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EXECUTIVE SUMMARY

Scope

In June of 2002, the NATIBO Steering Committee initiated a study of the technology and industrial base associated with small Gas Turbine Engines (GTE). The GTE - Industrial Base Analysis Working Group was established under the NATIBO Memorandum of Understanding. This working group, lead jointly with co-chairs from DoD and DND, conducted the study with support from Canadian Forces, the US Army, US Air Force, US Navy, DCMA, and the DLA. The focus of the study was an assessment of the overall responsiveness on the small GTE supply base to meet current military requirements. Specific goals for the study included:

- Characterizing the Original Equipment Manufacturer (OEM) Production Base
- Mapping the Supply Chain
- Assessing the Ability of OEMs to Respond to Logistic Support Requirements
- Identifying Collaborative Opportunities to Migrate Technologies and Processes that Reduce Cost / Improve Performance

Small GTEs were selected as a topic for study for two reasons. First, they provide a pervasive military capability in both countries and in all branches of the military. Small GTEs are present on both fixed and rotary aircraft used for training, transport, reconnaissance, and combat missions. Second, both the US and Canada have a strong technology and industrial base developing and producing small GTEs. This represents a significant industrial sector with sales not only to the military, but also to a broad range of commercial customers worldwide.

Methodology

The small GTE study took an approach that differed from previous NATIBO studies by building the scope of the assessment from the “bottom up”. This approach was driven by a need to understand engine production and logistics support at the part level in order to meet the goals of the project. The methodology employed for the study included:

- Identifying Candidate Engines
- Evaluating Sector Level Information
- Establishing the Supplier Base
- Assessing Selected Suppliers and Parts

Identifying Candidate Engines - Since this is a joint DoD/DND study, the intent was to include engines being used by the military services of both countries. The engines would include all GTE less than 8000 Shaft Horse Power (SHP) for turboshaft/prop and 8500 pounds per thrust (LBST) for turbofans and would cover the offerings of the major OEMs within the small GTE segment of the Engine Sector of the industrial base. Those small GTE are identified in Table 1 of the Engine Study Overview section of this report.

Sector Level Information and Evaluation - The Engine Study Overview (Section II) provides selected information at individual engine or individual company level as well as totals for all engines or all companies, depending upon what data is being provided. Information provided includes:

- Technical characteristics for selected engines
- Engines in service by aircraft, using services, and total
- Forecasted engine production quantity by company, by engine, by year out through 2011
- Forecasted dollars for engine production quantity, by company, out through 2011
- DoD Dollar value of prime contracts over $25,000 USD for all companies over the last 5 years
- Selected financial data for selected top suppliers, including a financial health “rating”

This information provides insight into trends in market share, phasing in or out of production lines and the potential impact of new aircraft programs or aircraft engine upgrade activities, and the potential for future industry consolidation through either mergers or cooperative ventures.

Establishing the Supplier Base - Once the candidate engines were identified, the supplier base supporting the small GTE segment of the industrial base was identified via a compilation of parts data from a number of different sources. These sources included military logistics databases, OEM web catalogs, and government program office information. Parts identified by a National Stock Number (NSN) were sorted by engine in a simple database that the Working Group participant from Army Aviation and Missile Command (AMCOM) developed.

The database facilitated analysis by tying the NSNs to manufacturers through the use of Commercial and Government Entity (CAGE) codes. The database provided a number of different “views” of the information, including:

- Identifying if multiple suppliers made a single NSN
- Supplier name & location associated with each CAGE Code
- Total number of NSNs supplied by a particular CAGE Code for all the engines in the study
- Number of NSNs supplied by a particular CAGE Code for each engine within the study

The AMCOM database includes over 1,500 CAGE Codes (suppliers) and 15,000 NSNs resident in the database. A sample of the format and content of but one of the “views” of the AMCOM database can be found in Appendix B, near the end of this study

Assessing Selected Suppliers and Parts – Section III of the study attempts to identify parts and/or suppliers, both domestic and non-North American, that have been in the past, or might be in the future, problematic and may negatively impact weapon systems, i.e., “problem parts and/or

suppliers". To accomplish this, the study compared NSNs in the database (study population) with information provided by or extracted from the following:

- US Army Materiel Systems Analysis Activity (AMSAA) Industrial Base Automated Rating System (IBARS) provides a color coded risk rating of NSNs from selected weapon systems based on factors ranging from recent contract activity to manufacturer financial viability
- US Air Force logistics systems. This includes backorder status and the Mission Capable (MICAP) reporting system that tracks equipment readiness and identifies those systems unavailable for use due to a parts problem
- DCMA company assessments are based on on-site surveys (primarily OEMs) that highlight known supplier concerns
- Direct solicitation of inputs from Government and industry Program Managers

It should be pointed out that such information represents a snapshot in time, meaning that circumstances relative to problem parts and/or suppliers are dynamic versus static and are, therefore, subject to change. To compensate for this, the study sought to identify pervasive trends that demonstrated an actual industrial base problem or constraint. One-time occurrences due to normal programmatic changes were discounted.

There are several definitions applied to components and suppliers that need to be understood when reading through the report. These definitions were used in discussing the relative importance and/or risk associated with the supply chain.

- *Critical Component* – This is a general term for parts that are difficult to manufacture, drive schedule (long lead), are flight critical, or push state-of-the-art technology. Any component that drives engine cost, schedule or performance can be designated critical by the OEM or government program manager.
- *Critical Supplier* – Manufacturer who supplies a critical component.
- *Single Source Supplier* – The selected source of supply. There are other manufacturers who possess the same capability to supply a similar component. Moving to another supplier may require resources (time and/or funding) if the component requires qualification testing.
- *Sole Source Supplier* – The only source of a component. No other manufacturer is available. This could be due to proprietary designs or unique manufacturing processes/facilities. Sole source suppliers always represent a potential program risk and industrial base constraint.

Concern or risk associated with a component or supplier can be a result of many factors. These can include; limited capacity, financial/market viability, inconsistent product delivery/quality, design/technology performance, and any other systemic problem that may result in failure to meet military requirements.

Future Business and Technology Trends – Section IV looks at both investment in engine technology and investment in new aircraft (versus upgrading existing fleets) to evaluate trends related to future product development, performance and support concepts. This provides a key indicator of future health on the industrial base for this sector. Specific topics examined, include:

- Improved High Performance Turbine Engine Technology (IHPTET) Program
- Engine Component Improvement Program (CIP)
- Service Life Extension Program (SLEP)

Findings

Overall, there were no unexpected findings after the information on the Small GTE Industrial Base was collected and analyzed:

- The selected engines were representative of the product lines of four major OEMs with operations in North America. They are partnered either with each other or with foreign aerospace firms in multiple Joint Ventures.
- The forecast business base is relatively flat in terms of both unit production and sales. To increase market share, the OEMs compete aggressively between each other for military and commercial contracts.
- While production of new aircraft is down, Service Life Extensions and Contractor Logistic Support programs are providing a stable business base.
- A review of "problem" parts from multiple reporting systems identified no systemic supply base issues. Some parts were at "risk" due to government purchasing difficulties, poor rating criteria, or the fact that a competent source was the only vendor qualified by the Government or OEM (single source situations).
- Investment in new technologies by both industry and government is structured to provide a long-term, evolutionary approach to incrementally improve engine performance (power output, fuel consumption, maintainability).

Conclusions/Recommendations

Three recommendations are offered that came out of both lessons learned from the process used to conduct the study as well as what the information assessed revealed:

1) Use of E-Commerce: Most OEMs are actively engaged in e-commerce to support commercial customers. As DoD and DND move more toward contractor logistics, information management needs to keep pace with commercially available customer support solutions. A follow-on project to evaluate Commercial "Best Practices" and DLA initiatives in e-commerce for application/integration with military inventory management and depot operations should be initiated.

2) This assessment was not easy to accomplish due to distributed parts management at the individual Service and even individual engine level. Multiple relationships within the government and between government and industry (HQ vs. Depot, Government vs. Contractor, Contractor vs. Contractor) further complicate how parts are tracked, ordered, reported and inventoried. The government needs to improve visibility into the root cause of parts shortages that impact

engine/aircraft availability by developing a capability that looks for multiple occurrences on the same engine type and rolls up capability across different engine models.

3) As a follow-on to the previous recommendation, the management of Diminishing Manufacturing Sources and Material Shortages (DMSMS) within DoD has focused primarily on microelectronics. DMSMS is the loss or possible loss of manufacturers or suppliers of items including shortages of raw materials. DMSMS is driven by both technology and market. The goal of Service DMSMS programs has been to reduce the impact of DMSMS situations by distribution of notices, and providing tools to single managers for identification and resolution of DMSMS situations to ensure the continued availability of items and essential materials needed to support current and, when possible, planned defense requirements. DoD needs to expand current DMSMS programs to include engine components.

Summary

The methodology used for this project proved a valid way to look at current weapon systems in inventory and to conduct a detailed assessment of a defined population within the industrial base. This methodology could be applied to other end items. To a large extent, the results revealed more about our ability to manage information than it did about small engines. However, the report has potential value as an input to sector strategies at a command level or as a cross-reference guide for a program manager experiencing a part problem.