

BRIEFING · BRIEFING · MACH-0001 · 2026-06-12

Engines of Tomorrow Briefing — June 2026

Lithium plasma at 120 kW, supersonic airbreathers, and the nuclear retreat

Engines of Tomorrow — Research Desk

Coverage: Engines of Tomorrow

ABSTRACT

This Briefing covers six current developments across novel propulsion: (1) NASA-JPL fires a lithium-fed magnetoplasmadynamic thruster at 120 kW — a U.S. electric-propulsion power record; (2) Hermeus' Quarterhorse Mk 2.1 logs its first supersonic flight, advancing a turbine-based combined-cycle path to hypersonic airbreathing; (3) Venus Aerospace's rotating-detonation rocket engine completes the first U.S. RDRE flight and moves toward a 2,000-lbf-class VDR2 ramjet; (4) Ursa Major's Draper storable liquid engine flies on an AFRL hypersonic demonstrator under stacked defense contracts; (5) the FY2026 budget zeroes nuclear thermal and electric propulsion as DRACO is wound down — a structural retreat with one stock at the center; (6) MIT and NASA prove a single green ASCENT propellant can feed both chemical and electro spray thrusters, collapsing dual-mode CubeSat propulsion to one tank.

Keywords: electric propulsion, MPD thruster, lithium, hypersonics, scramjet, TBCC, rotating detonation engine, RDRE, nuclear thermal propulsion, DRACO, green propellant, ASCENT, electro spray, Hermeus, Venus Aerospace, Ursa Major, BWXT

In this Briefing

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2. Hermeus' Quarterhorse goes supersonic — and validates the airbreathing path
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4. Ursa Major's Draper flies, stacking AFRL hypersonic and on-orbit contracts
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6. One green tank, two thrusters: ASCENT bridges chemical and electric propulsion

A 120 kW lithium plasma thruster quietly resets the U.S. electric-propulsion ceiling

What's new. On 24 February 2026, NASA's Jet Propulsion Laboratory fired an applied-field magnetoplasmadynamic (MPD) thruster running on lithium-metal vapor at up to 120 kW — the highest power level a U.S. electric-propulsion device has reached, disclosed publicly in late April. Unlike the gridded-ion and Hall systems that dominate today's flight hardware, MPD scales with current rather than grid area, which is why it is the architecture of choice for the megawatt-class propulsion a crewed Mars transfer would demand [1].

Evidence. The test reached "up to 120 kilowatts," more than 25× the ~4.9 kW of the Hall thrusters flying on Psyche, with JPL targeting 500 kW–1 MW per thruster "in the coming years." The lithium-fed design drove its tungsten cathode past 2,800 °C (~5,000 °F) across five ignition cycles. NASA's own framing puts a crewed Mars architecture at 2–4 MW total electrical power across multiple thrusters operating >23,000 h — i.e., this 120 kW unit is roughly a 4–8% slice of one thruster's eventual target, and a far smaller slice of a full stack [1].

THE TAKE:

The headline is power, but the buried lede is lithium. A condensable propellant that plates onto cold surfaces is operationally hostile to long-duration ground test — yet lithium's low ionization energy is exactly what lets MPD hit high thrust efficiency at these currents. The real gate to a flight system is not the thruster; it is the multi-megawatt *power source* and radiators to feed it. At ~25 kg/kW for space nuclear-electric power (Engines of Tomorrow estimate, mid-range of published fission-power studies), a 2 MW Mars tug implies ~50 t of reactor-plus-radiator mass before the thruster is bolted on — which is why the same budget cycle that celebrates this firing (see Topic 5) just defunded the reactor that would power it. The thruster is now ahead of its own energy supply.

Market read. No clean public-market read — the work is NASA-JPL in-house and the megawatt power source (the actual bottleneck) is unfunded. Watch the space-nuclear primes (BWXT) as the proximate beneficiaries *if* reactor funding returns; today this is an agency milestone, not an investable one.

Hermeus goes supersonic — the airbreathing hypersonic path takes a real step

What's new. Hermeus' uncrewed Quarterhorse Mk 2.1 made its first supersonic flight in May 2026 from Spaceport America, reaching Mach 1.21 — months after its February 2026 maiden flight and under an FAA clearance for up to seven supersonic sorties before year-end. The vehicle is the flying testbed for Chimera, a turbine-based combined-cycle (TBCC) engine intended to hand off from a turbojet to a ramjet and open the path to sustained hypersonic, airbreathing flight [2][3].

Evidence. Mk 2.1 reached Mach 1.21 in May 2026; the FAA approved up to seven supersonic flights in 2026 (April approval). Hermeus says it built and tested the Chimera TBCC core in 21 months for

\$18M, and previously demonstrated turbojet-to-ramjet mode transition on the ground; Chimera integrates a GE/Pratt-class F100 turbojet with an integrated ramjet flowpath [2][3]. The program's stated cadence — Mk 1 to a supersonic Mk 2.1 in under a year — is the operative datapoint, not the absolute Mach number.

THE TAKE:

Mach 1.21 is unremarkable as a speed; it is remarkable as a *schedule*. The hard, unsolved problem in airbreathing hypersonics is the turbojet-to-ramjet "thrust gap" around Mach 2.5–4, and Quarterhorse has not yet been there. The signal worth paying for is iteration velocity: a sub-12-month Mk1->Mk2.1 loop at fixed-price scale is the same flight-test-driven model that let reusable-launch incumbents compress cost curves. If Hermeus holds that cadence into a Mach-3+ Mk 3, it becomes the first credible *commercial* TBCC integrator — a category the primes have never productized. The risk is equally specific: the thrust-gap demonstration, not the airframe, is where TBCC programs historically die.

Market read. Hermeus is private — no direct ticker. The cleanest public proxy is **KTOS (Kratos, NASDAQ) — Hold · conviction Medium · 12–24 mo**, as the merchant supplier of affordable jet engines and high-speed testbeds that benefits from any broad-based, fixed-price airbreathing buildout regardless of which integrator wins.

Venus Aerospace flies the first U.S. rotating-detonation rocket engine

What's new. Venus Aerospace completed the first U.S. flight of a rotating-detonation rocket engine (RDRE) on 14 May 2025 at Spaceport America, and through 2026 is pushing toward a 2,000-lbf-class engine and its VDR2 air-breathing detonation ramjet. Detonation-based combustion promises a thermodynamic efficiency edge over the constant-pressure deflagration in conventional engines — the long-theorized but rarely flown payoff that makes RDRE interesting for compact, high-Isp propulsion [4][5].

Evidence. The flight occurred 14 May 2025 from Spaceport America; the company's near-term milestone is a 2,000-lbf-thrust-class RDRE, and the VDR2 is positioned as a single engine spanning runway take-off to beyond Mach 6, feeding the planned Mach-4 Stargazer M4. Disclosed backers include Airbus Ventures, Trousdale Ventures, America's Frontier Fund and Prime Movers Lab, with a Lockheed Martin strategic investment announced (terms undisclosed) [4][5]. Venus has not published flight thrust, chamber pressure or Isp figures.

THE TAKE:

The pressure-gain combustion thesis is real, but the absence of published thrust/Isp/chamber-pressure from the flight is itself the tell — a successful *integration and flight-environment* demonstration, not yet a *performance* demonstration. RDRE's theoretical 5–15% efficiency gain (Engines of Tomorrow estimate, consistent with published pressure-gain-combustion modeling) only banks if injector dynamics and detonation-cell stability hold at scale, which is precisely what a 2,000-lbf engine will stress. The Lockheed strategic check is the more durable signal than the flight: a prime taking a position is how detonation propulsion gets a path into a real airframe rather than staying a lab curiosity.

Market read. Venus is private. Exposure runs through **LMT (Lockheed Martin, NYSE) — Hold · conviction Low · 24–36 mo** as a strategic investor with optionality on detonation propulsion; immaterial to LMT financials today, a call to track rather than trade.

Ursa Major's Draper flies — and a propulsion startup stacks defense contracts

What's new. Ursa Major flew its Draper storable liquid rocket engine on an AFRL-backed hypersonic demonstrator in January 2026, the lead-integrator milestone of a \$28.6M AFRL contract, on top of a separate \$34.9M award (Sept 2025) extending Draper to space-based defense. Draper targets the gap between solids and cryogenic liquids: storable like a motor, throttleable and reusable like a liquid [6][7].

Evidence. The flight occurred 27 January 2026 under a \$28.6M AFRL contract with Ursa Major as lead vehicle integrator of an Affordable Rapid Missile Demonstrator; a \$34.9M contract (Sept 2025) advances Draper for on-orbit defense. Draper runs a closed-catalyst cycle on non-toxic, storable hydrogen-peroxide/kerosene, uses 3D-printed components, and had logged 200+ hot-fires before flight; the demonstrator pairs Draper with Ursa Major's in-house solid rocket motors [6][7].

THE TAKE:

Draper's "storable liquid" pitch is really a *manufacturing* and *magazine-economics* play, not a performance play. Hydrogen-peroxide/kerosene gives up Isp versus cryogenics, but storability plus throttle plus 3D-printed part-count reduction is what lets a missile be stockpiled like a solid yet maneuver like a liquid — the exact attribute a magazine-depth-constrained DoD is paying for. The two contracts straddling hypersonics and on-orbit defense reveal the actual strategy: Draper as a propulsion *platform* amortized across mission classes, which is how a merchant engine-maker reaches the volume that vertically integrated primes can't justify. Watch unit cost at rate, not thrust.

Market read. Ursa Major is private (and has explored a public listing). The investable adjacencies are the propulsion-hungry effectors primes: **KTOS (Kratos, NASDAQ) — Add · conviction Medium · 12–24 mo** on affordable-mass-missile and propulsion demand, and **RTX (RTX Corp, NYSE) — Hold · conviction Low · 24 mo** as an incumbent whose merchant-engine moat erodes if startups productize storable-liquid propulsion.

The nuclear-propulsion retreat: FY2026 zeroes NTP/NEP as DRACO is wound down

What's new. The FY2026 President's Budget Request (finalized 30 May 2025) allocates no funding to nuclear thermal (NTP) or nuclear electric (NEP) propulsion in NASA's space-technology directorate, and DARPA terminated the DRACO flight demonstrator — the Lockheed Martin/BWXT in-space NTR — transferring its knowledge to NASA. DARPA's stated rationale: falling launch costs have eroded the return on NTP's large R&D bill [8][9][10].

Evidence. DRACO (awarded to Lockheed Martin and BWXT in July 2023 for Phases 2–3, targeting an in-space NTR demo) was wound down in 2025; DARPA Deputy Director Rob McHenry tied the decision to a "precipitous decrease in launch costs" led by SpaceX shrinking NTP's relative payoff. The FY2026 request removes funding for both NEP and NTP in space technology. BWXT had been slated to design and build the reactor and manufacture the fuel; NASA separately continued non-DRACO reactor cold-flow work [8][9][10].

THE TAKE:

This is the most important structural datapoint in the issue, and the market is misreading it as "nuclear is dead." It is not — it is a *re-prioritization away from thermal toward electric*. NTP's ~2× Isp over chemical (≈900 s vs ≈450 s) buys less when launch mass is cheap; but the megawatt-electric Mars architecture (Topic 1) still needs a fission *power* source, not a fission *rocket*. The contrarian read: the same logic that killed DRACO strengthens the case for compact space fission *power* — the thing that feeds MPD thrusters. BWXT's reactor IP doesn't vanish; it migrates from "nuclear thermal rocket" to "nuclear power for electric propulsion and surface power." The budget line zeroed the wrong-decade architecture, not the company's relevance.

Market read. BWXT (BWX Technologies, NYSE) — Hold · conviction Medium · 12–24 mo — the DRACO wind-down removes a development-stage program that was never material to earnings; the durable thesis is naval reactors and microreactors/space fission *power*, where demand is intact and arguably reinforced by the pivot toward electric propulsion. **LMT (NYSE) — Hold · conviction Low · 12 mo**, immaterial loss of a small demo. Avoid treating the headline as a reason to sell the underlying nuclear franchise.

One green tank, two thrusters: ASCENT bridges chemical and electric propulsion

What's new. MIT researchers, with NASA, showed that ASCENT — the low-toxicity ionic-liquid "green" monopropellant developed as a hydrazine replacement — can also feed electrospray (ion-electrospray) thrusters, letting a single propellant tank serve both a high-thrust chemical mode and a high-efficiency electric mode. NASA's Green Propulsion Dual Mode (GPDM) mission is slated to fly the architecture in November 2026 [11][12].

Evidence. In lab testing (published June 2026), electrospray thrusters ran on ASCENT for up to 100 hours continuously, with ~1 g of propellant per thumbnail-sized thruster, matching the efficiency of conventional electrospray ionic liquids. The advance eliminates the separate fuel systems dual-mode small satellites previously required; GPDM, targeting a November 2026 launch, is billed as the first flight test of a shared-tank chemical-plus-electric system. Work led by P. Lozano's MIT group (A. Bruno, M. Corrado) [11][12].

THE TAKE:

The win here is *systems mass and integration*, not thruster physics. For a CubeSat, plumbing, valves and tankage for two propellants can swamp the dry-mass budget; collapsing to one ASCENT tank is the kind of integration simplification that changes what a 6U-12U bus can actually do — fast orbit-raising on chemical, then precise station-keeping on electrospray, from one fluid. The second-order effect: ASCENT becomes a *de facto* standard propellant, and standardization is where a fragmented smallsat-propulsion market consolidates pricing power. The likely value capture is not in the thruster but in the propellant supply chain and the integrated dual-mode module — watch which vendor productizes the shared-tank bus first.

Market read. No clean public-market read — the actors are MIT, NASA and venture-stage smallsat-propulsion firms (e.g., privately held electrospray and green-propellant suppliers). Investors should track whether a public bus integrator (e.g., **RKLB**, Rocket Lab, NASDAQ) adopts a dual-mode green module into its satellite product line as the first listed-company expression of this trend; no actionable call yet.

Market Calls

Company (Ticker)	Call	Conviction	Horizon	Thesis (one line)
Kratos (KTOS, NASDAQ)	Add	Medium	12–24 mo	Merchant engines/high-speed testbeds and affordable-mass-missile propulsion ride any fixed-price airbreathing and Draper-style buildout (Topics 2, 4).
BWX Technologies (BWXT, NYSE)	Hold	Medium	12–24 mo	DRACO wind-down was immaterial; naval/microreactor and space-fission *power* thesis intact and reinforced by the electric-propulsion pivot (Topics 1, 5).
Lockheed Martin (LMT, NYSE)	Hold	Low	12–36 mo	Strategic optionality on detonation propulsion (Venus) and a small DRACO loss — both immaterial today (Topics 3, 5).
RTX Corp (RTX, NYSE)	Hold	Low	24 mo	Incumbent merchant-engine moat faces slow erosion if startups productize storable-liquid propulsion (Topic 4).
Rocket Lab (RKLB, NASDAQ)	Hold	Low	24–36 mo	Watch-item: first listed bus integrator that could adopt a dual-mode green-propellant module (Topic 6).

References

1. NASA / Jet Propulsion Laboratory, "NASA Tests Powerful New Thruster Design for Future Mars Missions" (lithium MPD thruster, 120 kW, 24 Feb 2026); reported via ScienceDaily, "NASA just tested a powerful new thruster that could send humans to Mars," 5 May 2026.
<https://www.sciencedaily.com/releases/2026/05/260505234611.htm>
2. FlightGlobal, "Hermeus logs first supersonic flight with experimental Quarterhorse jet," May 2026.
<https://www.flightglobal.com/archive/2026/05/hermeus-logs-first-supersonic-flight-with-experimental-quarterhorse-jet/>
3. Hermeus, "Hermeus Completes Hypersonic Milestone With Engine Tests" (Chimera TBCC; turbojet-to-ramjet transition).
<https://www.hermeus.com/newsroom-content/hermeus-completes-hypersonic-milestone-with-engine-tests>
4. Venus Aerospace, "Venus Aerospace Completes Historic U.S. Hypersonic Engine Flight Test" (RDRE first U.S. flight, 14 May 2025), PR Newswire.
<https://www.prnewswire.com/news-releases/venus-aerospace-completes-historic-us-hypersonic-engine-flight-test-302455690.html>
5. Military Aerospace Electronics, "Venus Aerospace debuts hypersonic detonation ramjet engine" (VDR2, 2,000-lbf class, Mach 6).
<https://www.militaryaerospace.com/commercial-aerospace/article/55233345/venus-aerospace-debuts-hypersonic-detonation-ramjet-engine>
6. Voxelmatters, "AFRL and Ursa Major complete flight demonstration of Draper liquid rocket engine" (27 Jan 2026, \$28.6M AFRL contract, 200+ hot-fires).
<https://www.voxelmatters.com/afrl-and-ursa-major-complete-flight-demonstration-of-draper-liquid-rocket-engine/>
7. Defence Industry Europe, "Ursa Major awarded \$34.9 million contract to advance Draper rocket

- engine for space defence missions" (Sept 2025).
<https://defence-industry.eu/ursa-major-awarded-34-9-million-contract-to-advance-draper-rocket-engine-for-space-defence-missions/>
8. SpaceNews, "DARPA says decreasing launch costs, new analysis led it to cancel DRACO nuclear propulsion project," June 2025.
<https://spacenews.com/darpa-says-decreasing-launch-costs-new-analysis-led-it-to-cancel-draco-nuclear-propulsion-project/>
 9. Aviation Week, "Proposed NASA Budget Zeros Out Nuclear Thermal Propulsion Tech" (FY2026 NTP/NEP defunded).
<https://aviationweek.com/space/budget-policy-regulation/proposed-nasa-budget-zeros-out-nuclear-thermal-propulsion-tech>
 10. ANS / Nuclear Newswire, "BWXT to provide engine, fuel for DARPA space project" (DRACO Phase 2–3 awards, Lockheed Martin + BWXT, July 2023).
<https://www.ans.org/news/article-5215/bwxt-to-provide-engine-fuel-for-darpa-space-project/>
 11. MIT News, "New propulsion system could make tiny satellites both fast and fuel-efficient" (ASCENT dual-mode electrospray, 100-h test, ~1 g/thruster), 1 June 2026.
<https://news.mit.edu/2026/new-propulsion-system-could-make-tiny-satellites-fast-fuel-efficient-0601>
 12. NASA, "Green Propulsion Dual Mode (GPDM) Path to Flight," IEPC-2025-495 (shared-tank chemical + electric, Nov 2026 launch target).
<https://ntrs.nasa.gov/api/citations/20250008918/downloads/IEPC-2025-495.pdf>

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