

The **US Navy's** P-3 Orion and **USAF's** C-130 Hercules are powered by T-56 turboprop engines. The propeller blades are manufactured from high strength aluminum alloy forgings with hollow shanks. An aluminum bronze bushing is fitted into the propeller bore in the shank as part of the blade feathering mechanism. Contact between the dissimilar aluminum and bronze bushing alloys leaves the bore surface prone to stress corrosion cracking (SCC). To mitigate this cracking, the bore was originally heavily shot peened to introduce a shallow layer of beneficial compressive residual stress. This operation left an extremely rough surface, requiring reaming and machining to correctly fit the bronze bushing. After three machining cycles, propellers reach dimensional limits from material loss and must be retired. The peening-machining overhaul and replacement blades cost nominally \$1,000 and \$35,000, respectively, and limited availability of replacement blades threatened fleet readiness. The US Navy and Air Force required a solution.

SOLUTION: Low plasticity burnishing (LPB[®]) treatment of the taper bore surface was chosen to replace the heavy shot peening process. The depth and magnitude of compression produced with LPB is significantly deeper and more stable than shot peening and the smooth finish eliminates the need for reaming and machining. This removed the need for blade retirement, yielding an estimated \$10 million in replacement costs. The robotically controlled LPB system proved to be logically convenient and easy to implement in existing maintenance, repair and overhaul facilities.

IMPACT: Propeller blades can now be overhauled and returned to service indefinitely. Robotic LPB systems have been operational for nearly a decade at US Navy's Cherry Point depot, Warner Robbins Air Force Base, and Pacific Propeller International, treating both P-3 and C-130 propellers. Nearly 3,000 propeller blades have been treated to date, achieving substantial cost savings for both the US Navy and USAF. Incorporating the LPB process in propeller overhaul operations has reduced maintenance costs by an estimated \$1M annually. Fleet readiness has been ensured by LPB processing existing blades to allow continued service.

To learn more about how LPB can extend the life of your component, contact Lambda Technologies at 1-800-883-0851 or visit our website at www.lambdatechs.com.

