
PIASECKI AIRCRAFT
CORPORATION
Piasecki
Pioneers in Vertical Flight

70 Year Tradition of Innovation

Future

Today

SpeedHawk

President Reagan Awards
Frank Piasecki
National Medal of Technology

Navy Heli-Stat
1980s

Army Flying Geep
1960s

YH-16 World's
Largest Helo 1950s

PV-2 1943

Background

Piasecki Aircraft Corporation (PiAC) is a registered small aerospace research, development, testing, and rapid prototyping company, focused on both manned and unmanned aircraft technologies. PiAC's founder, Frank Piasecki, was one of the original pioneers of the U.S. Helicopter industry, developing the second successful helicopter in the U.S. and the world's first tandem rotor helicopter which served as a forerunner of today's CH-46 and CH-47 transport helicopters. Piasecki has developed over 25 different advanced aircraft, and was awarded the National Medal of Technology by President Reagan in recognition for major contributions to the Aerospace Industry and the Nation. In 2005 Piasecki was awarded the Smithsonian National Air and Space Museum's Lifetime Achievement Award. In 2012 Piasecki won Tibbetts Award for KlearPath navigation/sensor system.

The Beginning

INTRODUCTION

With over 70 years of experience in research, development, testing and aerospace technology rapid prototyping, for the military and civilian aerospace industry worldwide, Piasecki Aircraft Corporation (PiAC) is ideally suited to develop and manufacture integrated manned and unmanned aircraft systems quickly and effectively to meet customer requirements. Our team of highly skilled aerospace experts has real-world experience with product life cycles and time to market constraints. We are committed to helping our customers meet evolving mission requirements with innovative solutions. From conceptualization to end-item procurement, PiAC is positioned to confidently move your technology needs into reality.

PiAC is located in Southeastern PA, just below The Philadelphia Int'l Airport and currently has multiple programs under contract with the DoD, including DARPA's ***Aerial Reconfigurable Embedded System (ARES)*** and the NAVY's ***Object Proximity Warning System (OPWS).***

Many of PiAC's programs are sponsored by the DoD under the Small Business Innovation Research (SBIR) program, an area where PiAC has established a reputation for significant program accomplishments.

PiAC was the lead contractor in the U.S. Army's FCS Class II ***Air Scout*** Unmanned Aerial System (UAS) and FCS Class III ***Air Guard*** UAS programs, completing Phase I design and demonstration efforts, leading to selection for ***follow on*** Phase II detail design. While these UAV programs were deferred due to FCS Program funding constraints, PiAC has committed to continue its UAV technology development efforts.

PiAC occupies a 100,000 sq. ft. engineering and manufacturing facility on 55 acres, along the Delaware River, which includes administration and engineering office space, research and development facilities, component fabrication, system assembly, and test areas. In addition there are two FAA certified heliports on site.

OVERVIEW OF CURRENT PROGRAMS

ARES
Aerial Reconfigurable Embedded System

Under the DARPA ARES program, formerly Transformer (TX), PiAC and Team Member Lockheed Martin (Prime) are under contract to develop and demonstrate a flyable prototype modular air-vehicle system that provides Cargo pickup and delivery in 2015.

DARPA's goal is to provide individual ground units with "flexible, terrain-independent transportation that avoids ground-based threats, in turn supporting expedited, cost-effective operations and improving the likelihood of mission success."

ARES is a modular transportation system built around a Vertical Takeoff and Landing (VTOL) flight module operated as an Unmanned Aerial Vehicle (UAV). Twin tilting ducted fans would provide efficient hovering and landing capabilities in a compact configuration, with rapid conversion to high-speed cruise flight similar to small aircraft. The system could use landing zones half the size typically needed by similarly sized helicopters, enabling it to land in rugged terrain and aboard ships. The flight module would have a useful load capability of up to 3,000 pounds, more than 40 percent the takeoff gross weight of the aircraft. The flight module would carry one of several different types of detachable mission modules, such as Intelligence, Surveillance and Reconnaissance (ISR), casualty evacuation, and cargo resupply.

Units could direct the flight modules using apps on their mobile phones or ruggedized tablets. Initially, the system would be unmanned, with a future path towards semi-autonomous flight systems and user interfaces for optionally manned/controlled flight.

ARES Aerial Reconfigurable Embedded System

Object Proximity Warning System (OPWS)

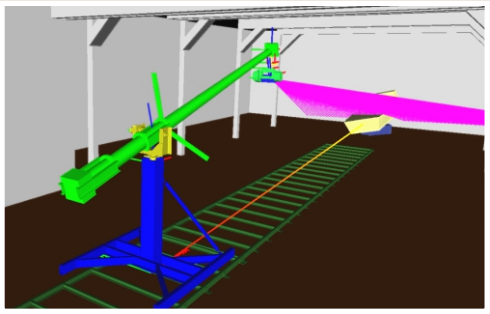
For Navy SBIR Topic N093-186, "MH-60S Vertical Replenishment Object Proximity Warning System (OPWS)", PiAC was awarded a Phase I contract by the Naval Air Systems Command in January 2010. The Phase I effort included selection of the sensor system and verified the effectiveness of the selection through both simulation and hardware testing. PiAC also updated prior sensor trade studies with a specific orientation to the requirements of VERTREP missions. The Phase I solution fused the LADAR image with that of a high definition visual sensor. Existing algorithms were extended to satisfy the VERTREP OPWS requirements. The trade study results and the algorithm extensions were validated through both simulations and hardware testing, and PiAC developed a conceptual design for mounting of its sensor assembly on the MH-60S.

Based on the success of the Phase I effort, a Phase II SBIR contract was issued by the Naval Air Systems Command in August 2012, spread over two Fiscal Years. The Phase II contract provides for the development and demonstration of an OPWS sensor and software for testing in a controlled, scaled environment. Specifically, the Phase II effort includes: (1) an OPWS sensor test rig that emulates rotorcraft and ship deck dynamic and relative ship motion, allows variation in sea state, approach path, and sensor configuration, (2) integration of a Phase II OPWS scanning LADAR sensor with EO sensor, fusing LADAR returns with EO data pose estimates, (3) comparison of Phase II OPWS sensor/software to truth data to characterize sensor performance with varying

OPWS (continued)

LADAR scan rate, field of view, and stepping angle vs. approach angle and sea state, and (4) demonstration of a time synchronized truth camera aligned with OPWS 3D model and simplified pilot display in real time.

Successful completion of this prototype demonstration program will establish the basis for a follow-on Phase II.5 or Phase III flight demonstration on an MH-60S or other representative full scale Navy rotorcraft.



OPWS Sensor and Test Rig Simulation

OPWS Rolling Boom Test Rig Elements With Sensor Mounted

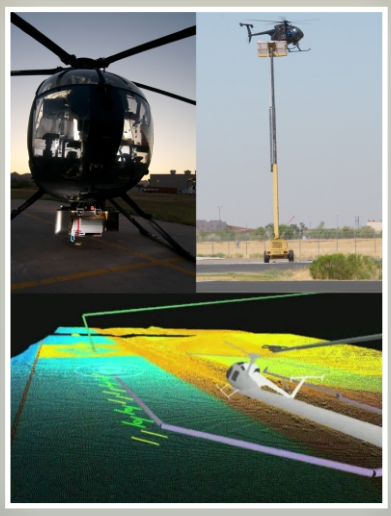
"Turais" Wing and Bomb Bay Launched UAV

The "Turais" Wing and Bomb Bay Launched Unmanned Air Vehicle (WBBL-UAV) is a reconnaissance system deployable in flight from either the P-3 or P-8, as well as other manned aircraft. Its main purpose is to increase coverage area, effective time on station, and stand off range from threat environments. Turais is turbojet-powered with a scissor wing and parachute recovery system, providing 200 pounds of payload capacity, a maximum speed of 250 knots and over 6 hours endurance. Under a Naval Air Systems Command (NAVAIR) Phase II SBIR contract, PiAC initiated design of the full-scale Turais air vehicle. A modification was issued for the Option Phase of this contract, under which PiAC completed the Turais proof of concept design and fabrication efforts, leading to a successful free flight demonstration.

"Turais" WBBL-UAV

RECENT PROGRAMS

CM-UAV Landing Zone Selection Demonstration



Autonomous Collision Avoidance and Landing Zone Selection

In May 2010, Piasecki Aircraft Corp. and Carnegie Mellon University demonstrated KlearPath,™ a navigation/sensor system that enabled a full-size autonomous helicopter, The Boeing Unmanned Little Bird (ULB), to fly at low altitude while avoiding obstacles; evaluate and select suitable landing sites in unmapped terrain; and land safely using a self-generated approach path. This demonstration was the culmination of a development and test program for a sensor assembly that enables unmanned helicopters to perform missions similar to those performed by manned utility and cargo helicopters in urban and wooded terrain. During different test and demonstration flights, the navigation/sensor system had to map an unknown area where large and small obstructions limited the possible landing sites, circumstances typical of any mission requiring landing in urban or wooded terrain. The system was able to reliably identify level landing sites that were accessible to troops on the ground. The technology is also applicable as a pilot aid to assist both military and civilian pilots, to help avoid obstacles, such as power lines, and select landing sites in unimproved areas such as emergency scenes, even when operating in low-light or low-visibility conditions. It is also directly applicable to aid unmanned air platforms as well. The sensor development and testing was sponsored by the U.S. Army's Telemedicine and Advanced Technology Research Center (TATRC) through a Small Business Innovation Research (SBIR) program, supplemented with significant additional funding from Piasecki.

SpeedHawk (X-49A) VTDP Compound Helicopter Technology Flight Demonstration Program (Cover Photo)

PiAC's "SpeedHawk" Vectored Thrust Ducted Propeller (VTDP) Compound Helicopter program was an Army Advanced Technology Demonstration (ATD) program to flight demonstrate potential improvements in speed, range, survivability and reliability, addressing the Army's Future Force requirements for greater rotorcraft operational reach and sustainability. The VTDP technology replaces the conventional tail rotor and provides anti-torque and yaw control with the additional ability to provide forward thrust and trim control. In combination with a lifting wing, this technology unloads the rotor, allowing the helicopter to fly 47% faster, twice as far, is more maneuverable and reduces vibration and fatigue loads, improving reliability and reducing life cycle costs.

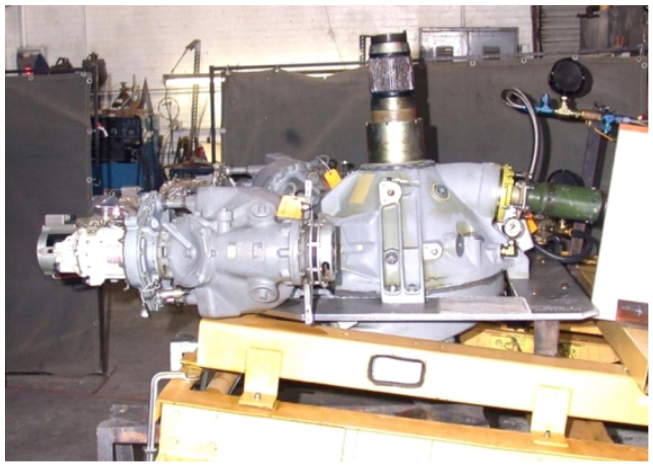
SpeedHawk (X-49A) VTDP (continued)

First flight of the X-49A SpeedHawk Demonstrator occurred on 29 June 2007 and the Phase 1 flight test envelope expansion program has been completed at the Flight Test Center, Wilmington, Delaware. All initial Phase I contract milestones have been accomplished and the results have met or exceeded all program objectives.

The follow-on Phase 2 program will incorporate additional power and airframe drag reduction with the objective of demonstrating speed well in excess of 200 knots and increased Gross Weight capability.

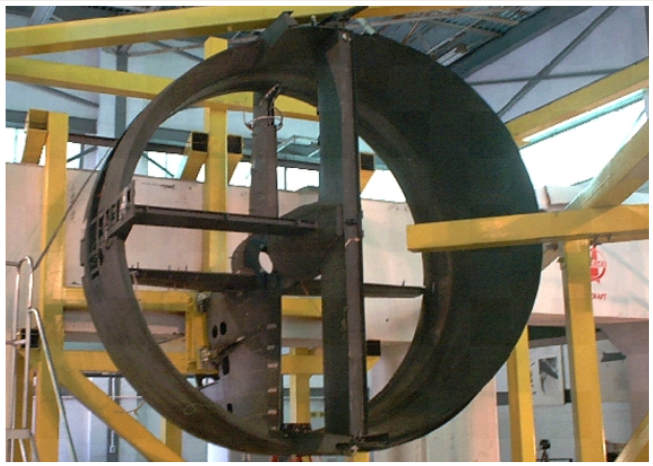
The SpeedHawk (X-49A) design, development and flight test program is a primary example of PiAC's engineering, manufacturing, and systems test capabilities. This program, initiated as an SBIR Phase I effort, has resulted in the Army Sponsored Advanced Technology Demonstration (ATD) program. Successful execution of this program has demonstrated PiAC's core capabilities to rapidly design, fabricate, assemble and accomplish the systems qualification tests necessary to achieve the test program objectives within very limited budgets. Specific examples follow:

Full Scale VTDP Ground Testing Stand



Drive System Qualification

All qualification objectives were met on schedule and within program funding availability, which lead to Government approval to initiate the X-49A prototype aircraft flight test operations and further validate the VTDP technology base for existing systems and future platforms.



Full Scale VTDP Structural Test Fixture

Wing Structural Test Fixture

FCS Programs

Air Scout FCS Class II UAS

The PiAC "Air Scout" UAS was the sole selectee for the FCS program funded Class II UAS design study as an alternative to two DARPA funded Class II programs. The PiAC Air Scout was designed to provide the Army Company Commander with real time situational awareness and understanding coupled with laser target designation capability enabling the rapid employment of direct and indirect fires, substantially improving the overall survivability and mission effectiveness of the FCS System of Systems. The Air Scout is based on a tandem shrouded rotor air vehicle. Air Scout provides 4 hours of endurance with a 30 lb payload, and is small and light enough to be handled by two soldiers and fit in the back of a HMMWV and the FCS Manned Ground Vehicle variants. Designed for excellent stability and control in near earth obstacle rich environments, the system incorporates collision avoidance and autonomous systems technologies. The air vehicle architecture provides for maximum reliability, maintainability, and availability, thus reducing life cycle cost. A company funded prototype has flown in tethered hover and is being readied for autonomous flight.

FCS Programs (continued)

Piasecki "Air Scout"
FCS Class II UAS

"Air Scout" Demonstrator in HMMWV

Air Guard FCS Class III UAS

PiAC's Air Guard was source selected as the #1 Best Value solution for the FCS Class III UAS requirement, beating out the three other competing systems. "Air Guard" is designed to support the Army Battalion Commander with real time reconnaissance, targeting, communications relay, and mine detection system. The Air Guard is an autonomous jump takeoff and vertical landing (JTOVL) autogyro. The platform provides over 10 hours of endurance with a 215 lb payload, is designed to be compact with 4 air vehicles fitting in an ISO 20 container, and is simple and reliable to enhanced supportability and logistics. PiAC successfully demonstrated Level IV Autonomous Control with its Air Guard Technology Demonstrator. This included pre-planned missions, dynamic re-tasking, target tracking, sensor slaving, and other Level IV autonomous control functions.

Piasecki "Air Guard"
Class III UAS

Piasecki "Air Guard"
FCS Class III UAS

Air Guard Technology Demonstrator

Facilities/Resources

Piasecki Aircraft Corporation has all the facilities and equipment required to support the engineering and manufacturing of aerospace systems and technologies. PiAC occupies a 100,000 sq. ft. plant, located on fifty-five acres with two licensed Heliport and ground testing facilities, approximately 3 miles south of Philadelphia International Airport. PiAC has a complete Engineering Department with 3D design capability utilizing SolidWorks. PiAC's Manufacturing Department is a complete aircraft light manufacturing facility. The Manufacturing Department includes machining operations, sheet metal and welding shops, composite fabrication, a transmission clean room, test facility, and major assembly area. PiAC maintains a fully qualified aircraft Quality Control Department with the company's Quality Management System fully compliant with ISO 9001 and AS9100 Revision C. Certification was received in October 2009. Some of the resources available to support PiAC manufacturing operations are listed on the next page along with samples of particular equipment and fabricated components.

On Site Fabrication
Composites and Sheet Metal

MACHINING:

Milling

3 & 4 Axis CNC Machining up to 50” x 26” x 26”
Manual vertical milling machines up to 30” x 15” x 16”
Manual horizontal milling machines up to 42” x 14” x 20”

Turning

From .125” to 25” Diameter
From 16” to 105” between centers

Jig Bore

Pratt & Whitney #3B 56” x 24” x 30”

FABRICATION:

Certified Welding

MIG
TIG
Spot

Sheet Metal

Shear up to 10’
Press Brake up to 10’

Composite

Tooling
Layup

INSPECTION:

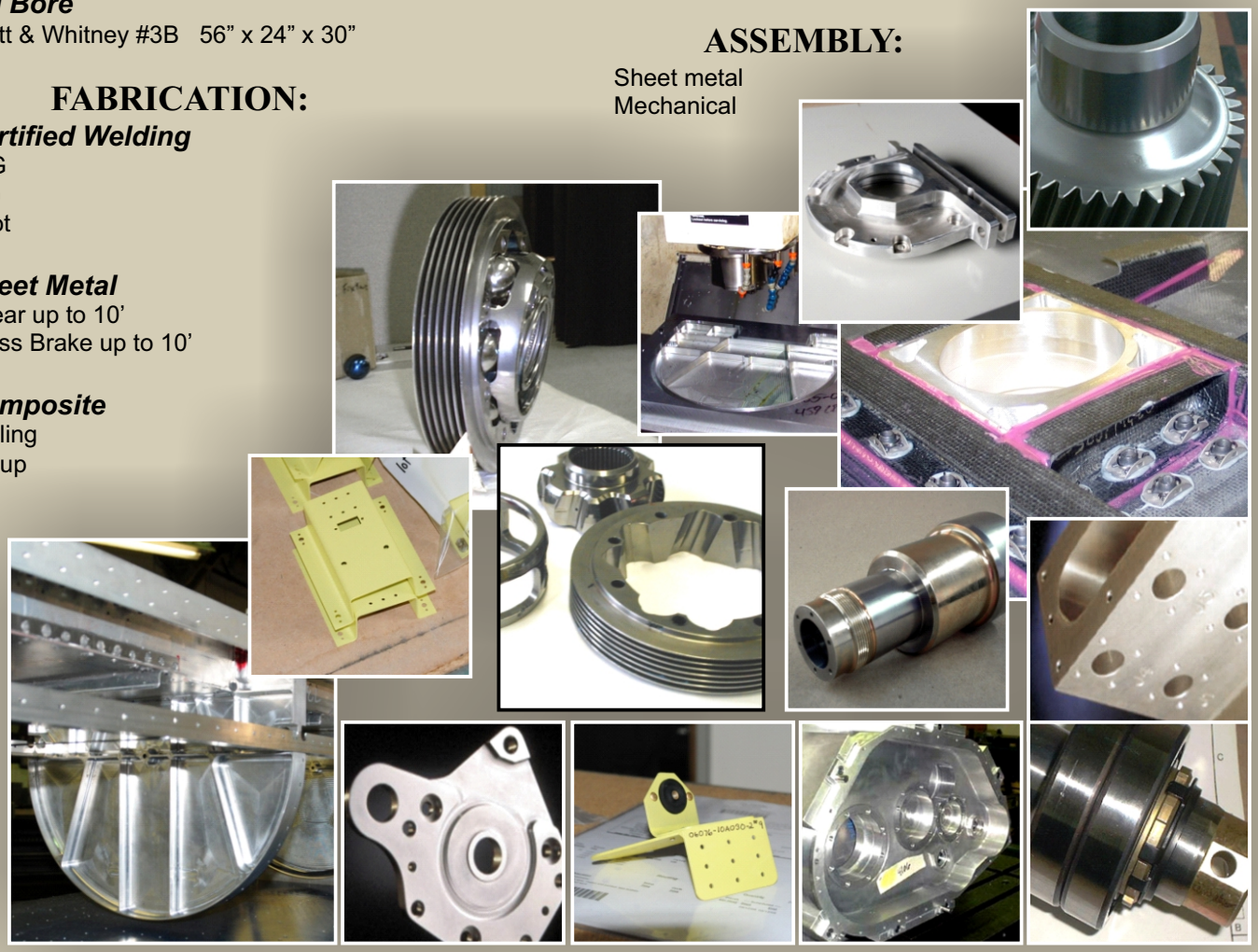
Large selection of micrometers, calipers and gauges (all current calibrations)

NONDESTRUCTIVE TESTING (NDT):

Fluorescent penetrant inspection in accordance with AMS 2647
Magnetic Particle inspection in accordance with ASTM E1444
All NDT personnel certified per NAS 410

ASSEMBLY:

Sheet metal
Mechanical



PIASECKI AIRCRAFT CORPORATION

Quality Policy

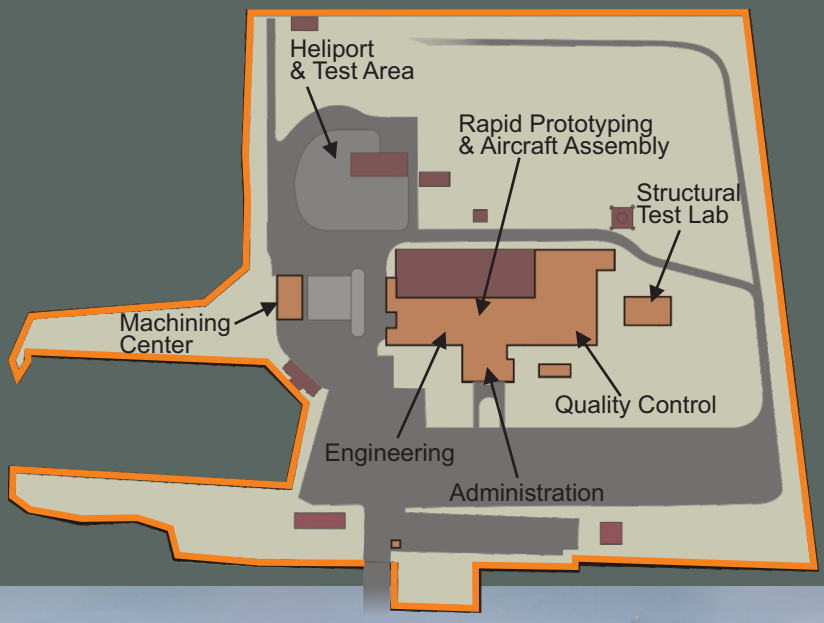
Piasecki Aircraft Pledges to Meet or Exceed its Customers' Requirements.

Each Team Member Will Deliver on This Pledge through:

- **Personal Pride and Commitment;**
- **Dedication to Craftsmanship;**
- **Application of Continuous Improvement; and,**
- **Strict Compliance with PiAC Quality System.**

X-49 Modal Shake Test

ISO 9001, AS9100



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