COMMERCIAL ENGINE SOLUTIONS:
A Case of Long-Term Product Sustainability

“Lockheed Martin’s Commercial Engine Solutions was born during a challenging decade when many military operations were being realigned or closed. Our long-term focus on trimming expenses and reconfiguring product lines has enabled us to remain competitive while delivering value to our customers. Today we face challenges of a similar nature and yet our sustainable, efficient mindset enables continued success as we keep pace with fast-growing, evolving markets.”

– Amy Gowder, Vice President and General Manager, Commercial Engine Solutions
Executive Summary

Lockheed Martin’s products have lifespans often measured in decades, so long-term sustainability is imperative. While not always defined under a “sustainability” label, our programs have been incorporating environmental, safety, and efficiency considerations into the design of our products for many years.

These efforts form the foundation of a continuously evolving Product Stewardship initiative. Our ultimate goal is to take an integrated approach that extends from suppliers to the production line to maintenance and disposal to make the most affordable product possible with the least impact on human health and the environment.

Lockheed Martin’s Commercial Engine Solutions (LMCES) has distinguished itself by enhancing engine performance through top-quality, affordable maintenance, repair and overhaul (MRO) services. Its 350 employees perform MRO for government and commercial organizations in the U.S. and other countries on five engine lines with more on the way.

The longest running program at LMCES was the TF39 engine, powering the C-5 aircraft, which was under contract at this location for 15 years.

As you read through the case study on the TF39 Program, consider the following as it relates to your own team:

- How many similar stories exist in your business that you may not have defined as ‘sustainability’ initiatives?
- What else can I do in my current programs to increase efficiency while reducing the long-term product costs and impacts?

Evolution of the TF39 Program and LMCES

The TF39 engine was developed to power the Lockheed C-5A Galaxy, the largest aircraft in the U.S. Air Force fleet capable of carrying more cargo farther than any other aircraft.¹

The Air Force awarded GE Aviation the first TF39 engine development contract in 1965.

The C-5 entered operational service in 1970, with continued aircraft delivery through the late 1980’s.

In February 1983, Lockheed Martin sub-contracted with GE Aviation for delivery of 200 TF39 engines and thrust reversers.

Initial delivery of the first engine occurred in January 1985 and the 200th engine shipped in November 1988.²

¹ www.lockheedmartin.com/us/products/c5.html
² www.geaviation.com/engines/military/tf39/
Engine Enhancements

Over the past 13 years, Lockheed Martin employees made multiple overhauls and performance enhancements to the TF39 engine, many of which resulted in efficiency and environmental improvements within the program. Here are a few examples:

- **Turbine Improvements**
  Improved material to reduce oxidation and improve cooling air flow.

- **Reliability Centered Maintenance**
  Restructured shop visits to proactively address near-failure items rather than only broken items.

- **Technical Data Corrections**
  Helped ensure implementation of best practices that both enhanced engine performance and reduced long-term operational costs.

- **Build Policies**
  Ensured life limited part thresholds were pushed out beyond the inherent failure rates to limit scheduled engine removals.

The improvements made to the TF39 engine were the result of a long-term partnership between Lockheed Martin, its supplier (GE) and its customer (the U.S. Air Force). Using Lockheed Martin’s engineering talent, we were able to diagnose for appropriate form and fit and recommend alternative solutions for increased customer satisfaction and on-wing performance. In the end, this collaborative approach reduced full life cycle costs of operating the TF39/C-5 aircraft, which continues to result in savings for the customer today. *As a result of this partnership, the TF39 Program has received Excellent U.S. Air Force Ratings for 12 consecutive years – proving our ability to support mission readiness for a key customer.*

**The Benefits of Collaboration**

- **Doubled**
  Engine on-wing life improvement

- **Reduced engine removals by Two-thirds**

- **Improved Mission Readiness and Decreased Costs to Customer**

- **Decreased Engine Inventory by 75%**

- **Reduced performance issues associated with engine removals**

LMCES, formerly Kelly Aviation Center, was born out of what was thought of as bad news, when the Base Closure and Realignment Commission announced in 1995 that Kelly Air Force Base in San Antonio, Texas was on the closure list.

LMCES later began conducting MRO on the TF39 engine.

In 1999, Lockheed Martin and the Oklahoma City Air Logistics Center won the Propulsion Business Area (PBA) for engine and aircraft accessory workloads, *resulting in Lockheed Martin's most successful public/private partnership, LMCES.*
This paper is part of a series called, "The Sustainability Edge," designed to highlight key ESH issues facing Lockheed Martin in the future. For more information and to get the other papers in this series, please visit: https://sharepoint.global.lmco.com/sites/EES/Web/default.aspx

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