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A Comparative Analysis of Title 14 Code of Federal Regulations Part 141 Flight Programs

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Abstract

Three, Title 14 Code of Federal Regulations (14 CFR) Part 141 four-year collegiate aviation institutions were asked to provide flight training data from the last five academic years. Each institution supplied a representative sample of 14 CFR Part 141 training records for each flight course offered. The records contained specific information including dual training received, solo flight time, simulator/flight training device (FTD) time, and total time acquired during flight training. The information provided by these institutions was tabulated by course offered and year. It was then compared to the minimum 14 CFR Part 141 Training Course Outlines (TCO) requirements for each institution. While TCO requirements did not vary greatly among universities, each school differed in their ability to meet their TCO standards. On average, the study found that actual flight times to complete training courses were eighteen percent higher than those specified in TCO minimums.

KEYWORDS: flight training, title 14, pilots, regulations, flight school

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Introduction

Training Course Outlines (TCOs) are governed by 14 Code of Federal Regulations (14 CFR) Part 141 (U.S. General Accounting Office, 2006a). All 141 flight schools in the United States must have a TCO approved by the Federal Aviation Administration (FAA) prior to conducting 141 operations. The written TCO guidelines for each 141 flight school must meet or exceed the minimum requirements set forth in 14 CFR Part 141. This set of regulations has evolved through several stages of amendments.

In 1929, regulations were added to the Air Commerce Act mandating flight and ground instruction in flight schools (Federal Aviation Administration, 2006a). In 1958, President Eisenhower approved the Federal Aviation Act leading to the formation of the FAA. The former regulatory bodies of aviation, the Civil Aeronautics Board (CAB) and the Civil Aeronautics Administration (CAA), were integrated into the newly created FAA. It was not until much later in 1964 that the Federal Aviation Regulations (FAR)s were completed. The FARs represented a culmination of regulations from the CAA and CAB as well as the newly created FAA. More stringent guidelines in pilot training and proficiency evolved in 1974. Flight schools were given increased obligations and responsibilities with regards to the testing and training of student pilots. Standardized curriculums were created to ensure continuity of instruction for student pilots from school to school.

Many universities offer 14 CFR Part 141 training and have detailed TCOs approved by the FAA. TCOs are individually approved for each university and can vary in content. However, the fundamental core training guidelines are mandated through the FAA and must be included within the TCO in order for the flight school to conduct operations under 14 CFR Part 141. It has been many years since the last revision to the TCO guidelines.

Today, many technological innovations have evolved which challenge the current 14 CFR Part 141 standards. New training standards are being developed (e.g. FAA Industry Training Standards or FITS; 14 CFR Part 142) in response to technological breakthroughs such as glass cockpits, advanced simulation, and synthetic vision. Now seemed to be the time to establish how universities are meeting the current 14 CFR Part

141 TCO requirements as a baseline for future comparisons with training under the new standards that are being developed.

A search of the literature yielded no prior comparisons of flight hours and TCO guidelines among collegiate aviation programs. However, several recent articles focus on current technology and its associated effects upon the flight training environment. In a recent study, conducted by Arch and Sherman (2006), it was found that the majority of UAA member institutions (61%) were using technically advanced aircraft (TAA) within training programs. Further, the Aircraft Owners and Pilot Association (AOPA) Air Safety Foundation reported that sales within the last two years to flight schools and universities have generally been technically advanced aircraft (AOPA Air Safety Foundation, 2005). Young and Fanjoy (2002) noted that some training institutions planned to purchase glass cockpit training aircraft in place of their traditional aircraft within five years.

As there are already studies concentrating on the new technology available, it seemed like a good time to conduct an initial study to assess flight training time in relation to TCO guidelines providing baseline data that may be used in future comparison studies. In addition, this study also looked for trends over time and compared the total flight hours amongst three universities.

Methodology

The researcher requested three 14 CFR Part 141 four-year collegiate aviation institutions to provide flight training data from the last five academic years. Each institution supplied a representative sample of 14 CFR Part 141 training records for each flight course offered. Institutions A and B provided all student training records for the years examined relative to this study. Institution C provided a sample size of 10 students per course for the years examined relative to this study. The maximum course enrollment for Institution C was 45 students. The records contained specific information including dual training received, solo flight time, simulator/flight training device (FTD) time, and total time acquired during flight training. Institution “A” provided the requested flight records for a four year period from 2000 – 2004. Institution “B” provided flight training records for a three year period from 2002 – 2005. Institution “C” provided records for a five year period from 2001 – 2005. Although each institution was encouraged to send the same five years of data, this was clearly not achieved. However, as this study was designed to compare the individual program performance with each university’s TCO guidelines (and not a direct comparison between the universities), it was determined by this researcher that the inequality of data between the three institutions did not appear to adversely affect the overall results of the study.

Data were collected, separated by specific university, flight course, and year offered. The data was then analyzed using the analysis of variance between groups (ANOVA). This method of data analysis was used to determine if there were variances in

each flight course throughout the years represented. After analysis of the data, each flight course was compared to the minimum 14 CFR Part 141 Training Course Outlines (TCO) requirements for each institution. After tabulation of the information, the results were examined to see if any trends could be associated with the data provided.

Institutional Backgrounds

The three institutions that participated in this study varied with regards to fleet size, student enrollment, and 14 CFR Part 141 course availability. Among the 3 institutions, the average fleet size was 19 aircraft and the average student enrollment was 140.

Institution “A” has offered a flight training program for over sixty years with degrees for the flight option major, as well as aviation management major. Fleet size consisted of 13 aircraft including 11 single-engine basic trainers, 1 complex/high-performance single-engine aircraft, and 1 complex/high-performance multi-engine aircraft. The average student enrollment was 140 flight students. 14 CFR Part 141 flight training from a private pilot single-engine land certificate through commercial pilot single-engine land certificate training was offered.

Institution “B” has offered a flight training program for over twenty-five years with degrees in both flight operations and aviation management. Fleet size consisted of an average of 21 aircraft including 17 single-engine basic trainers, 2 complex/high-performance single-engine aircraft, and 2 complex multi-engine aircraft. The average student enrollment was 146 flight students. 14 CFR Part 141 flight training from private pilot single-engine land through commercial pilot multi-engine land was provided.

Institution “C” has offered a flight training program for over sixty years with degrees in flight operations, aviation management, and additional aviation related degrees. Fleet size consisted of an average of 25 aircraft including 19 single-engine basic trainers, 4 complex single-engine aircraft, and 2 complex multi-engine aircraft. The average student enrollment was 135 flight students. 14 CFR Part 141 flight training from private pilot single-engine land through certified flight instructor training was provided.

All three institutions started with private pilot single engine courses and offered training through at least commercial pilot single engine. Two of the institutions offered additional courses under 14 CFR Part 141.

Table 1. Sequence of 14 CFR 141 flight courses in the three institutions

Institution "A"	Institution "B"	Institution "C"
Private Pilot Course	Private Pilot Course	Private Pilot Course
Cross Country Course	Instrument Course*	Commercial Course I
Instrument Course	Cross Country Course*	Instrument Course
Cross Country Course	Commercial Course I*	Commercial Certification
Commercial Certification	Commercial Certification	Flight Instructor Course
	Commercial Multi-Engine	

* These courses could be taken concurrently or in any order desired.

Institution "A" Review of Data

Institution "A" provided records pertaining to private pilot single-engine land training through single-engine commercial pilot training under 14 CFR Part 141 through the time period of 2000 – 2004. The approved training course outline (TCO) for the private pilot course requires a minimum of thirty-eight total hours. In the time period of 2000-2001 the mean was 47.8 (n=19; s.d.=9.32) for the total flight hours, 48.6 (n=27; s.d.=7.13) for 2001 – 2002, 45.6 (n=12; s.d.=5.21) for 2002 – 2003, and 51.7 (n=14; s.d.=7.28) for 2003 – 2004. An ANOVA test indicated no appreciable differences between the years analyzed (F=1.472; df=3,68,71: P=0.23).

When all years were combined, the mean for solo time for private pilot certification was 8.04 (n=72; sd=2.52), for dual flight time was 40.5 (n=72; sd= 7.85), and for total flight hours was 48.5 (n=72; sd=7.62). The difference between the TCO and the solo mean was an additional 2.04 hours. The difference between the TCO and the dual flight hours mean was an additional 10 hours. The difference between the TCO and the total flight hour mean was an additional 10.5 hours or an increase of 27% from the TCO minimums.

The flight hours for the cross country course were examined for the four year period from 2000 – 2004. The mean for the total flight hours in 2000 – 2001 was 57.7 (n=12; s.d.=6.95), for 2001 – 2002 was 55.3 (n=18; s.d.=1.5), for 2002 – 2003 was 55.8 (n=23; s.d.=1.44), and for 2003 – 2004 the mean was 56.5 (n=16; s.d.=1.61). An ANOVA test indicated no appreciable differences between the years analyzed (F=1.551; df=3,65,68: P=0.21).

When all years were combined, the mean for solo time for the cross county course was 29.3 (n=69; sd=0.497), for dual flight time was 18.8 (n=69; sd= 3.13), for sim/FTD time was 8.03 (n=69; sd=0.125), and for total flight hours was 56.2 (n=69; sd=3.21). The difference between the TCO and the solo mean was an additional 0.3 hours. The difference between the TCO and the dual flight hours mean was an additional 1.8 hours. The difference between the TCO and the sim/FTD mean was an additional

0.03 hours. The difference between the TCO and the total flight hour mean was an additional 10.2 hours or an increase of 22% from the TCO minimums.

When examining the data for the course leading to instrument certification, a noticeable increase of hours was noted as well. Data was correlated for the time periods from 2000 – 2004. Within this time period, the total hours ranged, on average, from 31.95 (2001 – 2002) to 34.58 (2003 – 2004). The TCO requirements for the course require a minimum of 27 hours. The mean for the total flight hours of 2000 – 2001 was 31.9 (n=6; s.d.=5.99), for 2001 – 2002 it was 30.5 (n=20; s.d.=3.37), for 2002 – 2003 it was 31.0 (n=18; s.d.=3.32), and for the period of 2003 – 2004 it was 34.6 (n=23; s.d.=7.29). An ANOVA test indicated no appreciable differences between the years analyzed (F=2.514; df=3,63,66: P=0.066).

When all years were combined, the mean for solo time for the course leading to instrument certification was 1.87 (n=66; sd=0.408), for dual flight time was 30.3 (n=67; sd= 5.40), for sim/FTD time was 11.2 (n=67; sd=1.57), and for total flight hours was 32.2 (n=67; sd=5.46). The difference between the TCO and the solo mean was an additional 0.37 hours. The difference between the TCO and the dual flight hours mean was an additional 4.8 hours. The difference between the TCO and the sim/FTD mean was an additional 1.2 hours. The difference between the TCO and the total flight hour mean was an additional 5.2 hours or an increase of 19% from the TCO minimums.

The flight hours for the commercial pilot I course were examined for the four year period from 2000 – 2004. The mean for the total flight hours of 2000 – 2001 was 46.3 (n=3; s.d.=0.577), for 2001 – 2002 it was 47.5 (n=7; s.d.=1.66), for 2002 – 2003 it was 46.6 (n=15; s.d.=0.960), and for 2003 – 2004 it was 47.6 (n=19; s.d.=1.61). An ANOVA test indicated no appreciable differences between the years analyzed (F=1.797; df=3,40,43: P=0.16).

When all years were combined, the mean for solo time for the commercial pilot I course was 29.5 (n=44; sd=0.981), for dual flight time it was 17.6 (n=44; sd= 0.774), for sim/FTD time it was 8.08 (n=44; sd=0.340), and for total flight hours it was 47.1 (n=44; sd=1.42). The difference between the TCO and the solo mean was an additional 0.5 hours. The difference between the TCO and the dual flight hours mean was an additional 0.6 hours. The difference between the TCO and the sim/FTD mean was an additional 0.08 hours. The difference between the TCO and the total flight hour mean was an additional 1.1 hours or an increase of 2% from the TCO minimums.

The flight hours for the commercial pilot certification course were examined for the four year period from 2000 – 2004. The mean for the total flight hours of 2000 – 2001 was 11.5 (n=9; s.d.=0.671), for 2001 – 2002 it was 11.8 (n=8; s.d.=1.42), for 2002 – 2003 it was 11.6 (n=14; s.d.=0.846), and for 2003 – 2004 it was 12.6 (n=19; s.d.=1.19). An ANOVA test indicated an appreciable difference between the years analyzed (F=3.046;

df=3,46,49: P=0.038). TCO syllabus and fleet changes were examined to determine ANOVA variance. However, no association could be found. It was believed that this variance was based on factors not examined by the study.

When all years were combined, the mean for solo time for the commercial pilot certification course was 1.10 (n=50; sd=0.301), for dual flight time it was 10.9 (n=50; sd= 1.05), for sim/FTD time it was 2.03 (n=50; sd=0.131), and for total flight hours it was 12.0 (n=50; sd=1.13). The difference between the TCO and the solo mean was an additional 0.1 hours. The difference between the TCO and the dual flight hours mean was an additional 0.9 hours. The difference between the TCO and the sim/FTD mean was an additional 0.03 hours. The difference between the TCO and the total flight hour mean was an additional 1 hour or an increase of 9% from the TCO minimums.

Table 2. Institution "A" Data

COMMERCIAL PILOT CERTIFICATION COURSE (SEL)				
	Dual	Solo	FTD	Total
2000 - 2001	10.38	1.16	2.00	11.53
2001 - 2002	10.44	1.26	2.13	11.77
2002 - 2003	10.74	1.01	2.01	11.68
2003 - 2004	11.47	1.07	2.01	12.57
TCO Minimums	10.00	1.00	2.00	11.00

Institution "B" Review of Data

Institution "B" provided records pertaining to private pilot single-engine land through multi-engine commercial pilot training under 14 CFR Part 141for the time period of 2002 – 2005. Data was merged and averaged by the host institution prior to the distribution of the data to the researcher. Because of this, ANOVA analysis for each course could not be performed.

Examining records for private pilot training revealed an increase of hours from the requirements stated in the TCO. The minimum 14 CFR Part 141 training requirements for the private pilot certificate are 35 hours of training. Examining the records, there was a notable difference between the TCO requirements and the actual hours obtained during training for the private pilot certificate. The mean for the total flight hours of 2002 – 2003 was 62 (n=23), for 2003 – 2004 it was 63 (n=29), for 2004 – 2005 it was 59 (n=18).

When the supplied data was combined, the mean for solo time for the private pilot course was 7 (n=70), for dual flight time it was 50.6 (n=70), for sim/FTD time it was 3.6 (n=70), and for total flight hours it was 61.3 (n=70). The difference between the TCO and the solo mean was an additional 0.5 hours. The difference between the TCO and the dual flight hours mean was an additional 25.1 hours. The difference between the

TCO and the sim/FTD mean was an additional 0.6 hours. The difference between the TCO and the total flight hour mean was an additional 26.3 hours or an increase of 75% from the TCO minimums.

The flight hours for the cross country course were examined for the three year period from 2002 – 2005. The mean for the total flight hours of 2002 – 2003 was 89, for 2003 – 2004 the mean was 89, and for 2004 – 2005 the mean was 89.

When the supplied data was combined, the mean for solo time for the cross country course was 55, for dual flight time it was 28, for sim/FTD time it was 6, and for total flight hours it was 89. There was no difference between the TCO and the solo mean. The difference between the TCO and the dual flight hours mean was an additional 28 hours. The difference between the TCO and the sim/FTD mean was a variance of 17 hours. The difference between the TCO and the total flight hour mean was an additional 1 hour. It should be noted that even though the dual flight hours note a significant increase from TCO minimums, the total hours for the course are within a few percent of the TCO minimums. This difference can be attributed to TCO changes throughout the three year period.

Flight training leading to an instrument rating under 14 CFR Part 141 for institution “B” was also examined. Data was correlated for the time periods from 2002 – 2005. The TCO requirements for the course require a minimum of 35 hours. The mean for the total flight hours of 2002 – 2003 was 47 (n=17), for 2003 – 2004 was 47 (n=43), and for 2004 – 2005 was 44 (n=31).

When all the data was combined, the mean for dual flight time leading to an instrument rating was 37.6 (n=91), for sim/FTD time it was 8.3 (n=91), and for total flight hours it was 46 (n=91). The difference between the TCO and the dual flight hours mean was an additional 16.6 hours. The difference between the TCO and the sim/FTD mean was a variance of 5.7 hours. The difference between the TCO and the total flight hour mean was an additional 11 hours or an increase of 31% from the TCO minimums.

Training in the commercial pilot I course was examined. The mean for the total flight hours of 2002 – 2003 was 23, for 2003 – 2004 it was 26, and for 2004 – 2005 it was 23. The TCO minimums required at least 21 total hours.

When all the data were combined, the mean for dual flight time for the commercial pilot I course was 13.6, for solo flight time was 10.3, and for total flight hours it was 24. The difference between the TCO and the dual flight hours mean was an additional 2.6 hours. The difference between the TCO and the solo flight hour mean was an additional 0.3 hours. The difference between the TCO and the total flight hour mean was an additional 3 hours or an increase of 14% from the TCO minimums.

The flight hours for the commercial pilot certification course were examined for the period from 2002 – 2005. The mean for the total flight hours of 2002 – 2003 was 12, for 2003 – 2004 it was 12, and for 2004 – 2005 it was 12.

When all years are combined, the dual flight time mean leading to commercial pilot certification was 11, the mean for sim/FTD time was 1, and the mean for total flight hours was 12. The difference between the TCO and the dual flight hours mean was an additional 1 hour or an increase of 10% from the TCO minimums. There was no difference between the TCO and the sim/FTD mean. The difference between the TCO and the total flight hour mean was an additional 1 hour or an increase of 9% from the TCO minimums.

Training under 14 CFR Part 141 leading to a multi-engine commercial rating was examined. The mean for the total flight hours of 2002 – 2003 was 24 (n=10), for 2003 – 2004 it was 23 (n=7), and for 2004 – 2005 it was 19 (n=15). The TCO minimums required a minimum of 15 total hours.

When all the data was combined, the mean for dual flight time leading to a multi-engine commercial rating was 22 hours (n=32). Since there was no solo or sim/FTD time required, the dual flight time mean was the same as that of the total flight hours required. The difference between the TCO and the total flight hour mean/dual hour mean was an additional 7 hours or an increase of 46% from the TCO minimums.

Table 3. Institution “B” Data

PRIVATE PILOT COURSE (SEL)				
	Dual	Solo	SIM/FTD*	Total
2002 – 2003	50.00	7.00	5.00	62.00
2003 – 2004	53.00	7.00	3.00	63.00
2004 – 2005	49.00	7.00	3.00	59.00
TCO Minimums	25.50	6.50	3.00	35.00
CROSS COUNTRY COURSE (SEL)				
	Dual	Solo	SIM/FTD*	Total
2002 – 2003	32.00	55.00	2.00	89.00
2003 – 2004	29.00	55.00	5.00	89.00
2004 – 2005	23.00	55.00	11.00	89.00
TCO Minimums	10.00	55.00	23.00	88.00
INSTRUMENT RATING COURSE (SEL)				
	Dual	Solo	SIM/FTD*	Total
2002 – 2003	38.00	0.00	9.00	47.00
2003 – 2004	39.00	0.00	8.00	47.00
2004 – 2005	36.00	0.00	8.00	44.00
TCO Minimums	21.00	0.00	14.00	35.00

Continued on next page…

COMMERCIAL PILOT I COURSE (SEL)				
	Dual	Solo	SIM/FTD*	Total
2002 – 2003	13.00	10.00	0.00	23.00
2003 – 2004	15.00	11.00	0.00	26.00
2004 – 2005	13.00	10.00	0.00	23.00
TCO Minimums	11.00	10.00	0.00	21.00
COMMERCIAL PILOT CERTIFICATION COURSE (SEL)				
	Dual	Solo	SIM/FTD*	Total
2002 – 2003	11.00	0.00	1.00	12.00
2003 – 2004	11.00	0.00	1.00	12.00
2004 – 2005	11.00	0.00	1.00	12.00
TCO Minimums	10.00	0.00	1.00	11.00
MULTI-ENGINE COMMERCIAL (MEL)				
	Dual	Solo	SIM/FTD*	Total
2002 – 2003	24.00	0.00	0.00	24.00
2003 – 2004	23.00	0.00	0.00	23.00
2004 – 2005	19.00	0.00	0.00	19.00
TCO Minimums	15.00	0.00	0.00	15.00

*Aircraft or FTD, note TCOs have changed over this period of time

Institution “C” Review of Data

Institution “C” provided 14 CFR Part 141training records pertaining to private pilot single-engine land through certified flight instructor certification for the time period of 2001 – 2005. Examination of 14 CFR Part 141 training records pertaining to the private pilot certificate revealed an increase in training when compared to the minimum hours required by the TCO. The records indicated that the student training totals range from 54 hours to 59 hours. The minimum hours required by the TCO was 43 and 45.5 hours. The TCO has changed, reducing the total number of hours required for the private pilot course, during the years reviewed. The difference between the total hours and the hours required by the TCO ranges from 11 to 14 hours or an increase of 25% to 30% when compared to the TCO minimum requirements.

When analyzing the data for the 14 CFR Part 141 course leading to private pilot single-engine land certification, the mean for the total flight hours of 2001 was 56.9 (n=6; s.d.=15.0), for 2002 it was 59.4 (n=10; s.d.=6.68), for 2003 it was 59.6 (n=8; s.d.=11.7), for 2004 it was 54.7 (n=10; s.d.=7.34), and for 2005 it was 55.1 (n=10; s.d.=10.1). An ANOVA test indicated no appreciable differences between the years analyzed (F=0.4974; df=4,39,43: P=0.74).

When all years are combined, the mean for solo time for the private pilot course was 10.5 (n=44; s.d.=1.38), for dual flight time it was 45.1 (n=44; s.d.= 8.77), for

sim/FTD between 2001 and 2003 it was 2.72 (n=24; sd=1.53), for total flight hours between 2001 and 2003 it was 58.8 (n=24; s.d.=10.5), and for total flight hours for 2004 and 2005 it was 54.9 (n=20; s.d.=8.62). The difference between the TCO and the solo mean was an additional 1.5 hours. The difference between the TCO and the dual flight hours mean was an additional 11.1 hours. The difference between the TCO and the sim/FTD mean for 2001 through 2003 was an additional 0.22 hours. The difference between the TCO and the total flight hour mean for the time period between 2001 through 2003 was an additional 13.3 hours. The difference between the TCO and the total flight hour mean for the time period between 2004 and 2005 was an additional 11.9 hours or an increase of 27% from the TCO minimums.

The flight hours for the commercial pilot I course were examined for the five year period from 2001 – 2005. The mean for the total flight hours of 2001 was 58.0 (n=9; s.d.=7.52), for 2002 it was 56.1 (n=9; s.d.=4.66), for 2003 it was 55.8 (n=9; s.d.=3.11), for 2004 it was 60.1 (n=9; s.d.=6.52), and for 2005 it was 56.0 (n=10; s.d.=2.97). An ANOVA test indicated no appreciable differences between the years analyzed (F=1.131; df=4,41,45: P=0.36).

When all years are combined, the mean for solo time for the commercial pilot I course was 27.6 (n=46; s.d.=2.36), for dual flight time it was 26.1 (n=46; s.d.= 4.07), for sim/FTD time it was 3.49 (n=46; sd=0.995), and for total flight hours it was 57.2 (n=46; s.d.=5.26). The difference between the TCO and the solo mean was a variance of 0.4 hours. The difference between the TCO and the dual flight hours mean was an additional 3.1 hours. The difference between the TCO and the sim/FTD mean was 0.01 hours. The difference between the TCO and the total flight hour mean was an additional 2.7 hours or an increase of 4% from the TCO minimums.

Data was provided from institution “C” regarding 14 CFR Part 141 training leading to the issuance of an instrument rating. The TCO requires 45.5 hours of training leading to the issuance of an instrument rating. The mean for the total flight hours of 2001 was 49.6 (n=10; s.d.=6.45), for 2002 it was 54.9 (n=10; s.d.=10.4), for 2003 it was 56.6 (n=9; s.d.=14.5), for 2004 it was 53.9 (n=10; s.d.=14.6), and for 2005 it was 51.1 (n=10; s.d.=7.22). An ANOVA test indicated no appreciable differences between the years analyzed (F=0.6336; df=4,44,48: P=0.64).

When all years are combined, the mean for solo time leading to the issuance of an instrument rating was 2.67 (n=49; s.d.=2.62), for dual flight time it was 37.2 (n=49; s.d.= 9.38), for sim/FTD time it was 13.3 (n=49; s.d.=3.35), and for total flight hours it was 53.1 (n=49; s.d.=10.9). The difference between the TCO and the solo mean was an additional 1.17 hours. The difference between the TCO and the dual flight hours mean was an additional 7.2 hours. The difference between the TCO and the sim/FTD mean was a variance of 0.7 hours. The difference between the TCO and the total flight hour mean was an additional 7.6 hours or an increase of 16% from the TCO minimums.

The flight hours for the commercial pilot II course were examined for a five year period from 2001 – 2005. The mean for the total flight hours of 2001 was 38.6 (n=9; s.d.=5.26), for 2002 it was 35.1 (n=9; s.d.=3.09), for 2003 it was 39.0 (n=10; s.d.=3.33), for 2004 it was 35.2 (n=10; s.d.=3.79), and for 2005 it was 37.5 (n=10; s.d.=2.64). An ANOVA test indicated no appreciable differences between the years analyzed (F=2.413; df=4,43,47: P=0.064).

When all years are combined, the mean for solo time for the commercial pilot II course was 14.4 (n=48; s.d.=2.02), for dual flight time it was 17.6 (n=48; s.d.= 3.51), for sim/FTD time it was 5.07 (n=48; sd=1.81), and for total flight hours it was 37.1 (n=48; s.d.=3.92). The difference between the TCO and the solo mean was a variance of 0.6 hours. The difference between the TCO and the dual flight hours mean was an additional 0.6 hours. The difference between the TCO and the sim/FTD mean was a variance of 0.93 hours. The difference between the TCO and the total flight hour mean was a variance of 0.9 hours or a decrease of 2% from the TCO minimums.

The flight hours for the single-engine commercial pilot certification course were examined for the five year period from 2001 – 2005. The mean for the total flight hours of 2001 was 34.1 (n=8; s.d.=3.36), for 2002 it was 36.6 (n=11; s.d.=4.22), for 2003 it was 37.4 (n=10; s.d.=4.45), for 2004 it was 37.6 (n=10; s.d.=4.93), and for 2005 it was 36.7 (n=10; s.d.=2.14). An ANOVA test indicated no appreciable differences between the years analyzed (F=1.054; df=4,44,48: P=0.39).

When all years were combined, the mean for solo time for the single-engine commercial pilot course was 7.92 (n=49; s.d.=3.73), for dual flight time it was 21.2 (n=49; s.d.= 4.97), for sim/FTD time it was 7.44 (n=49; s.d.=1.73), and for total flight hours it was 36.6 (n=49; s.d.=3.98). The difference between the TCO and the solo mean was an additional 2.92 hours. The difference between the TCO and the dual flight hours mean was an additional 0.2 hours. The difference between the TCO and the sim/FTD mean was a variance of 0.56 hours. The difference between the TCO and the total flight hour mean was an additional 2.6 hours or an increase of 7% from the TCO minimums.

The flight hours for the certified flight instructor single-engine land course were examined for the period from 2001 – 2002 and from the period from 2004 - 2005. The mean for the total flight hours of 2001 was 26.7 (n=7; s.d.=3.95), for 2002 it was 26.9 (n=8; s.d.=6.27), for 2004 it was 29.2 (n=10; s.d.=7.28), and for 2005 it was 32.0 (n=5; s.d.=11.7). An ANOVA test indicated no appreciable differences between the years analyzed (F=0.6991; df=3,26,29: P=0.56).

When all years are combined, the mean for solo time for the certified flight instructor course was 1.62 (n=30; s.d.=1.42), for dual flight time it was 26.3 (n=30; s.d.= 6.99), for sim/FTD time it was 0.537 (n=30; s.d.=0.844), and for total flight hours it was

28.5 (n=30; s.d.=7.20). The difference between the TCO and the solo mean was a variance of 2.38 hours. The difference between the TCO and the dual flight hours mean was a variance of 0.2 hours. The difference between the TCO and the sim/FTD mean was a variance of 0.46 hours. The difference between the TCO and the total flight hour mean was a variance of 3.0 hours or a reduction of 9% from the TCO minimums.

Table 4. Institution "C" Data

PRIVATE PILOT COURSE (SEL)				
	Dual	Solo	FTD	Total
2001	45.47	9.43	2.02	56.92
2002	45.53	10.92	2.94	59.39
2003	46.05	10.56	2.98	59.59
2004	44.14	10.59	0.00	54.73
2005	44.43	10.65	0.00	55.08
TCO Minimums	34.00	9.00	2.50/0.00	45.50/43.00
COMMERCIAL PILOT I COURSE (SEL)				
	Dual	Solo	FTD	Total
2001	27.46	27.00	3.57	58.02
2002	24.30	27.48	4.29	47.70
2003	25.39	27.67	2.79	55.84
2004	29.00	27.83	3.26	46.30
2005	24.68	27.78	3.53	55.99
TCO Minimums	23.00	28.00	3.50	54.50
INSTRUMENT RATING COURSE (SEL)				
	Dual	Solo	FTD	Total
2001	36.00	1.96	11.64	49.60
2002	38.19	2.06	14.62	54.87
2003	40.92	3.50	12.17	56.59
2004	36.53	3.85	13.55	53.93
2005	34.82	2.06	14.21	51.09
TCO Minimums	30.00	1.50	14.00	45.50
COMMERCIAL PILOT II COURSE (SEL)				
	Dual	Solo	FTD	Total
2001	19.41	15.11	4.06	38.58
2002	16.22	13.56	5.29	35.07
2003	19.17	15.33	4.51	39.01
2004	16.52	12.97	5.68	35.17
2005	16.77	15.00	5.74	37.51
TCO Minimums	17.00	15.00	6.00	38.00

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COMMERCIAL PILOT CERTIFICATION COURSE (SEL)				
	Dual	Solo	FTD	Total
2001	14.93	12.16	7.00	34.09
2002	18.25	11.14	7.16	36.55
2003	23.58	6.55	7.22	37.35
2004	24.53	5.16	7.93	37.62
2005	23.80	5.10	7.81	36.71
TCO Minimums	21.00	5.00	8.00	34.00
CERTIFIED FLIGHT INSTRUCTOR (SEL)				
	Dual	Solo	FTD	Total
2001	23.49	2.24	0.93	26.66
2002	25.05	1.58	0.25	26.88
2004	27.73	1.09	0.41	29.23
2005	29.42	1.90	0.70	32.02
TCO Minimums	26.50	4.00	1.00	31.50

Limitations

There were many limitations to this study including population size, causal effects, distribution of data, and limited resources and access to data. Five original institutions agreed to participate but only three provided the data requested. Such school variance in meeting TCO requirements could be attributed to differences in weather patterns, aircraft maintenance issues, or aircraft/instructor/student availability and other miscellaneous causal factors not identified within the study. It was also important to note that September 11, 2001 caused student flight training delays. However, it was not possible to determine which students were affected as stop and start dates were not reported with training records.

Conclusions

It has been many years since the FAA has reviewed and made adequate changes to the 14 CFR Part 141 TCO requirements. Since that time, aviation and the associated training environment have become more complex. Future revolutionary changes in technology will further impact student training, and, subsequently, impact the 14 CFR Part 141 TCO guidelines. Already the newer FAA/Industry Training Standards (FITS) program is finally allowing for the use of state-of-the-art cockpit technology in a more realistic, scenario-based training environment (Federal Aviation Administration, 2006b). In the January 2005 UAA Policy Seminar, Zaranek (2005) stated, “The program, FITS (FAA/Industry Training Standards), identifies the problem in general aviation of quickly advancing technology and slow-moving bureaucracy”.

Technological advances in flight simulation have led to 14 CFR Part 142 (U.S. General Accounting Office, 2006b) which has provided for greater use of simulators during pilot training. With the help of realistic simulation technology, these new standards are expected to increase the efficiency and decrease the cost of flight training.

Another technological innovation that will challenge training standards is the use of synthetic vision, or the digital representation of the world outside the aircraft. Synthetic vision will require training not currently covered under conventional training guidelines. Hansen, A.J., Rybacki, R. M., and Smith, W. G. (2006), remarked that synthetic vision technology is within the reach of general aviation.

Although TCOs were used by each institution in this study, their ability to meet the requirements differed. On average, the study found that actual flight times to complete training courses were eighteen percent higher than those specified in TCO minimums. This study did not examine causal factors that may or may not have attributed to each university's variance in the meeting of TCO requirements. Although these factors were not assessed in this study, a previous study conducted by Bryan (1996), noted that 88 percent of UAA institutions indicated experiencing student delays in flight training. Bryan found that some institutions could alleviate delays by setting financial requirements of flight students and by requiring use of ground based training devices during extended periods when obtaining actual flight time was not possible.

This small-scale study was conducted to determine if larger-scale research was needed to exam training under 14 CFR Part 141 TCO guidelines. Larger scale studies involving more universities are needed to validate the findings. Future studies could focus on the variance in training techniques utilized by different universities and the impact of new technology on the current 14 CFR Part 141 training standards. Such studies could also be used as a baseline to assess if new training standards (e.g. FITS; Part 142) have indeed improved the quality of training of new pilots.

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