repeat Lessons to Lessons Complete				
MBT	15	0.56248	0.3763	1.174
SBT	12	0.42059	0.2025	

***p>0.05**

Stage Check Performance

There were three stage checks that comprised UND's Title 14 CFR Part 141 approved Private Pilot Course – Stage 14, Stage 26, and Stage 30. Each stage check was administered by one or more members of pre-determined group of qualified instructors who were appointed by the University through the Aerospace's stage check system. Each stage check consisted of an oral and a flight portion with applicable tasks, see appendix C for a list of the associated tasks for each of the three stage checks. After the stage check each required task – as listed in UND's edition 9 Private Pilot syllabus – was marked by the designated stage check pilot or examiner as not attempted, unsatisfactory, or satisfactory in AIMS. For the purpose of this study, only tasks marked as unsatisfactory or satisfactory in AIMS were compared between the two student pilot groups. See table 8 on for the means, standard deviations, and t values of subject group stage check performance.

Table 8

Table 8
Means, Standard Deviations, and *t* value for Stage Check Performance

Measure	*N*	*M*	SD	*t*
Stage 14 Ground				
MBT	14	0.00	0.00	-----
SBT	12	0.00	0.00	
Stage 14 Flight				
MBT	14	1.57	2.821	0.754
SBT	12	0.42	0.669	
Stage 26 Ground				
MBT	14	0.14	0.535	-0.550
SBT	11	0.27	0.647	
Stage 26 Flight				
MBT	14	2.14	3.655	0.318
SBT	11	1.73	2.611	
Stage 30 Ground				
MBT	12	0.08	0.289	0.909
SBT	10	0.00	0.00	
Stage 30 Flight				
MBT	12	1.33	4.030	1.042
SBT	10	0.00	0.00	
All Stages				
MBT	12	5.08	6.112	1.320
SBT	10	2.30	2.869	

***p>0.05**

For the Stage 14 ground portion, none of the SBT or MBT subjects attempting this stage check failed any of the tasks, therefore there was no need to perform any form of analysis. For the flight potion of Stage 14, the mean number of tasks failed for the SBT group (M = 0.42, SD = 0.669) and MBT (M = 1.57, SD = 2.821) group were compared using an independent *t* test that did not reveal the means to be significantly different from each other.

On stage 26, the SBT subject group's mean number of unsat tasks for the oral portion was 0.27 (SD = 0.516), while the mean number of unsat tasks for the MBT group was 0.14 (SD = 0.535). The mean number of unsat tasks for the MBT group on the flight portion of Stage 26 was 2.14 (SD = 3.655) and for the SBT group was 1.73 (SD = 2.611). An independent group *t* test did not find any of these means to be significantly different from each other.

None of the ten members of SBT subject group who attempted the oral and flight portion of stage 30 failed any of the 56 tasks they were evaluated on. Therefore their mean number of unsat taks and standard deviations for the stage 30 oral and flight portions were zero. The twelve members of the MBT subject group who attempted stage 30 had a mean number of unsat tasks of 0.08 (SD = 0.289) for the oral portion and 1.33 (SD = 4.030) for the flight portion. An independent group *t* test did not find any of these means to be significantly different from each other.

The total number of unsat tasks was compared between the twelve members of the MBT group and the ten members of the SBT group who finished UND's Private Pilot Certification Course before the January 15, 2007 analysis date. The mean number of unsat tasks for the SBT group was 2.30 (SD = 2.869) tasks while the mean number of unsat tasks for the MBT group was 5.08 tasks (SD = 6.112). Although the thirteen members of the MBT group had twice as many unsat tasks as the ten members of the SBT group, an independent group *t* test did not determine these two means to be significantly different from each other.

Pilot Judgment Questionnaire

A 51-item PJT developed by Hunter (2003) of the FAA was used in the study to measure subjects' Aeronautical Decision Making (ADM) skills. The test was administered to subjects after the completion of Lesson 29, the last lesson before the final stage check of the FAR Part 141 Private Pilot Certification Course. The PJT presented subjects with a scenario and four plausible solutions which they were asked to rank order. If a subject's first choice concurred with the subject matter expert group's first choice, they received one point. Due to logistical problems only fifteen of the 23 subjects who reached ground lesson 29 completed the questionnaire. Refer to table 9 on the next page for the means, standard deviations, and t value of the PJT measure.

Eight subjects from the MBT group completed the PJT measure. The mean score of the MBT subjects was 24.25 (SD = 8.049). The mean score of the seven SBT subjects who completed the PJT was approximately one point higher at 25.29 (SD = 3.200). An independent group *t* test determined that these two means were not significantly different from each other.

Table 9

Table
Means, Standard Deviations, and *t* value for Pilot Judgment Questionnaire

Measure	*n*	*M*	SD	*T*
PJT Questionnaire				
MBT	8	24.25	8.049	-0.318
SBT	7	25.29	3.200	

***p>0.05**

GPS Ground Tracks

In an effort to compare and evaluate the pilotage and dead-reckoning skills of subjects in each group, the paths or tracks of subjects were observed and recorded by an independent hand-held GPS receiver on the final stage check. Subjects attempting Stage 30, the final stage, were asked to plan a cross-country involving a direct route – approximately 250 nautical miles – from Grand Forks, North Dakota to St Paul, Minnesota by their assigned stage check pilot. Subjects then flew the first 25 mile portion of that route.

By definition, pilotage and dead reckoning do not involve the use of radio navigation aids, but the stage check does involve the evaluation of a pilot's ability to use those aids. Therefore, subjects were allowed to use any radio navigation aid they desired up until one-minute after the course indicator for the navigation aid they were using became alive or began to indicate course deviation. At the one-minute point the stage check pilot administering the stage took away all navigation aids and asked the subject to navigate using pilotage and dead reckoning. Subject's tracks were saved in the GPS for later uploading and analysis utilizing the MapSource™ PC software developed by the Garmin Corporation.

Table 10

Table
Means, Standard Deviations, and *t* value for Time Spent at Deviation as Determined by GPS Ground Tracks Recorded on Stage 30

Measure	*n*	*M*	SD	*T*
Ratio of Outside 2nm				
MBT	3	0.26	0.456	-0.310
SBT	5	0.35	0.355	
Ratio of Outside 3nm				
MBT	3	0.23	0.398	0.592
SBT	5	0.10	0.228	
Ratio of Inside 2nm				
MBT	3	0.74	0.456	0.310
SBT	5	0.65	0.355	

***p>0.05**

MapSource™ PC software allowed the time spent at a deviation of greater than two and three miles to be determined. The two and three nautical miles were adopted from the FAA's practical test standards for commercial and private pilots. Refer to table 10 on the next page for the means, standard deviations, and t values of the GPS measure.

Due to logistical problems, and improper saving and downloading procedures, only eight GPS ground tracks from the 23 subjects who attempted stage 30 were saved properly and thus available for comparison. The mean time spent at deviation of two or more miles was 26 percent for the three MBT subjects and 35 percent for the five SBT subjects. The mean time spent at deviation of three or more miles was 23 percent for the three MBT subjects and ten percent for the SBT subjects. The mean amount of time spent inside two nautical miles was 74 percent for the MBT subject group and 65 percent for the SBT subject group. An independent group *t* test did not find any of these means to significantly different from each other

CHAPTER IV

DISSCUSSION

This study compared two groups of students – one taught using SBT the other taught using MBT – in UND's Title 14 CFR Part 141 approved Private Pilot Certification Course. An independent group *t* test was used to compare the mean performance of each subject group for the following measures: (a) Student Survey, (b) Vandenburg and Kuse Mental Rotation Test, (c) WAIS III Vocabulary subtest, (d) flight, ground, and simulator training times for each block of training and for the entire course, (e) number of unsatisfactory tasks for each of the three stage checks, (f) number for repeat lessons for each block of training and for the entire course, (g) scores on a PJT, and (h) GPS ground tracks recorded on stage 30. None of the means for the MBT and SBT groups for each of these measures was determined to be statistically significant from each other.

Student Survey and Pretests

Previous studies which compared MBT and SBT in an initial pilot certification course adopted a five hour limitation of previous flight training for subjects enrolling in the research in order to eliminate any confounding variables. However, due to low summer enrollment numbers this study included three subjects who did not meet the five hour limitation. These three subjects were included because extensive efforts were taken to ensure the mean flight aptitude and aviation experience levels between the two groups was equal by administering a brief one page survey and two pretests – Vandenburg and Kuse Mental Rotation Test and the WAIS III Vocabulary subtests.

These three measures allowed subjects who would otherwise be excluded in the research to participate. Their participation was necessary due to low enrollment numbers in the summer session of the Avit 102 class and the fact that previous research comparing SBT and MBT in initial pilot certification curriculum is limited. Since it is the eventual desire of the FAA to incorporate the FITS model of SBT training to the entire population of pilots, it would appear necessary to adopt these or similar pre measure procedures in future research projects comparing SBT and MBT to ensure SBT has been evaluated in a representative sample of the current pilot population.

Flight, Ground, and Simulator Training Times

This study compared the mean flight, ground, and simulator training times of MBT and SBT subjects in all three blocks of training and the entire Private Pilot Certification Course. The training times reported in this study can be considered to be extremely accurate because all times are managed by the University's AIMS software system and all records undergo a review – as required under 14 CFR part 141 – by the University's records department.

Previous research was not able to make an accurate assessment of the difference in training times between MBT and SBT because the subject matter covered on each lesson varied between the two subject groups since the research utilized two different syllabi (Craig et al., 2005). In other words, subjects in the MBT group were not undergoing the same tasks as the subjects in the SBT group. However, this study was able to make a direct assessment of training times between MBT and SBT because the material covered by each subject group was the same on each lesson since the same syllabus was used for each group.

This assessment revealed that there was no significant difference between the training times of MBT and SBT subjects on all measures with respects to the time spent training for the purpose of Private Pilot Certification. Therefore, it can be inferred that SBT takes the same amount of time as MBT with respects to ground, simulator, and aircraft training time in each block of training and for the entire UND Private Pilot Certification Course. However, sample size for this study is very limited and the subsequent power – or ability to detect any differences due to the independent variable – of the experiment is low (Howell, 2002). Therefore more research – similar in design and with greater sample sizes – is needed before an accurate and measurable assessment can be made. However, examining the mean training time trends of this study does offer insight into how MBT and SBT might differ from each other.

It appears that MBT takes less time for UND's entire Private Pilot Certification Course than SBT with respects to simulator, flight, and ground training times. The mean values of the MBT subjects who completed the course were less than the mean values of the SBT subjects who completed the course on all three training time measures (refer to table 6 in the previous chapter).

The mean difference for simulator training between the fourteen subjects of the MBT group and eleven subjects of the SBT group was 0.107 hours or just over 6 minutes for the three lessons which a flight training device was utilized. This mean difference was not significant and from a flight instruction standpoint would probably be considered minimal. The difference between these two means is most likely attributed to the fact that instructors conducting SBT were required to utilize the simulator by the supplement developed for this study in a way they had not done previously.

The mean difference in flight training time for the entire course was a larger difference at 2.80 hours between MBT and SBT. The mean total flight training time for MBT was 44.35 hours, while the mean flight training time for SBT was 47.160 hours.

Examining the mean flight training times for each block of training of UND's Private Pilot Certification Course reveals that MBT subjects took less time in block 1 or the pre solo block of the course. However, during the second block of training – where more complex skills such as cross country procedures and soft and short field landings were introduced in the aircraft – the MBT mean flight training time exceeded the SBT mean flight training time by 0.955 hours. Therefore it is possible that SBT students reap the benefits of the FITS model of SBT later on in UND's Private Pilot Certification Course when more complex flight and decision making skills of the pilot are emphasized and practiced. However, an independent group *t* test did not detect any significant difference between these two means. Therefore, similar research – with larger sample sizes – is needed to determine how SBT and MBT differ with respects to the amount of flight training time.

The mean ground training times for MBT and SBT followed a similar trend (refer to table 6 in the previous chapter). The total ground training time for the ten SBT subjects was greater than the mean total ground training time for the twelve MBT subjects who finished the course. This mean difference of 2.35 hours was not found to be significant by an independent group *t* test. Examining the mean trends of MBT and SBT subjects for each block of training indicates that MBT students spend less time covering material on pre and post briefings and ground lessons than SBT students early on in the course. However, later in the course MBT student spend more time than SBT students. However, none of the mean differences for this study were found to be significant, so it is still unclear how MBT and SBT differ with with respects to the amount of time spent on ground training. More research, similar in design, is needed before an accurate assessment can be made.

Repeat Lessons

Like the other measures for this study, an independent *t* test did not detect any significant difference between the means of the MBT and SBT subject groups with respects to the number of repeat lessons for each block of training and for UND's entire Private Pilot Certification Course. However, examination of the mean trends coincides with the mean trends of the MBT and SBT groups for flight and ground training times.

The MBT subjects who completed block I of UND's Private Pilot Certification Course had fewer repeat lessons that the SBT subjects in the same block of training. However, the mean number of repeat lessons for block 2 and 3 of UND's Private Pilot Certification Course was less in the SBT group (Refer to table 7 in the previous chapter). Craig et al. (2005) identified a similar trend in setbacks or the number of repeat lessons between MBT and SBT subjects and inferred that SBT subjects acquire complex flight skills more easily later on the course than MBT subjects. The mean trends of this study support this idea, however they are only trends. No significant differences were found between the two groups and therefore MBT and SBT do not differ with respects to the number of repeat lessons. Therefore more research with more subjects is needed to accurately assess how SBT and MBT differ with respects to the number of repeat lessons in an initial Private Pilot Certification Course.

Stage Check Performance

This study compared the mean number of unsatisfactory items for each group on the three stage checks which comprised UND's Private Pilot Certification Course in order to gather insight into how well each form of training prepares a student for these stage checks or check rides. An independent group *t* test did not detect any significant differences between the mean number of unsatisfactory tasks for MBT and SBT subjects on all three stage checks which comprise UND's Private Pilot Certification Course. However, the mean trends may provide some insight into how SBT and MBT differ with respects to the number of unsatisfactory tasks.

The mean number of unsatisfactory tasks for the SBT group was less than the number of unsatisfactory tasks of the MBT group on every stage check expect the ground portion of stage 26 of UND's Private Pilot Certification Course (refer to table 8 in the preceding chapter). Therefore, it may be inferred that SBT better prepares a student for an evaluation of pilot knowledge and skills than MBT throughout UND's Private Pilot Certification Course. This inference becomes wholly apparent by examining the mean number of unsat tasks for the twelve MBT students and ten SBT students who finished UND's Private Pilot Course. The mean number of total unsatisfactory tasks for the MBT students was 5.08 (SD = 6.122), while the mean number of total unsatisfactory tasks for the SBT group was 2.30 (SD = 2.869).

However, the internal and external validity of this measure is limited, since no effort could be made to standardize the questions and material covered on each stage check. Doing so would have compromised the integrity of UND's stage check system. However, published standards for each stage check exist and the evaluators who conduct these stage checks are standardized by UND's course management personnel. Although standardization and validity exist within UND's stage check system, the degree of this validity could not be determined. Therefore, this measure cannot be given the same considerations as the other measures of this study.

ADM Questionnaire

This study utilized a Pilot Judgment Test (PJT) in order to gather insight into how MBT and SBT differ with respects to the development of Aeronautical Decision Making (ADM) skills. Unfortunately only 15 questionnaires could be recovered from the 22 subjects who finished UND's Private Pilot Course. Although, the mean test score for the MBT group was less than the mean score for the SBT, this mean difference was not found to be significant. This is probably due to the fact that sample sizes for this measure were very limited.

However, the amount of measures which determine the ADM skills of pilots are severely limited throughout the academic and professional aviation communities. If the effectiveness of SBT, MBT, and future forms of training are to be compared within the aviation communities, devices which more sensitively measure ADM or the acquisition of ADM skills need to be created. More research is needed in this area before any determination of how MBT and SBT differ with respects to ADM skill acquisition can be made.

GPS Measure

This study utilized independent hand held GPS receivers to measure and compare the amount of time spent at a lateral deviation of two and three miles for subjects operating an airplane along a pre-determined route of flight. The purpose of this measure was to gather insight how SBT and MBT differed with respects to pilotage and dead reckoning skill acquisition. Due to recording errors and improper storing and downloading procedures only a handful of usable tracks were recorded and recovered for the 22 subjects of the study who attempted stage 30. Since sample size was so limited –

with only eight usable tracks – nothing can be inferred from the averages of these findings.

However, the validity and accuracy of this or similar measures should not be ignored when conducting research in the aviation community. Previous studies evaluating SBT and MBT utilized qualitative measures, likert scales, and blind raters to determine how SBT and MBT differed with respects to pilot skill application (Craig et al., 2005 & French et al., 2005). With the amount of technology and recording media available in the present day, these types of measures do not seem necessary or as accurate and unbiased as the GPS recording device used in this study. Therefore, Future studies should consider utilizing more technological based measures to determine how MBT and SBT vary with respects to pilot skill acquisition.

Recommendations

1) Since the research evaluating the FITS model of SBT is limited in number and scope, the University of North Dakota and other training institutions should not incorporate it as a standard means of training students until it has been accurately assessed how SBT differs with respects to MBT.
2) The University of North Dakota is a well respected collegiate aviation program. As such, it should take an active role in evaluating and studying the FITS model of SBT because the university has the expertise and population of pilots necessary to do so effectively and efficiently.
3) Since limited research on the FITS model of SBT exists, the Federal Aviation Administration should focus its efforts on the evaluation and research of the FITS model of SBT for all levels of pilot training before endorsing and incorporating it as the standard method of training for general aviation.

Future Studies

1) Due to the fact that this research did not find any significant differences between SBT and MBT and sample sizes were limited, more research is needed to determine how SBT differs from MBT in an initial pilot certification course.
2) Future studies which compare SBT and MBT need to have larger sample sizes that are more representative of the current population of pilots since it is the eventual desire of the FAA to implement the FITS philosophy to train all levels of pilots.
3) The FAA created the FITS model of training in order to combat a recent string of accidents that were the result of poor decision making. Therefore a research effort is in order to develop a standard measure of ADM that can be used to evaluate the level of decision making skills created by each method of training.

Concluding Remarks

Although this study did not detect any significant differences between SBT and MBT, it utilized an effective design that can be modeled by future studies. Also, it was the first study on the campus of the University of North Dakota that incorporated and measured the SBT model of FITS in its normal pilot curriculum and population. The study paved the way for future research on the campus that can be used by the FAA and industry professionals to determine whether or not the FITS model of SBT is a more effective means of training than MBT.

APPENDICES

Appendix A

AVIT 102 SBT Syllabus Supplement

NOT A FITS APPROVED TRAINING DOCUMENT

Confidential Document

Contact Jered Lease UND Aerospace before using this document
jclease@aero.und.edu
701-777-0888

FLIGHT INSTRUCTOR SCENARIO BASED TRAINING SUPPLEMENT
AVIT 102 Edition 9

Purpose: The purpose of this study is to validate the effectiveness of Scenario Based Training (SBT) when applied to UND's Part 141 Private Pilot Course. The data collected from this study will help support the benefits of SBT as a major component of the FAA Industry Training Standards (FITS) program.

Background on FITS: As you are probably well aware, there is a movement in the FAA and the flight training industry to abandon conventional training methods that rely on the teaching and evaluation of specific maneuvers. Professionals in the industry have come to the realization that maneuver based training fails to fully prepare pilots for real-world flying—especially in the areas of decision making and judgment. Therefore, the FAA spawned the creation of FITS, which advocates Scenario Based Training, Single Pilot Resource Management (SRM) and Learner Center Grading as the preferred format to improve development of aeronautical decision making skills. It is the feeling of many industry professionals that FITS will become the new way of training general aviation pilots. The FAA is eagerly integrating the FITS philosophy into the training environment and plans to soon alter its evaluation standards to match this new concept. In other words, FITS and SBT is the direction the industry is headed. By taking part in this study, you will be afforded the opportunity to be at the forefront of this movement. It is our hope that this study will help you learn to incorporate SBT into your daily training techniques, and will improve the overall quality of instruction we give at UND.

What is SBT: As previously stated, SBT is a major component of the FITS program and uses realistic scenarios as a script for daily flight training lessons. The following two elements help define SBT: First, flight lesson should be conducted to another airport. This helps put maneuver practice in the proper context—how a particular maneuver contributes to the overall mission of air travel—getting from point A to point B. Secondly, each maneuver should be <u>introduced</u> in a realistic format so that the student readily correlates how that maneuver fits in the overall mission scenario. SBT *does* allow for the repetitive practice of maneuvers to increase student proficiency if needed, but only after the maneuver has been introduced in a realistic context.

Use Steep Turns as an example. Under current Maneuver Based instruction, the instructor would take the student out to a practice area, clear the area, slow to recommended airspeed, trim the aircraft, pick a cardinal heading, and teach the elements of the maneuver. Often times the student does not truly understand why he or she is practicing this maneuver. Contrast this with SBT. Under SBT, the instructor would introduce the maneuver in a more realistic context by presenting a "scenario situation" that requires a steep turn. For example, while en-route to Crookston, the instructor calls out traffic at 12:00, opposite direction, at the same altitude, and directs a hard turn to the right for avoidance. The student immediately cranks the aircraft into a right hand turn—not too concerned about maintaining a set airspeed or altitude. And maybe, because it is the student's first attempt at a steep turn—it isn't too pretty. But now the student knows what a steep turn is all about (when it might be used, the aerodynamics involved, and what can go wrong) —because it was introduced in a realistic context. The instructor can later demonstrate the individual elements of a steep turn and allow the student to polish required techniques.

It is the belief of the FAA and industry professionals involved in FITS that using SBT will produce better pilots. It forces students to think and helps develop their aeronautical decision making skills. It also gives students a definitive reason or purpose for mastering each maneuver (why do I need to know this?), one of the major fundamentals of learning.

How to use this supplement: This supplement was designed to facilitate your transition to scenario based instruction. It should be used in conjunction with the syllabus and other UND directives and guidance to plan and execute syllabus lessons. It provides scenarios for each lesson of the AVIT 102 Edition 9 Syllabus. It should be considered *guidance* for introducing new maneuvers and completing lesson requirements, but should not be treated as the bible. If instructors come up with better SBT methods for introducing particular maneuvers, they should try them and share their methods with their colleagues. This study affords instructors the chance to incorporate SBT into daily instruction techniques. Have fun, be creative, and fly safe.

GROUND LESSON 1

STUDENT PREPARATION

1. Review Syllabus for contents of lesson.
2. Attain all necessary materials for this course.
3. Obtain necessary items for Course Enrollment.

INSTRUCTOR INFORMATION

Explain SBT and the FITS program to the student and how scenarios will be incorporated into the day-to-day instruction. Assign a scenario and destination for Lesson 2 (FTD).

FLIGHT LESSON 2

STUDENT PREPARATION:

1. Practice Warrior checklists using the online trainer on HTMLEZ.
2. Review Syllabus for lesson content.
3. Complete appropriate sections of Workbook.
4. Draw Practice areas on VFR sectional.

SCENARIO

You and a friend want to go to Fargo to see a Red Hawks' baseball game. Your plan is to land at the Fargo airport two hours before game time in order to allow enough time for lunch.

INSTRUCTOR INFORMATION

NOTE: Can use GS-Plus feature in the sim to accelerate the flight (located bottom right hand corner of track screen).

Preflight Discussion – Discuss scenario and how normal operations such as checklist usage and basic flight maneuvers are used on day-to-day flights like this one. Ask student to locate FAR on map and give basic navigation ideas on how to get there (head south, follow I-29, ect).

Ground Ops – Show student how to input a basic flight plan GFK to FAR in the GPS. Guide student through normal checklist procedures.

GFK Departure – Conduct a normal takeoff and climb, show effects of coordinated and uncoordinated climb (refer to Aero Demo).

Simulate Departure Control requesting a level-off at 3500 ft during climb and current airspeed (79 KIAS) to avoid inbound DC-9 traffic.

At this point, show effects of all control surfaces; highlight dutch roll with rudder (refer to Aero Demo).

Shortly after level off, Departure instructs you to continue your climb. Show effects of uncoordinated and coordinated climb (refer to Aero Demo).

Level off and Cruise – Level off at 5500 ft, do cruise checklist, and trim for approximately 100 KIAS.

Discuss how to maintain straight and level flight (refer to Aero Demo).

Show effects of elevator input and discuss aircraft stability (refer to Aero Demo).

At this time, Departure warns of opposite direction traffic at your same altitude, and suggests altering course to the right.

Show effects of turns (shallow, medium, and steep) and how to keep those turns level (refer to Aero Demo).

Departure informs you that traffic is no longer a factor, radar service terminated, squawk VFR and proceed on course.

Proceed back on course using the GPS. Show effects of adverse yaw when maneuvering back on course and the effects of too much and too little rudder (refer to Aero Demo).

Approach and Arrival at FAR – Start the descent checklist, get Fargo ATIS, and contact Fargo Approach.

NOTE: Make sure FAR has a generic airport in its position as you approach FAR (if GS plus feature is being used be sure to turn it off).

FAR Approach advises to expect a 5 mile final for Runway 17, and to start a descent at pilot’s discretion to 2000 feet.

Show effect of descent with and without power, level off at 2000 feet, and set-up for a long final to Runway 17 (refer to aero demo).

Add flaps on final and discuss effects of each additional setting. As you approach the runway, Tower directs a go around because of traffic on the runway (Sim feature may be used to put an aircraft on the runway). Conduct a normal go-around and show effects of each notch of flap retraction (refer to aero demo).

Go around the pattern at Fargo to a normal full-stop landing. Taxi to the ramp and complete all appropriate checklists. Emphasize that “mission is complete—we made a routine flight from A to B.”

Assign scenario for next lesson

FLIGHT LESSON 3

STUDENT PREPARATION

1. Review syllabus contents for lesson.
2. Complete appropriate sections of the workbook.
3. Practice Warrior Checklists using the on-line trainer on HTMLeZ.
4. Locate the Crookston Airport on the map and give consideration to how you will get there.

SCENARIO

You are a crop insurance salesman and a client of yours has a hail damage claim in one of his fields outside of Crookston. You will fly to Crookston, and while en-route, you will survey his field by air to assess the damage. After discussing the claim with him at Crookston, you will return to Grand Forks.

INSTRUCTOR INFORMATION

Ground Ops – Guide the student through obtaining a weather brief, pre-flight planning, and risk assessment. Discuss the scenario during the pre-flight discussion, showing where the hail damaged field is (suggest two miles south of Eldred). Show the student how to obtain info on Crookston using the AFD.

Leg 1 GFK – CKN

GFK Departure – Conduct a normal takeoff and climb out.

En-route to CKN – Review basic aircraft handling introduced on Lesson 2. After level off, discuss and demonstrate how to track a straight line to the farmer's field (appropriate point on map). Discuss scanning techniques and how to avoid other aircraft. Pretend you see an aircraft converging straight on--challenge student to take appropriate action. Discuss aerodynamic effects of whatever maneuver was executed. Once over the target field, make several turns to survey suspected damage and practice aircraft maneuvering. Perform the Aero Demo and other maneuvers as appropriate. Proceed to Crookston.

CKN Airport – Listen to the Crookston ASOS and CTAF. Discuss current traffic and weather situation. Complete appropriate pattern entry and full stop landing. If time allows, taxi to the ramp for validation of scenario. Observe other aircraft in the pattern and discuss separation standards and wake turbulence separation. Taxi out for takeoff and to practice normal takeoff and landings as time and fuel permit. Demonstrate and discuss methods for wake turbulence avoidance.

Leg 2 CKN – GFK

CKN Departures – Conduct a normal takeoff and climb out.

En-route to GFK – Practice maneuvers previously introduced as per the syllabus to ensure student understanding. When listening to ATIS, simulate a gusty wind condition. Discuss techniques for dealing with gusty winds and wind shear.

GFK Airport – Fly the pattern as though gusty winds and wind shear actually exist. Also simulate the need to follow a DC-9 on final; reinforce the appropriate methods for avoiding wake turbulence.

Post Flight Debrief – Discuss accomplishment of the hail survey mission to put all maneuvers and activities in the proper context. Assign Lesson 4 scenario. Have the student obtain an outlook briefing for GFK to TVF for the scheduled time of Lesson 4 (GND).

GROUND LESSON 4

STUDENT PREPARATION:

1. Review syllabus for contents of lesson.
2. Complete appropriate sections of the workbook.
3. Practice Checklists using the online trainer on HTMLeZ.
4. Pick three family members to go on this fictitious trip and fill out chart below.

SCENARIO

You and three family members are planning on flying from Grand Forks to Thief River, MN in order to tour the Artic Cat manufacturing plant. The plan is to fly to the Thief River Airport where a friend will meet you and take you to the plant.

Family Member's Coming On Trip	
Name/relation	Weight in lbs

INSTRUCTOR INFORMATION

Using the scenario, walk the student through proper pre-flight planning.

<u>Weather Briefings (Outlook and Normal)</u> – Discuss what action might be taken if you knew about this flight several days before the trip. If you wanted a briefing the night before, which type would you request, and how? Have the student obtain a weather briefing over the phone from a preflight briefer.

<u>Weight and Balance</u> – Assign an aircraft tail number and have student calculate a weight and balance using estimated family member weights. Discuss the CG envelope and how they can add, remove, or shift weight to get the aircraft within limits.

<u>Performance</u> - Have the student calculate appropriate performance numbers and discuss variables that might affect that performance. For example:
If the wind was 230 at 12 at TVF, how will our takeoff and landing distances change?
What if TVF elevation was 4730 ft MSL?
What if the temperature is -30°C?
Be sure to discuss with the student the accuracy of performance calculations, and how manufacturers calculate performance.

<u>Risk Assessment</u> – Discuss proper risk assessment and the factors that might influence their decisions. For example, if the sky is overcast at 1500 ft, with 7

SM visibility; how will this affect their Go/No Go decision? Would their risk assessment change if a good airline pilot friend (with lots of B777 experience) was going to make the trip with them? If this airline pilot friend was pressing you to go, how might that affect your decision making? Introduce the student to risk assessment tools--such as the PAVE acronym and Personal Minimums.

Hazardous Attitudes – Use NTSB accident reports, UND incident reports, or personal experiences to relate how hazardous attitudes influence aeronautical decision making.

Abbreviated Briefing – Once the discussion of pre-takeoff procedures is complete, simulate the need for an up-date on the current weather. What type of weather briefing should we ask for? Discuss the advantages of an abbreviated briefing, than have the student obtain one.

Assign Scenario for next lesson

FLIGHT LESSON 5

STUDENT PREPARATION

1. Review syllabus for contents of lesson.
2. Complete appropriate sections of the workbook.
3. Obtain a weather brief.
4. Conduct appropriate pre-flight procedures: weight and balance and performance.
5. Be prepared to lead discussions on how to secure your cargo and also your weight and balance computations.

SCENARIO

A friend of yours from Warren, Minnesota (D37) is an avid car collector. In order to have her 1966 Ford Mustang in tip top shape, she needs a new transmission bell housing. You have volunteered to pick one up for her in Grand Forks and deliver it to the Warren Airport where she will be waiting for you. The bell housing weighs 220 pounds and is split in the middle (each half weighs 110 lbs). It is up to you to decide if you can carry it and where you will put it in the aircraft.

During your preflight planning, you discover several NOTAM's for the Warren Airport. Apparently a telecommunications company has strung a temporary cable 1000 feet from the approach end of the runway. The cable is approximately 50 feet in the air, which means it protrudes through your normal VFR glide path. Also, there are several 300 ft cranes at the other end of the runway that are involved in the construction. They are not highly visible, and you are not certain of their exact location, so a normal climb-out may not clear them sufficiently.

INSTRUCTOR INFORMATION

<u>Preflight Brief</u> – Discuss with the student where the bell housing could be carried and how to secure it properly

Leg 1 GFK – D37

<u>Ground Ops</u> – monitor the student during their pre-flight; try to give as little input as possible. Quiz the student on aircraft/engine components.

<u>Departing GFK</u> – Normal takeoff and cruise climb (87 KIAS) should be conducted for correlation with future Vy climb comparisons.

<u>Enroute to Warren</u> – Practice aero demo and fundamentals of flight as necessary to promote skill acquisition.

<u>Warren Airport</u> – Discuss the location of power lines and cranes. Reiterate challenges they present and how a forward slip could be used after clearing this obstacle. VFR pattern should be flown with a high final until clearing power line, then slip to normal glide path, so as to land in the normal touchdown zone. Landing should be to a full stop, with a taxi to the ramp to unload the parts (this will add to the realism). Provide scenario related questions for the student to

contemplate—don't accept one-word answers—draw them out on their reasoning. This helps develop decision-making ability.   For example: Do you think we should unload these parts and keep the engine running to save time?

During taxi-out-for-takeoff, discuss obstacles off departure end and the proper procedure used to clear them. Conduct a normal takeoff with a max angle climb at Vx due to the obstacles.

Practice normal and crosswind landings emphasizing the use of slips for crosswind and glide path corrections. Also emphasize the importance of a stabilized approach, recognition of the need for a go around, and proper go-around procedures.

Leg 2 – D37 to GFK

<u>Departing D37</u> – Simulate a situation which would require a max rate climb at Vy. For example: You have to expedite your climb to 2100 ft back to GFK because a crop duster wants to beginning spraying a field below that altitude just south of the town. Point out the difference in climb rate at Vy versus the cruise climb conducted out of GFK.

<u>Enroute to GFK</u> - Practice forward slips, side slips, and other maneuvers needing review.

<u>GFK Airport</u> – Additional emphasis on slips, max performance climbs, and go-arounds as time permits.

<u>Post flight debrief</u> – Ask the student to identify some situations where they would use a forward slip and side slip. Ask them to identify some situations which would require a Go-around. Critique student's performance and assign next lesson's scenario.

FLIGHT LESSON 6

STUDENT PREPARATION

1. Review syllabus for contents of lesson.
2. Complete appropriate sections of the workbook.
3. Obtain a weather brief.
4. Conduct appropriate pre-flight procedures: weight and balance and performance.
5. Locate South Golden Lake on the sectional and look-up Northwood airport in your AFD. Make note of any necessary information for the flight.

SCENARIO

There is an EAA pancake breakfast/fly-in at the Northwood Airport today. You and your non-pilot friend decide to attend. Expect a lot of aircraft to be in the vicinity of this airport during the event. Just prior to the flight, your buddy, who is a big sail boat fan, asks you if it would be possible to over-fly the boat race that is taking place on South Golden Lake. You don't see any problem accommodating his request.

INSTRUCTOR INFORMATION

Preflight brief – Discuss scenario with student. What are some considerations when operating around the Northwood Airport? Do you expect extra traffic in the pattern? How will you avoid this traffic? How is this going to change/affect your pattern entry and operation? What about the boat race--are there any special considerations there?

Leg 1 GFK to 4V4

Ground Ops – Allow student to do entire pre-flight without instructor guidance (this instills a sense of responsibility and "the need to know"). Ask questions to stimulate thought, such as: What would we do if the entire wing was covered with frost? What if the gear strut had only ½ inch extension? Student should be able to start the aircraft and maneuver to the runway with little or no instructor guidance.

Departing GFK – Conduct a normal/crosswind takeoff and VFR departure. Allow student to do all checklists and radio calls enroute to the practice area with little or no prompting as a means to emphasize the importance of learning them.

Area Work—Once established in the practice area in level flight, call out simulated traffic at 11:00 and 2:00 (obviously headed to the Fly-in as well). Ask the student how to obtain additional spacing on those aircraft. Suggest that slowing down is one method, and ask the student to slow down to minimum practical air speed. Encourage the student to fly slower and slower to experience approaching stall and full stall indications. Instruct student to recover by simply reducing angle of attack. Repeat maneuver as appropriate.

Continue toward Golden Lake. Discuss other methods to gain spacing on traffic.

Steep Turns – When nearing South Golden Lake, your friend would like to take pictures for his website with a camera he brought. Ask questions to stimulate thought: Is there any maneuver that would allow your friend to take pictures without the wing being in the way? Demonstrate and practice steep turns. More questions: The camera your friend is using does not have a very good zoom capability……. What is the lowest altitude we could legally do this maneuver over the boats? Are you comfortable with that altitude? Why?

Power Off Stall – Pick a road or other distinguishable surface to set-up for a simulated approach and landing. Select an altitude that will allow for a stall and recovery above the MRA (1500 ft AGL). Enter downwind abeam the selected surface and conduct a normal approach and landing to that surface, adding flaps and configuring the aircraft for landing at the appropriate points. After turning a simulated final, add full flaps, enter a full power off stall and recover.

Practice stalls and other maneuvers as necessary to increase student proficiency, then proceed to Northwood airport.

Northwood Airport – Remind student of potential traffic in the pattern. Conduct a normal pattern entry into Northwood airport. Ask questions to stimulate thought:
What radio calls should we make, and where?
What is a good altitude to over-fly?
Is there any way we could figure out which runway is in use without over-flying?
Which is Runway 26? How do you determine runways?
Do we use a left-hand pattern for both runways?
On downwind, tell the student that another aircraft just conducted a full stop landing and will have to back-taxi on the runway to get to the ramp. What should we do to our pattern? Conduct a full stop landing and taxi to the ramp completing all appropriate checklists. Emphasize "mission accomplished"—everything that happened is how it might really be! Get ready for some flap jacks!

Leg 2 - 4V4 to GFK

Departing 4V4 – Conduct additional pattern work as necessary to increase student proficiency. Depart toward Practice Area when complete.

Power-on Stall - Maneuver into the practice area. Once established, simulate a thin cloud layer ahead. Should we go above it, or below it? If we go above it, how will we get into Grand Forks? Let's say you choose to go above it—what airspeed will you get you above it in the least distance? Climb at Vx. Once established, encourage student to gradually increase climb angle until aircraft stalls. Recover as appropriate. Now tell student you have changed your mind—let's go below it. But expedite descent because cloud layer is fast-approaching. Allow student to experience the Yellow Arc for post-flight discussion.

Continue inbound to Grand Forks – Normal pattern entry with pattern practice as appropriate.

Taxi-back/Shutdown – Tell the student to "Secure the aircraft—I'll see you inside." Leave the student to do the post flight—a pilot has to be responsible. Go into the building, but than come-up with an excuse to return to aircraft (follow-up on student procedures.)

Post Flight Debrief – Have student critique performance, lessons learned, and areas for improvement. "How did you like that speed up in the Yellow Arc?" Assign next lesson's scenario.

FLIGHT LESSON 7

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate sections of Workbook.
3. Obtain a weather brief.
4. Complete a Performance Calculation including Weight and Balance.
5. Plot the scenario survey location on VFR sectional.

SCENARIO

You are employed by an aerial survey company that uses on-board sensors to map property boundaries. This requires the pilot to fly the aircraft accurately over prominent landmarks at a precise altitude while correcting for winds. Some survey tasks require you to orbit over a specific landmark and maintain a constant radius from the landmark. There may be other survey aircraft working the same area, so it is important to be heads-up and prepared to take evasive action if necessary. A tough job—but the pay is good.

Your job today is to survey a road intersection at 47 41N/96 34W and the borders of the section that surround that ground reference. Because of the equipment on board the aircraft, your fuel is somewhat limited, so plan to gas-up at Crookston between missions.

INSTRUCTOR INFORMATION

Preflight Brief – Discuss with the student how to verify fuel loads with less than full tanks, and techniques for navigating to the survey area. Verify their plotting of the survey location and discuss any problems they might have had.

Leg 1-GFK to Location of Survey

Ground Ops – Student should be able to do all pre-flight and ground checklist procedures without assistance. Show how to use the GPS to create a user waypoint for survey area.

Departing GFK—Normal takeoff and climb-out.

Enroute to Survey Area – Practice syllabus maneuvers previously introduced.

Once in the Survey Area – Identify ground reference and surrounding section boundaries. Introduce techniques for tracking the section lines around the target area (rectangular course), how to orbit directly over the survey point while maintaining a constant radius (turns around a point), and how to acquire multiple survey plots over a roadway (S-turn along a road). Challenge student to determine wind direction based on required corrections.

Ask student what fuel state would necessitate proceeding to Crookston.

Enroute to Crookston – When time and fuel conditions require, proceed to the Crookston Airport. Once established at cruise altitude, simulate a traffic avoidance maneuver requiring a steep turn. Once accomplished, allow student to practice several steep turn maneuvers for skill development, as necessary.

Crookston Airport-- Allow student to initiate and execute proper pattern entry procedures and radio calls. Practice normal and crosswind landings emphasizing use of slips for crosswind and glide path corrections. Also emphasize importance of stabilized approach, recognition of the need for a go-around, and proper go-around procedures. Initial landing at Crookston should be a full-stop/taxi back simulating the need for refuel. Simulate pulling up to a fuel pump, and discuss associated hazards.

Leg 2-Crookston to GFK

Departure from Crookston - Simulate the need to climb immediately after takeoff to clear another area being surveyed just off the departure end of the runway. Task the student to choose the most appropriate climb (Vx, or Vy).

Enroute to GFK – Practice maneuvers needing review as necessary. Task student to point out designated VFR recovery points. Approaching Carpet or Lagoon, simulate converging traffic and challenge student to take appropriate traffic avoidance measures.

GFK Airport—Additional emphasis on lesson maneuvers, as time permits. While in the traffic pattern, correlate techniques practiced in the area (rectangular course, steep turns, etc) with VFR pattern techniques.

Post Flight Brief – Have student critique individual performance. Assign next lesson's scenario.

FLIGHT LESSON 8 (FTD)

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate sections of Workbook.
3. Obtain a UND Dispatch Form and review Risk Assessment on back of form..
4. Complete a Pilot Personal Minimums checklist. List what you think your personal minimums will be immediately after earning your Private Pilot License.
5. Consider whether or not this flight is within your personal limitations and how other factors presented in this scenario might affect your GO/NO GO decision..

SCENARIO

You have made plans to make a late afternoon flight to Thief River to meet a friend for dinner. Your friend has agreed to pick you up at the airport at 5:00 sharp, and must return to work no later than 8:00. Weather for the route is 4000 Broken with isolated rain showers. When you look out the window, the sun is poking through the clouds here and there across the whole area, with some scattered areas of virga, and the winds are out of the south at 10 kts. There are no NOTAMS affecting your flight, but the Dispatch/SOF radio is out of service. The aircraft was not serviced after the last flight and there is only 15 gallons total. The fuel truck people have already gone home, so you can't get any additional fuel added at GFK:

Where will you get fuel on this flight?
How do you know you'll be able to get fuel there?

INSTRUCTOR INFORMATION

Preflight Discussion – Discuss Dispatch Risk Assessment with the student.

Ask student to identify the potential hazards of this flight, and how the risks associated with those hazards might be reduced or eliminated.

Things like: Late afternoon flight, what if it gets dark?
Are you concerned about the rain showers? How would you avoid them at night?
Do you feel pressure to meet your friend at 5:00 "sharp"?
Is there anyway you could reduce that pressure?
Can you handle the winds? Are those unusual winds for this area?
Are you happy with the gas situation? Does the fuel status present a risk?

Allow student to explain his/her Personal Minimums and whether or not the flight scenario is within those minimums.
Ask the student to explain how to use the Aircraft Checklist, and why he/she considers it a good tool to use (specifically the emergency/abnormal section).
What portions are important to memorize and why?
Have student write down, from memory, the emergency action items for the following:

Engine Fire on Start
Electrical Fire in Flight
Engine Failure after Vr
Engine Failure in Flight
Emergency Descent

Encourage the student to identify other information that is important in an emergency but not included in the memory items of the checklist.

Leg 1—GFK-TVF

<u>Ground Ops</u>

Engine start—Engine backfires, but does not start. Another pilot starts waving at you frantically. You then notice smoke curling up from below the engine cowling. What will you do? Why? After executing the proper procedure, ask the student—now what? (Would you egress, stay in aircraft? How far away would you egress? Encourage student to take the scenario all the way to conclusion)

Prior to the next engine start, ask student what the approximate amperage draw will be with all the normal equipment on. Than after start, allow student to verify that prediction.

Engine run-up check—When you move ignition key to the Right position, rpm drops 225. Is this within limits? Which mag is malfunctioning? What are you going to do? Will the aircraft fly with the mag like this? What would happen if this mag got worse?
During check of Carb Heat, you get no rpm drop. What does this mean? Would you takeoff with this condition?

Pre-Takeoff—What do you look at during takeoff to ensure engine is running properly? Do you fixate on those gauges, or just crosscheck them? How often? What might the indications of engine failure be (consider both complete and partial failure)? What call-outs can we use to help us out?

Give Engine Low Oil Pressure immediately after brake release. (Hopefully student catches it and aborts—if not, give engine failure on climb out and let him/her deal with it.)

Enroute—Give student an abnormally high amp reading. Ask them to describe what this signifies. Than simulate a faint odor of burning insulation. Smoke appears to be coming from behind the circuit breaker panel. Ask student to evaluate what most likely is happening. What are the risks associated with this situation?
What will you do?
After taking appropriate checklist action, ask whether they would continue to destination or return to GFK?
How will you navigate to the airport?
Will anybody know about your situation?
Would you consider an emergency landing on a wide open bean field?

After making appropriate decisions to handle the above situation, the engine suddenly quits—just a rapid rpm decrease to almost nothing . Now what? Have student explain his/her actions.
Discuss the most frequent causes of engine failure (fuel starvation is #1)
Allow student to take situation to a conclusion, including discussion of what to do after landing.. (Will you egress aircraft? How far will you move away? Will you stay with aircraft, or walk to farm? Any emergency/survival equipment available? Do you have your boots, mittens, hat, etc?)
The local TV station is first on the scene. What are you going to say to them?

Leg 2—TVF-GFK

You are safe and sound, and delivered to the TVF airport. The FBO has arranged for another Warrior for you to fly back to GFK. (Preflight, ground ops, run-up checks, etc, are complete.)
Create the aura that time is critical—a realistic situation we often encounter. Ask student what systems/switches he/she considers the most important to check and ask them to set everything up without using the checklist. Then, prior to takeoff, have them review the checklist to see if they missed anything. Ask them to evaluate whether or not they feel comfortable not using the checklist?

Takeoff - Catastrophic Engine failure after Vr.
Ask student to evaluate his/her performance—did you do the right thing? If you had to do it all over again, would you do anything different? Why?
What are your priorities when something like this happens? (Save yourself first, than the aircraft, etc, etc)
What are some of the worst things you could envision happening in this situation? (Like losing control of the aircraft, stall/spin, colliding with major obstacle, etc.etc.) What pilot actions would prevent these bad things from happening?

If time permits: Partial power loss after takeoff (Mag failure, fuel contamination, induction ice, etc)
Depending on severity, student might land straight ahead, or maneuver back to runway. Once again, ask student to evaluate his/her actions. Ask student to consider: What if engine operation had gotten worse—would your decision still be a good one?

Subsequent takeoff—Normal.

Enroute to GFK—Carburetor icing. Discuss indications and proper procedures.

Than, Low Voltage Light illuminates. Ask student to explain what this means, and appropriate actions. Will you continue to GFK, or look for an intermediate airport? Why? Which do you consider the safest course of action?

While continuing to the selected airport, you suddenly hear a loud bang, followed by severe engine roughness with flames billowing from under the engine cowling.

Sparks also appear in the area of the wing root. Ask student to evaluate what he/she thinks has happened, and what the correct procedures will be. What is the worst thing that could happen with this scenario?
After securing the engine, a glow is till apparent out the left side of the engine cowling. Guide student through the proper emergency descent procedures. Then ask questions like: Why are we using a steep bank angle? How low will you descend in the emergency descent? Would you do the same thing at night? Allow student to take situation to a conclusion and than self-evaluate performance.

Post flight Brief - Allow student to evaluate his/her performance, discuss lessons learned, and what he/she would do different in similar situations. Assign next lesson's scenario.

FLIGHT LESSON 9

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate sections of Workbook.
3. Obtain a weather brief.
4. Complete a performance calculation including weight and balance.
5. Complete a Preflight Risk Assessment worksheet.
6. Do some preliminary planning on how you would navigate from KGFK to Carrington, ND. Plan to fly over the Northwood Airport enroute.
7. Be prepared to lead a discussion on what you would do if the engine failed while cruising at 4500 ft.

SCENARIO

You work for a veterinarian in Carrington, ND that owns a Piper Warrior. He has sent you to Grand Forks to pick up vaccine for West Nile disease and fly it back to Carrington. The vaccine is temperature sensitive and it is critical that you deliver it to Carrington within two hours after pickup. The flight up from Carrington was uneventful, but the winds are forecast to increase for your return flight with light to moderate turbulence. Both KGFK and Carrington are forecasting winds of 15kt with gusts to 25.

INSTRUCTOR INFORMATION

Leg 1 – KGFK to Carrington. (Student will land at Northwood due to engine failure)

Ground Ops – Let the student handle the entire ground ops without any assistance. This will enforce student's need to take charge and make decisions. While taxiing out, simulate a Low Voltage Light illuminated, and during run-up check a mag that drops 225 rpm. Also, during taxi, quarry student on location of the wind socks, and simulate a strong/gusty wind condition. Ask student how takeoff techniques should be modified for this condition.

Takeoff – No flap takeoff simulating gusty wind conditions.

Enroute to Carrington – Have student climb to 4500 ft and provide assistance to get on-course to Carrington with Northwood as an intermediate check point. Once on-course, simulate strange aircraft noise/vibration, and ask student to slow down to a slow flight airspeed to evaluate the vibration. Ask student to make several shallow turns at this airspeed. Than have student slow even more to experience the indications of imminent stall. Once complete, continue on toward Carrington.

Approaching Northwood – Simulate indications of impending engine failure at 4500 ft. Assist student in evaluating situation and taking proper actions to land safely at Northwood. Take situation to conclusion, including a discussion of "Okay, you made it safely onto the runway—now what? (i.e. Aircraft is dead on the runway, now what are you going to do? Where might you get assistance? Can you reach anybody on the radio? Is there any guidance in the aircraft POH? ***NOTE: As much as practical, let the student come-up with the solutions.***

Subsequent takeoff from Northwood**.** Traffic permitting, practice another Power-off Landing requiring a slip, then introduce a Zero Flap Landing. Challenge the student to think of a situation which might require a Zero Flap Landing. Practice multiple patterns as time permits, with both stop-and-go's and go-around's.

Leg 2 – Northwood to KGFK.

Normal takeoff and departure. Once in the area, practice stalls, slow flight, steep turns, and aerodynamics demonstration in a maneuvers format. Challenge student to navigate to KGFK without instructor assistance. Once established, simulate fuel starvation – allow student to handle ensuing power-off situation. If student follows appropriate procedures to re-establish fuel supply, engine power is regained. If appropriate steps are not followed, allow power off scenario to continue.

GFK Traffic Pattern – Practice normal, no-flap, and power-off landings as time permits.

After landing and clear of the runway– Simulate a situation where the left brake has failed. Allow student to experience the difficulty of taxiing with one brake inoperative and discuss the hazards associated with taxiing into a congested area with this situation. Ask student to analyze how he/she might handle this situation for real.

Post flight debrief – Allow student to critique performance and identify areas for improvement. Assign next lesson's scenario.

FLIGHT LESSON 10

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate sections of Workbook.
3. Obtain a weather brief.
4. Complete a performance calculation including weight and balance.
5. Complete a Personal Minimums worksheet based on your current capabilities.
6. Be prepared to brief your instructor on the KGFK departure procedures, practice area collision avoidance procedures, and enroute navigation techniques for a flight to the Warren Airport. Also be prepared to discuss features of the Warren Airport and traffic pattern.

SCENARIO

You are flying to Warren, Minn. to meet with Polaris Industries – a potential customer for your patented *tagnite* metal coating process. A division manager from Polaris has been visiting your shop in GFK and will ride with you to Warren. Once at Warren, the CEO of Polaris will meet you at the airport. Obviously, you wish to impress your passenger and the CEO with your professionalism – both in the air, and on the ground.

INSTRUCTOR INFROMATION

Leg 1 – KGFK to Warren

Ground Ops – Allow the student to conduct pre-flight, run-up, and taxi procedures without any instructor assistance. While taxiing from the ramp, simulate a situation with a fuel truck parked too close to the taxi line. Let student devise corrective action.

Takeoff – Normal takeoff. Once airborne, tower requests that you expedite climb to avoid a helicopter traveling East-West off the departure end of the runway. (should require climb at Vx, see if student realizes this

Enroute – Assist student in establishing initial nav leg to Warren. Have student point out landmarks for the primary choke points for VFR traffic returning to KGFK. Simulate a situation where Departure Control calls out opposite direction traffic at your altitude – allow student to decide what to do.

Warren Airport – Conduct standard pattern entry with normal landing to a full stop. Pull into ramp parking to simulate scenario completion. Allow student to critique performance – would Polaris employee be impressed?

Subsequent takeoff – Practice normal, no-flap, and power off landings. Emphasizing stabilized approach and proper decisions regarding go-arounds. If other aircraft are in the traffic pattern, simulate that one is a B-727 and ask student to demonstrate proper wake turbulence avoidance procedures. Simulate encounter with wind shear on short final.

Leg 2 – Warren to GFK

Normal takeoff and departure procedures. Challenge student to find his/her own way back to GFK and follow normal traffic pattern entry procedures.

Traffic Pattern GFK – If conditions permit, simulate engine failure upon initial arrival into traffic pattern. Encourage student to simulate appropriate emergency radio calls. After landing, have student explain post-landing intentions following the power off landing. Conduct pattern work as necessary to increase student skill.

Post flight Brief – Enable student to critique performance and identify areas needing further improvement prior to first solo. Assign next lesson's scenario.

GROUND LESSON 11

STUDENT PREPARATION

1. Review syllabus description for this maneuver.
2. Complete appropriate sections of the Workbook.
3. Bring FAR/AIM and highlighter to briefing.
4. Be prepared to lead a discussion on Student Pilot Limitations (IAW FAR Part 61)

SCENARIO

Congratulations – you just won a C-172 in Sporty's win a Skyhawk sweepstakes! You decide to use your new aircraft for a flight with three friends down to Minneapolis. One of your friends, Nathan, is a certified commercial pilot and has offered to operate as PIC for any phases of flight he might have to

C-172 Equipment List:

EQUIPMENT LIST

The following equipment list is a comprehensive list of all Cessna equipment available for this airplane. A separate equipment list of items installed in your specific airplane is provided in your aircraft file. The following list and the specific list for your airplane have a similar order of listing.

This equipment list provides the following information:

An **item number** gives the identification number for the item. Each number is prefixed with a letter which identifies the **descriptive** grouping (example: A. Powerplant & Accessories) under which it is listed. Suffix letters identify the equipment as a required item, a standard item or an optional item. Suffix letters are as follows:

- -R = required items of equipment for FAA certification
- -S = standard equipment items
- -O = optional equipment items replacing required or standard items
- -A = optional equipment items which are in addition to required or standard items

A **reference drawing** column provides the drawing number for the item.

NOTE

If additional equipment is to be installed, it must be done in accordance with the reference drawing, accessory kit instructions, or a separate FAA approval.

Columns showing **weight (in pounds)** and **arm (in inches)** provide the weight and center of gravity location for the equipment.

NOTE

Unless otherwise indicated, true values (not net change values) for the weight and arm are shown. Positive arms are distances aft of the airplane datum; negative arms are distances forward of the datum.

NOTE

Asterisks (*) after the item weight and arm indicate complete assembly installations. Some major components of the assembly are listed on the lines immediately following. The summation of these major components does not necessarily equal the complete assembly installation.

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	A. POWERPLANT & ACCESSORIES			
A01-R	ENGINE, LYCOMING O-320-H2AD (INCLUDES ELECTRIC STARTER, VACUUM PUMP PAD, SPARK PLUGS & CARBURETOR	0550333	269.5*	-19.7*
A05-R	FILTER, CARBURETOR AIR	C294510-0301	0.5	-26.0
A09-R	ALTERNATOR, 28 VOLT, 60 AMP (BELT DRIVE)	C611503-0102	10.7	-29.0
A17-R	OIL COOLER INSTALLATION	0550333	2.5*	-2.5*
	OIL COOLER	10599A	2.1	-2.5
A21-A	OIL FILTER INSTALLATION (SPIN-ON ELEMENT) NET CHANGE	0501060	2.5	-6.5
A33-R	PROPELLER ASSY. (FIXED PITCH-LANDPLANE)	C161001-0310	35.9*	-38.5*
	PROPELLER (MCCAULEY)	1C160/DTM7557	30.1	-39.1
	3.5 INCH PROP SPACER ADAPTOR (MCCAULEY)	C4516	3.6	-35.4
A33-O	PROPELLER ASSY. (FIXED PITCH-FLOATPLANE)	C161001-0307	37.5*	-38.6*
	PROPELLER (MCCAULEY)	1A175/ETM8042	31.8	-39.1
	3.5 INCH PROP SPACER ADAPTOR (MCCAULEY)	C4516	3.6	-35.4
A41-R	SPINNER INSTALLATION, PROPELLER	0550320	2.0*	-41.4*
	SPINNER DOME	0550236-8	1.2	-43.1
	FWD SPINNER BULKHEAD	0550321-4	0.3	-40.8
	AFT SPINNER BULKHEAD	0550321-10	0.4	-37.3
A61-S	VACUUM SYSTEM INSTALLATION	0501054	3.0*	-2.7*
	DRY VACUUM PUMP	C431003-0101	1.8	-6.3
	FILTER	1201075-2	0.2	5.4
	VACUUM GAUGE	C668509-0101	0.1	16.7
	RELIEF VALVE-REGULATOR	C482001-0401	0.4	5.0
A70-A	PRIMER SYSTEM, ENGINE THREE CYLINDER	0501056-1	0.3	-12.0
A73-A	OIL QUICK DRAIN VALVE (NET CHANGE)	1701015	0.0	- -
	B. LANDING GEAR & ACCESSORIES			
B01-R	WHEEL, BRAKE & TIRE ASSY, 6.00X6 MAIN (2)	C163018-0201	41.7*	57.8*
	WHEEL ASSY, MCCAULEY	C163005-0101	7.6	58.2
	BRAKE ASSY., MCCAULEY (LEFT)	C163032-0115	1.9	54.5
	BRAKE ASSY., MCCAULEY (RIGHT)	C163032-0114	1.9	54.5
	TIRE, 4-PLY BLACKWALL (EACH)	C262003-0101	8.5	58.2
	TUBE (EACH)	C262023-0102	1.8	58.2
B04-R	WHEEL & TIRE ASSY., 5.00X5 NOSE	C163018-0101	8.7*	-6.8*
	WHEEL ASSY., MCCAULEY	C163005-0201	2.4	-6.8

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	TIRE, 4-PLY BLACKWALL	C262003-0102	4.7	-6.8
	TUBE	C262023-0101	1.2	-6.8
B10-S	FAIRING INSTALLATION, WHEEL (SET OF 3)	0541225-1	17.8*	47.1*
	NOSE WHEEL FAIRING		4.0	-4.9
	MAIN WHEEL FAIRING (EACH)		5.7	60.3
	C. ELECTRICAL SYSTEMS			
C01-R	BATTERY, 24 VOLT, STANDARD DUTY	C614001-0105	22.8	0.0
C01-O	BATTERY, 24 VOLT, HEAVY DUTY	C614001-0106	24.8	0.0
C04-R	ALTERNATOR CONTROL UNIT, 28 VOLT WITH HIGH LOW VOLTAGE SENSING	C611004-0101	0.4	3.5
C07-A	GROUND SERVICE PLUG RECEPTACLE	0501064	2.7	-2.6
C16-O	HEATING SYSTEM, PITOT (NET CHANGE)	0422355	0.6	24.4
C22-A	LIGHTS, INSTRUMENT POST (REQUIRES INSTALLATION OF E34-O DELUXE GLARESHIELD)	0513094	0.5	16.5
C25-A	LIGHT, MAP (CONTROL WHEEL MTD, REQS E89-O)	0570087	0.2	21.5
C28-S	LIGHT, MAP & INSTRUMENT PANEL FLOOD (DOORPOST MOUNTED)	0700149	0.3	32.0
C31-A	LIGHTS, COURTESY ENTRANCE (SET OF 2)	0521101	0.5	61.0
C40-A	DETECTORS, NAVIGATION LIGHT (SET OF 2)	0701013-1, -2	NEGL	- -
C43-A	LIGHT INSTALLATION, OMNIFLASH BEACON	0506003	2.1*	184.2*
	BEACON LIGHT ON FIN TIP	C621001-0102	0.4	243.0
	FLASHER POWER SUPPLY	C594502-0102	0.8	205.8
	RESISTOR (MEMCOR)	CR95-6	0.3	208.1
C46-A	LIGHT INSTALLATION, WING TIP STROBE	0501027	3.4*	43.3*
	FLASHER POWER SUPPLY (SET OF 2 IN WING)	C622008-0102	2.3	47.0
	STROBE LIGHT, WING TIP (SET OF 2)	C622006-0101	0.2	43.5
C49-S	LIGHT INSTALLATION, COWL MOUNTED LANDING	0570312	1.9*	-27.1*
	LAMP, 250 WATT (G.E.)	4553	0.8	-29.0
C49-O	LIGHTS, DUAL COWL MOUNTED LANDING	0552141	3.2*	-23.0*
	LAMP, 250 WATT (G.E.) (EACH)	4591	0.5	-29.0
	D. INSTRUMENTS			
D01-R	INDICATOR, AIRSPEED	C661064-0102	0.6	16.2
D01-O	INDICATOR, TRUE AIRSPEED	0513279	0.7	16.3
D04-A	STATIC AIR ALTERNATE SOURCE	0501017	0.2	15.5

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
D07-R	ALTIMETER (SENSITIVE)	C661071-0101	1.0	14.0
D07-O-1	ALTIMETER, SENSITIVE (50 FT. MARKINGS) (FEET AND MILLIBARS)	C661071-0102	1.0	14.0
D07-O-2	ALTIMETER (SENSITIVE) 20FT. MARKINGS (FEET AND MILLIBARS)	C661025-0102	1.0	14.0
D10-A	ALTIMETER, 2ND UNIT INSTALLATION (DUAL)	2001015	1.0	14.5
D16-A-1	ENCODING ALTIMETER (REQUIRES RELOCATION OF REGULAR ALTIMETER)	0501049	3.0	14.0
D16-A-2	ENCODING ALTIMETER, FEET & MILLIBARS (REQUIRES RELOCATION OF REGULAR ALTIMETER)	0501049	3.0	14.0
D16-A-3	ALTITUDE ENCODER (BLIND, DOES NOT REQUIRE INSTRUMENT PANEL MOUNTING)	0501059	1.5*	14.4*
D19-R	AMMETER	S-1320-5	0.3	16.5
D22-A	GAGE, CARBURETOR AIR TEMPERATURE	0513339	1.0	14.0
D25-S	CLOCK, ELECTRIC	C664508-0101	0.4	16.3
D28-R	COMPASS, MAGNETIC-INSTALLATION	0513262-1	0.4	14.0
D38-R	INSTRUMENT CLUSTER, LH & RH FUEL QUANTITY	C669511-0102	0.4	16.5
D41-R	INSTRUMENT CLUSTER, OIL PRESS, OIL TEMP.	C669512-0102	0.5	16.5
D49-A	INDICATOR, ECONOMY MIXTURE (EGT)	0501043-2	0.6	7.8
D64-S	GYROS, ATTITUDE & DIRECTIONAL INDICATORS (NON-NAV-O-MATIC)	0501054-1	6.3*	13.6*
	DIRECTIONAL INDICATOR	C661075-0104	2.7	14.7
	ATTITUDE INDICATOR	C661075-0101	2.5	14.3
D64-O	GYRO INSTALLATION FOR 300 NAV-O-MATIC	0501054-2	6.9*	13.4*
	DIRECTIONAL INDICATOR (ARC)	40760-0101	3.3	14.3
	ATTITUDE INDICATOR	C661075-0101	2.5	14.3
D67-A	RECORDER INSTALLATION, FLIGHT HOUR	0501052	0.5	6.3
D82-S	GAGE, OUTSIDE AIR TEMPERATURE	C668507-0101	0.1	28.6
D85-R	TACHOMETER INSTALLATION, ENGINE	0506004	1.0*	12.1*
	RECORDING TACH INDICATOR	C668020-0118	0.7	16.0
	FLEXIBLE TACH SHAFT	S-1605-10	0.3	3.0
D88-S-1	INDICATOR, TURN COORDINATOR, 28 VOLT ONLY	C661003-0505	1.3	15.8
D88-S-2	INDICATOR, TURN COORDINATOR, 10-30 VOLT	C661003-0506	1.3	15.8
D88-O	INDICATOR, TURN COORDINATOR (FOR USE WITH NAV-O-MATIC 200A AND 300A)	42320-0028	1.3	14.6
D91-S	INDICATOR, VERTICAL SPEED	C661080-0101	1.0	14.9
	E. CABIN ACCOMMODATIONS			

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
E02-S	ARM RESTS - 2ND ROW (SET OF 2)	0715039	1.5	72.5
E05-R	SEAT, ADJUSTABLE FORE & AFT PILOT	0514141	12.6	44.0
E05-O	SEAT, INFINITE ADJUSTABLE - PILOT	0514142	23.0	41.5
E07-S	SEAT, ADJUSTABLE FORE & AFT- CO-PILOT	0514141	12.6	44.0
E07-O	SEAT, INFINITE ADJUSTABLE - CO-PILOT	0514142	23.0	41.5
E09-S	SEAT, REAR (ONE PIECE BACK CUSHION)	0514144	22.0	79.5
E09-O	SEAT, REAR (TWO PIECE BACK CUSHION)	0514143	23.0	79.5
E15-R	PILOT LAP BELT ASSY	S-2275-103	1.0	37.0
E15-S	SHOULDER HARNESS ASSY, PILOT	S-2275-201	0.6	37.0
E19-O	SHOULDER HARNESS INERTIA REEL INSTALLATION PILOT & CO-PILOT - REPLACES STD BELTS AND HARNESS (NET CHANGE)	0501046-1	2.0	82.0
E23-S	BELT & SHOULDER ASSY - CO-PILOT	S-2275-3	1.6	37.0
E27-S	BELT ASSY, 2ND ROW (SET OF 2)	S-1746-39	2.0	70.0
E27-O	SEAT BELT & SHOULDER HARNESS ASSY FOR 2ND ROW SEATING	S-2275-8	3.2	70.0
E34-O	DELUXE GLARESHIELD (NET CHANGE)	0515034	1.0	21.0
E35-A-1	LEATHER SEAT COVERING (NET CHANGE	CES-1151	2.0	62.0
E35-A-2	LEATHER & VINYL OR FABRIC COVER-NET CHANGE	CES-1151	1.5	62.0
E37-O	WINDOW, HINGED, RH DOOR (NET CHANGE)	0501075	2.3	47.0
E39-A	WINDOWS, OVERHEAD CABIN TOP (NET CHANGE)	0511800	0.9	47.9
E43-A	VENTILATION SYSTEM, REAR SEAT (NOT COMPATABLE WITH E88-A-1 OR E88-A-2)	0700322	1.7	60.0
E49-A	BEVERAGE CUP HOLDER	0501023	0.1	15.0
E50-A	HEADREST, 1ST ROW (WT EACH)	1215073-11	0.7	47.0
E51-A	HEADREST, 2ND ROW (WT EACH)	1215073-11	0.7	86.0
E55-S	SUN VISORS (SET OF 2)	0500040	0.9	32.8
E57-A	WINDOWS, TINTED FRONT, SIDE & REAR (NET CHANGE)	0500267	0.0	--
E65-S	BAGGAGE NET	2015009	0.5	95.0
E71-A	RINGS, CARGO TIE-DOWN (STOWED)(USE ARM AS INSTALLED WITH CARGO)	0500042	1.0	--
E85-A	CONTROLS INSTALLATION, DUAL	0513335	4.9	12.4
E87-A	RUDDER TRIM SYSTEM	0513290	1.9	9.4
E88-A-1	CABIN AIR CONDITIONING SYSTEM-CHILLED AIR	0501066	63.5*	43.2*
	COMPRESSOR ASSEMBLY		20.2	-29.0
	EVAPORATOR (LOCATED ABOVE AFT BAGGAGE		9.1	123.5
	CONDENSOR (LOCATED UNDER SIDE FUSELAGE)		5.3	96.2
E88-A-2	CABIN AIR CIRCULATING FAN	0501072	10.0	100.0
E89-O	ALL PURPOSE CONTROL WHEEL, NET CHANGE		NEGL	--
E93-R	HEATING SYSTEM, CABIN & CARBURETOR AIR (INCLUDES EXHAUST SYSTEM)	0550333 0506004	17.5	-21.0

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	F. PLACARDS, WARNINGS & MANUALS			
F01-R	PLACARD, OPERATIONAL LIMITATIONS-DAY VFR	0505087	NEGL	- -
F01-0-1	PLACARD, OPERATIONAL LIMITATIONS-DAY NIGHT VFR	0505087	NEGL	- -
F01-0-2	PLACARD, OPERATIONAL LIMITATIONS-DAY NIGHT VFR IFR	0505087	NEGL	- -
F01-0-3	PLACARD, OPERATIONAL LIMITATIONS-DAY VFR FLOATPLANE	0505087	NEGL	- -
F01-0-4	PLACARD, OPERATIONAL LIMITATIONS-DAY NIGHT VFR FLOATPLANE	0505087	NEGL	- -
F01-0-5	PLACARD, OPERATIONAL LIMITATIONS-DAY NIGHT VFR IFR FLOATPLANE	0505087	NEGL	- -
	NOTE THE ABOVE PLACARDS ARE INSTALLED ACCORDING TO AIRCRAFT EQUIPMENT			
F04-R	INDICATOR, AUDIBLE PNEUMATIC STALL WARNING	0523112	0.2	28.5
F13-S	LOW VOLTAGE WARNING LIGHT, ALTERNATOR		NEGL	- -
F16-R	PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL	D1138-13PH	0.5	- -
	G. AUXILIARY EQUIPMENT			
G07-A	RINGS, AIRPLANE HOISTING (CABIN TOP)	0541115	0.9	49.1
G13-A	CORROSION PROOFING, INTERNAL	0500036	10.0	77.0
G16-A	STATIC DISCHARGERS	0501048	0.4	143.2
G19-A	STABILIZER ABRASION BOOTS	0500041	2.7	206.0
G22-S	TOW BAR (STOWED)	0501019	1.6	95.0
G25-S	PAINT, OVERALL EXTERIOR (MODIFIED POLYURETHANE)	0504037	12.4*	90.9*
	OVERALL BASE WHITE		11.6	90.5
	WASH PRIME		0.4	90.5
	COLOR STRIPE		0.5	102.2
G25-A	OPTIONAL OVERALL PRIME COATING	0504037	3.3	90.5
G31-A	CABLES, CORROSION RESISTANT CONTROL (NET CHANGE)	0500036	0.0	- -
G55-A	FIRE EXTINGUISHER INSTALLATION	0501011	3.0*	43.8*
	FIRE EXTINGUISHER	C421001-0101	2.6	44.0
	FIRE EXTINGUISHER MOUNTING BRACKET	C421001-0102	0.3	42.2
G58-A	STEPS & HANDLES, REFUELING ASSISTING	0513415	1.7	16.3

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
G67-A	RUDDER PEDAL EXTENSIONS, REMOVABLE - SET OF 2 (STOWABLE - INSTALLED ARM SHOWN)	0701048	2.3	8.0
G88-A-1	WINTERIZATION KIT INSTALLATION, ENGINE	0501008	0.8*	-22.7*
	BREATHER TUBE INSULATION	0552011	0.4	-13.8
	TWO COWL INLET AIR COVERS (INSTALLED)	0552132-1, -2	0.3	-32.0
	(STOWED)	0552132-1, -2	0.3	95.0
G88-A-2	WINTERIZATION KIT INSTL., FLOATPLANE ONLY	0552011	1.0*	-7.2*
	BREATHER TUBE INSULATION		0.4	-12.0
	COWL OUTLET COVER (1) (INSTALLED)		0.6	-4.0
	(STOWED)		0.6	95.0
G92-D	FUEL SYSTEM, EXTENDED RANGE WING TANKS (NET CHANGE)	0501055	9.5	48.0
	H. AVIONICS & AUTOPILOTS			
H01-A	CESSNA 300 ADF INSTALLATION	3910159-2	7.0*	21.0*
	CONSISTS OF			
	RECEIVER WITH BFO (R-546E)	41240-0101	2.3	12.1
	INDICATOR (IN-346A)	40980-1001	0.9	14.0
	SENSE ANTENNA INSTALLATION	0570400-632	0.2	108.6
	LOOP ANTENNA INSTALLATION	3960104-1	1.4	39.3
	RECEIVER MOUNT, WIRES AND MISC ITEMS		2.2	13.7
H04-A	DME INSTALLATION, NARCO	3910166-1	7.5*	18.5*
	RECEIVER (DME-190)	3312-400	4.9	11.3
	MOUNTING BOX		0.6	11.3
	ANTENNA,	- -	0.2	86.1
H05-A	FOSTER R-NAV 511	3910203	3.4*	11.8*
	RECEIVER & MOUNT (511)		2.4	14.5
H07-A-1	CESSNA 400 GLIDESLOPE (INCLUDES VOR/ILS INDICATOR--NET CHANGE FOR VOR/LOC INDICATOR)	3910157	4.4*	81.1*
	RECEIVER (R-443B)	42100-0000	2.1	117.0
	ANTENNA (LOCATED-UPPER WINDSHIELD)	1200098-2	0.2	30.0
	VOR/ILS INDICATOR (IN-386A)(INDICATOR WT NET CHANGE, ACTUAL WT IS 1.7 LBS)	46860-2000	0.1	15.5
H07-A-2	CESSNA 400 GLIDESLOPE (INCLUDES AUTOCOURSE VOR/ILS INDICATOR, WT NET CHANGE FOR VOR/LOC INDICATOR)	3910157	4.6*	78.2*
	RECEIVER (R-443B)	42100-0000	2.1	117.3
	ANTENNA (LOCATED-UPPER WINDSHIELD)	1200098-2	0.2	30.0
	VOR/ILS INDICATOR (IN-386AC)(INDICATOR	46860-2200	0.3	14.7

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	WT NET CHANGE, ACTUAL WT IS 1.9 LBS)			
H11-A-1	PANTRONICS PT-10A HF TRANSCEIVER 2ND UNIT	3910156-9	20.2*	88.8*
	TRANSCEIVER (PANEL MOUNTED)	C582103-0102	4.2	10.4
	ANTENNA LOAD BOX	C589502-0201	4.2	112.5
	HF POWER SUPPLY (REMOTE)	C582103-0301	8.5	114.4
	POWER & SIGNAL CABLES		2.5	41.0
	ANTENNA INSTALLATION, 351 IN. LONG	3960117	0.3	144.4
H11-A-2	SUNAIR ASB-125 HF TRANSCEIVER, 2ND UNIT	3910158-1	22.0*	82.8*
	ANTENNA LOAD BOX	99816	4.9	112.0
	POWER SUPPLY (REMOTE)	99683	8.5	114.0
	TRANSCEIVER (PANEL MOUNTED)	99681	4.6	10.4
	ANTENNA INSTALLATION, 351 IN. LONG	3960117	0.3	144.4
	MISC SWITCHES, WIRES AND ETC.	- -	3.7	57.5
H13-A	CESSNA 400 MARKER BEACON	3910164-1	2.3*	34.5*
	RECEIVER (R-402A)	42410-5128	0.7	11.8
	ANTENNA, L SHAPED ROD	0770681-1	0.7	136.0
H16-A-1	CESSNA 300 TRANSPONDER	3910127-17	4.0*	25.8*
	TRANSCEIVER (RT-359A)	41420-1128	2.7	11.1
	ANTENNA	- -	0.3	126.0
H16-A-2	CESSNA 400 TRANSPONDER (USED FOR EXPORT)	3910128-21	4.2*	25.1*
	TRANSCEIVER (RT-459A)	41470-1128	2.9	11.1
	ANTENNA	- -	0.3	126.0
H22-A-1	CESSNA 300 NAV/COM. 720 CH, FIRST UNIT	3910183-4	15.3*	30.5*
	WITH VOR/LOC			
	RECEIVER-TRANSCEIVER (RT-385A)	46660-1100	5.5	11.5
	VOR/LOC INDICATOR (IN-385A)	46860-1000	1.6	14.5
	H34-A BASIC AVIONICS KIT	3910186	7.0	52.6
	MOUNT, WIRE & MISC HARDWARE		1.2	10.0
H22-A-2	CESSNA 300 NAV/COM, 720 CH, FIRST UNIT	3910183	15.5*	30.3*
	WITH VOR/LOC AUTOCOURSE INDICATOR			
	RECEIVER-TRANSCEIVER (RT-385A)	46660-1100	5.5	11.5
	VOR/LOC INDICATOR (IN-385AC) (AUTOMATIC RADIAL CENTERING)	46860-1200	1.8	14.5
	H34-A BASIC AVIONICS KIT	3910186	7.0	52.6
	MOUNT, WIRING & MISC HARDWARE		1.2	10.0
H25-A-1	CESSNA 300 NAV/COM 720 CH COM 2ND UNIT	3910183-6	9.3*	14.6*
	WITH VOR/LOC			
	RECEIVER-TRANSCEIVER (RT-385A)	46660-1100	5.5	11.5
	VOR/LOC INDICATOR (IN-385A)	46860-1000	1.6	14.5
	H37-A ANTENNA COUPLER KIT	3910185	1.0	37.5
	MOUNT, WIRING & MISC ITEMS	3960111-1	1.2	10.0
H25-A-2	CESSNA 300 NAV/COM 720 CH COM 2ND UNIT	3910183	9.5*	14.6*

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	WITH VOR/LOC AUTOCOURSE INDICATOR			
	RECEIVER-TRANSCEIVER (RT-385A)	46660-1100	5.5	11.5
	VOR/LOC INDICATOR (IN-385AC)(AUTOMATIC RADIAL CENTERING)	46860-1200	1.8	14.5
	H37-A ANTENNA COUPLER KIT	3910185	1.0	37.5
	MOUNT, WIRING & MISC ITEMS	3960111-1	1.2	10.0
H28-A-1	EMERGENCY LOCATOR TRANSMITTER	0470419-3	3.5*	116.5*
	TRANSMITTER (D & M DMELT-6-1)	C589511-0117	3.3	116.4
	ANTENNA	C589511-0109	0.1	122.0
H28-A-2	EMERGENCY LOCATOR TRANSMITTER (USED IN CANADA)	0470419-4	3.5*	116.5*
	TRANSMITTER (D & M DMELT-6-1C)	C589511-0113	3.3	116.4
	ANTENNA	C589511-0109	0.1	122.0
H31-A-1	NAV-O-MATIC 200A	3910162-1	9.2*	51.0*
	CONTROLLER-AMPLIFIER	3930144-6	1.6	13.1
	TURN COORDINATOR (NET CHNG) (G-300A)	42320-0014	0.0	- -
	WING INSTALLATION (SERVO IS 3.9 LBS AT 68.9 INCHES)(PA-495)	0522632-1	6.1	68.1
H31-A-2	NAV-O-MATIC 300A (AF395)	3910163-1	10.4*	46.2*
	CONTROLLER-AMPLIFIER & MOUNT	CA-395A	1.8	13.1
	064-0 GYRO INSTALLATION NET CHANGE	0501054	0.6	11.3
	088-0 TURN COORDINATOR NET CHANGE	42320-0028	0.0	- -
	WING INSTALLATION (SERVO IS 3.9 LBS AT 68.9 INCHES)(PA-495)	0522632-1	6.1	68.1
	RELAY INSTALLATION	3940151-1	0.4	4.0
H34-A	BASIC AVIONICS KIT--AVAILABLE WITH 1ST UNIT NAV/COM ONLY	3910186-2	7.0*	52.6*
	RADIO COOLING INSTL.	3930206	1.1	10.2
	NOISE FILTER-AUDIO (ON ALTERNATOR)	3940148-1	0.1	-26.1
	COM ANTENNA CABLE	3950122-3	0.4	27.8
	OMNI ANTENNA CABLE	3950122-4	0.6	116.0
	OMNI ANTENNA INSTALLATION	3960102-10	0.8	220.8
	LH VHF COM ANTENNA	3960113-1	0.4	62.4
	CABIN SPEAKER INSTL.	3970123-5	1.2	37.9
	MIKE INSTL--HANDHELD	3970124-1	0.3	17.2
	HEADPHONE INSTALLATION	3970125-4	0.2	14.2
	AUDIO CONTROL PANEL INSTL	3970131-1	1.9	12.5
H37-A	ANTENNA & COUPLER KIT	3910185-2	1.0	37.5
H55-A	MIKE-HEADSET COMBO. INSTL (HEADSET STOWED) (STOWED ARM SHOWN)(REQUIRES E89-0)	3970112-1	0.3	13.0
H56-A	PADDED HEADPHONES & MICROPHONE, REQUIRES E89-0 ALL PURPOSE CONTROL WHEEL	C596531-0101	1.1	- -

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	J. SPECIAL OPTION PACKAGES			
J01-A	SKYHAWK II EQUIPMENT CONSISTS OF ITEMS	0500510	25.5*	46.0*
	D01-0 TRUE AIRSPEED IND.(NET CHANGE)	0513279	0.1	16.7
	C16-0 HEATED PITOT SYSTEM	0422355	0.6	24.4
	E85-A DUAL CONTROLS	0513335	4.9	12.4
	C40-A NAV LIGHT DETECTORS	0701013	NEGL	- -
	C31-A COURTESY LIGHTS	0521101	0.5	61.0
	C43-A FLASHING BEACON LIGHT	0506003	2.1	184.2
	D04-A STATIC ALTERNATE AIR SOURCE	0501017	0.2	15.5
	H28-A EMERGENCY LOCATOR XMTR (ELT)	470419	1.8	116.6
	G25-0 SKYHAWK II PAINT (NET CHANGE)	0504035	0.0	- -
	H22-A-1 NAV/COM 385A VOR/LOC	3910183-4	15.3	30.5
J04-A	NAV-PAC INSTALLATION (SKYHAWK II ONLY)	3910161	20.3*	19.1*
	H25-A 385A NAV/COM VOR/LOC	- -	9.3	14.6
	H01-A 300 ADF (546E)		7.0	21.0
	H16-A-1 300 TRANSPONDER (RT-359)		4.0	26.1
J10-A	FLOATPLANE FUSELAGE STRUCTURAL MODIFICA- TIONS & FITTINGS (OPTION C)	0500083	6.1	45.5
J13-A	FLOATPLANE COWLDECK V BRACE (INSTALLED)	0513003	1.1	26.2
	(STOWED)		1.1	95.0
J15-A	FLOATPLANE AILERON-RUDDER INTERCONNECT	0560012	0.4	69.6
	FLOATPLANE ONLY (INSTALLED)			
	(STOWED)		0.4	95.0
	ITEMS J10-A & J13-A ARE ALSO APPROVED FOR LANDPLANE OPERATIONS.			
J27-A	MODEL 89A2000 FLOATS & 502 ATTACHMENTS NET CHANGE BETWEEN STANDARD LANDING GEAR (ITEM NOS. B01-R, B04-R, B10-S AND BRAKE & NOSE WHEEL STEERING SYSTEMS) AND FLOATPLANE KIT (ITEM NO. J30-A-1) IS APPROXIMATELY 155 LBS. AT 58.3 IN. THE CORRECT VALUES OF WT & ARM CHANGE FOR WT & BALANCE CALCULATIONS SHOULD BE DETERMINED FROM THE ACTUAL INSTALLATION.	EDO-36335	- -	- -
J30-A-1	FLOATPLANE EQUIPMENT KIT WITH PROP CHANGE AND CORROSION PROOFING CONSISTS OF--	0500083	21.7*	52.3*
	A33-0 PROPELLER, FLOATPLANE, EXCHANGE	0550320	1.3	-41.4
	F01-0- PLACARD, FLOATPLANE OPERATION	0505053	0.0	- -
	G31-A CABLES, CORROSION RESIST, EXCH.	0500036	0.0	- -

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	G13-A CORROSION PROOFING, INTERNAL	0500036	10.0	77.0
	G07-A RINGS, AIRPLANE HOISTING	0541115	1.1	49.1
	G58-A STEP & HANDLE, REFUELING	0513415	1.7	17.8
	J10-A FUSELAGE MODIFICATION (OPT C)	0500083	6.1	45.5
	J13-A COWL DECK V-BRACE (INSTALLED)	0513003	1.1	26.2
	J15-A INTERCONNECT SYSTEM, INSTALLED	0560012	0.4	69.6
	COWL ASSY, FLOATPLANE (NET CHG)	0552162	NEGL	- -
	FLOATPLANE PLACARD	0505085	NEGL	- -
J30-A-2	FLOATPLANE EQUIPMENT KIT WITH CORROSION PROOFING, V-BRACE STOWED AND NO PROP CHANGE	0500083	20.4*	62.5*
	F01-0- PLACARD, FLOATPLANE OPERATION	0505053	0.0	- -
	G31-A CABLES, CORROSION RESIST, EXCH	0500036	0.0	- -
	G13-A CORROSION PROOFING, INTERNAL	0500036	10.0	77.0
	G07-A RINGS, AIRPLANE HOISTING	0541115	1.1	49.1
	G58-A STEP & HANDLE,REFUELING	0513415	1.7	17.8
	J10-A FUSELAGE MODIFICATION	0500083	6.1	45.5
	J13-A COWL DECK V-BRACE (STOWED)	0513003	1.1	95.0
	J15-A INTERCONNECT SYSTEM (STOWED)	0560012	0.4	95.0
	COWL ASSY, FLOATPLANE (NET CHG)	0552162	NEGL	- -
	FLOATPLANE PLACARD	0505085	NEGL	- -
J30-A-3	FLOATPLANE EQUIPMENT KIT WITH PROP CHANGE & NO CORROSION PROOFING CONSISTS OF--	0500083	11.7*	31.2*
	A33-0 PROPELLER, FLOATPLANE, EXCHANGE	0550320	1.3	-41.4
	F01-0 PLACARD, FLOATPLANE OPERATIONS	0505053	0.0	- -
	G07-A RINGS, AIRPLANE HOISTING	0541115	1.1	49.1
	G58-A STEP & HANDLE, REFUELING	0513415	1.7	17.8
	J10-A FUSELAGE MODIFICATIONS	0500044	6.1	45.5
	J13-A COWL DECK V-BRACE (INSTALLED)	0513003	1.1	26.2
	J15-A INTERCONNECT SYSTEM (INSTALLED)	0560012	0.4	69.6
	COWL ASSY, FLOATPLANE (NET CHG)	0552162	NEGL	- -
	FLOATPLANE PLACARD	0505085	NEGL	- -
J30-A-4	FLOATPLANE EQUIPMENT KIT WITH NO PROP CHANGE OR CORROSION PROOFING (USED PRIMARILY IN CANADA)	0500083	10.4*	41.2*
	G07-A RINGS, AIRPLANE HOISTING	0541115	1.1	49.1
	G58-A STEP & HANDLE, REFUELING		1.7	17.8
	J10-A FUSELAGE MODIFICATIONS	0500083	6.1	45.5
	J13-A COWL DECK V-BRACE (INSTALLED)	0513003	1.1	26.2
	J15-A INTERCONNECT SYSTEM (STOWED)	0560012	0.4	95.0
	COWL ASSY, FLOATPLANE (NET CHG)	0552162	NEGL	- -
	FLOATPLANE PLACARD	0505085	NEGL	- -

INSTRUCTOR INFORMATION:

The following is a list of questions/problems the student might encounter in the above scenario. Let the student use the FAR's to find the answers to the following questions. Each group of questions has been supplied with the applicable FAR reference(s):

FAR 61.3
What certificates does your friend need to have on his possession to act as PIC during this flight?
    As a student pilot, what certificates would you need?
If you were going to act as PIC, would your friend still need their certificates?

FAR 61.19, 61.23, and 61.53
How long is your current student pilot certificate good for?
What class of medical certificate do you have now?
    How long is that good for?
    What other class medical certificates are there and how long are they good for?
If your friend has a broken arm in a cast, can he still be the PIC for this flight?

FAR 61.25 and 61.29
You pilot friend Janelle recently got married and changed her last name, does she have to change her name on her PCL? – How would she go about that?
The night before today's flight your friend discovers his medical certificate is missing, what should he do?

FAR 61.87, 61.89, and 61.93
As a student pilot can you make the flight described above? Why or why not?
Assuming the above flight was solo, what would we – as student and instructor – need to do in order to make the flight?
Can you go in the C-172 if all your training is in the Warrior?
After we go through all the necessary training can your friends come along? Why or why not?
What are some other limitations you are subject to as a student pilot?
If you didn't have a cross country endorsement, how far could you have legally gone before having to turn around?

FAR 91.3 and 91.13
Who is responsible for anything that might happen on today's flight?
Can you act as PIC on today's flight? Why or why not?
If you did anyway, do you think you'd still be held accountable for anything that went wrong?
As a holder of an SPC, when are you acting as PIC?
What authority does acting as PIC give you?

If you acted as PIC for the flight described above with only your current pilot training, do you think that it'd be considered careless and reckless? Why or why not?
How do you define careless and reckless?

FAR 91.103 and 91.151
Before going on this flight, what pre-flight actions must be done?
What if it was just a local flight in the traffic pattern?
How much fuel should the aircraft have upon landing at MSP (FAA and UND)?
    What if it was a night flight?

FAR 91.403, 91.405, 91.409, 91.411, 91.413, and 91.417
Before going flying you want to make sure your new C-172 aircraft is airworthy, how are you going to go about this?
Who is responsible for maintaining this aircraft in an airworthy condition?
Where are you going to look to find all the necessary maintenance information?
What are you looking for (inspections and AD's)?
What are AD's?
    Who issues them?
    When do we have to get them?
    Are there any AD's for our C-172N? Where do we go to find out?
    Are all AD's a one time compliance item?
What are service bullitens?
    Who issues them?
    If there is a service bulletin for our aircraft, what do we have to do?
Does this aircraft have to have an annual? What about a 100 hr, why?
How does an annual differ from UND's maintenance program?
If we discover the annual was done a year and three days ago, can we still go?
What inspections besides the annual must be complied with for us to go?

FAR 43.3 and 91.417
On pre-flight you discover the tire on your new aircraft has several bald spots and needs to be replaced, you're fairly certain you are capable of the task….
    As the holder of an SPC, can you do this? If not, who can?
    What other maintenance does not require an A&P?
    After the tire is replaced, what must be entered into which log?

Thank God all that is done, ignoring any certification or aircraft airworthiness problems, you and your friends unwisely decide to hop in the aircraft and go flying…

FAR 91.107
If the PIC for the flight forgot to give a thorough pre-flight passenger brief, would they be violation of the FAR's?

During taxi, your friend Bill – in the backseat of the plane – is complaining about the safety restraint digging into his hip. He asks if he can take it off, what do you tell him?
When can the pilot remove their shoulder harness on this flight? Safety belt?

FAR 91.113, 91.119, and 91.123
Before takeoff that annoying Bill asks you if you can over fly his house in Grand Forks, what the lowest altitude you'll be able to fly over it?
On climb out ATC gives you an early turn which puts you right over Truck Stop, suddenly Joe points out a UND warrior that is coming at you head on, what do you do?
If that aircraft was an Airship would your or his action been any different?
What are the other right of way rules you'll have to be aware of on this flight?

Good thing we avoided that mishap, you decide to continue on your way…

FAR 91.123, 91.126, and 91.127
When can you legally change frequencies from the GFK tower freq?
If the tower controller yelled at you for changing course to avoid the other aircraft that obviously he didn't know about, what would you tell him?
Was it wrong to alter your course for the other aircraft without being instructed?
What other situations do you not have to comply with an ATC clearance?

FAR 91.155 and 91.157
Using the MSP sectional talk about the different types of airspace that the student would encounter on their flight, good lead in question:
Why does airspace and VFR weather minimums exist?
Use other sectionals to show different types of airspace and the same type(s) of airspace you just discussed, quiz the student using a few simple scenarios.
Examples of good scenario type questions might be:

> If we were at this airport, what would be our weather minimums?
> If we were at 12,500 ft here, what would be our weather minimums?
> What if the visibility was 2sm at this Class D airport, could we still get in?
> Show me another airport you could get a SVFR clearance into.

Believe it or not, you and your friends arrive without incident at Flying Could airport…the next two days are filled with fun and excitement

FAR 91.205 and 91.113
You arrive at the airport about three hours before your friends on Sunday in order to have ample time to prepare for the flight back. After you finish your cross-country planning, you start on the preflight and discover the landing light on your aircraft does not work…what are you going to do?

Using this scenario cover in detail, step-by-step, what you would do if the aircraft did not have an MEL, use the attached C-172R equipment list:

How would you handle the same situation if you were flying N276ND or Sioux 76 (cover in detail what they should do if the aircraft does have an MEL, point out the advantage of an MEL)?

If the landing light was required what would you have to do in order to go on this flight?

What is the purpose of a ferry permit?
Where do you get one?

While you're waiting for your friends, a salesman comes up to you and offers you a deal on the latest wing/lift modification for your model Skyhawk. He tells you it only takes about an hour to install and it's fully STC'd, what does he mean by STC? When else would you need an STC?

FAR 61.14, 61.51, 61.16 and 91.17
Finally your friends arrive! You excuse yourself from the salesmen and walk over to them. You notice that Bill is staggering and only staying up because Joe is helping him walk. When you get closer you can smell the alcohol on Bill's breath. Joe is in a hurry to get back and prompts you to help him get Bill strapped in. "Don't worry", Joe says, "he'll pass out as soon as we get going." What do you tell him?

If Bill was the PIC on this flight, how long would he have to wait before he could go flying? What if he was flying a UND Aircraft?

While you wait for Bill to sober up and Nathan reviews your flight planning, Joe starts to ask you about getting his pilot's license. You know that Joe has had a problem in the past with a couple DUI's and marijuana possession. What do you tell him about the probability of getting his pilot's license?

He laughs and says they shouldn't be that harsh on recreational smokers. Joe excuses himself saying he needs to go to the bathroom. You get suspicious when you see him bypass the men's room and proceed around the corner of the hanger. You follow to investigate and discover Joe stuffing a pipe full of weed.

What are you going to do?
Since it's not yours, he pleads with you to let him take it, do you?

You and your pilot friend Nathan decide to leave your two ex-friends in Minneapolis. Hey, you were nice enough to secure them a ride to the Grey-hound station. Somewhere past Alexandria you alternator light comes on. You troubleshoot the problem but to no avail. The aircraft is only running on battery power. You and Nathan decide if you conserve your power you might have enough battery to still talk to Grand Forks Approach and Tower when you arrive. Unfortunately you were wrong, and your radio goes dead about 3 miles south of Truck stop. You had informed approach control of your problem and they had responded by telling you they would let tower know. Your final instruction was to enter at Truck stop.

91.125
If you receive a steady red light gun signal after entering truck stop, what will you do? Where will you circle?
What order of light-gun signals would you get if you were cleared by tower to do the following:

- Enter the traffic pattern
- Get clearance to land
- Taxi off the runway to the ramp

FAR 61.56
When you get home, could you log the past weekend’s flight?

- If your friend Nathan was acting as PIC, could he log it?

What time does a pilot have to log?

Administer pre-solo written exam and assign scenario for next lesson

FLIGHT LESSON 12 (FIRST SOLO)

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate sections of the workbook.
3. Obtain a weather briefing and calculate necessary pre-flight planning.
4. Be prepared to lead a discussion on how to get from Bravo apron to the runway, and from the runway to Charlie ramp.

SCENARIO

There is no scenario for today's flight. Congratulations on making it to your FIRST SOLO!!! You have taken the first big step to becoming a certified pilot. Have fun and fly safe.

FLIGHT LESSON 13

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate sections of Workbook.
3. Obtain a weather brief.
4. Complete a performance calculation including weight and balance.
5. Complete a Personal Minimums worksheet based on your current capabilities.
6. Be prepared to brief your instructor on the KGFK departure procedures, practice area collision avoidance procedures, and enroute navigation techniques for a flight to Crookston Airport. Also be prepared to discuss unique features of the Crookston Airport and traffic pattern.

SCENARIO

You are a Piper aircraft salesman who is taking a potential customer on a demonstration flight in the Piper Warrior. Your goal is to show the customer how easy the Warrior is to operate and also display some of its handling characteristics. You have decided to take him on a short cross country to Crookston Airport. During the flight to Crookston you will demonstrate basic aircraft handling maneuvers, to include the aerodynamics demonstration, and stall recognition and recovery. Upon reaching Crookston, you plan to demonstrate both normal and power off landings. During the return trip you plan to demonstrate whatever the customer wishes to see. Obviously, you want to make a good impression on this customer—he's got big bucks and is eager to spend them.

INSTRUCTOR INFORMATION

Leg 1 – KGFK to Crookston

Ground Ops – Allow the student to conduct pre-flight, run-up, and taxi procedures without instructor assistance. Play the part of a potential customer and ask relevant questions at any time.

Takeoff – Normal. Again, as the customer, you might ask appropriate questions regarding takeoff capabilities, limitations, procedures, etc.

Enroute – Ask relevant questions about the aircraft, like:
Can we get to altitude any faster if we pitch from Vy to Vx?
What are you looking at when you set cruise power settings? How do I prevent over-leaning the engine?
Are there special departure procedures when going to Crookston? How do you intend to find the airport?
How do you avoid all the aircraft that are returning to Grand Forks? Where would they be?

Once in the practice area, allow student to demonstrate the pre-briefed maneuvers.

As a potential customer, ask student to demonstrate proper reaction to an engine fire.

Crookston Airport – Allow student to demonstrate traffic patterns as per scenario.

Leg 2 – Crookston to KGFK

Takeoff – Normal

Enroute - During climb-out, simulate electrical malfunction resulting in complete loss of all electrical equipment (including radio and nav equipment). Student must now return to KGFK using pilotage only, and demonstrate radio failure procedures.

Traffic pattern KGFK – Request Tower to provide light gun signals as appropriate. Again, play the customer and ask student to explain procedures to follow, including what to do after landing.

If time permits, additional pattern work may be accomplished to demonstrate Warrior capabilities, such as slips, no flap landings, etc.

After landing – Simulate partial brake failure (the left brake is totally inop.). Allow student to attempt taxi using only one brake. Ask student to explain what the best course of action would be with this situation.

Post flight Brief – Student should debrief the flight to potential customer, highlighting what went right and what went wrong. Customers appreciate an HONEST SALEMAN. Wish them luck on their stage 14!

STAGE CHECK 14

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate sections of the workbook. All workbook assignments up to Stage 14 should be complete.
3. STUDY – applicable regulations and stan manuals.
4. Call stage check pilot to set-up a time and location for stage check.

SCENARIO

There is no scenario for this stage check other than the problems/scenarios the stage check pilot might present you with. The key to successful stage check outcomes is to study and have confidence in your abilities. Your instructor would not have put you in for this stage check if he/she thought you weren't ready. Have fun and Good Luck!

FLIGHT LESSON 15

STUDENT PREPARATION

1. Review syllabus for contents of lesson.
2. Complete appropriate sections of the workbook.
3. Obtain a weather brief and conduct appropriate pre-flight procedures: weight and balance, and performance.
4. Compute takeoff and landing data for short field and soft field takeoffs and landings.
5. Plot Temporary Flight Restriction (TFR) on your VFR sectional map.

SCENARIO

You and your friend (use instructor's weight for preflight planning) are going over to Crookston for a company soft ball game. However, when you obtain your weather briefing for the day's flight the briefer informs you of the following NOTAM's:

ND.. FLIGHT RESTRICTIONS GRAND FORKS, NORTH DAKOTA, PURSUANT TO TITLE 14, SECTION 91.141 OF THE CODE OF FEDERAL REGULATIONS, AIRCRAFT FLIGHT OPERATIONS ARE PROHIBITED WITHIN THE FOLLOWING AREA(S) UNLESS OTHERWISE AUTHORIZED BY ATC. WITHIN A 3 NMR OF 475331N/0965554W OR THE GFK101012.5 UP TO BUT NOT INCLUDING 3000 FT AGL EFFECTIVE 0605310200 UTC UNTIL 0610310600 UTC

CKN 06/005 CKN 13/31 CLSD FOR CNSTRCTN WEF 0605310000-0610011200

GFK 06/002 GFK RWY 17L THR DSPLCD 2400

INSTRUCTOR INFORMATION:

NOTE: To make the short/soft field experience as realistic as possible, select an airport with grass runways.

Preflight Brief **–** Discuss the scenario with the student. Use effective questioning to get the student thinking:

Where is this TFR and how will it affect your route of flight?
How will the NOTAM for GFK Rwy 17 affect your takeoff?
What type of takeoff should be used out of GFK?
How could we minimize the risks of this situation?
What is our estimated takeoff distance?
How will the NOTAM in CKN affect our flight?
Will you be able to land at CKN?

Leg 1 GFK – CKN

Ground Ops – Ask the student if there is any way to use the GPS to help avoid the TFR? Show them user waypoint function.

Departing GFK – Demonstrate a short field takeoff for the simulated displaced threshold on Rwy 17L. Ask questions to stimulate thought, such as: how should we position the aircraft on the runway. After takeoff follow normal departure procedures.

Enroute to CKN – have the student enter the practice area following normal procedures; ensure vigilance about avoiding the TFR. Once in practice area, practice maneuvers listed in the syllabus as necessary to enhance student skill.

Crookston Airport – Conduct a normal pattern entry into Crookston. Demonstrate a soft field approach and landing to one of the grass runways. Ask questions to stimulate Aeronautical Decision Making, such as: What concerns should we have when operating on the grass? How do we want to position our controls on rollout? How will the grass affect braking efficiency? If time permits, taxi to the ramp to emphasize "mission accomplished". Complete necessary checklists.

<u>Leg 2 CKN – GFK</u>

Departing CKN – Taxi to appropriate grass runway for takeoff. Demonstrate a soft field takeoff -- include the student in your decision making and thought process. Ask questions to stimulate thought, such as: Should we stop on the grass runway? Where should we do our run up? Perform pattern work at Crookston as necessary to practice soft field takeoffs and landings.

Enroute to GFK – Ask questions to stimulate thought, such as: How are we going to avoid that TFR? How wide a berth should we give it? Should we fly direct to GFK from CKN? Make the student alter course around the TFR on the way to GFK. Who could we talk to in order to find out if the TFR is still active?

Grand Forks Airport – Demonstrate a Short Field landing (remember there is a NOTAM closing the last 2400 ft of the runway). Ask questions to stimulate thought, such as: Where should we plan to touch down? Where should my aim point be? What aircraft configuration should I use? After touchdown, how should I brake? Practice short field takeoffs and landings as necessary to increase student skill.

FLIGHT LESSON 16 (FTD)

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate sections of Workbook.
3. Review FAA Airplane Flying Handbook, Chap 9, "Flight by Reference to Instruments".
4. Be prepared to lead a discussion on how you would handle the aircraft in the event of an unintentional flight into IMC.

SCENARIO

You are conducting a solo flight to Crookston Airport to practice VFR patterns. Current KGFK weather is reported as 3500 BKN 5miles visibility with winds light and variable. Scattered rain showers have been reported in the vicinity.

INSTRUCTOR INFORMATION

Preflight Instruction – Ask the student some basic instrument questions to determine level of knowledge

Such as: Explain how to verify proper operation of the flight instruments immediately after engine start-up.
Explain basic instrument markings and normal flight parameters.
Explain what your reaction would be to an inadvertent flight into IMC.

Cover scan techniques and proper recovery procedures from nose low and nose high unusual attitudes.

Leg 1 GFK to CKN

Ground Ops – Discuss how to verify proper instrument operation and how to tune and identify appropriate VOR and NDB frequencies. On taxi out, fail each instrument individually to provide an understanding of what each instrument looks like when it malfunctions.

Takeoff – Normal.

Departure – During climb-out, instruct student to intercept the GFK 120R and track outbound to the 20 DME fix. Student should continue to fly the aircraft using outside and inside references. Discuss bracketing and tracking techniques.

After Level-off – Simulate a realistic situation that might cause inadvertent flight into IMC (such as "scud running", flight below an indefinite ceiling, rain/snow showers, etc), and instruct the student on the basic instrument maneuvers required by the syllabus. Once the student has transitioned to instrument flight, ask him/her to consider how to expeditiously get out of this situation. For example: You were flying below the bases of the clouds and inadvertently entered IMC.

You know that there is clear air slightly below your present altitude, as well as behind you. What are you going to do? Student should be encouraged to go through the decision process, with only limited assistance from the instructor.

Unusual Attitude – Ideally, the student will put himself/herself into an unusual attitude simply because of limited instrument proficiency. This would be a realistic method to introduce proper recovery procedures. Another realistic option would be to distract the student (retrieving a pencil that has been dropped, digging for the checklist that has slid under the seat, programming the GPS, searching for a plotter in his/her flight bag, etc).

ADF orientation and homing – Advise the student that he/she has now departed IMC, but due to the previous weather encounter, is now disoriented with limited VFR references to key off of (which may be true). Ask student to go through the procedures for tuning, identifying, and homing to the CKN NDB.

Enroute to CKN - Have student tune in CKN ASOS. Simulate marginal VFR or IFR conditions at CKN necessitating a divert back to KGFK. Allow student to use GPS for initial navigation to KGFK.

Leg 2 Diversion from CKN

Enroute to KGFK – provide the following ATIS information: ***Grand Forks International Information Tango, winds 170 @ 10 knots, sky condition 900 broken, visibility 3 miles light rain and mist. Temp 7. Depoint 0. An arriving Regional Jet reported light rime icing in descent between 3000 and 5000 feet. Clear above 6000 ft.***

Challenge student: What are you going to do? Student should determine that field is below VFR and that icing is probable between 3000 and 5000 feet.
Assist student in consideration of all the available options: Climb or descend? Continue to KGFK or divert? Special VFR? What is the primary threat—IMC conditions, the ice, or diverting to an unfamiliar airport with unknown weather conditions possible? Can Tower, Approach Control, or the SOF provide additional information?

Regardless of the options the student comes up with, create a situation requiring the student to continue to KGFK under Special VFR with vectors to a visual straight-in.

Post-flight Discussion – Allow student to critique performance. This is a good opportunity to discuss the dangers of inadvertent flight into IMC and the high accident rate associated with this. Ask the student to describe his/her comfort level when flying on the instruments as a means to drive home the importance of avoiding these conditions. Ask the student if he/she considers inadvertent flight into IMC a "business as usual" situation, or time to take emergency precautions—

like seeking assistance, and/or declaring an emergency. Assign next lesson’s scenario.

FLIGHT LESSON 17

STUDENT PREPARATION

1. Review syllabus for contents of lesson.
2. Complete appropriate sections of the workbook.
3. Obtain a weather brief.
4. Conduct appropriate pre-flight procedures: weight and balance and performance.
5. Complete a risk assessment for today's flight. What are the hazards?
6. Be prepared to lead a discussion on how you would use the VOR to navigate to the Practice area and the Park River Airport.

SCENARIO

You have an important business meeting at Park River today. Your boss has advised that if you don't attend this meeting, the company will miss an opportunity to make a lot of money. So there is no question about it—you have to be there. A series of recent torrential rains have left most of the rivers and streams in the local area near or at flood stage. Due to this fact, there are numerous road closures and impassable bridges which would significantly lengthen the driving time from Grand Forks to Park River. Therefore, as a newly certificated pilot, you elect to fly. You arrange for a taxi to pick you up at the Park River Airport at a specific time for the meeting in town. The weather for today looks to be marginal VFR, but the forecasts call for improving conditions. The following are METAR reports for some of the airports in the surrounding area:

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KDVL 102315Z 01020G24KT 3SM FEW001 BKN020 OVC027 16/18 A3028
KGFK 102253Z 35014KT 9SM FEW013 OVC029 17/19 A3024 RMK AO2
     SNE07 SLP260 P0000 T10721094=
KGFK 102243Z 35013KT 10SM SCT013 OVC029 17/19 A3024 RMK AO2
     SNE07 P0000= (SPECI)
KGFK 102233Z 35013KT 10SM BKN013 OVC027 17/19 A3023 RMK AO2
KRDR 102255Z 35016KT 6SM BLSN BKN011 OVC025 17/19 A3024 RMK
     SLP260 LSR16=
KRDR 102212Z 35018KT 4SM BR -RA OVC015 17/20 A3022= (SPECI)
KRDR 102155Z 35018KT 3SM BR -RA OVC013 17/20 A3021 RMK SLP251
     LSR16=
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INSTRUCTOR INFORMATION

Preflight Brief – Discuss lesson scenario. Have student evaluate and suggest ways to manage the risks. Ask questions to stimulate thought, such as: Can this flight be done legally? Can this flight be done safely? How will the ceilings and visibility affect your normal procedures? Ask them how they will find Y37.

Leg 1 GFK – Y37

Ground Ops – With minimal instructor assistance, have the student tune, identify, and set-up the appropriate navaids for the flight.
Departing GFK – Explain that water from the recent flooding has rendered much

of the runway useless. Select a point where the water begins (i.e. A-4 Taxiway). Hopefully, the student will choose to do a short field takeoff. Fly a normal departure procedure.

Enroute to Y37 – When nearing the practice area, explain to the student that there is a cloud layer ahead and they will have to start a descent to get below it. As they continue into the practice area, make comments such as: “It’s getting hard to see very far ahead;” “The visibility is definitely getting worse;” and “I can’t see the ground anymore.” At this point put the hood on the student and tell them they just entered the clouds. Let the student come up with a solution. Hopefully they elect to do a 180 degree emergency turn. Practice flight by reference to the instruments and unusual attitudes as necessary to increase student understanding and skill. For unusual attitudes, have the student put their head down and respond to your basic flight instructions. Talk them into an unusual attitude. This will give the student a chance to experience illusions.

Park River Airport – Explain to the student that it looks like mud was left on the runway from the retreating flood waters. Ask questions to stimulate thought, such as: Do you think we should land there? How can we figure out if the runway surface is usable? What type of landing should we do? Execute a soft field landing and taxi to the ramp completing all necessary checklists for completion of the scenario.

<u>Leg 2 Y37 – GFK</u>

Departing Y37 – Practice short and soft field takeoffs and landings as necessary to increase student skill and understanding.

Enroute to GFK – Ask questions to stimulate thought, such as: How can we figure out what the weather is like at Grand Forks? If Grand Forks was reporting 2 SM visibility, could we still land there? What type of clearance would we have to get? Who would we get that clearance from?

Grand Forks Airport – Practice short and soft field takeoffs and landings as necessary to increase student skill and understanding.

<u>Post Flight Brief</u> – Allow student to critique their own performance. Have them discuss any illusions they might have felt during unusual attitudes. Stress that the instruments are their best source of information during IMC operations. Assign next lesson’s scenario.

FLIGHT LESSON 18

STUDENT PREPARATION

1. Review syllabus.
2. Complete appropriate sections of the workbook
3. Compute the short field takeoff ground roll and distance to clear a 50 ft obstacle at KGFK with the reported weather conditions. Assume full fuel load, plus you and your instructor.
4. Compute the short field landing distance and ground roll of the Warrior at Warren Airport. Assume fuel at tabs, plus you and your instructor.
5. Research the NTSB accident data base for an incident involving either a short or soft runway. Be prepared to lead a discussion of this accident. NTSB Website = http://www.ntsb.gov/NTSB/query.asp

SCENARIO

You are a Bush Pilot in Alaska. Today you are hauling a load of diphtheria vaccine into Red Dog, a native village in the Alaska bush. Red Dog has two runways—one is gravel (in the summer) or ice (in the winter), or mud (during break-up). The other is grass (in the summer) or snow (winter) and short (1500'), and normally only used by bush aircraft or when strong winds prevent using the longer runway. (Warren Airport has a similar runway configuration and will simulate Red Dog.) The weather is marginal VFR for your entire flight with unreported wind conditions. The native population is in dire need of the vaccine—it's your job to get it there.

INSTRUCTOR INFORMATION

Preflight Discussion – Allow student to brief the performance calculations for the Warrior. Correlate computed distances with known runway reference points.

Leg 1 GFK to D37 (Red Dog)

Ground Ops – Simulate situation where aircraft is parked in a pool of mud. How is the student going to get it out of the parking area? Challenge student to select appropriate navigation aids to find Red Dog. (Red Dog is not a surveyed airport, therefore it does not have a GPS database identifier.)

Short Field Takeoff – Tell student, "You are operating off a hard surfaced runway, but only 1000 feet of solid runway is available because the rest is breaking-up due to frost heaves, potholes, and major bumps." Instructor should point out a distinct reference in front of the aircraft where the solid runway ends (i.e. C1 taxiway). This puts the need for a short field takeoff in proper perspective.

Enroute to Red Dog (Warren) – Simulate deteriorating weather requiring descent to lower altitude and greater reliance on radio navigation. Marginal weather conditions require greater reliance on basic attitude instrument flying – practice

BAIF maneuvers as per syllabus. Simulate a situation requiring a 180 degree turn to exit deteriorating weather. In the turn, call out what appears to be high terrain or some other obstruction requiring a steeper turn to avoid. This may result in a situation requiring an unusual attitude recovery. (If not, create a distraction that does.)

Red Dog (Warren Airport) – If the grass runway is useable, create a situation that makes it the only runway available. Simulate that the last half of the runway (the part on the other side of the intersecting paved runway) is still wet from break-up and will not support the weight of the aircraft. Challenge the student to decide what to do—hopefully the choice will be a short field landing on the available runway. After landing, taxi to the ramp and simulate delivery of vaccine.

Leg 2 D37 (Red Dog) to GFK

Departing D37 – Depending on condition of the grass runway, Warren presents an excellent opportunity to experience the effects of a "real" soft field takeoff and/or landing. Practice both short and soft field takeoffs and landings as appropriate.

Return to KGFK – Accomplish any syllabus maneuvers requiring further review. Simulate the same marginal weather conditions for the return trip. After practicing maneuvers, challenge student to descend and level off at appropriate altitude to avoid simulated weather at 1000 AGL feet. Challenge the student to "Take me home!" Let the student figure out "how" (navigation, traffic avoidance, etc). Accomplish any syllabus maneuvers requiring further review.

Grand Forks Airport – If traffic conditions and the Tower will permit, have student fly a lower than standard downwind altitude (simulating low VFR weather conditions). This forces student to consider how pattern must be modified to accommodate non-standard conditions. Ask the student to pick a definable point on the runway as the desired short field touchdown point. Also ask for a prediction on where the aircraft will come to a stop. This forces student to analyze both aircraft and pilot capabilities. After landing, ask student whether or not he/she met those predictions, and if not, why.

Post-flight Discussion – Allow student to lead the debrief on lesson performance and what they learned. Assign scenario for next lesson.

FLIGHT LESSON 19 (SOLO)

STUDENT PREPARATION

1. Review syllabus for contents of lesson.
2. Complete appropriate sections of the workbook.
3. Obtain a weather brief.
4. Conduct appropriate pre-flight procedures: weight and balance and performance.
5. Complete a risk assessment for today's flight.
6. Be prepared to lead a discussion on student pilot privileges and limitations, and the unique features of the airport you will be soloing to.

SCENARIO

You will be conducting a solo flight today to another airport. Your mission is to practice the appropriate maneuvers listed in the syllabus, operate safely within the local Grand Forks area, and execute a landing at an airport other than Grand Forks. That is already a "realistic scenario." Have Fun!

INSTRUCTOR INFORMATION

Preflight Brief – Have student lead a discussion on student pilot privileges and limitations. Also quiz them on unique features of their solo destination and any operational considerations.

Post flight Brief –Good questions to ask are:

Did your flight go as planned?
Anything happen that you didn't expect?
How did you handle that situation?
Would you handle that situation any differently next time?
What did you learn?
Did you have fun?

GROUND LESSON 20

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate section of Workbook.
3. Review Warrior POH, Section 5 – Performance
4. Search the NTSB accident data base for three accidents attributable to poor performance calculations. Be prepared to lead a discussion on these accidents. NTSB Website = http://www.ntsb.gov/NTSB/query.asp

SCENARIO

You are conducting a Warrior flight from Cheyenne, Wyoming to Aspen, Colorado. Straight leg distance between the two airports is 300NM. Takeoff from Cheyenne is RWY 30 with a field elevation of 5350 ft. Winds are calm. OAT 85 deg F and a sea level pressure of 29.89. There are high mountains to the southwest enroute to Aspen that require you to climb to 8500 ft within 40 NM.

Assume standard temperatures during climb to 8500 ft with winds forecast to be 180/10.

Aspen, Colorado is located in a narrow valley surrounded by high mountains, with peaks to 11,000 ft. You plan to follow Windy Pass to the airport, with a max elevation of 8000 ft. Aspen has a 7000 ft runway with a field elevation of 7800 ft. OAT is 70 deg F with winds 200/15, and a pressure sea level pressure of 29.78. Plan to land RWY 15.

The aircraft is loaded with full fuel, 20 pounds of baggage, plus you and one passenger (170lbs). Use N356ND for planning purposes.

INSTRUCTOR INFORMATION

Walk the student through the appropriate performance charts. Compare aircraft performance from these two high elevation airports with normal Grand Forks performance.

Challenge student to consider how reduced performance will "look and feel" in the actual aircraft, and how reaction to emergencies and unusual situations might need to be altered. For example, during takeoff the engine will feel "sick" because it is producing significantly less power than normal. In addition, even a minor malfunction, like magneto failure, may have serious consequences. If something happens that necessitates return for landing (even when not an emergency), anticipate a significantly longer time to reach pattern altitude. Even routine events will not occur like you are used to.

Allow the student to summarize the NTSB accident reports associated with poor performance planning. Ask him/her to pin point poor pilot decisions, and how these pitfalls might be avoided.

Ask student whether he/she would make this flight based on the calculated performance. Ask if there are any ways that the associated risks could be diminished.

GROUND LESSON 21

STUDENT PREPARATION:

1. Review syllabus for lesson content.
2. Complete appropriate sections of the workbook.
3. Gather necessary supplies for cross country planning.

SCENARIO:

You and two friends, John and Sarah, will be traveling from Grand Forks today to several destinations around northern Minnesota. You will be renting a Piper PA-28-161 from the local FBO on the field.

You plan to depart Grand Forks around 11:00 a.m. and fly to Bemidji to have lunch with John's parents. After lunch, which will take approximately 3 hours, you and Sarah will continue on your trip to Fargo for some late afternoon and evening shopping. After having dinner with Sarah and her sister, you will than return to Grand Forks by yourself at night.

<u>Leg Information:</u>

Leg 1 Grand Forks (GFK) to Bemidji (BJI): Depart Grand Forks at 11:00 am local time.

Leg 2 Bemidji (BJI) to Fargo (FAR): Depart Bemidji at 15:00 local time.

Leg 3 Fargo (FAR) to Grand Forks (GFK): Depart Fargo at 21:20 local time.

Weight and Balance Information:
Use N356ND for planning purposes
John weighs 170 lbs and has 35 lbs of baggage
Sarah weighs 120 lbs and has 40 lbs of baggage
Your bag weighs 25 lbs

<u>Aircraft Information:</u>
Assume the following information has been extracted from the appropriate log
Piper PA-28-161 built in 1996
Last 100 was 1555.3, current tach time is 1659.6
Last Annual inspection was 9/02/05
Last transponder was 12/05/04
Last Pitot Static was 10/03/03
Last VOR Check was 4/07/06
ELT was temporarily removed on 7/17/06 due to an "unreliable signal"
Placard in cockpit reads "NO ELT"
Aircraft does not have an MEL

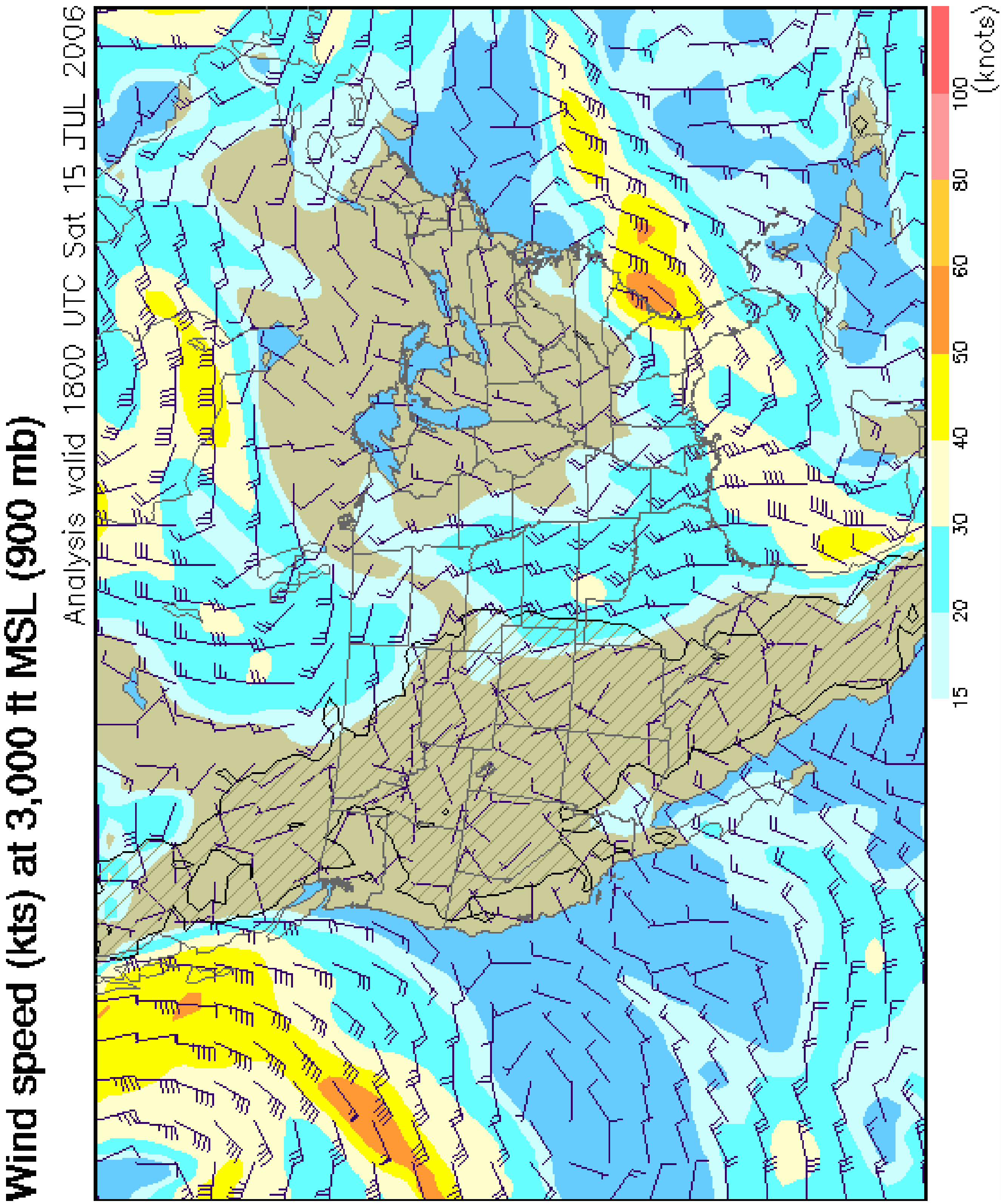
Pilot Information:
Received Private SES Rating on 4/04/05
2nd Class medical issued 6/14/05
Recent flight experience (log book entries) is as follows:

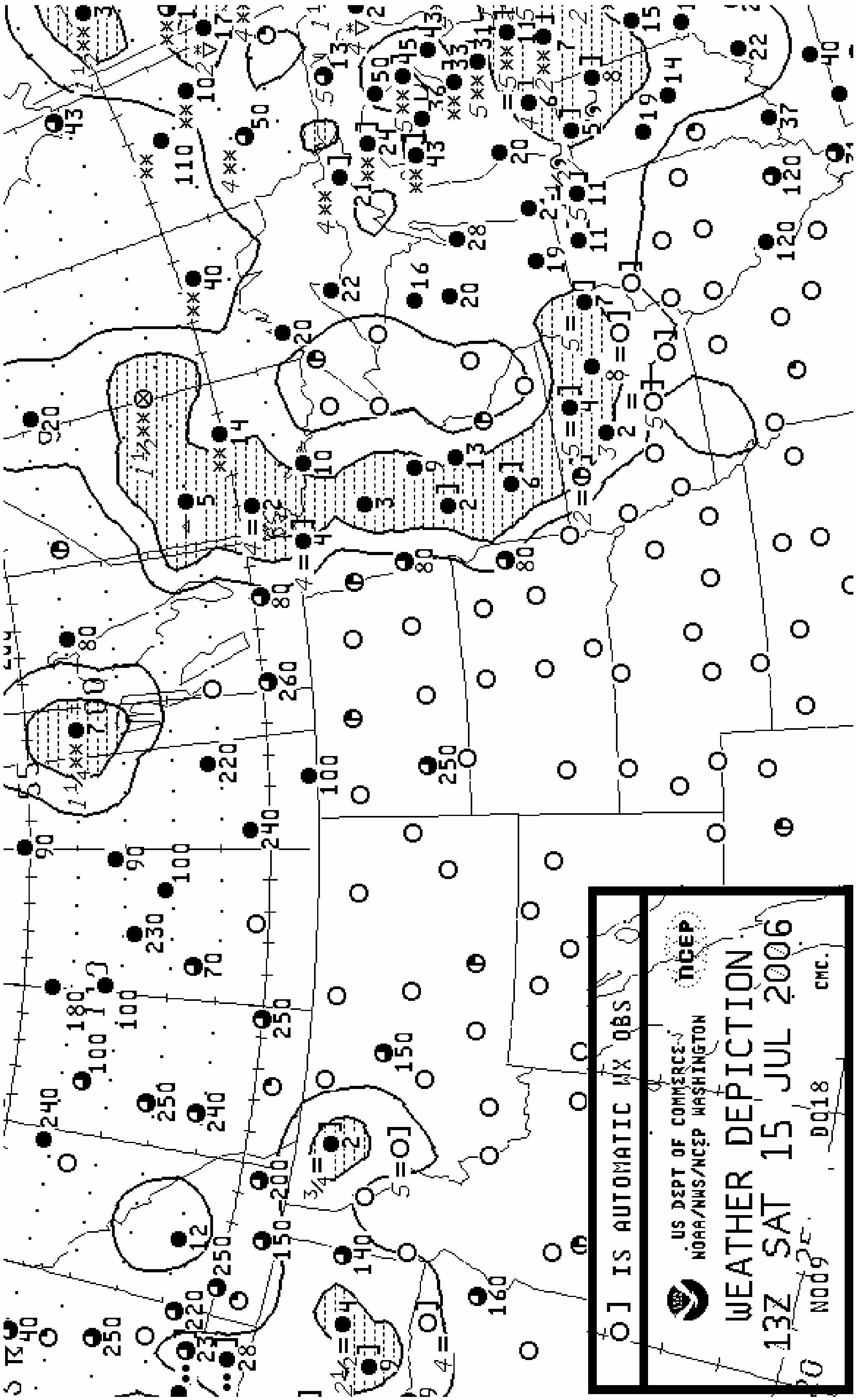
Date	Route	Land	AC type	AC ID	Total	Description
12/2/05	GFK-GFK	1	PA28	N22CD	1.2 hrs	Took Bob Flying
2/9/06	GFK-STP	1	SR20	N789F	1.8 hrs	Business Trip to MSP
2/14/06	STP-GFK	1N	SR20	N789F	2.0 hrs	Return Trip – fast airplane
2/27/06	GFK-GFK	3	C152	N224G	1.5 hrs	Fun Flight with Wife
3/5/06	GFK-GFK	2	C152	N224G	1.4 hrs	Fun Flight with Joe
5/9/06	CKN-CKN	2	C172	N45213	1.2 hrs	C172 checkout @ CKN
5/19/06	CKN-CKN	1	PA28	N222ND	1.1 hrs	PA28 Checkout @ CKN
6/6/06	GFK-STP	1	SR20	N789F	1.8 hrs	Business trip to Cities
6/14/06	STP-GFK	1	SR20	N789F	1.9 hrs	Return trip – nasty turblnc

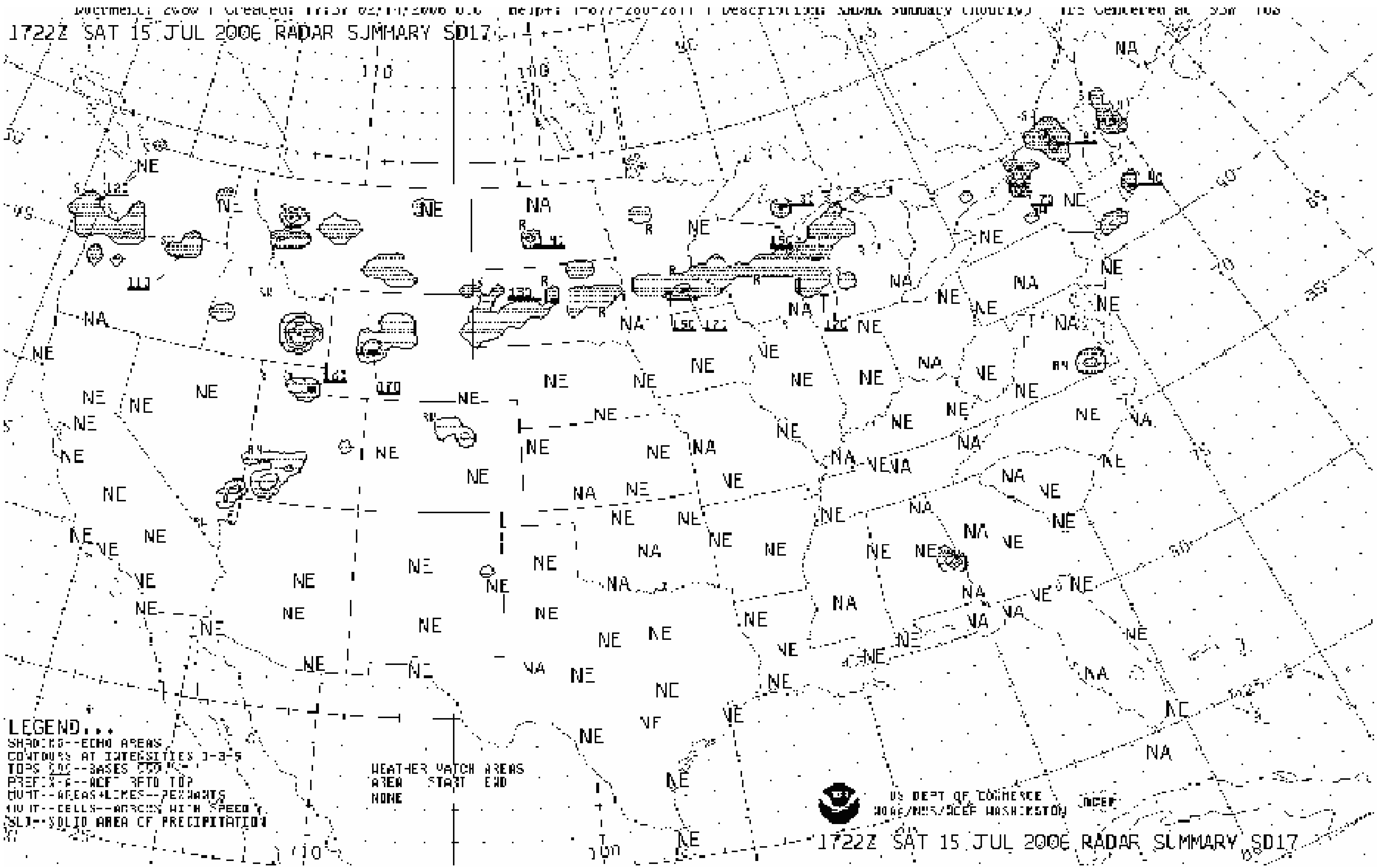
Weather Information:

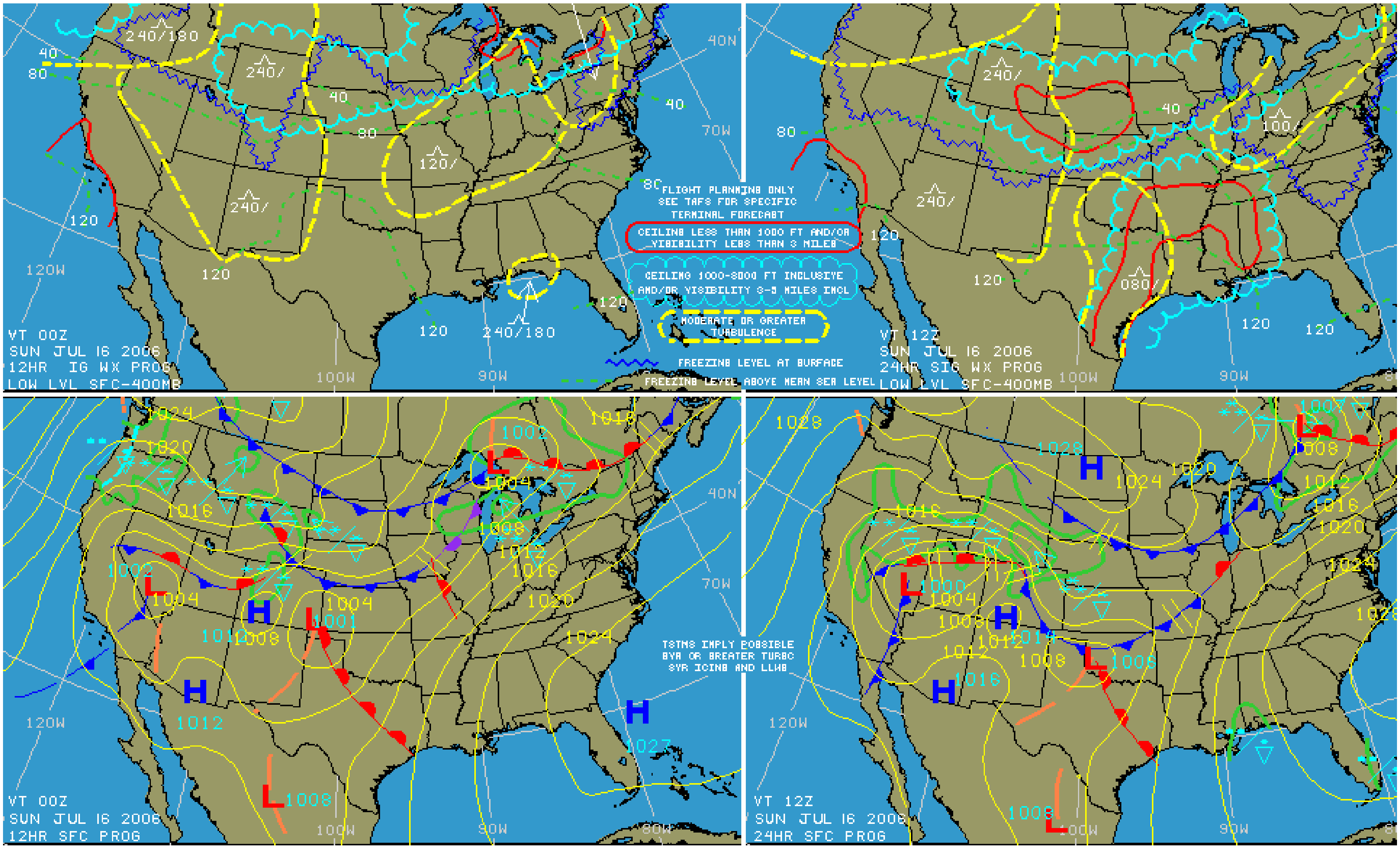
```
********  Surface Observations  ********
METAR KRDR 151855Z 27008KT 7SM SCT200 19/13 A3027 RMK SLP271
no reports available for XCH
METAR KGFK 151853Z 28006KT 10SM FEW250 19/13 A3028 RMK AO2 SLP273
    T10941128
METAR KCKN 151855Z AUTO 27006KT 10SM CLR 18/11 A3026 RMK AO2
METAR KCKN 151915Z AUTO 27007KT 10SM CLR 18/11 A3025 RMK AO2
METAR KTVF 151855Z AUTO 28007KT 10SM FEW003 FEW022 BKN031 19/12
    A3025 RMK AO1
METAR KTVF 151915Z AUTO 27008KT 10SM SCT019 BKN023 BKN029 19/12
    A3024 RMK AO1
METAR KFSE 151855Z AUTO 29010KT 10SM -RA OVC029 17/13 A3022 RMK AO2
METAR KFSE 151915Z AUTO 30010KT 10SM -RA OVC029 18/13 A3021 RMK AO2
METAR KBJI 151855Z AUTO 27012KT 10SM OVC033 19/14 A3021 RMK AO1
METAR KBJI 151915Z AUTO 26012KT 10SM OVC033 19/14 A3020 RMK AO1
METAR KDTL 151854Z AUTO 32011KT 3SM -RA BKN07 OVC012 17/15 A3025 RMK
AO2 WS01270/30KT
METAR KDTL 151914Z AUTO 31010G15KT 2 1/2SM -RA BKN007 OVC012 M07/M11
A3024 RMK
METAR KJKJ 151855Z AUTO 32010KT 10SM OVC044 M07/M11 A3029 RMK AO2
METAR KJKJ 151915Z AUTO 31010KT 10SM SCT033 OVC042 17/11 A3028 RMK AO2
METAR KFAR 151853Z 30011KT 10SM OVC060 M07/M12 A3030 RMK AO2
     SLP280 T01720117
********  Terminal Forecasts  ********
TAF KRDR 151818 28009KT 9999 FEW020 SCT200 QNH3009INS
     BECMG 0304 32010G20KT 9999 SCT030 OVC050 600504 QNH3011INS
     BECMG 0506 34010G15KT 9999 BKN020 OVC030 600205 QNH3015INS
     BECMG 1617 31012KT 9999 FEW020 BKN030 600304 QNH3026INS TM05/21Z
     TM12/11Z
TAF KGFK 151724Z 111818 28007KT P6SM SCT200
     FM0600 34015G21KT 6SM -RA OVC035
     FM1300 35012G18KT P6SM SCT250
TAF KBJI 151724Z 111818 28010KT P6SM BKN030
     FM2200 29007KT P6SM SCT200
     FM0800 34012G17KT P6SM -RA OVC020
```

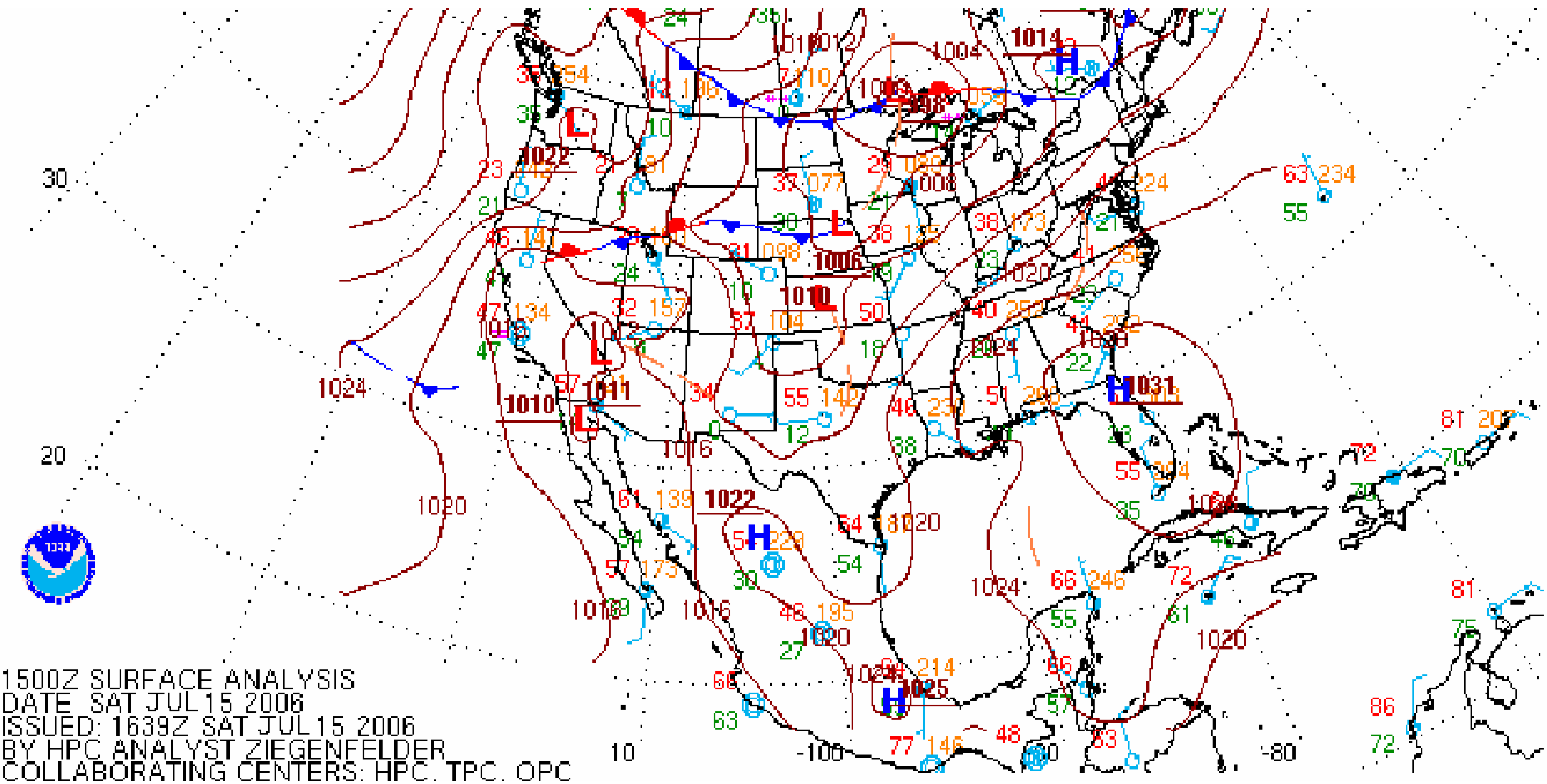
```
     FM1500 34012KT P6SM SCT250
TAF KFAR 151724Z 111818 30009KT P6SM SCT200 TEMPO 2123 BKN030
     FM0800 34015G21KT 6SM -RA OVC045
     FM1500 35013G18KT P6SM SCT250
********  FA Synopsis and VFR Clouds/Weather  ********
CHIC FA 111045
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 150500
CLDS/WX VALID UNTIL 152300...OTLK VALID 152300-150500
ND SD NE KS MN IA MO WI LM LS MI LH IL IN KY
.
SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.
TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HGTS DENOTED BY AGL OR CIG.
.
SYNOPSIS...LOW PRES SYS SERN AL/SWRN GA WITH CDFNT EXTDG SWWD
INTO GLFMEX MOVG EWD. RIDGE OF HIGH PRES FROM ROCKIES INTO PLNS.
BY 05Z...CDFNT WILL CURVE FROM LOW OVR SERN SD ACRS SRN SD AND
NERN WY INTO CNTRL MT.
.
ND
CIGS BKN-SCT015-025 BKN030-050. TOPS 100. ISOL -SHRA. BECMG 2023
CIGS BKN-SCT030-050. OTLK...VFR.
.
MN
AGL SCT-BKN015-025 BKN030-050. TOPS 100. ISOL -SHRA. BECMG 2023
CIGS BKN030-050. OTLK...MVFR CIGS.
.
WI MI LS LM LH
CIGS BKN-SCT015-025 BKN030-050. TOPS 100. WDLY SCT -SHSN.
OTLK...MVFR CIGS SHSN.
********  FD Winds Aloft Forecast  ********
DATA BASED ON 111200Z
REQUESTED
VALID 121200Z   FOR USE 0600-1700Z. TEMPS NEG ABV 24000
ALTITUDE
FT  3000    6000   9000    12000   18000   24000  30000  34000  39000
GFK 3636 0138-14 0144-14 3649-20 3670-30 3694-39 860750 369954 358654
```


Wind speed (kts) at 3,000 ft MSL (900 mb)
Analysis valid 1800 UTC Sat 15 JUL 2006
15
20
30
40
50
60
80
100
(knots)


IS AUTOMATIC WX OBS
US DEPT OF COMMERCE
NOAA/NWS/NCEP WASHINGTON
NCEP
WEATHER DEPICTION
13Z SAT 15 JUL 2006
DQ18
CMC.


1722Z SAT 15 JUL 2006 RADAR SUMMARY SD17
LEGEND...
SHADING--ECHO AREAS
CONTOURS AT INTENSITIES 1-3-5
WEATHER WATCH AREAS
AREA START END
NONE
US DEPT OF COMMERCE
NOAA/NWS/NCEP WASHINGTON
NCEP
1722Z SAT 15 JUL 2006 RADAR SUMMARY SD17


VT 00Z
SUN JUL 16 2006
12HR IG WX PROG
LOW LVL SFC-400MB
VT 12Z
SUN JUL 16 2006
24HR SIG WX PROG
LOW LVL SFC-400MB
FLIGHT PLANNING ONLY
SEE TAFS FOR SPECIFIC
TERMINAL FORECAST
CEILING LESS THAN 1000 FT AND/OR
VISIBILITY LESS THAN 3 MILES
CEILING 1000-3000 FT INCLUSIVE
AND/OR VISIBILITY 3-5 MILES INCL
MODERATE OR GREATER
TURBULENCE
FREEZING LEVEL AT SURFACE
FREEZING LEVEL ABOVE MEAN SEA LEVEL
TSTMS IMPLY POSSIBLE
SVR OR GREATER TURBC
SVR ICING AND LLWS
VT 00Z
SUN JUL 16 2006
12HR SFC PROG
VT 12Z
SUN JUL 16 2006
24HR SFC PROG



1500Z SURFACE ANALYSIS
DATE SAT JUL 15 2006
ISSUED: 1639Z SAT JUL 15 2006
BY HPC ANALYST ZIEGENFELDER
COLLABORATING CENTERS: HPC, TPC, OPC

******** Pilot Reports ********
BIS UA /OV BIS090003/TM 1810/FLUNKN/TP UNKN/RM BASES 3 EAST 010 RGGD
(ATCT VIA IDS4)

BJI UA /OV BJI315001/TM 1837/FLUNKN/TP E135/SK OVC008

BJI UA /OV BJI315001/TM 1813/FLUNKN/TP GLEX/SK OVC008

******** Radar Summaries ********
MBX 1835 PPINA AUTO

MPX 1835 AREA 4S 250/104 96/110 59W MT 160 133/46 C3122
AUTO
^MM22111 NK1112221 OJ11121

DLH 1835 PPINE AUTO

BIS 1835 CELL TSR+ 298/8 D3
AREA 6SW++ 242/19 48/10 21W
AUTO
^MM5

MVX 1835 PPINE AUTO

FSD 1835 PPINA AUTO

ABR 1835 AREA 6R+ 314/22 185/22 29W
AREA 7S- 218/99 133/94 40W MT 140 141/99
AUTO
^MM3 NK1 OM1111 PK111111 QL1
******** SIGMETs ********
current report not available

******** Convective SIGMET ********
MKCC WST 141855
CONVECTIVE SIGMET...NONE
OUTLOOK VALID 142055-150055
TS ARE NOT EXPD.
PDS

******** Center Weather Advisory ********
current report not available

******** AIRMETs ********
CHIT WA 141445
AIRMET TANGO UPDT 3 FOR TURB VALID UNTIL 142100
.
.
AIRMET TURB...ND SD NE MN IA WI LM LS MI LH
FROM 80NW INL TO YQT TO 20NW SSM TO YVV TO 30SE ECK TO DLL TO
70SW RAP TO 50NNW ISN TO 80NW INL
OCNL MOD TURB BTN FL220 AND FL410 DUE TO WIND SHEAR ASSOC WITH
JTST. CONDS CONTG BYD 21Z THRU 03Z.
.
....
CHIZ WA 151445
AIRMET ZULU UPDT 2 FOR ICE AND FRZLVL VALID UNTIL 152100

.
AIRMET ICE...ND SD NE MN
FROM FAR TO FSD TO ONL TO 70SW RAP TO 80SW DIK TO FAR
OCNL MOD RIME/MXD ICGICIP BTN FRZLVL AND 300. FRZLVL 160-300
THRUT. CONDS ENDG 18-21Z.

CHIS WA 151445
.
AIRMET IFR CONDS AND MTN OBSC...ND SD NE MN
FROM MSP TO GPZ TO 50SE INL TO DLH TO MSP
CONL CIG BLW 10 AND VIS BLW 3SM DUE TO BR AND RA CONDS ENDG 18-21Z

******** NOTAMs ********
!CARF 04/084 ZMP CARF NR. 157 ON TWA STATIONARY RESERVATION WITHIN
AN AREA BNDD BY DLH051/104 DLH068/091 SAW034/017 SAW016/046
FL200-FL250 WEF 0602142030-0602150030

!GFK 05/008 GFK TOWER 1153 (320 AGL) 9.3 E LGTS OTS (ASR 1230313)
TIL 0602162359
!TVF 07/008 TVF 31 ILS OTS WEF 0607141600-0607142300
!TVF 06/017 TVF 3/21 CLSD TO ACR MORE THAN 9 PAX
!PNM 11/106 5C3 AP CLSD
!BJI 06/101 BJI 7/25 CLSD WEF 0607152100-0607172300
!GFK 07/044 1A2 TOWER 2148 (944 AGL) 6.2 S LGTS OTS (ASR 1038760)
TIL 0602242359
!GFK 07/041 5N8 TOWER 1227 (319 AGL) 4.8 ENE LGTS OTS (ASR 1226078)
TIL 0602232359
!GFK 10/033 3H4 ABN CMSND

INSTRUCTOR INFORMATION

National Airspace System: Bring a variety of sectionals to the briefing in order to quiz the student on how to identify the different types of airspace and their associated operating requirements and weather minimums. Be sure to use several questions in scenario form to stimulate thought, such as:
"If I wanted to over fly this airspace, what altitude would I do it at?"
"Would I have to talk to anybody?"
"Would I need any special equipment to over fly this airspace?"

Certificates and Documents: Use the above pilot information to talk about this pilot's ability to go on this flight. Ask questions such as:
"According to this information, can you act as PIC on this flight? Why or why not"
"What would you have to do in order to act as PIC on this flight?"
"You haven't flown a Warrior in a while; is that going to be a problem?"
"If you, the pilot, wanted to share the costs of this flight, how could you go about it?"
"Which costs could be shared? With whom?"
"What is Sarah offers to pay for the whole flight, is that allowed?"
"If you look at your logbook it says you took a business trip to the cities, can you charge your company for the cost of the airplane?"
"Could you get paid travel time as a private pilot in that scenario?"

Airworthiness Requirements: Use the aircraft information provided to lead the student through airworthiness determination. If the aircraft is not airworthy, make the student determine what they would do to correct the problem. Also, tell the student on leg 2 the _______ broke. Have them correct the problem using the MEL. Then have them correct the same problem using 91.213. It's important to go through the process, don't just talk about it.

Weather and Cross Country Planning: Use the weather information in the scenario packet to plan the first leg of the proposed trip (GFK to BJI). Use the weather products provided in the scenario to demonstrate to the student how to extract information necessary for planning a cross country. Have the student select the proper route and altitude and execute a proper Go/No Go decision. Be sure to have the student identify any risks associated with the flight and a solution to minimize those risks.

FLIGHT LESSON 22 (Dual X-C)

STUDENT PREPARATION:

1. Review syllabus description for this lesson.
2. Complete appropriate sections of the workbook.
3. Obtain a weather brief for route assigned by instructor.
4. Complete a risk assessment for today's flight.
5. Complete necessary X-C planning for your assigned route.
6. Be prepared to explain/identify your GO/NO GO decision, fuel requirements. for the flight, alternates available, and any NOTAM's affecting your route.

SCENARIO

You and your instructor have been selected by John and Martha King to take part in a new training video they will be releasing early next year. The video is titled *Using Scenario Based Training to Teach Cross Country Procedures*. The film director has instructed you as the "the star student" to ignore the production crew completely and react with your instructor in a normal manner. In other words, film crew's presence on the flight should be transparent to you, and you don't have to memorize any lines. However, the camera equipment and production crew will add some additional limitations to your flight planning.

First, a camera technician, 145 lbs, and the director 158 lbs, will be coming with you for today's flight. They will sit in the back of the plane and run the camera equipment which will be placed in the following locations:

Camera 1 (right-side dash camera): 5 lbs, located at 48.8" aft of datum
Camera 2 (left-side dash camera): 5 lbs, located at 45.6" aft of datum
Camera 3 (back-seat camera): 5 lbs, located in the back seat with 2 passengers
Recording Equipment: 28 lbs, located in rear baggage compartment

Also, for recording purposes, the director would like you to plan at least one leg at *best power*, and at least one leg at *best economy* power settings. Because of limitations of the recording media, the camera technician will have to change tapes at some point during the flight. Therefore, the director asks you to taxi to the ramp and shut down the aircraft at one of your destinations. If you need fuel, this would be a great time to get it.

INSTRUCTOR INFORMATION

Pre-flight discussion: discuss the scenario with the student. Have them explain their GO/NO GO decision, how the extra weight in the above scenario affected their fuel/cross-country planning, and any fuel stops they might need. Without the student's knowledge, calculate actual aircraft weight and balance and associated performance, and alter dispatch form to reflect actual route. Student's planned route will be different from the actual route flown.

Ground Ops: Introduce programming a flight plan into the GPS. Student should be able to complete all other tasks without instructor guidance.

Leg 1 – (suggest GFK-BJI):

Departing GFK: Soft field takeoff with climb to cruise altitude. Assist student in opening flight plan on departure.

Cruise: Introduce pilotage, dead-reckoning, and keeping up with flight log. (Instructors can cover-up the GPS using the MSG button.)

Descent: Introduce descent planning and airport arrival procedures.

Pattern: Practice short field landings and takeoffs. When complete, taxi off runway to close flight plan and open plan for next leg.

Leg 2 (suggest BJI-PKD)

Ground Ops: Inform the student that weather has moved in and there is now a low overcast layer reported at 2500 ft AGL. Ask questions to stimulate thought, such as:

How will this affect our flight?
What can we do to get more weather information?
How can we find out what the weather will be at our destination?
What will be our new cruise altitude?

Departure: Have student execute a short field takeoff and climb. Let student decide when and how to open their flight plan. Give as little instructor input as necessary.

Cruise: Student should level-off at the appropriate cruise altitude based on simulated low weather. If the student climbs too high, put the hood on them. You can also use the aircraft's sun visor to limit the student's view, as vertical visibility would be limited by an overcast layer. When half-way into leg one, begin to hint that the weather is deteriorating. Make comments such as: "The visibility is getting worse" or "Boy, that overhead cloud layer appears to be getting closer." Let the student choose which action to take. If student does not take a corrective action, and continues at their present altitude and course, put the hood on them (simulating inadvertent entry into IMC). After student has chosen a corrective action, challenge them to come up with a heading that will take them to their destination and an ETA which will put them over the airport. Cover up the GPS screen using the MSG button and have the student fly their calculated heading for the time they specified.

Lost Procedure: When the student reaches their planned ETA, let them take the hood off and try to find their position. Guide them through the lost procedure process. Let them work from simple to complex: Challenge them to identify their position using the map before using any other available navigation aids (VOR, GPS, ect).

Descent and Patter Work: After the student identifies their position, have them enter the pattern and execute a soft-field landing. If this is the destination where the student planned to get fuel, taxi to the ramp and guide them through the process. Hopefully the student will initiate action to close the flight plan. Allow the student to decide on his or her own that this must be accomplished. Only prompt when getting close to Search and Rescue time.

<u>Leg 3 – (suggest PKD – FAR with instructor directed divert to DTL)</u>
NOTE: If you plan other than the suggested route, it's important to pick a route that has an approved airport available for diversion.

Ground Ops: Ask questions to stimulate thought, such as:

What can we do while the FBO refuels our aircraft?
How long should we wait to sump fuel?
Should we do an entire aircraft preflight or just "takeoff"?

Departure: Execute a soft-field takeoff and climb. Have student climb to cruise altitude and open the flight plan with little or no instructor guidance.

Diversion to DTL: About half-way into this leg, begin to simulate engine roughness. Make popping sounds and simulate power loss by pulling back the throttle a couple hundred RPM's every few minutes. Try to let the student come up with a solution to the problem. Ask questions to stimulate thought, such as:

Can we trouble shoot this problem?
Should we continue on our course?
What are our available alternates?
Should we declare an emergency?
If so, how would we do that?

Have the student plan a diversion to DTL (or other suitable airport). Guide them through the problem and their decision making process. Ask appropriate questions to stimulate thought.

Arrival DTL: Once on the ground, have the student taxi to the ramp and shut down. Hopefully the student will identify the need to close their flight plan and complete other post flight responsibilities. Give them time to make these decisions. Emphasize PERSONAL RESPONSIBILITY.

<u>Leg 4 – (suggest DTL to GFK)</u>

Ground Ops: Give the student time to re-plan to GFK. Tell the student that because weather is moving in, time demands that they be off the ground within 30 minutes. Let the student re-plan with as little guidance as possible. Continue to rush the student until in the air…put as much time pressure on them as possible. Tell them their passengers can't afford to get stuck in Detroit Lakes. Force them to file their flight plan in the air. Record any mistakes they make. If the mistakes aren't hazardous to the flight, do not correct them.

Departure: Execute a normal takeoff and climb. Have the student climb to altitude and file their flight plan with Flight Service in the air. If they have trouble with the radio phraseology, provide assistance as necessary.

Cruise: This leg's navigation can be done by any means the student deems necessary. Try to get them to use all available resources. Ask questions to stimulate thought, such as:

> Since we have no designated checkpoints how can we keep track of our flight progress?
> What is our best navigation source to use for this flight?
> How can we back-up this navigation source?

Teach student how to keep-up with location/create a flight log in cruise flight. Make sure they are comparing the time they filed with their actual route time.

Descent and Arrival: Let the student execute proper arrival and descent procedures into GFK. Student should be able to successfully enter the pattern and land at Grand Forks. Give the student time to realize they need to close their flight plan.

Post brief: Ask the student how they think the time pressure affected their performance. Show student the list of mistakes you recorded on the last leg, and have them identify the ones they felt were attributed to this pressure. Have them identify areas where they did well and the areas that need improvement throughout the entire flight.

FLIGHT LESSON 23

STUDENT PREPARATION:

1. Review syllabus for contents of lesson.
2. Complete appropriate sections of the workbook.
3. Obtain a weather briefing and complete necessary pre-flight planning.

SCENARIO
You have decided to take your “significant other” on a special date! This date includes a moonlit flight over your date’s house, followed by a landing at Crookston for a romantic dinner at a fancy restaurant, and then back to Grand Forks for dessert at the Blue Moose. Your date’s house lies approximately 2 miles south of Eldred; so the plan is take-off, fly over the house, and than proceed on into Crookston.

INSTRUCTOR INFORMATION

Group Ops – Guide the student through the preflight discussion items listed in the syllabus. Ask questions to stimulate thought, such as:
How long should we wait to let our eyes adapt to the night?
What do you think will be the greatest difference between night and day flying?
What illusions should we watch out for?
If we spot another aircraft, and only see a red light on their wing, what does that mean? Who has the right-of-way?

<u>Leg 1 GFK – CKN</u>

Preflight: Discuss and demonstrate with the student the differences between a night and day preflight. Ask questions to stimulate thought, such as:
Should we check the lights any different than we do during the day?
What color flashlight do you think would be best to use? Why?

Ground Maneuvering: Discuss and demonstrate with the student the proper taxi procedures at night. Ask questions to stimulate thought, such as:
Should we taxi with our landing light on the whole time? Why?
What should we do if an aircraft pulls off the runway in front of us with their landing light on? Why?

Departure GFK: Execute a normal takeoff and climb.

Enroute: Perform all maneuvers listed in the syllabus after entering the practice area. Attempt to identify location of date’s home. For steep turns, tell the student that their date would like to take pictures of their house but the wing is in the way. Be sure to ask the student to compare their visual cues during the day, versus their visual cues at night. Discuss how individual maneuvers differ at night (compared to day).

Crookston Airport: Student should enter the Crookston pattern with little instructor guidance. Ask questions to stimulate thought, such as:
How can we identify the Crookston Airport?
If the light near the windsock was burned out, how could we figure out which runway to use?
If the runway lights are too bright, how do we turn them down?
Conduct a full stop landing and taxi to the ramp completing all necessary checklists for validation of scenario.

<u>Leg 2 CKN – GFK</u>

Depart CKN: Conduct a normal takeoff. Practice landings in the patterns as necessary to increase student proficiency, then depart to GFK.

Enroute to GFK: Ask questions to stimulate thought, such as:
If we lost our engine right now, what would you do?
Is it better to land in an unlit area, or a lighted area?
What do you think of night flying?

Grand Forks Airport: Student should enter the Grand Forks airport with little or no instructor assistance. Encourage them to make the decisions. Practice landings as necessary to increase student understanding.

Post Brief: Assign route and scenario for next lesson

FLIGHT LESSON 24 (Dual Night X-C)

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate sections of the workbook.
3. Obtain a weather brief for route assigned by instructor.
4. Complete a risk assessment for today's flight.
5. Complete necessary X-C planning for your assigned route.
6. Be prepared to explain/identify your GO/NO GO decision, fuel requirements, alternates available, and any NOTAM's affecting your route.
7. Identify three night illusions you might experience during tonight's flight. Be ready to explain when and how they might occur (for example: on final at ????).

SCENARIO

Congratulations – after years of hard work, you got your first pilot job-- flying freight at night for a company based out of Grand Forks. Your route tonight will take you as follows:

Leg 1 – Grand Forks to Fargo (KFAR) –deliver 75 lbs of cargo to FAR, pickup 55 lbs

Leg 2 – Fargo, ND (KFAR) to Alexandria, MN (KAXN) – drop-off 20 lbs of cargo at AXN, pickup 30 lbs

Leg 3 – Alexandria (KAXN) to Detroit Lakes, MN (KDTL) – drop-off 25 lbs of cargo at DTL, pick up 50 lbs

Leg 4 – Detroit Lakes (KDTL) to Grand Forks – drop-off remaining cargo

In order to avoid any delays that may be caused by re-fueling, you should plan the trip with as little or no fuel stops as possible. Your boss has made it clear to you that he has taken a big chance hiring such a low-time pilot. Being that this is your first flight alone, you really want to impress him with your on-time performance and piloting skill.

It is up to you to decide where to put any cargo you will carry during this flight. It is very important to calculate weight and balance for each leg because the FAA recently fined the company for flying three aircraft overweight. The fines led to three of your fellow pilots losing their jobs. Also, the company's dispatch frequency is 123.50; any delays or changes in the original flight-plan should be reported to the company over this frequency.

INSTRUCTOR INFORMATION:

<u>Pre-flight discussion:</u> Discuss the lesson scenario. Have student explain their GO/NO GO decision and the three illusions they might encounter on tonight's flight. Be sure they are very specific as to why and where they will occur. Calculate actual weight and balance

and associated performance. Alter dispatch form to reflect actual route that will be flown. ***Student's planned route will be different from the actual route flown.***

Ground Ops: Student should be able to complete all tasks without instructor guidance. Be sure student programs flight plan into the GPS. Ask questions to stimulate thought, such as:

> There is a lot of traffic out tonight, is there anything we can do to help us avoid the other aircraft?

Introduce the student to flight following and the benefits it affords. Provide assistance on the radio as necessary.

Leg 1 – suggest GFK to FAR:

Departing GFK: Soft field takeoff with normal climb to cruise altitude.

Cruise: Student should demonstrate his/her ability to maneuver on course, identify and record checkpoints, and open flight plan without instructor assistance.

Descent: Student should demonstrate his/her ability to communicate with ATC, adequately plan a proper descent, and arrive and locate the airport with no instructor guidance.

Pattern: Short field landing. Pick two points on the runway where your simulated short field airport begins and ends. Challenge the student to pick proper aim and touchdown points. Practice landings and takeoffs as necessary to increase student proficiency.

Leg 2 – suggest FAR to AXN

Departing FAR: Short field takeoff. Inform the student they have a 200 ft obstacle, and that their altitude needs to be above 3000 ft before proceeding over the town of Fargo due to noise abatement procedures. Student should elect to do a Vx climb to 3000 ft.

Cruise: Wait for the student to open and/or close their flight plan if they have not done so already. Student should demonstrate his/her ability to maneuver on course, identify and record checkpoints, and open and close their flight plans with no instructor guidance.

Divert to DTL: After being handed off from Fargo and/or approximately 45 miles from Alexandria, inform the student that you see flashes of lightning in the distance. Ask questions to stimulate thought, such as:

> Do you think it's a good idea to continue towards what might be a thunderstorm?
> How can we find out if there is hazardous weather near Alexandria?
> What frequency will we use and who will we call?

Student should elect to get an in-flight weather brief from either flight watch or the nearest FSS. Guide them through the process and have them practice the actual radio calls by dialing in the appropriate frequencies but not keying the mike. As the instructor, you will play ATC and give the student the following weather info:

Convective SIGMET has been issued for central Minnesota, Southeastern North Dakota, and Northeastern South Dakota. A line of thunderstorms extending from 10 miles north of Alexandria, Minnesota to 10 miles south of Watertown, South Dakota is moving east at 30 Knots. The line of storms is predicted to produce heavy rain and lighting and large hail in excess of ¾ inch in diameter. Low Level Wind Shear with gusts up to 50 knots is expected in and around the line of storms.

Alexandria Automated station reporting wind southwesterly at 15 knots gust 28. visibility 7 miles in light rain, temperature 20 dew point 24, altimeter two niner - eight niner, lighting distant west southwest

(pause for effect)
Also…
Radar shows a line of thunderstorms well established approximately 20 miles southwest of Alexandria moving east with areas of light to moderate precipitation surrounding the location. Echo tops in the last half-hour moving toward Alexandria have increased from low-levels up to Flight Level two-five-zero

Anything else I can get you?

Answer any questions student may have…

Ask questions to stimulate thought, such as:

Do you think it would be safe to continue on to Alexandria?
Which destination makes the most sense for us to go to?
Do we have enough fuel to get there?
What other things should we consider?

Student should elect to go towards Detroit Lakes and be able to successfully alter their course to get there. Challenge the student to alter their flight plan with FSS. Initially let the student use all available means of navigation. After student has successfully amended their flight plan take away all navigational aids. Challenge to student to find Detroit Lakes using nothing but their map. If student becomes lost, have them start lost procedures.

Descent and Pattern at DTL: student should be able to plan a descent and enter the pattern at DTL with no instructor guidance. Pretend to be another aircraft and say over the intercom: "***Aircraft arriving at Detroit Lakes be advised that recent flooding has left the runway surface covered in sticky mud. Runway's usable, but is no longer a hard surface."*** Student should elect to do a soft-field landing. Practice takeoffs and landing as necessary to increase student proficiency. Have student taxi to the ramp and shutdown the engine when finished.

Leg 3 – (suggest DTL to GFK)

Ground Ops: Tell the student that the company has made an error in their dispatch planning. Rather than taking on 50 lbs of cargo in DTL, you will be taking on 150 lbs of cargo. It is up to them to decide if they can carry it and where. Remind them they never unloaded the cargo destined for Alexandria. Force student to quickly recalculate their weight and balance.

Departing DTL: Student should elect to do a soft-field takeoff due to the runway condition. Execute normal climb out.

Cruise: Student should demonstrate his/her ability to maneuver on course, identify and record checkpoints, and open and close their flight plans with no instructor guidance.

Basic Instrument/Lost procedure: After established in cruise, take control of the aircraft and have the student get the hood from the backseat. While student is reaching for the hood, cover the GPS screen using the MSG button and take away all nav aids. Also, spin the DG approximately 30 or more degrees right or left, but turn the aircraft to the heading the student was originally flying (this will have the student flying an incorrect heading towards their destination; the goal is to get them totally lost). After the student puts on the hood, have the student fly the heading that they think will take them to their destination for approximately 20 to 30 minutes. For further challenge, have the student change airspeeds in level flight while holding cruise altitude.

Lost Procedure: Have the student remove their hood and challenge them to execute the proper lost procedure. Work simple to complex: initially have the student try to locate their position using only their map. Let them confirm their position using a VOR crosscheck and finally the GPS. Student should be able to successfully identify the position of Grand Forks and navigate towards it. Ask questions to stimulate thought, such as:

Do we need to update our flight plan?
Has our time back to Grand Forks been altered?

Descent and Arrival: Student should be able to properly plan their descent into Grand Forks with no instructor input. Practice different takeoffs and landings as necessary to increase student proficiency.

Post brief: Ask the student if the night illusions they originally expected actually occurred? Did any illusions occur that weren't expected? Discuss how to avoid these illusions. Lead the student through a chronological critique of their whole performance.

FLIGHT LESSON 25

STUDENT PREPARATION:

1. Review syllabus for contents of lesson.
2. Complete appropriate sections of the workbook.
3. Obtain a weather briefing and complete necessary pre-flight planning.
4. Complete a risk assessment for the day's flight and be prepared to lead a discussion on it.
5. Complete XC planning to Jamestown (ND) using the most recent weather and be prepared to lead a discussion on your planning.

SCENARIO

You are a real estate tycoon with a very important meeting in Jamestown, ND. The purpose of the meeting is to negotiate the acquisition of a 50-unit apartment complex. If you negotiate well, your company stands to make a lot of money. Due to the time sensitive nature of the deal, you choose to fly your new Piper Warrior to Jamestown so as to be the "first buyer on-scene".

INSTRUCTOR INFORMATION

Pre-flight Brief: Review the student's cross-country planning to Jamestown. Have them explain their GO/NO GO decision; where they got their weather information; how they chose their cruise altitude and power setting; any risks or hazardous on the flight; and any NOTAM's affecting their flight.

Ground Ops: Student should be able to complete all tasks with no instructor guidance. If student gets confused or forgets to do something, let them work it out as long as it is within the constraints of safety.

Leg 1 GFK to JMS diversion 4V4

Soft Field Takeoff: Tell the student that it snowed last night and airport personnel have not plowed the runway yet. There is approximately 1" to 2" inches of light fluffy snow on the runway. Student should elect to do a soft field takeoff.

Climb: Student should demonstrate the ability to navigate and maneuver the aircraft on course. Allow the student to initially use all available means (GPS, VOR, etc.). Once on course, take away all navigation aids in order to effectively evaluate their pilotage and dead reckoning skills. Have student simulate opening their flight plan by selecting the proper frequency and going through the appropriate radio calls. Student should not key the mike, you will act as the FSS. Once in the practice area, ask questions to stimulate thought and further evaluate their abilities to successfully navigate to JMS, such as:

What is our Groundspeed?

What will be our ETA or ETE to Jamestown?

After we reach Jamestown, how much flight time will we have left?

Evaluate the accuracy of student's answers by using the GPS GS and ETE readouts.

BAIF: Have the student put on view limiting device and tell them they just entered the clouds. Student should elect to do a 180 degree turn without being prompted. Practice basic instrument flying maneuvers as per the PTS in order to evaluate student's skills.

Lost Procedure: Take the view limiting device off the student and have them start lost procedures working simple to complex (map only to navigation aids). Student should be able to locate their position using their map. After they identify their position, let them use navigational aids in order to verify their location.

Steep turns, slow flight, and stalls: Student should be able to set-up for and execute all maneuvers with no instructor input while maintaining the Block II completion standards.

Emergency Operations: Tell student the engine is on fire. Student should execute the appropriate checklist from memory. After they complete memory items, tell them the fire is still burning and is getting worse. Student should elect to do an emergency descent. Give them an airspeed at which the fire will be extinguished. After reaching that airspeed, student should level off, attain 73 KIAS, pick an emergency field or other suitable landing area, maneuver the aircraft for a simulated landing in that area, and complete all appropriate checklist items with no instructor input.

Ground Reference Maneuvers: Student should set-up for and execute all ground reference maneuvers listed in the Private Pilot PTS while maintaining block II completion standards with no instructor input.

Diversion: After student has completed the Ground Reference Maneuvers, have them start back to Grand Forks. Once student selects GFK ATIS, turn down the volume and provide the following information:

Grand Forks Tower information Bravo at (applicable Zulu time), Wind 350 at 12, visibility 1 sm, Overcast 400 ft in light rain, altimeter setting (appropriate setting), landing and departing runways 35L and 35R, ILS approach runway 35L is in use, arrive on initial contact you have Bravo

Student should elect to divert to the nearest airport (suggest 4V4).

Entry and Pattern Northwood 4V4: Student should enter the pattern correctly at Northwood with no instructor input. Tell the student it looks like much of the runway has been rendered unusable. Suggest the following limitation: runway starts at the first center line stripe and ends at the halfway point. Student should elect to do a short field landing. Have student pick appropriate touchdown and aim point.

NOTE: Northwood is an east/west runway. Therefore, if strong crosswinds exist, have student execute *normal* X-wind landing and consider completing other landings at Grand Forks.

Practice landings and takeoffs at Northwood as required.

Leg 2 4V4 to GFK

Takeoff and climb: If previous landing was a short field, student should elect to do a short field takeoff automatically due to length of runway available. If student does not elect to do a short field, tell them a construction crew has placed a 200 ft tall crane off the end of the runway. Student should then elect to do a short field takeoff.

Arrival and Pattern work at GFK: Student should be able to navigate to Grand Forks with no instructor input. Practice takeoffs and landings as necessary in order to increase student proficiency.

Post brief: Have student critique their own performance. Provide guidance for up-coming stage check.

STAGE CHECK 26

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate sections of the workbook. All workbook assignments up to Stage 26 should be complete.
3. STUDY – applicable regulations and stan manuals.
4. Call stage check pilot to set-up a time and location for stage check.

SCENARIO

There is no scenario for this stage check other than the problems/scenarios the stage check pilot might present you with. The key to successful stage check outcomes is to study and have confidence in your abilities. Your instructor would not have put you in for this stage check if he/she thought you weren't ready. Have fun and Good Luck!

FLIGHT LESSON 27 (SOLO X-C)

STUDENT PREPARATION:

1. Review syllabus description for this lesson.
2. Review student pilot limitations and applicable regulations affecting solo X-C operations
3. Complete appropriate sections of the workbook.
4. Obtain a weather brief for route assigned by instructor.
5. Complete a risk assessment for today's flight.
6. Complete necessary X-C planning for your assigned route.
7. Be prepared to explain/identify your GO/NO GO decision, fuel requirements, alternates available, and any NOTAM's affecting your route.

SCENARIO

You will be conducting a solo cross-country flight of at least 150 nautical miles with landings at a minimum of three points, one of which must a straight line distance of more than 50 nautical miles from the original point of departure. Your mission is to complete the necessary pre-flight planning for your assigned route, navigate safely and efficiently to all your assigned points, and return to Grand Forks as close as possible to your ETA. That is already a "realistic scenario." Have Fun and Fly Safe!

INSTRUCTOR INFORMATION

Preflight Brief – Have student lead a discussion on student pilot privileges and limitations and regulations applicable to solo X-C operations. Have them explain their GO/NO GO decision, any NOTAM's affecting their route, unique features of any of their destinations, and any fuel stops they might need.

Post flight Brief –Good questions to ask are:

Did your flight go as planned?
Anything happen that you didn't expect?
How did you handle that situation?
Would you handle that situation any differently next time? How?
What did you learn?
Did you have fun?

FLIGHT LESSON 28

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate sections of the workbook.
3. Obtain a weather brief for route assigned by instructor.
4. Complete a risk assessment for today’s flight.
5. Complete a list of personal minimums based on your current flight experience.
6. Complete necessary X-C planning for any route assigned by your instructor.

SCENARIO

This lesson is a review lesson. Therefore, all scenarios incorporated on this lesson will be assigned by your instructor.

INSTRUCTOR INFORMATION

This lesson is a chance for you to practice constructing lessons which incorporate SBT. Use scenarios throughout the flight to effectively evaluate the student’s ability to make decisions and safely operate the aircraft. Have Fun and Be Creative!!

GROUND LESSON 29

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate sections of the workbook.
3. Review materials as deemed appropriate by instructor

SCENARIO

This lesson is a review lesson. Therefore, all scenarios incorporated on this lesson will be assigned by your instructor.

INSTRUCTOR INFORMATION

This lesson is a chance for you to practice constructing lessons which incorporate SBT. Use scenarios to quiz the student as necessary in order to effectively prepare them for their final stage check. Have Fun and Be Creative!!

STAGE CHECK 30

STUDENT PREPARATION

1. Review syllabus description for this lesson.
2. Complete appropriate sections of the workbook. All workbook assignments up to Stage 30 should be complete.
3. STUDY – applicable regulations and stan manuals.
4. Call stage check pilot to set-up a time and location for stage check.

SCENARIO

There is no scenario for this stage check other than the problems/scenarios the stage check pilot might present you with. The key to successful stage check outcomes is to study and have confidence in your abilities. Your instructor would not have put you in for this stage check if he/she thought you weren't ready. Have fun and Good Luck!

Appendix B

Scenario Based Training Study AVIT 102 Student Questionnaire

How old are you in years?

_______________years

Approximately how much flight training time do you have logged (this is time logged in an A/C with a flight instructor)?

_______________hours

Approximately how much flight time do you have (this includes time not officially logged but in the front seat of an aircraft manipulating the controls)?

_______________hours

Is anyone in your immediate family an active certificated pilot (active is defined as operating an aircraft more than 50 hrs a year)?

(circle appropriate response) YES or NO

On a scale of 1 to 5, one being the lowest and five being the highest, how would you rate the following (circle appropriate response):

The amount of your previous aviation experience (this includes everything from reading books to riding in the backseat of an aircraft to playing Microsoft flight Sim)

1 2 3 4 5

Your exposure to the actual flight environment (this includes any time riding in an airplane where the flight controls/cockpit were visible)

1 2 3 4 5

Appendix C

List of Associated Task for Each Stage Check in UND's Private Pilot Certification Course

Task Items for the Stage 14 Oral

1) Aircraft Weight and Balance
2) Federal Aviation Regulations
3) Logbook Entries and Certificate Endorsements
4) Safety Policies and Procedures
5) V-speeds and Emergencies
6) Student Pilot Privileges and Limitations
7) Certificates and Documents
8) Performance and Limitations

Task Items for the Stage 14 Flight

1) Federal Aviation Regulations
2) Safety Policies and Procedures
3) Preflight Inspection
4) Engine Starting
5) Taxiing
6) Radio Communications and ATC Light Signals
7) Traffic Patterns
8) Wake Turbulence Avoidance
9) Wind Shear Avoidance
10) Runway Incursions
11) Normal and/or Crosswind Takeoff and Climb
12) Straight and Level Flight
13) Level Turns
14) Straight Climbs and Climbing Turns
15) Straight Descents and Descending Turns
16) Aerodynamics Demonstration
17) Stalls
18) Emergency Approach and Landing
19) Systems and Equipment Malfunctions
20) Power Off Landing (Single Engine)
21) Go-Around
22) Normal and/or Crosswind Approach and Landing
23) Post Flight Procedures
24) Use of Checklist
25) Smoothness and Accuracy

26) Exercising Judgment
27) Application of Aeronautical Knowledge
28) Mastery of Aircraft
29) Collision Avoidance

Task Items for the Stage 26 Oral

1) Aircraft Weight and Balance
2) Federal Aviation Regulations
3) Safety Policies and Procedures
4) Airworthiness Requirements
5) V-speeds and Emergencies
6) Certificates and Documents
7) Weather Information
8) VFR Cross-Country Flight Planning
9) National Airspace System
10) Performance and Limitations
11) Operation of Systems
12) Airport and Runway Markings and Lighting
13) Spin Awareness
14) Emergency Procedures

Task Items for the Stage 26 Flight

1) Preflight Preparation
2) Preflight Inspection
3) Cockpit Management
4) Engine Starting
5) Taxiing
6) Radio Communication and ATC Light Signals
7) Traffic Patterns
8) Wake Turbulence Avoidance
9) Wind Shear Avoidance
10) Runway Incursions
11) Soft Field Takeoff and Climb
12) Short Field Takeoff and Maximum Performance Climb
13) Normal and/or Crosswind Takeoff and Climb
14) Fundamentals of Flight
15) Steep Turns
16) Flight By Reference to Instruments
17) Recovery from Unusual Flight Attitudes
18) Pilotage and Dead Reckoning
19) Navigation Systems and Radar Services
20) Diversion
21) Lost Procedure
22) Maneuvering During Slow Flight
23) Power-Off Stall
24) Power-On Stall

25) Imminent Stalls – Power On and Power Off
26) Emergency Descent
27) Emergency Approach and Landing
28) Systems and Equipment Malfunctions
29) Rectangular Course
30) S – Turns
31) Turns Around a Point
32) Soft Field Approach and Landing
33) Short Field Approach and Landing
34) Go-Around
35) Normal and/or Crosswind Approach and Landing
36) Post Flight Procedures
37) Overall Flight
38) Use of Checklist
39) Smoothness and Accuracy
40) Exercising Judgment
41) Application of Aeronautical Knowledge
42) Collision Avoidance

Task Items for the Stage 30 Oral
1) Aeromedical Factors
2) Aircraft Weight and Balance
3) Federal Aviation Regulations
4) Publications
5) Aircraft Flight Manual
6) Airworthiness Requirements
7) V-speeds and Emergencies
8) Certificates and Documents
9) Weather Information
10) VFR Cross-Country Flight Planning
11) National Airspace System
12) Performance and Limitations
13) Operation of Systems
14) Radio Communication and ATC Light Signals
15) Airport and Runway Markings and Lighting
16) Spin Awareness
17) Emergency Procedures
18) Night Operations

Task Items for the Stage 30 Flight
1) Preflight Preparation
2) Preflight Inspection
3) Cockpit Management
4) Engine Starting
5) Taxiing
6) Radio Communication and ATC Light Signals

7) Traffic Patterns
8) Soft Field Takeoff and Climb
9) Short Field Takeoff and Maximum Performance Climb
10) Normal and/or Crosswind Takeoff and Climb
11) Fundamentals of Flight
12) Steep Turns
13) Flight By Reference to Instruments
14) Recovery from Unusual Flight Attitudes
15) Pilotage and Dead Reckoning
16) Navigation Systems and Radar Services
17) Diversion
18) Lost Procedures
19) Maneuvering During Slow Flight
20) Power-Off Stalls
21) Power-On Stalls
22) Imminent Stalls Power-On and Power-Off
23) Emergency Approach and Landing
24) Systems and Equipment Malfunctions
25) Ground Reference Maneuver
26) Soft Field Approach and Landing
27) Short Field Approach and Landing
28) Go-Around
29) Slip to Landing
30) Normal and/or Crosswind Approach and Landing
31) Post Flight Procedures
32) Overall Flight
33) Use of Checklist
34) Smoothness and Accuracy
35) Exercising Judgment
36) Application of Aeronautical Knowledge
37) Mastery of Aircraft
38) PTS Special Emphasis Areas

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