BRIEFING 07 · DARPA

How DARPA research changes the world — and what’s next

A deep dive into DARPA: how a small agency founded after Sputnik helped create the internet and GPS, how its program-manager model works, what's in the 2026 portfolio, and what engineers can learn from it.

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A deep dive into DARPA: how a small agency founded after Sputnik helped create the internet and GPS, how its program-manager model works, what's in the 2026 portfolio, and what engineers can learn from it.

1958	US$4.1B	6	4
founded after Sputnik	FY2024 enacted budget	technical offices	companies in QBI Stage C (Oct 2026)

Key takeaways

- DARPA funds high-risk, high-reward research through temporary program managers with clear goals, fixed timelines and independent evaluation.
- Its track record includes ARPANET, early satellite navigation, stealth, autonomous vehicles and early mRNA vaccine work.
- The 2026 portfolio spans quantum benchmarking (QBI), AI that does science (expMath, MATHBAC), decentralized AI (DICE), biocomputing (O-CIRCUIT), non-invasive BCIs (Firefox) and atomically precise chemistry (APM).
- QBI is a model for cutting through hype: independent teams test whether a utility-scale quantum computer can be built by 2033.
- The Heilmeier Catechism, DARPA's checklist for new programs, is a useful tool for any engineering proposal.

Origins

The Soviet launch of Sputnik in October 1957 shocked the United States. In February 1958 the Advanced Research Projects Agency (ARPA) was created so the US would never again be surprised by technology. It became DARPA in 1972. Its mission is to make pivotal investments in breakthrough technologies for national security [1].

How DARPA works

- **Program managers:** technical experts hired for a few years each, who design and run programs; turnover keeps ideas fresh.
- **Programs, not labs:** DARPA owns almost no labs; it funds universities, companies and government labs through competitive solicitations.
- **Clear goals and phases:** programs have measurable targets and go/no-go gates; teams that miss them are cut.
- **Independent test and evaluation:** separate teams measure results, as in DICE and QBI.
- **Budget:** about US$4.1 billion enacted for FY2024, with a FY2025 request of US$4.369 billion, across six technical offices [1].

The Heilmeier Catechism

George Heilmeier, DARPA director from 1975 to 1977, created a set of questions every program must answer. They are worth using for any project:

1. What are you trying to do? Articulate your objectives with no jargon.
2. How is it done today, and what are the limits of current practice?
3. What is new in your approach, and why do you think it will succeed?
4. Who cares? If you succeed, what difference will it make?
5. What are the risks?
6. How much will it cost?
7. How long will it take?
8. What are the mid-term and final "exams" to check for success?

A track record

- **ARPANET (1969):** the packet-switched network that became the internet.
- **Satellite navigation:** early work that fed into GPS.
- **Stealth:** the research behind low-observable aircraft.
- **Grand Challenges (2004–2007):** autonomous vehicle competitions that seeded today's self-driving industry.
- **mRNA:** early investments in rapid vaccine platforms that later mattered during COVID-19.
- **AI Cyber Challenge (2023–2025):** AI systems that find and fix software vulnerabilities.

The 2026 portfolio

- **Quantum Benchmarking Initiative (QBI):** will a utility-scale quantum computer be possible by 2033? DARPA selected 11 companies for Stage B in November 2025; on 7 October 2026 Atom Computing, Diraq, IBM and IonQ advanced to Stage C [2][3].
- **AI for discovery:** expMath (AI co-author for mathematics) and MATHBAC (self-improving agentic discovery) [4].
- **DICE:** decentralized coordination of up to 100,000 AI agents in simulation [5].
- **O-CIRCUIT:** living neurons and organoids as a computing medium [6].
- **Firefox:** a 100-channel non-invasive brain-computer interface [7].
- **APM:** programmable precision polymers [8].

How DARPA research changes life

Most of DARPA's impact arrives years later and indirectly: the internet you use, the navigation in your phone, the voice assistant on your desk, and vaccines developed in months instead of years all trace back partly to DARPA bets. Today's programs aim at the next layer: trustworthy quantum computers, AI that accelerates science, safer brain interfaces and new materials.

Future scenarios

2027–2028
QBI Stage C results; first O-CIRCUIT, DICE and Firefox prototypes.

2030
AI-for-science programs expand from math into physics, chemistry and biology.

2033
QBI's target for judging whether utility-scale quantum computing is achievable.

2035+
Spin-offs from today's programs reach civilian products.

Effects and risks

- **Dual use:** defense funding of AI, neurotech and biotech raises ethical questions and needs transparency.
- **Hype vs. evidence:** programs like QBI show how independent evaluation keeps claims honest.
- **Time lag:** civilian benefits may take a decade or more.

What to watch

- QBI Stage C evaluations and any new Stage C entrants.
- Awards under O-CIRCUIT, DICE, Firefox and APM.
- DARPA's FY2026–27 budget priorities.

My take

DARPA's real invention is a management model: bold goal, hard metrics, short tenure, independent evaluation, and permission to fail. It maps neatly onto how good infrastructure teams run reliability programs. I use the Heilmeier questions myself before starting a big project.

Key players & programs

DARPA offices	Six technical offices including Biological Technologies (BTO) and Information Innovation (I2O) [1]
QBI Stage C (Oct 2026)	Atom Computing, Diraq, IBM, IonQ [2]
Universities and labs	Most DARPA research is performed by funded external teams

Frequently asked questions

What is DARPA?
The US Defense Advanced Research Projects Agency, founded in 1958 after Sputnik to fund breakthrough technologies for national security.

What has DARPA invented?
DARPA funded ARPANET (the internet's predecessor), early satellite navigation, stealth research, autonomous vehicle challenges and early mRNA vaccine platforms, among others.

What is the Heilmeier Catechism?
A list of questions created by DARPA director George Heilmeier that every proposed program must answer: goals, current limits, what's new, who cares, risks, cost, time and how success is measured.

What is the DARPA Quantum Benchmarking Initiative?
A program testing whether a utility-scale quantum computer can be built by 2033. In October 2026, Atom Computing, Diraq, IBM and IonQ advanced to Stage C.

Glossary

Program manager (PM): A DARPA technical leader who designs and runs a research program for a few years.

BAA: Broad Agency Announcement, a public solicitation for research proposals.

Proposers day: A public briefing where DARPA explains a new program to potential bidders.

Utility-scale quantum computer: A quantum computer whose computational value exceeds its cost.

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