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FY2022–2026 ODNI S&T

STRATEGIC INVESTMENT FRAMEWORK

■ Catalyzing Research for Addressing Intelligence Community Needs



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FY2022–2026 ODNI S&T**STRATEGIC INVESTMENT FRAMEWORK****■ Catalyzing Research for Addressing Intelligence Community Needs****About the Cover**

The cover graphic portrays the convergence of disparate science and technology disciplines as central to the intelligence profession. Stretching vertically down the image, a double helix strand of deoxyribonucleic acid (DNA) appears as a futuristic rendering surrounded by fragments of information, suggesting the prospect of breakthrough at the confluence of biology and data analytics. This illustration represents but a single example of the Intelligence Community's wide-ranging interest in possible scientific and technological convergence, from which innovation and disruption often arise. In the near term, perhaps no technology will have greater influence on accelerating such innovation and disruption than artificial intelligence, which is represented in the graphic by grid patterns converging into a single, luminous, curved line. The silhouette of Earth conveys the international scope of the intelligence enterprise, the global nature of scientific knowledge and technological advancement, and the capacity to carry out worldwide operations as interlinked and integrated pillars of mission success.



FROM THE DIRECTOR OF NATIONAL INTELLIGENCE AND THE PRINCIPAL DEPUTY DIRECTOR OF NATIONAL INTELLIGENCE:

As President Biden noted in the White House's *Interim National Security Strategic Guidance*, our nation will only succeed in advancing our interests and upholding our universal values by working in common cause with our closest allies and global partners in industry and academia, and by renewing our own enduring sources of strength. Although the Intelligence Community's (IC) technological edge has long been one of these sources of strength, maintaining and increasing this advantage require us to look beyond the immediate horizon to ensure that we are postured to address developing threats and take on new opportunities as they arise.

The Office of the Director of National Intelligence's (ODNI) Science and Technology (S&T) Investment Planning Guidance—composed of the *FY2022–2026 ODNI S&T Investment Landscape*, the *FY2022–FY2026 ODNI S&T Strategic Plan*, and the *FY2022–2026 ODNI S&T Strategic Investment Framework*—collectively lays the foundation for better positioning the IC to advance our nation's interests by anticipating and preparing for the demands of the future. These documents serve as a roadmap for advancing and sustaining a diverse and talented technical workforce, championing and advocating for S&T that is not only effective but will provide the IC with a competitive advantage, enhancing and creating enduring and purposeful partnerships with a range of non-traditional public and private partners, managing risk, and integrating expertise across a range of technical and mission-oriented disciplines. Additionally, these documents clarify how we will work together within the IC and alongside our partners to identify, champion, and catalyze investments to ensure our continued technological advantage through a whole-of-nation approach to innovation.

Despite its unparalleled strengths, the IC cannot address these challenges alone. We look forward to the Community and its partners using these documents as a common basis for advancing our nation's intelligence advantage.

A handwritten signature in black ink, appearing to read "Avril D. Haines".

The Honorable Avril D. Haines
Director of National Intelligence

A handwritten signature in black ink, appearing to read "Stacey A. Dixon".

The Honorable Stacey A. Dixon
Principal Deputy Director of National Intelligence

From the Deputy Director of National Intelligence for Policy and Capabilities:

The intelligence capabilities available to future government officials and warfighters will be shaped significantly by the Intelligence Community's (IC) near-term investments in research and development. The *FY2022–2026 ODNI S&T Strategic Investment Framework* provides a mechanism to drive innovation; incentivize high-risk, high-payoff research; and catalyze game-changing application of technology to advance the IC's ability to address mission priorities and ensure our technical and technological advantage. Along with its companion documents, the *FY2022–2026 ODNI S&T Strategic Plan* and the *FY2022–2026 ODNI S&T Investment Landscape*, the *Framework* enables the IC to continuously assess its posture relative to future threats and challenges to ensure that the Community's investments and capabilities deliberately address the highest priority areas.

Mr. Dustin J. Gard-Weiss

Deputy Director of National Intelligence for Policy and Capabilities
Office of the Director of National Intelligence

From the Director of Science and Technology:

To make informed decisions regarding the shape, size, and direction of the IC's research portfolio against the Needs outlined in the *Landscape*, the Director of National Intelligence and other senior IC leaders must have sufficient insight into our existing and planned portfolios of science and technology (S&T) investments. To that end, I am pleased to provide the *Framework* as the principle means for relaying the processes by which the Office of the Director of National Intelligence (ODNI) and the broader Community will seek to resolve *Landscape*-documented challenges. Using this *Framework* document and sharing science and technology investment portfolios and challenges with Congressional oversight committees and the White House Office of Management and Budget, the IC and its partners will better ensure transparency and mitigate risk by informing S&T investment decisions.

Dr. John R. Beiler

Director of Science and Technology
Office of the Director of National Intelligence

From the Deputy Director of Science and Technology:

The *Framework* ensures greater collaboration and load sharing in the intelligence-related research efforts of the IC S&T enterprise, the broader U.S. Government, and our partners in industry, federally funded research and development centers, and academia. Implementation of the repeatable and enduring process outlined in this *Framework* document will be critical for better aligning the IC S&T enterprise's and partners' pursuits with future intelligence and broader national security needs. Your feedback on this document and its goals is most welcome, and can be provided to S&TInvestment@dni.gov. ODNI's Science and Technology Group looks forward to hearing from you.

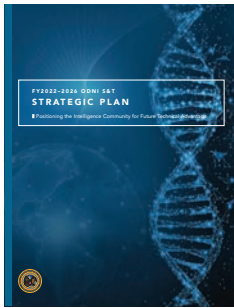
Dr. David M. Isaacson

Deputy Director of Science and Technology
Office of the Director of National Intelligence

■ ODNI SCIENCE AND TECHNOLOGY GROUP PUBLICATIONS

The below documents collectively capture and relay how the Office of the Director of National Intelligence (ODNI) Science and Technology Group (STG) substantively develops—in a transparent, repeatable, and inclusive fashion—its statutory requirement for investment recommendations to the Director of National Intelligence (DNI).

These documents broadly outline STG’s roles and activities to a range of internal (ODNI) and external (IC, U.S. Government, private sector) stakeholders.



FY2022–2026 ODNI S&T Strategic Plan

This *Plan* identifies the guiding principles for IC S&T Enterprise Investment and articulates four key goals for the ODNI intended to set the landscape for the development of S&T throughout the IC to ensure our technical advantage and more effectively pursue the IC’s mission.



FY2022–2026 ODNI S&T Investment Landscape

This report identifies the principal challenges facing the national security enterprise in order to focus S&T investment efforts on the IC’s critical needs. It describes the process by which the STG generates recommendations to the DNI and the broader IC on the capabilities, associated technologies and research areas that will address the future needs of the community. This *Landscape* additionally serves as the basis for ODNI’s longer-term investment strategy.



FY2022–2026 ODNI S&T Strategic Investment Framework

This publication explains how the STG will identify and manage risk within the IC’s research portfolio, given that it is not fiscally or otherwise possible for the IC to anticipate and sufficiently address every potential challenge. The approach outlined in this *Framework* is intended to ensure that in managing risk, the needs of users and customers are closely coupled to decision-making informed by technology subject matter experts.

■ INTRODUCTION

A key responsibility of the Office of the Director of National Intelligence (ODNI) Science and Technology Group (STG) is to help ensure that the U.S. Intelligence Community's (IC) future capabilities align to anticipated mission needs. To accomplish this goal, an overarching STG objective is to generate—in an efficient and collaborative fashion—substantiated investment guidance for the Director of National Intelligence and the broader IC on technologies and capabilities to address the Community's needs. This investment guidance is generally issued through collaboration with the IC elements and other ODNI offices during the development of the National Intelligence Program (NIP) budget through the Intelligence Planning, Programming, Budgeting, and Evaluation (IPPE) process.

To that end, STG generated the *FY2022–2026 ODNI S&T Strategic Plan* document to broadly relay its goals over the next five years—to include how it will seek to drive and influence future S&T investment recommendations. In this way, the *Strategic Plan* outlines how STG aims to comprehensively identify and continuously address at an actionable level the challenges our nation and its allies are anticipated to face as well as the means to aggregate ongoing activities and—only where absolutely necessary—lead or stimulate the development of new efforts to solve these challenges.

As the foundation of the *Strategic Plan*, the STG-issued *FY2022–2026 ODNI S&T Investment Landscape* captures the IC's view of the Needs now being faced—as well as those anticipated to be faced—by the Community. The *Landscape* provides the basis for ODNI's longer-term IC S&T investment strategy, as it documents STG-identified IC Needs that are typically framed as risks or opportunities, suggesting that a risk-based approach to portfolio management is appropriate for ODNI STG's efforts to advance the IC.

- By sharing the *Landscape* with our partners and soliciting their feedback—particularly in combination with reviews of IC elements' existing and planned S&T investment portfolios—STG provides IC leadership with a better understanding of where to bolster or reallocate scarce S&T resources.
- The inputs describing current and future customer Needs for the *Landscape* are derived from a wide variety of source documents at all levels of the IC, including Unifying Intelligence Strategies (UIS) from the National Intelligence Managers (NIM)¹ and technical challenges from the components.
- Director of National Intelligence Science and Technology Committee (NISTC)² members are also directly linked to and support some of the input sources and thus provide a key resource for analyzing and understanding how to best meet these user Needs. Translating customer Needs into an actionable S&T investment strategy is therefore a key NISTC activity.

¹ A cornerstone of the DNI's National Intelligence Strategy to integrate the operations of the Community is the appointment, designation, and empowerment of ODNI NIMs from amongst IC agencies' subject matter experts. NIMs oversee and integrate all aspects of the IC's collection and analytic efforts against a particular region or function and serve as the single focal point within the ODNI for the integration of all activities related to the particular region or function. Lastly, NIMs set strategic guidance to improve IC collection and analysis over the long term, and are responsible for the development, planning, execution and success of the UIS and generally the orchestration of UIS activities by managing the policies and relationships among Community agencies.

² The NISTC is the senior forum for the coordination and communication of S&T priorities and R&D investments across the IC. The NISTC is chaired by the DS&T and its members include the principal science advisors of the elements of the National Intelligence Program (NIP). The Intelligence Reform and Terrorism Prevention Act of 2004 established and broadly describes the duties and functions of the DS&T and the NISTC.

This document, the *FY2022–2026 ODNI S&T Strategic Investment Framework*, is differentiated from—and complementary to—the *Strategic Plan* and *Landscape* documents in that it is designed to relay how STG will work within and outside of the Community to identify and mitigate risk within the IC S&T enterprise’s research investment portfolio. In this way, *Framework*-derived activities proposed for consideration are evaluated and implemented as projects when IC leadership agrees that expending the technical effort, time, and cost anticipated to address a *Landscape* Need or set of Needs is appropriate.

■ MANAGING RISK WITHIN THE IC S&T RESEARCH PORTFOLIO

It is critical in developing an IC-wide S&T investment strategy that the Needs of users and customers be closely coupled to decision making informed by technology subject matter experts so that new ideas are rapidly explored, and the most salient technical advancements are exploited. Of course, it is not fiscally possible for the IC to anticipate and sufficiently address every challenge it faces, so some measure of risk management within the IC’s research portfolio must be practiced. To do so, STG employs a five-phase portfolio management approach to enable these tasks (Figure 1)³.

Figure 1 — **STG’s Risk-Based Portfolio Management approach to mitigating or resolving risk associated with the *Landscape* technology Needs.**



³ Additional details on this process flow are provided in Appendix A.

These many Needs represent desired potential opportunities to buy down aggregate mission risk. They are typically framed as risks or opportunities which span a wide variety of activities and timelines. Our desire to ensure the best use of S&T research funds suggests the use of a quantitative risk management framework. We require an effective approach to select among the large number of Needs to address and at what level, review progress against research goals, coordinate research activities, and share information on results and recent developments. Within the IC, developing the S&T investment strategy for the IC S&T enterprise, reviewing progress, coordinating research activities, and ensuring that information is shared among S&T subject matter experts (SME) are activities led by the Director of Science and Technology (DS&T) and the NISTC.

- Additional elements must be incorporated when considering the level of attention that particular Needs should receive. The typical management constraints of cost, schedule, and performance apply to any set of activities with defined start and finish criteria, i.e., a project. The set of projects to potentially address these Needs comprises the *Landscape*-based research portfolio.

To this end, STG defines risk as the measure of future uncertainties in addressing the set of Needs documented in the *Landscape*. Such risks are generally characterized by one or more of the following components:

- A future root cause (i.e., yet to happen) that—if eliminated or corrected—would prevent a potential consequence from becoming an active issue;
- A probability (or likelihood) assessed at the present time of that future root cause occurring; or
- The consequence (or effect) of a future occurrence.

Quantitative measures for likelihood and consequence enable our proposed methodology.

In seeking to resolve or mitigate risk associated with the *Landscape* Needs, STG pursues—in concert with the NISTC—a risk-based portfolio management approach. Such an approach can be generally described as an ongoing spiral of phases to continually optimize the use of resources in a collaborative and constrained environment.

This approach comprises five phases: Understand the Strategic Environment, Analyze Portfolio Risk and Opportunities, Select Projects and Develop Project Plans, Manage and Execute Projects, and Build Successive Spirals, as shown in Figure 1.

- **Understand the Strategic Environment** – Current and future customer Needs for the *Landscape* are derived broadly across the IC, translated into a common lexicon, filtered into categories of potential functional managers, potentially applicable technological areas are tagged, and then the Needs are cataloged into a database system.
- **Analyze Portfolio Risk and Opportunities** – The Needs are identified as potentially actionable requirements with the assessment of Likelihood and Consequence (L×C) to quantify the potential to address the risk associated with that Need. This is done utilizing a 1–5 scale for each L and C factor that is uniformly defined across the entire set of Needs.

- **Select Projects and Develop Project Plans** – The set of Needs identified as requiring attention drives the implementation of projects to mitigate or eliminate particular Needs. The proposed plans typically indicate a risk buy-down series of steps showing target L×C values.
- **Manage and Execute Projects** – The daily effort involved in the projects is typically done by IC components, either individually or in concert with other components or external partners. Oversight of these activities to facilitate collaboration and evaluate L×C progress is provided by the DS&T.
- **Build Successive Spirals** – Periodic evaluation of the effectiveness and distribution of resources across the S&T portfolio is done by examination of the L×C project metrics, the available human and monetary resources, and updated Needs indicated by the IC. This drives a rebalancing of the portfolio and a new spiral of activities.

Each phase of STG’s risk-based portfolio management approach is further described below.

■ UNDERSTAND THE STRATEGIC ENVIRONMENT

The *Landscape* serves as STG’s principal mechanism to aggregate, relay, and champion across the Community and its partners those anticipated IC-wide Needs that do not necessarily map directly to individual IC elements’ functional responsibilities. The inputs describing current and future customer Needs for the *Landscape* are derived from a wide variety of source documents at all levels of the IC, including the UIS from the NIMs and technical challenges from the IC components. The IC’s scientific and technical intelligence (S&TI)⁴ and counterintelligence (CI) communities also directly support some of the input sources and thus provide a key resource for analyzing and understanding how to best meet these user Needs. Translating the *Landscape*’s mission owner-derived Needs into an actionable S&T investment strategy is therefore a true, Community-wide activity.

- Such an approach provides an opportunity for IC leaders and stakeholders, such as the NIMs, to directly affect the allocation of IC S&T resources and industry’s independent R&D (IRAD) efforts and allows STG and the NISTC to champion Community-wide Needs which lie beyond the scope of individual IC elements’ functional responsibilities.

The Needs captured in the *Landscape* provide a common nomenclature and focus to enable a Community-wide understanding of the context within which resources may be utilized. A critical part of crafting the *Landscape* was identifying and comprehensively aggregating intelligence Needs from across the IC. To accomplish this, STG staff identified intelligence Needs from a variety of sources with differing perspectives: subject matter experts, program managers, specialized customers, and field end-users. Via the *Landscape*, STG communicates an IC-wide set of Needs to our partners to further improve planning and provide insight into the breadth of applicable S&T investments.

- Once these IC-wide Needs were aggregated, they were filtered into categories that are aligned with either IC Program Managers (PM) or others who are best positioned to champion solutions to a given IC Need, as shown in Table 1.

⁴ S&TI is the systematic study and analysis of foreign capabilities in basic and applied research and applied engineering. S&TI products are used to warn of foreign technical developments and capabilities and to guide the development of future capabilities, which are often provided through R&D.

Table 1 — **Mission Program–Derived Categorization of *Landscape* Needs**

NAME	BRIEF DESCRIPTION	EXAMPLE NEEDS
Category Zero	IC-wide analytic tool and methodology challenges.	Develop/enhance capabilities to mitigate bias introduced by machine learning techniques.
Category One	IC-wide S&T challenges that are best served by an individual Program Manager.	Develop/enhance understanding of global dual-use technologies that may be used for chemical, biological, radiological, and nuclear weapons programs.
Category Two	IC-wide S&T challenges that are potentially served by more than one Program Manager.	Develop/enhance analytic tools to identify critical and non-traditional indicators of nation-state instability, and/or threats to U.S. or Allied personnel and interests in a region.
Category Three	IC-wide S&T challenges that are best served by leveraging external and/or broader U.S. Government partners.	Develop/enhance standards and methods to address challenges of processing, sharing, and analyzing spectral and spatiotemporal data within emerging high-performance computing and cloud architectures.

Complementing the *Landscape* Needs aggregation, STG and the NISTC conduct annual IC S&T enterprise-wide portfolio reviews to inform IC enterprise-level program planning in support of the Needs listed in the *Landscape*. These activities feed directly into the *Framework*'s processes for informing the IPPBE process, identifying and resolving cross-program dependencies, recommending budget changes, and evaluating execution ability and performance.

- Ultimately, basing the annual portfolio reviews on the *Landscape* Needs helps ensure that IC element S&T investment portfolios combine to form a more comprehensive, integrated IC investment portfolio.

Of course, investment decisions on new technological capabilities are not driven solely by user requirements or existing research portfolios, but are also informed by new technical developments—regardless of where they originate. In particular, decision-makers require knowledge of, and exposure to, global R&D trends that could affect U.S. national security or undermine the U.S. Government's R&D efforts.

- To this end, STG and the NISTC leverage the IC S&TI community's collection and analysis of foreign strategies for science and technology developments and apply them as appropriate to IC R&D planning and resource allocation decisions.
- Further developing such relationships across the Community allows for the S&TI community to inform the S&T enterprise and IC operators regarding adversary capabilities and research developments while affording the IC S&T enterprise the opportunity to drive collection and analysis on adversary R&D efforts.
- Moreover, these relationships may also aid the Community in assimilating and adapting adversary capabilities.

Understanding the technical solutions that industry and our adversaries are pursuing, combined with insight into current programs gleaned from the IC S&T program reviews and the *Landscape* Needs, empowers IC leadership to align R&D resources to better manage cross-Community risk.

■ ANALYZE PORTFOLIO RISKS AND OPPORTUNITIES

Given the breadth of challenges captured in the *Landscape*, STG and the NISTC—with informed input from partners across the IC—use the finite resources at their disposal to responsibly triage the information provided and activities undertaken to help resolve *Landscape*-identified risk. Of course, given the range of mission-related topics covered by the *Landscape*, not all Needs are of the same importance or urgency, and many Needs are interrelated and composed of branching and intertwined components. In analyzing the Needs for the highest priorities, STG and the Community take several factors into consideration, to include:

- Ensuring that the background associated with—and nature of—each of the Needs is understood;
- Utilizing a consistent, defined, and repeatable structure for Need evaluations; and
- Incorporating the Community's qualitative evaluations into the analysis process.

Additionally, many different S&T domains are required for addressing the multitude of Needs identified by the Community. Choosing which Needs to address is facilitated by the use of informed determinations of risk and reward, as quantitatively provided through the use of Likelihood and Consequence metrics on a 1 (low) to 5 (high) scale (Appendix B)⁵.

- To address the Needs across the IC, periodic evaluations of the Needs and their Likelihood and Consequence are conducted to assure maximum efficacy for the resources expended. Based upon this evaluation, a determination of the relative focus and effort for each Need, even if currently none, is generated.

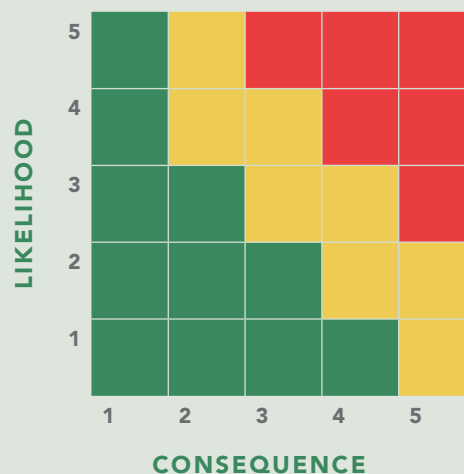
⁵ STG establishes the Likelihood and Consequence for each risk with input from the IC's S&TI and CI communities using specified, uniform criteria that are broadly applicable across all of the Needs. The DS&T and the NISTC will take these and other factors into consideration as recommendations are made to the DNI for future research investments.

Background on STG's Determination of Risk: Likelihood and Consequence Considerations

Each of the Needs examined has a set of root causes that makes it a risk. The aggregate risk for a particular Need is quantified by two values, Likelihood (Probability) and Consequence (Impact). A standard format for risk evaluation and reporting is the Risk Reporting Matrix. The level of risk for each Need becoming an impacting issue for the Community is reported as low (green), moderate (yellow), or high (red).

The Likelihood for each risk is established by STG with input from the IC's S&TI and CI communities using specified, uniform criteria that are broadly applicable across all of the Needs. The perceived level might be described by either a text-based form or by a percentage probability and subsequently reduced to a common framework, such as a 1–5 ranking. Similarly, the Consequence for each risk may be evaluated from several viewpoints: technical, schedule, and cost, with the technical value split into scope and quality if desired. (See Appendix A for additional details.)

STG will use this Landscape Needs-based Risk Reporting Matrix methodology to determine the most impactful opportunities for the Community, and—in concert with the NISTC—make recommendations to the DNI for future research investments.



Selecting which Needs to address and developing projects to meet those Needs are an optimization exercise best pursued within a federated construct. As described in the *Landscape*, each Need is associated with one or more PMs.

- STG will use the identified high-priority Needs (i.e., those with high Likelihood and high Consequence values) to drive focused portfolio reviews with the IC elements to identify ongoing and planned IC R&D activities related to this subset of Needs.
- Such targeted portfolio reviews will aid STG and NISTC in determining whether existing IC programs are sufficient, require additional resources, or if entirely new research directions or partners are required.

To help better appreciate the technical components and available data associated with the identified high-priority Needs, STG seeks to work with cleared industry and the IC's S&TI and CI communities to develop an understanding of the technology space

associated with these Needs. Any perceived lack of sufficient understanding or elevated risk identified in particular technical areas will drive the generation by SMEs of technical roadmaps⁶ to illustrate these pieces and thus identify those technical opportunities that the IC would most benefit from additional resources.

In this way, the roadmaps enable the visualization of a particular S&T domain and expose the components and their connections for resolving the *Landscape Needs*. They seek to identify those aspects that are well known, those aspects that require additional effort to realize a new capability, and those aspects that lack a fundamental knowledge base. This allows for informed granularity in decisions where additional attention and effort should be addressed.

- Importantly, the IC S&T enterprise may only need to develop a subset of the roadmap technical areas to drive down the perceived risk of an identified high-priority Need or set of Needs.

Additional Factors Affecting the IC S&T Enterprise's Risk Calculus

Many risk factors should be incorporated when considering potential Landscape Needs-based IC R&D projects. These include the following impacts on technical activity and impact to Need mitigation or resolution:

- *Sensitivity to specificity in the Need description;*
- *Sensitivity to uncertainty in operational needs, performance, and readiness parameters;*
- *The ability of the integrated system to achieve engineering objectives;*
- *The adequacy and capability of the test and evaluation program to assess attainment of key performance parameters (KPPs);*
- *The adequacy and capability to support verified, validated, and accredited models and simulations;*
- *The degree to which the proposed technology has matured;*
- *The ability to achieve logistics objectives for maintenance and support;*
- *The ability to manufacture and repair system elements;*
- *The life-cycle costs of the proposed system;*
- *The schedule allocation for fielding the proposed system;*
- *Government resources external to the program office required to support the system; and*
- *Sensitivity of budget fluctuations on program turbulence.*

An additional—and critical—component of risk for the IC encompasses the actions of near-peer competitors. Because of this, STG also includes information from the intelligence record pertaining to adversary goals and intentions to scope the likelihood and consequence of various technical risks. This novel approach to risk management allows the IC S&T enterprise to direct the optimum amount of resources to the most salient technical problems.

Through the common understanding developed in generating the roadmap, decision makers and resource managers will more clearly see the consequences of successfully pursuing particular projects, thereby enabling knowledgeable portfolio decisions within a particular S&T domain.

⁶ A critical component of STG's work to develop technical roadmaps will be its relationship with industry to obtain input for addressing IC mission needs. As their content spans across mission capabilities to supporting technologies to research challenges, these roadmaps will prove useful to a wide range of audiences across the public and private sectors, to include program offices, system engineers, and scientists.

- The knowledge set developed through this roadmap-driven identification and analysis allows for and advances a rational, traceable, and defensible process to manage risk within the Community, providing a process in which documented IC mission Needs are translated into technical challenges and relayed across the national security enterprise to provide a shared understanding and common basis for solving these challenges.

■ SELECT PROJECTS AND DEVELOP PROJECT PLANS

In evaluating the allocation of resources against the risks identified by STG-led reviews of the *Landscape* Needs, IC S&T portfolios, S&TI and CI products, and the *Landscape* Needs-based technical roadmaps, STG—in collaboration with relevant NISTC members—will produce initial investment recommendations and strategic-level Project Plans to resolve select *Landscape*-derived risk. Each identified project proposal may address multiple high-priority Needs and will be further prioritized based upon a DS&T and NISTC consensus review.

- Efficiently meeting these *Landscape*-identified challenges will often require whole-of-government and even whole-of-nation approaches.
- Aligning the IC S&T enterprise's efforts using the *Framework*'s selection processes further ensures that individual IC element S&T investments combine to form a more comprehensive, integrated IC investment portfolio while still incorporating inputs and priorities from across each element and its leadership.

Once approved by the DS&T and the NISTC membership, strategic Project Plans will be further developed with relevant NISTC components' SMEs based upon the knowledge and experience of the relevant organization(s) in the areas identified by the Need statements.

- This expertise and knowledge of the operational environment allows for the formulation of approaches that are most likely to prove effective against the Needs.
- A key goal for these plans will be to identify the resourcing required to address them within an effective schedule, to include key personnel needs and funding lines that can be applied.

■ MANAGE AND EXECUTE PROJECTS

Once specific opportunities are identified by the DS&T and the NISTC, every effort will be made to identify existing funding lines that can be applied to these projects to avoid unnecessary duplication of effort and help ensure fiscal responsibility. Accordingly, the primary route to making sure these research challenges are pursued would be to alert industry in the hopes that they will recognize a business opportunity and shift their IRAD funding accordingly. Should the private sector not see a profitable opportunity, STG would next explore IC- and U.S. government-wide research funding to help meet these challenges.

However, to catalyze approaches for transformative capabilities against which no applicable research efforts can be identified or stimulated, new funding avenues may still be needed. To this end, the DS&T and the NISTC will move to institutionalize and fund a mechanism to coordinate and catalyze pre-operational R&D efforts related to

cross-Community challenges, thereby freeing up PMs' resources to accelerate current programs or confront additional challenges within their functional areas. For these unmet challenges, STG developed a rational, traceable, and defensible basis for initiating research activities in support of *Framework*-derived technical opportunities.

- *Framework*-based research challenges for which STG and the NISTC could not ascertain existing or planned public- or private-sector funding would be presented to the DNI, with sponsorship of new funding occurring only in those areas where the DNI agrees that accepting risk is not an option.
- For these activities, a variety of external performers—to include defense contractors and federally-funded R&D centers as well as less-traditional partners—will likely be needed to ultimately perform targeted research in these areas.

This effort will be administered by the STG with input from the NISTC in the selection of specific projects. In this way, STG's approach represents a new level of strategic planning for the IC S&T enterprise, acting in parallel to other complementary efforts such as the Department of Energy's (DOE) sizeable Laboratory Directed Research and Development (LDRD) program and industry's IRAD funding to help ensure our nation's intelligence advantage.

- Fiscal responsibility was designed into STG's approach from the beginning, ensuring accountability and transparency. Targeted, periodic program reviews allow the DS&T and the NISTC to stay up to date on progress in funded areas and ensure that STG-funded research results are disseminated across the national security enterprise to advance work in these areas. This accountability and transparency will not end with the Executive branch—this work will also be regularly briefed to Congressional members and staffers.

Ultimately, key to STG's success is its due diligence in first seeking to leverage or stimulate private-sector IRAD funding. To meet its goals, the STG will also seek to influence our nation's considerable public-sector funding—to include that of ODNI's Intelligence Advanced Research Projects Activity, the Department of Defense, DOE's LDRD, the National Aeronautics and Space Administration, the National Institutes of Health, the National Science Foundation, and others—in support of *Framework*-identified intelligence challenges.

- As such, STG-funded research will supplement longer-term, strategic R&D planning efforts within the individual IC elements.

■ BUILD SUCCESSIVE SPIRALS

Integrating continuous improvement into the STG-led portfolio management process requires a clear definition of success. Those projects which have been shown to reduce risk—such as through the satisfactory resolution or mitigation of an existing *Landscape* Need or a notable reduction in the Need's determined Likelihood or Consequence values—are to be encouraged for continued expenditure of resources if determined to remain of importance. Similarly, those that have not shown sufficient progress will have their resources directed to other STG projects to continue improving the IC S&T enterprise's overall risk profile.

- A continued examination of project and portfolio resource consumption in time and costs against the degree of risk reduction with respect to the *Landscape Needs* will provide the historical context needed to build future portfolio efforts to address the next spiral of the IC S&T enterprise's strategically focused, risk-managed portfolio.

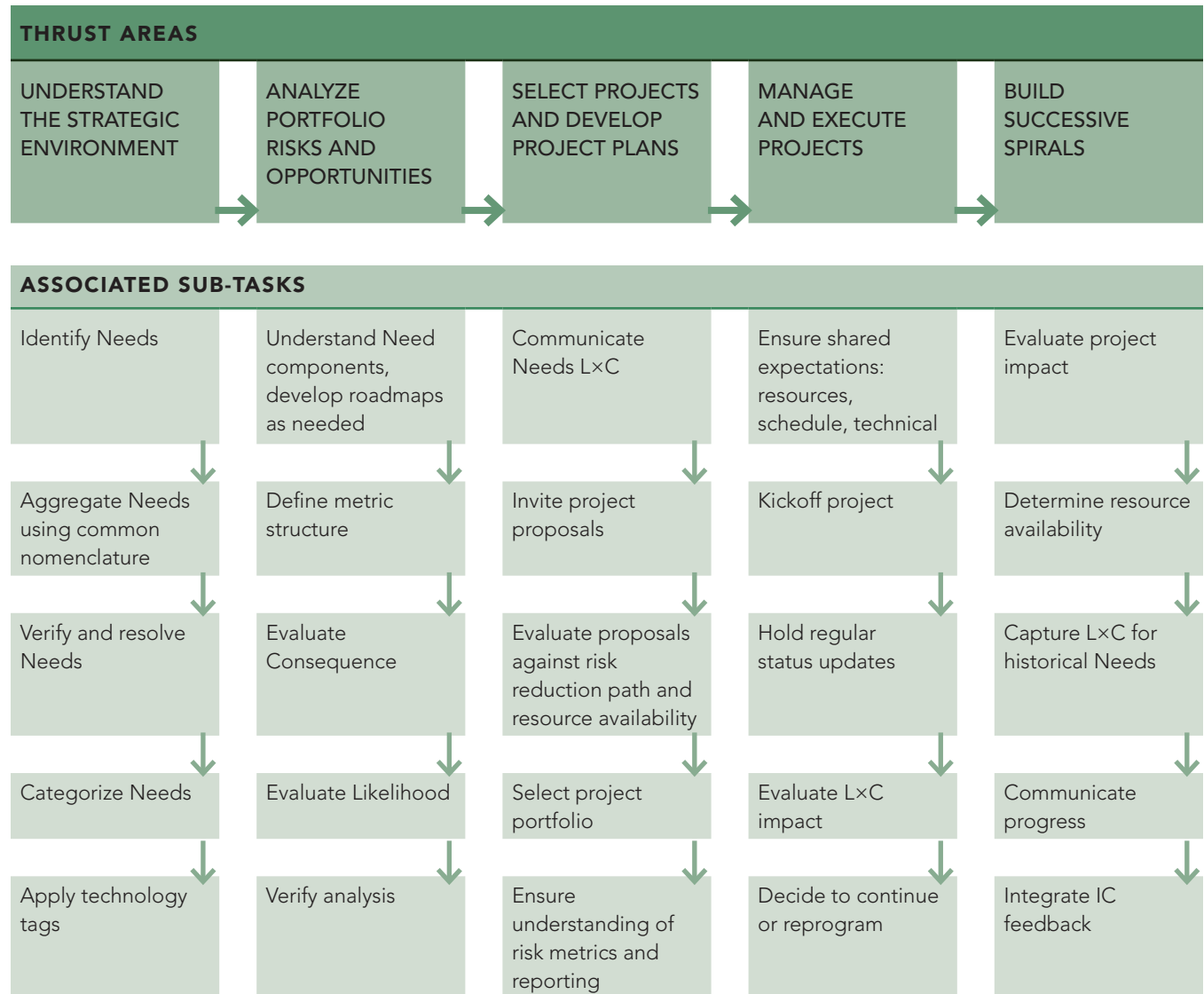
■ CONCLUSION

STG and NISTC efforts over FY2022–2026 will usher in a new era of investments to advance research opportunities identified from documented IC mission challenges. Instantiating such a process for the IC S&T enterprise will serve to achieve a truly unprecedented set of outcomes: an investment landscape of current and projected intelligence challenges as well as a research investment portfolio aligned to this same set of challenges. Moreover, such an approach will afford an efficient and auditable method for both the Executive and Legislative branches to provide effective oversight over IC S&T resource allocation decisions against these same challenges.

- Going forward, the STG's and NISTC's collaborative management of risk to rapidly identify and respond to the key challenges of today while anticipating future challenges and solutions will be a critical intelligence advantage.

Appendix A

Expanded Process Flow for Managing Risk within the IC Research Portfolio



Appendix B

Quantitative Risk Management

A typical quantification of Likelihood (L) and Consequence (C) is shown below. Choosing which Needs to address is facilitated by the use of perceptions of risk/reward, as quantitatively provided through the use of L and C metrics. These are to be defined using consistent scaling across the entire set of Needs.

Likelihood is quantified on a five-level scale:

L=1	Highly unlikely	~10%
L=2	Unlikely	~30%
L=3	As likely as unlikely	~50%
L=4	Likely	~70%
L=5	Highly likely	~90%

Similarly, Consequence is quantified also on a five-level scale, looking at technical, schedule, and cost considerations:

C=1	Minimal consequence to performance, minimal schedule impact
C=2	Minor, tolerable performance impact, able to meet key dates
C=3	Moderate performance impact, minor schedule slip with no impact to key milestones
C=4	Significant performance impact, critical path affected
C=5	Severe degradation in performance, cannot meet key performance parameters, cannot meet key milestones

Those Needs having higher Risk (e.g., when $R=(L^2+C^2)^{1/2}$ exceeds 5) will be considered high-priority Needs and given further consideration for future investment. As a baseline is established with this process, STG will also give consideration to pursuing additional investment classes, such as 'rapid risers', i.e., those Needs whose L or C values may remain low but are quickly increasing in value.

Appendix C

Acronyms

CI	counterintelligence
DNI	Director of National Intelligence
DOE	Department of Energy
DS&T	Director of Science and Technology
FY	fiscal year
IC	Intelligence Community
IPPBE	Intelligence Planning, Programming, Budgeting, and Evaluation
IRAD	independent research and development
KPP	key performance parameter
LDRD	Laboratory Directed Research and Development
NIM	National Intelligence Manager
NIP	National Intelligence Program
NISTC	Director of National Intelligence Science and Technology Committee
ODNI	Office of the Director of National Intelligence
PM	Program Manager
S&T	science and technology
S&TI	scientific and technical intelligence
STG	Science and Technology Group [ODNI]
UCC	Unified Combatant Command
UIS	Unifying Intelligence Strategy(ies)

Appendix D

S&T Portfolio Management

FUTURE CHALLENGES

Mission Needs



National Security Strategy & Other Executive Office of the President Priorities



National Intelligence Manager (NIM) Unified Intelligence Strategies



NIM Campaigns



Program Manager Plans & Others



Unified Combatant Command (UCC) Integrated Priority Lists



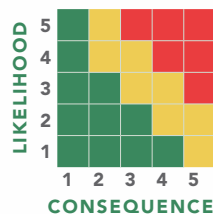
Translation of Mission-Derived Needs and Challenges into S&T Needs



Risk-Based Needs Analysis of S&T Needs



From Landscape



EXISTING INVESTMENTS

IC Element Data Call



National Intelligence Program S&T Portfolio Review



Budget Portfolio Analysis
Level of effort against Tier 1 Technology Domains



ODNI Science and Technology Group-led Identification of Gaps & Investment Opportunities
Director of Science and Technology and Director of National Intelligence Science and Technology Committee members prioritize identified gaps and drive investment recommendations.



S&T INVESTMENT GUIDANCE

New Projects and/or Additional Resources to Address Identified Gaps and Drive Revisions to Mission Needs



Issue Paper



Intelligence Planning Guidance/Consolidated Intelligence Guidance



Congressional Budget Justification Book

UNCLASSIFIED

