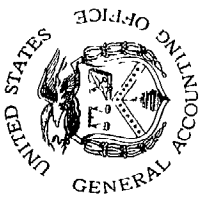


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REPORT TO THE GOVERNMENT  
ACTIVITIES SUBCOMMITTEE  
COMMITTEE ON GOVERNMENT  
OPERATIONS  
HOUSE OF REPRESENTATIVES

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Need For Improved Controls For  
Identifying And Correcting  
Safety Defects On Light Aircraft

B-164497(1)

Federal Aviation Administration  
Department of Transportation

BY THE COMPTROLLER GENERAL  
OF THE UNITED STATES

~~701581~~ [096336]

JUNE 8, 1973



COMPTROLLER GENERAL OF THE UNITED STATES  
WASHINGTON, D.C. 20548

B-164497(1)

The Honorable Jack Brooks, Chairman  
Government Activities Subcommittee 11 015:2  
Committee on Government Operations  
House of Representatives

Dear Mr. Chairman:

This is our report on the need for the Federal Aviation Administration, Department of Transportation, to improve controls for identifying and correcting safety defects on light aircraft. 30 19

Our examination was made in accordance with your request of January 25, 1972, and subsequent discussions with your office. As instructed by your office, we did not obtain comments on this report from the Department of Transportation.

As agreed with your office, we plan to make further distribution of this report when the Subcommittee starts hearings on the Federal Aviation Administration's delegation of aircraft certification responsibility.

Sincerely yours,

A handwritten signature in cursive script that reads "James B. Stacks".

Comptroller General  
of the United States

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ABBREVIATIONS

CAB Civil Aeronautics Board  
DOA Delegation option authorization  
FAA Federal Aviation Administration  
GAO General Accounting Office  
NTSB National Transportation Safety Board

COMPTROLLER GENERAL'S REPORT TO  
THE GOVERNMENT ACTIVITIES SUBCOMMITTEE  
COMMITTEE ON GOVERNMENT OPERATIONS  
HOUSE OF REPRESENTATIVES

NEED FOR IMPROVED CONTROLS FOR  
IDENTIFYING AND CORRECTING  
SAFETY DEFECTS ON LIGHT AIRCRAFT  
Federal Aviation Administration  
Department of Transportation  
B-164497(1)

D I G E S T

WHY THE REVIEW WAS MADE

At the request of the Chairman of the House Government Activities Subcommittee, GAO reviewed Federal Aviation Administration (FAA) aircraft safety regulatory activities involving selected manufacturers of light aircraft<sup>1</sup> to whom FAA had delegated certain authority for determining that their aircraft met Government regulations.

FAA is required, by law, to promote air safety and to foster the growth of air commerce. With respect to aircraft safety, FAA

- prescribes minimum aircraft design and performance standards,
- provides surveillance over aircraft-manufacturing activities,
- certifies aircraft manufacturers' production processes and aircraft products, and
- regulates manufacturers' activities for correcting recognized aircraft defects.

On the basis of the Chairman's request and of a subsequent meeting with the Subcommittee, GAO made historical analyses of several design

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<sup>1</sup>Propeller-driven aircraft weighing 12,500 pounds or less.

weaknesses in the manufacturers' aircraft. It also obtained information on the actions by FAA and the manufacturers in identifying and correcting these weaknesses.

The aircraft were selected, generally, because they had experienced unsatisfactory flight-handling characteristics requiring design modifications. Several aircraft were selected because their unsatisfactory characteristics were common to other light aircraft. Correcting these characteristics had been a principal concern of the Government and the industry.

FINDINGS AND CONCLUSIONS

During the past 10 years, accidents involving light aircraft have numbered between 4,600 and 6,100 a year and related fatalities have averaged 1,200 a year.<sup>2</sup>

The aircraft, the pilots, and flying environments have contributed in varying degrees to these accidents. As a result of the high number of fatal accidents attributed to pilot errors, FAA and the National Transportation Safety Board (NTSB)

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<sup>2</sup>It is not possible to accurately measure an accident rate trend in this period because of changes in NTSB accident reporting criteria.

undertook a study of aircraft-design-induced pilot errors and reported their findings in July 1967.

The report was intended to assist Government agencies and aircraft manufacturers in their safety programs by identifying design characteristics that appeared to influence pilot errors. It contained broad recommendations for improving 35 types of aircraft. The findings concerned such design weaknesses as aircraft stall-and-spin characteristics and weaknesses in fuel controls, as well as inadequacies in related FAA certification criteria. (See p. 10.)

FAA officials advised GAO that manufacturers had not taken corrective actions immediately following issuance of the report and that in a few areas complete corrective action was not practical. FAA revised some certification criteria and related procedures for compliance. According to FAA, additional statistical studies were made but followup efforts were limited because of the need for additional accident data and because of the assignment of employees to higher priority work. (See p. 11.)

In February 1972, the Department of Transportation engaged a consultant to evaluate selected light aircraft certification activities in the interest of consumer safety. The consultant reported to the Department in April 1972 that the Federal Aviation Regulations and FAA's surveillance system needed revision and modernization and that flight tests and evaluations of light aircraft should be made by FAA or another independent organization.

Department officials, in commenting on the consultant's report, said the results pointed to the need for an in-depth study which was under consideration by both FAA and the Department. (See p. 17.)

In April 1972 an aviation service organization responding to an FAA request submitted a proposal for a design and flight test evaluation program covering current production model light aircraft. The program was to consider potential design-induced pilot error characteristics identified in FAA's earlier studies. FAA officials advised GAO they are planning to obtain funding to undertake the program in fiscal year 1974.

In September 1972 NTSB completed a special statistical study of light aircraft stall-spin accidents. This type of accident has accounted for more fatal and serious injuries than any other. NTSB's recommendations were directed to improving training and responsiveness of pilots for stall-spin conditions and to correcting aircraft design weaknesses. FAA advised GAO that it has initiated a spin research program and plans to initiate a stall research program in response to NTSB's recommendations relating to aircraft design weaknesses.

Design weaknesses and their correction

In a number of cases aircraft, certified by the Government as airworthy, were later found to have design weaknesses. Some aircraft with design weaknesses were certified after the Government participated directly in design development and testing of the aircraft. Most aircraft were certified under delegation procedures whereby

manufacturers or certain of their employees were granted authority to determine by testing whether their aircraft comply with applicable Government regulations for safe performance. Government certification was generally based on manufacturers' determinations.

After it became known that aircraft had been manufactured with design weaknesses, FAA and the manufacturers usually did not resolve the problems promptly with design modifications. Most problems were eventually corrected. Years elapsed, however, while FAA and manufacturers disputed the meaning of FAA's regulations, the seriousness of the design weaknesses, and/or the adequacy of proposed corrective actions. Meanwhile, similar aircraft were being produced and put into use. Examples of actions taken by FAA and manufacturers in correcting design weaknesses are discussed on pages 12 and 13.

Participation in initial design and flight testing for safety

Under present delegation procedures, light aircraft manufacturers perform precertification ground and flight testing on their own planned production aircraft and determine aircraft safety compliance with applicable FAA regulations.

FAA's objectives in setting up these procedures were to reduce the time spent by manufacturers in meeting FAA test participation requirements and to reduce related Government and industry costs.

Such procedures deprive the public of the benefits of independent FAA airworthiness judgments involving regulation interpretation and flying and design safety characteristics for prototype aircraft that

could result from more active FAA participation in the certification process.

One of the difficulties in the delegation procedures is that manufacturers initially determine the intent of FAA regulations and compliance with them. The regulations, which establish minimum safety standards, are general and subject to interpretation. If difficulties in interpretation are not recognized or brought to FAA's attention before an aircraft is certified, they may surface later in connection with recognition of design weaknesses on aircraft in service.

One manufacturer's representative informed GAO his firm considered vagueness of FAA regulations an adverse factor in the delegated certification process.

Principal advantages and disadvantages of the delegated certification procedures, as presented by representatives of the manufacturers and FAA regional offices, are discussed on pages 14 and 15.

Conclusions

The delegation of certain FAA functions associated with the FAA Administrator's certification responsibilities offers several worthwhile advantages to both the Government and the light aircraft manufacturers. The delegation procedures provide a framework under which these benefits can be realized.

FAA should, however, more actively participate in the design and flight testing leading to type certification of new and modified aircraft. Such participation would better assure the public that aircraft comply with FAA safety regulations and are airworthy. FAA needs also to insure that design weaknesses found after aircraft have

been certified and sold to the general public are promptly corrected.

In view of problems experienced by manufacturers in interpreting light aircraft safety regulations, FAA should establish procedures for systematically monitoring these problems as they occur.

Such a system could provide information to correct weaknesses in regulations affecting industry and could result in more timely guidance to manufacturers in resolving their problems with FAA regulations.

#### RECOMMENDATIONS

GAO recommends that the Secretary of Transportation require FAA to

- participate fully in flight and other critical testing of newly designed or modified light aircraft before they are type certified for mass production,
- establish procedures for systematically monitoring manufacturers' problems in interpreting FAA light aircraft safety regulations, and
- establish criteria for guiding regional officials in identifying design weaknesses promptly, assessing seriousness of weaknesses in relation to safety, and undertaking effective and prompt corrective action.

#### AGENCY COMMENTS AND UNRESOLVED ISSUES

GAO discussed information contained here with FAA and NTSB. As instructed by the Subcommittee, GAO did not obtain written comments from the Department of Transportation on the report contents.

Manufacturers generally favored use of delegation procedures for type certification as the most economical and practical method of producing light aircraft in the United States.

FAA said it had recently become further involved in the delegation certification process because of rapidly changing state-of-the-art capabilities in aircraft and changes in airworthiness rules and policy. General views of the manufacturers and FAA are summarized on pages 17 and 18.

#### MATTER FOR CONSIDERATION BY THE SUBCOMMITTEE

Since FAA has not implemented a program to independently flight test major inservice light aircraft for the adverse flight characteristics identified in the 1967 and 1969 aircraft design-induced pilot error studies, the Subcommittee may wish to discuss with FAA the need for such a program in this area.



## CHAPTER 1

### INTRODUCTION

At the request of the Chairman of the Government Activities Subcommittee, House Committee on Government Operations (see app. I), we reviewed Federal Aviation Administration (FAA) aircraft safety regulatory activities involving selected manufacturers of light aircraft<sup>1</sup> to which FAA has delegated certain authority for determining that their aircraft meet Government regulations. These aircraft are sometimes used in commercial service, such as air-taxi operations, but they are generally used for private non-commercial flying.

On the basis of the Chairman's request and of a subsequent meeting with the Subcommittee, we directed our efforts to historical analyses of several design weaknesses in the manufacturers' aircraft and to the effectiveness of FAA's and the manufacturers' actions in identifying and correcting the weaknesses.

The aircraft were selected, generally, because they had experienced unsatisfactory flight-handling characteristics which required design modifications. Several of the aircraft were selected because the unsatisfactory characteristics they exhibited were common to many other light aircraft and because correcting these characteristics had been a principal concern of the Government and the light aircraft industry.

The Federal Aviation Act of 1958 (49 U.S.C. 1346, 1421) provides the FAA Administrator with responsibility for both fostering the growth of air commerce and promoting air safety. With respect to aircraft safety, the Administrator

--prescribes minimum standards governing aircraft design, materials, workmanship, construction, and performance;

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<sup>1</sup> Propeller-driven aircraft weighing 12,500 pounds or less.

- provides surveillance over manufacturers engaged in producing aircraft and/or related aircraft parts and equipment;
- certifies aircraft manufacturers' production processes and aircraft products; and
- regulates manufacturers' activities for correcting aircraft defects.

These responsibilities, formerly held by the Civil Aeronautics Administration under the Civil Aeronautics Act of 1938, were transferred to FAA in 1958.

### AIRCRAFT CERTIFICATION

FAA issues three categories of certificates: (1) type certificates which are normally issued to manufacturers for new or modified aircraft, aircraft engines, and propellers after FAA determines that the parts included in these items are of proper design and material and meet FAA specifications for safe operation, (2) production certificates which are issued to manufacturers that intend to produce type-certified aircraft or related parts, and (3) airworthiness certificates which state that an aircraft conforms to the approved design under a type certificate and is in condition for safe operation.

The Administrator has assigned the responsibility for principal aircraft inspection and certification activities to the directors of nine FAA regional offices within the contiguous United States where most aircraft that must be approved by FAA are manufactured. Regional offices are administratively responsible for this program to the Flight Standards Service in FAA's Washington headquarters.

The Federal Aviation Act authorizes the FAA Administrator to delegate any work or functions required for certifying aircraft to properly qualified employees of the manufacturers or supervised groups of their employees. The Civil Aeronautics Administration formerly held this authority. The Civil Aeronautics Administration and FAA made use of the authority by designating manufacturers' employees or groups of their employees as manufacturers' certification representatives responsible for performing Government compliance testing and surveillance functions.

In 1965 FAA revised this procedure and instituted delegation option authorizations (DOAs), under which entire aircraft manufacturing corporations that met FAA requirements were authorized to carry out Government responsibilities leading to light aircraft certification<sup>1</sup>. Under DOA procedures a manufacturer may perform, and certify the results of, most or all of the testing functions required for compliance with FAA regulations.

Prior to the certification of aircraft under DOA procedures, manufacturers advise the cognizant FAA regional office of design features planned to be incorporated in new aircraft that are different from previous models. FAA selects the ground and flight tests of the new features it wishes to witness or perform. Also, Type Certification Boards are established, which include engineering and flight-test specialists from the FAA regional office and the manufacturers, to discuss the details of the certification program and resolve any problems which may arise.

Before an aircraft can be type certified and produced, it must meet certain FAA safety standards governing aircraft design and performance. FAA regulations contain these standards which cover ground tests of aircraft designs and components and numerous flight tests of prototype aircraft performance. When responsibility for the program was transferred to FAA in 1958, FAA adopted the Civil Aeronautics Administration's regulations for certifying new aircraft. In 1965 FAA recodified these regulations into the FAA regulations presently used for all new aircraft.

At the final Type Certification Board meeting, FAA and the manufacturer inspect an aircraft and its new features and discuss major problems encountered during certification tests and how they were resolved. FAA then issues a type certificate for the new model aircraft on the basis of FAA's knowledge of the aircraft and the manufacturer's certification that the aircraft meet the applicable FAA regulations.

To insure that approved manufacturers continue to meet DOA eligibility requirements, FAA requires the manufacturers

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Manufacturers of air-carrier aircraft and other large aircraft are not eligible for DOAs.

to maintain detailed certification records which it audits periodically. Audits are comprehensive and cover such areas as airframes, systems and equipment, propulsion, flight tests, and manufacturing inspections. Special audits or participation in manufacturer testing may also be made at FAA's discretion.

#### METHODS FOR CORRECTING DESIGN PROBLEMS

When aircraft have been type certified and defects have been found in production models, several courses of corrective action are available to the manufacturers and FAA. The manufacturers may (1) elect to amend aircraft owners' manuals by issuing service letters or service bulletins suggesting new maintenance procedures or flying techniques to prevent or correct the problems, (2) recommend installing placards on aircraft warning pilots of operating conditions or flight maneuvers that are potentially dangerous, (3) initiate design modifications of inservice aircraft at either the manufacturers' or the owners' expense, and (4) modify future production aircraft.

FAA has several methods for obtaining correction of aircraft design defects. FAA may (1) issue maintenance alert bulletins advising owners and aircraft mechanics of recommended maintenance to prevent or correct problems or (2) issue mandatory airworthiness directives requiring owners to comply with the manufacturers' service bulletins or aircraft modifications and requiring the manufacturers to take acceptable corrective actions. FAA has the ultimate authority to ground unsafe aircraft until the problems have been corrected to FAA's satisfaction.

#### AIRCRAFT ACCIDENT AND SAFETY INVESTIGATIONS

The National Transportation Safety Board (NTSB) is responsible for determining the cause of civil aircraft accidents in the United States and for promoting air safety through recommendations to FAA and the aviation community. NTSB was established by the Transportation Act of 1966 (49 U.S.C. 1654) which transferred such responsibilities to NTSB from the Civil Aeronautics Board (CAB).

NTSB determines the cause of accidents through direct investigations, public hearings, and staff reviews and

analyses of accident information and suggests actions to prevent accidents through the public issuance of special studies and safety recommendations. NTSB is responsible for investigating all fatal light aircraft accidents. FAA, in connection with its regulatory responsibilities, participates with NTSB in these accident investigations and conducts investigations of nonfatal light aircraft accidents.

## CHAPTER 2

### NEED FOR IMPROVED CONTROLS FOR IDENTIFYING AND CORRECTING SAFETY DEFECTS IN LIGHT AIRCRAFT

During the past 10 years, general aviation accidents involving principally light aircraft have numbered between 4,600 and 6,100 a year and related fatalities have averaged 1,200 a year.<sup>1</sup> The aircraft, the pilots, and the flying environments have contributed in varying degrees to these accidents.

Historically, the aviation community has considered pilot error to be the major cause of light aircraft accidents. NTSB investigators advised us that they were often limited in determining all the factors contributing to light aircraft accidents by the lack of (1) clear evidence in aircraft wreckage, (2) knowledgeable witnesses to the accident sequence, and (3) radio control contact between the pilot and FAA.

The most obvious accident causes ordinarily fell into the pilot error category--flight below speed minimums, flight into poor weather, missed landing approaches, and similar factors. In contrast, design weaknesses as a possible accident cause element are more subtle and are not as easily recognized at the time of an accident.

In July 1967 NTSB published a report, cosponsored by FAA and entitled "Aircraft Design Induced Pilot Error," which statistically correlated specific aircraft design features with general aviation accidents involving pilot errors. The report was based on a study of 1964 statistical data undertaken as a result of the high number of fatal accidents attributed to pilot errors.

The report was intended to assist Government agencies and aircraft manufacturers in their safety programs by identifying certain design characteristics that appeared to

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<sup>1</sup>It is not possible to accurately measure an accident rate trend in this period because of changes in NTSB accident reporting criteria.

influence pilot errors. It contained a number of broad recommendations for improving 35 types of aircraft. The findings concerned such design features as aircraft stall-and-spin characteristics and weaknesses in fuel controls, as well as inadequacies in related FAA certification criteria.

FAA officials advised us that the manufacturers had not taken corrective actions immediately following issuance of the report and that, in a few areas, complete corrective action was found not practical. The officials said that FAA revised some certification requirements and related criteria for compliance.

In 1969 FAA completed a followup study which analyzed 1965-67 accident statistics for the 35 aircraft in the same manner as the earlier report. In the followup report the statistical significance of 12 types of accidents--such as stalls, spins, and fuel interruption--considered most common in light aircraft applications were analyzed; however, the report contained no recommendations.

According to FAA, further followup efforts were limited because of the need for additional accident data from NTSB and the assignment of employees to higher priority work. However, in April 1972 an aviation service organization, responding to an FAA request, submitted a proposal for a design and flight-test evaluation program covering current production model light aircraft. The program was to consider the six most common potential design-induced pilot error characteristics reported in FAA's 1969 study. FAA officials advised us that they had been unable to fund the program during fiscal year 1973 because of other FAA-funding priorities but were planning to begin the program in fiscal year 1974 if sufficient funds were available.

In September 1972 NTSB completed a special statistical study of light aircraft stall-spin accidents. This type of accident has historically accounted for more fatal and serious injuries than any other single accident type. NTSB's accident data generally indicated the pilot as a broad cause element in these accidents, and many of its recommendations were directed to improving the training and responsiveness of pilots for stall-spin conditions.

NTSB also recommended that FAA conduct (1) technical evaluations and operational testing for stalls and spins similar to the type proposed earlier by the aviation service organization and (2) a joint study with the General Aviation Manufacturers Association and the National Aeronautics and Space Administration to determine the potential for reducing stall-spin accidents through better airplane design. FAA plans to initiate a stall research program and has initiated a spin research program in response to the recommendations.

#### DESIGN WEAKNESSES AND THEIR CORRECTION

During the past 10 years, NTSB and CAB made many recommendations to FAA for correcting inservice light aircraft design weaknesses; FAA has encouraged aircraft owners and manufacturers to correct design weaknesses through airworthiness directives and other means; and manufacturers have initiated their own design improvement programs.

The aircraft included in our review were certified as airworthy but were later found to have design weaknesses. Some of the aircraft were certified after the Government reviewed the certification data or participated in the design, development, and testing of the aircraft. Most of the aircraft were certified under Government delegation procedures, whereby manufacturers or certain of their employees were granted the authority to determine by testing whether aircraft comply with Government regulations for safe performance. Government certification was generally based on the manufacturers' determinations.

After it became known that aircraft had been manufactured with design weaknesses, FAA and the manufacturers usually did not resolve the problems promptly with design modifications. Most of the problems were eventually corrected. Years elapsed, however, while FAA and the manufacturers disputed the meaning of FAA's regulations, the seriousness of the design weaknesses, and the adequacy of proposed corrective actions. Meanwhile, similar aircraft were being produced and put into use. The following examples are generally illustrative of the actions taken by FAA and the manufacturers to correct design weaknesses considered in our review.

--In 1961 one manufacturer became aware that, under certain flight maneuvers, fuel starvation problems could occur for certain models of its aircraft. FAA



first recorded observations of this problem in 1965. In 1968 FAA required that placards warning of the problem be placed in the affected aircraft. In 1969 FAA strengthened its regulation concerning the tests required to insure an uninterrupted flow of fuel for each intended operation and maneuver of the aircraft.

In 1972 the manufacturer announced a fuel system modification kit to provide for uninterrupted fuel supply during the maneuvers, which the placards previously warned against. Installation of this kit is optional for aircraft owners.

--In 1962 another manufacturer became aware of stall-and-spin flight problems with a prototype aircraft planned for production. The manufacturer modified the aircraft in an effort to alleviate the problem, but this modification was not fully successful. FAA first recorded observations of the stall-and-spin problem in 1964, when regional officials indicated that the aircraft did not comply with applicable regulations. During the ensuing years, the question of compliance and the method of demonstrating compliance became the subject of considerable debate in FAA.

In 1969 the manufacturer and FAA notified owners of certain restrictions on use of the aircraft required to avoid flight difficulties. Finally in 1970 the manufacturer announced a design modification for installation on affected aircraft. FAA approved the modification in June 1970. Installation of the modification has been made by most aircraft owners.

#### PARTICIPATION IN INITIAL DESIGN AND FLIGHT TESTING FOR SAFETY

The DOA certification process permits aircraft manufacturers to perform pre-type-certification ground and flight testing on their planned production aircraft and to determine aircraft safety compliance with applicable FAA regulations. FAA's objectives in implementing DOA procedures for type certification were to reduce the time spent by manufacturers in meeting FAA test participation requirements and to reduce related Government and industry costs.

Complete reliance on DOA procedures for aircraft certification deprives the public of the benefits of independent FAA airworthiness judgements involving regulation interpretation and flying and design safety characteristics for prototype aircraft. Such benefits could result from more active FAA participation in the certification process. Although FAA selectively tests new aircraft features, it generally certifies the aircraft on the basis of the manufacturers' representations that FAA regulations have been met in testing.

One of the difficulties in the DOA procedures is that manufacturers initially determine by testing the intent of FAA regulations and compliance with them. These regulations, which are general, establish minimum safety standards governing design, materials, workmanship, construction, and performance of aircraft. If difficulties in interpretation are not recognized or brought to FAA's attention before an aircraft is certified, they may surface later in connection with recognition of design weaknesses on aircraft in service. The design problems for some of the aircraft covered by our review were the subject of extended debates by the manufacturers and FAA because of varying interpretations of the regulations.

A representative of one manufacturer informed us that his firm considered the vagueness of FAA regulations an adverse factor in the DOA process. He expressed the view that many of the regulations were not finite and, to a great extent, were subject to the opinions of the persons making the compliance determinations.

We discussed the advantages and disadvantages of the DOA certification procedure with representatives of the manufacturers and FAA field offices. In general, they concurred in the advantages. However, most of the disadvantages were expressed by FAA field offices. FAA's and the manufacturers' views are summarized below.

#### Advantages

1. DOA permits manufacturers to promptly implement needed design modifications without FAA approval; this shortens the development cycle for aircraft and thereby reduces development costs and final production costs. Also DOA permits manufacturers to place more advanced aviation products on the market at earlier dates for public convenience.

2. DOA avoids duplicative testing by the Government and thereby saves taxpayers' money.

3. Responsibility for industry self-surveillance is sound because it places responsibility for product design where it belongs and still provides for adequate Government control through regulations, special conditions, and periodic audits of manufacturers' procedures. FAA's noninvolvement in aircraft development affords a more independent review and surveillance by FAA over aircraft in operation.

#### Disadvantages

1. The Government does not participate in testing the aircraft before production and therefore cannot influence aircraft design until after problems are reported on the aircraft in operation.

2. The manufacturers cannot act as a fully independent arm of FAA in testing airworthiness of aircraft, because they are involved in producing and selling the aircraft for profit.

3. In seeking to resolve design problems on inservice aircraft, the manufacturers may be reluctant to fully disclose their manufacturing and testing procedures because such disclosure may subject them to criticism and may affect their product liability.

4. FAA's limited participation in the development stages of the aircraft does not allow FAA to acquire early familiarity with the products; such familiarity would benefit its subsequent assessment of aircraft characteristics and performance.

DELAYS IN CORRECTING  
RECOGNIZED DESIGN WEAKNESSES

When a design weakness is found in an aircraft that had been type certified and when a number of these aircraft have been produced and placed in service, manufacturers are often faced with the prospects of costly design modification, possible product liability, and a potential adverse impact on sales. FAA has experienced difficulties in obtaining timely and effective actions by manufacturers to correct known aircraft design weaknesses. FAA generally did not require manufacturers to correct design weaknesses until it or NTSB had developed strong evidence of the need for correction through cumulative accident and incident investigations.

With respect to design weaknesses involving inservice aircraft, FAA has tended to rely first on such publications as manufacturers' service letters or bulletins to prevent the hazards involved. These publications are not effective in promptly solving design weaknesses; they generally point only to the existence of a problem and suggest operational and maintenance restrictions or procedures which pilots should use to minimize the problems. Compliance with these publications cannot be insured or enforced, and it is uncertain whether all users receive them.

DEPARTMENT OF TRANSPORTATION EFFORTS  
TO IMPROVE LIGHT AIRCRAFT SAFETY

In February 1972 the Department of Transportation contracted with a consultant to evaluate certain light aircraft certification activities. The Department's contract justification stated that, on numerous occasions, deficiencies in light aircraft flying quality, configuration, and equipment had come to its attention and that the evaluation had been undertaken in the interest of consumer safety to determine how the existing criteria for certifying light aircraft could be improved.

The consultant completed his evaluation and reported to the Department in April 1972 that the Federal Aviation Regulations and the DOA system needed revision and modernization and that, in the future, flight test and evaluation of light aircraft should be made by FAA or another independent organization.

The consultant stated that

- a portion of the accidents of light aircraft could be attributed to mediocre flying qualities of the airplanes,
- the flying qualities/deficiencies were detectable by objective flight testing,
- FAA regulations could be more clearly expressed and could provide a basis for screening poor flying qualities,
- it would be very rare when a test pilot, employed by the manufacturer, would force the optimization of flying qualities without the assistance of a critical user,
- as technology-cost relationships improve and weather penetration equipment is made readily available to more pilots, the adverse flight characteristics of the airplane could become a more prominent factor in accidents.

The consultant recommended in his report that an in-depth study be performed to focus on (1) the relation of regulations and the existing system to flying qualities, (2) the relation of flying qualities to accidents, (3) the function and effectiveness of flight tests, and (4) the effects of possible changes in regulations on the industry and the user.

Department officials, in commenting on the consultant's report, stated that the results pointed to the need for an in-depth study. Such an effort is now under consideration by both FAA and the Department. The Department also advised us that FAA had been examining the area for some time and was working to improve the existing system.

#### AIRCRAFT MANUFACTURERS' COMMENTS AND FAA'S VIEWS

Aircraft manufacturers made several general comments on the matters covered in our review which are set forth below.

- The manufacturers generally favored the use of delegation procedures for type certification as the most economical and practical method of producing light aircraft in the United States. Some of the manufacturers commented that the actions which they took in response to the design weaknesses in their aircraft would have been unchanged or would not have been accomplished earlier even with direct FAA involvement in the certification process.
- One manufacturer told us that generalization from particular occurrences could result in the unfair imposition on legions of aircraft owners a requirement to modify their airplanes primarily to protect the manufacturer and not themselves.
- Some of the manufacturers felt that greater recognition should be given to the actions of pilots as the contributing cause in light aircraft accidents.

FAA officials advised us that the case histories of some of the aircraft with design weaknesses covered by our review illustrate conditions that might well have been handled differently. They further indicated that FAA had found the need to increase its involvement in the delegation certification process as a result of rapidly changing state-of-the-art capabilities in aircraft, and changes in airworthiness rules and policy.

FAA officials indicated that under DOA procedures manufacturers were required to show compliance with FAA rules and that it was not possible to write every rule so that it would be fully understood by everyone. They indicated that the results of such misinterpretations were, on occasion, resolved with FAA legal opinions and that FAA flight-test guidelines should aid manufacturers in interpreting FAA regulations for performing flight testing.

## CONCLUSIONS

The number of cases in which light aircraft with design weaknesses were type certified by the Government and the delays in correcting the weaknesses raises a question whether the Department had taken all feasible action to insure implementation of a high-priority program to eliminate light aircraft design safety hazards.

Delegation of certain FAA functions associated with the FAA Administrator's certification responsibilities offers several worthwhile advantages to both the Government and the light aircraft manufacturers. The delegation option authorization procedures provide a framework under which these benefits can be realized.

However, to better insure the public that aircraft comply with FAA safety regulations before large numbers of aircraft are produced for sale, FAA should fully participate in all flight testing leading to type certification of new and modified aircraft and more actively participate in the design development of the aircraft. Such participation by FAA should provide the necessary clarification of FAA regulations and the procedures required to determine compliance with them and should aid in reducing the number of major design weaknesses found after aircraft have been type certified and sold to the general public.

In view of the problems experienced by manufacturers in interpreting light aircraft safety regulations, FAA should establish procedures for systematically monitoring these problems as they occur. Such a system could provide information to correct weaknesses in regulations affecting the light aircraft industry and could result in more timely guidance to the manufacturers to resolve their problems with FAA regulations.

The degree of success of a design safety improvement program is dependent not only on the early recognition of design weaknesses but also on the prompt correction of known weaknesses. It would be beneficial to establish criteria for guiding FAA regional officials in (1) assessing the seriousness of safety defects and (2) taking effective and prompt corrective actions.

#### RECOMMENDATIONS

We recommend that the Secretary of Transportation require FAA to:

- Participate fully in flight and other critical testing of newly designed or modified aircraft before they are type certified for production.

- Establish procedures for systematically monitoring manufacturers' problems in interpreting FAA light aircraft safety regulations.
- Establish criteria for guiding FAA regional offices in identifying design weaknesses promptly, assessing the seriousness of the safety weaknesses, and taking effective and prompt corrective actions.

MATTERS FOR CONSIDERATION BY THE SUBCOMMITTEE

Since FAA has not implemented a program to independently flight-test major inservice light aircraft for the adverse flight characteristics identified in the Government aircraft-design-induced pilot error studies, the Subcommittee may wish to discuss with FAA the need for such a program.



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**Congress of the United States**  
**House of Representatives**

GOVERNMENT ACTIVITIES SUBCOMMITTEE  
OF THE  
COMMITTEE ON GOVERNMENT OPERATIONS  
RAYBURN HOUSE OFFICE BUILDING, ROOM B350-B  
WASHINGTON, D.C. 20515

January 25, 1972

The Honorable Elmer B. Staats  
Comptroller General of the United States  
Washington, D. C. 20548

Dear Elmer:

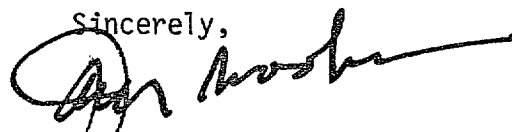
The Subcommittee has acquired fragmentary information of very serious import insofar as the operations of the Federal Aviation Administration are concerned.

Apparently, under so-called "delegated option authority" various aircraft manufacturers in the United States have been delegated considerable authority to certify as to the airworthiness of their own products. Based upon information we have, it may well be that this authority has been grossly abused. For this reason, it is essential that a records audit be made of the files in certain FAA regional offices and of the prerequisite files and records of certain aircraft manufacturers to determine whether any basis for such charges exists or whether or not this program is working in a manner consistent with the interests of the public.

In my opinion, a preliminary review of these records could be performed effectively by your staff assigned to the Department of Transportation utilizing field office personnel. After a preliminary review had been made, you and I could determine whether further investigations were necessary and if such investigations would be pursued by the Subcommittee directly or made the subject of a GAO audit report.

In line with the above, it is requested that Dick Kelley, who heads your Department of Transportation staff, get in touch with the Subcommittee and discuss the matter in detail.

Sincerely,



Jack Brooks  
Chairman

PRINCIPAL OFFICIALS OF  
 THE DEPARTMENT OF TRANSPORTATION  
 RESPONSIBLE FOR THE ADMINISTRATION OF ACTIVITIES  
 DISCUSSED IN THIS REPORT

<u>Tenure of office</u>	
<u>From</u>	<u>To</u>

DEPARTMENT OF TRANSPORTATION

SECRETARY OF TRANSPORTATION:

Claude S. Brinegar	Feb. 1973	Present
John A. Volpe	Jan. 1969	Feb. 1973
Alan S. Boyd	Jan. 1967	Dec. 1968

FEDERAL AVIATION ADMINISTRATION

ADMINISTRATOR:

Alexander P. Butterfield	Mar. 1973	Present
John H. Shaffer	Mar. 1969	Mar. 1973
David D. Thomas (acting)	Aug. 1968	Mar. 1969
Gen. William F. McKee	July 1965	July 1968
Najeeb E. Halaby	Feb. 1961	July 1965

DIRECTOR, FLIGHT STANDARDS SERVICE:

James F. Rudolph	Oct. 1967	Present
James F. Rudolph (acting)	June. 1967	Oct. 1967
Clifford W. Walker	Apr. 1966	June 1967
George S. Moore	Apr. 1963	Apr. 1966