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5. TRAINING EFFECTIVENESS ASSESSMENT: WHERE ARE WE?

GREG MCGOWAN

I would like to thank NASA and the FAA for allowing FlightSafety to participate in this workshop. What I hope to do is set a framework for your participation in the panel discussion that we will be doing on Thursday. I know with all the presentations going on there are a lot of questions you will not have the opportunity to ask or get answers to. I think the panel discussions will provide an opportunity for that kind of participation.

Concerning the Workshop itself, I look at it from an objective standpoint. Even though we are focusing on simulators and on certification criteria and so on, I think we should be looking at how to provide tools for instructors and companies like FlightSafety, to better serve end users like Curt Treichel and Jerry Golden, for example, in providing safer pilots and safer aircraft operations.

As an overview to this we will take a look at an introduction and historical review, not spending much time on the first three or four points. From a historical perspective, I think it is important to see where we have come from and why we got started in the first place and where we are now. Because we are using commercial helicopter simulators, we have to ask, how efficient are they and how can we optimize their utilization?

As far as where we are, I think we have to define that question in terms of a reference point. We have been beating around the bush about this a little bit, but I think this Workshop is really concerned with—or at least I am concerned with—commercial helicopter simulators in the United States. I had an opportunity to fly the LHX check simulator about 2 months ago. That simulator is a completely different animal. It represents some great technology, and interesting things are going to come out of it. However, I think the emphasis here must be on commercial helicopter simulators. We also need to define the environment. Are we talking about cost, safety, fidelity, and effectiveness of training? I think those are important issues that need to be looked at. No one of those issues is more important than another; it depends on the end users' requirements, on what is most important to them. I would like to take a look at some of those things today briefly, and in more detail in the panel discussions.

From a historical review standpoint, why did we even get involved with commercial helicopter simulation? Back in the 1970s, Bell Helicopter and Sikorsky Aircraft decided to build, for the first time, a commercial helicopter that was not merely a military derivative, the Bell 222 and the S-76, respectively. The customers they perceived to make up the market for those helicopters really consisted of two groups, corporate and offshore, or corporate and utility. Certainly there were segments of both of those markets that were going to require a simulator in training the pilots and maintenance technicians for those aircraft. And it was the position of both Bell and Sikorsky that it would be necessary to have a simulator-based training program as part of the overall marketing effort for those helicopters.

That is why the first commercial U.S. helicopter simulators were built. You might say the helicopter manufacturers, therefore, are the ones who provided that initial impetus to simulator development. But it is really the end users, the Curt Treichels and Jerry Goldens, the people who use the simulators who drive that market. Without that market requirement, the manufacturers would not have spent the money on developing simulators.

Initially, when a simulator-based training program is part of a manufacturing agreement, such as we have with Bell and Sikorsky, the first course to be developed is initial training,which is then quickly followed by recurrent training.

I am proud to say that we are now getting into what I call generic training, using simulators that are designed for specific aircraft, but using them in a generic way. For example, there are the Emergency Medical Service (EMS) helicopter pilot recurrent course and the instrument refresher courses. We have pilots flying Augustas and small Bell products, as well as the Aerospatiale products, which don't have simulators, enrolled in courses in which they are using an S-76 or Bell 222 simulator to get as

much as they can out of a simulator-based training program. They are practicing things like crew coordination, cockpit management, and instrument procedures. The technology is developed to the point that we can duplicate the actual aircraft, but we tend to forget the other applications that we used years ago in the Links and Dehenel trainers and the training devices, which are still applicable in the current generation of simulators.

We are really only talking about three simulators. We have two aircraft for which there are certified simulators, those being the 222 and the S-76B. There is also a third training device out there that did some ground breaking on its own from an exemption standpoint, and that is the S-76A.

More accurately, the S-76A is for all practical purposes a training device. It is the most sophisticated training device I have ever seen.

At the end of 1990, there were 174 Bell 222s, and 319 S-76 aircraft worldwide. A total of 3,747 pilots were trained in the Bell 222 and 5,096 were trained in the S-76; that is, in all types of training between 1980 and 1990. The check ride numbers are 354 for the Bell and 2,333 for the S-76. The reason I point this out is because there are significant opportunities for data collection here. Therefore, these two pilot training devices were used to train almost 9,000 pilots and to give about 2,700 FAR checks. A breakdown of those check rides shows virtually all of the 61.57 instrument competency checks (1,296) were done in the Bell 222 simulator. There are reasons for that I don't need to go into, but the primary one is that the 61.58 PIC check is not required in the Bell 222; as a result, the best thing you can do is a biennial flight review or instrument competency check.

The 61.57 instrument competency check totals (1,296) are from a combination of the Bell 222 and the S-76. The low numbers of 135.293 (129) and 135.297 (121) checks are a result of our doing them for only a couple of years.

Regarding the commercial helicopter simulators—without going into a lot of detail, I certainly will provide syllabuses for any of the courses to anyone who wants them; just give me a call and we will mail them out.

The initial training course is 2 weeks long. It was certainly the first course developed for either of the S-76 simulators, or for the Bell 222, for that matter. Most of the recurrent training courses are 4 days long. We do have specialized courses of 3 and 5 days for certain operators and special requirements. One of the points I want to make here, though, is that before we had our first exemption, our generic courses, things like the recurrent training and the initial training we were doing, were well attended, even though the pilots were getting absolutely no credit whatsoever. I think that that is an important point for all of us to remember: the end user, the pilot, the operator, the company, recognized the value of the training, and they were willing to pay for it in many cases without any checking credit, without any training credit whatsoever. On the other hand, I think we also need to realize that just because they have been doing it does not mean they are going to continue to do it, especially as costs go up.

Figure 1 shows what we call a pilot proficiency record. Actually, it is a five-page document. This is what our instructors use to evaluate pilots undergoing training and checking at the Center. It is a part of the pilot's training record. The shaded items are those that would be required for an ATP check or for a pilot command 61.58 proficiency check. I believe the regulation reads that the same items and maneuvers that would be done for the initial issuance of type-rating would be required or recommended for 61.58 pilot proficiency check.

The unshaded items are those things pilots are required to complete during our course of instruction, which, by the way, is FAA approved. They also receive what is called a flight-safety proficiency card. It has been mentioned that we did so much more than required. For example, on engine malfunction, the high-side governor failure was mentioned. We have them do high-side and low-side governor failures. They cannot do those in the aircraft, and it is something pilots make mistakes on. They can get that experience only on the simulator. That is what simulator-based training is all about. We can talk about this more in the panel discussion, if we get a chance.

A little history of the exemptions might be in order. Exemption 4609 was issued in January 1986 (table 1). I think we started the request in early 1984, I think we first had a meeting up in Washington, D.C. It took time, because we were breaking new ground; but we eventually got it for the S-76 training device and for the Bell 222 simulator, with which we do the PIC check and flight review. Numerous prerequisites and recency-of-experience requirements are stated.

In almost all cases, even with fixed-wing simulators in which checking or training are done, an approved course of instruction is included. You don't just go out and use these simulators to do a check ride. There is an approved program of instruction; the same is true for this exemption. For example, aeronautical experience from C.61 requires 50 hours in the last 12 months, 5 hours

FLIGHT SAFETY
Pilot Training Record

Captain_____

Organization_____

Course_____

GRADING LEGEND
1 = Proficient
2 = Normal Progress
3 = Additional Training Required
4 = Unsatisfactory
D = Discussed/Demo
Item(s) graded 3 or 4 must be defined under remarks

	YR						YR						YR						YR					
Date:																								
AIRCRAFT SYSTEMS																								
INSTRUMENT																								
E.M.S.																								
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AIRCRAFT	This Lesson																								
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MANEUVERS AND PROCEDURES

	MODE	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)	(T)
1. PREFLIGHT PLANNING	D																				
2. PREFLIGHT INSPECTION	A																				
3. BEFORE STARTING/STARTING ENGINES	C																				
4. ADDTIONAL CHECKS AND TESTS																					
a. Fuel Priming	C																				
b. Fire Extinguisher Test	C																				
*c. Flotation System Test	C																				
*d. Snow Protection System Test (A)	D																				
5. TAXI	S																				
6. PRETAKEOFF/TAKEOFF	S																				
7. HOVER OPERATIONS	S																				

Figure 1. FlightSafety pilot proficiency record.

Table 1. Exemption 4609

1. Exemption issued 28 January 1986
2. Applicable to S-76 training device; Bell 222 simulator
3. Prerequisites/recency requirements:
Approved training course
Aeronautical experience (61.161)
50 hours preceding 12 months in type
5 hours PIC last 60 days, make and model
3 takeoff and landings last 90 days
4. Amended 23 June 1988 to include S-76B level C simulator

Table 2. Exemption 5067

1. Exemption issued 29 June 1989
2. Applicable to S-76B level C simulator
3. Approved to conduct the following:
61.56: 24-month flight review
61.57: Day/night landing currency
61.58: 12/24-month PIC check
61.163: ATP rotorcraft (90%)
135.293: Recurrent testing
135.297: Instrument proficiency
4. Prerequisites/requirements:
Approved training course
Three slope takeoffs/landings 90 days
100 hours preceding 12 months (10 hr S-76)
50 hours preceding 6 months (5 hr S-76)
61.163 ATP/add-on, flight test in S-76
Visual inspection
360° pedal turn in hover
Normal takeoff from hover
Manually flown precision approach
Steep approach and landing at heliport

PIC, and three takeoff and landings in the last 90 days. The customer base we are addressing has no problem meeting these. It was amended in June to include the S-76 simulator. I am using those terms loosely because they don't really apply. We cannot call it a level C; it is an approved helicopter simulator. That is the proper terminology, but if you use it people ask you so many questions it is better to call it a level C and not have to explain all this.

Exemption 5067 was issued 29 June 1989; it is applicable to level C simulators. It is an outgrowth of the approval we got with the simulator, and it is approved for conducting the checks shown in table 2. Those pilots undergoing these checks have to certify that they have, for example, done three slope takeoffs and landing within the last 90 days. This is not a real big problem when you consider that runways are usually crowned and therefore have some degree of slope. The other prerequisites include 100 hours in the preceding 12 months, 10 hours in the S-76, 50 hours in the preceding 6 months, visual inspection, 360° pedal turn in hover, normal takeoff from hover, manual flown precision approach, and steep approach and landing.

As soon as an exemption or regulation requires that a pilot do anything in an aircraft, with respect to checking or training, you will eliminate a certain segment of that population that would otherwise train in the simulator. They won't train in the simulator because it costs you about $2,500 an hour to fly the aircraft. And it can cost even more if travel is involved in getting to the examiner. So a lot of these decisions are based very much on economics. That's something that we need to talk about in the panel discussion.

A question that really needs to be asked is how effective are commercial simulators? Objectively, I think more research is needed. That is one reason I showed you the numbers that we have. The people are coming to train, and as a result the opportunities for collecting data are there. At FlightSafety we certainly are not experts at collecting data. I don't know what kinds of questions to ask these people or what kinds of maneuvers to ask them to see and duplicate.

There is one thing I want to mention when talking about duplication. When we are evaluating these simulators and we go out and fly the aircraft and we come in and fly the simulator, we need to fly that helicopter at night. We need to be doing those 360° pedal turns in a hover at night over a runway similar to what we have in the aircraft, or in the simulator. I realize in some cases we are looking at breakout forces and things that don't really make a difference visually. But when you are subjectively evaluating the overall quality of a simulator I think it is unfair to go out in the daytime with all the daytime visual cues and compare it with a night visual system.

Subjectively though, I think the simulators are very good for a number of reasons. We have the data, we have the pilots, and we have a lot of FAA pilots that have gone through training who can tell you about the level of instruction, the kinds of things that can be simulated, the maneuvers that they can do in the simulator and then compare with the actual aircraft. We have some people say the simulator doesn't hover right, and we have others

who say it hovers just like the aircraft. That is why we need to collect more data and find out what the weaknesses and strengths are.

We also need to keep in perspective the overall idea that there is a lot more positive to be said about the simulator than negative. The article I mentioned earlier about the helicopter that went down in the river off of the Wall Street heliport is a good example. This is a quote from the pilot, Sandy Kaplan. "The engine quit on departure. We didn't have enough power to continue. We just went down, just like we practiced at FlightSafety—you bet!" That is an example of the benefits they gained from training received in a simulator that they could not have received in the aircraft.

Lastly, how are we going to optimize the effective utilization of helicopter simulators? We already talked about some of them. I think we need to look at the regulations and to have an opportunity for giving the two different types of check rides so you can substitute things that can be done in the simulator for things that perhaps cannot be done in the aircraft. In other words, maybe one low-side governor failure and one high-side governor failure and an engine fire could equal one 360° pedal turn in a hover—for lack of a better example. We need to look at the philosophy of simulator use.

That includes looking at things such as I just mentioned. We need to do a better job of training our instructors. We have problems as a company, as a simulator trainer company that uses instructors for simulator training. We need to better educate those instructors, we need to do a better job of training them in cockpit resources management, in how to do a better job of debriefing to get as much as we can out of the training tools. I refer also to cost. For example, Jerry Golden and Curt Treichel—they are the one who ultimately decide whether they will use the $10-million and $12-million simulators that we train with.

MR. McDANIEL: By the way, I flew that approach to Wall Street and landed in the water as well. I did it in his simulator a couple of weeks ago. We practice doing those things and we did it successfully the first time we tried it in the simulator. And after going through the procedures with instruction, we did high-side governor failure, we did low-side, tail-rotor failures, fixed pitch, all of those things. Quite frankly we were not always successful on our first attempts on those things in the simulator. But anyhow, the thing is, there is some excellent instruction out there that is available with this kind of thing. As we said, we had a number of discussions but active conversations on the usefulness of it, and I am convinced that it is a very useful training instrument and something that we need to get credit for and bring into the system. That is really why we are here.

MR. CARVER: Just three observations on that very excellent rundown. There is a lot of thought in what you said.

First of all, as far as training and checking are concerned, everybody wants credits for training devices or simulators or whatever. Of course the observation of pilot regulators is that pilots need more training than that which a regulator requires, so as long as training is not negative, then most regulators would support what you have just suggested, that is, without necessarily having credits, because it is the commercial public transport company that is responsible for the pilot training, and what the regulator wants is really a snapshot of something at the end.

As far as effectiveness is concerned, there are one or two other points. Effectiveness depends on the fidelity of the simulator, on its maintenance records above all. There is a thought there with regard to the complexity of the device and what effort the company is willing to put into its maintenance, and the ability and imagination of the instructor-examiners. I definitely agree there with you.

And finally, I am not a rotary pilot, but as far as the simulator is concerned, rotary really requires more piloting skills, so I think we have to be careful when giving licensing credits to a simulator. But certainly the generic, the human factor is certainly an area in which it is useful.

MR. McGOWAN: Those are good points. I hope you come to the panel discussion because those are the kinds of things I think we need to talk about. That is the whole ideas of this presentation: to whet your appetite for that panel discussion.

MR. LOMBARDO: When I first went to work for FlightSafety back in 1979 and 1980 in the King Air program, one of the things that I was very dismayed to discover was that the training for the instructor was very minimal, and there was an assumption, which it appears will continue through the 1990s, that if you are a good pilot you must be a good instructor. And what Curt will testify to is we did the job with the Blue Box and we can do a better job with more sophisticated equipment, but what industry needs, and I have had a devil of a time trying to convince anybody of, is guidelines for a structured training program for people who are going to instruct in simulators.

Typically what happens is we find somebody who is typed in the aircraft or has experience in the aircraft and

we put him in the box and assume he knows how to teach in a simulator. These people tend to fall into one of two categories: (1) those who use the simulator exactly as they use the aircraft, in which case they underutilize the equipment; or (2) those whose approach is let's see what I can do to them today, who overload the students. I am not a helicopter pilot; I am a fixed-wing pilot. Still, I would say that what needs to be done in the helicopter industry is to develop the guidelines for, or formulate a committee to put together, a program to teach people how to teach in simulators. You can do more with a good instructor and less accurate piece of hardware than you can do with a highly accurate piece of hardware and a poor instructor.

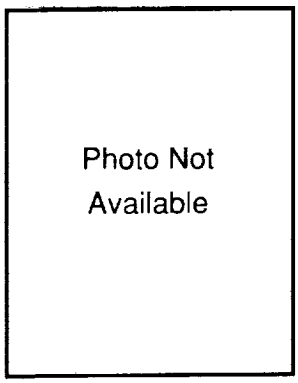
MR. McGOWAN: I agree with that last point that you made, totally. I will say that more than 4 years ago FlightSafety finally recognized part of what you said and developed an instructor development course that all of our instructors now go through. It is a 5-day course, standardized, taught in one location in Texas, and all of our instructors have to go through it.

There is a recurrent instructor course. It is not a do-all and end-all for the problem you are talking about. The Center is also ultimately responsible, through standardization, to ensure that the instructor is using these tools effectively. The FAA also has a part in that. Once you become a pilot-proficiency examiner you have to undergo check rides and they actually sit in on the check ride or a portion of it. A lot of the checks we do are progressive checks, and they have an opportunity to criticize or make comments on how you are doing your job, whether you are doing it effectively or not. These are important things. We could have a whole workshop dedicated to the subject of instructor training.

MR. McDANIEL: I agree with your point that a good pilot does not necessarily make a good instructor. I have known many very good pilots who are not very good at instructing. I would say that a good instructor pilot probably does have the skills to be a good simulator instructor. But there are differences between instructing in the actual aircraft and in the simulator and some strengths of the simulator, some capabilities of the simulator, make instructing in the simulator different from instructing in the real aircraft. I think we all appreciate and recognize this. I agree, you do need some kind of instructional program for the simulator instructor so he can best take advantage of the strengths of simulator use.

MR. CLENNEY: I agree 100%, because I also have been an instrument flight examiner in both airplanes and helicopters. When you start giving an instrument flight examination in a simulator, you are also now air-traffic control, and you have to plan your air-traffic control so it will be realistic for your pilot. the pilot is busy, but the instructor is busier. So I highly endorse this idea.

MR. McGOWAN: You are absolutely right. That is one of the things that have to be done in your instructor training. Probably the most difficult thing to teach an instructor is how to think further ahead than he or she has ever thought before because you have to be the ATC function, you have to be the Center, and you also have to, in some cases (for example in the EMS recurrent course) play the role of doctor, nurse, or EMT in the back of the helicopter during a loft scenario. It is a really busy job and it is actually, from a planning standpoint, much easier to do in the aircraft, because then you are really at the mercy of the system. You either get the ILS approach or you don't. In a simulator you have to plan for it. If you haven't done the proper planning, in the simulator there is no system to take care of you.



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