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Report to the Chairman, Subcommittee on
Investigations, Committee on Armed
Services, House of Representatives

DEFENSE PROCUREMENT

DOD Concerns Regarding Acceptance of FAA's Spare Parts Approvals



JUL 15 1992

92-18293





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National Security and
International Affairs Division

B-245503

June 18, 1992

The Honorable Nicholas Mavroules
Chairman, Subcommittee on Investigations
Committee on Armed Services
House of Representatives

Dear Mr. Chairman:

In response to your request, we have assessed two proposals related to the Department of Defense's (DOD) approval of aviation spare parts. You specifically asked us to review proposals that would require DOD to (1) accept Federal Aviation Administration (FAA) approvals on spare parts unless DOD provides specific justification for not accepting the approvals and (2) adopt the FAA practice of designating individuals who are not employees to perform certain spare parts approval functions on the agency's behalf. Both of these proposals were presented at March 1990 hearings before the Subcommittee on Investigations, House Committee on Armed Services, by a small business manufacturer of civil and military aviation spare parts. The manufacturer testified that requiring DOD to adopt these procedures would increase competition among contractors without sacrificing safety and reduce costs for both contractors and the government.

Results in Brief

Accession For	
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DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
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Neither DOD nor FAA maintain data on the universe of parts used by both civil and military aviation, and manufacturers do not make this data readily available.

Both DOD and FAA officials believe that the proposals would not be practicable because their agencies' missions and spare part approval processes differ substantially. FAA, in performing its regulatory mission of fostering civil aviation safety, sets minimum safety standards but permits the manufacturers and purchasers, such as commercial airlines, to exceed those standards. It does not establish non-safety performance standards. However, DOD, in performing the national defense mission related to purchasing and operating aircraft, determines both safety and performance requirements for military aircraft and spare parts. FAA designates non-FAA employees as representatives empowered to approve spare parts; DOD is not willing to have non-DOD employees determine conformance to DOD standards.



DOD and FAA officials acknowledge that their spare parts approval processes are complex and subjective, but they believe that their separate approaches are necessary for ensuring those parts meet the different standards of each agency. They explained that spare part “qualification” requirements—tests and other requirements a spare part must pass or meet to be approved—are based largely on the engineering judgment of responsible agency officials. DOD and FAA are coordinating the aircraft and spare part approval process for civil transport aircraft purchased by DOD.

Background

FAA Procedures

FAA’s regulatory mission is to promote the flight safety of civil aircraft in air commerce by prescribing minimum safety standards. FAA is responsible for establishing “airworthiness standards” for civil aviation, including standards for flight, operations, aircraft structure, materials, workmanship, vibration, and systems.

FAA awards various “certificates” and “approvals” to aircraft and parts manufacturers that qualify their products with the agency. FAA awards a “type certificate” to a manufacturer for an aircraft design if the design meets FAA standards. The holder of a type certificate may then seek approval to produce the aircraft by obtaining a “production certificate” by demonstrating to FAA that it has a quality control system ensuring that each aircraft or part produced will meet the design provisions of the type certificate. FAA awards an “airworthiness certificate” to each aircraft produced by the production certificate holder and may issue “airworthiness approval tags” for engines and parts. The holder of a type certificate may forego obtaining a production certificate by allowing FAA to inspect each completed aircraft. The manufacturer must provide FAA with a “certificate of conformity”—stating that the product conforms to the type design and is safe—before FAA will award an airworthiness certificate to each aircraft.

Once FAA’s minimum safety standards have been met, the manufacturer and a purchaser negotiate the final aircraft design. A purchaser may order spare parts directly from the manufacturer holding a type certificate.

A new manufacturer of civil aviation parts that lacks a type certificate must obtain a “parts manufacturer approval” from FAA. To obtain this approval, the new manufacturer submits to FAA its data on design, manufacturing

processes, and test results showing compliance with FAA's airworthiness standards. If FAA believes the design meets appropriate airworthiness standards and the plant produces parts matching the approved design, FAA awards a parts manufacturer approval to the new manufacturer.

DOD Procedures

In performing its defense mission, DOD both regulates the design and production of military aircraft and spare parts and purchases these items. When DOD purchases a new aircraft design, the manufacturer is awarded a contract to prepare "design specification documents" that serve as the baseline for the future production of the aircraft and its parts. These documents contain safety and performance requirements, qualification tests, special processes, and military specifications. Military specifications are either DOD minimum requirements or technical specifications and descriptions of such things as material processing, heat treatments, and component design (for example, hydraulics) and may include descriptions of the qualification testing needed to show compliance.

DOD does not use terms that are equivalent to FAA terms such as type certificate, production certificate, airworthiness certificate, and parts manufacturer approval.

Data Lacking on Comparability of Parts

Neither DOD nor FAA maintain data on the universe of parts used by both civil and military aviation. The manufacturer that testified at the March 1990 hearing estimates that about 3,500 parts might be used by both civil and military aviation; however, when we asked if this manufacturer had any information to corroborate this estimate, the manufacturer said it would not provide the information to us. We asked officials representing large aircraft manufacturers for information about the comparability of civilian and military parts, but they did not provide it.

To get some indication of the potential for adopting the proposals, we asked the manufacturer that testified to provide us with its analyses of the similarities and differences between the DOD and FAA approval processes for two sample parts. We then asked Air Force officials identified by the manufacturer to evaluate the data the manufacturer provided. The Air Force officials indicated that the FAA procedures did not adequately ensure that the parts were within the original specified tolerances. They also said that the military had to be concerned with not only safety, but also performance specifications affecting reliability, maintainability, and logistical supportability. (See app. I.)

Differences in Parts Approval Processes and Missions

Both DOD and FAA officials said that the differences in their parts approval processes and missions would make it difficult for DOD to implement the two proposals. DOD's approval process is similar to FAA's in that if the original manufacturer of a spare part makes its design available to other manufacturers, then a new manufacturer only has to show that it can make a part conforming to that design to receive approval to make the part. However, if the original manufacturer does not make the design available to others, a new manufacturer must prepare its own design. While the FAA reviews the new manufacturer's design to determine compliance with safety standards, DOD reviews the design as a purchaser to determine if the design meets performance requirements in the original design specification documents.

While both DOD and FAA qualification requirements for spare parts are based largely on the individual engineering judgments of the responsible officials, these individuals must consider their agency's mission. FAA and DOD engineers who determine the qualification requirements for spare parts consider a wide range of factors, and both DOD and FAA consider past experience with the manufacturer and the safety criticality of the part. However, DOD engineers also must consider performance factors related to the military mission, including mission suitability, life-cycle costs, affordability, and maintainability. According to DOD officials, this is an area where it is important that the reviewing engineer have sufficient experience with the part, criticality, and performance requirements in the design specification documents to assess the similarity of design and test results.

DOD officials said that their engineers, when determining the qualification requirements for a spare part, must consider the type of aircraft and the extreme environments in which military aircraft must be expected to operate. DOD engineers told us that they establish minimum qualification requirements for wear and failure of a part used in different aircraft that will satisfy the requirements of the highest performance military aircraft potentially using that part. Thus, some military parts may have to tolerate extremes that parts for civil aircraft will not be subject to. For example, some military aircraft fly at speeds of up to 1,700 miles per hour, whereas the maximum speeds of civil aircraft are usually about 500 to 600 miles per hour.

Because qualification requirements are based on engineering judgment and vary considerably from case to case, DOD officials said they would be reluctant to accept FAA approvals, with the exception of approvals for civil transport aircraft and spare parts that satisfy DOD's military needs. This

exception is discussed in appendix II. FAA officials declined to comment on DOD's approval procedures. One FAA official said that FAA does not have the experience and expertise to make decisions affecting the approval of spare parts by DOD. Moreover, FAA and DOD officials said that any coordination of the agencies' parts approval processes would have to begin when an aircraft system is being designed and test data could be monitored, shared, and accepted by both FAA and DOD. Officials said both agencies would have to be involved in determining minimum qualification requirements.

DOD and FAA officials also stated that it would not be reasonable or feasible to require DOD officials to provide specific justification on each FAA-approved part that DOD rejects. They said that the burden of demonstrating that an FAA-approved part meets DOD mission requirements should remain with the manufacturer.

DOD Has Reservations About Adopting Practice of Designating Representatives

The FAA Administrator designates private individuals to perform specific functions on behalf of the agency. Because of personnel limitations, FAA has found it advantageous to designate, as its certified representatives, qualified non-FAA employees to perform such functions as aircraft and spare parts safety approvals. These representatives include the following:

- A designated engineering representative determines whether a manufacturer's design data meets FAA standards. If so, the representative recommends design approval. After conducting appropriate testing of the design, FAA issues a type certificate to the manufacturer.
- A designated manufacturing inspection representative is authorized to issue, on FAA's behalf, airworthiness certificates for new aircraft coming off the assembly line and airworthiness approvals for engines and parts.
- A designated airworthiness representative issues airworthiness certificates for certain types of aircraft (for example, experimental aircraft) and can also issue airworthiness approvals for parts.

These FAA-designated representatives, who may be independent individuals or employees of the aircraft or parts manufacturer, are paid for their services by manufacturers seeking approval of their design, process, aircraft, or parts. FAA officials stated that FAA's Aircraft Certification Service has about 847 FAA employees and about 3,300 designated representatives. FAA officials said that the designated representatives are cost-effective because they perform necessary functions for FAA but are paid by the manufacturers who use the services.

DOD officials told us that they are unwilling to adopt FAA's practice of using designated representatives to perform spare parts approval functions because DOD wants to maintain control and independence in determining the acceptability of parts. DOD officials said they are reluctant to permit non-DOD employees to perform these approval functions because DOD engineers have the ultimate responsibility for the safety and performance of the aircraft. DOD officials believe they should continue to use their own personnel to determine if a part conforms to DOD standards. They also said that attempting to monitor designated representatives and to control the quality of the new parts would be extraordinarily difficult.

Scope and Methodology

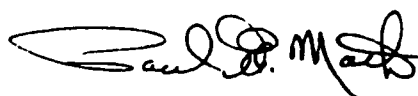
In conducting our review, we interviewed officials at FAA headquarters, Washington, D.C.; the Office of the Assistant Secretary of Defense for Production and Logistics, DOD headquarters, Alexandria, Va.; the Oklahoma City Air Logistics Center, Tinker Air Force Base, Oklahoma City, Oklahoma; and the Air Force Systems Command, Wright-Patterson Air Force Base, Ohio. We also interviewed officials at the Aerospace Industries Association of America, Inc., Washington, D.C., several large manufacturers of aircraft and spare parts, and officials from the equipment manufacturer that testified before the Subcommittee.

We performed our work from December 1990 to December 1991 in accordance with generally accepted government auditing standards. As requested, we did not obtain written DOD comments. However, we discussed the information in this draft with officials from the Commercial Acquisition Program in the Office of the Assistant Secretary of Defense (Production and Logistics) and from the Office of the Secretary of the Air Force. We have incorporated their comments where appropriate.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 15 days after its issue date. At that time, we will send copies to the Chairmen, House and Senate Committees on Armed Services and on Appropriations, Senate Committee on Governmental Affairs, and House Committee on Government Operations; the Secretaries of Defense, the Army, the Navy, and the Air Force; and the Administrator, FAA. We will also make copies available to others upon request.

Please contact me at (202) 275-8400 if you or your staff have any questions concerning this report. The major contributors to this report were John A. Rinko, Assistant Director, and Fred Lundgren, Evaluator-in-Charge.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Paul F. Math". The signature is fluid and cursive, with the first name "Paul" being the most prominent.

Paul F. Math
Director, Research, Development,
Acquisition, and Procurement Issues

Observations on Approval Procedures for Sample Parts

Because data on the nature and extent of specific parts used in both civil and military aviation was not readily available, we asked the manufacturer that had proposed that the Department of Defense (DOD) accept approvals of the Federal Aviation Administration (FAA) to provide us its analyses of the agencies' parts approval procedures for two of its parts that both agencies had approved. The parts were a plate seal and a windshield wiper assembly.¹

The manufacturer had "reverse engineered" these parts—that is, examined the original part made by another manufacturer and developed its own technical data package to manufacture it. The manufacturer submitted the parts and data to the Air Force for qualification and eventual Air Force procurement and about the same time submitted the parts and data to FAA for qualification and award of a parts manufacturer approval so that the manufacturer could sell the part in the civil aviation market. As agreed with the manufacturer, Air Force officials at the Oklahoma City Air Logistics Center, which had prior experience with the firm's parts, reviewed all of the firm's documentation and provided us their observations on the differences between FAA and DOD qualification processes on these parts. We also asked FAA officials to review this material.

Views of the Manufacturer

According to the manufacturer, FAA approved the designs of both parts after determining that they complied with airworthiness standards and conformed to parts with an approved design produced by the original manufacturer. FAA then awarded a parts manufacturer approval for each part. The Air Force approved the wiper assembly but initially rejected the plate seal, determining that, as designed, it would interfere with other parts and cause improper sealing. The manufacturer redesigned the part, and the Air Force approved it without further qualification testing.

The manufacturer cited several similarities between the DOD and FAA approval procedures. For example, both agencies (1) required that

¹The plate seal (National Stock Number 1610-00-717-8415) is used to seal the hydraulic fluid at the attachment face of the propeller pitch control valve and the reduction gear box. The reduction gear box assembly is used on the T-56 engine manufactured by Detroit Diesel Allison (General Motors Corporation) for use on the Lockheed C-130 military aircraft and the Lockheed L-100 Hercules and L-382 commercial aircraft. The original equipment manufacturer of the plate seal is United Technologies-Hamilton Standard.

The windshield wiper assembly (National Stock Number 1680-00-920-8048) is used on the military Boeing C-135 and the commercial Boeing 707 and 727 aircraft. The original equipment manufacturer is ALCO.

reversed-engineered parts be compared to and conform to parts produced by original equipment manufacturers with approved designs; (2) used similar dimensional inspection techniques for measuring the corresponding parts; (3) requested information on the company's history and capability, manufacturing processes, design factors, operating conditions, and applications; and (4) required the submission of drawings, data, and any applicable specifications. However, according to the manufacturer, a key difference in their qualification procedures was that the Air Force compared the manufacturer's parts, design drawings, and data to the original manufacturer's design drawings and data, whereas FAA only compared the manufacturer's design drawings to the original part before awarding the parts manufacturer approval.

Views of FAA and Air Force Officials

An FAA official who reviewed the manufacturer's documentation noted that a new manufacturer can obtain a parts manufacturer approval by two different procedures, depending on the situation. The new manufacturer can submit design data to demonstrate that its design is identical to the type certificate holder's design. However, when the new manufacturer reverse engineers a part, as was the case for the two sample parts, the design is not considered to be identical, and a new manufacturer must submit the new part for tests to prove the part meets airworthiness standards. The FAA official stated that in such cases, an applicant may be able to prove that it is using materials and dimensions identical to the type certificate holder's; however, it would be unlikely that processes and tolerances are identical.

Air Force officials who reviewed the manufacturer's documentation stated that the FAA procedures did not provide adequate assurance that the new manufacturer's design was identical to or was within the tolerances of the original design. The officials told us that if the original part used for measurements by the new manufacturer had dimensions at one end of the allowable spectrum of tolerances, the new manufacturer might establish new tolerances exceeding the limits on the original manufacturer's design drawing. Air Force officials said that a comparison of the new manufacturer's drawing to the original part would not reveal this condition, but a comparison to the original design drawing would.

Air Force officials stated that although safety was their first priority when determining whether to approve a spare part, they also considered reliability, maintainability, and logistics supportability. They also stated that the extent of qualification testing required by DOD was determined by DOD engineers' review of applicable design and performance specifications affected by the new design.

Efforts to Coordinate Approval Processes for Civil Transport Aircraft Purchased by Defense

DOD has about 300 modified civil aircraft in its inventory.¹ According to a DOD official, DOD uses FAA airworthiness standards when a civil aircraft is considered adequate for a military mission and operating environments are expected to be similar. However, DOD may modify the design to meet its unique operational needs, and the agency conducts tests on each completed aircraft it is purchasing to ensure it meets DOD requirements. For example, the military may test for a broader spectrum of vibrations at low altitudes because military pilots do more training at low altitudes than do civil aviation pilots.

During construction of the aircraft, FAA performs inspections to identify any DOD modifications. When the aircraft is completed, FAA issues a special certificate, known as a "conformity certificate-military aircraft," that lists all deviations from the FAA type certification. If, at some date in the future, DOD decides to sell the modified aircraft to a civil aviation buyer, these modifications must be corrected by the buyer before the aircraft may be operated in civil aviation.

In recent years, DOD and FAA have taken steps to improve their coordination in DOD's procurement of civil transport aircraft and spare parts. A joint working group was established in May 1989, and a draft memorandum of agreement has been prepared but not signed. Among the issues being discussed are (1) the appropriate extent of FAA participation in the approval of military products and (2) early coordination between DOD and FAA to prevent misunderstandings regarding their responsibilities.

According to the draft memorandum, the purpose of the working group is to reach agreement on the agencies' responsibilities concerning the approval of aircraft and spare part designs and to minimize redundant analyses, inspections, tests, demonstrations, evaluations, and approvals. DOD's responsibilities will be to plan, program, and manage the acquisition of its aircraft; substantiate the airworthiness of all deviations listed by FAA on the conformity certificate; include FAA in all formal meetings; substantiate that specification requirements are met; design special mission equipment (which would not be certifiable by FAA); and develop standardized data item requirements for an FAA type certification program plan. FAA's responsibilities will be to develop a joint quality assurance agreement identifying mutual acceptance of inspections and to conduct quality assurance audits. For each civil transport aircraft DOD acquires, FAA

¹For example, the KC-10 tanker is a military derivative of the DC-10 commercial transport. The modifications include additional fuel tanks, military avionics, and a boom refueling system.

**Appendix II
Efforts to Coordinate Approval Processes for
Civil Transport Aircraft Purchased by Defense**

will issue a conformity certificate listing deviations from the type design, including modifications and equipment that are not certifiable. FAA also will establish a liaison office and a list of contacts in DOD service components who are responsible for certification issues.

The draft memorandum states that DOD will be allowed to participate in the type certification process at the invitation of FAA; however, DOD's role will be limited to that of an observer, and DOD will not be allowed to direct or influence FAA's type certification activities. A DOD specification for a product may be more rigorous than that required by the Federal Aviation Regulations; however, FAA will be empowered to determine only whether the product meets FAA minimum safety standards. FAA type certification establishes only that the product is safe; it does not establish that the product meets DOD performance specifications or reliability and maintainability requirements, or that the product is operationally suitable for the DOD mission. An exemption based on the unique nature of the DOD mission would make that aircraft ineligible for an FAA airworthiness certificate.

The draft memorandum further states that aircraft with the greatest potential for acquisition cost savings would be those that are derivatives of aircraft previously issued FAA type certifications and have a mission that is expected to be similar to that of the civilian user. However, the modifications to the aircraft must also be evaluated and include the intended mission, operating environment, mission profile, maximum flight parameters, structure, systems, controls, hardware and software, and prior service experience. The draft memorandum states that, in general, the further the DOD aircraft deviates in these areas from the civil aircraft, the less likely that FAA type certification will meet DOD's needs and the less likely that any real cost savings to the government will be achieved. As such, FAA certification may not be appropriate for all non-developmental aircraft. In some cases, it may be prudent to certify the airframe and its systems but not the mission equipment. According to the memorandum, this limited certification would result in faster approval, less FAA involvement in militarily sensitive areas, and in some cases a more appropriate end product.