

Road to NextG Leadership: Technology Innovation & Workforce Development

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10/13 /2026

Disclaimer

The views expressed here are solely my own, and do not represent the views of the U.S. National Science Foundation (NSF) and should not be construed as such.





MISSION

PROMOTE the progress of science

ADVANCE the national health, prosperity, and welfare

SECURE the national defense

NSF Supports All Areas of Science & Engineering

**Biological
Sciences**

Engineering

**Mathematical
& Physical
Sciences**

**Computer &
Information
Science &
Engineering**

**Geoscience &
Polar Programs**

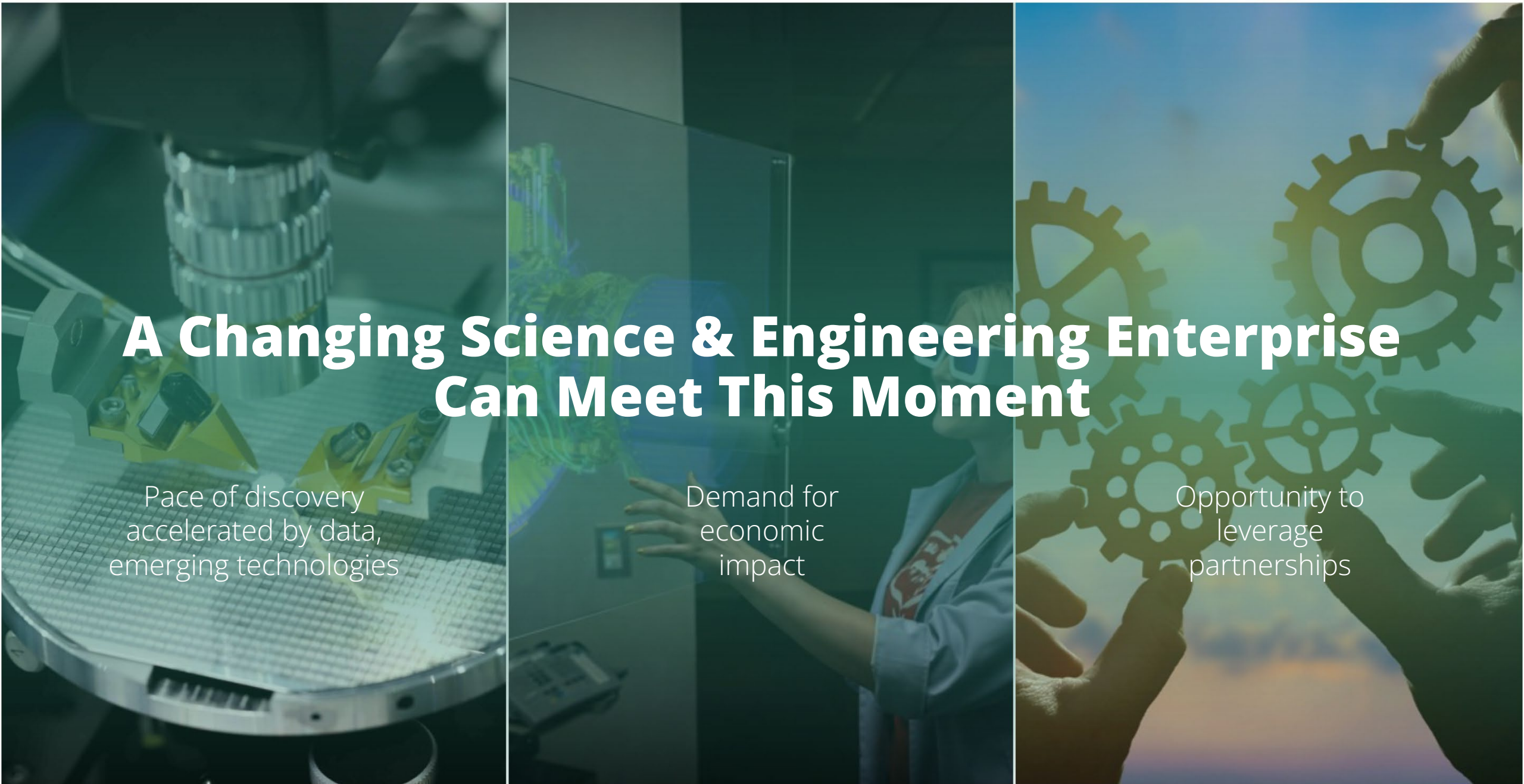
**Stem
Education**

**Social,
Behavioral &
Economic
Sciences**

Integrative Activities

International Science & Engineering





A Changing Science & Engineering Enterprise Can Meet This Moment

Pace of discovery
accelerated by data,
emerging technologies

Demand for
economic
impact

Opportunity to
leverage
partnerships



NSF's Strategic Priorities

Strengthening Established NSF

With investments that expand the frontiers of knowledge and discovery



Inspiring Missing Millions

Using capacity building and interventions that enhance and broaden participation



Accelerating Technology & Innovation

Through innovative, cross-cutting partnerships and programs

A New “Horizontal”: Strengthen, Scale Use-Inspired and Translational Research

**Biological
Sciences**

Engineering

**Mathematical
& Physical
Sciences**

**Computer &
Information
Science &
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**Geoscience &
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**Stem
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**Social,
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Economic
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Directorate for Technology, Innovation and Partnerships

Integrative Activities

International Science & Engineering

TIP Powers Technology Breakthroughs



**Public
Funds**

TIP bridges the gap



**Private
Funds**

Funding gap

LAB

**Foundational
Research**

**Use-Inspired
Research**

Proofs-of-Concept

Prototype Development

**Product/Solution
Development**

**National and
Societal Impact,
Commercialization**

SOCIETY

TIP'S Core Message

TIP works across NSF with ongoing research investments to drive research and innovation across all science and engineering fields, fostering U.S. competitiveness and economic growth.

1

**Accelerate critical
and emerging
technology**

2

**Expand the
geography of
American
innovation**

3

**Build a
competition-
ready workforce**

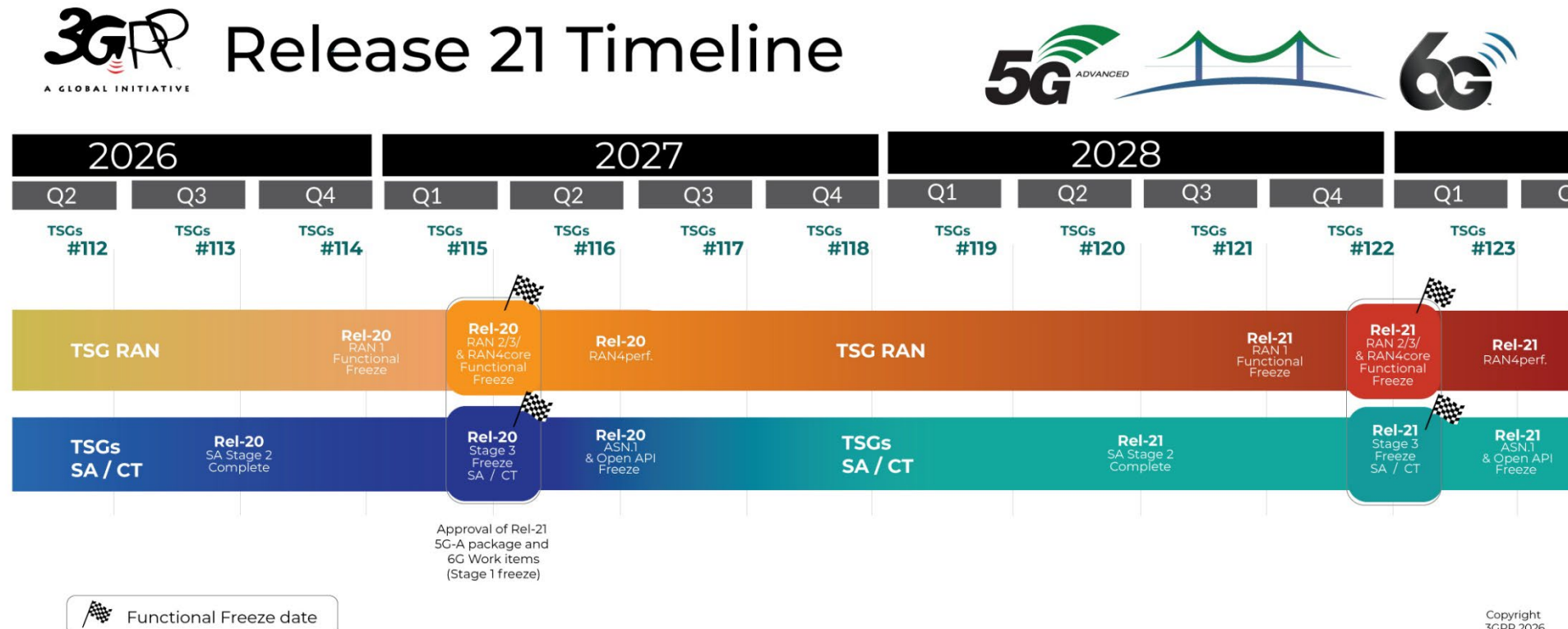
What is Happening in Global Telecom?

State of Global Wireless Industry

- **Global mobile wireless industry is growing**
 - Between Q1 2025 and Q1 2026, mobile network data traffic grew by 22% (Ericsson Mobility Report, June 2026)
 - 5G carries half of all mobile data traffic globally with over 3bn 5G subscriptions
- **5G infrastructure equipment market is dominated by PRC firms**
- **Satellite broadband subscriptions are steadily growing**
 - 10 million in 2025
 - Expect to be 15 million in 2026 and 33 million by 2031 (EMR)



All Eyes are on 6G



- **Global telecom industry is racing towards 6G**
 - 6G specifications in 2027-2029
 - First launches expected in 2030



What **will/should** Next-G look like?

May 2024: Speaking at the Linux Foundation Open Networking & Edge (ONE) Summit in San Jose, CA:

"Open source, open radio access networks (RAN) can play a role in the U.S. gaining ascendancy in Next-G networking. But open RAN alone isn't going to make the U.S. ascendant in 5G, or Next-G."

*"The most interesting and defining feature of Next-G networks may be that they are open and integrated in many ways, ... They'll be open and integrated across domains, connecting space-based, air, ground and undersea networks, and connecting networks of sensors, compute and communications. They will use open standards, not just in open RAN but also in other interface segments. **Next-G will be cloud-native and AI-native***

All of this can work to the U.S.'s benefit, because it allows us to play to our strengths"

From Fierce Network Research Bulletin, May 10, 2024

What **Should** Next-G look like?

Jan 09, 2025: Speaking at the *NSF Workshop on Open & Integrated Network Testbeds for Research & Translation, Worcester Polytechnic Institute, Worcester, MA:*

S. K. Jayaweera: Next-G Open & Integrated Networks

Open & Integrated Multifunctional Networks: A Verticals-driven Technology Roadmap

Open Integrated & Multi-functional Networks

- Integrated Space-Air-Ground (SAG) segments
- Integrated Sensing-Computing-Communications functionalities
- Wideband, multi-band/multi-mode, spectrum-agile operations
- Cloud-native, AI-native & Open-native
 - Open-native: Open-standards, Open-interfaces, Open-spectrum and (potentially) Open-source



- Build on and extend Open RAN, OS & DSS principles
- Leverage traditional US tech strengths in Space, Cloud, AI & Computing
- **Verticals-driven**

34

The trend has already started ...

Where are we now?

October 2025:

“NVIDIA Unveils a Massive Partnership With Nokia, Bringing Next-Gen 6G Connectivity By Leveraging the Power of AI”

“At the GTC 2025 keynote, NVIDIA's CEO announced a pivotal partnership with Nokia, formally entering the race for achieving 6G connectivity through a new suite of AI-RAN products combined with Nokia's leading telecom infrastructure. To consolidate the collaboration, NVIDIA is investing \$1 billion into Nokia,... ”

WCCFTECH, Oct 28, 2025

Image credits: Nvidia



Where are we now?

July 2026:

Innovation Fund Round 4 (2026) AI Native Telecommunications

"This NOFO aims to support projects that:

- Develop and validate AI native architectures capable of running AI workloads alongside telecommunications workloads.*
- Demonstrate real world field deployments that showcase commercially viable, export ready AI enabled services.*
- Strengthen U.S. supply chain competitiveness for next generation wireless technologies.*
- Advance secure, open, and interoperable network designs aligned with the Administration's AI Action Plan.*

"



Where are we now?

May 2026:

AT&T, T-Mobile and Verizon agreed to a Satellite Joint Venture

“

In May, 2026, AT&T, T-Mobile and Verizon agreed to create a satellite D2D joint venture to fill coverage dead zones and simplify integration with satellite providers.

”



What is holding us back?

- Status quo and relative lack of planning
 - No place for big picture perspectives and bold new ideas in telecom
 - Hesitancy to challenge conventional wisdom in telecom research and industry
 - Incremental/safe work draining resources
- Lack of translational pathways
 - No direct agency/hub responsible for moving basic research outcomes to translational impact
 - No systematic coordination of industry and academia
 - No recognition of value of translational activities in academic community



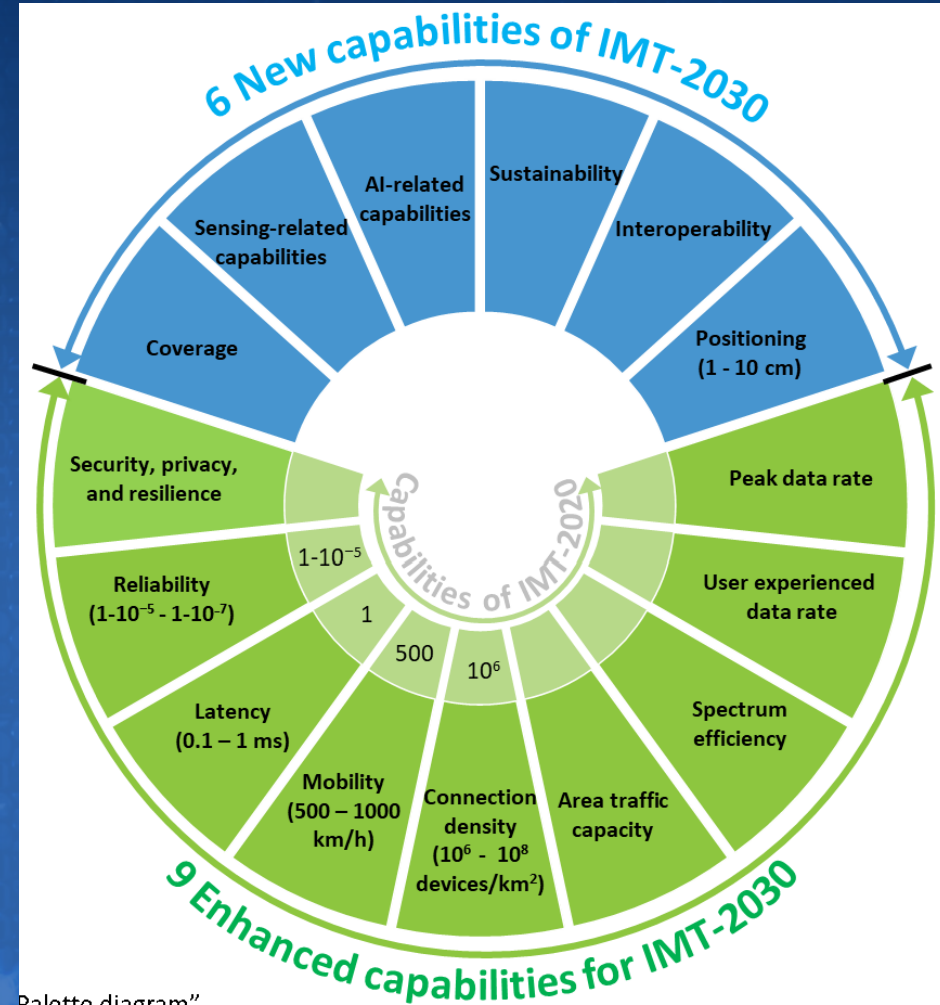


Overcome Our Challenges by Leveraging Our Strengths

- **United States does not have a shortage of innovation**
 - We have been, and still are, leading the world in research in advanced networking, telecommunications and related areas.
- **We assume leadership in NextG by developing and translating NextG technologies that build on our existing technical, technological and industrial strengths**
 - Leverage: Cloud, AI, Software, Open-source, Computing, Space & Satcom
 - Make them integral components of NextG technologies (ISAC, NTN integration, AI-native, cloud-native, DSS, software-centric)
 - Incentivize traditional/established industry leaders in these tech to venture into NextG telecom

6G Capabilities: **Here we go again?**

- As with 5G, 6G aspires to extremely low latencies, very high data rates and reliabilities and even denser IoT
- 5G vertical industries that were **guessed to be enabled** by such performance improvements have not yet materialized
- **Will there be a demand for networks with even greater performance?**



NSF 24-545: Breaking the Low Latency Barrier for Verticals in Next-G Wireless Networks (Breaking Low)

- Identify and solve critical architectural, technical and technological issues in 5G/ Wi-Fi and next-generation (Next-G) wireless networks to provide the **low-latency** performance necessary for the success of key emerging industries.
- Post-project translational impact objectives: Adoption, standardization and/or commercialization
 - **Focus on the E2E latency performance for specific vertical applications**
 - E2E: RAN, Core, Transport, Cloud and Vertical application
 - What data rate at what latency at what reliability
 - **Demo the developed networking technologies in at-scale low-latency vertical pilot projects**
- More than **\$17 million** awarded to three teams in 2025



BREAKING LOW

Lessons for Next-G from Breaking Low

- Lack of understanding/attention to what latency performance is needed for different vertical applications
- At the application level, optimizing latency performance alone (or any other performance aspect for that matter) is not sufficient
 - Latency need to be specified in the context of data rate, reliability and coverage etc
 - What latency metrics are ultimately important at application level?
- While we may not want to tailor network designs to specific verticals, there is great value in paying attention to the needs of verticals in developing Next-G network capabilities
 - Not just latency, but in terms of all performance aspects



NSF 25-539: Vertical-enabling Intelligent Network Systems (VINES)

- Track 1 (Use-inspired Fundamental Research) will support activities focused on use-inspired fundamental research to develop novel networking techniques and solutions.
- Track 2 (Verticals-Driven Technology Development, Demonstration, and Translation) will support activities focused on technology development, maturation, demonstration, integration, and translation of solutions with higher technology readiness levels (TRLs), with the goal of producing adoption-ready technologies.



U.S. National Science Foundation
Verticals-enabling Intelligent
Network Systems

VINES

Verticals-enabling
Intelligent Network Systems

- NSF VINES Goals:
 - To enhance U.S. competitiveness in advanced telecommunications technologies
 - To establish U.S. as a global leader in both NextG wireless telecommunications and emerging potential NextG vertical industries
 - To address the need for skilled workforce and expertise in these technology areas.
- VINES program will connect and bring together NextG research/tech community and stakeholders to create an ecosystem that spans basic research, technology development and translation

NSF VINES Track 1

- 3-year awards up to \$1.5M each
- NSF Funding: \$33M
- **Proposers can only be universities**
- Potential co-funding from international and other federal agency partners
 - Finland (RCF), India (MeitY), Japan (JST), Sweden (SRC)
 - Budget for the U.S. team up to \$750K.
 - Total combined budget must not exceed \$1.5 million.
- Standard Grants
- **Awarded: 32 Projects (53 awards)**

NSF VINES Track 2

- 3-year awards up to \$6M each
- NSF Funding: \$33M
- **Proposers can be industry and universities**
- Potential co-funding from international and other federal agency partners
 - Finland (BF), India (MeitY), Japan (NICT)
 - Budget for the U.S. team can range between \$2 million to \$4 million.
 - Total combined budget must not exceed \$6 million.
- Cooperative Agreements
- **Awarded (till now):**
- **More awards yet to be announced**

VINES Track 2 Technical Scope: Primary Networking Technologies

1. Integrated Sensing and Communications (**ISAC**)
2. Mobile/Multi-access Edge Computing (**MEC**)
3. Open & integrated networks (open standards and interfaces-based space-air-ground integration) (**OIN**)
4. Semantic communications and networking (**SEM**)
5. Advanced spectrum technologies such as Dynamic Spectrum Sharing (DSS), operation at higher frequencies, Multi-band, Multi-mode Radios (MBMMR) and low-power & spectrum-agile radios (**SPEC**)
6. High-performance data transport (e.g., fiber, WDM), transport layer, and automation technologies for various network environments, including software-defined wide area networks (SD-WAN) and data center and cloud networks (**SDN**)
7. Reconfigurable Intelligent Surfaces (**RIS**)



U.S. National Science Foundation
Verticals-enabling Intelligent
Network Systems

VINES Verticals-enabling Intelligent Network Systems

Next-G: Verticals-driven Open, Integrated & Multi-functional Networks

- Demand for new capabilities and enhanced performance of 6G/Next-G Open, Integrated & Multi-functional Networks will have to come from new and emerging vertical applications
- Wireless verticals (or terrestrial verticals)
 - Traditional 5G/Next-G vertical industries: e.g. CAVs, smart factories
- Space & aerial verticals
 - Space applications that may require or benefit by having ubiquitous (e.g. D2D/D2C) connectivity: e.g. In-space manufacturing, disaster response, maritime/ITS, space tourism



The Best Way to
Predict the Future is
to Create It

NextG Leadership Through Research & Technology Innovation: One Network to Rule Them All

- Paradigm shift from fully cellular to integrated space-air-ground networks for seamless coverage
 - An opportunity to develop and translate technologies that will make it happen
- But what about the Physics?
 - Terrestrial cellular reuses frequencies every 0.5 to about 2km but a LEO beam may span 25km to 50km
 - Less network capacity
- LEO and cellular will both play a role in a seamlessly integrated NextG network
 - About 80% of cellular traffic originates indoors
 - A NextG network that integrates Wi-Fi for indoors with a balanced use of cellular, aerial and LEO for outdoors

It's the "Integrated", Stupid

- Key attribute of NextG: Networks will be Integrated Networks
 - Certainly, across space-air-ground domains
 - But more importantly across cellular, satellite, Wi-Fi, Fiber and other fixed
- "Satellite as primary" networks
 - Capacity vs. Coverage of mobile networks may be irrelevant
 - "Supplemental Capacity from XXX" instead of "Supplemental Coverage from Sky"
- But what about latency?
 - Oh, please!

NextG Leadership Through Research & Technology Innovation: **One Network to Bind Them All**

- **Integrated:** space, air, ground, underground
 - Seamless indoor-outdoor coverage
 - Seamless Cellular, Wi Fi, Aerial & Satellite
 - Multiband/multimode
- **Multi-functional:** sensing, computing, communications, PNT
- Software-centric & cloud-native
- AI-native & AI-Ready
- Open: Open standards, open interfaces, OSS
- Dynamic Spectrum Sharing native
- **Semantic-native:** Semantic-aware networking
- Reverse UL / DL asymmetry supported

NextG Leadership Through Research & Technology Innovation: One Network to Bring them All

- Promote U.S. developed NextG technologies within global SDOs
 - Influence global & regional standards
 - Take the lead in setting standards relevant for emerging NextG technologies: AI, Integrated space-air-ground, integrated functionalities
- Build ecosystems of stakeholders
 - Span from basic research to tech dev to tech translation to impact (the lab-to-market bridge)
 - Testbeds for rapid validation (ease of access, at-scale)
 - Open-source software/communities
 - Application industry engagement

That's a wrap

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S. K. Jayaweera: NextG Leadership through Research & Technology Innovation