

# CH-47 Composite Tunnel Cover for Aviation Composite Structures

## PROBLEM / OBJECTIVE

CH-47 Chinook helicopter tunnel covers are made with 2024-T3 aluminum inner and outer skins, bonded to aluminum honeycomb core. There are six (6) tunnel covers on each CH-47, all of which utilize rivets and metal bonding which relies heavily on surface preparation and experiences corrosion issues. The covers also suffer from poor fit up, seals that are difficult to replace and limitations on step zones for mechanics to perform routine maintenance.

A composite tunnel cover was designed to reduce weight, increase durability and reduce acquisition and life cycle costs associated with the CH-47 Tunnel Covers. However, new composite processes that utilize the latest materials and methods to manufacture them were expensive and inefficient. The objective of this Army ManTech effort was to demonstrate improved manufacturing methods for composite tunnel covers.

## ACCOMPLISHMENTS / PAYOFF

**Process Improvement:** This project demonstrated an improved composite structure that has increased durability and sustainability with lower maintenance costs. The project demonstrated a modular tooling approach, utilizing a single tool to manufacture all six of the individual tunnel covers on the CH-47. This effort evaluated multiple configurations for testing, including: a legacy aluminum tunnel cover; an autoclave cured sandwich with Nomex OX-core; an Out-of-Autoclave (OoA) cured sandwich with Nomex OX-core; and an OoA cured sandwich with 2.5lb X-Cor™. Specific manufacturing improvements included:

- Modular tooling concept with Optical Layup Templates (OLT) for high rate production
- Demonstration of OoA manufacturing capability
- Improvements in manufacturing method reduced part count (54%) from 289 to 133
- Advancement of TRL 5 and MRL 4 composite technology to TRL/MRL 6+

**Implementation and Technology Transfer:** The improved manufacturing parameters were transitioned to PM Modernization - Cargo Helicopters in 2012.



## Expected Benefits and Warfighter Impact:

Potential benefits include:

- 16% weight reduction (from over 94 lbs to ~79 lbs) per aircraft
- Recurring cost reduction of 44% (based on 3 ship sets per month for 5 years)
- Improved step load performance (600 lbs over 3”X3” area) which could aid personnel maintaining the aircraft – only one legacy cover (aft) was previously capable of any step load (400lbs)
- Elimination of corrosion related maintenance

Over the baseline metal structure, the advanced tunnel covers could potentially benefit the Warfighter through improved durability and supportability, reduced weight, and reduction in acquisition and O&S costs.

## TIME LINE / MILESTONE

Start Date	September 2010
End Date	April 2012

## FUNDING

U.S. Army ManTech	\$2.0M
-------------------	--------

## PARTICIPANTS

U.S. Army RDECOM Aviation and Missile Research, Development and Engineering Center (AMRDEC)  
 Redstone Arsenal, AL  
 Boeing, Philadelphia, PA