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Designated Pilot Examiner's Perception of Private Pilot Certification in General Aviation Advanced Technology Cockpits

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All aircraft require some degree of instrumentation. With the explosion of computer and flat panel display technology, the "glass cockpit" has entered aviation. In the past, pilots transitioned into the new technology after years of flight experience. These pilots already understood: the regulations, principals of flight, navigation, and the performance characteristics of their aircraft. The new glass equipped cockpits are now entering the environment of primary flight training where pilots are still learning the basics. Additionally, there is no structured or generally accepted methodology for training in advanced cockpits. The FAA has not established specific new guidelines for pilot-in-command for these aircraft nor much guidance to Flight Examiners (FEs) that must perform the actual certification of new pilots. The basic research question being explored is whether Designated Flight Examiners perceive whether the current FAA certification process is adequate for a private pilot to safely operate advanced technology in GA aircraft?

All aircraft require some degree of instrumentation in order to operate, but they differ in degree of complexity. The instrumentation can be categorized into: engine and aircraft performance, navigation, communication, and flight management. The complexity of the instrumentation is a function of the aircraft type and the flight environment. The necessity for "safety of flight" requires redundancy for many of these devices, which further increases cockpit complexity and density.

Until recently these individual equipment items were typically self-contained with their own displays and dedicated controls. Each was also individually connected to the central electrical buss. Other instruments, such as: altimeters, air speed and rate of climb indicator instruments utilized only vacuum and/or static pressure sources in order to operate. Despite being produced by different manufacturers, these devices had the same basic appearance, operated in a similar manner, and were certified under FAA Technical Standard Orders (TSOs).

The term "glass cockpit" refers to the flat panel displays common in modern laptop computers. The glass cockpit originated in military aircraft where it became a necessary in order to display the multitudes of information required to fly military missions. The finite real estate in military aircraft also made these compact/high density displays a necessity. With the advancement of microelectronics/microprocessors, glass cockpit displays have taken on even more functionality

including flight management and mission planning. As the glass cockpit technology matured, these devices moved into the commercial sector. They first appeared in the Boeing 757 aircraft. Glass cockpits have become even more wide spread. In fact, these devices are now available: on new production general aviation aircraft and as retrofits kits for older general aviation aircraft.

Statement of the Problem

Recent advances in glass cockpit systems include enhanced situational awareness. The new features include: terrain, XM weather, traffic information service, airways, airport, and IFR approaches all of which can be displayed in a variety of formats and overlays. This variety and density of informational content, multiple display-formats, new symbology, and computational capability of Technology Advanced Aircraft (TAA) creates concerns about the effectiveness of current training methodology and certification process. "The common denominator in all these changes is the need to have an adaptable flight training system that will not only maintain but greatly improve the safety and utility of general aviation flight operations" (Wright, 2002).

The integrated glass systems have a vast amount of flight information, databases, and presets available. The databases required frequent updates. System software is also routinely updated to correct errors or add new features. Also these systems permit tailoring of their presentation at the user's discretion. A pilot using rental aircraft that had limited training on these systems could be placed in a challenging or confusing situation (AOPA 2007). This could lead to a potential safety hazard. The enhanced situation awareness within the cockpit further decreases the amount of time pilots to look outside the aircraft.

These high-tech aircraft are being placed into service at many flight-training facilities yet many training programs have not been adapted to reflect the required changes in learning strategy. In an Aviation Monthly 2004 Safety Report, it stated that pilots were "on their own" with respects to learning the new technology. The article points out that "the one size fits all approach" or the traditional method of training is no longer adequate. An APOA Safety Foundation report stated "training to use nontraditional avionics using traditional methods is not optimal" an goes on further to say "any training institution or CFI that attempts to do in-the-air training on advanced IFR GPS navigators, FMSs, or glass cockpit aircraft before having a through introduction and practice on ground via similar, ground powered aircraft, or at the very least with computer based instruction, is just not performing in the best interests of the client" (AOPA 2007).

The FAA has recognized the changing environment of advanced avionics and TAA and created the FITS program. While FITS is a step forward for training in advanced technology, it is not a mandatory requirement. Also, the FAA has begun updating certain publication to reflect the changing environment of TAA. Specifically, the Instrument Flying Handbook (FAA-H-8083-15A) has been revised to include the depiction and interpretation of flight information on glass systems. Discussions with multiple flight centers indicate no structured or generally accepted methodology for training TAA. According to one survey, reading printed media (manuals) are not found to be helpful with advanced avionics because they are not interactive (AOPA 2007).

Research Questions

To date, the FAA has not established specific new guidelines for pilot-in-command for these aircraft: no special endorsement or sign-off is required. Related to this matter, the FAA has provided little guidance to Flight Examiners (FEs) that must perform the actual certification of new pilots. Contact with several FEs in Oklahoma has showed this to be a concern.

An FAA Aviation News article addressed concerns of FAA's GA OPS inspectors or FE not having sufficient training in TAA aircraft to affective fly these aircraft and utilize the onboard systems. Specifically, the article pointed out that one manufacturer's glass system does not necessarily respond or display information the same as another's. Also, there is an inability to demonstrate certain system failures without experiencing a true failure.

The governing regulations concerning general aviation flight training are contained in the Federal Aviation Regulations (FAR) Part 61 for certification of pilots, flight instructors, and ground instructors and Part 141 for pilot schools (Wright, 2002). These regulations have not seen substantial changes since 1977 even though FAA officials have noted: "emerging changes in system safety philosophy and changes in NAS flight procedures and in flight technologies may call for a new approach to flight training" (Wright, 2002).

There is a need to know the extent to which Flight Examiners perceive a problem with the current private pilot certification process with respect to the operation of TAA that could have a negative impact on aircraft safety. The primary research question of this study is "Do Designated Flight Examiners perceive that the current FAA certification process is adequate for a private pilot to safely operate in the National Airspace System with the introduction of advanced technology in GA aircraft?"

Methodology

This research consisted of a survey instrument mailed to a random sample of the FAA DPE population of 1076 examiners. Every member of the DPE population had an equal chance of being selected (Fraenkel & Wallen, 2003, p270). The Stat Trek website was utilized to generate a table of 250 random numbers ranging from 1 to 1076.

A similar survey of all DPE's conducted by the FAA received a 64% response rate (Hackworth, King, Cruz, Thomas, Roberts, Bate, and Moore, 2007). It was anticipated that a similar response rate was achievable for this study because of the apparent high interest in this topic and the ability of this research to allow DPEs to voice their concerns and potential influence the FAA to take action.

The two-fold goal of the survey instrument was first to profile the general population of DPEs exposure to advanced technology. This profile identified what aircraft flown, what advanced technology, how they prepared themselves for exploiting the technology, number of practical test given, and their perceptions of the current requirements for pilot certification in advanced technology and its impact on safety. The second goal was to select DPEs for an in depth

interview into what may be needed to improve the process for preparing pilot for the advancing technology.

Results

Surveys were mailed to one hundred randomly selected DPEs. Forty six valid responses were received. Based on the consistency of the results from the returned surveys, the decision was made that additional surveys would not need to be mailed. The results from the survey are discussed below.

The questionnaire profiled the DFEs' experience and qualification as FAA examiners. DPE experience range from 2 years to 61years with an average of 17.4 years. Within the past 12 months, DFEs average 70 practical tests each of which 8.8 were given in ADT/TAA. Worth noting, 17 of 46 DFEs or 37% reported giving no practical tests in ADT/TAA within the past 12 months.

The heart of the questionnaire dealt with DFEs' perceptions of the certification process and performing Practical Tests in Advanced Technology equipped aircraft. The questionnaire was sectioned to explore perceptions on: FAA guidance & regulations, safety impacts, knowledge & training requirements, performing practical test, and examiner training.

The DFEs were asked whether they were satisfied with the current FAA guidance and regulations for certifying new Airmen in Advanced Display equipped aircraft. Of the DFEs responding to the questionnaire, the majority or 64% are indeed satisfied.

The DFEs were asked whether the experience, practical test, and knowledge requirements were adequate. Again, the majority of DFEs responding agree that these requirements are adequate at 56%, 66%, and 67% respectively (*Figure 1*. It is worth noting that the adequacy of pilot experience requirements is approximately 10% below the practical test and knowledge requirements. Several DPEs commented in the remarks section of the questionnaire that the insurance companies often dictate the experience requirements for flying TAA/ADT equipped aircraft.

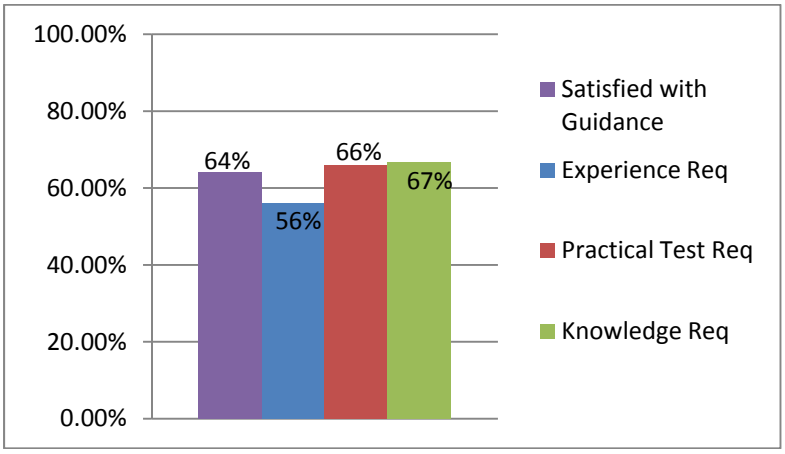

Figure 1. Adequacy of FAA guidance and regulations.

The DFEs were asked whether pilot licenses should specify either traditional or ADT equipped aircraft. The response was overwhelmingly "NO" at 86%. Asked if a Flight Instructor's logbook endorsement should be required for ADT equipped aircraft, 65% of DFEs responding agree to a one-time logbook endorsement but only 44% agree that the endorsement should be model specific (*Figure 2)*.

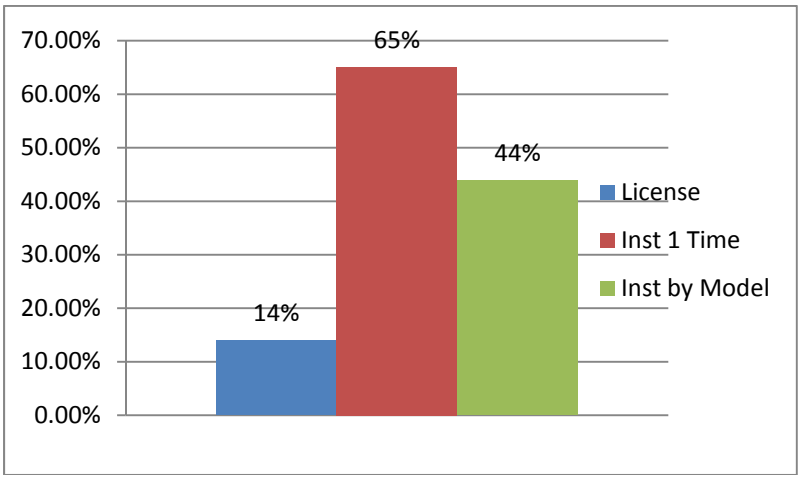

Figure 2. Technology endorsement recommendations.

With the ability of Advanced Display Technology to alert pilots of potential danger, examiners were asked whether they perceived an effect on risk-taking behavior with usage of this technology in various flight conditions. The DPEs believe that ADT effects is to fly in lower visibility (23 DPEs), fly in hazardous weather (21 DPEs), and fly lower altitude (12 DPEs), fly closer to terrain (11 DPEs), and closer to other aircraft (6 DPEs). 12 DPEs believe ADT had no effect on risk-taking behavior (*Figure 3)*.

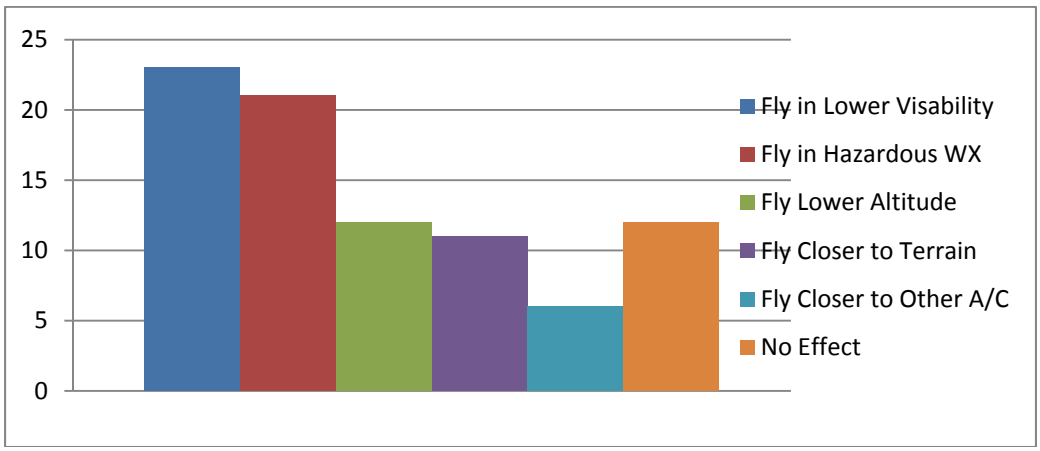

Figure 3. Flight examiner perceptions concerning safety of flight with ADT aircraft

Examiners were asked if they were required to demonstrate a specific feature or task associated with ADT during an FAA flight check and 48.8% agreed they had. When asked if they required

demonstration a specific feature or task associated with ADT during a PT, 92.7% agreed they do require a specific demonstration. DPEs were asked if there were tasks or procedures that were difficult to perform/demonstrate in ADT equipped aircraft and 72.2% agreed there were task difficult to perform. One examiner commented that performing partial panel operations was difficult in ADT. Asked if a procedural/aircraft simulator would be more suitable for demonstrating certain features or task associated with advanced avionics, 71% agreed a simulator would be more appropriate.

Summary of the Findings

The DPEs are generally satisfied with the FAA's guidance and regulations pertaining to certifying new airmen specifically with new cockpit technology and ATA. The examiners overwhelming agree that a pilot should have a logbook endorsement for the technology flown. Most DPEs perceive that ADT has created additional risk taking on the part of pilots. It appears that a standardized ADT training curriculum is needed. DPEs need to ensure applicants meet the requirements of the Practical Test Standards especially with respect to conventional navigation skills. Examiners and Certified Flight Instructors need to take responsibility for their own training and be proficient in the technology flown.

Acknowledgements

The results of the initial survey confirm the need for the next stage of this research – qualitative interviews with flight examiners to further explore the perceptions of the flight examiners. When asked whether they would be willing to participate in a follow-up telephone interview 87 percent of those who completed the survey were willing to assist further and only five declined outright. The complete results of the survey along with the results of the interviews will be published in the dissertation of Michael Friday.

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