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Tim Brady
Embry-Riddle Aeronautical University, bradyt@erau.edu

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THE IMPACT ON EDUCATIONAL TECHNOLOGY OF A FATAL AIRLINE ACCIDENT: A CASE STUDY

Tim Brady
Embry-Riddle Aeronautical University
United States of America

Abstract

This is a study of how a virtual technology burden was created that impacted the professional pilot college student and various colleges/universities that offer professional pilot degree programs. A cascading set of events began as a result of U.S. congressional reaction to a tragic airline accident. The resulting legislation forced the Federal Aviation Administration to publish new rules for first officer qualifications that were unmindful of the recommendations of professional pilot groups for simulation-based training. Ultimately, this placed a financial burden on both the college/university training curriculum and on the professional pilot student.

Description of the Project

This paper investigates the impact of a fatal aircraft accident in the United States (the Cogan Airlines accident) on the virtual technology (aircraft simulation) used by colleges and universities in training airline pilots for service as first officers. It examines the training profile used prior to the accident in question, the Cogan accident, the congressional reaction to it, the subsequent legislation, followed by the federal rule-making process leading to a new rule, and, finally, the implementation of that rule within a collegiate environment.

The Use of Simulation in Airline Pilot Training Prior to the Cogan Accident

The use of simulators in training airline pilots has long been recognized in the airline industry as an effective means to prepare a pilot to operate a particular type of an airplane. It is a more cost effective means of training than operating the aircraft itself. For example a Boeing 737 costs approximately \$5,750 per flight hour to operate. On the other hand, the full-flight simulator, which is highly specific to the airplane and has a data package that allows it to mimic the flight characteristics of the airplane, costs about \$150 per flight hour to operate (P. Morton, personal communication, February 7, 2014). So clearly, it makes sense to train as much as possible in the simulator.

The economic equation for the use of sophisticated simulators is not quite so clear in the academic world of flight education where the mission is to prepare students for entry-level airline pilot positions. In 2001, when Embry-Riddle Aeronautical University acquired its simulators for the Cessna 172, the cost per simulator was \$379,000. The cost of the actual airplane at that time was \$200,000. It's

important to note here that the Cessna 172 simulators are actually non-motion devices called Flight Training Devices (FTDs). These devices are specific to the airplane (level 6), have a data package as sophisticated as the full-flight simulators, and have a 220° wrap-around visual. These are the most sophisticated trainers in the world for the type of aircraft being simulated. Thus, on the face of it, the airplane seems cheaper to operate than the FTD. However, when one considers the fuel costs, the amount of time each day the airplane can be operated, and the wear and tear on the airframe and engine, the simulator has lower operating costs than the airplane - \$78 per hour and \$150 per hour, respectively. Additionally, the FTDs can be operated eighteen hours per day, need no fuel, and have very low maintenance costs.

Brady and Macchiarella (2006) conducted a study to test the training value of these FTDs. Twenty-six students were selected at random from an entering class of freshmen students in the Professional Pilot degree program. These were the control group and flew the airplane (Cessna 172) for 100% of the private pilot syllabus. Twenty-six other students were chosen at random as the experimental group. They also flew the entire private pilot syllabus but with 60% of it flown in the FTD and 40% in the airplane. All appropriate controls were observed to eliminate rater bias and to minimize nuisance variables. At the end of the experiment, which was the achievement of the Private Pilot Certificate, it was determined that there was virtually no difference in the competencies of the control group and the experimental group. Unmistakably, the experiment demonstrated that using a high percentage of very high fidelity simulation in a pilot training syllabus could dramatically reduce training costs, even at the Private Pilot level.

Many university flight education programs wish to prepare students for entry into the airlines by using a capstone course in an FTD that simulates a jet aircraft used by the airlines, usually a Canadair Regional Jet or similar aircraft. Full-flight simulators, which can cost upwards of \$10 million, are usually too expensive for university programs and, prior to the Cogan accident, were not required in a collegiate program.

Before that accident, pilots graduating from flight education degrees possessed the Private, Commercial, Instrument, and Multi-engine ratings and certificates, and had accumulated 250 to 350 flight hours. With these qualifications they met the standards for entry into the first officer position (co-pilot) in an airline, usually a regional airline. The marketplace for pilots was based on airline demand, which governed when a given pilot would be hired. At times these new pilots were hired at 350 hours and at other times, the flight time was much higher, perhaps 1,200 to 1,500 hours. This variation in flight time was simply a function of demand as all pilots were qualified.

A study was undertaken beginning in 2003 to determine which new-hire pilots performed the best in initial airline training. It was important for the airlines to

know this since additional training flights meant additional training costs for the airlines that they, of course, wished to avoid. The study, which began as a Pilot Yield Study and eventually became the Pilot Source Study (Smith, 2010), involved six airlines and seven universities. The study examined 2,156 first officer new hires to determine the “best” pilots. Best was defined as those new-hire pilots who had the fewest incomplete lessons or the fewest repeat lessons in new-hire training. Three characteristics defined the best pilots, those who: (1) had been graduated from a flight education program in a four-year institution accredited by the Aviation Accreditation Board International, (2) had some experience as a flight instructor, and (3) had between 500 and 1000 flight hours.

The Cogan Accident

On February 12, 2009, Cogan Air Flight 3407 crashed at Buffalo, New York killing all 49 aboard the aircraft and one on the ground. The flight was operating in instrument flight conditions at night in icing conditions. The flight crew was composed of an Airline Transport Pilot (ATP) rated captain, age 47, with 3,379 hours of flight time and a first officer, age 24, with 2,244 flight hours. The aircraft was a Bombardier Q-400 twin-engine turboprop.

When the aircraft received a clearance to begin an approach, the pilot reduced power and as the airspeed began to diminish, the crew began to configure the aircraft for landing. The airspeed continued to decrease until the pilot felt the stick shaker begin to react. The “stick-shaker” is a warning to the crew that the airplane is approaching an aerodynamic stall; the control wheel and yoke (stick) actually physically trembles. When this occurred, the captain pulled back on the control wheel, while the correct action is to push forward. As the airplane began to roll off on a wing, the pilot pulled harder, four times, each harder than the last. He was not able to recover the aircraft from the stall and it crashed into a house three miles short of the runway. The National Transportation Safety Board’s (NTSB) investigation concluded, “The captain’s response to stick shaker activation should have been automatic, but his improper flight control inputs were inconsistent with his training and were instead consistent with startle and confusion” (NTSB, 2009, p. 89). The NTSB also concluded, “The probable cause of this accident was the captain’s inappropriate response to the activation of the stick shaker, which led to an aerodynamic stall from which the airplane did not recover” (p. 155).

It is interesting to note that in the NTSB report there were no recommendations regarding the achievement of the ATP or the accumulation of flight time. The Captain held an ATP certificate and the First Officer was old enough (minimum requirements for the ATP was age 23) and had enough flight time (minimum flight time was 1,500 flight hours) to hold an ATP. Nevertheless, even before the NTSB had completed the investigation, Congress overreacted.

Congressional Reaction to the Cogan Accident

By June of 2009, Congress (the House) had put together H.R. 3371, the Airline Safety and Pilot Training Improvement Act of 2009. This act required that all pilots entering airline service must have earned the ATP. This means that each pilot would have to be at least 23 years of age and have logged at least 1,500 hours of flight time. This was a five-fold increase over the previous requirements, which, on average, were about 300 hours. As this proposal began to be circulated, many in aviation higher education became very alarmed that the legislation was attempting to solve a non-existent problem and was likely to achieve the inverse of its goal. In a letter to a Congressman, representatives from one university stated, “While we do support this effort, we also want to alert you to a provision in H.R. 3371 . . . that may have a detrimental impact on airline safety and pilot training – the opposite effect of the bill’s intent” (Johnson, 2009). The provision being described is one that required pilots in airline service to possess the ATP.

The leadership of the two primary aviation education organizations – the University Aviation Association (UAA) and the Aviation Accreditation Board International (AABI) – began to organize to fight against the provision. Representatives from this group met with House Aviation Subcommittee staff members on September 3, 2009 and with subcommittee members on September 15. The group was invited to send a representative to testify before the House Aviation Subcommittee hearing on September 23, 2009. The individual chosen was a well-established aviation educator who had previously been the President of each of the UAA and AABI organizations. The title of his testimony was *Quality not Quantity*. Referring to graduates of university/college aviation pilot education programs he said:

I submit that there is a direct relationship between quality and safety. The higher the quality of the entering pilot work force, the higher the level of safety. But the ATP-only provision in this bill would close the cockpit doors to these high quality entry level first officers. (The Federal Aviation Administration’s Call to Action, 2009, p. 15)

Within two weeks after the hearing, the ranking minority party member of the subcommittee asked the educator group to submit amending language to the bill to address member concerns. This was accomplished and after several iterations, the following language was inserted into the bill:

(d) Credit Toward Flight Hours. – The Administrator may allow specific academic training courses, beyond those required under subsection (b) (2), to be credited toward the total flight hours required under subsection (c). (Airline Safety and Pilot Training Improvement Act of 2009. Section II, 2009)

This means that the FAA Administrator was given the authority to deviate from the ATP requirements (1,500 hours; age 23) on the basis of academic training should he judge that it was appropriate. This required that the FAA convene an Aviation Rulemaking Committee (ARC), which occurred in July 2010. The

ARC was composed of several groups with an interest in pilot education and training, including Airline Pilots Association (ALPA), Air Transport Association (ATA), Aircraft Owners and Pilots Association (AOPA), Aviation Accreditation Board International (AABI), Coalition of Airline Pilots Association (CAPA), National Air Disaster Alliance/Foundation (NADA/F), Pilot Career Initiative (PCA), Regional Air Cargo Carriers Association (RACCA), and Regional Airline Association (RAA) (FOQARC Report, 2010). AABI chose its executive director and the same individual who had testified before Congress as its representatives to the ARC. Shortly after the FOQARC began, H.R. 3371, which had now become H.R. 5900, was passed into law, becoming Public Law (PL) 111-216 (Airline Safety and Federal Aviation Administration Extension Act of 2010).

Several recommendations were made by the FOQARC to the FAA. Among those was a graduated scale for awarding flight time credits for academic training courses. Those at the high end of the scale were pilots who had been graduated from four-year accredited aviation programs, had achieved the Certified Flight Instructor certificated for Instrument and Multi-engine, had taken an advanced jet training course as part of their curriculum, and had accumulated some flight instructor time. Pilots with these qualifications could be qualified to enter airline service with as little as about 550 flight hours. Pilots who had been graduated from a non-collegiate but structured program and had all of the other qualifications could enter airline service at about 750 hours. The low end of the spectrum was a pilot who had none of these qualifications; that person would need the full 1,500 hours (FOQARC Report, 2010).

Another important recommendation was related to the level of simulation required to implement the training recommendations. In general, the higher the level, the more the device mimics the actual aircraft. Numbered levels are used to describe only non-motion simulators. Simulators capable of movement are known as full-flight simulators and are designated by letters such as A, B, C, D. Simulators designated as “D” are more capable than those designated as “C.” The term that encompasses both motion and non-motion simulators is FSTD (Flight Simulation Training Devices). The ARC described the recommended simulation level in its definition of an Advanced Jet Training course: “an AJT course must employ a level 5 or greater flight training device for students to receive the aeronautical experience credit . . .” (FOQARC Report, 2010, p. 78). The FAA was under no obligation to adopt any of the ARC’s recommendations.

The Resulting FAA Rulemaking Activities

Prior to publishing a rule, the FAA issues a Notice of Proposed Rulemaking (NPRM). All who wish to comment on a rule’s provisions are free to submit comments to the FAA. The NPRM concerning the use of simulation for First Officer training was published in February 2012 and titled, Pilot Certification and Qualification Requirements for Air Carrier Operations. In this document, the FAA proposed that “at least 8 hours of training in a Level C or higher full flight simulator . . .” (p.105) would be required for certification.

During the open comment period, a national conference, the National Training Aircraft Symposium (NTAS), was held to discuss issues related to the NPRM. The conference had attendees from the airlines, aviation education institutions, flight trainers and others interested in preparing professional pilots. A number of questions were asked in which each attendee could respond via a cell phone, including, "If FSTD training is required what level of FSTD is appropriate" (Embry Riddle Aeronautical University, 2012, slide 49). Sixty-five percent responded that a level 5 or above was sufficient; another 33% stated that devices below level 5 were acceptable. Only 2% responded that a full-flight simulator was appropriate. These results were reported to the FAA via responses to the NPRM on behalf of NTAS.

Yet, despite the recommendations from the FOQ ARC, the National Training Aircraft Symposium, and many others, the requirements of the rule published July 2013, stated that candidates for First Officer positions with the airlines would need to train in a full-flight simulator, specifically:

15. FSTD TRAINING TOPICS. As stated in § 61.156(b), the ATP CTP must include at least ten hours of training in an FSTD, qualified under 14 CFR part 60. Of the ten required hours, at least six hours of training must be completed in a full flight simulator (FFS), Level C or higher. (FAA, 2013)

Implementing the New Rule in a Collegiate Environment

While the new rule does not require college or university professional pilot degree programs to provide training for the ATP CTP (Airline Transport Pilot Certification Training Program), many such institutions take great pride in preparing professional pilots for first officer positions as a function of the curriculum. To do so, institutions may need to acquire a full-flight simulator or partner with a simulator training provider. In the first instance, even a good used full-flight simulator for a type of aircraft currently in service with the airlines will cost upwards of \$7 million (see Figure 1). Thus, for many institutions, the latter approach is the better option. In both cases, the financial burden falls upon the student who will likely pay from \$5,000 to \$10,000 for the ATP CTP course. This is in addition to the flight training fees that already total nearly \$40,000.

In sum, because of congressional over-reaction, a collegiate system which produced excellent first officer candidates who had below 500 flight hours and who had been demonstrated scientifically to be efficient, skilled, and safe, was upended. The flight hour requirements were increased five-fold with little regard to its impact on the pilot pool. Congressional legislation forced the FAA to create and publish new rules that were unmindful of the simulation recommendations of professional pilot groups and required virtual simulation technology new to the college/university training environment. At the bottom of this forced technology totem pole is the student.



Figure 1. A CRJ 200 full-flight simulator. This is typical of those required by the new FAA rule for first officer qualification.

As a side note, it is disheartening to note that because of these new flight time requirements, the pool of available pilots has shrunk, forcing some airlines to curtail commitments. For example, as recently reported by Everdeen Mason (2014) referring to Republic Airways Holdings Inc. in the *Wall Street Journal* online:

The regional airline company said in a regulatory filing Tuesday that it has 41 ERJ aircraft with leases set to expire this year and intended to seek extensions. But because of the congressionally mandated rule that requires pilots to have 1,500 hours of experience, there aren't enough qualified pilots and it won't seek extensions for all the aircraft (p. 1).

Further, the new flight time requirements have already begun to cause shortages of qualified first officer candidates. The result is that regional airlines are beginning to curtail service to several communities. For example, "Great Lakes Airlines ended service to a half-dozen small towns on Feb. 1 after seeing its pilot ranks slashed from more than 300 to fewer than 100" (Bachman, 2014).

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Author Details

Tim Brady

bradyt@erau.edu