Scaled Composites Agile Responsive Effective Support (ARES) Demonstrator Aircraft

Contents

NOTE: The information in this document was extracted from the Wikipedia articles Scaled Composites, https://en.wikipedia.org/wiki/Scaled_Composites, July 21, 2020, and Scaled Composites ARES, https://en.wikipedia.org/wiki/Scaled_Composites_ARES, July 21, 2020. See the original Wikipedia articles for updates.

The Scaled Composites Agile Responsive Effective Support (ARES), Figure 1, is a demonstrator aircraft built by Scaled Composites.

Figure 1. The Scaled Composites 151 ARES on the ramp at the Troutdale Airport (KTTD) near Portland, Oregon. View is of the left side of the aircraft, showing the engine intake. The cockpit canopy is closed.

Scaled Composites History

Scaled Composites was established in 1982 and purchased by the Beech Aircraft Corporation in 1985, as a result of the collaboration on the Starship project. In 1988, Beech's parent company, Raytheon, sold Scaled back to Rutan, who then sold it to Wyman-Gordon. After Wyman-Gordon was acquired by Precision Castparts Corp., Rutan and ten investors re-acquired the company as Scaled Composites, LLC. Northrop Grumman, a major shareholder in the company with a 40% stake, said it would acquire the company outright on July 20, 2007. Both companies said Northrop Grumman's acquisition would not affect Scaled Composites' strategy or involve replacing Burt Rutan as senior manager.[1][2] The acquisition by Northrop Grumman was completed on August 24, 2007.[3] Rutan retired in April 2011.[4] Ben Diachun, a long time employee, was president of Scaled from Oct 31, 2015[5] until April 2019[6][7]. Cory Bird, another long time employee, became president of Scaled in April 2019[8]

ARES Development

In 1981, U.S. Army Aviators Jim Kreutz and Milo Burroughs undertook a study for a *low cost battlefield attack aircraft* (LCBAA), as they felt the close air support aircraft available were inadequate to support

the U.S. Army operations. They decided that a fixed-wing aircraft with excellent maneuvering capabilities at very low altitudes and resistance to stall would be necessary.

Burt Rutan joined their study to design an aircraft to meet the requirements with a two-phase program. The first phase was the preliminary design of LCBAA, while in the second phase the Long EZ aircraft was modified to serve as a technology demonstrator. The original layout was of a low wing canard configuration, aircraft powered by a pusher turboprop, and built around a 30 mm Gatling gun capable of destroying light armored vehicles. It was decided that as much military hardware as possible would be used in the design.

When a Pentagon official promised that they would evaluate his aircraft if he built it, he built a demonstrator aircraft in 1986.

By this time the aircraft had changed significantly. It retained the general configuration, but now had a single Pratt & Whitney Canada JT15D-5 turbofan engine rather than a turboprop as the propeller was vulnerable to debris kicked up by the nosewheel.

A GAU-12/U 25 mm rotary barreled cannon was mounted in the aircraft to the right of the nose in a concave recess under the cockpit. The concave recess trapped gun exhaust gases, creating a pressure buildup in the recess which pushing the aircraft's nose to the left, cancelled the recoil of the large cannon, which otherwise pushed the nose to the right. To prevent exhaust gases from the gun entering the engine intake and reducing engine performance, the engine intake was located on the left side of the nose, opposite the cannon making the aircraft asymmetric. Thrust was redirected to the centerline via a series of ducts, which also reduced the infrared signature.

After Beechcraft sold Scaled Composites back to Rutan, he chose to complete the project with company funds. This aircraft was renamed ARES, and first flew on February 19, 1990, piloted by Scaled Composites test pilot Doug Shane. Since then it has flown more than 250 hours, and met its original design specifications for performance and range. In 1991 under US Air Force contract, the ARES 25 mm cannon was installed and during testing the cannon performed well but the ARES remains a private project.

After an appearance in the movie *Aces: Iron Eagle III* as a fictional Me 263 fighter, the aircraft has become a commercially available research test bed. The aircraft was stored in December 2000 at the Mojave Spaceport until Scaled Composites became a Northrop Grumman subsidiary and flown again on March 7, 2008.[1]

ARES Design

The ARES is of canard configuration to enable safer flight at low altitude. The foreplane provides pitch control and is designed so that it reaches critical angle of attack sooner than the main wings, protecting the aircraft from stall while full roll control is retained. The foreplane has a wingspan of 19.2 feet (5.85 m) and is unusual in being swept 7 degrees forward from its attachment point behind the cockpit.

The main wing has a span of 35 feet (10.7 m) and a reference area of 191 sq. ft. (17.7 m^2), not including the strakes. It is swept aft 16 degrees at the leading edge. The strakes are swept 49 degrees at the leading edge. These strakes, combined with a wet wing center-section area, form the bulk of the 2,200 lb (1000 kg, approximately 333 U.S. gallons) fuel capacity. The wing has conventional ailerons on the outboard trailing edge, and spoil-flaps (similar to the dive-brake flap) on the inboard trailing edges. The ailerons are actuated by push-rods, and the spoil-flaps are hydraulically operated.

Directional stability is provided by twin boom-mounted fins, each of 18 sq ft (1.7 m^2). area. Each has a cable-actuated rudder at its trailing edge. The rudder actuation system also drives the full-time mechanical nosewheel steering for ground operations.

The engine inlet is another major unique feature of ARES. Since gun gas ingestion posed significant problems in other aircraft development programs (like A-10), the configuration of ARES was designed to avoid this problem: the engine inlet is entirely contained on the left side of the aircraft, and the gun is installed on the right side. The inlet has a circular cross section, and is straight into the fan face. The engine is mounted slightly transversely in the fuselage, with an 8-degree misalignment from the aircraft's longitudinal axis.

The engine exhaust is turned back to the longitudinal axis by a curved composite tailpipe. A composite tailpipe was to help get the gun recoil reaction closer to the aircraft lateral center of gravity (CG) location, the gun is sub-merged as deeply as practical into the right side of the fuselage. Also, the fuselage is not centered about the aircraft centerline, but is offset to the left by three inches. This results in the firing barrel of the gun being only about 18 inches from the lateral CG. This minimizes the yaw movement caused by the recoil of the gun.

The aircraft fuselage is almost completely made of fiberglass composite material installed over the foam core. The fabrication technique of composite aircraft fuselages has been perfected by Scaled Composites in previous aircraft.

To assure a low cost and high reliability of the components ARES primarily includes off-the-shelf aircraft systems. The engine is the Pratt and Whitney Canada JT15D with 2,900 lb (13.2 kN) of thrust at sea level. The hydraulic system, used for spoiler flaps and landing gear actuation, uses a Piper Malibu hydraulic pump, which operates at 1500 psi. Instrumentation for the demonstrator consists mainly of standard general aviation equipment. In addition there is a head-up display which currently[*when?*] displays only a fixed reticle to aim the gun but is capable of displaying the complete data range of an F-16.[*citation needed*][*dubious – discuss*] The pilot sits in a Universal Propulsion Company SIIIS-3ER ejection seat with zero-zero capability.

The fuel system consists of auxiliary wing tanks feeding an armored, fuselage-mounted main tank, which sits just forward of the engine and behind the firewall. The main tank can feed the engine in all attitudes. This tank is continuously refilled from the main wing tanks with no fuel management duties required of the pilot. By feeding the main tank from the two auxiliary wing tanks, the size of the fuel tank in the fuselage was effectively halved, creating a large space behind the pilot empty of any tanks or other aircraft systems. This bay had no dedicated function on the demonstrator, but was intended to be left available for any additional equipment which the Army might wish to install in the production version.

The main flight controls are completely mechanical and the engine has a backup mechanical fuel control so the aircraft can retain control even if the electrical system fails. The controls were specially designed to minimize the forces on the stick.

Besides the GAU-12 gun, there are additional pylons to carry another ordnance (Hydra 70 FFAR, for example).

The ARES has very good turning performance as a result of low wing loading. Its turn rate is 32 degree/second at 6G and 36 degree/second at 7G (the structure is limited to 8G). The corner speed is 210 kt (390 km/h) the stall speed is 78 kt (145 km/h).

Due to high fuel volume and good cruising efficiency the aircraft can have a range of 1200 nautical miles (2200 km) at altitude and long endurance.[2]

ARES Specifications (Scaled Composites 151 ARES)

Data from Jane's All The World's Aircraft 1993–1994[3]

General characteristics

- Crew: 1
- **Length:** 29 ft 5.25 in (8.97 m)
- **Wingspan:** 35 ft 0 in (10.67 m)
- **Height:** 9 ft 10 in (3.00 m)
- **Wing area:** 188.3 sq ft (17.49 m^2)
- **Empty weight:** 2,884 lb (1,308 kg)
- **Gross weight:** 4,804 lb (2,179 kg)
- **Max takeoff weight:** 6,100 lb (2,767 kg)
- **Powerplant:** 1 × Pratt & Whitney JT15D turbofan, 2,950 lbf (13.1 kN) thrust

ARES Performance

- **Maximum speed:** 466 mph (750 km/h, 405 kn) (TAS) at 25,000 feet (7,600 m)
- **Combat range:** 690 mi (1,100 km, 600 nmi)
- **Service ceiling:** 35,000 ft (10,670 m) [4]
- Thrust/weight: 0.43 (at maximum weight)

ARES Armament

- 1× 25 mm GAU-12/U Gatling cannon
- AAMs: 2× AIM-9 Sidewinder *or* 4× AIM-92 Stinger
- Air-to-ground weapons include unguided rockets

Links for Aircraft Similar to ARES

- Textron AirLand Scorpion
- IML Addax, similar project from New Zealand
- British Aerospace P.1233-1 Saba
- PZL-230 Skorpion

External Links

Wikimedia Commons has media related to Scaled Composites ARES.

- Scaled Composites company *ARES* web page
- Photos of ARES and other Rutan aircraft
- More photos of ARES (in Russian)
- YouTube Demo video narrated by Burt Rutan

References from Wikipedia Articles

Scaled Composites

[1] *"MP-RTIP: Rutan To Get First Crack At Flight Test". UVOnline.com. Shephard Group. Archived from the original on September 28, 2007. Retrieved December 7, 2006.*

[2] *Associated Press (July 20, 2007). "Northrop to Own SpaceShipOne Builder". Forbes. Retrieved July 27,2007.* [dead link]

[3] *"Northrop Grumman Completes Acquisition of Scaled Composites, LLC". Archived from the original on July 7, 2012. Retrieved August 25, 2007.*

[4] *"Burt Rutan Announces Retirement Plans" (PDF). Retrieved July 10, 2011.*

[5] *Drew, James (October 23, 2015). "Scaled president appointed VP of advanced design at Northrop". Flightglobal.com. Retrieved May 5, 2019. Long-time Scaled vice-president of engineering, Ben Diachun, has been named to fill the vacancy of president effective 31 October*

[6] *"Urban Air Mobility Startup Opener Hires Key Execs for Future Blackfly eVTOL". CleanTechnica. April 11, 2019. Retrieved May 5, 2019. Ben Diachun is an industry veteran and innovator who is also now Opener's President. Diachun comes from Scaled Composites and worked with the late Paul Allen on designing and flying the experimental air-launched rocket-powered aircraft SpaceShipOne.*

[7] *Inc, OPENER (April 2, 2019). "OPENER Names Ben Diachun President". GlobeNewswire News Room. Retrieved May 5,2019. "As OPENER's President, my goal is to take what has been accomplished by this amazing team to the next level, and successfully bring a safe and affordable flying vehicle to market."*

[8] *"Scaled Composites Announces Cory Bird as President". spaceref.com. Retrieved May 5, 2019. Monday, April 8, 2019. Scaled Composites has announced Cory Bird as the company's new president.*

ARES

[1] *Flight International*, 4–10 March 2008, p. 17.

[2] Kreutz, Jim, "Low Cost Battlefield Attack Aircraft", Sky Blue Aviation, 1989, unpublished.

[3] Lambert 1993, pp. 554–555.

[4] *Air International* May 1990, p. 266.

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- Lambert, Mark. *Jane's All The World's Aircraft 1993–94*. Coulsdon, UK: Jane's Data Division, 1993. ISBN 0-7106-1066-1.
- The Complete Encyclopedia of World Aircraft by David Donald