

Why GAO Did This Study

Composite materials, made by combining materials such as carbon fibers with epoxy, have been used in airplane components for decades. Although composites are lighter and stronger than most metals, their increasing use in commercial airplane structures such as the fuselage and wings has raised safety concerns. Boeing's 787 is the first mostly composite large commercial transport airplane to undergo the certification process. The Federal Aviation Administration (FAA) and the European Aviation Safety Agency (EASA) certify new airplane designs and evaluate the airworthiness of novel features—like composite structures—against existing safety standards, which are often based on the performance of metallic airplanes. In August 2011, FAA and EASA certified the 787, which is expected to enter commercial service in the fall of 2011.

GAO was asked to review FAA's and EASA's certification processes and FAA's oversight of the composite airplanes once they enter service. GAO examined how FAA and EASA assessed the use of composite materials in the Boeing 787 fuselage and wings, and the extent to which FAA has addressed safety-related concerns associated with the repair and maintenance of composite airplanes. GAO reviewed certification documentation, conducted a literature search, discussed repair and maintenance issues with experts, and interviewed FAA and EASA officials and Boeing representatives. GAO is not making recommendations in this report. FAA, EASA, Boeing, and others provided technical comments, which were incorporated as appropriate.

View [GAO-11-849](#) or key components. For more information, contact Gerald Dillingham, Ph.D., at (202) 512-2834 or dillinghamg@gao.gov.

AVIATION SAFETY

Status of FAA's Actions to Oversee the Safety of Composite Airplanes

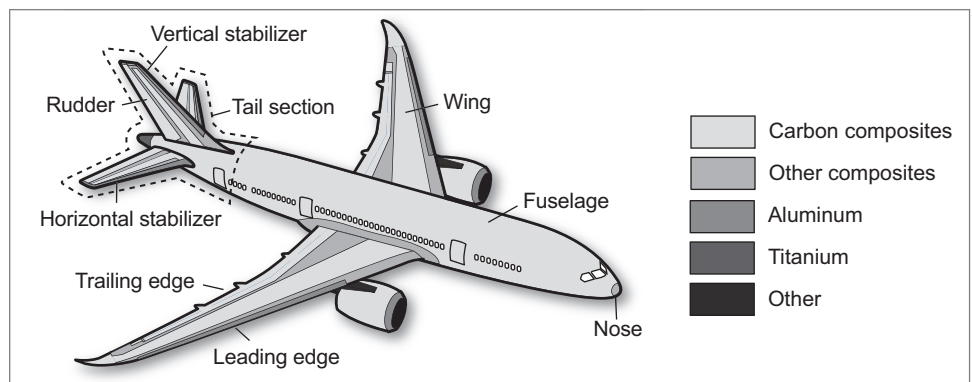
What GAO Found

GAO found that FAA followed its certification process in assessing the Boeing 787 airplane's composite fuselage and wings (see fig.) against applicable FAA airworthiness standards. FAA applied five special conditions when it found that its airworthiness standards were not adequate to ensure that the composite structures would comply with existing safety levels. These special conditions require Boeing to take additional steps to demonstrate the 787's structures meet current performance standards. FAA also granted Boeing an equivalent level of safety finding when the manufacturer determined it could meet the standard but prove it differently from the method specified in that standard. On the basis of a review of FAA's special condition requirements, Boeing submissions, and discussions with FAA and Boeing officials, GAO found that FAA followed its process by documenting the technical issues related to the design of the composite fuselage and wings, determining the special conditions and equivalent level of safety finding, obtaining public comments on draft special conditions, and monitoring Boeing's compliance with those conditions.

EASA also assessed the use of composite materials in the Boeing 787 and relied on FAA to oversee Boeing's compliance in some cases. EASA's process for determining whether its existing airworthiness standards were adequate to ensure the 787's composite fuselage and wings met current levels of safety was similar to FAA's special conditions process and resulted in some additional review items, partly because of differences in their respective standards.

On the basis of expert interviews and a review of literature, GAO identified four key safety-related concerns with the repair and maintenance of composites in commercial airplanes—(1) limited information on the behavior of airplane composite structures, (2) technical issues related to the unique properties of composite materials, (3) standardization of repair materials and techniques, and (4) training and awareness. None of the experts believed these concerns posed extraordinary safety risks or were insurmountable. FAA is taking action to help address these concerns identified by GAO related to the repair and maintenance of composite airplane structures. However, until these composite airplanes enter service, it is unclear if these actions will be sufficient.

Boeing 787's Use of Composite Materials



Source: GAO presentation of Boeing Company information.