Ignition Alignment Analysis

NASA's Technology Portfolio vs. the March 2026 Strategy

733 active projects · 19 capability areas · ~187 shortfalls

This analysis was generated using Claude (Anthropic) with live access to NASA's public TechPort database via an MCP server. All data comes from the public TechPort REST API (techport.nasa.gov) and public web sources — no internal or restricted NASA data was used.

The TechPort MCP server is open-source and accessible at:
nasatechport.alexandervandijk.com/mcp
github.com/tobedetermined/techport-mcp

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What Ignition Declared

March 24, 2026 — Administrator Jared Isaacman

Gateway effectively canceled — resources redirected to lunar surface

Permanent lunar base by 2030 — phased build starting 2026

Space Reactor-1 Freedom — nuclear electric propulsion to Mars by end of 2028

100 kWe fission surface power for the lunar base (with DOE)

CLPS 2.0 — next-gen commercial lunar payload procurement

Artemis III (2027), then annual landings — Artemis IV in 2028

"Sovereign-Commercial Nexus" — NASA as anchor customer for commercial space

Five Flagship Technology Bets

1
Nuclear Fission Surface Power

100 kWe for permanent lunar base by 2030

2
Nuclear Electric Propulsion

Space Reactor-1 Freedom
to Mars by end of 2028

3
Lunar Surface Infrastructure

ISRU, construction, landing pads, habitation

4
Commercial Lunar Services

CLPS 2.0, reusable hardware, landing cadence

5
Cryogenic Systems

NTP fueling, ISRU liquefaction, transfer

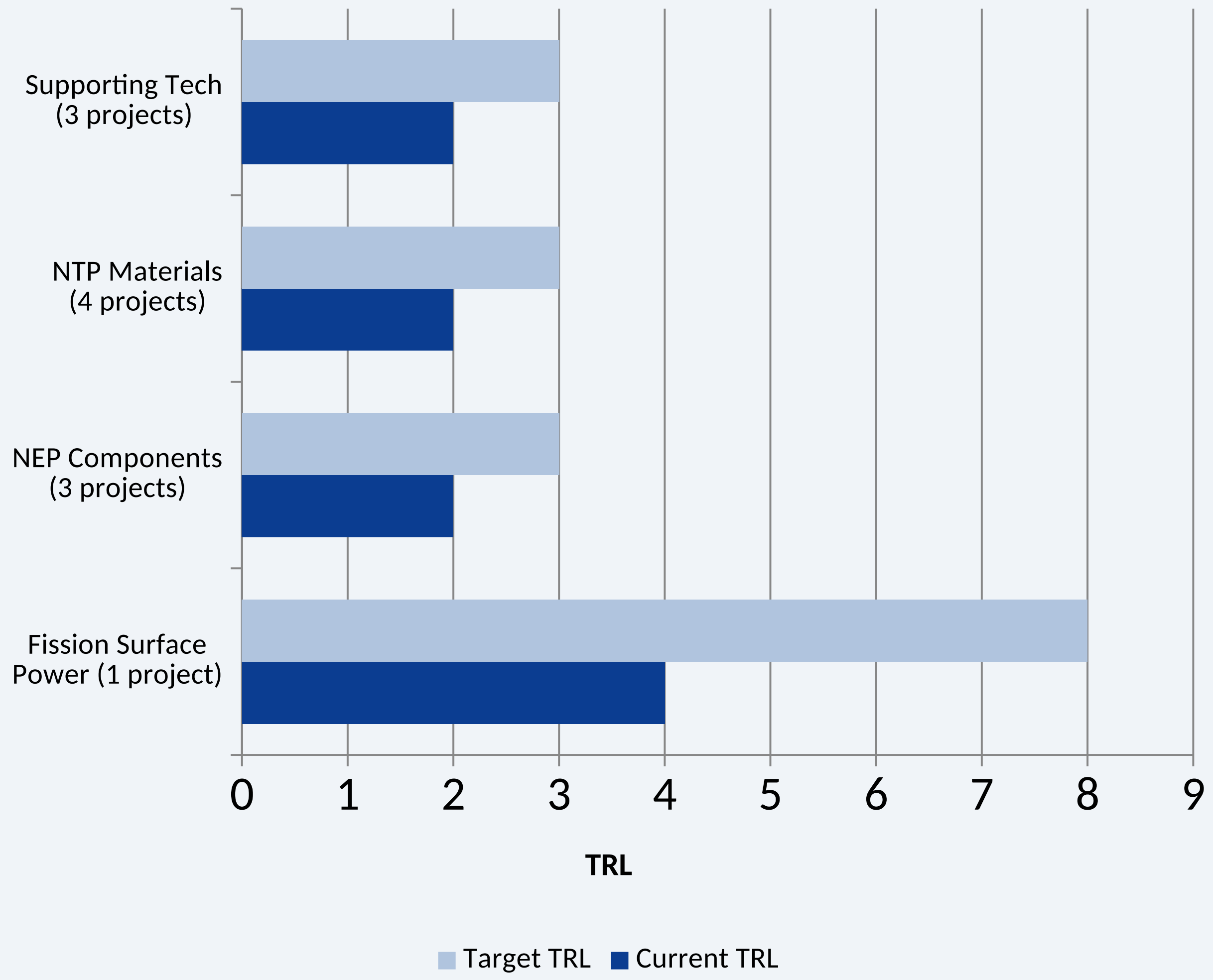
19 Capability Areas: Ignition Alignment

How NASA's official gap areas map to the new strategy

Space Nuclear Propulsion	Flagship
Power and Energy Storage	Flagship
In-Situ Resource Utilization	Flagship
Cryogenic Fluid Management	Flagship
Excavation, Construction, Outfitting	Critical
Advanced Habitation Systems	Critical
Precision Landing & Hazard Avoidance	Critical
Surface Systems	Critical
Thermal Management Systems	Critical
Advanced Propulsion	High
Autonomous Systems & Robotics	High
Communications & Navigation	High
Advanced Manufacturing	Moderate
Advanced Avionics	Moderate
Sensors & Instrumentation	Moderate
Small Spacecraft Technologies	Moderate
20t Lunar/Mars Global Access	Moderate
EDL for Science Missions	Lower
ISAM and RPOC	Deprioritized

Nuclear: The Ambition-Readiness Gap

Ignition says Mars by 2028. The pipeline is at TRL 2.



Fission Surface Power is on track

- TRL 4→8 by 2028 (GRC, TDM program)
- Directly matches Ignition's lunar base timeline

Everything else is TRL 2

- NEP: thermionic conversion, MW generators
- NTP: refractory metals, engine modeling
- All university STRG grants, no flight hardware

The gap documents show a 4-phase roadmap

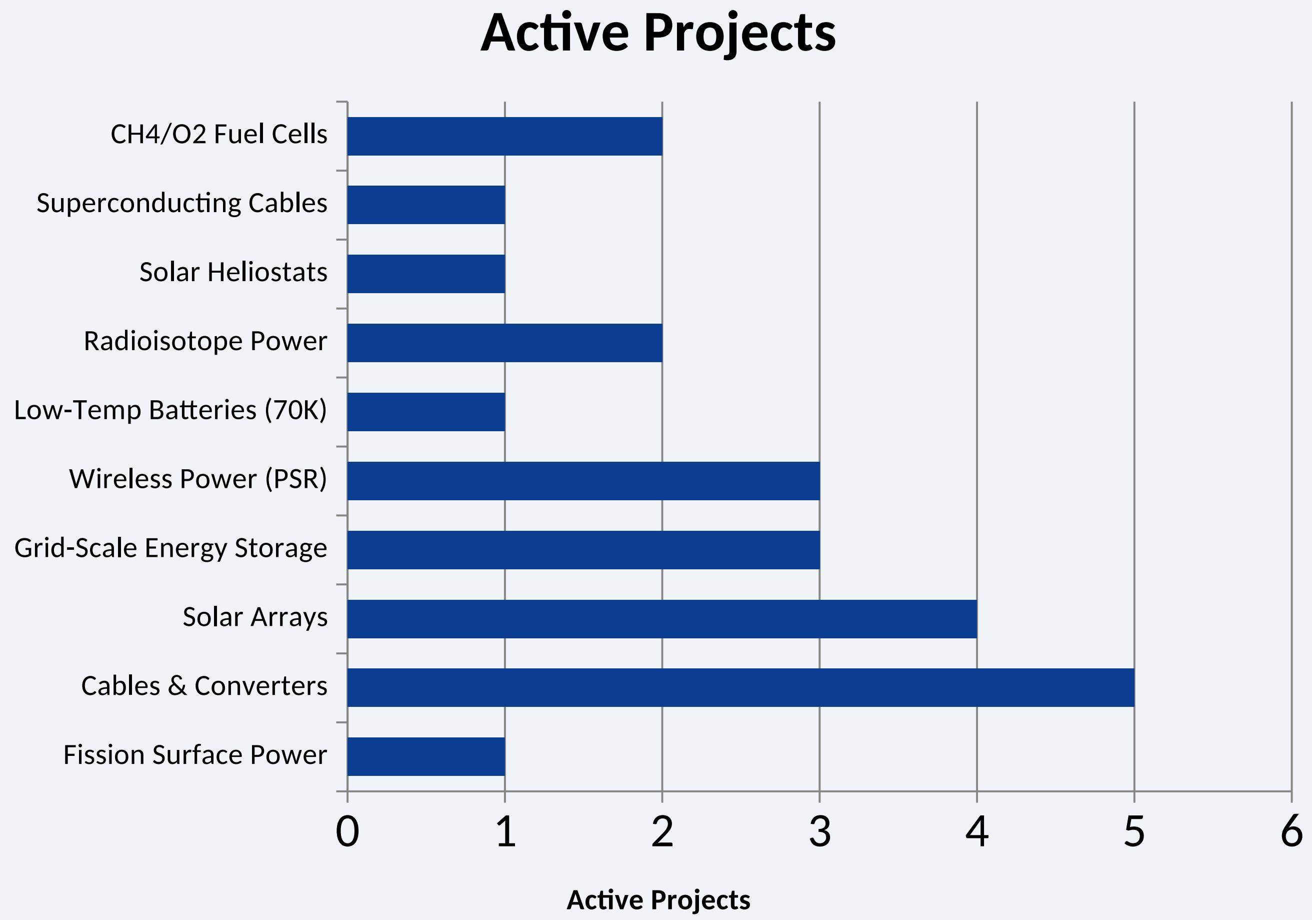
- Phase 1: Design — appears current
- Phase 2: Engineering maturation — not visible
- Phase 3: Capability demo — not funded
- Phase 4: Flight demo — notional

DARPA DRACO and DOE work is outside TechPort

- The full picture may be less dire

Power & Energy: Best-Positioned Flagship Area

10 defined gaps — most detailed and actionable gap framework



STRONG COVERAGE:

- FSP (TDM) — TRL 4→8 by 2028
- LunaGrid (Astrobotic) — power cables, TRL 4→7
- TYMPO (JPL) — tethered power, TRL 4→5
- VSAT (Langley) — vertical solar, TRL 6
- Blue Origin — ISRU-based solar from regolith

GAPS TO WATCH:

- Low-temp batteries (70K) — 1 project only
- Heliostats for PSR illumination — 1 project
- Superconducting cables — 1 project at TRL 2

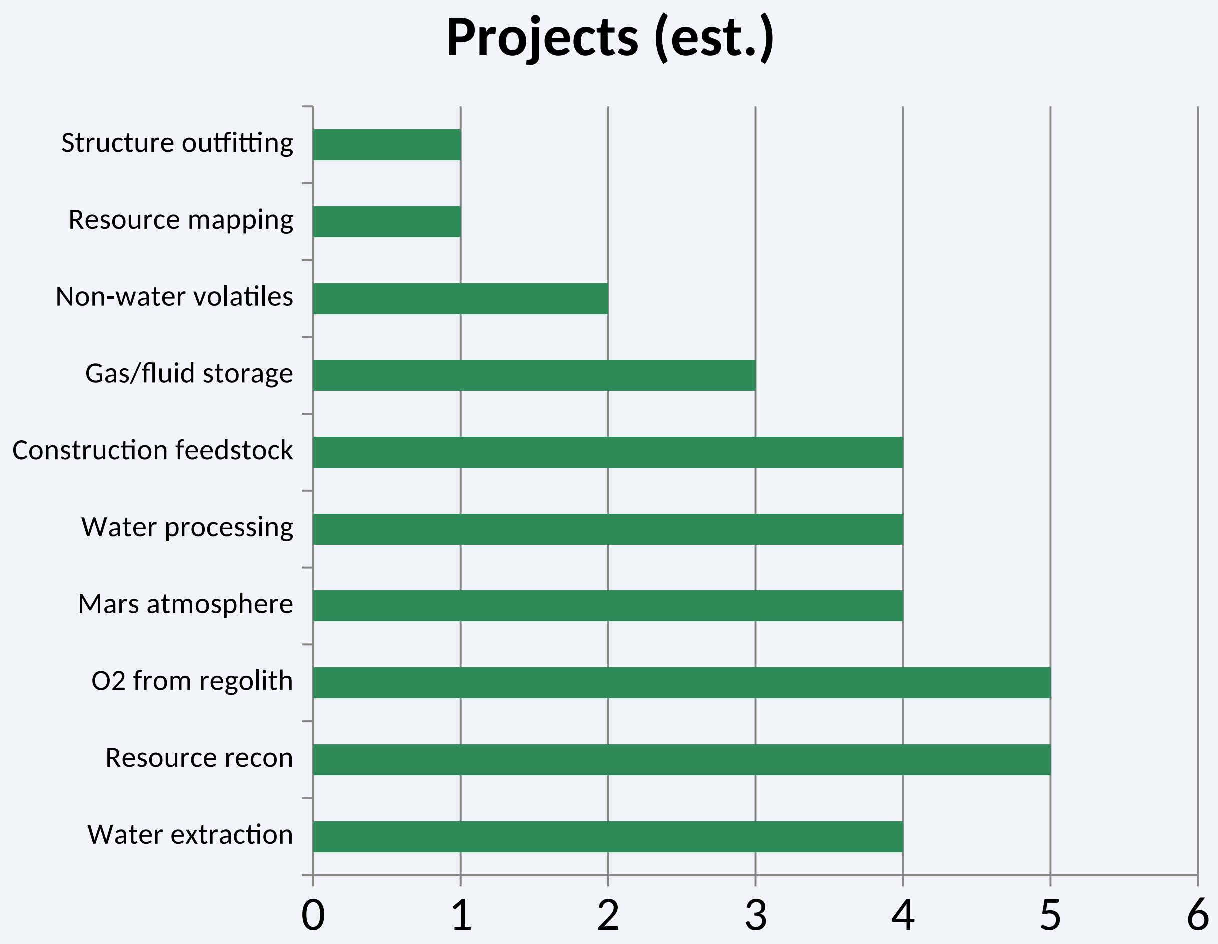
The gap doc calls ISRU "the killer app for surface power" — O2 production drives demand to ~2 MWe

Gap IDs: A=Fission B=Cables C1=Solar C2=Storage D1=Wireless D2=Batteries D3=Radioisotope D4=Heliostats D5=Superconducting E=Fuel Cells

Source: NASA STMD "Power and Energy Storage" capability gap document (techport.nasa.gov)

ISRU: Good Breadth, No Path to Scale

34 active projects across 10 shortfalls — but pilot demos vs. industrial targets



KEY PROJECTS:

ISRU Pilot Excavator (Astrobotic, TRL 5)
→ First lunar excavation demo: 10 mT

MATRI(x) (AI SpaceFactory, TRL 6)
→ Regolith-based construction material

Mason (Redwire, TRL 4, TDM)
→ Infrastructure from lunar regolith

MARS-C (UT San Antonio, TRL 4, FO)
→ Electrochemical Mars ISRU

THE SCALE PROBLEM:

Current demo: 10 mT in 15 days
Industrial target: 1,000s mT / year
That's a 100x scale-up with no intermediate projects visible

55% of ISRU projects are industry-led — aligned with commercial nexus model

Surface Systems: The Biggest Red Flag

10 shortfalls — most gaps have ZERO active investment

Gap	Investment
Autonomous surface umbilicals	Minimal
Autonomous asset tracking	1 project
Debris characterization	None
Waste/trash management	None
Autonomous cryo flow control	None
Hardware impact damage assessment	None
Intelligent maintenance devices	2 SBIRs
Dust/cold tolerant seals	None
Logistics management (sustained)	Minimal
Planning and scheduling	None

These are the "blue collar" technologies that make a permanent base work:

How do you transfer fluids?
How do you track 10,000 assets?
How do you manage waste?
How do seals survive dust + cold?
How do you detect debris damage?

NASA knows exactly what it needs. The gap documents are detailed and actionable.

The problem is not knowledge. It's investment.

Portfolio Alignment Scorecard

ALIGNED — Portfolio matches Ignition ambition

Fission Surface Power	TDM project, TRL 4→8, on timeline
Power distribution/cables	Multiple GCD/SBIR, industry-led
Solar arrays for lunar	VSAT at TRL 6, dust mitigation active
Precision landing (SPLICE)	COTS pathway, TRN commercializing
Cryogenic fluid mgmt	LOXSAT demo, strong TDM/TP portfolio
ISRU excavation	Astrobotic IPEx at TRL 5, GCD

GAPS — Dangerous mismatches between ambition and readiness

Nuclear propulsion (NEP/NTP)	All projects at TRL 2 — Mars target is 2028
Surface Systems	Most gaps have zero investment
Low-temp batteries	1 project for a critical PSR capability
ISRU scale-up	Pilot demos, no path to industrial scale
Heliostats / reflectors	1 project for PSR illumination
Superconducting cables	1 project at TRL 2
Habitation dormancy	Uncrewed base periods need this

The Three-Temporal-State View

Past heritage, present portfolio, future gaps — all through the Ignition lens

PAST

19,343 completed

- Deep heritage base informs what's possible
- NERVA NTP engine at TRL 6
- Soviet Topaz fission flights
- ISS ECLSS decades of data
- 12,134 SBIR/STTR completions

PRESENT

733 active

- Well-aligned at flagship level (power, landing, CFM)
- Critical gaps in enabling tech (surface systems, batteries)
- 62% of projects at TRL 2–4
- Only 16 projects at TRL 7+
- STMD owns 69% of portfolio

FUTURE

~187 shortfalls

- NASA knows exactly what it needs — gaps are defined
- Problem is not knowledge but investment prioritization
- Surface Systems: 10 gaps, most with $0 investment
- ISRU scale-up: 100x gap from demo to industrial
- Nuclear propulsion: TRL 2 vs. 2028 Mars deadline

Recommended Next Analyses

1. **Nuclear propulsion deep dive**

   Cross-reference TechPort with DARPA DRACO and DOE partnerships. TechPort alone shows a thin pipeline — the full picture may be less dire.

2. **Commercial readiness scoring**

   For each Ignition priority, assess industry vs. NASA center project share. The Sovereign-Commercial Nexus requires industry capability.

3. **Surface Systems investment case**

   The gap between detailed gap documents and zero investment is the most actionable finding. Build the cost-to-close case.

4. **ISRU-to-power integration**

   The power gap document calls ISRU 'the killer app for surface power.' Map production rate dependencies to power system sizing.

5. **Gateway orphan audit**

   Identify Gateway-adjacent projects and assess: do they redirect to lunar surface, or are they strategically stranded?

Sources and References

NASA Ignition Announcement (March 24, 2026)

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- spacenews.com/nasa-halts-work-on-gateway-to-develop-a-lunar-base/
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TechPort Data Sources

- NASA TechPort public API — techport.nasa.gov/api
- TechPort capability gap documents — techport.nasa.gov/framework/feedback
- NASA STMD Civil Space Shortfalls — nasa.gov/spacetechpriorities/
- TechPort MCP server — nasatechport.alexandervandijk.com/mcp
- MCP server source code — github.com/tobedetermined/techport-mcp

METHODOLOGY

This analysis was produced using Claude (Anthropic) with real-time access to NASA's public TechPort database via a custom MCP (Model Context Protocol) server.

The MCP server queries TechPort's public REST API and returns structured project, program, capability, and shortfall data. No internal or restricted NASA systems were accessed.

Web sources were used for context on the Ignition announcement and related policy.

All project IDs referenced in this analysis can be verified at techport.nasa.gov/view/{projectId}

The capability gap documents referenced are publicly available slide decks published by NASA STMD at techport.nasa.gov.

The portfolio is well-aligned at the flagship level.

The dangerous gaps are in the enabling technologies that determine whether a permanent base actually works.

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