ATEC ADVANCED TURBINE ENGINE COMPANY

A JOINT VENTURE OF

Honeywell Pratt & Whitney A United Technologies Company

FOR THE U.S. ARMY'S NEXT GREAT HELICOPTER ENGINE: TWO SPOOLS ARE BETTER THAN ONE

STATE OF THE ART ENGINE ARCHITECTURE

The gas turbine engine revolutionized military and commercial aviation in the 1930s and 40s. Early gas turbines featured impressive power but gulped fuel rapidly, limiting their effectiveness. This problem was solved in the late 1940s with the introduction of "dual-spool" engine architecture. Dual-spool engines feature two compressors, each rotating independently at its optimum speed and each powered by its own turbine.

The first U.S. military dual-spool engine, the Pratt & Whitney J-57, entered service with the U.S. Air Force in the early 1950s and the world never looked back. Combined with the later advent of variable compressor stators, which greatly improved engine operability, the dual-spool engine became the industry standard for all engine manufacturers and remains the standard to this day. The ATEC T900 engine for the U.S. Army's Improved Turbine Engine Program (ITEP) brings this state-of-the-art industry standard to the Army's next great helicopter engine, the Improved Turbine Engine (ITE).

ATEC member companies Honeywell and Pratt & Whitney are, and have long been, industry leaders in government and company-funded technology development and provide a rich portfolio of continually advancing technologies for ATEC to apply to its products. The idea that modern technology and dual-spool architecture are opposed to one another is misleading. In fact, the two go hand-in-hand. The selective and successive application of advanced engine technologies complements the cycle efficiency of the dual-spool engine architecture and allows achievement of optimum engine performance for a given application. The efficiency of the dual-spool engine, however, precludes the need to introduce and apply technologies prematurely, leaving those technologies that are still on the steep part of the maturation curve for future engine growth through technology insertion as they reach appropriate levels of maturity.

ATEC's T900 incorporates industry leading aerodynamics, state of the art materials, and an engine control system derived from the latest fifth generation fighter engines in use by the U.S. Department of Defense. Our technologies have powered the AGT1500 gas turbine engine that has been the force behind the Abrams M1 Main Battle Tank since the early 1980s, proving that the dual-spool architecture can meet high performance standards in some of the most challenging environmental conditions. ATEC's approach delivers an engine design that is

optimally balanced between superior performance and low risk to production introduction. The ATEC T900 engine provides that optimum balance to the U.S. Army's ITEP application.

DESIGNED FOR FLEXIBLE MAINTAINABILITY

Modular engine designs have been an industry standard for decades, regardless of engine architecture or manufacturer. Modular engines afford greater flexibility for maintenance actions and for future power growth as technology insertions can be made independently for the engine's interchangeable modules.

Dual-spool engines in use by the U.S. military have afforded the opportunity for modular maintenance and reduced logistics footprints for several generations of engines, and ATEC's T900 is no exception. The T900 is designed to cleanly separate into four distinct, wholly contained, fully interchangeable modules for efficient maintenance actions. This modular maintenance concept is an integral part of an overarching and relentless focus on 'design for ease of maintenance' that has been a staple of the T900 engine program since its inception. ATEC had opportunity to demonstrate the T900 modular maintenance concept during the recently completed Technology Maturation and Risk Reduction (TMRR) phase of the program and featured a modular display of the T900 engine in its booth at the Association of the United States Army (AUSA) annual meeting in Washington, D.C. in October this year.

PROGRESSIVE DESIGN MATURITY THROUGH INVESTMENT

As ATEC prepares to enter the final phase of T900 design and qualification, Engineering and Manufacturing Development (EMD), the T900 engine design has progressed through a series of progressive maturity steps. Launched as the HPW3000 during the Army's Advanced Affordable Turbine Engine (AATE) Science and Technology phase, the engine design progressed through numerous component rig tests and two full demonstrator engine tests. Engine testing included a rigorous and very successful sand ingestion demonstration, ensuring that the advanced performance of the T900 engine would also survive rugged operating environments experienced by Army aviation.

Following the engine demonstrations, ATEC continued maturing the T900 design through further component rig tests, incorporating lessons learned from full engine testing. Component performance improvements validated through this additional rig testing formed a solid and increasingly mature foundation for the T900 preliminary design effort recently completed in the TMRR phase. The maturity of the T900 engine design as demonstrated through this progression of testing, combined with the robust airframe integration effort accomplished and demonstrated during TMRR ensure that the T900 is ready to enter the EMD phase of engine design and qualification.

THE BEST ENGINE FOR THE FUTURE OF ARMY AVIATION

Industry leading technologies; the power and efficiency of state-of-the-art dual-spool architecture; designed for ease and flexibility of maintenance for the U.S. Army and other users; and a demonstrated, progressively maturing engine design ready to enter EMD – all proof that the ATEC T900 engine is the best engine for the U.S. Army Improved Turbine Engine Program and for the future of Army aviation.