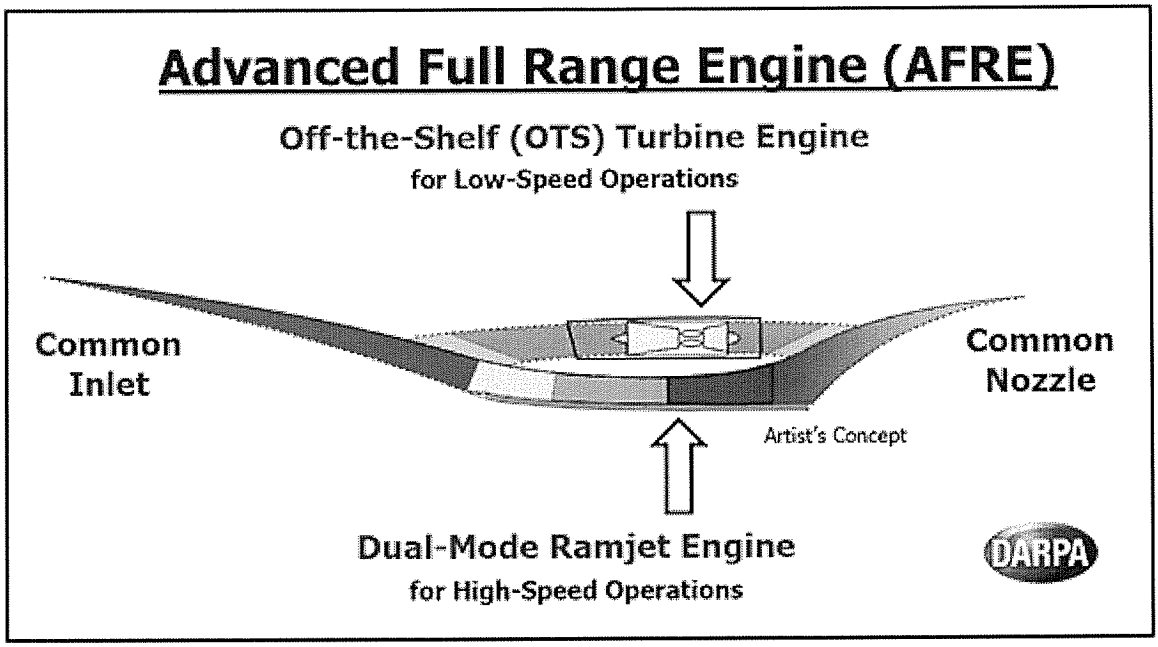
Advanced Full Range Engine (AFRE) Program Envisions Hybrid Propulsion System Paving the Way to Routine, Reusable Hypersonic Flight

Reliable, affordable system would combine turbine and hypersonic engine technologies for seamless transition from low-speed takeoff to Mach 5+ and back

outreach@darpa.mil

6/24/2016



In the decades-long quest to develop reusable aircraft that can reach hypersonic speeds—Mach 5 (approximately 3,300 miles per hour/5,300 kilometers per hour) and above—engineers have grappled with two intertwined, seemingly intractable challenges: The top speed of traditional jet-turbine engines maxes out at roughly Mach 2.5, while hypersonic engines such as scramjets cannot provide effective thrust at speeds much below Mach 3.5. This gap in capability means that any air-breathing hypersonic vehicles developed today would use disposable rockets for one-time boosts up to operating speed, limiting the vehicles' usefulness.

To help remove these constraints and lay the framework for routine hypersonic flight with reusable vehicles, DARPA has launched its Advanced Full Range Engine (AFRE) program. AFRE seeks to develop and demonstrate a new aircraft propulsion system that could operate over the full range of speeds required from low-speed takeoff through hypersonic flight.

"Instead of designing an entirely new kind of engine, we're envisioning an inventive hybrid system that would combine and improve upon the best of off-the-shelf turbine and ramjet/scramjet technologies," said Christopher Clay, DARPA program manager. "This won't be the first time that ambitious engineers will attempt to combine turbine and ramjet technologies. But with recent advances in manufacturing methods, modeling, and other disciplines, we believe this potentially groundbreaking achievement may finally be within reach."

AFRE aims to explore a turbine-based combined cycle (TBCC) engine concept, which would use a turbine engine for low-speed operations and a dual-mode ramjet—which would work efficiently whether the air flowing through it is subsonic (as in a ramjet) or supersonic (as in a scramjet)—for

high-speed operations. The two components of the hybrid engine would share a common forward-facing air intake and rear-facing exhaust nozzle to release thrust.

AFRE aims to develop critical technologies and culminate in ground-based testing of a full-scale, integrated technology demonstration system. If that testing is successful, further development of the AFRE technology would require flight testing in a potential follow-on demonstration program.

Systems that operate at hypersonic speeds offer the potential for military operations from longer ranges with shorter response times and enhanced effectiveness compared to current military systems. Such systems could provide significant payoff for future U.S. operations, particularly as adversaries' capabilities advance.

To familiarize potential participants with the technical objectives of AFRE, DARPA has scheduled a Proposers Day in advance of a planned Broad Agency Announcement (BAA). The Proposers Day will be held on Wednesday and Thursday, July 13 and 14, 2016 at the DARPA Conference Center in Arlington, Va. The event will run from 1:00 PM to 5:00 PM Eastern on July 13 and from 9:00 AM to 12:00 PM Eastern on July 14.

The Special Notice announcing the event is available at http://go.usa.gov/chjzj. Advance registration is required through the registration website: http://ow.ly/Qm7a3016sgG. Registration closes Wednesday, July 6, 2016 at 2:00 PM Eastern or when capacity is reached, whichever comes first. There is no fee for registration. Due to space limitations of the conference facility, attendance is limited to the first 150 registrants and no more than four representatives per organization (parent company). Questions about the AFRE Special Notice and Proposers Day may be directed to DARPA-SN-16-43@darpa.mil.

Image Caption: *DARPA's new Advanced Full Range Engine (AFRE) program seeks to develop and demonstrate a new aircraft propulsion system that could operate at subsonic through hypersonic speeds and lay the framework for routine, reusable hypersonic flight. Click below for high-resolution image.*

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