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Student Enthusiasm for Part 135 Flight Simulations

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Abstract

The need to develop collegiate aviation simulation activities that mirror corporate and commercial operating practices, particularly those regulated by the Federal Aviation Administration (FAA) under Part 135 of Title 14 of the Code of Federal Regulations is critical for graduates to succeed in professional pilot careers in the future. New simulation technology, in particular the Personal Computer-Based Aircraft Training Devices (PCATDs) and it's extensive database of diverse aircraft and geographic features, is becoming an economical substitute to traditional simulation in many collegiate aviation education programs. In fact, research by the University of Illinois (Taylor, et al., 2003) substantiated the value of utilizing a PCATD in preparing pilots for an instrument proficiency check. With the distribution of AC 61-126 (U. S. Department of Transportation, 1997), the FAA recognized the value of PCATD simulations for instrument flight training, but this new technology is more then a simple duplication of flight training device-based aviation simulation efforts. It offers collegiate aviation educators opportunities to realistically duplicate Part 135 operating practices that students need to learn before pursuing employment within this industry.

As director of a cost conscious aviation education program at Bowling Green State University, I conducted an examination of the effectiveness of utilizing a PCATD for teaching high performance, instrument flight skills to senior students pursuing Part 135 employment. As this project progressed, I noted the enthusiasm students had for this PCATD simulation activity. The intent of this paper is to advocate the inclusion of Part 135 simulation activities in collegiate aviation education processes.

Introduction

Aviation educators have long sought economical ways to duplicate, or better described as simulate, the human processes necessary to safely operate an aircraft in flight and on the ground in a device other than an actual aircraft. The reasons for providing such simulations are many, but in particular represent a cost effective way to train and educate pilots as the costs associated with operating aircraft in flight lessons increase. The capability to simulate actual flight conditions, began in 1934 as the C-3 Link Trainer or "blue canoe" as it was called by the military pilots who used it. Flight simulation equipment grew in popularity through the 1980s resulting in the construction of multimillion dollar, multi-functional simulation marvels that remain a flight training foundation for every branch of the military as well as the major airlines world wide (Williams, 1994).

However, recent advances in software and hardware systems have allowed engineers to build much smaller, more cost effective devices that provide as accurate a simulation of Part 135 flight conditions as those bulky, stand alone facilities of the 1980s. One of the newest devices is the Personal Computer-based Aviation Training Device (PCATD). PCATDs are computer powered hardware and software devices, that are small enough to fit on a large table, have the same flight controls, levers, and instrumentation as an actual aircraft, and even emulate on computer monitors the various weather phenomena pilots encounter when they actually fly aircraft in poor meteorological conditions. These types of flight simulation devices, usually costing less then $20,000, represent a new and cost effective way to educate our students in commercial operating practices.

Expectedly, there has been an increase in the academic examination of PCATDs (Taylor, et al., 2003). As computer capabilities improve, and hardware configurations better represent the flight deck environment of operational aircraft, the PCATD has become a valuable educational tool for presenting realistic, high-quality representations of aircraft performance and instrumentation. Studies identified by Taylor et al. have provided evidence of the positive transfer of aircraft operating skills from the PCATD to the aircraft. Data from a study conducted by the Institute of

Aviation at the University of Illinois (as cited in Taylor et al.) indicates that the PCATD is as effective for teaching and retaining instrument flight skills as more traditional Flight Training Devices (FTDs).

Background

I joined the faculty of the aviation education program at Bowling Green State University in 2000, and quickly realized that this Federal Aviation Regulation Part 141 flight training environments needed to address the critical thinking skills and higher level learning required to operate high performance, turbine powered, multiengine aircraft. This flight school, plagued by a history of poor fiscal operating practices, was never going to be able to justify to a skeptical administration the value of purchasing a $250,000 simulator to provide laboratory instruction of Part 135 operating practices. After investigating the cost effectiveness of a two pilot PCATD to meet these needs, I successfully lobbied administrators to purchase a $15,000 Precision Flight Controls PCATD with software capable of simulating turbine powered aircraft, the aircraft operating in many Part 135 operations.

Simulation education at Bowling Green generally takes the form of lessons in a single pilot Frasca 141 FTD, in a single engine, piston, and non-visual configuration. Such simulations teach basic instrument procedures and approaches within a predetermine number of laboratory lessons. Flight instructors direct students through basic instrument flight maneuvers terminating with local instrument approaches. As long as the student shows proficiency in basic maneuvers and local approaches, they progress normally. None of these lessons are scripted for content, rather directed from instructor experience in the local flying environment.

Last summer I began the task of scripting PCATD simulation scenarios to teach seniors advanced levels of cognitive reasoning and critical thinking. The focus of such simulations, similar to a capstone course, was to allow students to synthesize all the learning they had accomplished in the flight education program. The first five simulations involved flying a light twin aircraft, in a two pilot configuration, from a controlled multi-runway airfield within Class B airspace. Since most of these students had recently completed their multiengine flight training, this simulation was a logical progression to learn Crew Resource Management skills. Additionally, I developed Pilot Fly (PF) and Pilot Not Flying (PNF) checklists so students would have to work as a *team* to successfully complete their simulation activity. All scenarios were scripted to represent Part 135 operations under Instrument Flight Rules (IFR), in controlled airspace, culminating in precision and non-precision terminal approaches in poor weather conditions, with various aircraft malfunctions, often diverting to alternate airfields.

The next semester I accelerated student learning by simulating a King Air aircraft. I was already introducing turbine aircraft systems, as well as airline-based flight deck operating practices in our traditional aircraft systems class, and wanted to extend this learning activity to a learn, practice, and gain proficiency learning process. Again, PF and PNF checklists were used, but this time I had students operate the King Air as a Part 135 charter operation from major urban airfields such as Denver, Salt Lake, Los Angeles, and San Francisco. Simulations now included flying Standard Instrument Departures (SIDs) into Class A airspace and holding at altitude. Enroute flight routes utilized the Jet Route structure, terminating with a Standard Terminal Arrival Routes (STARs) to a Precision Approach at another urban airfield, again in poor weather, with aircraft malfunctions, and diversion to alternate airfields. Additional activities such as revised enroute clearances and severe weather were added to challenge the best students.

Methods

Participants

My goal in recruiting participants in this study was to obtain comment from individuals with a mix of operational flight experience. Table 1 lists relevant demographic information on the five student volunteers from the class of ten students. I did achieve my goal of gaining a mix of flight experience. Two participants were Federal Aviation Administration (FAA) certified flight instructors for instruments (CFII), one had recently obtained a Commercial Pilot Certificate, and two students were still participating in the Commercial Pilot flight lab course.

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Table 1

Demographic Information of Participants

Participant*	Gender	Flight Experience	Class
Sue	Female	CFII	Senior
Joe	Male	Commercial - ME	Senior
Tom	Male	Private - Instrument	Junior
Sam	Male	CFII	Senior
Bill	Male	Private – Instrument	Junior

* All names used in this report are pseudonyms.

Data Collection

The methodology for this paper takes the form of a qualitative research ethnographic study that provides student views of using a PCATD to improve learning in a collegiate aviation culture. According to Creswell (1997), ethnography is a process of combining participant-observation with an analysis of qualitative sources as field notes, interviews, and videotaping, and is "an appropriate format to study participant's behavior, language, and artifacts" (p. 59). From the viewpoint of a university professor with over twenty years of military experience instructing commercial flight deck operating practices, and as teacher-researcher as well as participant-observer, I believe ethnography is appropriate to study this new learning activity. Additionally, as Maxwell (1996) writes, qualitative research is not primarily concerned with eliminating variance between researchers in values and expectations they bring to the study, but understanding how a particular researcher's values influence the conduct and conclusion of the study. Appropriately, my background not only motivated the creation of these simulations and this study, but also adds a degree of bias that readers need to be aware of. Creswell (2003) adds bias is part of an ethnographic study and once detailed, need not impact validity, adding that the narrative for ethnography should take the form of the first person, since the researcher is a participant-observer in this type of research process.

I met with each student in my office for one-on-one interviews after each had completed three King Air Part 135 lab simulations. Each interview began with the general question, "Are the simulations of Part 135 operating practices we're doing in the PCATD a valuable learning activity?" From there, we discussed whatever the student brought up as important to them when considering this educational activity. I took field notes during each lab lesson, taped each interview, transcribed the audiotapes, and made additional field notes as I listened to each discussion again.

Results

The primary theme of each interview was the student's enthusiasm for this simulation activity. As Bill said,

> It's a really good tool to let us use what we learned in the class for the bigger aircraft we talk about in class in relation to the real world. We learn what the systems are and when you get into the real world you'll know what's going on.

"As instructors," an enthusiastic Sue adds, "we're teaching all this stuff through Commercial and then you hop in the PCATD and have to work as a crew. That's all new and something we need to learn." All students echoed that this learning activity was worthwhile. Tom suggesting that, "We need to do more of them." In particular Sam adds excitedly, "I think it's teaching us a lot in regards to what we know and what we need to learn."

Within this primary theme, there were three sub-themes that deserve recognition:

(1) Comparisons of learning accomplished in a traditional single pilot FTD and the two pilot PCATD,
(2) The link between Advanced Aircraft Systems Class and Part 135 simulations, and
(3) The "... we don't get to do those things around here" observation concerning what can be learned (and practiced) in a rural flight education environment and what can be learned (and practiced) in activities that simulate Part 135 aircraft operations in dense, urban areas.

I present a set of quotations regarding each theme as well as summaries of each theme.

Comparisons of Learning Accomplished in the FTD and the PCATD

Although the traditional FTD is primarily used during the private, instrument, and commercial flight education lab lessons, the addition of the two pilot PCATD as a lab activity is new to these students. To that end, the students discussed the advanced level of learning occurring in the single pilot FTD and what is learned in the two pilot PCATD. Joe vigorously states, "The PCATD is 10 times better than the FTD. The FTD is good for instrument training work, but you can also do instrument work on the PCATD. The visuals are better on the PCATD." Tom adds,

> I use the FTD for instrument training. It's good for currency and I use it all the time. The PCATD goes a step further, different kinds of aircraft, going to lots of different places and the software gives you so many more options. I like the screen on the PCATD and going down to minimums, things that we aren't likely to see here.

The PCATD format of a two pilot crew-based learning process also brings comment when comparing the FTD with the PCATD. Sue says, "We get to see how much of a work load it is on the pilot to get down to minimums." Overall, students consider both the FTD and PCATD to be worthwhile as learning activities. Each student also enthusiastically supports the use of the PCATD for Part 135 advanced simulations activities.

The Link between Advanced Aircraft Systems Class and PCATD Simulations

My original intention in adding the Part 135 simulations to the lecture-based Advanced Aircraft Systems Class was to allow students to see how aircraft systems actually work instead of relating to textbook descriptions. For example, my lecture on turbine engine operations focuses on the various gauges that indicate how a jet engine operates. Students exhibit knowledge of RPM, Oil Temperature, and Oil Pressure gauges; but lack knowledge concerning Internal Turbine Temperature (ITT), Torque, and Prop RPM gauges. After completing this lecture, I take the students to the PCATD lab where they actually start a turbine engine, albeit simulated. Tom was the first to endorse this learning process,

> We study jet engines and turbine engines in class and then we get to actually see how they work. There are the engine gauges we don't even get to see in our airplanes, or get to see how they work when something goes wrong. You also get to see different emergency situations. It's a great learning experience.

Sue adds,

> They're going to fly complex multiengine aircraft and need to learn what *blue line* means because they don't know. They (classmates) may not know this already and they need to, and experience V1 *cuts*, and engine failures, and what a critical engine is.

Not all students were in agreement with linking of Advance Systems Class with Part 135 simulation activities. Joe states, "I don't know how it truly applies to aerodynamics and systems although other students might disagree. I think it should be a class all its own."

"... We Don't Get to Do Those Things Around Here"

As a collegiate aviation education program, we instruct students for the Private Pilot Certificate the freshman year, accomplish instrument training to gain an instrument rating the second year, and complete the requirements for a Commercial Pilot Certificate their third. All of these activities focus on operating an aircraft as a single pilot. Although this philosophically aligns with FAA regulatory guidance and the traditional model of flight education, few high paying job opportunities exist in single pilot aircraft operations. With this limitation in mind, the sub-theme of "...we don't get to do those things around here" arose when students commented on the learning occurring as a result of simulating Part 135 flight deck operations. Mike comments that, "There are things here that everyone needs to learn." When referring to the Bowling Green flying environment he continued "This is a very small world." Sue reinforces this theme when she says, "We rarely do actual instrument training here." Bill comments that, "We're stuck in this little box," adding, "it's a good tool (the PCATD) because we don't get to do those things (Part 135 type operations) around here." Joe concurs with his comment, "That's the whole thing about the time to cross whatever fix at an altitude; we've never seen that before. We've never been high enough to need to figure that out before."

Discussion

The primary theme concerning the value of flight simulation is supported in literature. Thorndike's Theory of Identical Elements (as cited in Lintern, 1992) addresses the efficiency of skill transfer when two common tasks are practiced and shared. I offer that the results of simulating a certain flight task can be the same as accomplishing that task in an actual aircraft. Hampton (1991) states the transfer of training is high when simulators are used, pointing out that Lombardo in 1985 proved training can be reduced by up

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to 50% when simulation was used to supplement learning. This PCATD-based learning activity not only allows students to learn in a classroom environment, but also extends that learned behavior to a practice and reinforcement activity. The three sub-themes relate to the ability of this learning activity to provide more then just an alternative way to learn text material, students were expanding their learning environment outside their "... very small world." According to the FAA in Advisory Circular 61-126, "PCATD's may be highly beneficial when used ... to achieve learning in certain procedural tasks such as area departures and arrivals, navigational aid tracking, holding pattern entries, instrument approaches, and missed approach procedures" (p. 2). I agree with the FAA that a PCATD can be beneficial, and a valuable tool for every flight education program.

Conclusion

Based on my observations as a teacher-researcher, as well as the comments made by students in this study, the use of Part 135 simulations to expand student learning and to synthesize what students have learned in the classroom to useable skills in the simulator, appears to be positive outcomes of this activity. Although students were not in total agreement as to the need to combine this activity with a traditional lecture class, students were in agreement that it was a valid learning experience. Seeing *different aircraft, different airports,* and *different systems* is important to students. Sub-themes indicate this simulation activity generated learning beyond traditional methods. The comment that "... we don't get to do those things around here" is another appropriate indication of the impact this simulation activity is having on student learning outcomes. The significance of these testimonies and observations validate the learning that was taking place for both novice and advanced flight students as they master the flight skills they need for viable Part 135 pilot employment in the future.

Reflections for Flight Schools Administrators

As a director of a collegiate flight education program, I am constantly challenged by administrators to justify the cost effectiveness of the resources we use to educate students. While classroom activities remain relatively constant in terms of their costs and benefits, the costs of laboratory activities to supplement classroom activities, both flight and simulation, is ever increasing and is a continual fiscal burden to aspiring flight students. This paper offers insights into how I utilized Part 135 simulations to improve the learning activities of a lecture-based class. I challenge the reader to consider what other lecture-based activities can be improved with simulations of industrial practices. New teaching technology offers aviation educators the ability to simulate industry operating practices without the fiscal burden of obtaining, and maintaining high costs commercial equipment. Devices such as a PCATD may not be perfect, but they offer advantages that we, aviation administrators and educators, cannot ignore as a valuable tool for student learning.✈

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