121-216

federal register

Monday
April 9, 1990

Part III

# Department of Transportation

Federal Aviation Administration

14 CFR Parts 121, 125, and 129
Airborne Low-Altitude Windshear Equipment Requirements and TCAS II Implementation Schedule; Final Rules

**DEPARTMENT OF TRANSPORTATION**

**Federal Aviation Administration**

**14 CFR Part 121**

**[Docket No. 19110; Amdt. No. 121-216]**

**RIN 2120-AD18**

## Airborne Low-Altitude Windshear Equipment Requirements

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Final rule.

**SUMMARY:** The FAA is amending the airborne low-altitude windshear equipment rule to: (1) Remove the requirement that windshear flight guidance equipment be installed on older airplanes; (2) amend the provision allowing for an extended compliance period based on an approved airplane retrofit schedule; and (3) provide for acceptance of alternative airplane equipment in the form of an approved airborne windshear detection and avoidance system (predictive systems). This rule allows certificate holders to install windshear equipment in coordination with the installation of traffic alert and collision avoidance system (TCAS II) equipment; the coordination will reduce the prospect that carriers will have to divert critical maintenance resources from other safety programs.

**EFFECTIVE DATES:** May 9, 1990.

**FOR FURTHER INFORMATION CONTACT:** Mr Gary Davis, Project Development Branch (AFS-240), Flight Standards Service, Federal Aviation Administration, 800 Independence Avenue SW., Washington DC 20591; telephone (202) 267-8096.

**SUPPLEMENTARY INFORMATION:**

### Background

On September 27, 1988, the FAA issued regulations requiring the installation of airborne low-altitude windshear equipment and windshear training for flight crewmembers (53 FR 37688). Under the regulations, part 121 air carriers are required to install approved systems for windshear warning and flight guidance on turbine-powered airplanes by January 2, 1991. Air carriers can obtain extensions of the compliance date by obtaining FAA approval of a retrofit schedule. The purpose of the combined windshear equipment and training requirements is to reduce windshear-related accidents and increase the margin of safety if windshear is inadvertently encountered.

On March 17, 1989, the Air Transport Association (ATA) submitted comments to the FAA concerning the windshear rule. Included with those comments were studies on the retrofit of airborne windshear warning and flight guidance equipment on older airplanes. On June 1, 1989, the ATA petitioned the FAA to amend the windshear rule to exclude certain older airplanes from the flight guidance systems requirements and to extend the compliance date (54 FR 27023, June 27, 1989). In response to the ATA petition and studies, as well as to the possibility that Congress would permit an extension of the mandated date for installation of Traffic Alert and Collision Avoidance Systems (TCAS II), the FAA published a notice of proposed rulemaking (NPRM) on August 18, 1989 (54 FR 34394). In the NPRM, the FAA proposed three changes:

- Certain older airplanes would be excluded from the requirement to install flight guidance systems.
- Certificate holders would be able to obtain an extension to the compliance date in § 121.358(a). Under the proposed extension, certificate holders would be allowed to install windshear systems on the same schedule as they install TCAS II equipment.
- Approved predictive windshear systems would be allowed when they become available.

The FAA held a public meeting on August 16, 1989, to solicit comments on issues related to TCAS II and windshear systems.

In addition, the FAA has determined, based on a letter received from Fokker Aircraft, that it inadvertently included a certain group of turbopropeller airplanes in the equipment requirements of this final rule. Fokker Aircraft stated that its F27/F227 series airplanes were not specifically excluded by § 121.358, but neither are they included in the FAA's definition of turbine-powered airplanes since its engines are without "constant speed controls" as compared to "with constant speed controls." The FAA agrees and has revised its definition of turbine-powered airplanes in this final rule.

Based on public comments and its own analysis, the FAA is adopting the revisions to § 121.358 as proposed, with only minor corrections. A detailed discussion of the comments follows.

### Discussion of Comments

The FAA received 16 comments. The commenters include airline and pilots' associations, one airline, an airplane manufacturer, two windshear equipment manufacturers, the National Transportation Safety Board (NTSB) and one avionics engineer. In general, all commenters except the NTSB support the proposed change in the compliance date and the proposed inclusion of predictive systems. All but three commenters support the exclusion of older airplanes from the flight guidance system requirements.

*Exclusion of Older Airplanes*

Under the proposed rule, certain older airplanes would be excluded from the requirement to install flight guidance systems. Installing flight guidance requires a design that will accommodate digital instrumentation. For purposes of this rule, an older airplane is one that is manufactured without the capability to install digital equipment easily and therefore requires a major retrofit process. The exclusion of older airplanes is based on two considerations. First, these systems are difficult and expensive to install in older airplanes not designed to accommodate them easily and require a major retrofit process. Once the retrofit is done, these airplanes must be recertified.

Second, when a flight guidance system is installed in an older airplane it does not function the same way as when it is installed in newer airplanes. For example, in newer airplanes that are designed to accommodate digital flight guidance systems, the pilot may select flight guidance at any time. A pilot observing a potentially threatening weather situation ahead has the option of activating flight guidance at any position during the approach and does not have to wait for a warning. In contrast, flight guidance in older airplanes does not give a pilot the option of activating flight guidance before a warning.

Several commenters support the exclusion of older airplanes and agree that required windshear training appears to be highly successful. McDonnell Douglas takes issue with the claim in ATA's studies that, in some cases, pilots using flight guidance systems waited for guidance before employing windshear avoidance techniques. The commenter states that a well-trained pilot would not delay avoidance procedures in a critical situation. However, McDonnell Douglas also suggests that the retention of windshear training is not yet proven.

The agency does not endorse ATA's studies which suggest that some pilots may delay implementing a windshear avoidance strategy until there is a warning. A properly trained pilot should not delay windshear avoidance techniques. Further, the FAA believes that methods for ensuring the retention of windshear training are adequate. Pilots in command must undergo windshear training every six months.

Past experience with proficiency checks shows that periodic training results in successful retention.

Delta expresses the concern that excluding older airplanes from the flight guidance system requirement could undermine pilots' confidence in the systems installed in other airplanes. The FAA emphasizes that the exclusion of certain older airplanes is not based on any inadequacies in flight guidance systems, but rather on the difficulty and costs of installing the equipment in certain older airplanes.

Honeywell and Sextant Avionique, manufacturers of flight guidance systems, as well as the NTSB, oppose the proposed exclusion of older airplanes. Honeywell states that flight guidance systems provide better information than the Windshear Training Aid ("training manual" or "manual"). The company says that comparisons of manual and flight system guidance have been done in simulators with limited wind models. According to Honeywell, its research indicates that, using a wider variety of wind models shows that, "(flight) guidance (is) significantly better than other methods using the criterion of the ability of the aircraft to successfully exit the windshear condition." Both companies state that flight guidance systems are easier for pilots to use because they require monitoring a single instrument rather than at least three primary instruments that must be watched when flying manually. Finally, both manufacturers argue that the incremental cost of adding flight guidance systems is relatively low. According to Honeywell, the figure is about 15 percent of the cost of adding the windshear warning system alone (or about $6,000). However, this figure differs from the information provided to the FAA from air carriers who have installed windshear flight guidance equipment. Honeywell does not indicate whether this cost applies only to older airplanes or to newer airplanes or is an average for both types of airplanes.

The FAA agrees that flight guidance systems provide good information in a way that is relatively easy for the pilot to use; indeed, if the FAA did not believe these systems increase safety, the agency would not require them for any airplanes. The question, therefore, is not whether flight guidance should be added to all airplanes, but whether the increased level of safety it provides offsets the costs of installing these systems for older airplanes. In addition to the additional cost to retrofit flight guidance on older airplanes, the fact that these older airplanes may have a short in-service life (5–10 years) makes these costs more consequential.

Five commenters raise issues dealing with certification. These commenters are the Airline Pilots Association (ALPA), Delta, McDonnell Douglas, the NTSB, and Honeywell. ALPA and McDonnell-Douglas support the exclusion for older airplanes only if the windshear warning systems installed provided warnings on positive performance rather than only negative performance. (When an airplane encounters a microburst type of windshear, it first experiences a sharp increase in airspeed, then a sharp decrease. Warnings on positive performance alert the pilot to the sharp increase, thereby giving extra seconds to react and overcome the sudden decrease in airspeed.) ALPA further states that the FAA should require all guidance systems to be "upgradeable" as better systems are developed.

The agency declines to require that windshear warning systems be modified to sound an alarm during increases in positive performance. Increases in positive performance occur for many reasons other than a microburst type of windshear. Windshear warning systems that are activated during increases in positive performance will result in an unacceptable rate of false windshear warnings. False warnings will discourage pilot reliance on the warning system and, consequently, diminish the system's effectiveness. With respect to the question of whether windshear systems should be upgradeable, the FAA appreciates this position and believes that carriers should install improved windshear systems as older systems fail or deteriorate. The agency expects that a carrier will do this through its normal maintenance and repair schedule. The FAA declines, however, to require upgrades as often as new systems become available because that approach would impose frequent unnecessary costs on the industry.

Delta raises a number of concerns relative to certification. First, the carrier states that the proposed rule changes should not create conflicts with windshear systems that have already been certificated and installed. McDonnell Douglas expresses this same concern. The FAA notes that nothing in this rule is at variance with a carrier's choice to install windshear equipment on older airplanes, nor has the agency proposed to withdraw approvals for systems already certificated.

Delta's second certification concern is that without flight guidance, a pilot flying an airplane equipped with only a windshear warning system may be inclined to follow flight director commands, which could be inappropriate, during a windshear encounter. The NTSB raises the same issue, and both commenters suggest that the FAA require flight director commands to be eliminated during these encounters in airplanes without flight guidance systems.

The FAA agrees that it may be appropriate to bias out flight director commands during a windshear encounter in airplanes equipped only with a warning system. This rule, however, requires an approved system. Before the agency can approve a system, it must work out a methodology to assess each element of the system. The FAA declines to place in this rule the methodology by which it will assess the airworthiness of various configurations of windshear systems.

Delta further states that requiring the installation of reactive windshear detection systems may inhibit the development and installation of predictive systems. The final rule specifically allows for the installation of predictive systems if they become available.

Finally, with respect to certification, Honeywell argues that the strategies taught using the Windshear Training Aid do not account for the effect of heavy rain on airplane performance. The company cites a NASA study suggesting that heavy rain affects the stall characteristics of airplanes in such a way as to make the training manual avoidance strategy inappropriate for windshear encounters in heavy rain.

The agency recognizes that windshear accompanied by heavy rain may reduce the margin of safety in responding to this kind of encounter. Until the FAA receives and evaluates the final results of the NASA study as to the effect of heavy rain, it believes that the training manual strategy is appropriate for windshear encounters even if they are accompanied by heavy rain. The agency does not believe that the preliminary results of the NASA studies compel a contrary conclusion. The FAA continues to fund NASA studies on the effects of heavy rain and supports the development of data to understand and address this phenomenon.

McDonnell Douglas states that the MD–11 and MD–80 should not be excluded from flight guidance requirements. These airplanes are relatively new, and have been manufactured with the capability to accept digital instrumentation. Another commenter (avionics engineer) states that limiting the requirement for flight guidance systems on the MD–80 to those

airplanes equipped with the Honeywell-970 digital flight guidance computers, as was proposed, would permit certificate holders to avoid installing flight guidance by refusing to install the Honeywell system. This commenter further argues that MD-80s equipped with electronic flight instrument systems (EFIS) should have flight guidance installed.

The FAA agrees with McDonnell Douglas that the MD-11 should be required to install flight guidance and has added the MD-11 to the list of covered airplanes. The FAA does not agree that all MD-80's should be required to install flight guidance or that MD-80's equipped with EFIS should be required to install flight guidance. Furthermore, the FAA has determined that the MD-80 with the Honeywell-970 by itself, as proposed, is not appropriate for the installation of flight guidance. However, an MD-80 airplane equipped with EFIS and the Honeywell-970 is adaptable to flight guidance installation without a major retrofit. Therefore, the proposal has been amended so that EFIS MD-80's equipped with a Honeywell-970 must install flight guidance.

Sextant Avionique questions whether the Airbus A300 B2/B4 are considered part of A310 or A300-600 family, both of which are included on the list of airplanes that require flight guidance systems. The company states that the airplanes could easily be equipped with flight guidance systems and should be required to install flight guidance.

The FAA disagrees. The A300 B2/B4 airplanes have analog as opposed to digital systems. Based on the information in the economic summary, the FAA believes that installing flight guidance systems in these airplanes is not cost-effective.

*Compliance Schedule*

Congress recently passed legislation permitting an extension of the installation schedule for TCAS II. The FAA is revising its original schedule for installing TCAS II equipment on board airplanes. The installation of TCAS II and windshear equipment requires disassembly and reassembly of the airplane. The FAA believes it would be more efficient if certificate holders could install both systems at the same time. As a result, the FAA proposed that the final compliance date for certificate holders who obtain extensions would be the same as the date on which 100 percent compliance with TCAS II regulations would be required.

Commenters generally support the coordination of windshear and TCAS II installation. McDonnell Douglas states that the compliance date for windshear equipment should be delayed until January 2, 1992. The company offers no explanation for this request.

A principal impetus in reconsidering the windshear installation compliance date is to give carriers the maximum flexibility to install equipment consistent with maintaining safe air operations. The FAA believes that giving certificate holders the option of petitioning for an approved retrofit schedule, and thereby extending the final compliance date to 1993 provides ample time to meet the windshear installation requirements.

Turbulence Prediction Systems objects to the "phased installation schedule," and states that such a schedule would lead certificate holders to commit to reactive systems thereby limiting the market for predictive systems when they become available. The FAA notes that the original rule requires the air carrier to have a percentage phased-in compliance schedule for installing windshear equipment. However, this final rule allows for approval of a retrofit schedule that relieves the air carrier from the requirement of a percentage phased-in compliance schedule for installing windshear equipment. This relaxed retrofit schedule should make it easier for air carriers to install predictive systems should they become available.

The NTSB states that the FAA should not grant "indefinite extensions" for equipping airplanes with flight guidance systems based on the installation schedule for TCAS II. According to the NTSB, the TCAS II extension is based on an expectation that there may be software and hardware changes refining the system as it is assessed in-service. The NTSB argues, on the other hand, that there is no need to assess windshear technology or in-service operation further. The NTSB's concern appears to be that failure to require a mandatory percentage phase in for windshear equipment installation across the fleet amounts to an indefinite extension for compliance to 1993—especially because the rule does not "(provide) guidance (for) an acceptable retrofit schedule."

The agency does not agree that allowing operators to petition for an approved retrofit schedule amounts to an indefinite extension. A certificate holder must petition the FAA for an extension of the compliance date and must submit a retrofit schedule for approval. Further, although the windshear compliance date is tied to the schedule for installing TCAS II, the principal reason for making these schedules compatible is to minimize the prospect that a carrier would have to take airplanes out of service for two cycles of retrofit. Indeed, there was a question whether a carrier could install TCAS II and windshear equipment on the schedules proposed without sacrificing other safety-critical maintenance and repair procedures. Finally, the FAA believes that it is in the carrier's interest to phase-in the installation of windshear equipment as its fleet comes in for service because that approach is the most efficient way to meet either the 1991 or 1993 compliance date.

*Predictive Systems*

Windshear warning systems can be reactive or predictive; reactive systems recognize a windshear once the airplane has encountered it while predictive systems will recognize the windshear before the airplane encounters it. Because predictive systems would provide pilots with an opportunity to avoid the encounter, the FAA proposed amending § 121.358 to allow the use of predictive systems as soon as they are available and certificated.

Commenters generally support the inclusion of predictive systems and note that such systems will make flight guidance systems less critical. One commenter notes that wording of the proposed paragraph (b)(1) should be revised to allow predictive systems to satisfy the equipment requirements for airplanes manufactured before January 1, 1991. The FAA agrees and has revised the rule.

Commenters at the public hearing said that airlines that participate in testing predictive systems should automatically be granted extensions. On the other hand, NTSB raises a concern that because predictive systems still are under development, a carrier's petition to extend the compliance date for installing windshear equipment should not rest on the carrier's intention to install a predictive system. The NTSB notes especially that predictive systems may not be totally effective in detecting a descending microburst (one type of severe windshear) immediately in front of an airplane and that ultimate windshear avoidance technology may incorporate predictive and reactive systems.

The FAA disagrees that carriers who test predictive systems should have an automatic extension. Further, the FAA appreciates NTSB's concern and recognizes again that predictive systems are still under development. The FAA notes that this rule permits the installation of approved systems only and that a predictive system must be certificated before it can be installed in

an airplane. In addition, the agency believes that it is inappropriate to grant an unreviewed extension for predictive systems precisely because it is new technology. Nothing in this rule diminishes the agency's ability to consider the safety of these systems in a certification process.

The final rule has been reorganized and edited for clarity. There is, however, no substantive change from the rule as proposed.

## Economic Summary

Executive Order 12291 dated February 17, 1981, directs Federal agencies to promulgate new regulations or modify existing regulations only if the potential benefits to society for the regulatory change outweigh its potential costs. The order also requires the preparation of a draft regulatory impact analysis of all major proposals except those responding to emergency situations or other narrowly defined exigencies. A major proposal is one that is likely to result in an annual effect on the economy of $100 million or more, a major increase in consumer costs, a significant adverse effect on competition or is highly controversial.

The FAA has determined that this regulatory action is not a major action as defined in the executive order, so a full draft regulatory impact analysis identifying and evaluating alternative proposals has not been prepared. A more concise regulatory evaluation has been prepared, however, which includes estimates of the economic consequences of this regulation. This regulatory evaluation is included in the docket and quantifies, to the extent practicable, estimated costs to the private sector, to consumers, and to Federal, State and local governments, as well as estimated anticipated benefits and impacts.

The reader is referred to the full regulatory evaluation contained in the docket for the complete detailed analysis. This section contains only a summary of the full regulatory evaluation. This section also contains an initial regulatory flexibility determination as required by the Regulatory Flexibility Act of 1980 and a trade impact assessment.

### *Background*

The FAA has considered the economic impact of amending the airborne low-altitude windshear equipment requirements as requested by ATA in its June 1, 1988, petition. The FAA determines that the issues raised by the petition have merit and, therefore, the FAA is granting the relief requested by ATA.

ATA attached additional data to its June 1 petition regarding the installation of windshear escape flight guidance equipment into older airplanes. ATA submitted this data after the comment period for the final windshear rules had closed, too late for consideration in the final determination of the rule. The petition indicates that the industry agrees with the $372.2 million, in 1987 dollars, as the cost of equipping airplanes with on board windshear warning and escape flight guidance systems over a 15-year period. According to the petition, however, industry sources maintain that training and maintenance during the same 15-year period would drive costs to over $800 million.

### *Costs*

The petition claims that the incremental cost of adding windshear flight guidance (separate from windshear warning equipment costs) into all affected airplanes is $183.4 million, in 1987 dollars, over the 15-year period. ATA does not show how it arrived at these costs.

The FAA realizes that installing windshear escape flight guidance systems into older airplanes is more expensive than either installing these systems into existing airplanes with digital flight instrumentation systems or factory installation of these systems into newly manufactured airplanes. The FAA estimates the difference in costs between installing flight guidance into older airplanes as opposed to installing it into digital airplanes to be about $3,000 per airplane. This was shown in the regulatory evaluation of the final windshear rule.

Furthermore, ATA states that airlines and airframe manufacturers are discovering that recertification of older airplanes after installing windshear flight guidance is more difficult than expected when the FAA developed its cost analysis for the windshear final rule. The certification problems are twofold. First, current flight control systems have to be recertificated because the flight director systems of older airplanes must be reassembled after windshear flight guidance systems are installed. Second, obtaining certification of the installed flight guidance systems themselves is more difficult than expected. ATA does not show how it arrived at its estimated costs nor does it indicate the number of airplanes that may need recertification of the affected associated flight instrumentation systems.

Based on the information presented by ATA, the FAA acknowledges that certain certificate holders may incur recertification costs not previously considered, but the petition does not provide sufficient data to verify the recertification cost estimate presented by the ATA. For the same reason, the FAA cannot verify the other revised costs presented in the petition. The ATA did not submit additional costing details or information into the docket in response to the FAA's various economic questions set forth in the NPRM. Moreover, ATA does not attempt to quantify the marginal costs of installing windshear flight guidance systems into older airplanes, although it seeks relief from the requirement to install such systems into only these airplanes.

The FAA notes that the costs set forth in its windshear regulatory analysis were those actually experienced by certain certificate holders that installed the required windshear systems into various types of airplanes. Guided by these actual reported costs, the FAA estimates that installing windshear escape flight guidance systems into an older airplane costs about $10,000. Therefore, granting the relief requested by ATA would result in a cost savings to the affected certificate holders of $19.4 million ($10,154 × 1910). Exhibit B of the full regulatory evaluation sets forth in detail how these costs were derived. The following assumptions were used to derive the estimated costs:

(1) 50 percent of the affected existing airplanes have electro-mechanical flight instrumentation systems and would be relieved of the requirement to install windshear escape flight guidance systems;

(2) Escape flight guidance equipment costs $5,000 per unit;

(3) Engineering necessary to accomplish installation of escape flight guidance costs $34,000 per airplane type;

(4) 49 types of airplanes have electro-mechanical flight instrumentation systems;

(5) Installing the escape flight guidance equipment costs $3,500 per unit for installation only; and

(6) Spares and inventory cost $5,000 per airplane type.

### *Benefits*

The ATA petition claims that the FAA's estimate of $451.6 million in benefits over 15 years, assuming that all of the requirements of the rule would eliminate windshear accidents, is overstated. According to the petition, these benefits were predicated on an accident rate of 1.13 per year (17 windshear accidents occurred during the 15 years preceding the analysis). The FAA notes that, in its regulatory evaluation of the windshear final rule, it

predicated its projection of potential avoidable accidents on the basis of accidents per operation rather than on an annual rate. The petition submits that, since the 1983 Academy of Sciences Study and the subsequent voluntary implementation of windshear training by 80 percent of certificate holders affected by the windshear rules, the accident rate has dropped dramatically. In fact, no accidents have occurred in the 42 months preceding the petition, or four times longer than the previous accident free period. Thus, in the last six years, since the academy study, the accident rate has fallen to 0.5 accidents per year. The petition maintains that pilot reports attribute the above reduction in accidents to the avoidance of windshear made possible by heightened awareness of clues to its existence and their significance rather than to the use of recovery techniques.

While the FAA does not dispute ATA's assertion that no windshear accidents have occurred in the 42-month period cited in the petition or that pilot training in handling windshear conditions has significantly affected the windshear accident rate, it is unwilling to accept that the reduction in accidents over the cited 42-month period can be attributed solely to pilot training. Other factors, such as controller awareness, increased forecasting capability, coincidental avoidance of windshear conditions, etc., could also have played a role in the reduction of such accidents. For example, 1985 was the aviation industry's safest year. The exact cause for this has never been pinpointed nor has the industry been able to repeat that year's safety record. Thus, the FAA is reluctant to give the cited 42-month period the overwhelming weight in estimating benefits that it was given in the ATA petition. The FAA believes that a longer period is necessary to accurately ascertain the effects of any action taken to improve safety.

ATA's petition also claims that safety may be decreased because windshear flight guidance in older airplanes requires windshear warning before it can be activated. As the FAA understands ATA's contention, pilots who are trained to avoid windshear conditions may fail to initiate early avoidance procedures, and instead wait for the warning and flight guidance.

The FAA does not agree that safety necessarily would be reduced by pilot reliance on these systems. First, the FAA does not believe that any properly trained pilot will deliberately enter a windshear of unknown intensity. In addition, the systems have been designed adequately to recover an airplane from windshear encounters in instances where a pilot enters airspace unaware of these conditions. These systems should be no less effective in instances where the pilot may enter airspace aware that windshear conditions are likely to exist.

Nevertheless, the FAA agrees that fundamental technical differences exist between older airplanes, whose avionics systems employ largely analog electronics and the newer airplanes, whose avionics systems are largely digital. This difference manifests itself in how most retrofitted flight guidance systems perform. First, a delay in activating the windshear warning is built into both newer and older airplanes' flight guidance systems in order to filter out false alarms. This delay may be longer in older airplanes, because their analog flight director systems may not process the data as fast as digital flight director systems. In some cases, this delay can last several seconds. Second, if a pilot inadvertently enters a windshear, an analog airplane with retrofitted flight guidance will provide that guidance only after the warning has been given. On the other hand, the flight guidance in most digital airplanes can be activated by the pilot before the windshear warning. Thus, the performance of flight guidance on digital airplanes is somewhat superior to that in retrofitted analog airplanes.

The petition attempts to isolate the incremental benefit of windshear flight guidance by referring to a study carried out with cooperation from industry and the FAA, which ATA refers to as the FAA Windshear Training Aid Studies (the FAA refers to it as windshear training aid). This study compares "optimum" flight guidance, i.e., guidance methods having full knowledge of the wind field and optimized for the conditions, with warning plus flight guidance and warning plus training techniques. In this study optimum flight guidance is given an effectiveness value of 100 percent; warning plus flight guidance is given an effectiveness value of 97 percent; and warning plus trained techniques is given an effectiveness value of 94 percent. Using the 3 percent increment in effectiveness values between warning plus flight guidance, on the one hand and warning plus trained techniques, on the other, the petition allocates $5.9 million over the 15-year period as the benefit attributable to flight guidance alone. In order to obtain its estimated benefits, ATA applies the 3-percent effectiveness factor to the FAA's original $451.6 million estimated benefits, reduced by its 0.5 accident rate factor based on the 42-month accident free period (see above).

The FAA does not believe that estimates of relative effectiveness of various components of the airborne windshear systems contained in the windshear training aid are accurate enough to use as a primary basis for rulemaking. While the cost of each element can be individually identified, the FAA believes that the benefits are inextricably related and, therefore, inseparable. The FAA recognizes the value and importance of training, while at the same time it is aware of its limitations. For instance, no human factors or other studies are available to support the premise that training alone can produce a single standard response by pilots in assessing a hazard. The question of judgment is further clouded by the fact that a pilot may seldom be exposed to windshear in an operating environment. As a result, a pilot may not immediately recognize the level of threat. Evidence of this is provided by the safety record, which reveals that pilots have observed other airplanes landing or taking off safely moments before they entered a catastrophic windshear. To isolate the discrete benefits of training, windshear warning and flight guidance equipment requires a judgment to be made concerning the accident prevention value of each in a violent and life-threatening interval of a few seconds, typical of an inadvertent windshear encounter. The FAA believes that in a low-altitude windshear encounter, it is not feasible to distinguish the safety merit of any one element comprising the FAA's "systems concept" for solving the problem of low-altitude windshear from another.

Notwithstanding the FAA's views, it must make a determination regarding the ATA's petition. In making this determination, the FAA must consider the economic impact of granting the requested relief. While no method of accurately allocating benefits to the various components of the windshear systems is currently available, the FAA can calculate that windshear flight guidance on older airplanes would have to be given an effectiveness value of 16 percent (using a system similar to the windshear training aid system used by the ATA) in order to show that granting the requested relief is not cost effective. This calculation is based on the estimated cost savings of granting the requested relief, i.e., $451.6 million in total windshear benefits $\times$ 27 percent proportion of older airplanes to total fleet generating benefits = $121.9 million benefits applicable to older airplanes/ $19.4 million in estimated cost

savings=15.9 percent (see Exhibit C in the full regulatory evaluation for details). If this were so, the effectiveness of windshear warning plus training would be reduced to about 60 percent, based on the approach taken in the windshear training aid. The FAA does not know precisely the relative effectiveness of flight guidance, but on the basis of the information available, may draw certain conclusions. Sixteen percent may be high, particularly for older airplanes, in light of the problems noted above and is certainly high when compared to the 3 percent in the windshear training aid, which, while not considered accurate by the FAA, is the measure presented by the petitioner.

Another consideration is that the older airplanes will be the first to be retired from U.S. air carrier service. Accurately quantifying this factor is difficult. Under these circumstances, the incremental effectiveness of flight guidance alone would need to be increased by an amount commensurate with the reduced life of the retired airplanes in order to make equipping the older airplanes with flight guidance cost beneficial.

Other benefits, that have not been quantified, can be ascribed to granting the relief requested by the petition. As pointed out by ATA, a number of certification difficulties are inherent in retrofitting the older airplanes, which were not considered when the original windshear rule was promulgated. Many of the flight directors which at present are engineered and approved for low visibility (Cat II and Cat III) landings cannot be modified without recertifying the new design. The cost of recertifying these flight directors may be substantial. However, the FAA does not have sufficient data available in the docket to specifically quantify these costs. These costs would not be incurred in the class of aircraft for which compliance requirements would remain because the digital systems of newer airplanes readily accept or already have incorporated these features. In addition, there is the benefit of avoiding modification or maintenance activities which has little benefit over other acceptable alternatives. The demands on maintenance and modification facilities available to U.S. airlines are great. Aging aircraft requirements imposed since the adoption of this rule, coupled with the new requirements for installation of TCAS leave little room for additional work. Any relaxation of the requirement to retrofit flight path guidance equipment has a significant positive outcome in effectively providing additional capability over and above the actual dollar savings realized.

*Conclusion*

While the FAA cannot fully agree with all of the assertions in ATA's petition, it concedes that the petition raises significant points concerning the decrease in windshear related accidents and the cost effectiveness of installing windshear flight guidance systems into older airplanes. The FAA realizes that certain certificate holders may incur recertification costs that were not taken into account in the regulatory evaluation of the final windshear rules. Introducing flight guidance into these airplanes may result in time consuming and expensive recertification of associated flight systems. In addition, it is possible that, as certificate holders continue to install flight guidance into various models of older airplanes, further problems with recertification will arise. The FAA finds that the cost efficiency of installing windshear flight guidance into older airplanes is reduced because of the recertification costs not previously considered. Although the exact reduction in safety cannot be calculated, the FAA concludes that the savings incurred from not installing flight guidance into older airplanes will exceed the reduction in safety that may result from not installing flight guidance into these airplanes. Therefore, the FAA is granting the requested relief.

**Regulatory Flexibility Determination**

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress in order to ensure, among other things, that small entities are not disproportionately affected by Government regulations. The RFA requires a regulatory flexibility analysis if a rule has a significant economic impact, either detrimental or beneficial, on a substantial number of small business entities. FAA Order 2100.14A, *Regulatory Flexibility Criteria and Guidance*, establishes threshold cost values and small entity size standards for complying with RFA review requirements in FAA rulemaking actions. The small entities that would be affected by the proposed rule amendments are part 121 certificate holders that own nine or fewer aircraft, which is the size threshold for small aircraft operators. The cost thresholds are $94,500 for operators of scheduled services with entire fleets having a seating capacity of over 60; $54,000 for other scheduled operators; and $3,700 for unscheduled operators.[1] A substantial number of small entities means a number which is not less than eleven and which is more than one-third of the small entities subject to the proposed rule.

The FAA has determined that granting ATA's petition requesting the elimination from the windshear regulations the requirement that windshear escape flight guidance systems be installed into certain older airplanes with electro-mechanical flight instrumentation systems may have a significant beneficial economic impact on a substantial number of small entities.

According to the FAA data for the period ending December 1, 1987, 51 certificate holder subject to part 121 operated nine or fewer aircraft. Twenty-seven of these certificate holders conducted scheduled service and the remaining 24 engaged in unscheduled operations. These 51 certificate holders are small entities that will be affected by the final rule changes.

Although the FAA does not have sufficient information to accurately estimate the level of the economic impact on these small operators, it has determined that the impact may be significant by using data in the regulatory evaluation of windshear final rules. The impact of relieving small certificate holders from the requirement that windshear escape flight guidance systems be installed on certain older airplanes should exceed the $3,700 cost threshold for nonscheduled part 121 certificate holders. While the FAA does not have data readily available indicating how many of the affected aircraft each of these small entities has in its fleet, the FAA feels secure in assuming that more than one-third of such small certificate holders have at least one of the affected aircraft in their fleet. Thus, a substantial number of nonscheduled part 121 certificate holders are expected to incur a significant beneficial economic impact as a result of the amendments to the windshear regulations. On the basis of this finding a full regulatory flexibility analysis is attached as Exhibit A to the full regulatory evaluation.

**Trade Impact Assessment**

The final rule amendments will have little or no impact on trade by either U.S. firms doing business in foreign countries or foreign firms doing business in the United States. The final rule will apply only to part 121 certificate holders who compete domestically for passenger

[1] Thresholds appearing in the order have been inflated from 1986 to 1989 dollars using the Consumer Price Index appearing in "FAA Aviation Forecasts, Fiscal Years 1989–2000" (FAA–APO–89–1) March 1989.

and cargo revenues with other U.S. operators between points within the United States. Therefore, the amendments will not cause a competitive fare disadvantage for U.S. carriers.

**Federalism Implications**

The regulations herein will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government. Thus, in accordance with Executive Order 12612, it is determined that these regulations do not have federalism implications requiring the preparation of a Federalism Assessment.

**Paperwork Reduction Act Approval**

The recordkeeping and reporting requirements contained in this final rule (§ 121.358) have been submitted to the Office of Management and Budget. Comments on these requirements should be submitted to the Office of Information and Regulatory Affairs (OMB), New Executive Office Building, room 3001, Washington, DC 20530. Attention: FAA Desk Officer (telephone 202-395-7340). A copy should be submitted to the FAA docket.

**Conclusion**

The FAA has determined that this amendment is not major under Executive Order 12291, but that it is significant under the Department of Transportation Regulatory Policy and Procedures (44 FR 11034, February 26, 1979). For the reasons discussed above, it certified that the amendments to part 121 will have a significant beneficial economic impact on a substantial number of small entities.

**List of Subjects in 14 CFR Part 121**

Air carriers, Air transportation, Aviation safety, Safety, Transportation, Windshear.

**The Rule**

Accordingly the Federal Aviation Administration amends part 121 of the Federal Aviation Regulations (14 CFR part 121) as follows:

## PART 121—CERTIFICATION AND OPERATIONS; DOMESTIC, FLAG, AND SUPPLEMENTAL AIR CARRIERS AND COMMERCIAL OPERATORS OF LARGE AIRCRAFT

1. The authority citation for part 121 continues to read as follows:

**Authority:** 49 U.S.C. 1354(a), 1355, 1356, 1357, 1401, 1421-30, 1472, 1485, and 1502; 49 U.S.C. 106(g) (Revised Pub. L. 97-449; January 12, 1983.)

2. Section 121.358 is revised to read as follows:

**§ 121.358 Low-altitude windshear system equipment requirements.**

(a) *Airplanes manufactured after January 2, 1991.* No person may operate a turbine-powered airplane manufactured after January 2, 1991, unless it is equipped with either an approved airborne windshear warning and flight guidance system, an approved airborne detection and avoidance system, or an approved combination of these systems.

(b) *Airplanes manufactured before January 3, 1991.* Except as provided in paragraph (c) of this section, after January 2, 1991, no person may operate a turbine-powered airplane manufactured before January 3, 1991 unless it meets one of the following requirements as applicable.

(1) The makes/models/series listed below must be equipped with either an approved airborne windshear warning and flight guidance system, an approved airborne detection and avoidance system, or an approved combination of these systems:

(i) A-300-600;
(ii) A-310—all series;
(iii) A-320—all series;
(iv) B-737-300, 400, and 500 series;
(v) B-747-400;
(vi) B-757—all series;
(vii) B-767—all series;
(viii) F-100—all series;
(ix) MD-11—all series; and
(x) MD-80 series equipped with an EFIS and Honeywell-970 digital flight guidance computer.

(2) All other turbine-powered airplanes not listed above must be equipped with as a minimum requirement, an approved airborne windshear warning system. These airplanes may be equipped with an approved airborne windshear detection and avoidance system, or an approved combination of these systems.

(c) *Extension of the compliance date.* A certificate holder may obtain an extension of the compliance date in paragraph (b) of this section if it obtains FAA approval of a retrofit schedule. To obtain approval of a retrofit schedule and show continued compliance with that schedule, a certificate holder must do the following:

(1) Submit a request for approval of a retrofit schedule by June 1, 1990, to the Flight Standards Division Manager in the region of the certificate holding district office.

(2) Show that all of the certificate holder's airplanes required to be equipped in accordance with this section will be equipped by the final compliance date established for TCAS II retrofit.

(3) Comply with its retrofit schedule and submit status reports containing information acceptable to the Administrator. The initial report must be submitted by January 2, 1991, and subsequent reports must be submitted every six months thereafter until completion of the schedule. The reports must be submitted to the certificate holder's assigned Principal Avionics Inspector.

(d) *Definitions.* For the purposes of this section the following definitions apply—

(1) "Turbine-powered airplane" includes, e.g., turbofan-, turbojet-, propfan-, and ultra-high bypass fan-powered airplanes. The definition specifically excludes turbopropeller-powered airplanes.

(2) An airplane is considered manufactured on the date the inspection acceptance records reflect that the airplane is complete and meets the FAA Approved Type Design data.

Issued in Washington, DC, on April 3, 1990.

**James B. Busey,**
*Administrator.*

[FR Doc. 90-8075 Filed 4-4-90; 10:10 am]
BILLING CODE 4910-13-M

---

**14 CFR Parts 121, 125, 129**

**[Docket No. 25954; Amdt. No. 121-217, 125-14, 129-21]**

**RIN 2120-AD23**

## TCAS II Implementation Schedule

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Final rule.

**SUMMARY:** This rule revises the schedule for installing Traffic Alert and Collision Avoidance Systems (TCAS II) on airplanes with more than 30 passenger seats. The TCAS II system will provide a collision avoidance capability that operates independently of the ground-based Air Traffic Control (ATC) system and in areas where there is no ATC coverage. Congress recently passed legislation permitting an extension of the schedule. This action implements the legislation, reduces the prospect that carriers will divert critical maintenance and modification resources away from other safety programs to meet the TCAS II schedule, and allows the FAA to