

White Paper  
**Value Proposition - Extending Service Life of Northrop F-5 Aircraft**

October 16, 2017

**Introduction**

Northrop F-5 aircraft have operated in over 30 countries since the first F-5A and B models were delivered in the late 1960s and early 1970s. After winning the International Fighter Aircraft program in 1972, the company introduced the F-5E & F models at a cost of \$2.1 for single seat F-5E model, slightly more for the dual seat F model; about \$20-25 million in 2017 dollars. Estimated number of F-5s still flying is above 600 aircraft in over 20 countries.

Most of the F-5Es and Fs that are still operating have low total hours on the airframes. Northrop's original construction 'build-quality' was exceptional, resulting in F-5s with 10, 15 and perhaps 20 more years of service life remaining today. Operating at a fraction of the costs of an F-16, the F-5 becomes a valuable asset to the countries still operating them.

Today, the F-5's avionics and radar may be outdated but the aircraft's supersonic performance and low operating cost is still of significant value to operators of the platform. With the advances in electronics, GPS and visual displays comes low cost upgrade products for the F-5. The costs for the 'glass cockpit' is minimal compared to the cost of a new fighter platform. Several countries are performing modernization of their F-5 fleets today including Thailand, Honduras, and Tunisia.

F-5 aircraft are finding new roles. In January this year, COC was contracted to survey 21 F-5Es that were ultimately purchased by a US company that is providing Aggressor Training to USAF and Navy. The USAF announced that they will purchase over 40,000 hours of red flag type training from commercial contractors including TacAir, ATAC-Textron and Draken.

Countries and operators of F-5s have fighter aircraft that would cost many millions to replace. Unlike more modern aircraft including the F-16, the OEM of the F-5 never developed formal SLEP (Structural Life Extension Program) programs for the aircraft. COC is addressing the requirements to life extend the airframes of F-5 to enable them to fly another 15 to 20 years or more. Similar to the restoration of a classic automobile, COC is providing the necessary life extension refurbishment and repairs for the F-5 using Advanced Technologies. These technologies speed return to flight by four to five times over traditional methods at cost savings of over 50%.

**Product Support and Sustainment**

Operators of more contemporary aircraft incorporate modern Fleet Management software systems that work in Cloud-Based computer environments accessible with smart phones and tablets. Young Air Force cadets entering the services today are far more technology savvy than the officers they are replacing. This creates a market for computer and video based support and training tools needed to effectively manage older platforms like the F-5. These Fleet Management systems are capable of storing and accessing vast amounts of data, making the management of aging aircraft like F-5 much more efficient and robust. Development of the Internet of Things (IoT) provides interconnection of computing devices embedded in everyday objects, enabling them to send and receive data. This 'power of information' didn't exist as little as five years ago. Today, it's a global source of information and control that when

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incorporated into support and sustainment of complex, sophisticated products like fighter aircraft, it empowers the operator to be proficient and effective in supporting their aircraft.

Supersonic aircraft require high levels of engineering and technical support. COC is using the latest Photogrammetry and 3D Surface software systems to quickly capture and record dimensional airframe measurements and features. With COC's Patent Pending systems, it is now possible to measure each individual aircraft's surface features with accuracy exceeding 0.005", about the thickness of a business card. This is critical to successful aero-structure repairs because each aging F-5 is slightly different in dimensions, thereby effecting fastener locations and fitting of components onto the airframe. These F-5 aircraft have been in service over 30 years, flying thousands of hours. This results in airframe dimensions that change from aircraft to aircraft making it essential measure every aircraft. Attempting to repair and refurbish the airframes becomes extremely costly and difficult if attempted using traditional methods. The T.O.s (Technical Manuals) including repair instructions produced by the USAF and the OEM date back more than 25 years. Air Force technical personnel that were trained on F-5s are now long retired, leaving the operators without the skilled workforce they once had.

Technologies, including Video Projection Systems, can project Work Instructions directly onto the airframe. These video systems use projectors now found in home theaters, and are amazingly clear, sharp and can accurately locate features like fastener locations, alignment of replacement components and more. With the instructions projected directly onto the airframe in real time, the time it takes to perform the work is greatly reduced. In addition, the projected locations and instructions are so accurate, technicians can avoid errors during the repair process. This dynamic, real-time Video Projection is used as a training tool, enabling training at the same time as restoration and repairs are performed. Other tools, such as handheld EDM (Electronic Discharge) drilling equipment, empower the technicians to remove 10-12 fasteners in the same time as it takes to remove one using traditional methods. These new EDM EDrills are light in weight and, unlike typical mechanical drills, take little mechanical force when applied to the work surface. Fixtures for the airframes to prevent movement during repairs can be designed to be much lighter, cheaper and faster to make.

### **Supply Chain Challenges**

As the F-5 moves forward in its over 30 years of service, the supply chain of qualified and experienced contractors that support this platform is becoming smaller and less knowledgeable. COC is in a unique position because of the company's long history and international recognition, 50 years, and experience supporting the F-5. Since 1992, COC has focused exclusively on the F-5, first as Licensee of Northrop Grumman and today as the Complete Support partner to the worldwide operators.

As the F-5 has aged, so have the challenges of acquiring quality, genuine spares, skilled platform engineering support and training. Unfortunately, this opens doors to unscrupulous suppliers that counterfeit parts or lack the expertise to manufacture them to specifications. Typical military supply chain management is often performed by government workers that often change positions within their organizations, and therefore don't acquire much platform expertise. Unlike the U.S. Government's Defense Logistics Agency, most countries do not have a robust First Article inspection system. In addition, most of the spares are still made or found in the U.S.

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However, the operators can ensure high quality, genuine parts by follow contemporary and internationally recognized supplier qualifications and certification protocols, such as ISO9001:2015 and AS9100 International Aerospace Quality Standards. Simple training on what certification and test reports to expect when purchasing spare parts can dramatically reduce and eliminate counterfeit parts and unqualified repairs.

**Conclusion**

The F-5 is an appreciating asset to the countries operating them. There are simply not enough supersonic aircraft in the world's inventory to meet demand. New aircraft including the KAI T-50 and Saab JAS 39 Gripen cost in excess of \$30 million each, and the F-35 JSF pushes the \$100 million mark - and that is before support equipment and training. Most countries cannot afford these new platforms. Operators of the F-5 have an appreciating asset; supersonic jets with low operating costs and low modernization costs. The hurdles and stumbling blocks to sustaining the F-5 have been the high cost of spare parts, lack of quality and authenticity of these spares, coupled with the lack of OEM support with regards to technical support, sustainment support and low cost life extension.

COC fills that void.

- Quality spare parts manufactured to all OEM standards and requirements, verified with certifications, test reports, dimensional inspections and more.
- Life extension solutions that are 4-5 times faster than traditional methods coupled with cost savings of more than 50%.
- Advanced Technologies using Photogrammetry, Video Projection, Cloud-Based Fleet Management software, and more.
- Dynamic technical training, incorporating Video Projected work instructions displayed real-time onto the aircraft.
- Long history and decades of technical knowledge and experience on F-5 aircraft.

With so few supersonic jets currently in the marketplace, the F-5 increases in value each year. New and growing mission requirements including the recent USAF announcement of procuring over 40,000 hours of aggressor aircraft training assures a long future for the F-5. With the right partner providing Complete Support, F-5 operators can enjoy many more years of successful flight hours.

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