Part 25.1309: New Approach to Certification

A major change in certification that began 12 years ago is beginning to affect new aircraft. It's overturning a World War I philosophy of how to determine the safety of flight.

by Len Buckwalter

Last year, an Avionics Inspector in an FAA district office began receiving phone calls from shops in his area. The shops, it seems, were complaining that a sales representative of a corporate jet manufacturer was warning aircraft buyers that only the airframe factory could install radios in the new aircraft.

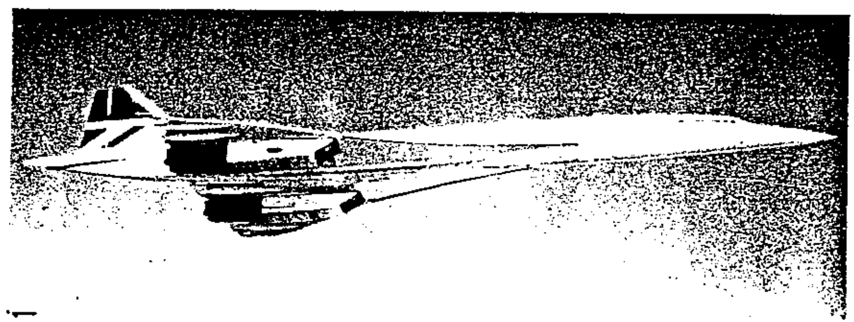
That alone was not surprising; the trend in recent years is for airframers to provide the navcom and flight control package. What had alarmed those shops, however, was a new development. The salesman was spreading the word that aircraft certified under Part 25 *must* have avionics fitted at the factory because new regulations made installation in the field too difficult. To prove his point, he held up Section 1309 of Part 25 of the FAA Federal Air Regulations; the one headed "Equipment, Systems and Installations."

Section 1309 was first adopted nearly twenty years ago to recognize that aircraft were growing out of the DC-3 era. During the 1960's, however, Britain and France were planning a greater leap — the one that would lead to the first SST civil transport. As the Europeans studied design objectives for the Concorde SST, they decided the aircraft was too sophisticated for ordinary standards. The British had dealt with a similar question while designing automatic landing systems in the 1950's. They were able to evaluate what could fail, but conventional guidelines were not sufficiently firm, often triggering such questions as; "How many failures should be considered for a single flight?" — or "How do we combine failures with such environmental conditions as wind shear?"

In a simpler age, a designer could rely on his intuition for answers. Common sense guided builders of World War I aircraft to rig wings with dual wires, install left and right magnetoes and two spark plugs per cylinder. Even now the belief persists that the hazard of radio failure is overcome by dual and triple redundancy. Such solutions for today's aircraft, and their highly interactive systems, have been judged as crude and uncertain. (One observer bluntly remarked; "If you install dual radios for redundancy, you could end up with two lousy radios!")

It was becoming clear that fresh concepts were needed to replace the classic "single fault" criteria used by certifying How does the designer define "probability" — and how severe is "severity?" Although few people would disagree that complex aircraft need to be certified with sophisticated methods, the amended Part 25 was vague and perplexing. It contained no guidelines.

After numerous attempts to fill this gap, a long-awaited Advisory Circular — AC 25.1309.1 — was published last year. Its appearance was timely because of an increasing urgency by government and industry to certify new airline and corporate



Studies for the Concorde stimulated thinking about how to design against multiple failures.

agencies. Somehow, the industry would have to deal with the threat of multiple and hidden faults, or simultaneous malfunction in several systems. And digital software often conceals bugs that intuition and judgment simply never see.

By 1970, a new philosophy appeared. In simplest terms it said: The more serious the failure, the lower must be the risk. In its engineering expression, the idea stated that "Systems should be designed so there is an inverse relationship between the probability of a failure and its severity."

This basic concept, introduced to Part 25.1309 a decade ago — in the form of Amendment 23 — touched off what many in the industry believe was the most confusing regulation ever to issue from FAA. transports under 25.1309 — and only a few specialists could do it. Further, airframers wanted to upgrade older aircraft as "hybrids," where only certain systems are certified under the new standards, reasoning that a 1309 certification not only produces a safer airplane, but is a powerful marketing tool.

For newly Type Certificated Part 25 aircraft, however, *all* functional systems FAA says, require some proof of compliance, which may be anything from a simple design review to an extensive analysis using "fault trees" or other techniques. If a function is defined as "critical" it will require a *probability* analysis; while "essential" functions *may* require the same treatment. FAA engineering judgment may also

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affect the outcome.

Certain systems are deeply influenced by 1309; for example, automatic control of engines and fuel systems, high authority automatic stabilization and control functions, a yaw damper which interconnects with electrical, hydraulic and mechanical systems — and digital systems which are separate from each other, but use the same software — because a common design error can lead to simultaneous failures. Displays for altitude, attitude and airspeed are also affected.

Which aircraft? Among the first of the new aircraft to be certified under 1309 were the Mitsubishi 300 Diamond, Falcon 50 and Challenger. The new digital airliners — the Boeing 757 and 767 — were also licensed under 1309 and new Douglas Super 80 systems were upgraded to 1309. Two aircraft are "hybrids" — the Gulfstream III and the Citation III — meaning they were Type Certificated too early to come under the new Part 25 rules, but the manufacturers elected to certify upgraded systems to the newer standard.

When Amendment 23 revised 1309, it introduced the concept of "probabilistic terms." The concept originated when the world's regulatory authorities searched for methods which would enable the designer to assess the acceptability of a failure condition. The result of their work, which serves as a basis for 1309, assumes the risk of a serious accident from all causes as approximately 1 in 1 million per hour of flight (or 1×10^{-6}). About ten percent of these accidents are caused by avionics, power, control and other systems, which is a probability of 1 in 10 million (1×10^{-7}). Thus it's possible to require that the probability of an accident caused by systems aboard the aircraft be no more than 1 in 10 million (1×10^{-7}).

This assessment, however, proved too general and cumbersome, so it was refined further. It was decided there are 100 potential failures in an airplane which could cause a serious accident. If the allowable risk for such systems is 1×10^{-7} then dividing that risk equally among 100 systems allocates to each system an upper risk limit of 10^{-9} (for catastrophic failures for each hour of flight). With this as target, FAA devised a scenario to satisfy the concept that the more serious the failure, the lower must be the risk.

Defining Risk

Part 25.1309 is vague on its terms of probability, but the new advisory circular pinpoints them as follows:

Probable — 1×10^{-5} or greater, per hour of flight. "Probable" events may be expected to occur several times during the life of the airplane.

Improbable — Probability from 10^{-5} to 10^{-9} per hour, not expected to occur in the life of a single aircraft, but will occur in the life of all airplanes of one type.

Extremely improbable — These occur 10^{-9} or less and are considered so unlikely, they don't have to be considered unless engineering judgment says otherwise.

Given these guidelines, other terms are given quantitative values; for example, the meaning of "non-essential" and "critical," how they affect aircraft and crew, and where they fit on the scale of failure probability. All of these relationships are shown graphically in Fig. 1, and provide the designer with basic definitions needed to proceed further.

Dave Gilles of Douglas Aircraft has instructed hundreds of FAA engineers and personnel in private industry in the techniques of certifying to Part 25.1309.

To look at the practical side of complying with 1309, Avionics visited Dave Gilles of Douglas Aircraft. Mr. Gilles has extensive experience in developing that company's aircraft reliability programs and validating digital flight control systems. He has trained over 300 FAA engineers, several airframe manufacturers and airline technical personnel in the background needed to certify systems for 1309. *Avionics* asked Mr. Gilles;

"Can you start by describing which systems aboard the aircraft must be considered for certification under 1309?"

"In principle," he replied, "the regulation applies to all systems on the airplane and to all avionics, as a first step. FAA

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Relationship Between Probability and Failures

Effect on aircraft and occupants	No significant degradation of aircraft or crew capability	Reduction of aircraft or crew ability to cope with adverse operating conditions	Prevention of continued safe flight and landing.
Criticality	Non-essential	Essential	Critical
Qualitative Probability	May be "Probable"	Must be "Improbable"	Must be "Extremely Improbable"
Quantitative Probability	10^{-0} 10^{-5} 10^{-9} Probability of Failure Condition (for one flight or flight hour)		

Fig. 1. Chart shows how subjective terms of "probable", "improbable" and "extremely improbable" are related to measured values. For example; a failure which must be "improbable" (near lower right) may occur with a probability between one in 100,000 and one in 1 billion (or 10^{-5} and 10^{-9}).

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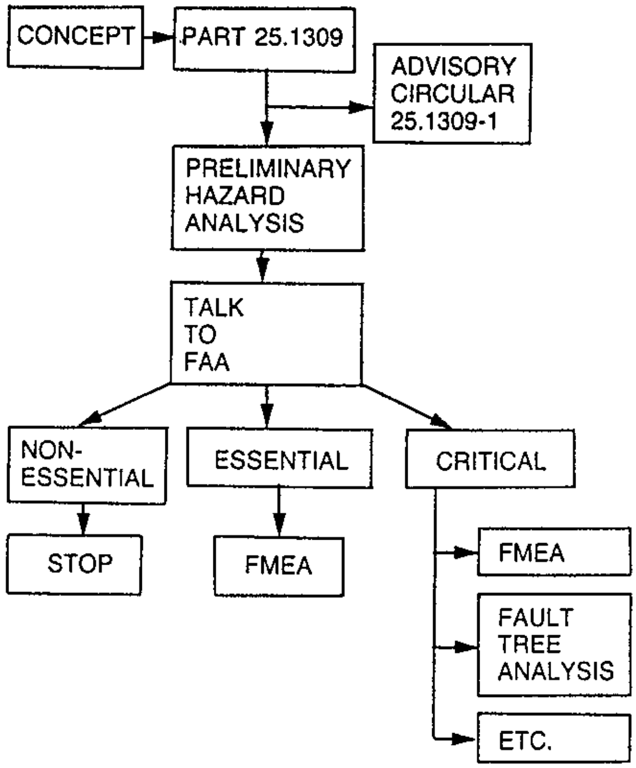

Fig. 2. Basic approach to Part 25.1309 certification. *It begins with a Concept (which may be a system, component, line replaceable unit, etc.) Much of the analysis is non-mathematical and qualitative, drawing on the designer's or installer's experience, especially for items judged Non-Essential and Essential.. When Critical, however (at the right), deeper analysis using quantitative, or numerical, assessment is often required.*

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thinking is that first you assess a system from a functional point of view and ask what it can do to hurt you if it doesn't do its job, or does it incorrectly at the wrong time. The terminology for talking about that first step is the *preliminary hazard analysis*. And you can do one even before you have a schematic; all you need is the concept or function. If your conclusion at the outset is that the system can't harm the airplane, then you can say it's *non-essential* and you're finished with it.

"But if you find certain things which can put the pilot in a difficult position, but are not catastrophic, you may be working in the area we call *essential*. It could be a fly-by-wire control system, a wing load alleviation or maybe an electronic fuel control. If it has a potential for malfunctioning in a way that could be catastrophic, it's classified as critical and requires the full-blown 1309 treatment.

"The basic thinking is that 25.1309 applies, at least, to the first review on everything on the airplane. You eliminate things depending on how you categorize the need for going further in your safety assessment."

Mr. Gilles pointed out that newer versions of older systems may need a fresh look, as in the transition from electromechanical to electronic instruments.

"A year ago the FAA held a workshop in Palo Alto on the subject of displays because this equipment had not been considered critical before. But now, because of digital technology and software-based systems with a CRT scope display, the concern is that we have to verify that it is extremely improbable that a display will give false information to the crew that could lead it into a disastrous situation. So, while the function of the device hasn't changed, the way it is mechanized has opened the door for failure conditions that could not have occurred before. In other words, where you had independent side-by-side mechanical devices with flags, we now consolidate them in a magic tube. What happens if the tube says something it shouldn't? An analogy I use is that years ago, when we worked with sliderules, it was easy to have confidence that an error was some percentage shift from the value you wanted. In other words, analog devices tend to drift only little bit from nominal. The problem with a digital system is that I have to take on faith that the answer is correct, but it could be off several orders of magnitude. That is a basic problem with digital equipment; you have to analyze it . . . or there is potential for failure modes that we didn't have before.

"If your conclusion is 'No,' then your job is done. If it's 'Yes,' then the next question is, 'How likely is it to occur?' A numerical-type risk assessment, however, is required only on failures you have determined are serious to the airplane."

Redundancy. "We used to say if something fails during a flight, you're in trouble, so let's put in another for a backup. That is a straight qualitative philosophy, but it isn't sufficient anymore with the new complex systems. Now FAA is saying 'We no longer will tell you, you must have two or three or four channels. We're asking what is the effect on the airplane, and the bottom line is that the effect must be shown to be extremely improbable. That's now defined as one chance in a billion for the design you select.

"So 1309 is more of an objective, where the FAA is not going to say how many channels to have, but expects you to come up with the configuration which controls the risk."

"There appears to be a misunderstanding in the field on redundancy because, in speaking with airframe people, a frequent answer is 'We'll put in two of them and avoid any complications.' Are they correct?"

"In theory," Mr. Gilles replied, "if I can make a single channel system with a demonstrated reliability equal to or greater than a multi-channel system, my single channel system will meet the regulation. And where we have become enlightened over the past several decades is that we have often been fooled by someone who has a design, and he duplicates it on the premise 'Now it's safe enough.'

"If you analyze how things fail and how often, you find it's not difficult to put two lousy things on the airplane as a crutch for one good one — and two lousy things can be more hazardous than one good one. So the automatic replication of a function is no guarantee of a safe system.

"Doesn't 1309 call for higher mathematics?

"No. As a matter of fact, I've been working in this area for twenty years and have yet to run into a problem I can't solve on that." (Mr. Gilles pointed to a pocket calculator.)

"There's a lot of in-depth theory behind probability," he continued, "but it's not the arithmetic, but the logic that people stumble over. Probability is misunderstood and misapplied because everyone feels it's a subject they understand a little bit of. If they have ever been to Las Vegas or flipped for coffee, they think they understand probability. When I teach the course, we don't go any higher than high school algebra. That's the level of mathematical sophistication needed to handle any problem.

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Approaching 1309

"Can you draw a block diagram that would show the overall steps a designer might follow in preparing a 1309 certification for the first time?"

"I would begin with the *concept* (see Fig. 2), which could be a system or unit on the airplane. Before proceeding, it's important to study and understand the advisory circular (AC 25.1309.1). As the circular says, you do a Preliminary Hazard Analysis to determine whether, in the designer's view, the system is *non-essential, essential* or *critical*. In other words, the applicant does that study. In my opinion, and this is not required by law, before you do any additional work, it's time to talk to the FAA and show what you've done. Reach agreement on your ideas before taking further steps.

"Next, if the system is judged non-essential, then that's all you have to do. If it's essential, the advisory circular provides guidance on the next step. Generally speaking, if the system is not difficult to understand as a concept, without esoteric new technology, a *qualitative* assessment will be satisfactory. There may be failure conditions that are marginal, and FAA might ask for a bit of probability analysis. If you are in the essential category, however, the bulk of your effort will be limited to a *qualitative* FMEA (Failure Mode and Effects) Analysis. It's a fairly straightforward, easy-to-learn procedure. There is no industry standard as to format, but I usually get people to understand it in an hour or two.

If you have a function which could cause a catastrophic failure, then that is assessed as a critical. Generally, you do all the qualitative work but, in most cases, you will also do some kind of a probability analysis. One popular technique is Fault Tree Analysis which structures the logic that leads to the numerical probability. It isn't difficult to learn but is relatively new and many engineers in our industry have not been exposed to it. It was evolved by the nuclear energy industry, and what I like about it as an approach to probability analysis, rather than pages of formulas, is that a fault tree is relatively easy to do. It's not time-consuming and is an excellent communication vehicle. You can show a fault tree to a vice president and he can comprehend what you're doing. If you show 16 pages of calculations, you're not communicating. The fault tree graphically illustrates

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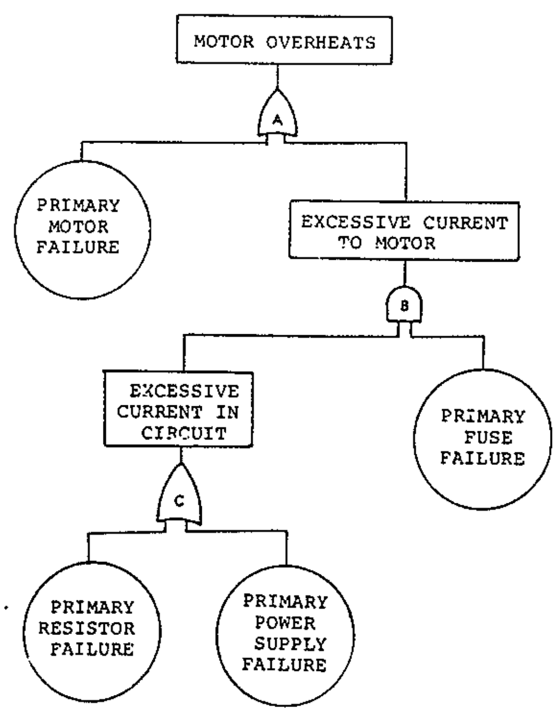

Fig. 3. Fault Tree Analysis reveals relationships among faults and failures, and identifies problem areas. It's constructed from the top down ("Motor Overheats"), then branches to faults and basic events. The tree is complete when all events are developed down to primary failures (bottom), whose failure rates can come from other sources (MTBF) or probability analysis. Logic symbols used in Fault Tree are: OR gate (A and C); and AND gate (B). Rectangles contain events which result from a combination of faults or failures. Events in circle are primary failures which need no further development.

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those equations and, in fact, if you've designed it correctly, you can put numbers on the blocks and use it to do calculations because it uses logic symbology (And and Or gates, etc.).

"The logic of probability works the same way. There are And and Or conditions, and modifications of both. Any avionics engineer who can draw schematics could probably do a good job on a fault tree. If you need calculations, in many cases that can be done right on the fault tree.

"The kinds of things that completion centers need include support from the manufacturer of the airplane and avionics equipment maker. As an assembler of the system, the completion centers must have information from those two ends of the spectrum. Their job is relatively easy, because all they have to analyze is the installation. The completion center is buying equipment from a manufacturer who has done the required analysis inside the black box, so the center doesn't have to do that.

"For the Preliminary Hazard Analysis, would you use Mean Time Between Failures (MTBF)?

"No, here you don't use numbers at all. Let's take an autopilot. I don't know how I'm going to install it; whether I'm going to grab control cables or electronically drive hydraulic actuators at the surfaces. All I know is that I'm going to put in an autopilot. That's all I have to know to start this process. Now, I say, 'What can this autopilot do to hurt me? I can get a hardover, a slowover, or it can disconnect inadvertently.' This starts my preliminary hazard analysis."

"Just using your own prior knowledge?

"Right. Quite often at the completion centers, the quality of these analyses are largely a function of the individual's knowledge and experience. So it might benefit him to talk to pilots because you can't do this in isolation if you haven't got the background."

FMEA

"If the installer or designer must perform a Failure Mode and Effect Analysis, what format should he follow?"

"There is no standard format for an FMEA, but we can provide guidance with an example (see Fig. 4). In the far left column, you identify the failure or error mode. This format allows you to consider human or maintenance error and other factors. In this particular case, we're talking about an APU starter relay, but you could apply it to each Line Replaceable Unit (LRU) in your system. In this particular case, we take the relay and say 'Fails to close, starter power circuit.' Now what causes that — mechanically, electrically, or whatever? We enter *faulty contacts* as a possible cause and ask 'Is there a phase of flight that is more critical than others if that occurs? These are listed under Phase: taxi, takeoff, etc.

"What is the effect of this failure? (Under column 4), the starter motor will not rotate to start the APU. Now we use the FAA's guidance and say, 'How hazardous is this to the airplane?' In our case we're building Part 121 airplanes, so we asked the designer to make a judgment because these systems will have a minimum equipment list. He decides whether the operator can dispatch the airplane without the item working. His judgment, in this case, was yes. Because the APU is not required in flight, he said you can dispatch with this fault (Col. 6). Then we ask several questions (Col. 7) that are important because this is where you learn how far you have to go. If the malfunction occurs, what is the indication to the flight crew? If your answer is *None*, you know immediately you have one of these latent, undetected failures and you'd better look at what else is going to happen if the next failure occurs.

"Assuming there is an indication, the

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Failure Mode & Effect Analysis

Component: Relay, APU Starter

1 Failure Mode	2 Failure Cause	3 Phase	4 Effect of failure	5 Hazard Class	6 Dispatch Inop. Yes No	7 (A) Indication to flight crew. (B) Other failures with same indic. (C) how does crew isolate fault? (D) - - -	8 Effect of additional failures
Fails to close starter power circuit	Faulty contacts, open coil	Static system operating	Starter motor will not rotate to start APU	I. Safe	Yes	(A) APU will not start. N2 gage indicates no rotation (B) Faulty electronic control box 2. Faulty proximity switch 3. - - -	
Fails to reset	Welded contacts	In flight	Power not removed from starter, causing overspeed, seized bearings	III. Critical II. Marginal IV. Catastrophic	No	(A) None (B) Not applicable	Shutting down APU with starter overspeeding will damage starter clutch

Fig. 4. Failure Mode and Effect Analysis (FMEA). *In this highly simplified example, an FMEA is being prepared for the starter relay of an APU. The analysis determines what happens to the system when failures occur in its individual parts. It's recommended that an FMEA be performed on systems which perform critical functions, where the effects of failures are not obvious. Such systems can include primary and secondary flight control systems, engine controls which affect all engines simultaneously and systems which display attitude, altitude and airspeed to the crew.*

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next question is; 'How does the crew isolate the fault (Col. 7C)? They know something's wrong, but do they know it's this relay? Is the indication to the crew ambiguous? Can several things go wrong that would cause this same indication? That could be a significant hazard.

"What is the corrective action? (Col. 7D) Here, we mean the flight crew; what can it do right now? Can the crew get advanced warning by some instrument or indicator that the failure is impending, like loss of oil pressure? "After we answer those questions we have a good insight, and have forced the designer to think through his own system. I'm convinced that a valuable benefit of this exercise is that a designer may uncover a problem, and can take care of that issue so it never shows up again."

"Do the completion centers follow the same overall procedure?

"I think so. The avionics manufacturers would be dealing inside the box, while the completion center would be in the same position we (airframers) are. There are interfaces to worry about and questions like 'What are the outputs from the box?' In other words, I would put the box in (the FMEA chart) and say, 'How can the box fail?' I don't care what's going on *inside.* How does a failure appear to the outside world?' That's the level the completion center would work on, but they need to get information from the manufacturer about what can be seen at the output of that box."

"At what point does probability analysis require a mathematical treatment?"

"Two ways; if I find a latent, undetected failure and that failure, coupled with a second failure, will put me in a dangerous situation, I note that here (Col. 8) I may have to go into a probability analysis to find whether that is acceptable and how much time I may allow a latent failure to go undetected before I have severely increased my risk to where it's no longer acceptable. The system may require something added to the airplane or a method to detect failure when it occurs. Or I must impose one of these periodic checks, which airline operators detest. That's one way.

"The other is if I find dangerous effects where a single factor can cause a Class IV (catastrophic) hazard, it would be very difficult to convince me that the single failure is extremely improbable, or that it will never occur. You don't build stuff that. So you've got to reconfigure the system. When I've done that, I'm into a multiple failure case that could give an event that is critical. Now I may have to go into a probability analysis to satisfy myself there is sufficient backup. Just duplicating the channel is not sufficient; you've got to show you can meet the criteria.

"That's why, even on the critical items, an FMEA has to be done. On a lot of the *essential* items you may be able to stop, but not always. And you may find unique cases that force you to look deeper.

"Why are some airframe companies certifying aircraft to 1309, when the law doesn't require it?"

"There is an advantage to the manufacturer. I've asked some of the business jet people, 'Why do you want to go through the trauma and the expense of certifying to Part 25, when you have the choice of certifying to Part 23?' They say, 'Because, it's good marketing strategy — a good investment.' The corporate heads buying business jets today want something they feel is certified to the same standards as a commercial airliner. So they've decided that the additional cost and trauma are worth it in their marketing strategy. It's what the customer wants.

"Another advantage is that, quite often, it isn't costly because you build your airplane to a level of regulation that exists at the time, but because you have experience in certain areas, technology evolves that exceeds minimum requirement. Let's take the DC-10. Its original certification base was to Amendment 16, but we designed the airplane to our own standards. Quite often the standards and practices of industry are a little ahead of the bow wave of regulations that follow. So, we design a system a certain way, even though the regulations may not require that. Maybe three or four years later, because all manufacturers are doing it a better way, the FAA reviews its regulations and says, 'Everybody's doing that, and it's a better, safer way, so let's revise the regulation and bring it up to that standard.' So when we go back and modify the airplane, we find we already meet a great many of the regulations. That's why someone like Cessna or Learjet would do the same thing."

"You mentioned the MU-300, Citation III, Lear and others. Would they include the Challenger?"

"I was going to mention the Challenger, but its original certification was with Canadian DOT, and they followed 25.1309. I believe that's true and the U.S. certification followed."

"The Gulfstream III?"

"Gulfstream III is another hybrid. I think that they upgraded to FAR 25 requirements voluntarily.

"Any other airframe manufacturers in this certification procedure, aside from the four or five mentioned?"

"The MU-300, as well as the 757 and 767 and the Challenger — those four to the best of my knowledge are the only airplanes that started from scratch, where their application for type certification on the original model was to post-Amendment 23, 1309 status. So it was a total application of that regulation to the airplane. All the others, I think, were based on an earlier type design that volun-

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tarily or, through special conditions, had 1309 philosophy applied to some systems, but not to the whole airplane."

General Aviation: Completions and Mods

"How will the avionics shops in General Aviation — the completion and mod centers — deal with 1309? Some are expressing concern over its complexity."

"I've been to four or five completion centers and given weekend seminars. My answer is that anyone — anyone who really wants to — can do it. It's not something that must be done by the manufacturer. Where the problem lies is that most completion centers are only beginning to be exposed to 1309. That happens when they modify or install *essential* or *critical* systems. If they want to get into the business of Part 25 airplanes, as opposed to Part 23, which most had been doing, they've got to step up to the requirements. And it does require an effort to understand what has to be done and getting the skills in their shops. It's not going to overwhelm them. I've been to completion centers where they've had excellent engineers, with only one or two who are DERs, and they got STC's for Part 25 by applying 1309 — with no trauma. So it can be done.

"The most annoying problem I've run into is that the completion center has been used to tapping into a system that exists on the airplane. When the airplane arrives the customer says, 'I want this and this, put it all in.' Then the shop calculates 'So much for material and costs multiplied by something' and they make a bid, not considering the requirements to get the STC.

"FAA says, 'Wait a minute. That is a Part 25 airplane, so you have to meet the equivalent standards for whatever modification you do.' If you are going to tap in and add equipment, there are now two tasks. You not only must show that this equipment meets the intent of 1309, but that your installation and method of tying into an existing system hasn't affected its certification status.

"The requirement is that a completion center should go to the manufacturer and have enough dialogue to where the manufacturer provides the information to assess that impact. Sometimes a manufacturer says, 'No. You can't have it, that's proprietary.' And that's where the problem comes in."

"Are there struggles between the airframe manufacturer wanting to install as much avionics as possible, versus the completion center?"

"No question about it. But now we're into an area that says, 'Look, the regulations clearly say what you have to do. What you guys are arguing about is a busi-

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ness matter and that's out of our (FAA) domain, so settle it anyway you can.'

"I think as a matter of business, the completion centers have got to assess this impact when they estimate costs for their customers, and say 'We've got to enter an agreement where the airframe manufacturer provides information we need to do the certification. If there are expenses, it's got to be part of doing the job. We've got to somehow come to contractual terms.

"I don't want to single out Canadair, but they did produce a summary document of a 1309-type analysis done while certifying the airplane into what they called a completion center handbook. They make it available for certifying additional equipment. I don't know what the arrangements were, but that was a step in the right direction.

"One weakness is that a completion center may be deficient in bits and pieces of information. It may require him to get on the phone and exchange ideas with someone back at the airframe manufacturer. To the degree the manufacturer is willing to invest an engineer's time to benefit the completion center, again is a business matter. Also consider that the customer may say 'I'm going to buy this airplane and want you (the airframer) to ship it to the completion center and have it put more avionics on it.' The airframer says, 'No, we don't want to. The customer could then say, 'To heck with it. I ain't going to buy your airplane!' I think there's a motivation for the airframe manufacturers to cooperate."

"Is it possible for a DER in a completion center to go it alone, so to speak, if he did not get the cooperation of the airframe manufacturer in getting data?"

"I'd say it's possible, but more difficult. And I've advised some of them to do that, which leads us to a related problem. I suggest as the first step, before they even make up a cost book to bid the job, to send the DER to talk to his FAA counterpart. He should openly and objectively explain the situation, 'Here's what we're going to do and where I think my problems will be.' Right from the start, reach agreement on what the FAA will require, because FAR 25.1309 is an objective requirement and, while the advisory circular recommends a way, it's not the only way to show compliance.

"The actual activity to satisfy the FAA is negotiable because the regulations do not say 'You must follow the bouncing ball, Step 1, Step 2, Step 3.' They say come up with an approach that satisfies us, the FAA — and you have met the intent of this regulation." □

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