

**Air Force Research Laboratory
Information Directorate**



INNOVARE
ADVANCEMENT CENTER

**Five Year Strategy
for
Open Innovation**

August 2020

“Mind-blowing ideas are being birthed out in U.S. startup companies, but the Pentagon largely misses out on them. We have to do business at the speed of ideas so we can both inspire and accelerate startup creativity towards national security challenges.” – Will Roper, Assistant Secretary of the Air Force for Acquisition, Technology and Logistics

***Innovare** (pronounced inn-oh-VAR-ay) *Latin “Into the new”*

Executive Summary

In 2020 the world needs technology solutions—now more than ever.

An unprecedented global pandemic is reshaping our society, and has catalyzed the emergence of new modes of living, working, and interacting; acclimating the world, almost overnight, to social distancing and virtual interaction, setting the stage for the emergence of new and innovative forms of virtual collaboration and community building—worldwide.

As we embrace this form of globalization, we are guided by the United States Air Force 2030 Science and Technology Strategy, the AFRL Information Directorate's (AFRL/RI's) Strategic Plan 2019-2024, and the global call to action for technological progress, social justice, and a renewed national focus on the air and space domains. AFRL/RI is proud to introduce an open innovation model, which represents the execution of a pivotal strategic shift that prioritizes immediate engagement of new partners in Air Force R&D to deliver to the American defense community technological solutions that enable a global competitive edge in C⁴I&Cyber. This urgent strategic and cultural shift necessitates the integration of new tools, talent, and community engagement models that enable rapid, agile, and open innovation across government, industry, and academia.

By natural extension of its collaborative culture and inspired by the call to action underlying the 2030 S&T Strategy, AFRL/RI has intensified its pursuit of new academic and industry partners with complementary capabilities to enable rapid performance cycles to meet the urgent demand for AI/ML, cyber, quantum, and UAS solutions that enhance the United States' national security and economic competitiveness. With support from all levels of local, regional, state, and federal government, AFRL/RI has, in parallel to advancing new partnerships, led the development of a state-of-the-art open innovation environment just “over the fence” to expand the Lab's reach into academic, industry, and startup partners who have vastly extended the Lab's own capabilities, leveraging diverse computing systems, chip fabrication facilities, novel university technologies, and other federal programs and venture capital investments. A comprehensive overview of AFRL/RI's history, core partners, and greater strategic context, is included with this document as *Appendix A*.

Quietly preparing for its moment, in 2020 AFRL/RI assumes its role as the national leader in information-based defense solutions that will enable the United States to regain its leadership and advantage in national security and economic competitiveness by pushing new boundaries of AI/ML, cyber and quantum technologies. AFRL/RI's world-class technical expertise meets cutting-edge R&D facilities, specialized equipment, and an international community of students and faculty in an open environment designed to attract the best and brightest scientific and entrepreneurial talent to converge on ten, specific Air Force challenges that we seek to solve over the next five years. Together, a globally-recognized community of information scientists, engineers, and entrepreneurs will create new technologies, spin out new startups, and catalyze new investments to push the boundaries of the human-machine partnership in furtherance of our national security and economic competitiveness.

Together, AFRL/RI and its strategic partners are well-positioned to meet this challenge by the inclusion of R&D leaders with extraordinary vision and technical knowledge; broad experience in federal, industrial, and academic organizations; broad communications networks that traverse complex organizational boundaries; and the command of significant, diverse capabilities that can be leveraged against the national challenge of coupling cutting-edge R&D facilities with a talent pipeline that is equipped to develop breakthrough technologies in fields that necessitate technical convergence.

This is . . .



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Our Vision, Mission and Strategy

Vision

Emerge as a global catalyst to converge world-class talent with cutting-edge facilities and focused technology challenges to accelerate the development of game-changing capabilities that protect and empower our country.

Mission

Build a magnetic ecosystem in which the world's leading scientific and entrepreneurial talent tackle the country's greatest challenges to national security and economic competitiveness.

Strategy

The core of the Innovare strategy is:

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To activate this strategy, all members of the Innovare community must act with urgency and intention across organizational boundaries to converge diverse capabilities in strategic priority areas such as artificial intelligence and machine learning, cyber, nanoelectronics, neuromorphic computing, quantum, and UAS; organize and motivate diverse teams to tackle specific technical challenges; and deliver high-impact, performance-ready capabilities that enhance American competitiveness through diversified commercialization pathways.

Areas of Action:

- Engage and incentivize university partners to align curricula and experiential talent development opportunities to strategic priority areas;
- Refresh approaches to industrial engagement;
- Leverage our open innovation environment to engage international R&D capabilities;
- Advance a more a collaborative, adventurous, supportive, results-driven, entrepreneurial, and uplifting culture;
- Reduce and eliminate time to solution barriers by streamlining administrative processes to enable work to proceed with more partners, faster;
- Accelerate the availability of game-changing technology through diversified transition and commercialization vehicles connected to diverse sources of capital;
- Develop talent pathways and strengthen pipelines across organizational boundaries;
- Partner with local, regional, and state government;
- Communicate outcomes and impacts through loud, proud, and engaging digital storytelling.

Goals

Our mission can only be as bold as the goals we have set to make it happen. Further details on specific action steps, initiatives and measurements, appear below.

Goal 1

Build Rome's runway to the world, engaging a global community of 100 diverse partners to introduce game-changing capabilities built on Air Force core strengths in AI/ML, cyber, quantum and UAS.

Goal 2

Advance our innovation ecosystem with 100 entrepreneurial ventures and tech startups.

Goal 3

Elevate by 10% our community's intellectual leadership.

Metrics and Indicators

The very nature of innovation is grounded in novelty, risk, and uncertainty. However, we believe that there are three definitive pillars which will define Innovare success in the first five years of operation: Productive Partnerships, New Ventures, and Advancement of Knowledge.

A comprehensive overview of all performance indicators that are relevant to this strategy, and which will be monitored in its execution, are included with this document as *Appendix B*. Innovare's annual performance assessment and reporting process will include both a look back and look forward, including a critical assessment of the preceding year's progress by quantitative and qualitative standards set by the Innovare Leadership Council; the approval of an execution plan for the year ahead; and the public release of an annual report of key achievements and milestones, bolstered by engaging storytelling that expresses the true impact of Innovare's work on national security and economic competitiveness.

Goal 1

Build Rome's runway to the world, engaging a global community of 100 diverse partners to introduce game-changing capabilities built on Air Force core strengths in AI/ML, cyber, quantum and UAS.

Key Indicator

Productive Partnerships

Rationale

The highest value partners in the Innovare community are defined by: 1.) talent, technologies and other resources that are otherwise inaccessible within AFRL/RI; 2.) demonstrated commitment to operate in a collaborative model; and 3.) achievement of

deliverables, including experiments, publications, reports, technologies, business models, or special events.

Goal 2

Advance our innovation ecosystem with 100 entrepreneurial ventures and tech startups.

Key Indicator

New Ventures

Rationale

Intentionally diversifying private sector pathways available to develop potentially disruptive technologies, with a focus on new and emerging enterprises, is essential to maximize Innovare community investments in innovation and to leverage private sector resources and opportunities. New Ventures include AFRL/RI intellectual property assets making their way to products in commercial markets through Innovare partnerships; startups emerging from entrepreneurial education programs of Innovare partners who grow to leverage Air Force capabilities for customer discovery, nondilutive capital, incubation, or tech transition; the organization of grand challenges and creative collisions that stimulate entrepreneurial teams and technologies; and AFRL alumni making the entrepreneurial leap to startup leadership. Innovare values aspiring and seasoned entrepreneurs alike, and recognizes the value of accelerating startup success for the development of talent and technologies in our greater ecosystem.

Goal 3

Elevate by 10% our community's intellectual leadership in AI/ML, cyber, quantum and UAS.

Key Indicator

Advancement of Knowledge

Rationale

The advancement of academic credentialing and the external visibility of the extraordinary talent that comprises the Innovare community is essential to achieve our highest potential and to secure our place on the world stage. Important to note, effort both to achieve personal credentials, as well as to promote the academic attainment of others, are valued equally in the Innovare community. As such, achievements of value include: leveling up one's academic attainment to the next greatest credential; supporting one's direct reports to do the same; devoting AFRL/RI time to lead, develop curricula, or instruct STEM summer camps, bootcamps, or other programming that promotes the engagement and retention of the Mohawk Valley's K-12 students in STEM fields; AFRL/RI personnel providing mentorship to a member of the Innovare student community, whether in a summer internship facilitated by the Griffiss Institute or participant in a university entrepreneurial education program; assuming a courtesy or adjunct appointment to share knowledge relevant to community skill development in AI/ML, cyber, quantum, UAS or other strategic priority area; or acting as an advisor to a

graduate thesis or PhD dissertation defense, and encouraging others to do the same - all are activities and accomplishments celebrated by Innovare.

Communications and Marketing Strategy

It is critical to communicate to internal and external audiences Innovare Advancement Center's business model based on the shared vision, mission, strategic goals and collaborative opportunities of its key partners. The "Final Communications and Marketing Strategy & Summary of Deliverables Report" outlines the key means to achieve these objectives, including detailing the ways in which new promotional "infrastructure" has been built to reach key audiences, complementing the proposed innovative business model and its resultant talent and tech acceleration, community connections, entrepreneurial culture, and the catalysis of a successful economic engagement and educational pipeline.

To build the required promotional channels to enable robust current and future communications and marketing efforts built on a firm foundation, extensive fact-finding meetings took place with stakeholders, including leaders from the AFRL/RI, GI, Oneida County, SUNY, and wide-ranging community partners. From there, branding concepts and materials were developed, shared to receive feedback, and then updated as necessary to ensure alignment across a variety of opinions and concerns. Please also see Appendix B of the Final Communications and Marketing Strategy & Summary of Deliverables Report which features monthly reports, which may provide additional helpful context. Throughout this process, the need to understand key partners' hopes and limitations drove regular weekly meetings, along with unprecedented current events which are also factored into the strategy because of the impact to media opportunities, along with a global change in mindset related to the use of communications technologies—presenting both challenges and opportunities.

In short, by providing key communications and marketing materials, Innovare is poised to maximize its critical impact to its audiences. A robust FAQ, found in Appendix A of the Final Communications and Marketing Strategy, provides a template for language to be used in a myriad of other deliverables, from the formatted news release and media advisory, to the newly created website. A suite of branded graphics, as well as a branding guide encourages consistency in feel, and positive news coverage can be promoted on the new website and reach interested parties around the world via the suite of social media channels that have been developed. "Tease" and other promotional videos were created to further establish the center's brand, whether across social media channels, including YouTube, on the website, or for use in future symposia.

For a world increasingly online and eager for connection, these digital "microphones" will be able to drive additional interest, amplifying your latest messaging, fostering a promotion-centered virtuous cycle initiated during Innovare's launch for long-term momentum. Detailed communications strategies, from creating and pitching positive news items to considerations for responding to potentially negative inquiries, in addition

to strategies for connecting across organizations to build interest around a collaborative event, event protocols, and suggestions for employing various narrative and promotional options are all shared in the Communications Strategy.

In sum and substance, the Innovare communications strategy is to empower all members of the Innovare community to engage in loud and proud digital storytelling to elevate the visibility of our collective capabilities and accomplishments, and to attract new partners with diverse resources.

Conclusion

Innovare Advancement Center aims to be a global catalyst to converge world-class talent with cutting-edge facilities and focused technology challenges to accelerate the development of game-changing capabilities that protect and empower our country. An open innovation environment immediately adjacent to Air Force Research Laboratory's Information Directorate in Rome, NY, Innovare Advancement Center offers a globally connected innovation ecosystem in which world-class scientific, engineering, and entrepreneurial talent from universities, government and industry can leverage highly specialized resources in critical research areas, including artificial intelligence/machine learning, cybersecurity, and quantum, to tackle the country's greatest challenges to national security and economic competitiveness. To learn more, visit innovare.org.



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APPENDIX A - Background and Strategic Context

The United States Air Force 2030 Science and Technology Strategy (“2030 S&T Strategy”) calls for novel approaches to gain efficiency in the delivery of our mission, including “. . . *service pilots similar to the U.S. Army Research Laboratory’s Open Campus, potentially expanding engagement and formally integrating them into Air Force procedures.*”

Guided by the 2030 S&T Strategy and keenly focused on building upon AFRL/RI’s unrivaled foundation of innovation in computing and communications, *Innovare* seizes the challenge of increasing global competition and converts it to a focused drive to regain the United States’ leadership and competitive advantage in C⁴I&Cyber.

Created in 1942, Griffiss Air Force Base was born of fortitude. Early missions included fighter interceptors, electronic research, installation, and support activities, aerial refueling, and bombers. Electronics research began at Rome Air Depot in 1949, integrating capabilities from The Watson Laboratory in New Jersey between 1950 and 1951 as a response to the specific electronics needs of air forces learned by the U.S. Army Signal Corps during WWII under the auspices of the Rome Air Development Center. For more than forty years, “AFRL/RI” delivered cutting edge hardware and software products to the American warfighter, including radar and communications solutions, as well as modern software algorithms in multiple mission areas.

In 1993, Griffiss AFB was selected for realignment by the Base Realignment and Closure Commission. By September 1995, 30% of the city's economic base was lost. Almost overnight, 5,000 jobs and 10,000 members of the local population vanished. Formerly the largest overall employer in rural Oneida County, Griffiss AFB had been reduced from a full-scale air base and research command to just three core functions: AFRL/RI; Eastern Air Defense Sector (EADS) of North American Air Defense Command (NORAD); and the Defense Finance and Accounting Service (DFAS). Griffiss AFB was converted to a business and technology park; Oneida County assumed responsibility for the air strip; and with deep humility and purpose, AFRL/RI, EADS, and DFAS, continued to serve the armed forces and preserved what was left of a shrunken local economy, ever optimistic and determined that with hard work and commitment to technological prominence, the future would bring new opportunities.

For the past 25 years, AFRL/RI has quietly delivered extraordinary innovation in service to the intelligence community. Birthplace of the laser disc, CD-ROM, ARPA-Net and the technology that powers Apple’s *Siri*, among thousands of other solutions that have served the defense community and hundreds of diversified commercial applications. In 2020, AFRL/RI resumes its role as the national leader in information-based solutions that will enable the United States to regain its leadership and advantage in national security and economic competitiveness by pushing new boundaries in critical technology areas.

In these 25 years, AFRL/RI has leveraged its base support from DOD to triple its R&D expenditure by attracting investment from other sources within the larger C⁴I&Cyber

community. In FY19, AFRL/RI had a total annual economic impact estimated at \$467 million for a local five-county impact area, up by 13.2% or \$54 million from 2018. This follows a 5.1% increase in 2018 compared to 2017. The Lab's total employment grew to 816 civilian and military employees, up from 777 in 2018 and 782 in 2017. This track record of external engagement positions the team extraordinarily well for further growth with new and diverse partners.

AFRL/RI 2019-2024 Strategic Plan

The overarching strategy for AFRL/RI is summed up in a simple sentence; "Mastering complexity in a future Joint All-Domain C2 environment" (formerly Multi-Domain Command and Control or MDC2). To achieve this vision, the Information Directorate focuses its portfolio on these major technology areas:

- Joint All-Domain C2
- Cyber Power Projection
- Assured Communications & Networks
- Data-to-Decisions
- Artificial Intelligence, Autonomy and Machine Learning
- Processing Power

AFRL/RI has five strategic goals:

- Goal 1: Strengthen and enhance the world-class cadre of professionals at AFRL/RI
- Goal 2: Maintain and enhance unique facilities and laboratory spaces to support AFRL/RI's Mission
- Goal 3: Increase DoD, Air Force and AFRL collaborations/partnerships
- Goal 4: Rapidly develop, transition and deploy technologies to assure our warfighting advantage
- Goal 5: Continuous Business Process Improvements

The AFRL/RI 2020-2025 Open Innovation Strategy also sets forth specific action steps for the execution of this agenda. This open innovation strategy is subservient to, and is specifically designed to augment or bolster all five goals of the AFRL/RI plan, as described below.

Innovation is at the core of the AFRL/RI mission. The modern word *Innovation* comes from the Latin *innovationem*, noun of action from the past participle *innovare*. Commonly confused with concepts of invention and novelty, innovation is actually a process that renews something that currently exists, enabling evolution, rebirth, or renaissance. "Innovare," or "to renew or change," results from Latin *innovatus*, where *in-* means "into" and *novus* means "new." The central meaning is renewal; literally, to push into the new. For innovation to truly be effective, it is necessary for the people who drive it to challenge the status quo and intentionally make decisions that are outside of the norm. Thus, examining current modes of operating and intentionally making decisions outside of the

norm to push into the new is central to the AFRL/RI agenda at Innovare Advancement Center.

Built on Strength: Innovare Partners

Creativity, tenacity, disruption, and grit are hallmarks of the culture of Innovare's core partners. And *Innovare Advancement Center* is the modern embodiment of the cutting-edge capabilities and deeply passionate, competitive culture that makes the AFRL/RI community unique.

Building on 50 years of the best and brightest thinking; over \$17M investments in the past five years to develop world-leading facilities for quantum and AI innovation; and unwavering commitment of trusted strategic and community partners in the public and private sectors—Innovare is positioned to catalyze growth.

By all accounts, recent demonstrations of AI and quantum scientific and technical progress by academia, industry, and government labs, both domestically and abroad, necessitate that the United States intensify its pursuit of next generation AI and quantum-based capabilities. Early adopters of these technologies will be awarded significant advantages in national security and economic competitiveness, but the broad and diluted distribution of scientific talent in AI and quantum information science and technology across the United States necessitates cohesive, long-term collaboration to develop U.S. capabilities and achieve technological prominence in these areas.

AFRL/RI has a strong track record of collaborating across organizational boundaries, with approximately \$200M of its \$1.8B annual budget as direct mission support from DOD and the remainder derived from projects performed for the intelligence community in government and industry. And in the past two years, AFRL/RI has worked hard to expand engagement with university partners with complementary capabilities that will enable *Innovare* to meet its mission. Specifically, the President's Council of Advisors on Science and Technology predicts a deficit of one million STEM Professionals in the next decade, with only 18% of U.S. high school students at or above proficiency in science. Notably, in the metropolitan statistical area surrounding AFRL/RI, the community age 25+ lags all neighboring Upstate NY cities, and all of New York State, by more than -10% in baccalaureate attainment. The call, therefore, has never been greater to intensify engagement with students to increase focus on STEM education and develop a talent pipeline in Air Force-relevant technical areas in the Mohawk Valley.

AFRL/RI Partnership Intermediaries

"Technology transition is the process of inserting critical technology into military systems to provide effective weapons and support systems needed by the warfighter to carry out assigned missions. Technology transition could be thought of as a contact sport, and is built on relationships and trust." – **AFRL/RI Strategic Plan 2019-2024**

Partnership Intermediaries are a valuable mechanism for Air Force programs to leverage the capabilities of nonprofit partners to accelerate external engagement in technology transfer, STEM Education, and workforce development, and to generally

lessen the administrative burdens of government laboratories to meet their mission. AFRL/RI maintains two current Partnership Intermediary Agreements, with The Griffiss Institute and NYSTEC.

The Griffiss Institute

The Griffiss Institute (GI) is a partner with AFRL/RI and acts as an intermediary between the Lab, industry, and academia. Through this partnership and the collaborative research environment it has created, the Griffiss Institute (GI) facilitates and grows the technology base of the Upstate New York region. Creating new business opportunities within an environment conducive to the growth of technology and ideas invigorate the relationships developed by the GI for AFRL/RI with industry, academia and world class technology experts. To learn more about Griffiss Institute, please visit www.griffissinstitute.org

The Griffiss Institute was established in 2002 as an independent nonprofit, governed by a Board of Directors, to advocate and facilitate the cooperation of private industry, academia, and government in developing solutions to critical cyber security problems. Over time, the GI's role to serve AFRL/RI and the local community has evolved to include all three core functions:

- 1.) Technology Transfer
- 2.) STEM Education
- 3.) Workforce Development

The GI achieves technology transfer by facilitating cooperative research and development agreements with private industry and other federally funded laboratories, commercial test agreements with customers requesting assistance in product validation/verification, and educational partnership agreements with universities. The GI holds 77 Education Partnership Agreements (EPAs) with universities, 40 of which are actively working with AFRL/RI, and 36 CRADAs with industry partners, with an average time from inception to contract execution of only three weeks—a testament to the speed and agility with which the GI is able to execute on external business opportunities for AFRL/RI.

The GI is also home to various commercialization programs designed to advance Air Force technology through startups. In the past four years, the GI has supported the launch of 46 startups, 58% of which remain operational—in contrast to the national average of 4%. The AFRL/RI Commercialization Academy and AFRL Demo Day provide GI startups with access to the networks they need to be successful in commercializing defense-relevant technologies.

The GI also provides professional development through training programs for laboratory personnel in software development and program management certification, as well as Science, Technology, Engineering & Mathematics educational opportunities. The GI is focused on a multitude of community outreach activities from involvement in the annual Air Force Association competition, CyberPatriot, and robotics, to the year-long DimensionU competition with middle and high school students. AFRL/RI received the

2014 Federal Laboratory Consortium for Technology Transfer National STEM Award based upon the teaming of the GI and AFRL/RI for workforce development.

NYSTEC

NYSTEC is an independent technology consulting company serving as a trusted advisor to government at the federal, state, and local levels, as well as to companies in the public and private sectors. NYSTEC is based in Rome, New York, with offices in Albany and New York City.

NYSTEC was incorporated in 1996 to act as a state equivalent of a federal systems engineering and technical assistance (SETA) advisor, providing objective, expert technical advice to state entities for their ongoing and future technology initiatives, as well as to help leverage technologies and expertise from the Rome-based Air Force Research Laboratory for the benefit of government entities statewide.

NYSTEC sources and provides professional consulting services to research, design, acquire, develop, manage, test, and transfer technology activities and projects, including but not limited to telecommunications, communications networks, information processing and databases, software, artificial intelligence, quantum information science, electromagnetics, digital signal processing, photonics, and electric reliability.

One of NYSTEC's primary goals is to help foster an innovation ecosystem - empowering technology leaders and visionary thinkers by facilitating connections among entrepreneurs, academic organizations, and government agencies across the state - and beyond. As technical experts, the NYSTEC team provides insight into technology initiatives in areas such as artificial intelligence (AI), quantum computing (QC), cybersecurity, healthcare technology, and drones/unmanned aerial systems (UAS).

NYSTEC holds a partnership intermediary agreement (PIA) with the AFRL to engage academia and industry on behalf of government to accelerate tech transfer and licensing. As a nonprofit and an objective independent advisor with a deep understanding of the industries in which our clients work, NYTEC is well positioned to increase the likelihood of success in conducting cooperative or joint activities with small business firms and institutions of higher education to make use of technology-related assistance from the AFRL and other government labs.

In 2015, NYSTEC launched IgniteU NY, an independent program that fosters innovation and leadership across industries, connecting small business entrepreneurs with mentors and other resources to help them scale their businesses and enter the state and federal government markets.

Partnership Intermediaries in the Future

The most impactful partnerships are those where each partner is doing something the other cannot do. For AFRL/RI to meet its technical mission, the time of Lab personnel is best spent on mission critical activities that focus scientific and engineering talent at its highest and best purpose: pushing to scientific advancement in interdisciplinary teams. The GI and NYSTEC, on the other hand, have no technical missions, but complementary support missions to provide business development and technology transfer services to AFRL/RI and potential partners in academic, industry, and government. These services, in this context, must be best-in-class, and AFRL/RI will lean heavily on its long-term relationships with the GI and NYSTEC as trusted partners to deliver superior service to AFRL/RI professionals in execution of this strategy.

Advancing the AFRL/RI Strategic Plan with an open innovation focus means attracting new partners to focused conversations in areas of collaboration that will ultimately deliver solutions to the warfighter. That means courting new potential partners, exploring complementary capabilities, and making decisions about which relationships are useful and produce their intended purpose.

Business development is a funnel. All potential prospects in industry, academia, and government go into this funnel for marketing purposes. A smaller subset will be potential partners. A yet smaller subset will be considered true partners, and even assuming positive relationships between the individuals involved, an even smaller subset of these relationships will produce anything of value to either party. This funneling process is absolutely necessary for open innovation, but has very low final yield stacked against the total time invested to market, court, and engage partners. Therefore, it is essential to maximize the resources and capabilities of GI and NYSTEC to execute cost-efficient and highly effective business development processes for AFRL/RI, and to align these processes with: 1.) the basic research agenda of the Air Force Office of Scientific Research; 2.) AFRL/RI internal investment strategy; and 3.) strategic partners' research agendas and initiatives in innovation and entrepreneurship.

Education Partners

AFRL/RI has a proud history of partnering with academic institutions to drive innovation forward through education partnerships, cooperative research and development, centers of excellence, and special purpose institutes, within and beyond the United States.

For example, the Information Institute began in 1996 to strengthen RI's relationship with regional universities, provide a mechanism for the academic community to connect with RI, and leverage academic research applicable to RI. At that time, the leaders of RI recognized that the landscape of the DOD being the lead driver of technology was changing, which required a fundamental shift in how RI both conducts research and connect with universities. Since its inception, the Information Institute has grown to 90+ university college membership, supporting the basic level research of the directorate.

AFRL/RI has also partnered with the Air Force Office of Scientific Research (AFOSR) to connect with universities through onsite faculty tenures, typically in the summer months. In 2020, RI hosted 57 professors and 17 accompanying students, from 40 different universities, from 20 different states. RI and AFOSR also collaborate to fund both post-doctoral positions and senior faculty research positions at RI. The goal of these programs is to provide onsite, collaborative opportunities to generate ideas, conduct research, and keep RI technically strong. Finally, AFOSR leans on RI to help recommend awardees for the prestigious National Defense Science and Engineering Graduate Fellowship Program, which is designed to develop future STEM researchers.

In January 2019, AFRL/RI executed a landmark EPA with the State University of New York, calling for the rapid advancement of collaboration in technology areas with potential to enhance our national security and economic competitiveness.

The State University of New York contributes unmatched capabilities to this effort. The largest comprehensive system of public higher education in the United States, SUNY's 64 campus system - of 1.2 million students, a \$1.7B annual R&D expenditure, 1,693 patents, and 110 tech startups - carries a massive responsibility to create transformational research opportunities in leading-edge fields at the undergraduate, graduate, and postdoctoral level, aligning well with AFRL/RI's goals to advance its cadre of professionals and expand university partnerships.

SUNY also has an outstanding track record of building large-scale partnerships to drive the acceleration of talent and technology across a full spectrum of scientific and engineering disciplines, particularly those that are directly relevant and adjacent to AFRL priorities in quantum, cyber, neuromorphic computing, nanoelectronics, artificial intelligence, and machine learning. Specifically, SUNY has established itself as the academic leader in New York State to expand the number of researchers, educators, and students with training in AI and QIS to develop a workforce pipeline; promote the development and inclusion of multidisciplinary curricula and research opportunities for AI and QIS at the undergraduate, graduate, and postdoctoral levels; address basic research knowledge gaps, including computational research gaps; promote the development of facilities and innovation available for QIS and technology research, testing and education; and stimulate research to promote more rapid development of quantum-based technologies.

In the past two years, SUNY and its Research Foundation established two large-scale strategic industry partnerships to develop commercialization pathways directly relevant to S&T 2030. The SUNY-IBM AI Collaborative Research Alliance focuses on AI fundamental research and next-generation materials and computing devices, while the SUNY-Applied Materials Research Institute (SAMRI) is focused on electronic, photonic, and quantum materials and devices research to advance computing and display technologies. Together, these initiatives are funded with over \$100M to drive innovation in academic-industry teams leveraging each other's unique talents, cutting edge facilities and massive compilations of data to move disruptive solutions to market in healthcare, IT, and manufacturing.

The Education Partnership between SUNY and AFRL/RI opens the door for the DOD to leverage the technological capabilities of these large-scale academic industry partnerships to rapidly catalyze solutions that advance the defense community as a whole, including accelerating the development of talent and technology to meet national demand.

Partner Convergence

In the past two years, **Innovare's** community partners have collaboratively:

1. Catalyzed a strong, collaborative, global quantum community activated on national challenges through a series of high-visibility Quantum Workshops. The most recent was in July 2019, when SUNY and AFRL together hosted a quantum workshop with nearly 200 researchers from 14 countries, as well as the Air Force Chief Scientist; Undersecretary for Commerce; NIST Director; and leadership from OSTP, OSD, NSF and DOE. At the conclusion, one team was awarded \$100K to stimulate quantum solutions;
2. Attracted more than \$3B to develop R&D facilities and programs in Upstate NY to advance next-gen computing solutions, including industry partnerships to power “*upside-down innovation*” with global computing leader IBM; global leader in material engineering Applied Materials; and market-leading innovator of semiconductor products for power and radio-frequency (RF) applications and lighting-class LEDs, CREE - all of which are co-located on SUNY Polytechnic Institute's upstate campuses.
3. Established new partnerships with diverse national assets and created new pathways to pull university talent into federal programs, including an AI/ML curriculum development partnership with University of Wisconsin; AIM Photonics' AIM Academy; and various internship and fellowship programs, including combining forces with Brookhaven National Laboratory for SUNY Lab Days, at which we conducted over 200 1:1 meetings with students and faculty across 13 campuses in only eight hours, yielding over 75 summer placements in internships and fellowships between these two government laboratories.
4. Worked across federal agency boundaries with DOE, NSF, and NIST to develop a national technology roadmap for America's quantum internet testbed, with novel, scalable quantum repeaters enabling long-distance quantum communication between DOE and DOD laboratories with technology developed at and owned exclusively by SUNY.
5. Launched the Quantum Collider, the United States Air Force Pitch Day for Quantum Information Technologies. Invited companies pitched to a panel of Air Force end-users, Air Force major commands, program offices, and the Air Force Research Laboratory on quantum timing, sensing, information processing/computing, and communication/networking.

6. Launched development of SkyDome, a premier instrumented Unmanned Aircraft Systems (UAS) experimentation indoor/outdoor facility to support the development and test of technologies for autonomous swarms, resilient swarm communications, advanced sensing and to survive and operate in contested environments. Designed to accommodate year-round testing of UAS. The SkyDome facility is immediately adjacent to the space shared by the AFRL/RI, the Griffiss Institute, and SUNY in the Innovare Advancement Center complex. SkyDome will include:
- Indoor instrumented UAS experimentation facility (200'x200'x50') connected to an outdoor, instrumented, netted UAS experimentation area(250'x150'x70')
 - Pre-test facility with RF test equipment and workbenches to support multiple development/test teams (~50'x50')
 - Operations Center and Data Management System
 - Observation, office, and meeting areas

Together, the coalition of partners who comprise the *Innovare* community seek to catalyze a movement within the international research community that accelerates the delivery of game-changing capabilities through high-risk, high-impact research, innovation and commercialization activities that are uniquely enabled by the world-class talent, facilities, culture, and global connectedness of the *Innovare* community.

Innovare Facilities

This Innovare community is enabled by a 40,000 square foot, three-floor facility, located in the heart of New York's State's picturesque Mohawk Valley, which provides exciting mixed-use space, from leading-edge labs to versatile event spaces, including its renovated hangar area - all complemented by training areas, classrooms, conference, and breakout rooms supporting a wide range of fundamental research, engaging events, and educational opportunities.

Innovare Advancement Center's first floor houses state-of-the-art laboratory space, featuring two quantum- and two nanoelectronics and neuromorphic-centered labs. The quantum research areas are the heart of this floor. Its heartbeat will be the result of the unique, diverse, and engaging international partnerships between academia, government, and industry.

The second floor is focused on providing a business space, which is notably as important as the technical innovation area, to help develop and advance partnerships and educational opportunities for the community and beyond. A 250-seat auditorium hosts workshops and researchers all in the same space. The front of the building is home to the Griffiss Institute, which will be able to work with innovative small businesses and others in order to support research, development, and commercialization opportunities driven by Innovare's synergistic environment.

Innovare's third floor provides a rapid prototyping space with a mix of large "pods," some open to offer a transparent, collegial atmosphere, others closed for closer, collaborative efforts. One room is specifically designed for quantum computing, where access is offered to the IBM Q Hub to reach the stated goal of 100 partners utilizing this valuable computational resource. Overall, the space aims to be one in which researchers from various teams are able to work directly with top talent from around the world, bolstered by talent exchanges, to tackle large problems with significance to our society away from stovepipes while striving to be world-class leaders in key areas.

Complementary to the open innovation facility, a world-renowned co-located small unmanned aircraft systems (sUAS) Test Site provides a powerful setting as a testbed for next-gen flight technologies, which are critical for numerous global capabilities.

Appendix B - Innovare Advancement Center Strategic Indicators

Innovare's progress against the strategic goals laid out herein will be monitored through a comprehensive dashboard that enables a robust annual performance assessment and reporting process, including a critical assessment of the preceding year's progress by quantitative and qualitative standards set by the Innovare Leadership Council. The metrics that may be useful to comprise each indicator are summarized below. Each Strategic Goal has a indicator "categories" which can support a number of specific metrics to measure progress in the category.

Goal 1: Productive Partnerships

Build Rome's runway to the world, engaging a global community of 100 diverse partners to introduce game-changing capabilities built on Air Force core strengths in AI/ML, cyber, quantum and UAS.

University Partnerships – Collaborative work with an academic institution in a focus area of the Innovare Advancement Center (cyber, AI/ML, quantum, UAS) where one or more AFRL scientists are actively engaged in research with one or more university professors on a common topic towards a deliverable, which could be an experiment, publication, report, technology, or special event.

Metrics include:

- Productive Educational Partnership Agreements - The number of academic institutions actively participating in Innovare through AFRL/RI relationship.
- Education Partnership Agreement Retention – Of those EPAs, the number retained beyond the agreement period. Expressed as a number and ratio/percentage.
- MOUs/Agreements held by Academic Institutions in focus areas – Outside of EPAs, the number of agreements with academic institutions held in the focus areas of Innovare.
- AFRL Personnel in Residence at Academic Institution – The number of AFRL employees in residence full or part time at a university for purposes of conducting collaborative research with faculty. Does not cover employees engaged in pursuing academic degree.
- Academic Personnel in Residence at AFRL – The number of faculty in residence full or part-time at AFRL working with AFRL or other Innovare members. Does not cover summer faculty (those faculty who participate in a summer program and are paid by AFRL/government for the appointment).
- Academic Personnel in Residence at IAC – The number of faculty in residence full or part-time at Innovare Advancement Center working with AFRL or other Innovare members. Does not cover summer faculty, i.e., faculty who participate in a summer program and are paid by AFRL/government for the appointment.
- Co-Authored Research Proposals – The number of research grant/proposals co-authored by academics partnering through engagement/interaction at Innovare.

- Summer Faculty/Graduate Program – The number of faculty and graduate students participating in summer residency programs at AFRL or Innovare.
- Joint Publications – The number of publications submitted with co-authorship between Innovare partners. The number of publications accepted with co-authorship between Innovare partners.
- Licenses – The number of licenses granted for use of academic or government research code/platforms. These are academic licenses to use research platforms. In the commercial case, Innovare partners who grant commercial licenses for used by the Innovare community might also apply.
- Products on Market – Any jointly researched products at Innovare which are provided (storefront) for use by Innovare partners or other academic institutions.

Agency Partnerships – Collaborative work with a government (federal, state, or local) research team or government agency in a focus area of the Innovare Advancement Center (cyber, AI/ML, quantum, UAS) where one or more AFRL scientists are actively engaged in research with a team or group within a government agency or institution on a common topic towards a deliverable, which could be an experiment, publication, report, technology, or special event.

Metrics include:

- Productive Memorandums – MOA/MOU – the number of active agreements by Innovare or AFRL with other government agencies.
- Productive Leveraged Educational Partnership Agreements – The number of EPA with AFRL that also share research area/work with another government agency, and, the number of other government agency EPAs which are engaged in cooperative work between AFRL and that other government agency.
- AFRL Personnel in Residence at Agency – The number of AFRL employees in residence full or part time at another government agency for purposes of conducting collaborative research with other government researchers.
- Agency Personnel in Residence at AFRL – The number of other government agency researchers in residence full or part-time at AFRL working with AFRL or other Innovare members.
- Agency Personnel in Residence at IAC – The number of other government researchers in residence full or part-time at Innovare Advancement Center working with AFRL or other Innovare members.
- Co-Authored Research Proposals – The number of research grant/proposals co-authored between researchers at different government agencies through engagement/interaction at Innovare.
- Joint Publications – The number of publications submitted with co-authorship between Innovare government partners. The number of publications accepted with co-authorship between Innovare government partners.

- Joint Licenses – The number of licenses granted for use of government off the shelf (GOTS) code/platforms either by use at Innovare or by Innovare partners granted to wider research community.
- Joint Products/Capabilities – Any jointly researched government product or capability at Innovare which are provided (storefront) for use by Innovare partners or other non-government purposes.

Commercial Partnerships – Collaborative work with a research team in a focus area of the Innovare Advancement Center (cyber, AI/ML, quantum, UAS) where one or more AFRL scientists are actively engaged in research with a team or group within a business institution on a common topic towards a deliverable, which could be an experiment, publication, report, technology, or special event.

Metrics include:

- Cooperative Research and Development Agreements – The number of companies actively participating in Innovare through an AFRL/RI relationship.
- Cooperative Research and Development Agreement Retention – Of those CRADAs, the number retained beyond the agreement period. Expressed as a number and ratio/percentage.
- Embedded AFRL Personnel – The number of AFRL employees in residence full or part time at a corporate partner for purposes of conducting collaborative research with resident researchers.
- Industry Personnel in Residence at AFRL – The number of corporate researchers in residence full or part-time at AFRL working with AFRL or other Innovare members.
- Industry Personnel in Residence at IAC – The number of corporate researchers in residence full or part-time at Innovare Advancement Center working with AFRL or other Innovare members.
- IRAD Ratio – The ratio of IRAD dollars against corporate earnings. Individually a measure of the company's commitment to invest in research. In aggregate, a measure of the depth of collaborative research potentially open to Innovare.
- Leveraged Funding/Resources – The amount of funding contributed to a collaborative Innovare venture against the total cost (resources needed) of the venture. Individually, a measure of commitment. In aggregate, a measure of the health of all collaborative activity.
- Research Consortium – The aggregate number of research consortium to which a corporate partner belongs. A measure of how active/engaged is the corporate partner.
- Joint Publications – The number of publications submitted with co-authorship between Innovare and commercial partners. The number of publications accepted with co-authorship between Innovare and commercial partners.
- Joint Licenses – The number of licenses granted for use of a commercial partner's code/platforms either by use at Innovare or by Innovare partners in association with a wider research community.

- Collaborative Products on Market – Any jointly researched product or capability at Innovare which are provided (storefront) for use by Innovare partners or other commercial purposes.

International Engagements – Collaborative discussions with a non-US academic or government team in a focus area of the Innovare Advancement Center (cyber, AI/ML, quantum, UAS) and covered by a broad international R&D collaborative agreement where one or more AFRL scientists are actively engaged in research with one or more university professors on a common topic towards a joint paper, article, or report.

Metrics include:

- Draft International Cooperative Agreements – The number of international agreements in draft between the USA (AFRL) and foreign governments for the purpose of conducting research on mutual problem sets. Potential for metric to include international partners bridged through corporate partners (see AFRL Legal).
- Summer Faculty/Graduate Program – The number of international faculty and graduate students participating in summer residency programs at AFRL or Innovare.

International Project Arrangements – Collaborative work or project with a non-US government team in a focus area of the Innovare Advancement Center (cyber, AI/ML, quantum) and covered by a specific/negotiated R&D project arrangement where one or more AFRL scientists are actively engaged in research with one or more non-US government personnel on a common topic towards a deliverable, which could be an experiment, publication, report, technology, or special event, article, or report.

Metrics include:

- Signed and Productive International Cooperative Agreement – The number of international agreements in signed and actively in force between the USA (AFRL) and foreign governments for the purpose of conducting research on mutual problem sets.
- Draft/Signed International Project Arrangements – The number of projects agreed to between the USA (AFRL) and foreign governments where the nations jointly sponsor the costs of the project.
- International Cooperative Agreement Retention – The number of international cooperative agreements that spawn follow-on agreements or parallel agreements covering areas of mutual interest.
- Joint Publications – The number of publications submitted with co-authorship between Innovare and international partners. The number of publications accepted with co-authorship between Innovare and international partners.
- Joint Licenses – The number of licenses granted for use of an international partner's code/platforms either by use at Innovare or by Innovare partners in association with a wider research community.

- Joint Products/Capabilities – Any jointly researched product or capability at Innovare which are provided for use by Innovare partners.

Partnership Viability – Quantitative & qualitative feedback from academic, commercial, and international partners to ensure that partnerships are healthy and vibrant.

Metrics include:

- Engagement – An annual survey developed to measure how much Innovare partners communicate, interact,
- Net Promoter Score – As assessment of how one Innovare community partner supported other partner(s).
- Value – An annual survey developed to measure how much value Innovare partners believe they receive from the relationship.

Goal 2: New Ventures

Advance 100 entrepreneurial ventures and tech startups.

Intellectual Property – Transfer/Conversion of intellectual property (patents, copyrights, licenses) to seed/launch technology companies.

Metrics include:

- Commercialization Academy
- Demo Day(s) – Total startups pitching on a given event
- Entrepreneur/Start-Up Seminars – the number of seminars given or sponsored by Innovare partners.
- Patents & Copyrights – The number of patents and software copyrights applied for and granted.
- AFRL Scientist Participation

Venture Reservoir – Partnerships between interested government and business organizations to establish capital to be channeled into ventures aligned along the Innovare focus areas (cyber, AI/ML, quantum).

Metrics include:

- AFWERX, AF Small Business (SBIR/STTR) partnerships
- Venture Pool
- Idea NY
- Incubators
- Talent Pool/Skilled People (Former Entrepreneurs, Business Leaders, Technical Leaders)
- Technology
- Capital – Leveraged Funds Deployed

Grand Challenges – Specialized/Focused events where government and private equity push a specific objective for technological or capability advancement.

Metrics include:

- Participation in Pitch Days/Colliders/Accelerators

Ecosystem Outreach – Working with other ecosystems (Boston, NY, etc.)

Metrics include:

- Participants leveraging resources of partner sites
- Leveraged funds (\$)

Entrepreneurial Network Viability/Strength – How healthy is the ecosystem we are trying to support?

Metrics include:

- Participants in hosted entrepreneurial education programs with Innovare partners
- Size of Mentor Network – The scope of those companies participating in Innovare that either have mentee startups or are recognized for their mentorship.
- Entrepreneurial events listed on IAC/GI calendar or held in IAC Auditorium (number)
- Innovare web visits
- Innovare contact calls
- Social Media – friends and followers
- Companies served by IAC

Goal 3: Advance Knowledge

Elevate by 10% our community's intellectual leadership.

Metrics include:

- Subject Area Symposia Hosted
- Conferences, Workshops Hosted
- Patents Filed, Issued, Licensed
- SW/Algorithm Copyright Generation
- New Hire Credentials
- Summer Faculty/Students
- Personnel Advancing their Academic Attainment
- Personnel holding Adjunct or Courtesy Appointments at Academic Institutions
- Peer-reviewed Publications
- Joint peer-reviewed publications with academia
- Joint peer-reviewed publications with industry
- Citations or H-Index
- Mentored Graduate Students
- Guest/Invited Lectures given by Personnel

Local Community – Focused on increased visibility of technical ecosystem to local (50-75 mi radius) communities.

Metrics include:

- K-12 Participation in STEM camps
- Professional Association Usage of IAC Auditorium
- Tech Talks – Discussions of AFRL Tech open to Local Community
- Students enrolled in Summer Internships
- Engagement of minority/underserved community population

Regional Community – Development of regional (250 mi) partnerships and activities

Metrics include:

- Career Fair Participation
- Volunteers in regional STEM programming
- Innovare Collaboration/Partnerships with other Regional Innovation Activists
- Joint/Shared Programs – Number of shared programs across the region. For example, host in one location, and have other locations be satellites for the program – either all virtual (at the satellite) or some shared virtual presentation/learning/experience

Closing note: These indicator categories are meant to be comprehensive and illustrative, but neither exhaustive nor exclusive. Annual execution plans are expected to progressively refine the most useful indicators as this new strategy is executed and continuous learning informs approaches and measurements going forward.