GLASS COCKPIT TRANSITION TRAINING IN COLLEGIATE AVIATION:

ANALOG TO DIGITAL

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A Thesis

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ABSTRACT

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The purpose of this study was to analyze, develop, and validate a training protocol for digital cockpit transition training in collegiate aviation, due to recent changes in aircraft cockpit instrumentation from analog to digital. The objectives of the study were to determine an effective teaching method for glass technology training for collegiate aviation pilots transitioning from analog to digital, to determine how human factors affected the training required to successfully transition a collegiate aviation pilot to glass cockpit technology, and to develop a protocol or training process for collegiate aviation pilots for use in transitioning from analog to digital cockpit instrumentation.

The research design used for this study was a qualitative comparative analysis; which was well-suited to the comparison of data from Avidyne, Bowling Green State University, Cirrus, and Cessna. Through the use of a matrix, comparison of each company’s training process and tasks were cross referenced with the others, resulting in discovery of integration and how each of the parts related to each other. A recommendation matrix resulted from the best practices that were revealed through the comparative data matrix of Avidyne, Bowling Green State University, Cessna, and Cirrus for three common criteria; (a) Course Structure, (b) Training Requirements/Training Course Outline, and (c) Evaluation. The researcher highlighted the training strengths represented by each institution in order to develop a digital cockpit instrumentation transition training protocol for use in collegiate flight training.

A survey was used as validation of the training protocol recommendations. The panel of experts represented six collegiate aviation institutions. Overall, the panel agreed with the survey
and protocol and validated that the training protocol was appropriate. The few exceptions were the concern for the sufficient training for IFR pilot qualification levels through ground training and course depth. This was consistent with the comments of three of the panel members in their suggestion to increase the ground training content for Instrument Flight Rules pilot competency and digital instrumentation systems. The researcher concluded, based on the recommendations from the expert panel, that the protocol was logical, efficient, and well-suited to a collegiate aviation flight school for IFR digital instrumentation transition and that there are numerous areas for future study.
“…and furthermore directed that I should not proceed by land to the East, as is customary, but by a Westerly route, in which direction we have hitherto no certain evidence that anyone has gone.”

-entry from the journal of Christopher Columbus on his voyage of 1492
Dedicated to my son, whose determination in life is inspiring beyond words.

To my husband for his enduring support and commitment.

To my family for making this possible, for their amazing love and kindness.

To my friends for their incredible motivation through challenging times and for encouraging me in the completion of this degree.

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CHAPTER 1: INTRODUCTION

Context of the Problem

Historically, pilots have flown aircraft with instrumentation powered by steam and the training provided to them was deeply rooted in the process of learning how to use these analog gauges to create situational awareness and decipher flight and ground information. With the advancement of technology, cockpit visual instrumentation has advanced to the presentation of flight data in a digital or glass presentation. Pilots in the general aviation industry now find themselves in a position to transition to this technology but do not have the training infrastructure required to do so. The need has been identified and industry now struggles to find the best solution and ensure that general aviation, and more specifically collegiate aviation pilots receive adequate and thorough training.

Statement of the Problem

The purpose of this study was to analyze, develop, and validate a training protocol for glass cockpit transition training in collegiate aviation, due to recent changes in aircraft cockpit instrumentation from analog to digital.

Significance of the Study

Exploration of the history of pilot training on steam gauges rather than glass technology played a role in the development of this transition training. The type of user, or pilot, was also a factor. An analysis of the user as an experienced professional pilot or an inexperienced hobby pilot, a need for the training to address the use in Instrument Meteorological Conditions or in Visual Meteorological Conditions, and in high performance aircraft or simple training aircraft was made. The significance of each factor played a part in the determination of the appropriate transition training course. Knowledge of the glass cockpit systems and the computing function
levels had to be assessed and adapted into the transition course, as well as an understanding of modes of operation within the glass cockpit systems, and how, when and why to use each mode. A consideration of the human factors involved in pilot adaptation and transition training to glass cockpits also had to be made. Finally, a determination of what training protocol or method would be best suited to the glass transition training course was made.

*Figure 1.* Analog cockpit instrumentation (steam gauges).

*Figure 2.* Digital cockpit instrumentation (glass).
Objectives of the Study

The objectives of the study were as follows:

- Determine an effective teaching method for glass technology training for collegiate aviation pilots transitioning from analog to digital.
- Determine how human factors affected the training required to successfully transition a collegiate aviation pilot to glass cockpit technology.
- Develop a protocol or training process for collegiate aviation pilots for use in transitioning from analog (steam gauges) to digital (glass) cockpit instrumentation.

Limitations

The following limitation was inherent in the study:

Proprietary information was received from Cirrus Design and Cessna Aircraft

Definition of Terms

**Analog:** “using hands, dials, etc. to show amounts” (Your Dictionary, 2008). Analog is also operationally defined for the purpose of this study as instrumentation driven by vacuum tubes with a direct connection to actual atmospheric conditions. To be used interchangeably with the term steam.

*Cathode Ray Tube: (CRT)* invented by German physicist Karl Ferdinand Braun in 1879, “is an evacuated glass envelope containing an electron gun (a source of electrons) and a fluorescent screen, usually with internal or external means to accelerate and deflect the electrons. When electrons strike the fluorescent screen, light is emitted”. (Wikipedia, 2008)

**Digital:** “designating or of data, images, sounds, etc. that are stored, transmitted, manipulated, or reproduced by a process using groups of electronic bits represented as 1 or 0.” (Your Dictionary, 2008) To be used interchangeably with glass cockpit instrumentation.
**Federal Aviation Administration: (FAA)** “an agency of the United States Department of Transportation with authority to regulate and oversee all aspects of civil aviation in the U.S. The Federal Aviation Act of 1958 created the group under the name "Federal Aviation Agency", and adopted its current name in 1967 when it became a part of the United States Department of Transportation.

The Federal Aviation Administration's major roles include:

- Regulating U.S. commercial space transportation
- Encouraging and developing civil aeronautics, including new aviation technology
- Regulating civil aviation to promote safety
- Developing and operating a system of air traffic control and navigation for both civil and military aircraft
- Researching and developing the National Airspace System and civil aeronautics
- Developing and carrying out programs to control aircraft noise and other environmental effects of civil aviation” (Wikipedia, 2008)

**Federal Aviation Administration/Industry Training Standards: (FITS)** “program is a partnership between FAA, Industry, and Academia designed to enhance general aviation safety. This is accomplished by developing flight training programs that are more convenient, more accessible, less expensive, and more relevant to today’s users of the National Airspace System. FITS is focused on the redesign of general aviation training. Instead of training pilots to pass practical test, FITS focuses on expertly manage real-world challenges. Scenario based training is used to enhance the GA [general aviation] pilots’ aeronautical decision making, risk management, and single pilot resource management skills. We do this without compromising basic stick and rudder skills”. (Federal Aviation Administration, 2008)
**G1000:** Garmin 1000 digital cockpit instrumentation system. (Garmin, 2008)

**Glass cockpit:** “A glass cockpit is an aircraft cockpit that features electronic instrument displays.” (Wikipedia, 2008) To be used interchangeably with the term digital instrumentation and additionally, as used in glass cockpit flying.

**Global Positioning System: (GPS)** “Gives the exact location of someone or some place. The location is based on information transmitted from a constellation of 24 satellites.” (Your Dictionary, 2008)

**Ground Training:** “means that training, other than flight training, received form an authorized instructor.” (Federal Aviation Administration, 2008)

**Instrument Flight Rules: (IFR)** “are a set of regulations and procedures for flying aircraft whereby navigation and obstacle clearance is maintained with reference to aircraft instruments only and separation from other aircraft is provided by Air Traffic Control.” (Wikipedia, 2008)

**Instrument Meteorological Conditions: (IMC)** “refers to meteorological conditions expressed in terms of visibility, distance from clouds, and ceiling less than minima specified for visual meteorological conditions (VMC).” (Federal Aviation Administration, 2008)

**Liquid Crystal Display: (LCD)** “is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. It is often utilized in battery-powered electronic devices because it uses very small amounts of electric power.” (Wikipedia, 2008)

**Multi Function Display: (MFD)** “a small screen (CRT or LCD) in an aircraft surrounded by multiple buttons that can be used to display information to the pilot in numerous configurable ways.” (Wikipedia, 2008)
Multimedia devices: “The term is used in contrast to media which only utilize traditional forms of printed or hand-produced text and still graphics. In general, multimedia includes a combination of text, audio, still images, animation, video, and interactivity content forms. Multimedia (as an adjective) also describes electronic media devices used to store and experience multimedia content.” (Wikipedia, 2008)

Primary Flight Display: (PFD) “is a modern aircraft instrument dedicated to flight information. Much like multi-function displays, primary flight displays are built around an LCD or CRT display device. Representations of older six pack or "steam gauge" instruments are combined on one compact display, simplifying pilot workflow and streamlining cockpit layouts.” (Wikipedia, 2008)

Recurrent Training: Operationally defined for the purpose of this study as flight or ground training with the intention of sustaining pilot proficiency.

Steam gauge flying: Operationally defined for the purpose of this study as flight with reference to digital cockpit instrumentation. To be used interchangeably with flight by analog instrument presentation.

Switchology: Operationally defined for the purpose of this study as a pedagogy of learning what a particular switch on an aircraft instrument panel, or pilot action, accomplishes in performing an aircraft operating task, or set of tasks, during checklist challenge and response activities.

Technologically Advanced Aircraft: (TAA) “are equipped with technologically advanced avionics that utilize computing power and modern navigational aids to improve pilot situational awareness, system redundancy and dependence on equipment, and to improve in-cockpit information about traffic, weather, airspace and terrain. By FAA declaration, a TAA is equipped
with at least the following items: a moving-map display, an IFR-approved GPS navigator, and an autopilot.” (AOPA, 2005)

Transition Training: “An instructional program designed to familiarize and qualify a pilot to fly types of aircraft not previously flown such as tailwheel aircraft, high performance aircraft, and aircraft capable of flying at high altitudes.” (Dynamic Flight, 2008)

Visual Flight Rules: (VFR) “are a set of aviation regulations under which a pilot may operate an aircraft in weather conditions sufficient to allow the pilot, by visual reference to the environment outside the cockpit, to control the aircraft’s attitude, navigate, and maintain safe separation from obstacles such as terrain, buildings, and other aircraft.” (Wikipedia, 2008)

Visual Meteorological Conditions: (VMC) “refers to meteorological conditions expressed in terms of visibility, distance from clouds, and ceiling equal to or better than specified minima.” (Federal Aviation Administration, 2008)
CHAPTER 2: REVIEW OF LITERATURE

The purpose of this study was to analyze, develop, and validate a training protocol for glass cockpit transition training in collegiate aviation, due to recent changes in aircraft cockpit instrumentation from analog to digital presentation. The review of literature provides a historical context, relevant theory, a review of the current literature, and summary.

Historically, pilots have flown aircraft with instrumentation powered by steam and the training provided to them was deeply rooted in the process of learning how to use these round gauges to create situational awareness and decipher flight and ground information. With the advancement of technology, cockpit visual instrumentation has advanced to the presentation of flight data in a digital or glass presentation. Pilots in the aviation industry now find themselves in a position to transition to this technology but do not have the training infrastructure required to do so. The need has been identified and industry now struggles to find the best solution and ensure that pilots receive adequate and thorough training.

Consideration of the history of pilot training on steam gauges rather than glass technology will play a role in the development of this transition training. The type of user, or pilot, will also be a factor. An analysis of the user as an experienced professional pilot or an inexperienced hobby pilot, a need for the training to address the use in Instrument Meteorological Conditions or in Visual Meteorological Conditions, and in high performance aircraft or simple training aircraft should be made. The significance of each factor will play a part in the determination of the appropriate transition training course. Knowledge of the glass cockpit systems and the computing function levels will have to be assessed and adapted into the transition course, as well as an understanding of modes of operation within the glass cockpit
systems, and how, when and why to use each mode. A consideration of the human factors involved in pilot adaptation and transition training to glass cockpits will have to be made. Finally, a determination of what training protocol or method would be best suited to the glass transition training course would need to be made.

**Historical Basis of General Aviation Aircraft Instrumentation**

The historical basis of general aviation cockpit displays lies in the steam gauge. Since 1953, aircraft instrumentation has been based on analog (round dial) technology. The air, or steam, powered round dial and geared instrumentation was used to present a multitude of information to the pilot throughout ground and flight operations. Air tubes and wires transmitted airflow and electric signals to gyroscopes and transmitters that spun mechanical gears and springs to represent on round dials, the flight parameters of the aircraft. Since this technology was the foundation of most general aviation aircraft, so too was it the foundation for pilot training.

Pilots have used steam gauges from their basic visual training and instrument flight conditions training through their certified flight instructor and multi-engine certificate training. According to AOPA Safety Foundation (2005), “although the bulk of the existing 180,000-plus light GA (General Aviation) airplanes still use steam gauges, virtually every newly designed transportation airplane is a TAA (Technically Advanced Aircraft)” (p. 6). Since 2002 general aviation aircraft manufacturers, producing airplanes powered by small engines and propellers, have offered digital instrumentation in new aircraft (McDermott, 2005). Air tubes and wires are replaced with “black boxes” that transmit digital signals to Cathode Ray Tube displays and now to more advanced Liquid Crystal Displays. Traditional aircraft instrumentation has been the mechanism to accomplish instrument flight since 1953 utilizing a visual instrument scanning
pattern of a standardized “T” (airspeed, attitude, altitude, and heading) (Mumaw, Sarter, Wickens, 2001).

The traditional six situational instruments have been replaced in many general aviation industry aircraft as two LCD screens, the primary flight display and the multifunction display. With these two screens, all information previously displayed on six separate instrument dials is displayed on the screens along with moving map displays, terrain, weather, other aircraft traffic, engine instrumentation, navigation, and many other items. Introduction of digital aircraft instrumentation requires pilots, as adult learners, to modify their cognitive mental processes to safely accomplish flight in instrument conditions.

Historically, in aircraft equipped with steam instrumentation, the pilot learned of the aircraft position (both vertically and laterally) relative to the ground. This determination involved a cognitive mental process of space, time and altitude orientation (McDermott & Smith, 2006). Now, with the glass cockpit presentation, pilots have a moving map and greater visual situational awareness and the cognitive process is thereby decreased because of the comprehensive visual presentation of data. The scanning technique of the glass pilot is where we start to encounter uncharted territory. According to Mumaw, et al. (2001), “There are no documented strategies for effectively monitoring this diverse set of indications, and, as a result, pilots often develop their own – not necessarily effective – approaches to the task.” (p. 2) Technically Advanced Aircraft, equipped with new-generation glass cockpit systems have been deemed by the Federal Aviation Administration as equipped with at least a moving-map display, an Instrument Flight Rules approved global positioning system (GPS) navigator, and/or an autopilot system (AOPA, 2005, p. 4).
Increasing accident rates in Technologically Advanced Aircraft have raised questions about the safe use of digital instrumentation in instrument conditions. An examination and consideration of how adults learn new technology that replaces foundational learning of the past must be made. As a note, the Federal Aviation Administration does not require any re-training to operate this new technology. The burden of learning how to use this new technology is on the “user.”

Assessment of the Type of User

The second consideration for transition training for general aviation pilots into glass cockpits would be an assessment of the type of user. The most basic notion of the pilot’s level of piloting and flight experience is a determining consideration. An inexperienced or hobby pilot will require a different level of training than an extremely experienced or professional pilot. The pilot’s level of flight experience will also influence different depths of content. The depth to which an experienced pilot could be trained might differ from the level that an inexperienced or hobby pilot could comprehend.

Emerging theories raise questions whether or not the generalization could be made that the experienced pilot might have the cognitive skills, judgment, aeronautical decision making skills to better understand the training than the inexperienced pilot whose skill foundation is not yet concrete. Also, a consideration of a pilot’s exposure to glass cockpit aircraft experience would be a factor. Has the pilot ever participated or piloted an aircraft with the digital flight instrumentation, to what extent would they need transition training?

Important considerations which might determine the need for training or type of training might be the pilot’s intended flight application. The more experienced professional pilot or instrument trained pilot would be trained to fly the aircraft with sole reference to the aircraft’s
instrumentation with little or no outside visual cues. A consideration of whether the pilot will need to be trained to a very high level of competency for flying in instrument meteorological conditions (IMC) or rather to a more basic level of training for visual flight conditions (VFR) would need to be made. This is not to say that the level of training should be in any way inferior in the visual conditions, but rather to say that the risk associated with flight operations in conditions where the pilot is unable to maintain operations in visual conditions carries with it a greater risk and requires more extensive training.

The basic or hobby pilot would use visual cues such as looking outside the aircraft and flying with reference to the horizon, not having to rely on the instruments. Boatman (2006) stated “As a VFR-only pilot, you will likely spend more time on maneuver skills and VFR scenarios, with VFR-into-IMC scenarios addressed…” (p. 104) Boatman continues stating that as an Instrument Flight Rules pilot you will likely spend more time on Instrument Flight Rule scenarios and less time on visual maneuvers.

Additionally, although no immediate aviation studies have been completed to address the implications of developing a transition training course for the pilot as an adult learner, it could be said that Malcolm Knowles’ Forced Learning Theory might also be applicable both to refute and support how the pilots will transition to glass cockpit technology. With many aviation organizations transitioning their aircraft fleet to glass cockpit displays, this theory might relate to the formation of a training program that involves the adult learners instead of being a burden upon them, thereby reducing the implication of the forced learning theory.

Yet another aspect of the learner that would need to be evaluated would be that the collegiate aviation population currently enrolled in glass cockpit transition is significantly more technology adept than the typical adult learner in aviation. According to Prensky, (2008) “The
traditional classroom lecture creates massive boredom, especially when compared to the vibrancy of their media-saturated, tech-driven world.” Technology obsessed youth of today grew up using computers and are bored and frustrated with teachers lack of adaptation to ever-changing technologies. Perhaps a different approach to education of collegiate aviators transitioning to glass technology will need to be explored.

*Pilot Knowledge of Glass Systems, Function Levels, and Mode Awareness*

A key component of the transition training for pilots in glass cockpit aircraft would require a pilot to gain knowledge of the glass systems and the various function levels and possess a level of mode awareness. The consideration of how various cockpit components interface with others and how continuity of the glass cockpit system is maintained would be important concepts to include in pilot training. Beyond the knowledge of the aircraft functions, the glass cockpit or digital flight instrumentation would bring with it a whole new vocabulary and necessity for a new working knowledge. Not unlike the introduction of the computer into the world, an understanding of the components of the glass system and how the system works will be necessary for safe operation.

A component of the need for transition training would be educating pilots about the importance of mode awareness. “Mode awareness refers to the knowledge and understanding of the current and future state and behavior of the automation” (Mumaw, et al., 2001). Mode confusion is a digital flight instrumentation hazard. The need for the pilot to gain and maintain an awareness of the current state of flight deck automation and current mode of operation is critical. The complexity of various modes of operation and the many and complex paths taken to achieve the mode of operation are critical to the pilot. Mode confusion might result from disuse of a particular mode or from the complex path used to achieve the mode. Confusion about when
to use certain modes, how to engage them, and why a particular mode would be used are all factors in mode confusion. According to Mumaw, Boorman, Griffin, (2001) the “how” would refer to the knowledge and skills used to execute basic automation tasks, the “when” would refer to strategic knowledge about which automation actions are most appropriate for a given situation, and the “why” would refer to the pilot’s mental model of the Flight Management System that helps him or her make sense of the system performance by revealing the design philosophy and goals for each mode and feature. By identifying these factors, the pilot training of automation and glass cockpit technology can become precise and target specific methods of training for an optimum result.

Human Factors

A fourth key component is the consideration of human factors as it relates to the general aviation pilot transitioning to glass or digital flight instrumentation. What is the cognitive process involved in automation decision making, would age be a factor, would experience level play a role? With the introduction of digital displays, color-coded information, and two-dimensional screen displays, the human factors consideration of the pilot and color blindness, visual scanning, and deciphering ability becomes a factor.

Additionally, moving from the historical use of the round gauge, steam powered instrumentation to the digital presentation radically changes the role of the pilot. A pilot would no longer be a human piloting an aircraft, but rather a human operating a system. The transition to the pilot becoming a systems operator is foreign to pilots. According to AOPA (2005),

Many observers believe that the deeper importance of TAA takeover goes beyond just equipment. The larger definition includes a new mindset for pilots, encompassing a revised view of what constitutes GA (General Aviation) flying, with airline-style
procedures, regular use of autopilot, and greater dependence on avionics for multiple
tasks beyond pure navigation. Although pilots flying classic high-performance aircraft
under IFR often use this approach, its application is essential in TAA. To process large
amounts of information and not allow flight safety to suffer, pilots must add “system
manager” to basic stick and rudder skills. This mental shift has proven to be a challenge
for some conventionally trained pilots. (p. 5)

Also, consideration must be made for the repercussions of transitioning from one glass cockpit
aircraft to another from a different manufacturer. According to Boatman (2006), the switching
around from one system to another caused the pilot to not be trained to a “champion” Instrument
Flight Rules appropriate level. Considering the level of safety and training proficiency required
for flight in instrument meteorological conditions, this would have an adverse effect and would
need to be addressed in the transition training course.

**Type of Training**

A fifth key component is the consideration of the type of training that would provide the
most beneficial outcome. The Federal Aviation Administration began a movement towards
scenario based training for pilots in 2005, citing that this training is more realistic to the
situations pilots would encounter daily. The other type of training would be skills based training,
involving no realistic scenarios, but rather demonstration of a skill set for completion of an
isolated maneuver to certain standards.

The question has been posed whether the scenario training would produce the best result
with the glass cockpit pilot training while ensuring an acceptable level of safety and learning.
Would skills training be more appropriate to the transition? A recent study of students at Middle
Tennessee State University concluded that the Federal Aviation Administration’s scenario based
training (FITS, FAA Industry Training Standards) reduced the amount of time spent in training when compared with skills based training (Glista, 2005, p. 25). Glista reported findings that support FITS training and its ability to help pilots relate to real world scenarios and to have the ability to diagnose problems better. According to Boatman (2006), a negative aspect to the use or adaptation of FITS training over the use of skills-based training is that it is “hard to ‘can’ – while skills-based training can be knocked out like pats of butter” (p. 98). The Federal Aviation Administration continues to research the possibilities and best methods for adapting pilot training to scenario based FITS programs.

**Conclusions**

As a brief summary and overview, the five key considerations addressed in identifying a need for glass cockpit transition training in the aviation industry, and more specifically collegiate aviation are: (a) historical basis of general aviation aircraft instrumentation; (b) assessment of the type of user; (c) pilot knowledge of glass systems, function levels, and mode awareness; (d) human factors; and (e) type of training. Each of the key considerations addresses an aspect of the pilot and the development of a proper glass cockpit transition training course. Though there could be many more, the researcher does not think that there could be any less. In order to achieve a high degree of success for the pilot and ultimately for the transition of complex and new technologies to the general aviation industry, it is paramount for each to be considered.

By conducting a thorough analysis separating each component of the ultimate need for glass cockpit transition training in aviation, the steps towards the development of appropriate curriculum are more obvious and will lead to organized course development. By placing each key component in combination with the others, it can be synthesized that the need for glass cockpit transition training in the general aviation industry is apparent and largely unfilled. The
implications of the development of a proper curriculum could address a multitude of current glass cockpit training issues and resolve that proper and effective training could be delivered to pilots. With a lack of statistical data and study to draw upon currently it becomes critical to add to the knowledge base and research of this subject.

Training pilots to improve their understanding of cockpit automation must be a primary key in the solution. Training to improve pilot mental models and to improve monitoring strategies needs to be developed until cockpit technology interface improvements can be established. The FAA Industry Training Standards team needs to develop modules for specific audiences and for developing information on how to transition a pilot from a conventional cockpit to glass cockpit instrumentation. Development of training to address the need for improvements in the design and training of the Flight Management Systems to help pilots make use of the full range of capabilities provided by flight deck automation would need to be realized. A study of the exact nature of the human factors affect on the pilot’s role and ability to transition to glass cockpit should be conducted and incorporated. It is through this process of attentive and in-depth analysis of the factors affecting pilots during a transition from traditional cockpit instrumentation to a glass cockpit instrumentation that will prove value and industry-wide significance.
CHAPTER 3: METHODOLOGY

Restatement of the Problem

The purpose of this study was to analyze, develop, and validate a training protocol for glass cockpit transition training in the collegiate aviation, due to recent changes in instrumentation from analog to digital.

Research Design

The research design used for this study was a qualitative comparative analysis (QCA). Qualitative comparative analysis was developed by sociologist Charles Ragin in 1987 for use in “extracting Boolean summaries of truth tables, datasets, usually small-n, of cases comprised of combinations of dichotomous variables” (Monroe & Gold, 2004). Ragin more recently developed fuzzy set qualitative comparative analysis, “a system for analysis of continuous indicators of fuzzy set memberships” (Monroe & Gold, 2004). This analytical technique allows for comparison of qualitative data in order to discover integration, or how the different parts of data fit together or relate to each other. “QCA makes it possible to bring the logic and empirical intensity [sic] of qualitative approaches to studies that embrace more than a handful of cases – research situations that normally call for the use of variable-oriented, quantitative methods” (Northwestern University, 2005) This method was well-suited to the comparison of data from Avidyne, Bowling Green State University, Cirrus, and Cessna. Through the use of a matrix, comparison of each company’s training process and tasks was cross referenced with the others, resulting in discovery of integration and how each of the parts related to each other.

Sampling Design & Procedure

This study utilized a sample of the aviation industry’s aircraft manufacturers, a software manufacture, and a collegiate flight training institution. This sample was chosen based on
nonprobability sampling, more specifically purposive sampling methods, since they were best suited to the qualitative research that was utilized (Mertler, 2008). The researcher’s judgment, as a certified senior flight instructor, was used to decide which segments of the aviation industry were pertinent and purposeful to the study.

The data gathered was used to cross reference Avidyne, Bowling Green State University, Cessna, and Cirrus, and against three common criteria, via a matrix design. Once the data was compiled and structured into a matrix for each company or institution, a comparative analysis matrix representing all the institutions and criteria was formed. The final comparative analysis was conducted using this matrix in order to discover the strengths and weaknesses and best practices of each institution for each of the three criteria.

The final procedure involved in this study was to then produce a training protocol recommendation based on the findings. In order to validate the training protocol, a panel of six experts was surveyed. An analysis of the survey findings and the panel recommendations was conducted to complete the process and provide a validated recommendation for transition training in a collegiate aviation flight school.

Data Collection Instrument

The data collected for this study was gathered through internet research, industry representatives, document review, and a survey. A comparison of the data was conducted through the use of various matrixes. A training protocol was developed after the data had been collected, compiled, and analyzed.

A survey was utilized to validate a training protocol through a panel of experts. The panel of experts represented six collegiate flight training institutions. These institutions included Bowling Green State University, Indiana State University, Kent State University, Ohio
University, University of Central Missouri, and Western Michigan University. Five of the six
panel experts selected to validate the survey responded to the survey instrument.

Each panel member was chosen on the basis of his or her professional position in the
collegiate flight institution and for their expertise and knowledge in the operations of digital
cockpit instrumentation. The panel of experts was considered to be qualified based on the
following qualifications:

- Kent State University - Chief pilot for a Federal Aviation Administration Part 141
  Flight School and a FAA Designated Pilot Examiner.
- Ohio University - Chair of the Department of Aviation, a professor, a pilot; with
  experience in the aviation business industry and military.
- Western Michigan University - Assistant Chief Flight Instructor and Program
  Manager, with previous flight experience in charter and airline operations.
- Indiana State University - Chair of the Aviation Technology Department with
  previous pilot experience in military and airline operations.
- Bowling Green State University - Director of the Aviation Studies program and
  an Assistant Chief Flight Instructor for a FAA Part 141 Flight School, with
  previous military pilot experience.

Procedures of Data Analysis

A matrix was used to cross reference Cirrus, Cessna, Avidyne, and Bowling Green State
University with three criteria to determine critical items for transition training to glass cockpits,
as well as provide insight into possible industry training weaknesses and strengths. Each matrix
represented data organized in relationship to three criteria: (a) course structure, (b) training
requirements and training course outline, and (c) evaluation. Once a comparison of each
company to these three criteria had been compiled, a comparative matrix was assembled representing Cirrus, Cessna, Avidyne, and Bowling Green State University versus the three criteria. This comparative analysis matrix revealed the common training components, as well as differences. From this matrix the researcher was able to provide the basis for a training protocol recommendation.

Protection of Human Subjects

It was determined that Human Subjects Review Board approval was not necessary for this study.

Timeline

The timeline (Appendix A) was as follows:

July 2008

- Approval of Thesis topic by committee
- Contact Avidyne, Cessna, Cirrus, and Bowling Green State University and obtain training materials
- Continue additional research for current literature

August and September 2008

- Compare and Contrast glass training methods and practices to discover best practices and weaknesses via matrix comparison
- Develop a recommendation for a glass transition training course
- Develop and disseminate a survey instrument to validate training protocol

October 2008

- Thesis defense
- Submit copy of thesis to Technology Graduate Office

November 2008
- Submit electronic copy of thesis to Graduate College and Ohio Link

December 2008

- Expected Graduation with Master of Education

Proposed Budget

The researcher did not incur any expenses in this study.
CHAPTER 4: FINDINGS

Introduction

The purpose of this study was to analyze, develop, and validate a training protocol for glass cockpit transition training in collegiate aviation. The researcher reports the data analysis of each individual matrix representing Avidyne, Bowling Green State University, Cessna, and Cirrus, as well as the data analysis of an overall comparative matrix in this chapter. Additionally, results of the survey instrument used for protocol validation have been analyzed and reported within this chapter.

Matrix Data Analysis

For each institution or company, a matrix was used to provide a method for data compilation and analysis. Each matrix was further divided and organized in reference to three criteria: (a) Course Structure, (b) Training Requirements/Training Course Outline, and (c) Evaluation. The results of the matrix data analysis have been narrated according to their institution and criteria.

Avidyne Corporation

A course structure was not provided by Avidyne Corporation (Appendix B). Avidyne was described as “…the market-leading developer of Integrated Flight Deck Systems for light general aviation (GA) aircraft. Avidyne’s Entegra line revolutionized flying in 2003 as the first Integrated Flight Deck for light GA” (Avidyne Corporation, 2008). Avidyne did however have a technical support center and web-links for addition assistance with their industry partners, such as Piper and Cirrus.

Training requirements/training course outline, were again, not provided due to the nature of Avidyne Corporation as an integrated flight deck system developer. Avidyne however had an
“Entegra Freeplay Simulator” in a downloadable format for the customer to train in an interactive fashion. They also had software demonstrations of their instrument approach functions, weather broadcast, datalink, and Global Positioning System (GPS) simulations. “This interactive training software is designed to emulate the FlightMax EX500 and EX5000 Multi-Function Display in either 4-knob (radar-capable) or 2-knob (non-radar) modes on your PC. The software includes CMax™ Electronic Charts and a demonstration version of both XM broadcast and 2-way Datalink weather” (Avidyne 2008).

Evaluation was not applicable to Avidyne Corporation since there were no training objectives, outlines, or instructional designs to consider.

Bowling Green State University

Bowling Green State University (Appendix C) is a Federal Aviation Administration certified Collegiate Flight School under the Federal Aviation Regulations for both Part 61 and 141. This four-year state university offered a digital cockpit transition training course as a requirement towards the completion of a Bachelor of Science degree; typically offered at the junior level of flight training.

The course structure was approximately a four to six day course; requiring flight students to have accomplished training in a complex aircraft, though not necessarily complex endorsed, prior to beginning transition training. Pre-training for both ground and flight included an assessment to ensure that the student was not only instrument current, but more importantly instrument competent before beginning the digital cockpit transition. Students were trained towards both a VFR and IFR level of competency, as well as abnormal and emergency procedures. Upon completion of the training course, an endorsement was made by the certified flight instructor.
Training requirements/training course outlines were structured as a nine hour minimum ground training course and a six lesson, nine hour minimum, flight training course. The ground training included switchology, familiarization with digital instrumentation position, function, programming, mode awareness, level of automation, review of aircraft systems, GPS programming practice, Avidyne familiarization lesson, differences training, and review of the Avidyne pilot manual for the PFD, MFD, and S Tech 55 autopilot system. (Bowling Green State University, 2006) The flight training was comprised of six lessons, the first of which was a two hour (minimum) simulation unit in a Personal Computer Aircraft Training Device (PCATD) to ensure the student was both instrument competent and autopilot competent prior to flight training in the transition course.

The first flight unit included an emphasis on introducing the digital cockpit instrumentation while conducting skills-based commercial pilot maneuvers in a VFR setting, as well as effective use of a lack of automation thru full automation of the flight director and autopilot, and aircraft system and digital malfunction emergency procedures training. The transition training units focused on hand-flown instrument approaches and procedures in unit three, flight director assisted instrument approach approaches and procedures in unit four, and autopilot coupled instrument approaches and procedures in unit five. In unit six, the course was completed through the use of a cross-country flight with destinations at two airports other than the home base of operations; in which the student demonstrated proficient use of hand-flown, flight director assisted, and autopilot coupled instrument approaches and procedures.

Evaluation was conducted by certified flight instructors during and at the completion of each unit. The instructor assessed the student’s performance level against FAA Practical Test Standards for Commercial Pilot. Additionally, each unit provided guidance as to the completion
standard for that particular lesson’s focus, such as in study unit for where “the student is able to use digital instrumentation to execute Flight Director accompanied approaches” (Bowling Green State University, 2006). In the final study unit, an evaluation of the student’s performance was measured against completion requirements in order to verify that the student has the ability to safely and efficiently operate Bowling Green State University’s Glass aircraft as Pilot in Command, in IMC with abnormal or emergency situations. (Bowling Green State University, 2006)

_Cessna Aircraft Company_

Cessna Aircraft Company (Appendix D) is an aircraft manufacturer with a Pilot Training Department. They developed a G1000 Transition Course designed for pilots who purchase a new Cessna G1000 equipped CE-172, CE-182, or CE-206 aircraft. Cessna made the transition training available to other customers for a price of $1470.00 per person for a pilot accompanying the new aircraft owner, or $2100.00 without the purchase of a new Cessna aircraft.

Course structure of the FITS approved, G1000 Training is a three day course inclusive of eight hours of ground training and four to six hours of flight training dependent upon the customer’s proficiency level. No prerequisite training assignments for the customer prior to beginning the transition training course was required. Cessna structured the G1000 Transition Training Course to provide training on a Technically Advanced Aircraft (TAA), not to provide training towards any other certifications or endorsements such as high performance, instrument proficiency check, or biennial flight reviews; these would require additional training time. Cessna’s Federal Aviation Administration Industry Training Standards approved program was “designed to accommodate pilots with varied levels of experience …and the training approach differed significantly from conventional training methods” (Cessna Aircraft Company, 2008).
Training requirements/training course outlines were structured to transition pilots from traditional panel to TAA, but because of time constraints it was not designed to make the customer an expert. The course included two ground training modules (Appendix E). Each module was a four hour lesson to include discussion of all components of the G1000 digital instrumentation system, an overview and advanced study of all flight display indications for all modes of operation, phases of flight, and levels of automation; as well as aircraft systems and system malfunctions. Cessna employed the use of interactive simulation using desktop simulators in order to familiarize their customer with the G1000 digital instrumentation system and table top trainers in an interactive lab portion to engage the customer in hands-on training.

Three scenario-based flight training modules, three hours each, were designed to transition the customer utilizing the G1000 instrumentation system, with an emphasis on the use of autopilot and instrument approaches (Appendix F). The basis of the three flight scenarios was a VFR lesson, IFR lesson, and emergency situations lesson while operating the G1000 digital instrumentation system. All three flights were scenario-based lessons, with flights to unfamiliar airports. Upon successful completion of the course, Cessna awarded a FITS certificate and pilot logbook endorsement.

Evaluation was conducted by Cessna certified flight and ground instructors. The purpose of the scenario based training Cessna utilized was to transform the thought processes, habits, and behaviors of the customer during the planning and execution of each scenario, to better represent real world situations while piloting a TAA. The customer was required to meet proficiency levels for both Maneuvers Grades or tasks and Single Pilot Resource Management Grades. Within the Maneuver Grade or task, the pilot was evaluated on three parameters (a) Explain, (b) Practice, and (c) Perform. Within the Single Pilot Resource Management (SRM) Grades the
pilot was evaluated on three parameters (a) Explain, (b) Practice, and (c) Manage/Decide.

Course completion standards were measured on a scale of desired outcomes for both Maneuver Grades and Single Pilot Resource Management Grades (Appendix D).

_Cirrus Design_

Cirrus (Appendix G) is an aircraft manufacturer with a pilot training department. They provide training programs for all Cirrus model aircraft and provided materials for transition of a current and proficient pilot in visual or instrument meteorological conditions.

Course structure for the transition training was designed to be completed in either three days for a VFR certification proficiency level or five days for the IFR proficiency certification level. Additional training for the purpose of a Biennial Flight Review made the course a ½ day longer in either case. Cirrus suggested that at the completion of the transition training course pilots follow a recurrent training schedule outlined in the Cirrus Pilot Learning Plan (Cirrus, 2008). Both the VFR and IFR transition courses were FITS accepted courses and utilize scenario-based training. Pre-training study and reference materials were provided. These included various publications and the Cirrus Aircraft Training Software (CATS), an interactive systems trainer.

Training requirements/training course outlines developed by Cirrus detailed a seven lesson transition syllabus for VFR certification with a minimum of 10 hours of flight training; of which a maximum of three hours were approved in a flight training device. They also required a minimum of 20 landings in the TAA. The VFR ground training syllabus outlined a minimum of eight hours of training. Cirrus designed the first lesson of the VFR syllabus to provide an introduction to scenario-based training and Cirrus transition training, a review of pre-training materials and a session in a cockpit procedures trainer. Each additional lesson provided an
increase in the pilot’s abilities, from VFR maneuvers, takeoffs and landings to cross country operations with normal and abnormal flight situations. Emphasis was placed on single pilot operations, risk management and good aeronautical decision making.

Cirrus designed the IFR transition training syllabus with 10 lessons. This required a minimum of 15 hours of flight training; of which nine hours had to be in the airplane, with a maximum of six hours in an approved flight training device. Additionally, Cirrus required a minimum of 20 landings. The IFR ground training syllabus outlined a minimum of eight hours of training.

The first lesson was designed to provide an introduction to scenario-based training and Cirrus transition training, as well as IFR topics and a session in a cockpit procedure trainer or computer-based avionics trainer. Each additional lesson provided an increase in the pilot’s abilities, from VFR maneuvers, takeoffs and landings to cross country operations with normal and abnormal flight situations. Cirrus then introduced IFR operations and procedures from a basic level to an advanced level, while accomplishing flight in various states of automation. The training required the pilot to conduct cross country operations, instrument approaches and procedures, in both normal and simulated emergency situations. The ninth lesson was an opportunity for the pilot to apply their knowledge while the conducted an IFR scenario and was intended to serve as a review for the final flight lesson. The final lesson included all tasks required by the FAA Instrument Practical Test Standards for the completion of an Instrument Proficiency Check and an emphasis was placed on single pilot operations, risk management and good aeronautical decision making (Appendix G).

Evaluation “The Cirrus Standardized Instructor Program (CSIP) was designed to provide a certified flight instructor (or international equivalent) the necessary tools and skills to teach in a
technically advanced aircraft” (Cirrus, 2008). The flight instructor was responsible for evaluating pilot performance of maneuvers and procedures according to the FAA’s standards and in accordance with FITS. The purpose of the scenario based training Cirrus was utilizing was to transform the thought processes, habits, and behaviors of the customer during the planning and execution of each scenario, to better represent real world situations while piloting a TAA.

The evaluation was “with Learning Centered Grading Evaluation Principles” (Cirrus, 2008). The desired-outcomes of Maneuver Grades or tasks and Single Pilot Resource Management Grades were utilized to evaluate the pilot. The customer was required to meet proficiency levels for both Maneuvers Grades or tasks and Single Pilot Resource Management Grades. Within the Maneuver Grade or task, the pilot was evaluated on three parameters (a) Explain, (b) Practice, and (c) Perform. Within the Single Pilot Resource Management (SRM) Grades the pilot was evaluated on three parameters (a) Explain, (b) Practice, and (c) Manage/Decide. Course completion standards were measured on a scale of desired outcomes for both Maneuver Grades and Single Pilot Resource Management Grades (Appendix G).

**Comparative Data Matrix**

The data analysis of the comparative matrix (Appendix H) provided a comprehensive view of Avidyne, Bowling Green State University, Cessna, and Cirrus as they related to the three common criteria of (a) course structure, (b) training requirements/training course outline, and (c) evaluation. Though there were differences that emerged, there were also similarities that were revealed through the comparison. The one exception to the comparison was that Avidyne, the integrated flight deck system designer, did not have a transition training course to compare to the other three intuitions, and therefore was not applicable for the majority of the comparative process; except where noted.
Course structure revealed that each program provided for both a VFR and IFR level of certification with both ground and flight training lessons. The shortest amount of training required was three days, with the longest at six days, though these amounts were generally predicated on whether the course was to a VFR or IFR level of certification. Definite similarities were revealed in the intention of the training, in that it was not intended to train for other purposes such as high performance aircraft training or biennial flight review, but rather to focus on the transition of the cockpit instrumentation from analog to digital. Optional training was addressed for the purposes of any further pilot training and endorsement by both Cessna and Cirrus.

The audience of Bowling Green State University was a junior level collegiate flight training student, whereas both Cessna and Cirrus were predominantly an adult purchasing a new aircraft or upgrade for general aviation use; though they did train a younger pilot audience as well. While all three institutions were conducting training towards the transition to TAA, Bowling Green State University required the training to be conducted in a complex aircraft. The use of scenario based and skills based training was conducted in all three institutions; however, where both Cessna and Cirrus were FITS accepted transition training programs, Bowling Green State University was not. All four companies provided and recommended supportive reference materials for use during transition training and the use of simulation devices to help the pilot learn the new digital presentation.

Training requirements/training course outlines were structured similarly, again with the exception of Avidyne. All three institutions had a minimum of eight to nine hours of ground training. The ground training contained, for the most part, very similar material, though they each structured the lessons differently. The use of a simulation device to pre-train the pilot prior
to flight training was also a common idea to integrate even in the Avidyne framework. In all three transition training courses, the building block concept of learning was used to ensure VFR maneuver competency prior to advancing to hand-flown IFR operations and thru to the level of Flight Director and autopilot assisted instrument approach procedures and operations, while conducting cross country operations with simulated system malfunctions and emergency procedures. (FAA, 1999)

Evaluation was similar for Bowling Green State University, Cessna, and Cirrus only in that the certified flight instructor was the individual responsible for assessing the pilot’s ability to meet both FAA standards and the appropriate Transition Training Course desired outcomes. Both Cessna and Cirrus had designed their training with FAA Industry Training Standards accepted methods of teaching and evaluating. While Bowling Green State University used a blended approach to teaching and evaluating with both scenario-based and skill-set based techniques, their transition training was not FITS accepted.

For Cessna and Cirrus, the use of desired-outcomes for Maneuver Grades or tasks and Single Pilot Resource Management Grades were the means to evaluate the pilot. The customer was required to meet proficiency levels for both Maneuvers Grades or tasks and Single Pilot Resource Management Grades. Within the Maneuver Grade or task, the pilot was evaluated on three parameters (a) Explain, (b) Practice, and (c) Perform. Within the Single Pilot Resource Management (SRM) Grades the pilot was evaluated on three parameters (a) Explain, (b) Practice, and (c) Manage/Decide. Course completion standards were measured on a scale of desired outcomes for both Maneuver Grades and Single Pilot Resource Management Grades.

All three institutions stated that the pilot would receive a logbook endorsement at the successful completion of transition training. Additionally, all three institutions required the pilot
to demonstrate good judgment, aeronautical decision making, and single pilot resource management to fly safely and efficiently with the TAA.

**Comparative Data Matrix Recommendations**

The recommendations matrix (Appendix I) resulted from the best practices that were revealed through the comparative data matrix for Avidyne, Bowling Green State University, Cessna, and Cirrus. The researcher highlighted the training strengths represented by each institution in order to develop a digital cockpit instrumentation transition training protocol for use in collegiate flight training.

**Survey Results**

A survey was utilized to validate the training protocol through a panel of experts. The panel of experts represented six collegiate flight training institutions. These institutions included Bowling Green State University, Indiana State University, Kent State University, Ohio University, University of Central Missouri, and Western Michigan University. Of the six panel experts selected to validate the survey, only one expert did not respond to the survey instrument, providing the researcher with an 83% return rate for the transition protocol validation.

The results of the survey provided a two-fold analysis of the digital cockpit instrumentation transition training protocol. In the first eight questions of the survey instrument, a Likert-scale was used to determine if the expert panel members agreed or disagreed, and to what degree, with the researcher’s statement. The panel rated their responses based on six choices; (a) Not Applicable, (b) Strongly Disagree, (c) Disagree, (d) Neither Agree or Disagree, (e) Agree, or (f) Strongly Agree. The following figure represented a comprehensive view of the panel of experts’ response to the survey statements.
Figure 3. Digital Cockpit Instrumentation Transition Protocol Survey Results from Panel of Experts.

The majority of the panel of experts felt that the training protocol was complete and structured logically for a collegiate level flight program, though a few panel members questioned whether the protocol was rigorous or deep enough. When asked if the protocol contained an adequate amount of ground and flight training to qualify a pilot for both VFR and IFR flight, the panel agreed. The one exception was in the area of the protocol having an adequate amount of ground training for IFR pilot qualification, where one panel member disagreed.

The following data represents the response of the five experts to the survey questions.
Figure 4. Survey Question 1.

**Question 1: The training protocol is complete for a collegiate level flight program.**

<table>
<thead>
<tr>
<th>Expert Response</th>
<th>20%</th>
<th>20%</th>
<th>60%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Disagree</td>
<td></td>
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</tr>
</tbody>
</table>

n=5

Figure 5. Survey Question 2.

**Question 2: The training protocol is rigorous.**

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<th>Expert Response</th>
<th>20%</th>
<th>20%</th>
<th>40%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Agree</td>
<td></td>
<td></td>
<td></td>
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<td>Neither</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Agree/Disagree</td>
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<tr>
<td>Disagree</td>
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</tbody>
</table>

n=5

Figure 6. Survey Question 3.

**Question 3: The training protocol is sufficiently deep for a collegiate level flight program.**

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<thead>
<tr>
<th>Expert Response</th>
<th>20%</th>
<th>60%</th>
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<tbody>
<tr>
<td>Agree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neither</td>
<td></td>
<td></td>
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<tr>
<td>Agree/Disagree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Disagree</td>
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</table>

n=5
Figure 7. Survey Question 4.

**Question 4:** The training protocol is structured logically for a collegiate level flight program.

<table>
<thead>
<tr>
<th>Expert Response</th>
<th>20%</th>
<th>60%</th>
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</thead>
<tbody>
<tr>
<td>n=5</td>
<td></td>
<td></td>
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</tbody>
</table>

- Strongly Agree
- Agree
- Neither
- Agree/Disagree

Figure 8. Survey Question 5.

**Question 5:** The training protocol has an adequate amount of ground training for VFR pilot qualification.

<table>
<thead>
<tr>
<th>Expert Response</th>
<th>20%</th>
<th>80%</th>
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</thead>
<tbody>
<tr>
<td>n=5</td>
<td></td>
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</table>

- Strongly Agree
- Agree

Figure 9. Survey Question 6.

**Question 6:** The training protocol has an adequate amount of ground training for IFR pilot qualification.

<table>
<thead>
<tr>
<th>Expert Response</th>
<th>20%</th>
<th>80%</th>
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<tbody>
<tr>
<td>n=5</td>
<td></td>
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</table>

- Agree
- Disagree
In the last two questions, questions 9 and 10, of the survey instrument, the researcher was able to gather additional subjective data regarding the recommended protocol. These suggestions and comments will provide a basis for protocol improvement in the next chapter.

In response to question nine, when asked what the experts would change, add, or suggest improving or modifying the training protocol, two out of five had no response. The remaining three panel members made the following recommendations:

- “As a point of comparison, I would suggest looking at the transition syllabus that Cirrus design uses for their customers. It is a well organized syllabus and has proven itself over the course of several years. Additionally, it fully embraces the concept of scenario based training.”
• “The course of training might be a bit long on flight time. Our experience is that students tend to pick up the operation of the systems quickly; however it can be negative when I administer and FAA flight check due to the increased amount of information available to the applicant. Therein my [sic] lie the strength of this program in that it would allow time for students to get a more indepth [sic] understanding of the system and how to use it to their advantage during flight checks. It would be interesting to conduct research with this model and a group without any set procedure for training.”

• “I believe the training course needs more ground training. The more training on ground the easier the flight training would become. The VFR training seems to be sufficient, but in the IFR world its [sic] an all together different ballgame. I believe this is where the addition of training should take place.”

Overall, the panel validated that the training protocol was appropriate. The few exceptions were the concern for the sufficient training for IFR pilot qualification levels through ground training and course depth. This was consistent with the comments of three of the panel members in their response to question nine of the survey instrument.

Figure 12. Digital Cockpit Instrumentation Transition Protocol Recommendations.

The researcher has developed the following recommendations, based on a comparative data analysis of the aviation industry, aircraft manufacturers, software manufacturers, and collegiate flight training with regards to digital aircraft training practices.

Course Structure:

• Four to six day transition training course, dependent upon student progress and pre-training.
• Training in both visual and instrument flight rules, with an emphasis placed on achieving a high degree of instrument competency.

• The training demographic will be collegiate aviation students.

• Basic aircraft pre-training required prior to starting transition training. Instrument competency must be exhibited in a Flight Training Device (FTD) prior to proceeding to flight lessons in the aircraft.

• Technologically Advanced Aircraft (TAA) required.

• Ground Training and Flight Training required.

• The primary purpose of the training will be to transition the pilot from analog to digital cockpit instrumentation, rather than to give training towards a high performance aircraft endorsement, high altitude endorsement, complex aircraft endorsement, flight review, or instrument proficiency check endorsement. Training specifically intended for these purposes will not be a part of the transition course unless additional training has been arranged.

• The training will be comprised of a blend of skills-set and scenario-based training.

• Throughout this training an emphasis will be placed on developing judgment, aeronautical decision making, risk management and single pilot resource management throughout the use of skills-set and scenario based training in order to alter established paradigms of aircraft flight operations such as habits and behaviors of the pilot during the planning and execution of aircraft operations in instrument meteorological conditions.

• The appropriate study of training materials is required prior to starting the transition training regimen.
• Additional training materials will be provided to address checklist usage, digital cockpit instrumentation (for example G1000 or Avidyne Entegra) operating procedures, and use of digital instrumentation for instrument approaches.

• The availability of periodic training to refresh the concepts and effective use of the digital cockpit is highly recommended in order to maintain student TAA competency to an instrument metrological level once the transition course has been completed.

Training Requirements:

• Nine hours minimum ground training, three hours required briefing (pre post flight).

• Time under Ground/ Pre Post Time is and approximate and may vary based on experience and scenario.

• Ground Training Topics should include a minimum of the following items:

  o Pilot introduction to scenario-based training and the collegiate transition training course, including a review of pre-training materials, aircraft model-specific topics, and a session in a cockpit procedures trainer.

  o “Switchology”, familiarization with digital instrumentation position, function, programming, mode awareness, level of automation, review of aircraft systems, digital instrumentation function, GPS programming practice, Avidyne/G1000 briefing lesson, aircraft analog vs. digital differences training lesson, PFD and MFD overview and advanced training, and autopilot training manual review.

Training Course Outline:

• Nine hours minimum flight training (seven hours in airplane, maximum of two hours in an approved FTD/PCATD may be used towards the nine hour minimum course flight time requirement).
Flight Training will be comprised of the following concepts: Basic VFR operations, instrument approaches, abnormal and emergency approaches.

Lesson One:

- Dual simulation time in a Flight Training Device (FTD) or Personal Computer Aircraft Training Device (PCATD).
- Two hours minimum (could be more depending of level of instrument and autopilot competency demonstrated by pilot). Required completion prior to proceeding to study unit two.
- Content to include IFR clearance and read back, IFR departure procedures, two non-precision approaches and one precision approach hand flown, followed by two non-precision approaches and one precision approach flown utilizing autopilot functions to MDA/DH, exhibiting effective use of autopilot operations.
- Pre/Post Briefing utilized (by the flight instructor) to brief the student in FTD/PCATD operations and autopilot use. The instructor will ensure that the student is proficient in instrument flight.
- The lesson objective is to review and increase instrument proficiency as well as introduce autopilot operations.
- Completion requirements – the student is able to navigate safely through the national airspace system and is both instrument current and competent prior to advancing in flight training to a TAA.

Lesson Two:

- Two hour dual flight training, one hour ground training.
- Ground instruction will include cockpit familiarization.
o Dual flight time in a TAA with an instructor. Content will include cockpit familiarization, commercial flight maneuvers (private if applicable to pilot’s certification level), emergency procedures, introduction to autopilot/flight director use. The flight will consist of commercial pilot maneuvers (or private pilot if applicable), takeoffs and landings in various configurations and situations in VFR conditions.

o Pre/Post Briefing (by the flight instructor) to brief the student on digital aircraft instrumentation operations and autopilot use in visual flight rule conditions and to ensure that the student is proficient in the basic use of the digital aircraft instrumentation for visual commercial pilot maneuvers (or private pilot if applicable).

o The lesson objective is to introduce the student to the safe and efficient use of digital aircraft instrumentation in visual flight conditions.

o Completion requirements – the student is able to use the basic functions of digital aircraft instrumentation to include pages, functions, and buttons. This unit will utilize a blended approach to flight training with a mix of both skills and scenario based training.

- Lesson Three:
  
o One hour minimum dual flight training.

  o Dual flight time in a complex TAA with an instructor, the flight will consist of hand flown approaches.

  o Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (hand flown), and effective autopilot/flight director use.
Pre Briefing (by the flight instructor) to brief the student on digital aircraft instrumentation operations and autopilot use with an emphasis on hand flown approaches. Post Brief to ensure that the student is proficient in the basic use of the digital aircraft instrumentation and hand flown instrument approaches.

The lesson objective is to continue to transition the student to efficient use of digital aircraft instrumentation while hand flying the aircraft.

Completion requirements – the student is able to use the digital aircraft instrumentation to execute hand flown instrument approaches.

Lesson Four:

One hour minimum dual flight training.

Dual flight time in a complex TAA with an instructor. The flight will consist of approaches utilizing the Flight Director.

Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (Flight Director), effective autopilot/flight director use.

Pre/Post Briefing (by the flight instructor) to brief the student on digital instrument operations and Flight Director use with emphasis on approaches, and to ensure that the student is proficient in the basic use of the digital instrumentation and Flight Director assisted approaches.

The objective of the lesson is to continue to transition the student to the efficient use of digital aircraft instrumentation, in particular the use of the Flight Director, during various phases of flight.

Completion requirements – the student is able to use the digital instrumentation to execute Flight Director accompanied approaches.
Lesson Five:

- One hour minimum dual flight training.
- Dual flight time in a TAA with an instructor. The flight will consist of approaches utilizing a coupled autopilot system.
- Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (coupled autopilot), and effective autopilot/flight director use.
- Pre/Post Briefing (by the flight instructor) will be to brief the student on digital instrument operations and autopilot use with emphasis on autopilot coupled approaches and to ensure that the student is proficient in the basic use of the digital instrumentation and coupled instrument approaches.
- The lesson objective is to continue to transition the student to efficient use of digital aircraft instrumentation, with an emphasis on full automation and autopilot coupled instrument approaches.
- Completion requirements – the student is able to use the digital instrumentation to execute coupled approaches.

Lesson 6:

- Two hour minimum dual flight training.
- Dual IFR cross-country flight time in a TAA with an instructor. The flight will be a review of all approach types covered in the transition training course. These approaches will include coupled, flight director, and hand-flown instrument approaches.
Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (at two airports other than the airport of base flight training operations), and effective autopilot/flight director use in both normal and simulated abnormal/emergency operating situations.

- **Pre Briefing** – Instructors will pose questions to the student to determine if they have a good understanding of how to use the instrument panel and knowledge of the appropriate ground training materials. Instructors will review the student’s IFR cross-country planning and filing to determine if it is suitable for the route.

- **Post Briefing** – The flight instructor will ensure that the student is proficient in the use of the digital instrumentation and all of the resources that the TAA provides for executing instrument approaches. These resources include use of the flight director, autopilot and all supplementary information gathered from the GPS, Primary Flight Display and Multi-Function Display. Following the flight, the instructor will give an overview of the student’s performance.

- The lesson objective is to evaluate if the student is able to efficiently utilize the digital aircraft instrumentation in any phase of flight while demonstrating a high degree of IFR competency.

- Completion requirements – Appropriate performance is the ability to utilize the digital instrumentation to accomplish instrument approaches using all resources provided by a TAA or digital cockpit instrumentation airplane. Students should be able to fly using instrument flight rules in the airplane without any assistance at this point in order to receive a logbook endorsement indicating that the pilot is qualified to operate in the collegiate flight program’s TAA as pilot in command.
Evaluation:

- Purpose of the skills-set and scenario-based training is to change the thought processes, habits, and behaviors of the pilot during the planning and execution of aircraft operations in instrument metrological conditions.
- Within each lesson the instructor and pilot will reference the skills-set checklist or scenario-based training, as applicable, and the appropriate assessment items to determine whether each skill-set or scenario is complete to the minimum desired outcome needed to meet the lesson completion standards.
- The pilot shall perform the maneuvers and procedures at the standard defined in the FAA Practical Test Standards for the pilot certificate held.
- Appropriate recognition of completion will be awarded at the satisfactory completion of transition training when the student has met the required desired outcomes for all required tasks while demonstrating appropriate judgment, aeronautical decision making abilities, single-pilot resource management and risk management skills to safely and effectively operate a TAA.

Summary

The purpose of this study was to analyze, develop, and validate a training protocol for glass cockpit transition training in collegiate aviation, due to recent changes in aircraft cockpit instrumentation from analog to digital presentation. This chapter contained the digital instrumentation transition training data analysis of Avidyne, Bowling Green State University, Cessna, and Cirrus. Through the use of comparative analysis and survey validation, a protocol was developed and confirmed as an effective method for training pilots to transition from analog to digital presentations in the cockpit for collegiate aviation students.
CHAPTER 5: DISCUSSIONS AND CONCLUSIONS

Discussion and Recommendations for Future Study

The researcher provides a summary of this study and draws conclusions based on the data collected in this chapter. Through the collected and analyzed data, it was reasonable to surmise that the industry has developed some effective models of digital cockpit instrumentation transition training. It was also reasonable to conclude that the industry could provide parallels in effective training practices to those needed for collegiate aviators. Only after the innumerable amounts of data pertaining to digital training methods and sequences were analyzed, was it more evident where the industry exhibited strength in training practices and where collegiate aviation could benefit.

Two of the study objectives; to determine an effective teaching method for glass technology training and to develop a training protocol for collegiate aviation pilots transitioning from analog to digital cockpit instrumentation, were met through the use of comparative data analysis and survey validation. The expert panel provided reassurance of the protocol recommendations set forth by the researcher. As displayed in figure 13, the majority of the panel members of the survey questions were generally in agreement with the Protocol recommendations.

The analysis of data confirmed many of the researcher’s thoughts regarding the best practices associated with a transition training course design. The practice of assigning pre-training materials, combining simulation and ground training prior to the flight portion of transition training, and conducting all training to an IFR qualification level were among common best practices of the transition training courses in industry; and were integrated into the researcher’s protocol recommendations.
The use of a blended approach towards instruction, utilizing both scenario-based and skills-set training methods, was one difference the researcher discovered throughout data analysis. The majority of the industry transition training courses utilized a scenario-based approach only, without training using a skills-set approach typical to how the student would be evaluated on an FAA pilot certification checkride. Though the use of scenario-based training is excellent because the pilot is training in a practical situation, they do not address individual skills required by the FAA’s practical test standards. Based on this difference, and understanding the importance of both training styles, the researcher made a recommendation for a blended style composed of both scenario-based and skills-set methods.

*Figure 13. Expert Panel Validation of Digital Cockpit Instrumentation Training Protocol.*
In order to truly determine if the training protocol was effective in collegiate flight training, further research would need to be conducted. A study of specific age demographics, student technology levels, gender, or prior exposure might be areas where the protocol should explore in determining an effective training method.

Since the data analysis was conducted utilizing data from Avidyne, it would be worthwhile to conduct further analysis to include Garmin as a digital software designer and manufacturer to better understand the differences among the digital instrumentation presentation, and possibly even more significant would be the study of how pilots transition from one digital instrumentation system to another, such as training on Avidyne and transitioning to Garmin. Furthermore, future comparisons of other collegiate flight training institutions would be interesting, as they might reveal strengths and weaknesses when compared with other collegiate flight training schools. Would the protocol look the same or would there be significant differences with the comparative data not being drawn from the general aviation industry?

The third objective of this study was to make a determination of how human factors affected the training required to successfully transition a collegiate aviation pilot to glass cockpit technology. The study allowed an analysis of how general aviation adult learners were transitioning to digital instrumentation. A human factors determination of the collegiate aviation flight student was analyzed and used as a basis of protocol development through a consideration of the multimedia savvy, technologically comfortable type of user the students of today. The simulation and computer experience the collegiate students have grown up with, have made the transition smoother than that of the general aviation adult learner; though it would be important to conduct future research on this factor.
What is the cognitive process involved in automation decision making, would age be a factor, would experience level play a role? Technological advancement is bringing color-coded weather data, synthetic terrain, and airspace with the use of digital displays; the human factors consideration of the pilot and color blindness, visual scanning, and deciphering ability becomes a significant factor. How might pilot color blindness and the use digital data display alter the protocol recommendations or form a basis for future study; especially considering that the majority of pilots are male and that colorblindness is more prevalent for males.

In conclusion I would like to thank all the industry contacts who provided assistance in obtaining and gathering the data that made this thesis possible. The analysis of data, from both the aviation industry and from a collegiate flight school, has provided the basis for a digital cockpit instrumentation training protocol that will hopefully bridge the gap for collegiate aviation training.
References


cockpit.


## APPENDIX A. THESIS FLOWCHART

| Thesis Flowchart | JULY 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
|------------------|--------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1. Make points of contact with |        |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| a. Cirrus         | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| b. Cessna         |        |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| c. Avidyne        |        |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| d. Bowling Green State University | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 2. Obtain Training Manuals for |        |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| a. Cirrus         | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| b. Cessna         |        |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| c. Avidyne        |        |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| d. Bowling Green State University | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 3. Research additional |        |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Lit Review material |        |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 4. Edit Lit Review |        |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 5. Define Statement of the Problem | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 6. Methodology - panel of experts | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 7. Compare and Contrast via Matrix | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| a. decide on 3 criteria | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| b. training manuals | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| c. best practices/industry weakness | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 8. Develop protocol of what transition training might look like | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| a. best practices/industry weakness | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| b. collegiate aviators | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| c. human factors of demo. as learners | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 9. Have training reviewed by panel of experts for validation | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| a. Ohio University | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| b. Bowling Green State University | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| c. Kent State | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| d. University of Central Missouri | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| e. Indiana State University | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| f. Western Michigan University | ☑️      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 10. Make adjustments according |        |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

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*Note: The flowchart above outlines the steps involved in completing a thesis, with dates corresponding to July 1 to July 31.*
### Thesis Flowchart

1. Make points of contact with
   - Citrus
   - Cessna
   - Avidyne
   - Bowling Green State University

2. Obtain Training Manuals for
   - Citrus
   - Cessna
   - Avidyne
   - Bowling Green State University

3. Research additional Lit Review material

4. Edit Lit Review

5. Define Statement of the Problem

6. Methodology - panel of experts

7. Compare and Contrast via Matrix
   - decide on 3 criteria
   - training manuals
   - best practices/industry weakness

8. Develop my own transition training
   - best practices/industry weakness
   - collegiate aviators
   - human factors of demo as learners

9. Have training reviewed by panel of experts for validation
   - Ohio University
   - Bowling Green State University
   - Kent State
   - University of Central Missouri
   - Indiana State University
   - Western Michigan University

10. Make adjustments according
## APPENDIX B. AVIDYNE MATRIX

<table>
<thead>
<tr>
<th>Course Structure</th>
<th>Training Requirements and Training Course Outline</th>
<th>Evaluation</th>
</tr>
</thead>
</table>
| Avidyne Corporation:  
  - Market-leading developer of Integrated Flight Deck Systems for light general aviation aircraft  
  - 4 locations in United States | Entegra and Envision Freeplay Simulators:  
  - Downloadable from Avidyne website  
  - Windows XP operating system required, further system requirements listed on Avidyne website | Not applicable, no training outcomes established by software manufacturer |
| Entegra line revolutionized flying in 2003 as the first Integrated Flight Deck for light general aviation. | Links to Aerosim Technologies  
  - PC based flight simulation software developer  
  - Offers a comprehensive Entegra training course developed in conjunction with Cirrus and Avidyne |  |
| Philosophy: make flying safer, more accessible and more enjoyable for pilots and their passengers | CMax update guide |  |
| Avidyne Product Line:  
  - Entegra – integrated flight decks for new aircraft  
  - Envision – integrated flight decks for existing aircraft  
  - Datalink-capable EX5000 and EX500 multi-function displays  
  - Dual-antenna TAS600 series of active traffic advisory systems  
  - MLB700 broadcast datalink receiver  
  - TWX670 Tactical Weather Detection system | Technical Publications Library:  
  - Entegra EXP5000 MFD Pilot’s Guide  
  - Entegra EXP5000 PFD for Piper Guides  
  - Flight Situation Display Pilot’s Guide |  |
| Avidyne Support Center:  
  - Technical Support and Service and After Hours TechLine Support | Training Software:  
  - Full-Function EX500 and EX5000 Simulator with CMax and MultiLink |  |
- Support links for Cirrus, Columbia, Piper, MFD
- Interactive Training Software designed to emulate the FlightMax EX500 and EX5000 MFD in either 4-knob (radar capability) or 2-knob (non-radar) modes on your PC
- Software includes CMax Electronic Charts and a demonstration version of both XM broadcast and 2-way Datalink weather
- GPS Simulator

Affordable, state-of-the-art integrated display technology to business and general aviation flight decks with Entegra

Integrated flight decks – enhanced safety, capability, and reliability

Entegra EXP5000 Primary Flight Display (PFD):
- Presents standard flight instrumentation including attitude direction indicator (EADI), horizontal situation indicator (EHSI), altitude, airspeed, vertical speed, moving map, weather, terrain, and traffic on large 10.4-inch diagonal, high-resolution, sunlight-readable full color displays, in easy-to-read formats
- Conveys a pilot-selectable moving map presentation of flight plan data and an RMI pointer, all within the primary field of view, reducing pilot workload.

Entegra EX5000 Multi Function Display (MFD):
- Displays navigation data, broadcast datalink weather, lightning, color radar, traffic, obstacles, terrain, and CMax approach plates with an intuitive user interface

<table>
<thead>
<tr>
<th>EMax for Entegra – Total Engine Management System</th>
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<table>
<thead>
<tr>
<th>CMax for Entegra – CMax Approach Charts</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Entegra system ideal for high-performance singles, piston twins, turboprops, and light jets</th>
</tr>
</thead>
</table>

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<tr>
<th>Entegra integrated flight deck system consists of EXP5000 PFD, the EX5000 MFD, the Entegra Air Data and Altitude, Heading Reference System (ADAHRS), and Entegra 3-Axis Magnetometer</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>The advanced technology of the Entegra EXP5000 PFD provides the highest level of flight instrument integration available for GA aircraft</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>The fully-integrated Entegra EXP5000 Attitude Direction Indicator (EADI) puts you attitude, heading, airspeed and vertical speed instruments onto a single display, reducing workload and improving scan</th>
</tr>
</thead>
</table>

## APPENDIX C. BOWLING GREEN STATE UNIVERSITY MATRIX

<table>
<thead>
<tr>
<th>Course Structure</th>
<th>Training Requirements and Training Course Outline</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital cockpit transition training course</td>
<td>Ground Training: (minimum) 9.0 hours Required Ground Topics:</td>
<td>Note Section in Course grade record for additional instructor comments regarding student performance</td>
</tr>
<tr>
<td></td>
<td>- “Switchology”, familiarization with digital instrumentation position, function, programming, mode awareness, level of automation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Review of aircraft systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Digital instrumentation function</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- GPS programming practice</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Avidyne PowerPoint material lesson</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Piper Arrow, PA 28R-201 analog vs. digital differences training lesson</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Avidyne PFD, MFD, and S Tec 55 autopilot Pilot Manual</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.0 hours Required Briefing:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Pre/Post Flight Briefing</td>
<td></td>
</tr>
<tr>
<td>Required curriculum for Bowling Green State University Aviation Studies Program in Flight Training Operations major</td>
<td>Study Unit 1 : (Simulation Unit)</td>
<td>Study Unit 1: Completion requirements – the student is able to navigate safely through the national airspace system and is current in instrument flight</td>
</tr>
<tr>
<td></td>
<td>- Dual simulation time in Personal Computer Aircraft Training Device (PCATD), 2.0 hours minimum (could be more depending of level of instrument and autopilot competency demonstrated)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Content to include IFR clearance and read back, IFR departure procedures, 2 non-precision (VOR, LOC) and 1 precision (ILS) hand flown, followed by 2 non-precision</td>
<td></td>
</tr>
</tbody>
</table>
and 1 precision flown utilizing autopilot functions to MDA/DH, effective use of autopilot operations

- Required completion prior to proceeding to study unit two
- Pre/Post Briefing (by the flight instructor) to brief the student in PCATD operations and autopilot use and to ensure that the student is proficient in instrument flight
- Objective is to review and increase instrument proficiency as well as introduce autopilot operations
- Completion requirements – the student is able to navigate safely through the national airspace system and is current in instrument flight

<table>
<thead>
<tr>
<th>Designed for junior level flight student to transition from analog instrumentation to digital instrumentation in a complex aircraft in both visual and instrument flight conditions</th>
<th>Study Unit 2 (Ground/Flight Lesson):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- 2.0 hour dual flight training, 1.0 hour ground training</td>
</tr>
<tr>
<td></td>
<td>- Ground instruction for cockpit familiarization and dual flight time in PA 28R-201 with an instructor, the flight will consist of commercial pilot maneuvers</td>
</tr>
<tr>
<td></td>
<td>- Content will include cockpit familiarization, commercial flight maneuvers, emergency procedures, effective autopilot/flight director use</td>
</tr>
<tr>
<td></td>
<td>- Pre/Post Briefing (by the flight instructor) to brief the student on digital aircraft instrumentation operations and autopilot use and to ensure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study Unit 2:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Completion requirements – the student is able to use the basic functions of digital aircraft instrumentation to include pages, functions, and buttons</td>
</tr>
</tbody>
</table>
that the student is proficient in the basic use of the digital aircraft instrumentation for visual commercial pilot maneuvers
- Objective of lesson is to introduce the student to the safe and efficient use of digital aircraft instrumentation
- Completion requirements – the student is able to use the basic functions of digital aircraft instrumentation to include pages, functions, and buttons

| Pre-training flight and ground experience in complex aircraft required so that the focus of the training will be on the instrumentation transition, not aircraft transition (to complex) | Study Unit 3 (Flight Lesson):
- 1.0 hour minimum dual flight training
- Dual flight time in PA 28R-201 with an instructor, the flight will consist of hand flown approaches
- Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (hand flown), effective autopilot/flight director use
- Pre/Post Briefing (by the flight instructor) to brief the student on digital aircraft instrumentation operations and autopilot use with emphasis on approaches, and to ensure that the student is proficient in the basic use of the digital aircraft instrumentation and coupled approaches
- Objective of lesson is to continue to introduce the student to efficient use of digital aircraft instrumentation
- Completion requirements – the student is able to use the digital aircraft instrumentation to execute coupled approaches | Study Unit 3:
- Completion requirements – the student is able to use the digital aircraft instrumentation to execute coupled approaches |
<table>
<thead>
<tr>
<th>Ground Training and Flight Training required</th>
<th>Study Unit 4 (Flight Lesson)</th>
<th>Study Unit 4: Completion requirements – the student is able to use the digital instrumentation to execute Flight Director accompanied approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Unit 5 (Flight Lesson)</td>
<td>• 1.0 hour minimum dual flight training</td>
<td></td>
</tr>
<tr>
<td>Study Unit 5: Completion requirements – the student is able to use the digital instrumentation to execute coupled approaches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dual flight time in PA 28R-201 with an instructor, the flight will consist of approaches utilizing the Flight Director</td>
<td>• Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (Flight Director), effective autopilot/flight director use</td>
<td></td>
</tr>
<tr>
<td>Pre/Post Briefing (by the flight instructor) to brief the student on digital instrument operations and Flight Director use with emphasis on approaches, and to ensure that the student is proficient in the basic use of the digital instrumentation and Flight Director assisted approaches</td>
<td>• Objective of lesson is to continue to introduce the student to efficient use of digital aircraft instrumentation</td>
<td></td>
</tr>
<tr>
<td>Completion requirements – the student is able to use the digital instrumentation to execute Flight Director accompanied approaches</td>
<td>• Completion requirements – the student is able to use the digital instrumentation to execute coupled approaches</td>
<td></td>
</tr>
</tbody>
</table>

**Collegiate Aviation Program:**
- Bowling Green State University, 4 year Collegiate Institution
- Federal Aviation Administration regulated part 61 and 141 aviation program

**Study Unit 5:** (Flight Lesson)
- 1.0 hour minimum dual flight training
- Dual flight time in PA 28R-201 with an instructor, the flight will consist of approaches utilizing a coupled autopilot
- Content will include IFR clearance and read back,
IFR procedures, Instrument Approach procedures (coupled autopilot), effective autopilot/flight director use
- Pre/Post Briefing (by the flight instructor) to brief the student on digital instrument operations and autopilot use with emphasis on approaches, and to ensure that the student is proficient in the basic use of the digital instrumentation and coupled approaches
- Objective of lesson is to continue to introduce the student to efficient use of digital aircraft instrumentation
- Completion requirements – the student is able to use the digital instrumentation to execute coupled approaches

<table>
<thead>
<tr>
<th>Study Unit 6 (Flight Lesson)</th>
<th>Study Unit 6:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 2.0 hour minimum dual flight training</td>
<td>• Completion requirements – Appropriate performance is the ability to utilize the digital instrumentation to accomplish instrument approaches using all resources provided by a “glass” airplane</td>
</tr>
<tr>
<td>• Dual cross country flight time in PA 28R-201 with an instructor, the flight will be a review of all approach types covered in the course, these approaches will include coupled, flight director, and hand-flown instrument approaches</td>
<td>• Students should be able to fly IFR in the airplane without any assistance at this point in order to receive a logbook endorsement indicating that the pilot is qualified to operate N786BG as PIC</td>
</tr>
<tr>
<td>• Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (at 2 airports other than 1G0), effective autopilot/flight director use</td>
<td>• Pre Briefing – Instructors will ask the students questions to determine if they have been</td>
</tr>
</tbody>
</table>
reading and have a good understanding of how to use the instrument panel. Instructors will review the student’s IFR cross-country planning and filing to determine if it is suitable for the route.

- Post Briefing – The flight instructor will ensure that the student is proficient in the use of the digital instrumentation and all of the resources that the glass arrow provides for executing instrument approaches. These resources include use of the flight director and the autopilot. Following the flight, the instructor will give an overview of the student’s performance.
- Objective of lesson is to continue to introduce the student to efficient use of digital aircraft instrumentation.
- Completion requirements – Appropriate performance is the ability to utilize the digital instrumentation to accomplish instrument approaches using all resources provided by a “glass” airplane. Students should be able to fly IFR in the airplane without any assistance at this point in order to receive a logbook endorsement indicating that the pilot is qualified to operate Bowling Green State University’s Digital Instrumentation Piper Arrow (N786BG) as pilot in command.
### Student performance will be evaluated on the basis of Federal Aviation Administration Practical Test Standards to a minimum of a Private Pilot certification level

### APPENDIX D. CESSNA MATRIX

<table>
<thead>
<tr>
<th>Course Structure</th>
<th>Training Requirements and Training Course Outline</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 day course</td>
<td>Training designed to transition pilots from traditional panel to TAA, but because of time constraints it is not designed to make customer an expert, but rather to provide the customer with the tools to begin using the G1000 system</td>
<td>Purpose of scenario based training is to change the thought processes, habits, and behaviors of the pilot during the planning and execution of the scenario</td>
</tr>
<tr>
<td>8 hours of ground school, 2 Modules, 4 hours each</td>
<td>FITS Accepted Transition Training, G1000 Transition Course Outline for G1000 equipped Cessna 172/182/206</td>
<td>Course completion standards are measured on a scale of desired outcomes for both Maneuver Grades and Single Pilot Resource Management Grades</td>
</tr>
<tr>
<td>4-6 hours of flight time (depending on level of proficiency and whether or not high altitude training is received) 3 Scenarios, 3 hours each</td>
<td>FITS curriculum designed to accommodate pilots with varied levels of experience, scenario based training</td>
<td>Goal of the course is to train the pilot to achieve the Perform level for Maneuver Grades, and the Manage/Decide level for Single Pilot Resource Management Grades (proficiency)</td>
</tr>
</tbody>
</table>

**Ground school:**
- System components of G1000
- Overviews of PFD/MFD
- Aircraft systems
- Autopilot operation

**Ground Training Module One:**
- See attached Format

**Ground Training Module Two:**
- See attached Format

**Outcomes for Maneuver Grades:**
- Explain
- Practice
- Perform

**Flight school:**
- Basic VFR operations
- Variety of instrument approaches
- Abnormal and emergency procedures

**This training provides instruction to develop the skill to use the G1000 to maneuver the aircraft**

**Outcomes for Maneuver Grades Explain:**
- At the completion of the scenario the PT will be able to describe the scenario activity and understand the underlying concepts, principles, and procedures that comprise the activity.
Significant instructor effort will be required to successfully execute the maneuver.

<table>
<thead>
<tr>
<th>Bring to training</th>
<th>Information will be provided to the pilot in the use of checklists, G1000 operating procedures, and use of the G1000 for instrument approaches</th>
<th>Outcomes for Maneuver Grades Practice:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Pilot’s license</td>
<td></td>
<td>• At the completion of the scenario the PT will be able to plan and execute the scenario activity.</td>
</tr>
<tr>
<td>• Current Medical Certificate</td>
<td></td>
<td>• Coaching and/or assistance from the CFI will correct minor deviations and errors identified by the CFI</td>
</tr>
<tr>
<td>• Government issued photo ID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Aircraft headset</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Outcomes for Maneuver Grades Practice:

- At the completion of the scenario the PT will be able to plan and execute the scenario activity.
- Coaching and/or assistance from the CFI will correct minor deviations and errors identified by the CFI.

Outcomes for Maneuver Grades Perform:

- At the completion of the scenario the PT will be able to perform the activity without assistance from the CFI.
- Errors and deviations will be identified and corrected by the PT in an expeditious manner.
- At no time will the successful completion of the activity be in doubt.
- "Perform" will be used to signify that the PT is satisfactorily demonstrating proficiency in traditional piloting and systems operation skills.

Outcomes for Single Pilot Resource Management Grades Explain:

- The PT can verbally identify, describe, and understand the risks inherent in the flight scenario.
- The student will...
| charged aircraft) | need to be prompted to identify risks and make more decisions |
| FITS training in customer’s Cessna Single Engine Piston aircraft (or rental at customer expense) | Outcomes for Single Pilot Resource Management Grades Practice:  
- The PT is able to identify, understand, and apply SRM principles to the actual flight situation  
- Coaching, instruction, and/or assistance from the CFI will quickly correct minor deviations and errors identified by the CFI  
- The student will be an active decision maker  
FITS curriculum designed to accommodate pilots with various levels of experience | Outcomes for Single Pilot Resource Management Grades Manage/Decide:  
- The PT can correctly gather the most important data available both within and outside the cockpit, identify possible course of action, evaluate the risk inherent in each course of action, and make the appropriate decision.  
- Instructor intervention is not required for the safe completion of the flight  
Scenario based (rather than traditional task based training) | A certificate will not be issued unless the Perform, Manage/Decide level is achieved  
Any particular scenario, or portions thereof, may be repeated (by desire of instructor or customer) | Upon successful completion of the ground training, the pilot will be familiar with the G1000 system |
Briefing and Debriefing are included in the total amount of time necessary to complete the flight training. Upon successful completion of the flight training curriculum, the customer will be able to operate the G1000 avionics. Pilots will apply the elements of SRM as part of the flight training process.

<table>
<thead>
<tr>
<th>Ground Training-</th>
<th>Ground Training Module One –</th>
<th>Ground Training Module Two –</th>
<th>Ground Training Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Information on G1000 operation and selected systems</td>
<td>• In depth look at components</td>
<td>• Expanded overview of:</td>
<td>• Classrooms</td>
</tr>
<tr>
<td>• Simulation/Interactive exercises (transition pilot from classroom to cockpit)</td>
<td>• Interactive simulation using desktop simulators to familiarize customer with G1000 and its controls</td>
<td>o MFD</td>
<td>• Computers for each customer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Autopilot</td>
<td>• Overhead projectors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o System malfunctions</td>
<td>• “Smart Boards” – used for PowerPoint presentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Basic overview of Cessna systems</td>
<td>• Kiosks and Table Top Trainers hands-on training with actual G1000 for interactive lab portion of ground training modules</td>
</tr>
</tbody>
</table>

Goal of FITS is to ensure that pilots learn to safely, competently, and efficiently operate a TAA in modern National Airspace System, using scenario based training.


GROUND TRAINING MODULES

A. Module One

1. Welcome

2. Introductions

3. Training Overview

4. System Components

a. G1000 Components

i. Control Display Units

ii. Attitude and Heading Reference System (AHRS)

iii. Air Data Computer (ADC)

iv. Engine & Airframe Unit

v. Integrated Avionics Unit

vi. Datalink

vii. Transponder

viii. Magnetometer

ix. Standby Instruments

5. Display Overview

a. Airspeed

b. Altitude/Vertical Speed
c. Primary Attitude

d. Horizontal Situation Indicator

i. ILS Indications

6. Flight Director/Autopilot Pre-flight and Operation Introduction

a. HDG, NAV, VS, and ALT modes

7. System Start-up

a. Preflight Cabin Checklist

b. Before Starting Engine Checklist

c. Before Takeoff Checklist

d. Standby Battery Check

8. Primary Flight Display (PFD) Overview

a. Information Displayed

b. Softkeys

c. Bezel Controls

d. Color Coding

9. Multi-Function Display (MFD) Overview

a. Information Displayed

b. Engine Indications

c. Map Page 1 and Map Setup

d. Waypoint Page 1

e. Flight Plan Page Group and Pages

B. Module Two

1. Multi-Function Display Advanced (MFD)
a. Map Page Group and Pages
   i. Situational Awareness Tools (TIS, WX-500, GDL, Terrain)

b. Waypoint Page Group and Pages

c. Auxiliary Page Group and Pages

d. Nearest Page Group and Pages

e. Procedure Loading

2. Expanded Autopilot Operations

a. Precision Approach

b. Missed Approach

c. Holding

d. Non-Precision Approach

3. Wide Area Augmentation System (WAAS)

a. General Operation

b. RNAV Approach Minimums

4. System Malfunctions

a. Annunciations (Advisory, Caution, Warning)

b. Malfunction Checklist Items

c. Component Failures

5. Audio Panel Operations

6. Aircraft Systems

a. Inflatable Restraints

b. Propeller

c. Turbo-charging (if appropriate)
d. Oxygen (if appropriate)
Cessna Aircraft Company  
Single Engine Piston (SEP)  
G1000 Transition Training  
Pilot Training Department

FLIGHT TRAINING SCENARIOS

A. Scenario One: This scenario consists of a VFR flight to an unfamiliar airport. After landing, a new flight will be planned continuing to another airport. Somewhere along the route, the pilot will be advised of the necessity to divert to a different airport using the G1000. This leg of the flight will also be used to further familiarize the pilot with the aircraft and cockpit displays. After reaching the diversion destination, the pilot will be instructed to return to the original departure airport.

1. Scenario Planning
   a. Flight Planning
   b. Weight & Balance
   c. Determining Performance

2. Normal Preflight & Cockpit Procedures
   a. Checklist Usage

3. Engine Start & Taxi Procedures
   a. Engine Start
   b. G1000 Setup
   c. Taxi

4. Before Takeoff Checklist
   a. Normal & Abnormal Indications
   b. G1000 Setup
   c. Autopilot Checks

5. Takeoff
a. Normal / Crosswind

6. Climb Procedures
a. Autopilot Climb
b. Checklist Usage
c. Division of Attention

7. Cruise Procedures
a. Autopilot Cruise
b. Checklist Usage
c. Lean Assist
d. Division of Attention

8. PFD Crosscheck
a. Straight and Level Flight
b. Normal Turns
c. Climb and Descent

9. Flight Maneuvers
a. Steep Turns
b. Slow Flight
c. Stalls

10. G1000 Programming
a. COM/NAV Frequency Loading
b. Flight Plans

11. Flight Director/Autopilot Operation
a. Vertical Modes
b. Lateral Modes

12. Situational Awareness Aids
   a. TIS/TAS
   b. Stormscope
   c. Weather Datalink
   d. Terrain Awareness/TAWS

13. Descent Planning & Execution
   a. VNAV Programming
   b. Autopilot Descent
   c. CFIT Avoidance
   d. Division of Attention

14. Landing
   a. Before Landing Checklist
   b. Normal / Crosswind

15. Aircraft Shutdown & Securing Procedures
   a. Shutdown Checklist

B. Scenario Two: This scenario consists of an IFR flight to an unfamiliar airport utilizing numerous IFR procedures. Instrument approach procedures using the G1000 and the autopilot will be emphasized. During this flight, four different approaches will be performed including manual and coupled ILS’s, VOR, and GPS approaches. The trainee will experience straight in approaches, circling approaches, and missed approaches. If the aircraft is equipped with a turbo charger, an introduction to higher altitude operations will be incorporated. The flight will consist of a climb to a cabin pressure altitude of at least 14,000 feet MSL, use of the oxygen system, a discussion of regulations pertaining to high altitude flight, and high altitude engine operation.

1. Normal Preflight & Cockpit Procedures
   a. O2 System Checks
   b. Differences in Mask Types
2. PFD / *Instrument* Crosscheck
   a. Straight & Level Flight
   b. Normal Turns
   c. Climbs & Descents

3. G1000 Programming
   a. Instrument Approach Procedure Loading

4. Flight Director/Autopilot Operations
   a. Vertical Modes
   b. Lateral Modes

5. Instrument Approach Procedures
   a. ILS
   b. VOR
   c. GPS
   d. DME Arcs
   e. Holding/Procedure Turns
   f. Missed Approach

C. **Scenario Three:** This scenario includes recognizing and handling different emergency situations that might occur with the G1000 system, during both VFR and IFR flight. During the flight, both a PFD failure and an AHRS / ADC failure will be simulated and dealt with. If the pilot is instrument rated, two instrument approaches will be flown with these simulated failures. A non-instrument rated pilot will be expected to navigate to another airport and land with these failures.

1. Instrument Approach Procedures with Failures (if applicable)
   a. ILS
   b. VOR
2. Emergency Procedures
   a. Display Failure
   b. AHRS/ADC Failure
   c. Flying on Standby Instruments
   d. Checklist Usage

3. Landing
   a. Landing with Failures
## APPENDIX G. CIRRUS MATRIX

(VFR Matrix)

<table>
<thead>
<tr>
<th><strong>Course Structure</strong></th>
<th><strong>Training Requirements and Training Course Outline</strong></th>
<th><strong>Evaluation</strong></th>
</tr>
</thead>
</table>
| Designed to transition current and proficient pilots into all models of Cirrus aircraft to a VFR proficiency level | Lesson 1 (Ground Lesson):  
- Introduction to scenario-based training and Cirrus transition training  
- Includes a review of pre-training materials including model-specific topics, and a session in a cockpit procedures trainer | Certificate of completion will be awarded at the satisfactory completion of lesson 7 when the Cirrus pilot has met the required desired outcomes for all required tasks while demonstrating judgment, aeronautical decision making abilities, single-pilot resource management and risk management skills to safely fly a Cirrus aircraft |
| Upon successful completion of all course objectives, the instructor will issue a certificate of completion and a course summary detailing flight and ground time acquired during this course | Lesson 2 (Flight Lesson):  
- Introduction to the operational characteristics of Cirrus aircraft  
- Focus will be on maneuvers and takeoffs and landings in various configurations and situations | The Cirrus pilot shall perform the maneuvers and procedures at the standard defined in the FAA Practical Test Standards (or international equivalent) for the pilot certificate held. Evaluations will be with Learning Centered Grading Evaluation Principles. |
| Designed to take approximately 3 days to complete, additional half day each to complete the optional Biennial Flight Review and/or an Instrument Proficiency Check. | Lesson 3 (Flight Lesson):  
- Introduction to normal procedures  
- It is a 3-leg cross country where the Cirrus pilot will implement normal procedures including checklists, enroute procedures, and arrival procedures | Each element will be described in detail throughout the training course  
- The following elements will be used in conjunction with the overall course completion standards:  
  ○ Desired Outcome  
  ○ Task Checklist  
  ○ List of Assessment Items  
  ○ Lesson Completion Standards |
| Transition course composed of 7 required lessons and 1 optional lesson | Lesson 4 (Flight Lesson):  
- Focus on abnormal and emergency procedures that are somewhat common to all aircraft | Desired Outcomes – is the grade the Cirrus pilot has achieved for the particular task (Describe, Explain, Practice, Perform, Manage/Decide) |
- Transition training does not constitute a FAA practical test, Biennial Flight Review (BFR) or an Instrument Proficiency Check (IPC)
  - If a BFR or IPC is desired, additional time will be required
  - A high performance endorsement will be awarded at the successful completion of all course objectives, if necessary

| Transition training prerequisites, detailed in training syllabus, must be completed prior to starting transition training |
| Successful on-schedule completion of the Transition course is heavily dependent on devoting the proper amount of time to reviewing and studying the pre-training materials |

| Specific transition training prerequisites, detailed in training syllabus, must be completed prior to starting transition training |
| Successful on-schedule completion of the Transition course is heavily dependent on devoting the proper amount of time to reviewing and studying the pre-training materials |

| Training course incorporates FAA Industry Training Standards (FITS) |
| Optional Lesson: |

| Lesson 5 (Flight Lesson): |
| Focus on avionics malfunctions |
| It is a 3-leg cross country that will focus on abnormalities with the PFD, MFD, autopilot and GPS receivers |

| Task Checklist – these items need to be completed by the Cirrus pilot to the appropriate desired outcome |

| Lesson 6 (Flight Lesson): |
| Focus on systems malfunctions |
| It is a 3-leg cross country that will emphasize good ADM and risk management while generating acceptable solutions to malfunctions of systems of the aircraft |

| List of Assessment Items – explanation of what needs to be observed by the instructor for the Cirrus pilot to meet the desired outcome for each task |

| Lesson 7 (Flight Lesson): |
| Final evaluation flight |
| It is a 2-leg cross country in which the Cirrus pilot will demonstrate the knowledge and skill required to safely fly the Cirrus aircraft in single pilot operations |

| Lesson Completion Standards – explanation of the requirements to consider each lesson complete or incomplete |

| Optional Lesson: |
| Biennial Flight Review |

| Within each lesson the instructor and Cirrus pilot will reference the task checklist for |
training techniques, and is FITS Accepted.
- Emphasis is placed on developing judgment, aeronautical decision making, risk management, single pilot resource management, and simulating real-world consequences throughout the use of scenario based training.

<table>
<thead>
<tr>
<th>Reference Materials list provided to include:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Interactive Pre-training</td>
</tr>
<tr>
<td>• Training Publications</td>
</tr>
<tr>
<td>• Aircraft Publications</td>
</tr>
<tr>
<td>• Additional Training Resources</td>
</tr>
<tr>
<td>• FAA Publications</td>
</tr>
<tr>
<td>• Cirrus Aircraft Training Software (CATS) – Interactive systems trainer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Each lesson and the appropriate assessment items to determine whether each task is complete to the minimum desired outcome needed to meet the lesson completion standards.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Minimum of 10 hours of flight training (7 hours in airplane, maximum of 3 hours in an approved FTD may be used towards the 10 hour minimum course flight time requirement)</td>
</tr>
<tr>
<td>• Minimum of 20 Landings</td>
</tr>
<tr>
<td>• Minimum of 8 hours of ground training/Pre Post time (time noted under Ground/Pre Post Time is an approximate and may vary based on experience and scenario)</td>
</tr>
</tbody>
</table>

| Training program includes instruction on normal and emergency procedures as well as proven standard operating procedures developed by Cirrus Design. |

| A level one or higher flight training device (FTD) can be used to complete specified lessons in this course provided it matches the avionics configuration and model of the aircraft in which the flight training is being conducted. One hour of simulator time is given complimentary per aircraft transition to complete CAPS Recognition |

| Minimum of 10 hours of flight training (7 hours in airplane, maximum of 3 hours in an approved FTD may be used towards the 10 hour minimum course flight time requirement) |
| Minimum of 20 Landings |
| Minimum of 8 hours of ground training/Pre Post time (time noted under Ground/Pre Post Time is an approximate and may vary based on experience and scenario) |
training in the flight training device. This normally consists of three scenarios in which a CAPS deployment is required. Some scenarios are black and white (a mid-air) others are more shades of gray, VFR into IMC, loss of control, etc.


(IFR Matrix)

<table>
<thead>
<tr>
<th>Course Structure</th>
<th>Training Requirements and Training Course Outline</th>
<th>Evaluation</th>
</tr>
</thead>
</table>
| Designed to transition current and proficient instrument rated pilots into all models of Cirrus aircraft with a high level of instrument competency | Lesson 1 (Ground Lesson):  
- An introduction to scenario-based training and Cirrus transition training  
- Includes a review of pre-training materials including model-specific and IFR topics, and a session in a cockpit procedures trainer, hot bench, or a computer-based avionics trainer | The instructor is responsible for ensuring the Cirrus pilot meets acceptable standards in all subject matter areas, procedures, maneuvers included in the tasks within the appropriate instrument rating practical test standards required for an IPC |
| Familiarize operators with the unique operating situations in VFR and in IFR operations, both normal and abnormal | Lesson 2 (Flight Lesson):  
- Introduction to the operational characteristics of Cirrus aircraft  
- Focus on maneuvers in addition to takeoffs and landings in various configurations and situations | Certificate of completion will be awarded at the satisfactory completion of lesson 10 when the Cirrus pilot has met the required desired outcomes for all required tasks while demonstrating judgment, aeronautical decision making abilities, single-pilot resource management and risk management skills to safely |
| Emphasis on safely and efficiently operating in IFR system under normal and abnormal situations | Lesson 3 (Flight Lesson):  
- Introduction to normal VFR procedures and some Basic Attitude Instrument Flying (BAIF) in Cirrus aircraft  
- Consists of 3-leg cross country in which the Cirrus pilot will implement normal procedures including checklists, enroute procedures, and arrival procedures  
- Instrument approaches will be conducted visually to acquaint Cirrus pilots with basic instrument procedures while using the autopilot | The Cirrus pilot shall perform the maneuvers and procedures at the standard defined in the FAA Practical Test Standards for the pilot certificate held |
|------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
|                   | Lesson 4 (Flight Lesson):  
- Introduction to basic instrument procedures  
- Cirrus pilot will conduct various types of instrument approaches under simulated or actual instrument conditions  
- Both hand flying and autopilot usage will be accomplished | Each element will be described in detail throughout the training course  
- The following elements will be used in conjunction with the overall course completion standards:  
  - Desired Outcome  
  - Task Checklist  
  - List of Assessment Items  
  Lesson Completion Standards |
| Transition training does not constitute a FAA practical test, Biennial Flight Review (BFR)  
- If a BFR or IPC is desired, additional time will be required  
- A high performance endorsement will be awarded at the successful completion of all course objectives, if necessary | New Cirrus pilots will complete an Instrument Proficiency Check (IPC) in conjunction with the final evaluation lesson and will leave the training event current – and more importantly proficient – while |
| Lesson 5 (Flight Lesson):  
- Cirrus pilot will continue to develop basic instrument skills while being introduced to advanced IFR procedures | Desired Outcomes – is the grade the Cirrus pilot has achieved for the particular task (Describe, Explain, Practice, Perform, Manage/Decide) |
| Flying IFR in Cirrus aircraft | • Consists of 3-leg cross country in which the Cirrus pilot will conduct enroute procedures, arrival and departure procedures, and holding procedures  
• Practice with and without the use of the GPS/FMS will be accomplished |  |
| --- | --- | --- |
| Successful on-schedule completion of the Transition course is heavily dependent on devoting the proper amount of time to reviewing and studying the pre-training materials | Lesson 6 (Flight Lesson):  
• Cirrus pilot will be introduced to abnormal and emergency procedures while in simulated instrument conditions  
• Consists of 3-leg cross country that is best performed in a Flight Training Device (FTD), but may be accomplished in the aircraft if necessary | Task Checklist – these items need to be completed by the Cirrus pilot to the appropriate desired outcome |
| All Cirrus pilots should follow the recurrent schedule outlined in the Cirrus Pilot Learning Plan after successful completion of the transition training event | Lesson 7 (Flight Lesson):  
• Focus on systems malfunctions while in simulated instrument conditions  
• Consists of 3-leg cross country that will emphasize proper ADM and risk management while generating acceptable solutions to simulated malfunctions of various aircraft systems | List of Assessment Items – explanation of what needs to be observed by the instructor for the Cirrus pilot to meet the desired outcome for each task |
| • Training course incorporates FAA Industry Training Standards (FITS) | Lesson 8 (Flight Lesson):  
• Focus on avionics | Lesson Completion Standards – explanation of the requirements to consider each task |
training techniques
- Emphasis is placed on developing judgment, aeronautical decision making, risk management and single pilot resource management throughout the use of scenario based training

malfunctions while in simulated instrument conditions
- Consists of 3-leg cross country that will focus on simulated abnormalities with the PFD, MFD, autopilot, and GPS receivers

lesson complete or incomplete

| Transition training course is composed of 10 required lessons and 1 optional lesson |
| Takes approximately 5 days to complete the required lessons, additional half day to complete optional BFR |
| Lesson 9 (Flight Lesson):
  - Lesson will give the Cirrus pilot a chance to apply his/her knowledge by conducting an IFR scenario
  - This scenario will be modeled after Line Oriented Flight Training (LOFT)
  - It is best performed in an FTD but may be accomplished in an aircraft if necessary
  - Lesson will also serve as a review lesson that will give the Cirrus pilot a chance to enhance his/her skills to prepare for the final evaluation and IPC |
| Within each lesson the instructor and Cirrus pilot will reference the task checklist for each lesson and the appropriate assessment items to determine whether each task is complete to the minimum desired outcome needed to meet the lesson completion standards |

| Lesson 10 (Flight Lesson):
  - Final evaluation flight
  - Consists of 3-leg cross country in which the Cirrus pilot will demonstrate the knowledge and skill required to safely fly the Cirrus aircraft in single pilot IFR operations |
| Content of this lesson |
is modeled around scenario based training and includes all tasks required by the FAA Instrument PTS to complete and IPC

Optional Lesson:
- Biennial Flight Review

- Minimum of 15 hours of flight training (9 hours in airplane, maximum of 6 hours in an approved FTD may be used towards the 15 hour minimum course flight time requirement)
- Minimum of 20 Landings
- Minimum of 8 hours of ground training/Pre Post time (time noted under Ground/Pre Post Time is and approximate and may vary based on experience and scenario)

## APPENDIX H. COMPARATIVE ANALYSIS MATRIX

### A. Course Structure:

<table>
<thead>
<tr>
<th>Software Manufacturer</th>
<th>Collegiate Flight Training School</th>
<th>Aircraft Manufacturer</th>
<th>Aircraft Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entegra system ideal for high-performance single engine aircraft, piston twin engine aircraft, turboprop engine aircraft, and light jets.</td>
<td>Digital cockpit transition course</td>
<td>Digital cockpit transition course, designed to transition pilots from traditional panel to TAA, but because of time constraints is not designed to make customer an expert, but rather to provide the customer with the tools to begin using the G1000</td>
<td>Digital cockpit transition course, designed to transition current and proficient pilots into all models of Cirrus aircraft to a VFR proficiency level (or high level of instrument competency if IFR transition)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ground*</th>
<th>VFR/IFR</th>
<th>VFR/IFR</th>
<th>VFR/IFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight: Basic VFR operations, instrument approaches, abnormal and emergency approaches</td>
<td>Flight: Basic VFR operations, instrument approaches, abnormal and emergency approaches</td>
<td>Flight: Basic VFR operations, instrument approaches, abnormal and emergency approaches</td>
<td></td>
</tr>
</tbody>
</table>

<p>| NA | Flight training course | FITS certificate upon | FITS certificate upon |
| 4-6 day course | 3 day course | 3 days VFR, 5 days IFR |
| Optional BFR (additional training time arranged) | Optional BFR (additional training time arranged) |
| No IPC or BFR endorsements or training during transition course – focus on transition not learning aircraft type | No high performance, IPC or BFR endorsements or training during transition course (unless additional training arranged) | IPC included in conjunction with final evaluation flight (IFR) | High performance endorsement will be awarded at the successful completion of all course objectives, if necessary |</p>
<table>
<thead>
<tr>
<th>Requirement</th>
<th>Completion</th>
<th>Completion and Course Flight and Ground Time Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGSU Bachelor of Science in Technology degree program</td>
<td>FITS scenario based learning, FITS approved training course, FITS curriculum designed to accommodate pilots with various levels of experience</td>
<td>FITS scenario based learning, FITS approved training course, FITS curriculum designed to accommodate pilots with various levels of experience</td>
</tr>
<tr>
<td>NA</td>
<td>Blend of skills and scenario-based training, not FITS approved course</td>
<td>FITS – purpose of scenario based training is to change the thought processes, habits and behaviors of the pilot during the planning and execution of the scenario</td>
</tr>
<tr>
<td>Integrated flight decks – enhanced safety, capability, and reliability</td>
<td>FITS – emphasis placed on developing judgment, aeronautical decision making, risk management and single pilot resource management throughout the use of scenario based training</td>
<td></td>
</tr>
<tr>
<td>Entegra Integrated Flight Deck System for new aircraft install, Envision for existing aircraft Affordable, state-of-the-art integrated display technology to business and general aviation flight decks with Entegra</td>
<td>Audience of junior-level collegiate aviators in university flight school setting</td>
<td>New aircraft purchase customers* or upgrade customers, typically adult learner</td>
</tr>
<tr>
<td>NA</td>
<td>Complex aircraft pre-training required, Instrument competency prior to flight</td>
<td>No pre training study material mandated</td>
</tr>
<tr>
<td>NA</td>
<td>Complex aircraft required, TAA</td>
<td>Pre training materials study required prior to starting transition training and for on-time completion</td>
</tr>
<tr>
<td>Supportive services with Avidyne</td>
<td>Supportive Reference information provided</td>
<td>Supportive Reference List Materials</td>
</tr>
</tbody>
</table>
technical support, and partners (Piper Aircraft, Jeppesen, Cirrus, Columbia, MFD, Aerosim Technologies), Manuals in Technical Publications Library, Downloadable Entegra/Envision Freeplay Simulator, Interactive Training Software, GPS Simulator

| NA | Instrument competency level required in PCATD prior to advancing to flight training lessons | No mention | No mention |
| NA | No mention | No mention | All Cirrus pilots should follow the recurrent schedule outlined in the Cirrus Pilot Learning Plan after successful completion of the transition training event |

B. Training Requirements and Training Course Outline:

<table>
<thead>
<tr>
<th>Avidyne</th>
<th>BGSU</th>
<th>Cessna</th>
<th>Cirrus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated flight decks – enhanced safety, capability, and reliability</td>
<td>9 hours minimum ground training, 3 hours required briefing (pre/post flight)</td>
<td>8 hours Ground (2 modules, 4 hours each)</td>
<td>8 hours minimum ground training/Pre Post time (time under Ground/ Pre Post Time is and approximate and may vary based on experience and scenario)</td>
</tr>
<tr>
<td>Philosophy: make flying safer, more accessible and more enjoyable for pilots</td>
<td>9 hours minimum flight time (2 hours minimum PCATD, 7 hours minimum)</td>
<td>4-6 hours actual Flight hours (3 scenarios, 3 hours each including pre/de</td>
<td>10 hours minimum flight training (7 hours in airplane, maximum of 3 hours</td>
</tr>
<tr>
<td>and their passengers</td>
<td>actual flight training)</td>
<td>brief time)</td>
<td>in an approved FTD may be used towards the 10 hour minimum course flight time requirement) Minimum of 20 landings</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td>Training Software: Full-Function EX500 and EX5000 Simulator with CMax and MultiLink. Interactive Training Software designed to emulate the FlightMax EX500 and EX5000 MFD in either 4-knob (radar capability) or 2-knob (non-radar) modes on your PC. Software includes CMax Electronic Charts and a demonstration version of both XM broadcast and 2-way Datalink weather. GPS Simulator</td>
<td>Ground Training Topics: “Switchology”, familiarization with digital instrumentation position, function, programming, mode awareness, level of automation, Review of aircraft systems, Digital instrumentation function, GPS programming practice, Avidyne PowerPoint material lesson, Piper Arrow, PA 28R-201 analog vs. digital differences training lesson, Avidyne PFD, MFD, and S Tec 55 autopilot manuals</td>
<td>Ground Training Module One: 4.0 hours, System components, Display overview, FD/Autopilot Pre-flight and Operation Introduction, System start-up, PFD overview, MFD overview</td>
<td>(VFR transition training course) 7 required lessons, 1 optional (BFR)</td>
</tr>
<tr>
<td>NA</td>
<td>Study Unit One: Dual simulation time in Personal Computer Aircraft Training Device (PCATD), 2.0 hours minimum (could be more depending of level of instrument and autopilot competency demonstrated), Content to include IFR clearance and read back, IFR</td>
<td>Ground Training Module Two: 4.0 hours, MFD advanced, expanded autopilot operations, WAAS, System malfunctions, Audio Panel Operations, Aircraft Systems</td>
<td>(IFR transition training course) 10 required lessons, 1 optional (BFR)</td>
</tr>
</tbody>
</table>
departure procedures, 2 non-precision (VOR, LOC) and 1 precision (ILS) hand flown, followed by 2 non-precision and 1 precision flown utilizing autopilot functions to MDA/DH, effective use of autopilot operations, Required completion prior to proceeding to study unit two, Pre/Post Briefing (by the flight instructor) to brief the student in PCATD operations and autopilot use and to ensure that the student is proficient in instrument flight, Objective is to review and increase instrument proficiency as well as introduce autopilot operations, Completion requirements – the student is able to navigate safely through the national airspace system and is current in instrument flight

| NA | Study Unit Two: 2.0 hour dual flight training, 1.0 hour ground training, Ground instruction for cockpit familiarization and dual flight time in PA 28R-201 with an | Flight Training Scenario One: 3.0 hours, VFR, unfamiliar airport operation, scenario planning, normal preflight and cockpit procedures, before takeoff checklist, | Lesson 1 (Ground Lesson): Introduction to scenario-based training and Cirrus transition training. Includes a review of pre-training materials including model-specific topics, and a |
instructor, the flight will consist of commercial pilot maneuvers. Content will include cockpit familiarization, commercial flight maneuvers, emergency procedures, effective autopilot/flight director use, Pre/Post Briefing (by the flight instructor) to brief the student on digital aircraft instrumentation operations and autopilot use and to ensure that the student is proficient in the basic use of the digital aircraft instrumentation for visual commercial pilot maneuvers, Objective of lesson is to introduce the student to the safe and efficient use of digital aircraft instrumentation, Completion requirements – the student is able to use the basic functions of digital aircraft instrumentation to include pages, functions, and buttons.

| NA | Study Unit Three: 1.0 hour minimum dual flight training, Dual flight time in PA 28R-201 with an | Flight Training Scenario Two: 3.0 hours, IFR to unfamiliar airport, Normal preflight and  | Lesson 2 (Flight Lesson): Introduction to the operational characteristics of Cirrus aircraft. Focus |
instructor, the flight will consist of hand flown approaches, Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (hand flown), effective autopilot/flight director use, Pre/Post Briefing (by the flight instructor) to brief the student on digital aircraft instrumentation operations and autopilot use with emphasis on approaches, and to ensure that the student is proficient in the basic use of the digital aircraft instrumentation and coupled approaches, Objective of lesson is to continue to introduce the student to efficient use of digital aircraft instrumentation, Completion requirements – the student is able to use the digital aircraft instrumentation to execute coupled approaches

<p>| NA | Study Unit Four: 1.0 hour minimum dual flight training, Dual flight time in PA 28R-201 with an instructor, the flight | Flight Training Scenario Three: 3.0 hours, VFR and IFR emergency situations, instrument approach procedures with | Lesson 3 (Flight Lesson): Introduction to normal procedures. It is a 3-leg cross country where the Cirrus pilot will |
| Study Unit Five: 1.0 hour minimum dual flight training, Dual flight time in PA | Lesson 4 (Flight Lesson): Focus on abnormal and emergency procedures, landing | implement normal procedures including checklists, enroute procedures, and arrival procedures |</p>
<table>
<thead>
<tr>
<th>NA</th>
<th>Study Unit Six: 2.0 hour minimum dual flight training, Dual cross country flight time in PA 28R-201</th>
<th>Lesson 5 (Flight Lesson): Focus on avionics malfunctions. It is a 3-leg cross country.</th>
</tr>
</thead>
</table>

28R-201 with an instructor, the flight will consist of approaches utilizing a coupled autopilot. Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (coupled autopilot), effective autopilot/flight director use, Pre/Post Briefing (by the flight instructor) to brief the student on digital instrument operations and autopilot use with emphasis on approaches, and to ensure that the student is proficient in the basic use of the digital instrumentation and coupled approaches. Objective of lesson is to continue to introduce the student to efficient use of digital aircraft instrumentation. Completion requirements – the student is able to use the digital instrumentation to execute coupled approaches. Procedures that are somewhat common to all aircraft. It is a 3-leg cross country. The desired outcomes of this lesson are best achieved in a Flight Training Device (FTD), but the use of an aircraft is acceptable.
with an instructor, the flight will be a review of all approach types covered in the course, these approaches will include coupled, flight director, and hand-flown instrument approaches, Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (at 2 airports other than 1G0), effective autopilot/flight director use, Pre Briefing – Instructors will ask the students questions to determine if they have been reading and have a good understanding of how to use the instrument panel. Instructors will review the student’s IFR cross-country planning and filing to determine if it is suitable for the route. Post Briefing – The flight instructor will ensure that the student is proficient in the use of the digital instrumentation and all of the resources that the glass arrow

country that will focus on abnormalities with the PFD, MFD, autopilot and GPS receivers.
provides for executing instrument approaches. These resources include use of the flight director and the autopilot. Following the flight, the instructor will give an overview of the student’s performance. Objective of lesson is to continue to introduce the student to efficient use of digital aircraft instrumentation. Completion requirements – Appropriate performance is the ability to utilize the digital instrumentation to accomplish instrument approaches using all resources provided by a “glass” airplane. Students should be able to fly IFR in the airplane without any assistance at this point in order to receive a logbook endorsement indicating that the pilot is qualified to operate Bowling Green State University’s Digital Instrumentation Piper Arrow (N786BG) as pilot in command.

<p>| NA | Lesson 6 (Flight Lesson): Focus on |</p>
<table>
<thead>
<tr>
<th>Lesson</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>Lesson 7 (Flight Lesson): Final evaluation flight. It is a 2-leg cross country in which the Cirrus pilot will demonstrate the knowledge and skill required to safely fly the Cirrus aircraft in single pilot operations.</td>
</tr>
<tr>
<td>NA</td>
<td>Optional Lesson: Biennial Flight Review</td>
</tr>
<tr>
<td>NA</td>
<td>(IFR) Lesson 1 (Ground Lesson): An introduction to scenario-based training and Cirrus transition training. Includes a review of pre-training materials including model-specific and IFR topics, and a session in a cockpit procedures trainer, hot bench, or a computer-based avionics trainer.</td>
</tr>
<tr>
<td>NA</td>
<td>(IFR) Lesson 2 (Flight Lesson): Introduction to the operational</td>
</tr>
</tbody>
</table>
characteristics of Cirrus aircraft. Focus on maneuvers in addition to takeoffs and landings in various configurations and situations.

| NA   | (IFR) Lesson 3 (Flight Lesson): Introduction to normal VFR procedures and some Basic Attitude Instrument Flying (BAIF) in Cirrus aircraft. Consists of 3-leg cross country in which the Cirrus pilot will implement normal procedures including checklists, enroute procedures, and arrival procedures. Instrument approaches will be conducted visually to acquaint Cirrus pilots with basic instrument procedures while using the autopilot. |
| NA   | (IFR) Lesson 4 (Flight Lesson): Introduction to basic instrument procedures. Cirrus pilot will conduct various types of instrument approaches under simulated or actual instrument conditions. Both hand flying and autopilot usage will |
| NA | (IFR) Lesson 5  
(Flight Lesson): Cirrus pilot will continue to develop basic instrument skills while being introduced to advanced IFR procedures. Consists of 3-leg cross country in which the Cirrus pilot will conduct enroute procedures, arrival and departure procedures, and holding procedures. Practice with and without the use of the GPS/FMS will be accomplished. |
| NA | (IFR) Lesson 6  
(Flight Lesson): Cirrus pilot will be introduced to abnormal and emergency procedures while in simulated instrument conditions. Consists of 3-leg cross country that is best performed in a Flight Training Device (FTD), but may be accomplished in the aircraft if necessary. |
| NA | (IFR) Lesson 7  
(Flight Lesson): Focus on systems malfunctions while in simulated instrument conditions. Consists of 3-leg cross country that will emphasize proper ADM and risk |
management while generating acceptable solutions to simulated malfunctions of various aircraft systems.

| NA | (IFR) Lesson 8 (Flight Lesson): Focus on avionics malfunctions while in simulated instrument conditions. Consists of 3-leg cross country that will focus on simulated abnormalities with the PFD, MFD, autopilot, and GPS receivers. |
| NA | (IFR) Lesson 9 (Flight Lesson): Lesson will give the Cirrus pilot a chance to apply his/her knowledge by conducting an IFR scenario. This scenario will be modeled after Line Oriented Flight Training (LOFT). It is best performed in an FTD but may be accomplished in an aircraft if necessary. Lesson will also serve as a review lesson that will give the Cirrus pilot a chance to enhance his/her skills to prepare for the final evaluation and IPC. |
| NA | (IFR) Lesson 10 (Flight Lesson): Final evaluation flight. |
Consists of 3-leg cross country in which the Cirrus pilot will demonstrate the knowledge and skill required to safely fly the Cirrus aircraft in single pilot IFR operations. Content of this lesson is modeled around scenario based training and includes all tasks required by the FAA Instrument PTS to complete and IPC.

Optional Lesson: Biennial Flight Review

C. Evaluation:

<table>
<thead>
<tr>
<th>Avidyne</th>
<th>BGSU</th>
<th>Cessna</th>
<th>Cirrus</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>Additional Note section in grade record for instructor comments regarding student performance</td>
<td>Purpose of scenario based training is to change the thought processes, habits, and behaviors of the pilot during the planning and execution of the scenario</td>
<td>Certificate of completion will be awarded at the satisfactory completion of lesson 7 when the Cirrus pilot has met the required desired outcomes for all required tasks while demonstrating judgment, aeronautical decision making abilities, single-pilot resource management and risk management skills to safely fly a Cirrus aircraft</td>
</tr>
<tr>
<td>NA</td>
<td>Study Unit 1: Completion</td>
<td>Course completion standards are</td>
<td>The Cirrus pilot shall perform the</td>
</tr>
<tr>
<td>NA</td>
<td>Study Unit 2: Completion requirements – the student is able to use the basic functions of digital aircraft instrumentation to include pages, functions, and buttons</td>
<td>Goal of the course is to train the pilot to achieve the Perform level for Maneuver Grades, and the Manage/Decide level for Single Pilot Resource Management Grades (proficiency)</td>
<td>The following elements will be used in conjunction with the overall course completion standards: Desired Outcome Task Checklist List of Assessment Items Lesson Completion Standards</td>
</tr>
<tr>
<td>NA</td>
<td>Study Unit 3: Completion requirements – the student is able to use the digital aircraft instrumentation to execute coupled approaches</td>
<td>Outcomes for Maneuver Grades: Explain Practice Perform</td>
<td>Desired Outcomes – is the grade the Cirrus pilot has achieved for the particular task (Describe, Explain, Practice, Perform, Manage/Decide)</td>
</tr>
<tr>
<td>NA</td>
<td>Study Unit 4: Completion requirements – the student is able to use the digital instrumentation to execute Flight Director accompanied approaches</td>
<td>Outcomes for Maneuver Grades Explain: At the completion of the scenario the PT will be able to describe the scenario activity and understand the underlying concepts, principles, and procedures that comprise the activity. Significant instructor</td>
<td>Task Checklist – these items need to be completed by the Cirrus pilot to the appropriate desired outcome</td>
</tr>
</tbody>
</table>
| NA | Study Unit 5: Completion requirements – the student is able to use the digital instrumentation to execute coupled approaches | Outcomes for Maneuver Grades
Practice:
At the completion of the scenario the PT will be able to plan and execute the scenario activity. Coaching and/or assistance from the CFI will correct minor deviations and errors identified by the CFI. | List of Assessment Items – explanation of what needs to be observed by the instructor for the Cirrus pilot to meet the desired outcome for each task |
| NA | Study Unit 6: Completion requirements – Appropriate performance is the ability to utilize the digital instrumentation to accomplish instrument approaches using all resources provided by a “glass” airplane. Students should be able to fly IFR in the airplane without any assistance at this point in order to receive a logbook endorsement indicating that the pilot is qualified to operate N786BG as PIC |
| NA | Student performance will be evaluated on | Outcomes for Single Pilot Resource |
| NA | | Within each lesson the instructor and |
| the basis of Federal Aviation Administration Practical Test Standards to a minimum of a Private Pilot certification level | Management Grades
Explain:
The PT can verbally identify, describe, and understand the risks inherent in the flight scenario. The student will need to be prompted to identify risks and make more decisions. | Cirrus pilot will reference the task checklist for each lesson and the appropriate assessment items to determine whether each task is complete to the minimum desired outcome needed to meet the lesson completion standards |
| --- | --- | --- |
| NA | Outcomes for Single Pilot Resource Management Grades Practice:
The PT is able to identify, understand, and apply SRM principles to the actual flight situation. Coaching, instruction, and/or assistance from the CFI will quickly correct minor deviations and errors identified by the CFI. The student will be an active decision maker | (IFR) The instructor is responsible for ensuring the Cirrus pilot meets acceptable standards in all subject matter areas, procedures, maneuvers included in the tasks within the appropriate instrument rating practical test standards required for an IPC |
| NA | Outcomes for Single Pilot Resource Management Grades Manage/Decide:
The PT can correctly gather the most important data available both within and outside the cockpit, identify possible course of action, evaluate the risk inherent in each course of action, and | (IFR) Certificate of completion will be awarded at the satisfactory completion of lesson 10 when the Cirrus pilot has met the required desired outcomes for all required tasks while demonstrating judgment, aeronautical decision making abilities, |
make the appropriate decision. Instructor intervention is not required for the safe completion of the flight.

<table>
<thead>
<tr>
<th>NA</th>
<th>A certificate will not be issued unless the Perform, Manage/Decide level is achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>Upon successful completion of the ground training, the pilot will be familiar with the G1000 system</td>
</tr>
</tbody>
</table>

single-pilot resource management and risk management skills to safely fly a Cirrus aircraft under IFR.
## APPENDIX I. RECOMMENDATIONS COMPARATIVE ANALYSIS MATRIX

Digital Cockpit Instrumentation Transition Protocol Recommendations  
Catherine E. Smith  
Matrix Comparative Analysis

A. Course Structure:

<table>
<thead>
<tr>
<th></th>
<th>Avidyne</th>
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<th>Cessna</th>
<th>Cirrus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Manufacturer</td>
<td>Collegiate Flight Training School</td>
<td>Aircraft Manufacturer</td>
<td>Aircraft Manufacturer</td>
<td></td>
</tr>
<tr>
<td>Entegra system ideal for high-performance single engine aircraft, piston twin engine aircraft, turboprop engine aircraft, and light jets.</td>
<td>Digital cockpit transition course</td>
<td>Digital cockpit transition course, designed to transition pilots from traditional panel to TAA, but because of time constraints is not designed to make customer an expert, but rather to provide the customer with the tools to begin using the G1000</td>
<td>Digital cockpit transition course, designed to transition current and proficient pilots into all models of Cirrus aircraft to a VFR proficiency level (or high level of instrument competency if IFR transition)</td>
<td></td>
</tr>
<tr>
<td>VFR/IFR Ground*</td>
<td>VFR/IFR</td>
<td>VFR/IFR</td>
<td>VFR/IFR</td>
<td></td>
</tr>
<tr>
<td>NA</td>
<td>Flight: Basic VFR operations, instrument approaches, abnormal and emergency approaches</td>
<td>Flight: Basic VFR operations, instrument approaches, abnormal and emergency approaches</td>
<td>Flight: Basic VFR operations, instrument approaches, abnormal and emergency approaches</td>
<td></td>
</tr>
<tr>
<td>NA</td>
<td>4-6 day course</td>
<td>3 day course</td>
<td>3 days VFR, 5 days IFR</td>
<td></td>
</tr>
<tr>
<td>NA</td>
<td>No BFR</td>
<td>Optional BFR (additional training time arranged)</td>
<td>Optional BFR (additional training time arranged)</td>
<td></td>
</tr>
</tbody>
</table>
| NA | No IPC or BFR endorsements or training during transition course – focus on transition not learning aircraft type | No high performance, IPC or BFR endorsements or training during transition course (unless additional training arranged) | IPC included in conjunction with final evaluation flight (IFR)  
High performance endorsement will be awarded at the successful |
<p>| NA | Flight training course requirement of BGSU Bachelor of Science in Technology degree program | FITS certificate upon completion | FITS certificate upon completion and course flight and ground time summary |
| NA | Blend of skills and scenario-based training, not FITS approved course | FITS scenario based learning, FITS approved training course, FITS curriculum designed to accommodate pilots with various levels of experience | FITS scenario based learning, FITS approved training course, FITS curriculum designed to accommodate pilots with various levels of experience |
| Integrated flight decks – enhanced safety, capability, and reliability | Philosophy: make flying safer, more accessible and more enjoyable for pilots and their passengers. | FITS – purpose of scenario based training is to change the thought processes, habits and behaviors of the pilot during the planning and execution of the scenario | FITS – emphasis placed on developing judgment, aeronautical decision making, risk management and single pilot resource management throughout the use of scenario based training |
| Entegra Integrated Flight Deck System for new aircraft install, Envision for existing aircraft | Audience of junior-level collegiate aviators in university flight school setting | New aircraft purchase customers* or upgrade customers, typically adult learner | New aircraft purchase customers, typically adult learner |
| NA | Complex aircraft pre-training required, Instrument competency prior to flight | No pre training study material mandated | Pre training materials study required prior to starting transition training and for on-time completion |
| NA | Complex aircraft required, TAA | In customer’s Cessna Single Engine Piston | In any Cirrus model aircraft, TAA |</p>
<table>
<thead>
<tr>
<th>Supportive services with Avidyne technical support, and partners (Piper Aircraft, Jeppesen, Cirrus, Columbia, MFD, Aerosim Technologies), Manuals in Technical Publications Library, Downloadable Entegra/Envision Freeplay Simulator, Interactive Training Software, GPS Simulator</th>
<th>Supportive Reference information provided in ground training course and Avidyne manual</th>
<th>Supportive information on checklist usage, G1000 operating procedures, and use of G1000 for instrument approaches</th>
<th>Supportive Reference List Materials provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>Instrument competency level required in PCATD prior to advancing to flight training lessons</td>
<td>No mention</td>
<td>No mention</td>
</tr>
<tr>
<td>NA</td>
<td>No mention</td>
<td>No mention</td>
<td>All Cirrus pilots should follow the recurrent schedule outlined in the Cirrus Pilot Learning Plan after successful completion of the transition training event</td>
</tr>
</tbody>
</table>

B. Training Requirements and Training Course Outline:

<table>
<thead>
<tr>
<th>Avidyne</th>
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<th>Cessna</th>
<th>Cirrus</th>
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<tbody>
<tr>
<td>Integrated flight decks – enhanced safety, capability, and reliability</td>
<td>9 hours minimum ground training, 3 hours required briefing (pre/post flight)</td>
<td>8 hours Ground (2 modules, 4 hours each)</td>
<td>8 hours minimum ground training/Pre Post time (time under Ground/ Pre Post Time is and approximate and may vary based on experience and scenario)</td>
</tr>
<tr>
<td>Philosophy: make flying safer, more accessible and more enjoyable for pilots and their passengers</td>
<td>9 hours minimum flight time (2 hours minimum PCATD, 7 hours minimum actual flight training)</td>
<td>4-6 hours actual Flight hours (3 scenarios, 3 hours each including pre/debrief time)</td>
<td>10 hours minimum flight training (7 hours in airplane, maximum of 3 hours in an approved FTD may be used towards the 10 hour minimum course flight time requirement) Minimum of 20 landings</td>
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<tr>
<td>Training Software: Full-Function EX500 and EX5000 Simulator with CMax and MultiLink. Interactive Training Software designed to emulate the FlightMax EX500 and EX5000 MFD in either 4-knob (radar capability) or 2-knob (non-radar) modes on your PC. Software includes CMax Electronic Charts and a demonstration version of both XM broadcast and 2-way Datalink weather. GPS Simulator</td>
<td>Ground Training Topics: “Switchology”, familiarization with digital instrumentation position, function, programming, mode awareness, level of automation, Review of aircraft systems, Digital instrumentation function, GPS programming practice, Avidyne PowerPoint material lesson, Piper Arrow, PA 28R-201 analog vs. digital differences training lesson, Avidyne PFD, MFD, and S Tec 55 autopilot manuals</td>
<td>Ground Training Module One: 4.0 hours, System components, Display overview, FD/Autopilot Pre-flight and Operation Introduction, System start-up, PFD overview, MFD overview</td>
<td>(VFR transition training course) 7 required lessons, 1 optional (BFR)</td>
</tr>
<tr>
<td>NA</td>
<td>Study Unit One: Dual simulation time in Personal Computer Aircraft Training Device (PCATD), 2.0 hours minimum (could be more depending of level of instrument and autopilot competency)</td>
<td>Ground Training Module Two: 4.0 hours, MFD advanced, expanded autopilot operations, WAAS, System malfunctions, Audio Panel Operations, Aircraft Systems</td>
<td>(IFR transition training course) 10 required lessons, 1 optional (BFR)</td>
</tr>
</tbody>
</table>
demonstrated), Content to include IFR clearance and read back, IFR departure procedures, 2 non-precision (VOR, LOC) and 1 precision (ILS) hand flown, followed by 2 non-precision and 1 precision flown utilizing autopilot functions to MDA/DH, effective use of autopilot operations, Required completion prior to proceeding to study unit two, Pre/Post Briefing (by the flight instructor) to brief the student in PCATD operations and autopilot use and to ensure that the student is proficient in instrument flight, Objective is to review and increase instrument proficiency as well as introduce autopilot operations, Completion requirements – the student is able to navigate safely through the national airspace system and is current in instrument flight.

| NA | Study Unit Two: 2.0 hour dual flight training, 1.0 hour ground training, Ground instruction | Flight Training Scenario One: 3.0 hours, VFR, unfamiliar airport operation, scenario | Lesson 1 (Ground Lesson): Introduction to scenario-based training and Cirrus transition training. |
for cockpit familiarization and dual flight time in PA 28R-201 with an instructor, the flight will consist of commercial pilot maneuvers, Content will include cockpit familiarization, commercial flight maneuvers, emergency procedures, effective autopilot/flight director use, Pre/Post Briefing (by the flight instructor) to brief the student on digital aircraft instrumentation operations and autopilot use and to ensure that the student is proficient in the basic use of the digital aircraft instrumentation for visual commercial pilot maneuvers, Objective of lesson is to introduce the student to the safe and efficient use of digital aircraft instrumentation, Completion requirements – the student is able to use the basic functions of digital aircraft instrumentation to include pages, functions, and buttons

| NA | Study Unit Three: 1.0 | Flight Training | Lesson 2 (Flight Planning, normal preflight and cockpit procedures, before takeoff checklist, takeoff, climb procedures, cruise procedures, PFD crosscheck, flight maneuvers, G1000 programming, flight director/autopilot operations, situational awareness aids, descent planning and execution, landing, aircraft shutdown and securing procedures) Includes a review of pre-training materials including model-specific topics, and a session in a cockpit procedures trainer |
| Study Unit Four: 1.0 hour minimum dual flight training, Dual flight time in PA 28R-201 with an instructor, the flight will consist of hand flown approaches, Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (hand flown), effective autopilot/flight director use, Pre/Post Briefing (by the flight instructor) to brief the student on digital aircraft instrumentation operations and autopilot use with emphasis on approaches, and to ensure that the student is proficient in the basic use of the digital aircraft instrumentation and coupled approaches, Objective of lesson is to continue to introduce the student to efficient use of digital aircraft instrumentation, Completion requirements – the student is able to use the digital aircraft instrumentation to execute coupled approaches | Scenario Two: 3.0 hours, IFR to unfamiliar airport, Normal preflight and cockpit procedures, PFD/Instrument crosscheck, G1000 programming, flight director/autopilot operations, instrument approach procedures | Lesson): Introduction to the operational characteristics of Cirrus aircraft. Focus will be on maneuvers and takeoffs and landings in various configurations and situations |
| Flight training, Dual flight time in PA 28R-201 with an instructor, the flight will consist of approaches utilizing the Flight Director, Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (Flight Director), effective autopilot/flight director use, Pre/Post Briefing (by the flight instructor) to brief the student on digital instrument operations and Flight Director use with emphasis on approaches, and to ensure that the student is proficient in the basic use of the digital instrumentation and Flight Director assisted approaches, Objective of lesson is to continue to introduce the student to efficient use of digital aircraft instrumentation Completion requirements – the student is able to use the digital instrumentation to execute Flight Director accompanied approaches | to normal procedures. It is a 3-leg cross country where the Cirrus pilot will implement normal procedures including checklists, enroute procedures, and arrival procedures |
| NA | Study Unit Five: 1.0 hour minimum dual flight training, Dual flight time in PA 28R-201 with an instructor, the flight will consist of approaches utilizing a coupled autopilot, Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (coupled autopilot), effective autopilot/flight director use, Pre/Post Briefing (by the flight instructor) to brief the student on digital instrument operations and autopilot use with emphasis on approaches, and to ensure that the student is proficient in the basic use of the digital instrumentation and coupled approaches, Objective of lesson is to continue to introduce the student to efficient use of digital aircraft instrumentation Completion requirements – the student is able to use the digital instrumentation to execute coupled approaches | Lesson 4 (Flight Lesson): Focus on abnormal and emergency procedures that are somewhat common to all aircraft. It is a 3-leg cross country. The desired outcomes of this lesson are best achieved in a Flight Training Device (FTD), but the use of an aircraft is acceptable |
| NA | Study Unit Six: 2.0 | Lesson 5 (Flight }
hour minimum dual flight training, Dual cross country flight time in PA 28R-201 with an instructor, the flight will be a review of all approach types covered in the course, these approaches will include coupled, flight director, and hand-flown instrument approaches, Content will include IFR clearance and read back, IFR procedures, Instrument Approach procedures (at 2 airports other than 1G0), effective autopilot/flight director use, Pre Briefing – Instructors will ask the students questions to determine if they have been reading and have a good understanding of how to use the instrument panel. Instructors will review the student’s IFR cross-country planning and filing to determine if it is suitable for the route. Post Briefing – The flight instructor will ensure that the student is proficient in the use of the avionics.

Lesson): Focus on avionics malfunctions. It is a 3-leg cross country that will focus on abnormalities with the PFD, MFD, autopilot and GPS receivers.
digital instrumentation and all of the resources that the glass arrow provides for executing instrument approaches. These resources include use of the flight director and the autopilot. Following the flight, the instructor will give an overview of the student’s performance. Objective of lesson is to continue to introduce the student to efficient use of digital aircraft instrumentation. Completion requirements – Appropriate performance is the ability to utilize the digital instrumentation to accomplish instrument approaches using all resources provided by a “glass” airplane. Students should be able to fly IFR in the airplane without any assistance at this point in order to receive a logbook endorsement indicating that the pilot is qualified to operate Bowling Green State University’s Digital Instrumentation Piper.
| Arrow (N786BG) as pilot in command | Lesson 6 (Flight Lesson): Focus on systems malfunctions. It is a 3-leg cross country that will emphasize good ADM and risk management while generating acceptable solutions to malfunctions of systems of the aircraft. |
| NA | Lesson 7 (Flight Lesson): Final evaluation flight. It is a 2-leg cross country in which the Cirrus pilot will demonstrate the knowledge and skill required to safely fly the Cirrus aircraft in single pilot operations. |
| NA | Optional Lesson: Biennial Flight Review |
| NA | (IFR) Lesson 1 (Ground Lesson): An introduction to scenario-based training and Cirrus transition training. Includes a review of pre-training materials including model-specific and IFR topics, and a session in a cockpit procedures trainer, hot bench, or a computer-based avionics trainer. |
| NA                  | (IFR) Lesson 2  
(Flight Lesson): Introduction to the operational characteristics of Cirrus aircraft. Focus on maneuvers in addition to takeoffs and landings in various configurations and situations. |
|---------------------|---------------------------------------------------------------|
| NA                  | (IFR) Lesson 3  
(Flight Lesson): Introduction to normal VFR procedures and some Basic Attitude Instrument Flying (BAIF) in Cirrus aircraft. Consists of 3-leg cross country in which the Cirrus pilot will implement normal procedures including checklists, enroute procedures, and arrival procedures. Instrument approaches will be conducted visually to acquaint Cirrus pilots with basic instrument procedures while using the autopilot. |
| NA                  | (IFR) Lesson 4  
(Flight Lesson): Introduction to basic instrument procedures. Cirrus pilot will conduct various types of instrument approaches under simulated or actual |
Instrument conditions. Both hand flying and autopilot usage will be accomplished.

| NA       | (IFR) Lesson 5 (Flight Lesson): Cirrus pilot will continue to develop basic instrument skills while being introduced to advanced IFR procedures. Consists of 3-leg cross country in which the Cirrus pilot will conduct enroute procedures, arrival and departure procedures, and holding procedures. Practice with and without the use of the GPS/FMS will be accomplished. |
| NA       | (IFR) Lesson 6 (Flight Lesson): Cirrus pilot will be introduced to abnormal and emergency procedures while in simulated instrument conditions. Consists of 3-leg cross country that is best performed in a Flight Training Device (FTD), but may be accomplished in the aircraft if necessary. |
| NA       | (IFR) Lesson 7 (Flight Lesson): Focus on systems malfunctions while in simulated instrument conditions. |
| NA | | Conditions. Consists of 3-leg cross country that will emphasize proper ADM and risk management while generating acceptable solutions to simulated malfunctions of various aircraft systems. |
| NA | | (IFR) Lesson 8 (Flight Lesson): Focus on avionics malfunctions while in simulated instrument conditions. Consists of 3-leg cross country that will focus on simulated abnormalities with the PFD, MFD, autopilot, and GPS receivers. |
| NA | | (IFR) Lesson 9 (Flight Lesson): Lesson will give the Cirrus pilot a chance to apply his/her knowledge by conducting an IFR scenario. This scenario will be modeled after Line Oriented Flight Training (LOFT). It is best performed in an FTD but may be accomplished in an aircraft if necessary. Lesson will also serve as a review lesson that will give the Cirrus pilot a change to enhance his/her skills to prepare for the final |
NA | (IFR) Lesson 10 (Flight Lesson): Final evaluation flight. Consists of 3-leg cross country in which the Cirrus pilot will demonstrate the knowledge and skill required to safely fly the Cirrus aircraft in single pilot IFR operations. Content of this lesson is modeled around scenario based training and includes all tasks required by the FAA Instrument PTS to complete and IPC. 

NA | Optional Lesson: Biennial Flight Review

C. Evaluation:

<table>
<thead>
<tr>
<th>Avidyne</th>
<th>BGSU</th>
<th>Cessna</th>
<th>Cirrus</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>Additional Note section in grade record for instructor comments regarding student performance</td>
<td>Purpose of scenario based training is to change the thought processes, habits, and behaviors of the pilot during the planning and execution of the scenario</td>
<td>Certificate of completion will be awarded at the satisfactory completion of lesson 7 when the Cirrus pilot has met the required desired outcomes for all required tasks while demonstrating judgment, aeronautical decision making abilities, single-pilot resource management and risk management skills to</td>
</tr>
<tr>
<td>NA</td>
<td>Study Unit 1: Completion requirements – the student is able to navigate safely through the national airspace system and is current in instrument flight</td>
<td>Course completion standards are measured on a scale of desired outcomes for both Maneuver Grades and Single Pilot Resource Management Grades</td>
<td>The Cirrus pilot shall perform the maneuvers and procedures at the standard defined in the FAA Practical Test Standards (or international equivalent) for the pilot certificate held</td>
</tr>
<tr>
<td>NA</td>
<td>Study Unit 2: Completion requirements – the student is able to use the basic functions of digital aircraft instrumentation to include pages, functions, and buttons</td>
<td>Goal of the course is to train the pilot to achieve the Perform level for Maneuver Grades, and the Manage/Decide level for Single Pilot Resource Management Grades (proficiency)</td>
<td>The following elements will be used in conjunction with the overall course completion standards: Desired Outcome Task Checklist List of Assessment Items Lesson Completion Standards</td>
</tr>
<tr>
<td>NA</td>
<td>Study Unit 3: Completion requirements – the student is able to use the digital aircraft instrumentation to execute coupled approaches</td>
<td>Outcomes for Maneuver Grades: Explain Practice Perform</td>
<td>Desired Outcomes – is the grade the Cirrus pilot has achieved for the particular task (Describe, Explain, Practice, Perform, Manage/Decide)</td>
</tr>
<tr>
<td>NA</td>
<td>Study Unit 4: Completion requirements – the student is able to use the digital instrumentation to execute Flight Director accompanied approaches</td>
<td>Outcomes for Maneuver Grades Explain: At the completion of the scenario the PT will be able to describe the scenario activity and understand the underlying concepts, principles, and procedures that comprise the activity. Significant instructor</td>
<td>Task Checklist – these items need to be completed by the Cirrus pilot to the appropriate desired outcome</td>
</tr>
<tr>
<td>NA</td>
<td>Study Unit 5: Completion requirements – the student is able to use the digital instrumentation to execute coupled approaches</td>
<td>Outcomes for Maneuver Grades Practice: At the completion of the scenario the PT will be able to plan and execute the scenario activity. Coaching and/or assistance from the CFI will correct minor deviations and errors identified by the CFI.</td>
<td>List of Assessment Items – explanation of what needs to be observed by the instructor for the Cirrus pilot to meet the desired outcome for each task</td>
</tr>
<tr>
<td>NA</td>
<td>Study Unit 6: Completion requirements – Appropriate performance is the ability to utilize the digital instrumentation to accomplish instrument approaches using all resources provided by a “glass” airplane. Students should be able to fly IFR in the airplane without any assistance at this point in order to receive a logbook endorsement indicating that the pilot is qualified to operate N786BG as PIC</td>
<td>Outcomes for Maneuver Grades Perform: At the completion of the scenario the PT will be able to perform the activity without assistance from the CFI. Errors and deviations will be identified and corrected by the PT in an expeditious manner. At no time will the successful completion of the activity be in doubt. “Perform” will be used to signify that the PT is satisfactorily demonstrating proficiency in traditional piloting and systems operation skills.</td>
<td>Lesson Completion Standards – explanation of the requirements to consider each lesson complete or incomplete</td>
</tr>
<tr>
<td>NA</td>
<td>Student performance will be evaluated on</td>
<td>Outcomes for Single Pilot Resource</td>
<td>Within each lesson the instructor and</td>
</tr>
</tbody>
</table>
| the basis of Federal Aviation Administration Practical Test Standards to a minimum of a Private Pilot certification level | Management Grades

Explain:
The PT can verbally identify, describe, and understand the risks inherent in the flight scenario. The student will need to be prompted to identify risks and make more decisions. | Cirrus pilot will reference the task checklist for each lesson and the appropriate assessment items to determine whether each task is complete to the minimum desired outcome needed to meet the lesson completion standards |
|---|---|---|
| NA | Outcomes for Single Pilot Resource Management Grades Practice:
The PT is able to identify, understand, and apply SRM principles to the actual flight situation. Coaching, instruction, and/or assistance from the CFI will quickly correct minor deviations and errors identified by the CFI. The student will be an active decision maker | (IFR) The instructor is responsible for ensuring the Cirrus pilot meets acceptable standards in all subject matter areas, procedures, maneuvers included in the tasks within the appropriate instrument rating practical test standards required for an IPC |
| NA | Outcomes for Single Pilot Resource Management Grades Manage/Decide:
The PT can correctly gather the most important data available both within and outside the cockpit, identify possible course of action, evaluate the risk inherent in each course of action, and | (IFR) Certificate of completion will be awarded at the satisfactory completion of lesson 10 when the Cirrus pilot has met the required desired outcomes for all required tasks while demonstrating judgment, aeronautical decision making abilities, |
| NA | A certificate will not be issued unless the Perform, Manage/Decide level is achieved |
| NA | Upon successful completion of the ground training, the pilot will be familiar with the G1000 system |

| NA | single-pilot resource management and risk management skills to safely fly a Cirrus aircraft under IFR |

- Make the appropriate decision. Instructor intervention is not required for the safe completion of the flight.
APPENDIX J. TRANSISTION PROTOCOL SURVEY

Digital Cockpit Instrumentation Transition Protocol Survey

Introduction of Thesis Intention:
The purpose of this study is to analyze, develop, and validate a training protocol for glass cockpit transition training in collegiate aviation, due to recent changes in instrumentation from analog to digital.

Survey Purpose:
The purpose of this survey is to determine if this training protocol effectively provides a method of transition training from analog cockpit instrumentation to digital cockpit instrumentation for a collegiate aviation flight training student.

Survey: Please respond to the survey statements using the following scale:

1. The training protocol is complete for a collegiate level flight program.
2. The training protocol is rigorous.
3. The training protocol is sufficiently deep for a collegiate level flight program.
4. The training protocol is structured logically for a collegiate level flight program.
5. The training protocol has an adequate amount of ground training for VFR pilot qualification.
6. The training protocol has an adequate amount of ground training for IFR pilot qualification.
7. The training protocol has an adequate amount of flight training for VFR pilot qualification.
8. The training protocol has an adequate amount of flight training for IFR pilot qualification.

In your own words, please respond to the following question.

9. What would you change, add, or suggest to improve or modify the training protocol?

**Demographic Data:**
I assure that all data will be reported out in aggregate.

Name: ________________________________
Company: ________________________________