Air Logistics Center Keeps Planes Flying With I-DEAS™

SITUATION

The Oklahoma City Air Logistics Center (ALC) is one of the nation's largest military aircraft maintenance and repair facilities. Its work is critical to the readiness of planes such as the B-1B, B-2 and B-52 bombers; the KC-135 tanker; E-3 AWACS plane, as well as commodity support for all other Air Force aircraft. When an aircraft component fails, the ALC must find out what caused the problem, then design and manufacture a replacement. This must happen quickly because if the problem is a serious one, all planes in the fleet may be grounded until replacement parts are ready. As a result, the ALC is continually striving to speed the process, and to take steps to become more proactive by being better able to predict potential part problems before they occur.

OBJECTIVES

✔ Replace existing 2D CAD/CAM programs with an integrated solids-based CAD/CAM/CAE system to reduce acquisition and manufacturing cycle time for critical repairs.

✔ Apply sophisticated assembly modeling capabilities, along with advanced mechanisms and finite element analysis techniques, to become more proactive in predicting fatigue-related problems.

"Our implementation of an integrated CAD/CAM/CAE system is resulting in a series of concrete and quantifiable successes."

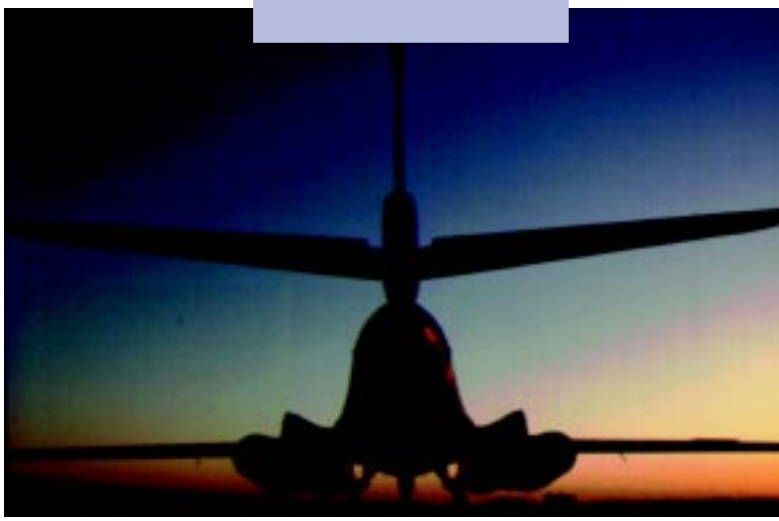
- Ed Kincaid, Team Leader of Technology Insertion, Oklahoma City Air Logistics Center

PROCESS VISION

✔ Use a master model approach to permit analysts and manufacturing engineers to work from CAD data rather than having to re-create it in their systems.

✔ Implement a "generative" CAM system capable of reading part features, such as a hole, and automatically generating the process and NC code needed to manufacture it.

✔ Adopt a "virtual factory" approach to allow sites around the country to manufacture emergency replacement parts. In this approach, all information needed to manufacture a part would be captured in the system data base in Oklahoma City. It would then be transmitted electronically to other sites to speed availability of replacement parts.



ACTIONS

✔ The Air Logistics Center chose I-DEAS Master Series™ software because: 1) it had the best integration among design, analysis, and manufacturing of all systems evaluated; 2) its feature-based modeling capability supports generative machining; and 3) its variational modeling capability speeds the process of changing designs.

✔ New parts and assemblies are now designed in solids. Existing parts and assemblies that fail in the field are remodeled as solids as the first step in the repair process.

I-deas™

Get There Faster™

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✔ Solid models are used for structural analysis (with I-DEAS Model Solution Linear™ software) and kinematics analysis (with I-DEAS Mechanism Design™ software) to detect areas of high stress and interferences. Analysis results are used to modify design.

✔ Solid models are used by I-DEAS Generative Machining™ software to produce toolpaths and other machining instructions. No data translation is required.

RESULTS

✔ The use of SDRC's integrated CAD/CAM/CAE system enabled the ALC to redesign a failed aileron bracket on a C-130 transport plane, have the replacement machined, and be available to the fleet in two weeks. This is about half the time that it would have taken with the old process.

✔ Incorporating design data directly into downstream applications has given the ALC time to use tools such as finite element analysis in the redesign of a failed part. In the past, this wasn't done because creating an analysis model from a 2D drawing added weeks to the repair cycle. Now feedback from FEA routinely guides a redesign, without delay.

✔ For a redesign of a cracked B-1B bellcrank (part of the landing gear), the mechanism was modeled in I-DEAS™ software, analyzed, and redesigned to reduce stress by 60%. The redesign took 18 days, a substantial improvement over the old process.

✔ The ALC delivered vertical stabilizer bars for the B-1B in 12 weeks, compared to the two-year delivery time estimated by the outside supplier.

✔ At this stage in the development process, the ALC has experienced decreases in NC programming time of 30% to 80% through the use of I-DEAS Generative Machining. They expect that to become a 90% overall reduction as their process vision becomes fully realized.

✔ To help find potential problems before they occur, ALC engineers, along with personnel from SDRC and University of Oklahoma engineering students, recently finished modeling the entire landing gear of the B-1B. The team is now performing a mechanism analysis to evaluate the loads to which the various components are subjected.

PLANS

ALC plans to continue refining its virtual factory concept through tests with off-site facilities. It will also continue its proactive study of the B-1B landing gear by completing mechanism and stress analyses of the assembly model. This will allow ALC engineers to detect areas that have the potential to cause failures, thus making it possible to change the design to eliminate them.

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