Procedural Handbook for NOAA Administrative Order (NAO) 216-115B: Research and Development in NOAA

Table of Contents

NAO 216-115B Procedural Handbook: Research and Development at NOAA

Issuing Office: NOAA Science Council, National Oceanic and Atmospheric Administration (NOAA)

Release Date: 1/25/2023

Explanation of Material Transmitted: This Handbook establishes procedures for the planning, monitoring, evaluation and reporting of the NOAA Research and Development (R&D) Portfolio in support of NAO 216-115B

Filing Instructions:

1. **Remove:** NAO 216-115A, Procedural Handbook, dated: 02/23/2018
2. **Insert:** NAO 216-115B, Procedural Handbook, dated: 1/25/2023

Information: For information on the content of the Handbook, contact the issuing office listed above. To access the Handbook Chapters on-line, use this URL: https://www.noaa.gov/organization/administration/nao-216-115a-research-and-development-in-noaa

Chapter 1: Introduction to the NAO for Research and Development at NOAA (NAO 216-115B) and this Procedural Handbook

A. Purpose

This chapter serves as an introduction for aligning the Procedural Handbook to the NAO on Research and Development in NOAA (NAO 216-115B[1]).

B. Policy Background

NAO 216-115B establishes the principles, policies, and responsibilities by which Research and Development (R&D) throughout NOAA can be continually reviewed, evaluated and rebalanced in light of evolving mission needs, thus allowing the Agency to apply a logical and informed approach to its R&D investment portfolio. NOAA will use this Order to strengthen the quality, relevance, and performance of its corporate R&D portfolio.

This Handbook is established in accordance with NAO 200-3B[2] which specifies that NOAA handbooks and manuals containing policy or procedures be elements of the NAO series, providing in-depth coverage of those subjects so complex or extensive as to benefit from coverage in the form of a handbook or manual (NAO 200-3B §4.03.a).

NOAA handbooks and manuals establishing policy and responsibilities shall be authorized by an NAO and shall have the same force and effect as that NAO (NAO 200-3B §4.03.b).

C. NOAA Research and Development (R&D) Framework

The remaining chapters of this Procedural Handbook provide the details needed to implement NAO 216-115B and address Planning, Monitoring, Evaluation, and Reporting of R&D.

1. Planning

The Planning Chapter provides the details needed to ensure the R&D enterprise is relevant to and optimally aligned with the NOAA strategic plan, research guidance and other relevant documents as appropriate (e.g., annual guidance, Annual Operating Plans (AOP), the Department of Commerce (DoC) Strategic Plan, statutory requirements, etc.). The Planning Chapter sets the context for subsequent chapters; planning and developing appropriate metrics is the basis for monitoring, evaluation, and reporting, such that NOAA's understanding of what and how it is doing is based upon an understanding of what it should be doing and why, including appropriate metrics.

2. Monitoring

Consistent with the principle of Accountability (NAO 216-115B §3.08), and in line with the need to maintain information on NOAA's R&D portfolio (NAO 216-115B §5.06),

[1] NOAA (2022) NAO 216-115B: Research and Development in NOAA. Retrieved from https://www.noaa.gov/organization/administration/nao-216-115a-research-and-development-in-noaa

[2] NOAA (2008): NAO 200-3: The NOAA Administrative Order Series. Retrieved from https://www.noaa.gov/organization/administration/nao-200-3b-noaa-administrative-order-series

the Monitoring Chapter provides the implementation details for collecting and tracking NOAA's R&D project and performance data that are essential to managing NOAA's R&D portfolio, as well as the transition portfolio managed by the Line Office Transition Managers (see NAO 216-105B on Transition of R&D[3]). Relevant enterprise and portfolio metrics will be developed to support the collection and use of monitoring data. Systematic monitoring of NOAA's R&D through a NOAA-wide R&D Database is essential for improving the efficiency and effectiveness of the organization and evaluating and reporting on the R&D enterprise. The data will enable NOAA to make informed investment decisions, optimize the project portfolio, and track advancements in quality, relevance, and performance.

3. Evaluation

The Evaluation Chapter provides the implementation details for conducting the evaluations critical to determining program success in achieving intended outcomes. Evaluations are performance management tools used to inform strategic planning and decision-making regarding execution of future R&D activities, and to report on the performance of NOAA's R&D enterprise. Rigorous independent evaluations are a key resource in determining whether R&D programs are delivering high quality scientific advancements and achieving their intended outcomes. These evaluations will enable policy makers and agency managers to strengthen the Federal science enterprise (OMB, 2009c[4]). NOAA's evaluations comply with Administration (including the Office of Management and Budget (OMB)), Congressional, DoC, and other requirements for evaluation at all levels of execution. The chapter describes periodic evaluations, laboratory/science center/program evaluations, portfolio reviews, and benchmark evaluations.

4. Reporting

The Reporting Chapter provides the details on implementing NOAA's standardized reporting for its R&D enterprise. This reporting is necessary to document the current state of the enterprise, highlight strategic R&D investment needs for the future, and communicate the return-on-investment and overall benefits to society derived from NOAA's current R&D portfolio. This Chapter also provides implementation guidance for the Annual NOAA Science Report.

---

[3] NOAA (2016): NAO 216-105B: Policy on Research and Development Transitions. Retrieved from https://www.noaa.gov/organization/administration/nao-216-105b-policy-on-research-and-development-transitions

[4] OMB (2009): Increased Emphasis on Program Evaluations, Memorandum for the Heads of Executive Departments and Agencies from Peter R. Orzag, Director of the Office of Management and Budget (M-10-01). Retrieved from https://www.whitehouse.gov/wp-content/uploads/2018/10/m10-01.pdf

Figure 1. The cyclical steps of planning, monitoring, evaluation, and reporting are essential to good management of an R&D portfolio.

D. Principles of NOAA Research & Development

The eight principles of NOAA R&D (see NAO 216-115B §3.01) are essential to the successful planning, monitoring, evaluation, and reporting of R&D (Figure 1):

1. Mission Alignment
2. Transitioning R&D
3. Research and Development Portfolio Balance
4. Partnerships
5. Facilities and Infrastructure
6. Workforce Excellence
7. Scientific Integrity
8. Accountability

E. Maintenance of the NAO and this Procedural Handbook

1. Schedule

NAO 216-115B and this associated Procedural Handbook will be periodically reviewed and reconfirmed or revised, as needed. It is recommended that a review should be conducted no more frequently than once every three years and not less frequently than every 5 years.

2. Responsibilities for Maintenance

The NOAA Science Council is responsible for preparing and maintaining NAO

216-115B and for answering questions regarding its provisions or subject matter (NAO 216-115B §1.05).

The NOAA Science Council is responsible for developing, reviewing, approving and promulgating this Procedural Handbook (NAO 216-115B §6.02).

F. Responsibilities

See NAO 216-115B Section 6 for Roles and Responsibilities.

Chapter 2: Planning

A. Purpose

This chapter establishes a framework for the Science Council to conduct corporate planning of the NOAA R&D portfolio, which includes programs, projects, and activities (hereafter referred to collectively as "activities") conducted in NOAA's Line Offices (LOs), including R&D efforts funded by NOAA LOs and conducted externally, and Staff Offices (SOs).

B. Scope

Planning includes strategic planning (i.e., long-term, ultimate goals), implementation planning (i.e., near-term objectives), and execution planning (i.e., annual milestones, performance targets, and resource requests) integrated across NOAA.

The scope shall be limited to the continuum of exploratory and innovative activities commonly referred to as R&D. This shall be inclusive of basic research, applied research, development, and deployment activities (per the definitions in NAO 216-115B and NAO 216-105B, and to the extent that these activities apply to NOAA's portfolio), as well as to the transfer of knowledge and technology created in the conduct of R&D (i.e., transition of R&D per NAO 216-105B).

The NAO and this Procedural Handbook apply to all NOAA R&D activities, internal or external, including R&D conducted by NOAA and sponsored by others (NAO 216-115B§2.01).

C. The Purpose of Planning

To achieve its mission, NOAA must continually strengthen the quality, relevance, and performance of its R&D, and balance its R&D portfolio[5]. The purpose of R&D planning is to establish objectives, priorities, performance expectations, and resource requirements for R&D activities. R&D planning enables consistent and coordinated management of these activities both within and across organizational units, as well as establishes the foundation for assessing the performance of NOAA's R&D enterprise (Figure 2).

The products of planning (i.e., plans) codify and communicate programmatic cause-and-effect, thus providing a structure for monitoring and evaluation. R&D plans can also serve as important tools to communicate the importance and value of NOAA science to the Administration, DoC, the Congress, academia, regulated and user communities, and the public at large.

D. Planning Documents

1. The Department of Commerce (DoC) Strategic Plan

It is typical for the DoC Strategic Plan to be revised every two to four years, or on the occasion that a new Secretary of Commerce is appointed. The DoC Strategic Plan is the top-level guidance document for NOAA R&D.

[5] See the definition of "Portfolio Balance" in Appendix 1.1: Glossary for NAO Procedural Handbook.

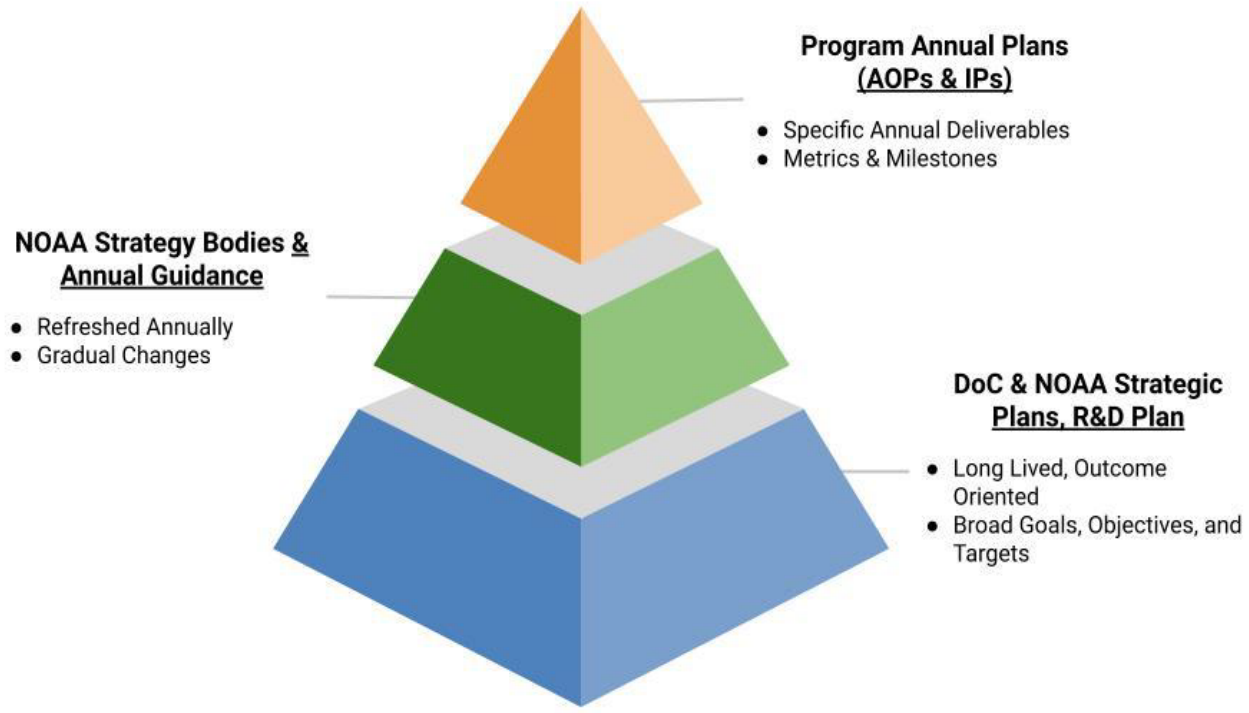

Figure 2. Plans are nested and support the goals, objectives, targets, and milestones of the plans that they are nested under.

2. Other Strategic Plans

Strategic plans establish Missions and Visions for the agency based upon an understanding of the agency's statutory and regulatory duties, Administration priorities, demands and concerns of internal and external stakeholders, and assessments of possible developments in NOAA's external environment over the long-term. Visions are detailed by a set of clearly defined long-term, outcome-oriented Goals. Strategic Plans also establish outcome-oriented Objectives and are updated periodically.

3. The 20-Year NOAA R&D Vision

The 20-Year NOAA Research & Development Vision[6] is a vivid description of the desired outcome of NOAA R&D 20 years from the time of writing. Its purpose is to inspire and direct all NOAA R&D to a common, long-term end point. The R&D Vision is limited to NOAA's R&D activities and their particular outcomes. The NOAA R&D Vision may rely upon guidance from the NOAA Strategic Plan[7]. The Chief Scientist, advised by the Science Council, and, if needed, in consultation with the NOAA Science Advisory Board, shall periodically update NOAA's 20-Year Research Vision (NAO 216-115B

[6] National Oceanic and Atmospheric Administration (2005). NOAA 20 Year Research Vision. Retrieved from https://sciencecouncil.noaa.gov/sites/nrc/Documents/Reduced%20file%20size_20%20yr%20Research%20Vision.pdf

[7] National Oceanic and Atmospheric Administration (NOAA), US Department of Commerce (2022): Building a Climate Ready Nation: NOAA FY22-26 Strategic Plan. Silver Spring, MD. Retrieved from http://noaa.gov/sites/default/files/2022-06/NOAA_FY2226_Strategic_Plan.pdf

§5.03).

4. Other R&D Plans

The Chief Scientist, advised by the Science Council, may develop plans to facilitate alignment of NOAA's R&D with NOAA's strategic plan and the Department of Commerce strategic plan (NAO 216-115B §5.04).

5. Annual Guidance

Annual guidance focuses agency attention on the NOAA Administrator's priorities and identifies fiscal assumptions for planning. The Office of the NOAA Administrator typically prepares annual guidance every year. In the determination of corporate priorities, the Science Council can offer recommendations to the Administrator from the perspective of NOAA R&D enterprise and portfolio.

6. Research and Development Guidance

Each year the Chief Scientist, advised by the Science Council, may issue annual guidance highlighting those areas of R&D that merit special consideration for budget formulation. While issued on an annual basis, this guidance is intended to guide R&D investments on the budgetary time scale of two to five years. As such, there is an expectation that changes to this guidance each year will be gradual, except in the case of external forcing factors.

7. Annual Operating Plans (AOPs)

Each NOAA R&D component is recommended to have an AOP with an explicit R&D section. NOAA Strategy Councils, boards, and committees (and other strategy bodies) with applicable AOPs are recommended to have explicit R&D sections. AOPs at the Line Office level should have an explicit section identifying and discussing R&D milestones.

8. Transition Plans

Transition plans identify the comprehensive activities necessary to transfer a research and development result to operations. Please refer to NAO 216-105B and the respective Procedural Handbook[8] for further guidance on transition plans. Example transition plans can be found on the NOAA Science Council website[9].

E. The Planning Process

1. Strategic Planning

Strategic planning for R&D occurs on a multiannual basis. Strategic R&D plans respond to the NOAA strategic plans and the long-term (20-year) R&D vision by detailing a near-term strategy for the agency's R&D enterprise. The strategic R&D plan objectives and

[8] NOAA (2017): NAO 216-105B: Policy on Research and Development Transitions Procedural Handbook. Retrieved from https://www.noaa.gov/sites/default/files/legacy/document/2020/Mar/Handbook_NAO216-105B_03-21-17.pdf

[9] https://sciencecouncil.noaa.gov/NOAA-R-D-Policies/Example-Transition-Plans

targets should be reflected in the R&D components of the relevant implementation plans.

Strategic plan development should include alignment to other relevant plans within the parent organization and overarching entities and should be developed in coordination with relevant stakeholders (particularly NOAA's operational units). Strategic plans should be informed by portfolio evaluations of NOAA's R&D enterprise, assessments of the possible developments in science and technology, the perceived constituent landscape over the long-term (a.k.a., "futures" scenarios), and include input from the NOAA Science Advisory Board and the public.

2. Annual Planning

Annual planning establishes tactical priorities within longer-term strategies. It typically begins by analyzing the strategic context for NOAA R&D, and how it may have changed over the year. Change can originate externally, such as in scientific or technological capabilities, economic or budgetary context, political or legislative context, environmental conditions, and evolving stakeholder demands. Change can also originate internally, such as recent and historical performance with respect to strategy. Key inputs for annually assessing the strategic context for NOAA's R&D enterprise include evaluations (internal and external) of R&D projects, programs, and portfolios, as well as the NOAA Science Report.

Based on corporate priorities, an understanding of program-level capabilities, and recommendations from program managers, Line and Staff Offices, and cross-Line Office and strategy bodies coordinate to determine R&D portfolio options. This includes setting performance expectations and resource requirements for Implementation Plans (IPs) and AOPs. Performance expectations and requirements serve as a basis for monitoring and evaluation as well as the basis for updates to program- and project-level plans.

Chapter 3: Monitoring

A. Purpose

Consistent with principle of Accountability (NAO 216-115B §3.08), and in line with the need to maintain information on NOAA's R&D portfolio (NAO 216-115B §5.07), this chapter establishes procedures for monitoring NOAA R&D through a project-level corporate database.

B. Policy Background

Monitoring NOAA's R&D portfolio involves tracking NOAA's internally and externally supported R&D projects, including such information as mission alignment, transition pathways, partnerships, facilities and infrastructure, workforce, and performance measures. This chapter focuses on the procedures, requirements, and content for monitoring via the NOAA R&D Database (NRDD; formerly referred to as the Projects Database and Management System, or PDMS).

Corporate participation and implementation of the NOAA R&D Database is encouraged. The NOAA R&D Database provides information that enables NOAA to assess and optimize its R&D portfolio and may be useful for informing other planning activities in NOAA. Systematic monitoring of NOAA R&D is needed to:

1. Collect, track, analyze, and monitor R&D projects and funding;
2. Catalog and track the transition of R&D projects to operations, commercialization, applications, and other uses (R2X) in their various states of readiness levels (RLs);
3. Share information across NOAA's enterprise to improve communication, collaboration, integration, coordination, and planning across NOAA; and
4. Calculate metrics (e.g., from information in NOAA databases) for corporate reporting of performance that can be used to analyze and demonstrate the performance, quality, and relevance of NOAA's R&D projects and the associated programs.

In 2009, NOAA was charged by a position now referred to as the NOAA Chief Scientist to develop an Enterprise R&D PDMS. After extensive development, review, and NOAA-wide engagement, the Science Council (as the former Research Council) voted on September 29, 2016 to implement a NOAA R&D Database. Furthermore, in a memorandum dated December 13, 2016, the NOAA Chief Scientist specifically requested all AAs to fully implement the NOAA R&D Database across all NOAAs R&D units.

C. NRDD Governance

1. Roles and Responsibilities

a. Governance Committee

The NOAA Research and Development Enterprise Committee (RDEC)[10], a working committee under the NOAA Science Council, provides oversight for NRDD. The RDEC serves as a governance body with ultimate responsibility for meeting the goals of

[10] https://sciencecouncil.noaa.gov/About/Committees

the NRDD.

b. NRDD Management Team

The NRDD Management Team manages the overall design and functionality integrity of NRDD from a technical perspective. The NRDD Management Team fulfills high level query requests regarding the portfolio of NOAA's Research and Development Enterprise.

2. Site Access

a. Security

As a U.S. Government database that contains fiscal information, NRDD is restricted by Federal law to NOAA Federal Employees and Contractors only. It is suggested that each NOAA office designate a NRDD Data Enterer to be responsible for collecting information from NOAA scientists and principal investigators at partner institutions. The NRDD Management Team is responsible for ensuring that the NRDD site meets the NOAA IT requirements.

b. Site Requirements & Design

The initial site design requirements were identified by the RDEC and translated to contractual documents. The site design, governed and executed by the NRDD Management Team, is based on requirements and user requests.

c. Site Modifications and Enhancements

Site modifications and enhancements guidance, ideas, and requests are received by the NRDD Management Team. NRDD site enhancements are received via the nrdd.admin@noaa.gov service account, NRDD Monthly User Forum, and the RDEC. Changes to the NRDD are coordinated with the RDEC before being implemented. Site enhancements generally are prioritized in the order received.

3. Data

The NRDD site[11] is available for data entry throughout the year. Data entry may be accomplished either by manual entry one R&D project at a time or by bulk import using the NRDD Import Template. Data may be exported from a database and imported into the NRDD database by using the NRDD Import Template. The NRDD Field Guide provides definitions and guidance to ensure that project entries are consistent across NOAA. NRDD Documents can be found on the NRDD Documents site[12].

a. R&D Project Definition

A project is defined as: a sequence of tasks that must be completed to attain a certain finite output. In the purview of NOAA research and development, a project is further defined as

[11] https://researchprojects.noaa.gov/

[12] https://researchprojects.noaa.gov/Welcome/Information/Documents

a planned effort that develops novel knowledge, or improves upon technology or otherwise aims to describe, predict, or explain some specified phenomena and includes hypothesis-driven research. A project is temporary and has a definite beginning and end. It can be managed by one or more people, depending on the complexity. Programs differ from projects in that programs contain multiple projects, though the definition of program and project will continue to be refined as enhancements are made to the NRDD on how projects can be clustered for oversight and information.

For a project to be included in NRDD, it must meet all of the following criteria:

i. a defined objective(s), final deliverable(s), and output(s);

ii. a defined timeline/endpoint (generally up to 4 years, but can be longer for some projects);

iii. a defined budget for the funded project (one or more of the following):

    a. equipment and materials,
    b. personnel working on the project (FTE time or dollars), and/or
    c. other leveraged resources (e.g., ship or aircraft time);

iv. a single designated Readiness Level at the beginning of the project and expected Readiness Levels at the end of the project (see NAO 216-105B for the definition of Readiness Levels).

Operational systems (e.g., observing systems that are operational)[13] are not considered R&D projects, even if effort and/or funds are spent to maintain these systems, and even if they are generating scientific data. However, each hypothesis-driven endeavor that uses the resulting data to answer a specific scientific question would be entered into the NRDD as its own project. Similarly, any effort to improve upon the operational system technology would be entered as an NRDD project.

b. R&D Data Accountability

The primary NOAA funding office is responsible for entering the project data and ensuring the quality of the data being entered, however the primary funder may delegate project entry to the executing office. Data quality is defined by mandatory field accuracy, field completeness, and field compliance. The NRDD management team can provide guidance and identify areas of potential quality issues but the primary NOAA funding office is ultimately responsible to maintain the quality.

c. Data Fields

The original data fields were specified by the RDEC. All changes to NRDD data fields must be submitted via a change request form. All proposed additions or deletions or changes to the NRDD data fields are to be proposed to the RDEC. The RDEC is

[13] See the definition of "Operations" in NAO 216-105B: Policy on Research and Development Transitions. Retrieved from https://www.noaa.gov/organization/administration/nao-216-105b-policy-on-research-and-development-transitions

responsible for the review and approval of all proposed additions, deletions, or changes to the NRDD mandatory and optional data fields. However, in the situation where the RDEC cannot reach consensus on a proposed addition, change, or deletion to a data field, the issue will then be raised to the Science Council for resolution.

D. Other Monitoring Activities

Performance measures and milestones are monitored over time for use in R&D evaluations (Chapter 4, Section E).

Monitoring data that is used in periodic R&D evaluations (described in more detail in Chapter 4, Section F) also informs corporate R&D monitoring when Line Offices share their Lab/Science Center/ Program reviews with the Science Council.

In capturing and reporting on yearly accomplishments, the NOAA Science Report (Chapter 5) publicly describes an accounting of NOAA's R&D activities.

Chapter 4: Evaluation

A. Purpose

This chapter establishes policy and procedures for evaluating the quality, relevance, scientific performance, and balance of the NOAA R&D portfolio. Scientific evaluations assess the strength and appropriateness of R&D endeavors and make recommendations for improving scientific innovation and output. Scientific evaluations are often a component of programmatic evaluations. Rigorous independent evaluations within a framework of informative performance data connect planning to execution to validate whether government programs are achieving their intended outcomes. Such reviews provide an opportunity to identify what is working well, gaps, issues, emerging items, and how performance can be improved in the future.

B. Policy Background

Evaluation of NOAA's R&D activities will include regular, independent peer reviews, as informed by OMB (2004)[14] and GAO (1999)[15] performed at least every five years, or, if preferred, more frequently. These reviews shall assess R&D activities for the quality of the science, as well as how well the activities meet NOAA's mission needs and/or requirements (i.e., relevance and performance). These reviews shall be separate from and not duplicative of existing reviews for grants, cooperative agreements, contracts, purchase orders, interagency agreements, or project agreements (NAO 216-115B §5.07). Evaluations detailed in this handbook will cover five categories: periodic evaluations, program evaluations (encompassing Programs, Laboratories, Science Centers, and science themes), Ad Hoc evaluations, R&D Progress to Plan evaluations, and NOAA portfolio reviews. All reviews should focus on the quality, performance, and relevance of R&D (see Appendix 2.2).

C. Relationships Among Evaluations

Evaluation activities roll up hierarchically from the individual principal investigator to the corporate level. An overview of R&D evaluations can be found in Table 1.

1. Peer Review is conducted on NOAA research and development.
2. Periodic evaluations track execution progress and inform annual and long term planning activities.
3. Program evaluations examine quality, relevance and performance rolled up to the level of a laboratory, center, program, or science theme.
4. Portfolio reviews incorporate the Program evaluations to examine NOAA-wide performance issues, the relevance of NOAA's R&D enterprise to its strategic and research goals, and the balance of the NOAA R&D portfolio relative to those goals, priorities, and characteristics critical to strategic planning.

Evaluation is an integral component of the strategic planning, execution, and budgeting

[14] OMB (2004): Final Information Quality Bulletin for Peer Review. Retrieved from https://www.federalregister.gov/documents/2005/01/14/05-769/final-information-quality-bulletin-for-peer-review

[15] U.S. Government Accountability Office (GAO) (1999): Federal Research: Peer Review Practices at Federal Science Agencies Vary. Retrieved from https://www.gao.gov/assets/rced-99-99.pdf

processes. Periodic and Program evaluations assess execution relative to IPs, AOPs, and other strategic documents (Chapter 2) and support recurrent NOAA reporting activities (Chapter 5). Program R&D Progress to Plan, and Portfolio evaluations inform future planning efforts (e.g., annual guidance, IPs, and Program and NOAA-wide strategic plans).

Table 1: Overview of R&D evaluations described in the handbook

Evaluation	What is being evaluated?	Purpose	Who conducts evaluation?	Criteria	Relative to which plan?	Methods	How often?
Periodic	LO / Goal current FY execution	Determine the state of execution relative to plans for a given FY (AOP)	PRSS / NEP / NEC	Variable	IP or AOP	Process evaluation	Variable
Laboratory / Science Center / Program	All entities conducting or funding R&D	Evaluate criteria relative to R&D within a Program	Independent review panel	Quality, Relevance, Performance of Science	Program strategic or R&D strategic plan	Outcome evaluation	Every five years
Ad Hoc	Variable	Evaluations outside the normal cycle to address specific topics or science themes	Variable	Variable	Variable	Variable	As needed
NOAA R&D Portfolio Evaluations	NOAA R&D enterprise	Evaluate the critical/ timely priorities and entire R&D portfolio relative to the R&D plan to inform subsequent strategic and R&D plans	NOAA Science Council	Quality, Relevance, Performance, Balance	R&D strategic plan	Process & Outcome evaluations	Every two to four years

D. Review of Fundamental Research Communications

Procedures for review of Fundamental Research Communications (FRC) including, but not limited to, peer-reviewed publications, conference presentations, datasets, R&D-related websites, and other communications, are described in the Handbook to accompany NAO 202-735D.2: Scientific Integrity[16] and the NOAA Framework for Internal Review and Approval of Fundamental Research Communications[17]. NOAA authors are responsible for submitting publications to the NOAA Institutional Repository per NOAA's Plan for Increasing Public Access to Research Results[18].

E. Performance Measurement

[16] NOAA (2021): Procedural Handbook for NAO 202-735D.2: Scientific Integrity. Retrieved from https://www.noaa.gov/sites/default/files/2021-08/Scientific_Integrity_ProceduralHB_NAO_202-735D-2.pdf

[17] NOAA (2016): NOAA Framework for Internal Review and Approval of Fundamental Research Communications to accompany NOAA Administrative Order 202-735D: Scientific Integrity. Retrieved from https://www.noaa.gov /organization/administration/nao-202-735d-2-scientific-integrity

[18] NOAA (2015):NOAA plan for increasing public access to research results : a response to the White House Office of Science and Technology Policy memorandum 'Increasing access to the results of Federal funded scientific research' issued February 22, 2013. Retrieved from https://repository.library.noaa.gov/view/noaa/10169

Performance measurement is integrated into all phases of R&D under this NAO. Performance measures and milestones (also referred to as metrics) are monitored over time and reported periodically for evaluating progress toward achieving objectives set in planning. Performance measurement is essential for good management of R&D, as well as communication of the value of R&D, serving to:

1. Gauge whether R&D is producing desired outputs and achieving desired outcomes on the desired schedule;
2. Act as an early warning system – to identify the need for targeted improvements or adjustments, thereby improving execution;
3. Understand connections and interdependencies among performance targets;
4. Understand the resource requirements and risks (including the risks of not properly resourcing a project);
5. Message to NOAA, DoC, OMB, Congress, the SAB, and others;
6. Quantify and justify Federal budget requests and current programs; and
7. Communicate program goals and achievements.

Where practical and commensurate with the size and importance of the work, performance measures should be developed for key aspects of activities. A variety of topics may be informed by performance measures, such as:

1. R&D achievements;
2. Quality of R&D and products;
3. Relevance of R&D to NOAA mission/goals/objectives;
4. Response to customer/user needs (usage of R&D and products);
5. Efficiency and/or cost benefit analyses;
6. Maturation and output achievements; and
7. Outcome achievements.

Performance measures must include a baseline, an endpoint or target, a unit of measure, and a timeframe to achieve the target(s).They should also include an explanation if the meaning and importance will not be clear to a non-specialist.

Performance measures will be an important part of the evaluation process. It is useful to have a broad set of performance metrics that address multiple levels of NOAA's research and development activities (e.g., milestones, outcome, output, efficiency) and aggregation. These measures should integrate hierarchically. Specific performance measures at the program level (e.g., milestones, distribution of maturation, and resource levels) should contribute to broader measures at the NOAA, DoC, or Federal government level to provide information on broader outcomes.

F. R&D Evaluations

1. Periodic R&D Evaluations

Such reviews often focus on progress toward meeting the performance expectations documented in the IPs and AOPs. They may include evaluating Line Office (LO) performance metrics relative to their targets, such as milestones, performance measures, OMB Government Performance and Results Act (GPRA) measures, and

contributions to the DoC and NOAA Strategic Plans. Many of these monitoring data will be tracked in the NOAA R&D Database (Chapter 3). Current examples include quarterly, mid-year and year-end execution reviews.

2. Laboratory/Science Center/Program R&D Evaluations

A laboratory/science center/program R&D evaluation is conducted by an independent peer-review panel (see Appendix 2.2) and will cover the quality and relevance of the R&D and the performance of the program/laboratory/center conducting that R&D. The primary benchmarks upon which to evaluate these criteria are the NOAA strategic and R&D plans, and their associated derivatives (e.g., IPs, a laboratory strategic plan). As a component of "performance" (see core evaluation criteria below), evaluation of the internal management and administrative components of a program that affects the R&D is required via this mechanism. LOs have the flexibility to expand (but not reduce) the scope of the evaluation per their internal needs.

For purposes of this document, "Program evaluations" shall cover all major internal NOAA entities that conduct or fund scientific research and development: laboratories, science centers, program offices, matrix programs, etc.

Each LO will arrange for evaluations of its Programs on a regular and recurring basis (not less frequently than once every five years). The AA of each LO, or their delegate, is responsible for administering evaluations of each Program. The AA is responsible for appointing and charging the external peer review panel, receiving the review panel's report, making final decisions on actions to be taken as a result of the report, and providing the results of evaluations to the Science Council. Within each LO, the AA may delegate authority for implementing Program evaluations per internal policies; however, authority for the evaluation should not be delegated to the individual responsible for (or residing under) the organization being evaluated. If a required review is past due, the responsible LO will semi-annually brief the Science Council on the plan and status for completing the past-due review. The RDEC will maintain a listing of required reviews and their status, providing updates to the Science Council on a periodic basis.

LOs are tasked to share the findings and pending actions from Lab/Science Center/ Program reviews with the Science Council (in an informational, non-directional or decisional capacity) to inform corporate R&D planning, monitoring, evaluation, and reporting.

3. Ad Hoc R&D Evaluations

Ad hoc evaluations are conducted on an as-needed basis in response to a particular mandate or event. Jurisdiction for these reviews will vary per their unique terms of reference or mandate. Evaluations related to R&D activities should be considered in broader strategic planning initiatives as any other regularly scheduled evaluation would be (e.g., contributing to revisions of the AGM and strategic and R&D plans).

4. NOAA R&D Portfolio Evaluations

a. R&D Progress-to-Plan Evaluations

Progress will be measured and reported relative to the targets established in NOAA's R&D plans and integrated with the relevant, developed logic models. Key questions to consider for core evaluation criteria are included in 4.b R&D Portfolio Reviews.

b. R&D Portfolio Reviews

R&D portfolio review within NOAA enables evaluation of how the current portfolio of R&D projects meets the agency's mission and strategic objectives. Portfolio reviews will evaluate the strategic balance of NOAA's R&D portfolio (e.g., risk, maturity) and progress toward achieving the objectives presented in NOAA R&D plans (e.g., a strategic R&D plan, annual guidance, etc.) (Appendix 2.3). NOAA will conduct a portfolio review periodically, depending on the frequency of which the NOAA plans are revised. Reviews should precede and inform the formulation of the next strategic plan and R&D plan.

The Science Council Chair is responsible for administering a Portfolio review, and Science Council members representing each LO are responsible for contributing the data necessary to enable the review. The review will include developing a final report that will inform current strategic planning and the next iteration of NOAA's R&D plan. The Science Council chair shall deliver the final report to and brief NOAA senior leadership.

The core evaluation criteria will be established by the content in the NOAA R&D plan. Key questions to consider include:

a. Has NOAA made expected progress toward achieving its R&D plan objectives? If not, why; and how can this be improved?
b. Relevance: Is the current set of NOAA R&D portfolio priorities relevant to its mission, strategic plan, administrator priorities, and the state of science and technology? If not, how should priorities be realigned?
c. Portfolio Balance: Is the balance of the R&D portfolio—the criteria and procedures to be determined for conducting the review—aligned to expectations in the relevant NOAA strategic R&D plan?

G. External Partnership Program Evaluations

External partnership programs refer to those non-NOAA organizations that have a formalized institutional relationship with NOAA and receive NOAA funding to conduct R&D or administer grant programs. Examples include Cooperative Institutes[19], Cooperative Science Centers, and State Sea Grant programs.

In the absence of evaluation/review guidance specified in the grant, cooperative agreement, contract, purchase order, interagency agreement, or project agreement, scientific component evaluations shall cover the quality and relevance of the scientific R&D and the performance of these non-NOAA organizations conducting that R&D. Scientific component evaluations shall cover the quality and relevance of the scientific R&D and the performance of these non-NOAA organizations conducting that R&D. The primary benchmarks upon which to evaluate these criteria are the NOAA strategic and R&D plans, their associated derivatives, and other

[19] NOAA (2021). NAO 216-107A: NOAA Policy on Cooperative Institutes. Retrieved from https://www.noaa.gov/organization/administration/nao-216-107-noaa-policy-on-cooperative-institutes

requirements for evaluation, as set forth in the charter and financial agreements between the program and NOAA. Evaluations shall be conducted per the schedule set forth in the partnership program agreement.

Responsibilities:

1. The Director of the office overseeing the partnership program (e.g., the Sea Grant Director), or the appropriately charged FACA committee (i.e., the convening authority), is responsible for administering evaluations, appointing review team members, receiving the final review team report, and approving the partnership program's response plan (if required).
2. The partnership program director (e.g., Maine Sea Grant Director) shall be responsible for organizing and conducting the evaluation and responding to and implementing recommendations.

Chapter 5: Reporting

A. Purpose

This chapter establishes procedures for reporting on the NOAA R&D Portfolio. In conjunction with the Planning, Evaluation, and Monitoring chapters of the Handbook, implementation of this chapter is designed to provide a representative picture of NOAA's R&D Portfolio, based on the NOAA R&D Vision Areas, for use in planning and budget development, as well as to provide information to external partners, stakeholders, and the interested public.

B. Reporting Procedures

1. Scope

a. At a minimum, NOAA will prepare, complete, and disseminate an annual NOAA Science Report to describe the quality, relevance, and performance of the NOAA R&D Portfolio.
b. The NOAA Science Council (Science Council) and/or the NOAA Chief Scientist may also request additional reports (e.g., AOP quarterly reporting and prior year R&D accomplishments for the NOAA Budget Blue Book) throughout the year to provide a more complete picture of the R&D Portfolio.

2. Schedule

a. End-of-year reporting should be completed in time to inform both the budget cycle and the next planning cycle.
b. Interim reporting will be completed in the timeframe requested by the Science Council.

3. Responsibilities

a. The NOAA Chief Scientist is the NOAA Science Council Chair and will be responsible for oversight of NOAA's R&D reporting activities. In the absence of a NOAA Science Council Chair, the NOAA Science Council Vice Chair fulfills this role.
b. The Science Council will oversee and approve all R&D reporting products.
c. The Science Council, in coordination with LO Communications staff, will be responsible for gathering and reporting annual R&D accomplishments to NOAA Budget for development of the Blue Book.
d. LO Chief Financial Officers will be responsible for gathering and reporting R&D financial information for the development and defense of the NOAA budget.

C. The NOAA Science Report

1. Scope

a. The primary audience of the NOAA Science Report encompasses NOAA leadership, the Department of Commerce, the Office of Management and Budget, the Office of Science and Technology Policy, Congress, NOAA partners and stakeholders, and the public; consequently the report should provide a high-level snapshot, written in clear,

minimally-scientific language.

b. The report will focus on a single fiscal year (FY), but also include limited coverage of other years, in order to adequately capture the long-term nature of R&D.
c. The NOAA Science Report will provide selected scientific accomplishments to highlight specific priority areas outlined in guidance memoranda and strategic plans.
d. The data gathered and presented in this report constitute the minimum level needed to provide a useful reporting of the adequacy of quality, relevance, and performance.

2. Responsibilities

The responsibilities for the NOAA Science Report are as follows:

a. The RDEC on behalf of the Science Council is accountable for completion and submission to NOAA Leadership and partners.
b. The Science Council will review and clear the document.
c. Representatives from NOAA's Line Offices and Staff Offices will provide necessary information to the Science Council staff as requested.

3. Content

The content of the NOAA Science Report may include:

a. A short message from the Chief Scientist
b. A snapshot of NOAA's R&D and engagement that provides a high-level overview of NOAA's R&D portfolio logic addressing questions such as:
    i. Why NOAA invests in R&D,
    ii. What kind of R&D does NOAA support
    iii. What principles guide NOAA R&D
c. Recent scientific accomplishment highlights
d. NOAA-wide bibliometric data
e. NOAA's Scientific Workforce
f. Scientific Awards and Achievements
g. Scientific Integrity
h. Laboratory and Program Science Reviews

4. Distribution

The final NOAA Science Report may be made broadly available via:

a. A briefing to NOAA Leadership by the Chief Scientist
b. A briefing to the NOAA Science Advisory Board by the Chief Scientist
c. Posting to the NOAA Science Council website and permanent archival in the NOAA Institutional Repository.
d. Email distribution of the NOAA Science Report link on the Science Council website to all of NOAA.
e. Email distribution of the NOAA Science Report link on the Science Council website to key NOAA R&D partners and stakeholders.
f. Seminar series highlighting select R&D accomplishments from the Science Report.

Appendix 1.1: Glossary for NAO Procedural Handbook

Activity: Activities are the processes through which NOAA uses assets to generate outputs. NOAA's activities represent what NOAA needs to do in order to achieve its corporate strategic objectives.

Chief Scientist: A Presidential appointee serving as senior scientist for NOAA. The Chief Scientist drives policy and program direction for science and technology priorities and serves as the Science Council Chair. If the Chief Scientist position is vacant, these responsibilities fall under the individual performing the duties of the Chief Scientist.

Conflict of Interest: Any financial or other interest which conflicts with the service of the individual on the review panel because it: (1) could significantly impair the individual's objectivity or (2) could create an unfair competitive advantage for any person or organization.

Core Evaluation Criterion: A major category by which the research and development program is judged (e.g., quality, relevance, performance).

Development: The systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes (Organization for Economic Co-operation and Development [OECD], 2015; NAO 216-115B §4.02).

Efficiency: Achieving the desired objective while minimizing the expenditure of resources, i.e., time, funding, labor, and materials/equipment.

Enterprise: A purposeful undertaking that generally requires the coordination of different organizations, types of expertise, and capital. Alternatively, the cross-cutting science, administrative, engagement, infrastructure, and management functions that support NOAA's distinctive capabilities.

Evaluation: A study conducted periodically or on an ad hoc basis to assess how well a program is working against specified benchmarks or standards. (NAO 216-115B §4.02).

External Research and Development (R&D): R&D conducted by any entity outside of NOAA (e.g., Cooperative Institute, academic institution, state or local government entity, other federal agency, etc.; NAO 216-115B §4.04).

Goal: Goals specify the components of NOAA's vision, translating the vision into a limited number of high-level results that NOAA will seek to achieve. NOAA's strategic goals are outcome-oriented—that is, they specify future social, economic, and environmental conditions that the agency is committed to achieving, and how society will benefit from NOAA's success. The timeframe for NOAA's strategic goals is multi-decadal.

Internal Research and Development (R&D): R&D conducted at NOAA facilities and/or by NOAA employees, regardless of funding source (NAO 216-115B §4.05).

Mission: NOAA's mission summarizes the agency's fundamental mandates and responsibilities. It is a succinct and distinctive statement of what NOAA does. The mission statement

encapsulates the set of statutory requirements that drive NOAA's functions, and is assumed to be stable over the planning period.

NOAA Invention: A new, useful process, machine, manufacture or composition of matter, or any new and useful improvement to a process, machine, manufacture or composition of matter, developed by NOAA (NAO 216-105B).

Objective: Objectives further describe strategic goals or enterprises by detailing the societal, environmental, or organizational benefits that NOAA seeks to achieve in the five year time frame. Objectives toward goals are outcomes for society and the environment, whereas objectives toward enterprises are outcomes for NOAA to achieve its goals. Objectives should be specific, measurable, attainable, realistic, and time-bound (SMART).

Peer Review: A widely used, time-honored practice in the scientific and engineering community of judging and potentially improving a scientific or technical plan, proposal, activity, program or work product through documented critical evaluation by individuals or groups with relevant expertise who had no involvement in developing the object under review (NRC, 2000; NAO 216-115B §4.09).

Performance: Assessing performance involves evaluating the effectiveness and efficiency with which tasks are executed, as well as the adequacy of the leadership, workforce, and infrastructure needed to achieve the designated goals. This evaluation criterion considers how R&D activities are progressing relative to milestones and benchmarks. Performance evaluation also includes all aspects of how R&D is conducted, including all components that feed into creating a high quality R&D enterprise (e.g., leadership, innovation, planning, monitoring, efficiency and effectiveness of processes, resource utilization, reporting).

Portfolio: A set of investments held by an organization (or an individual, program, lab, etc.) that yields benefits and has cost and associated risks. Through management of its R&D portfolio, NOAA can explicitly assess the tradeoffs among competing projects in terms of their benefits, costs, and risks.

Portfolio Balance: The proportion of R&D projects (or resources) in a portfolio that are allocated among categories (e.g., among strategic goals, topics, risk, research horizon, investment). Such an analysis is used to evaluate whether R&D priorities are being adequately addressed.

Program: Throughout this Procedural Handbook, the term "Program" is inclusive of laboratories, science centers, program offices (e.g., OAR's Weather Program Office), and matrix organizations (e.g., Coral Reef Conservation Program).

Project: A project is defined as a sequence of tasks that must be completed to attain a certain finite output. In the purview of NOAA research and development, a project can be further defined as a planned effort that either develops or improves upon a system, process, product, service, or tool, or is hypothesis-driven research. A project is temporary and has a definite beginning and end. It can be managed by one or more people, depending on the complexity. Programs differ from projects in that programs contain multiple projects (See Appendix 2.1.§4.a for additional information on R&D Projects).

Quality: This refers to the merit of R&D within the scientific community. Assessing the quality of scientific and technical work done involves the time honored tradition of peer review. Bibliometric data on peer-reviewed publications and citations, as well as awards and other professional recognitions, are critical to understanding the R&D quality of individuals and organizations, particularly for benchmarking against other organizations of similar size and scope. Quality is measured by the novelty, soundness, accuracy, and reproducibility of a specific body of R&D, as represented by the outputs (i.e., products) delivered by the project or program. This evaluation criterion establishes the relative merit and repeatability of the R&D or program relative to that of contemporaries in the community of practice, whether the scientific methodologies were appropriate, adhered to, and thoroughly documented.

Relevance: This refers to the value of R&D to users beyond the scientific community. Relevance includes not only hypothetical value, but actual impact. Assessing NOAA's relevance involves measuring the broader benefits of the work. It answers the question, "What would not have happened if R&D did not exist, and how much would society have missed?" The impact of R&D can be realized through the application of scientific knowledge to policy decisions, through the improvement of operational capabilities at NOAA's service lines, or by patenting and licensing of inventions for commercial use. Relevance is measured by how well a specific body of R&D supports NOAA's mission and the needs of users and the broader society. At a minimum, this evaluation criterion establishes how the R&D aligns with the strategic plan and priorities of the agency, as demonstrated by links to validated agency requirements, key legislative mandates, administration priorities and societal benefits. Relevance is more reliably established by evidence of actual impact and retrospective (or concurrent) analysis of how R&D causes measurable improvements in operational performance and social and economic value.

Research:

a) Basic Research: Experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts. Basic research may include activities with broad or general applications in mind, such as the study of how plant genomes change, but should exclude research directed towards a specific application or requirement, such as the optimization of the genome of a specific crop species (OMB Circular No. A-11, 2021; NAO 216-115B §4.12).
b) Applied Research: Original investigation undertaken in order to acquire new knowledge. Applied research is, however, directed primarily towards a specific practical aim or objective (OMB Circular No. A-11, 2021; NAO 216-115B §4.12).

Strategic plan: A plan that identifies what NOAA should produce in the future (i.e., outputs), and why those are important (i.e., outcomes). Distinguishing between outcomes and outputs gives flexibility to change agency activities while staying true to its overall purpose.

Strategy: Explains what the agency intends to do and why it intends to do it. It relates a statement of output (e.g., mission, functions or activities) to a statement of outcome (e.g., vision, long-term strategic goals or objectives) to succinctly convey NOAA's fundamental purpose, direction, and value to society.

Vision: An envisioned future state of society and the environment that, implicitly, cannot be achieved without NOAA. The vision describes long-term success in terms of the value that NOAA will generate for society—in effect, why the agency exists. The timeframe for NOAA's

vision is multi-decadal.

Appendix 1.2: Abbreviations

AA	Assistant Administrator
AGM	Annual Guidance Memorandum
AOP	Annual Operating Plan
CIO	Chief Information Officer
CRADA	Cooperative Research and Development Agreement
CS	NOAA Chief Scientist
DoC	Department of Commerce
FACA	Federal Advisory Committee Act
FY	Fiscal Year
IP	Implementation Plan
LO	Line Office
NAO	NOAA Administrative Order
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRDD	NOAA Research and Development Database
OAR	Office of Oceanic and Atmospheric Research
OMB	Office of Management and Budget
R&D	Research and Development
RDEC	Research and Development Enterprise Committee
SAB	NOAA Science Advisory Board
SBIR	Small Business Innovation Research
SC	NOAA Science Council
SO	Staff Office

Appendix 2.1: Evaluation Descriptions for Quality, Relevance, and Performance of NOAA Research and Development Programs

The following criteria descriptions are guidelines for developing policies in LO-specific implementation plans. Standard criteria listed below can be used to establish the assessment baseline "Meets Expectations." Standard criteria for meeting expectations can be augmented with additional base expectations as appropriate. Not all evaluation questions listed below will be appropriate for every review.

A. Quality

Quality refers to the merit of R&D within the scientific community. Assessing the quality of scientific and technical work involves the time honored tradition of peer review. Bibliometric data on peer-reviewed publications and citations, as well as awards and other professional recognitions, are critical to understanding the R&D quality of individuals and organizations. Measuring quality is particularly useful for benchmarking R&D at NOAA against other organizations of similar size and scope.

Quality is measured by the novelty, soundness, accuracy, and reproducibility of a specific body of R&D, as represented by the outputs (e.g., products) delivered by the project or program. This evaluation criterion establishes the relative merit and repeatability of the R&D or program relative to that of contemporaries in the community of practice and whether the scientific methodologies were appropriate, adhered to, and thoroughly documented. An example rubric of evaluating quality can be found in Table 2.

Criteria for Meeting Expectations

- Program scientists and leadership are recognized for excellence through collaborations, R&D accomplishments, and national and international leadership positions.
- Programs have clear guidelines to ensure the quality of R&D products, including peer review, scientific integrity, data quality, and data management.
- Each Program may have additional criteria, as appropriate.

Evaluation Questions to Consider

- Does the Program conduct (or oversee/fund) preeminent R&D? Are the scientific products and/or services meritorious and significant contributions to the scientific community?
- How does the quality of the Program's R&D rank among programs in other U.S. Federal agencies? Other science agencies/institutions?
- Do Program researchers demonstrate scientific leadership and excellence in their respective fields (e.g., through collaborations, R&D accomplishments, externally funded grants, awards, societies)?
- (If applicable) What is the quality of outreach programming and products? How is the quality of communications and education programs maintained/improved?

Table 2: Example rubric for evaluating quality. *Work Product Areas (Publications, Technology

Development, Data Contributions, Outreach and Communications) - Not all of the work product areas are applicable to all labs/programs. Some labs may have lower publication rates but high transition rates. Reviewers should indicate the 2 to 4 work product areas on which they believe the lab/program should be scored for quality.

QUALITY Element	Needs Improvement	Satisfactory	Exceeds Expectations	Highest Performance
Novelty	Scientific products are duplicative.	Scientific products add to the field.	Scientific products contribute significantly to the field.	Scientific products are breakthrough advancements.
Soundness, accuracy, and reproducibility	Science produced is not sound, accurate, or reproducible.	Science produced is sound, accurate, and reproducible.	Science produced exceeds expectations in soundness, accuracy, and reproducibility.	Science is top ranked among R&D intuitions.
Technology Development*	Few or no technologies (e.g., observing systems, information technology, numerical modeling algorithms) transferred to operations / application.	Multiple technologies transferred to operations / application and assessment shows positive impacts.	Multiple technologies transferred to operations / application and assessment shows significant positive impacts.	Numerous technologies transferred to operations / application and assessment shows transformational impacts.
Data Contributions*	Little contribution to data systems or poor quality, inaccurate, or inaccessible data.	Contributions of data streams and involvement in developing databases that are quality controlled to ensure accuracy, precision, interoperability, and accessibility.	Prior column plus contributions are numerous and significant.	Shows leadership in developing or contributing to data streams with high impact to society.
Outreach and Communications*	Little outreach is conducted, communications are unclear.	Outreach programs and products, communications, and education programs fulfill basic needs.	Outreach exceeds expectations.	Outreach and education results in transforming public behavior.
Scientists are Leaders in their Fields	Researchers are not represented in any national or international leadership positions.	Researchers participate actively in national and international organizations but do not have formal leadership positions.	Researchers in national and international leadership positions.	Numerous researchers in national and international leadership positions.
Awards and Recognitions	Scientific work and researchers have not received awards or other forms of recognition.	Scientific work and researchers have received awards / recognition.	Scientific work and researchers have received multiple, prestigious awards / recognitions.	Scientific work and researchers have received numerous, prestigious awards / recognitions.

The following Indicators of Preeminence may help assess these questions:

- Bibliometric representation of scientific literature output:
    - A Program's total number of refereed publications per unit time, per scientific

Full Time Equivalent staff (FTE), and/or per dollar invested.
    - The number of citations for scientific staff by individual or some aggregate.
    - There are other bibliometric methods that may be more appropriate for program evaluation. Librarians from the NOAA Central Library in particular recommend percentile analysis though other methods found in the Chief Scientist's Annual Report may also be appropriate. The program should work directly with NOAA Library staff to tailor bibliometric analyses to their needs.
- Technologies transferred to operations/application (e.g., observing systems, information technologies, numerical modeling algorithms).
- R&D products, information, and services delivered to and used by stakeholders
- Patents, Cooperative Research and Development Agreements (CRADAs), and other activities with industry.
- Collaborations with national and international R&D groups, both inside and outside of NOAA, as well as reimbursable support from non-NOAA sponsors.
- Contributions of data and expertise to national and international databases, programs, and state-of-science assessments.
- Service of individuals to technical and scientific societies (e.g., journal editorships, boards or executive-level offices), U.S. interagency groups, international R&D-coordination organizations, international quality-control activities (to ensure accuracy, precision, inter-comparability, and accessibility of global data sets).
- Memberships or fellowships in prestigious science organizations (e.g., National Academies of Sciences or Engineering, American Meteorological Society, American Geophysical Union, or American Association for the Advancement of Science).
- Awards or other recognition received by groups and individuals for R&D, application, and/or service.

B. Relevance

Relevance refers to the value of R&D to users beyond the scientific community, including hypothetical value and actual impact. Assessing NOAA's relevance involves measuring the broader benefits of the work, answering the question, "What would not have happened if R&D did not exist, and how much would society have missed?" The impact of R&D can be realized by applying scientific knowledge to policy decisions through improving operational capabilities at NOAA's service lines, or by patenting and licensing inventions for commercial use.

Relevance is measured by how well a specific body of R&D supports NOAA's mission and the needs of users and the broader society. At a minimum, this evaluation criterion establishes how the R&D aligns with the strategic plan and priorities of the agency, as demonstrated by links to validated agency requirements, key legislative mandates, administration priorities and societal benefits. Relevance is more reliably established by evidence of actual impact and retrospective (or concurrent) analysis of how R&D causes measurable improvements in operational performance and social and economic value. An example rubric of evaluating relevance can be found in Table 3.

Table 3. Example rubric for evaluating relevance.

RELEVANCE Element	Needs Improvement	Satisfactory	Exceeds Expectations	Highest Performance

Mission Linkage	R&D only weakly linked to the NOAA mission.	R&D linked to the NOAA mission.	R&D strongly linked to the NOAA mission.	R&D achieves key aspects of the NOAA mission.
Strategic Plan Linkage	R&D only weakly linked to OAR and lab / program strategic plans.	R&D linked to OAR and lab / program strategic plans.	R&D strongly linked to OAR and lab / program strategic plans.	R&D achieves key aspects of OAR and lab / program strategic plans.
Value to Society	R&D does not address existing or future societally relevant needs.	R&D addresses societal needs.	R&D is applied to policy decisions, improves operational capabilities of NOAA's service lines, and/or results in inventions for commercial use.	R&D improves important policy decisions, revolutionizes operational capabilities, and/or results in transformational inventions for commercial use.
Responsiveness to Stakeholder Needs	Lab / program develops products intended to meet stakeholder needs but products do not meet needs.	Some efforts to work with stakeholder needs but these are not consistent throughout the activity area.	Lab / program builds trusted relationships with stakeholders and develops products that meet their needs and exceed expectations.	Lab / program continuously engages with stakeholders to deliver solutions with high impact to stakeholders and society.

Criteria for meeting expectations:

- The R&D enterprise of the Program is tied to NOAA's mission, Strategic Plan, and R&D Plan, and is of value to the nation.
- The Program is effective and efficient in delivering products/outputs to applications, operations or users.
- Current, desired outcomes can be traced back to R&D that was instrumental in realizing those outcomes
  Return on investment, where "return" can be performance improvement (activities and outputs) and value to stakeholders (outcomes)

Evaluation Questions to Consider:

- "What would not have happened if the R&D did not exist, and how much would society have missed?"
- How well do R&D activities address issues/areas identified in the NOAA strategic and research plans or other policy or guiding documents?
- Do the R&D activities address existing (or future) societally-relevant needs (national and/or international)? Are there R&D topics relevant to national needs that the Program should be pursuing, but is not? Are there R&D topics in NOAA, LO, or Program plans that the Program should be pursuing, but is not?
- Are users/customers engaged to ensure the relevance of the research?
- Do program assessments address the alignment of the R&D portfolio with the unit's and NOAA's mission?

C. Performance

Performance refers to the effectiveness and efficiency with which R&D activities are organized, directed, and executed. Assessing performance involves evaluating the effectiveness and

efficiency with which tasks are executed, as well as the adequacy of the leadership, workforce, and infrastructure needed to achieve the designated goals. This necessarily involves understanding the quality of management, including interaction with stakeholders, clear articulation of strategic direction, as well as development and management of an R&D portfolio appropriately balanced across objectives, dimensions, and intended applications.

Performance is measured by both effectiveness (the ability to achieve useful results) and efficiency (the ability to achieve quality, relevance and effectiveness in a timely fashion and with little waste). This evaluation criterion considers how R&D activities are progressing relative to milestones and benchmarks as well as all aspects of how R&D is conducted, including all components that feed into creating a high quality R&D enterprise (e.g., leadership, innovation, planning, monitoring, efficiency and effectiveness of processes, resource utilization, reporting). An example rubric of evaluating relevance can be found in Table 4.

Criteria for Meeting Expectations:

- The Program has clearly documented scientific objectives and strategies through strategic and implementation plans (e.g., AOP) and a process for evaluating and prioritizing activities.
- The Program management functions as a true team and continuously strives to improve the operation of the Program.
- The Program demonstrates effectiveness in completing its established objectives, milestones, and products.
- The Program strives to increase efficiency (e.g., through leveraging partnerships).

Evaluation Questions to Consider:

R&D Leadership and Planning

- Does the Program have clearly defined and documented scientific objectives, rationale, and methodologies for key projects and a selection process for new projects?
- Does the Program have an evaluation process for R&D projects: selecting / continuing those projects with consistently high marks for merit, application, and priority fit; ending projects; or transitioning projects?
- Does the Program have the leadership and flexibility to respond to unanticipated events or opportunities that require new R&D and outreach activities (i.e. time and resources)?
- Does the Program provide effective scientific leadership to and interaction with NOAA and the external community on issues within its purview?
- Does the Program management function as a team and strive to improve operations?
- Has the Program effectively responded to and/or implemented previous formal recommendations?

Table 4. Example rubric for evaluating performance. *Not relevant for programs undergoing their first review.

PERFORMANCE Element	**Needs Improvement**	**Satisfactory**	**Exceeds Expectations**	**Highest Performance**
Leadership & Management	Management does not function as a	Management functions as a team	Prior column plus leadership nurtures	Prior column plus leadership

	team, work to improve operations, or foster culture conducive to achieving mission.	and works to improve operations. Management fosters diversity, equity, and inclusion.	organizational culture that supports creativity and maximizes staff morale and productivity. Lab / program implements effective succession planning.	demonstrates visionary thinking and flexibility in responding to emerging needs, capabilities and unanticipated events. Leadership serves as a model for other organizations.
Strategic Planning	Lack of lab / program strategic plan, lack of effective process for planning R&D.	Objectives documented in lab / program strategic plans. Lab / program has a process for evaluating and prioritizing activities.	Prior column plus lab / program planning process results in selecting / continuing those projects with consistently high marks for merit, application, relevance, and priority fit.	Prior column plus lab / program maximizes strategic planning to drive results. Serves as a model for other organizations.
Progress towards performance targets and milestones	Key performance targets and milestones in AOP missed without explanation, or AOP non-existent.	Meaningful, timely progress towards performance targets and milestones in AOP. Key products delivered. Effective project management.	Prior column plus targets and milestones in AOP are challenging and are met or exceeded in most cases.	Prior column plus lab / program performance substantially advances NOAA goals well beyond expectations.
Efficiency	Financial, staff, and/or time resources not used wisely.	Lab / program operates with efficiency (efficient use of financial resources, workforce, time).	Prior column plus leadership deftly navigates planning and budgeting processes at the lab / program, OAR, and NOAA levels as well as with external partners to maximize mission achievement.	Prior column plus lab / program uses novel efficiencies and/or partnerships to achieve mission with fewer resources than expected.
Recommendations from Previous Review Implemented*	Lab / program has not responded to recommendations from previous science reviews.	Lab / program has responded to and/or implemented most recommendations from previous science reviews.	Lab / program has responded to and/or implemented all recommendations from previous science reviews in a way that exceeds expectations.	Prior column plus lab / program leveraged prior review to spur significant growth and progress.
Managing Transition of Research to Applications	Lab / program fails to transition any R&D into application.	Lab / program transitions R&D into applications effectively.	Prior column plus transitioned products exceed expectations of users.	Prior column plus transition management is a model for others.

- Do program plans reflect a deliberate and appropriate balance across the spectrum of R&D dimensions (e.g., time horizon, risk level, degree of change, and driver of change)?
- Do program assessments address the unit's R&D portfolio balance with respect to: strategy, time horizon, risk level, degree of change, driver of change, uniqueness to NOAA, how conducted, output type, and engaging other disciplines?
- Who designs and manages the assessment? What are the criteria for ensuring the credibility and validity of the assessment?

Program Efficiency and Effectiveness

- Does the Program execute its R&D in an efficient and effective manner, given the Program's goals, resources, and constraints? Are R&D investments being made in the right places (effectiveness)? Are the most economical R&D investments being made (efficiency)?
- Are R&D projects on track and meeting appropriate milestones and targets? If not, why, and how can effectiveness be improved?
- How well integrated is the work with NOAA's planning, budgeting, execution, and evaluation processes?
- Is the overall level of support provided by NOAA sufficient for efficient and effective operations? Are there institutional, managerial, resource, or other barriers to the team working effectively?
- Is the Program leveraging relationships with internal and external collaborators and stakeholders to maximize R&D outputs? Leveraging internal and external funds?
- Are human resources adequate to meet current and future needs? Does the Program provide professional development opportunities to its staff?
- Is infrastructure sufficient to support high quality R&D outputs?

Transition of R&D to Operations/Applications/Users

- Does the organization comply with NAO 216-105B on transition of R&D, as well as the associated Procedural Handbook and relevant LO policies supporting the NOAA policy?
- Does the organization have a process for identifying its stakeholders and customers?
- How well is the transition/dissemination of R&D to applications, operations and/or information services planned and executed?
- Does the Program's portfolio have an appropriate balance between transition and non-transition R&D?
- Has the Program defined who its stakeholders and end users are? Does it provide sufficient interactions/communication? Are end users of the R&D involved in the planning and delivery of applications and/or information services? Are they satisfied?

Appendix 2.2: Requirements for Peer Review Panel

A. General Guidance

If peer review panels are used (e.g., for evaluations), the responsible authority for the evaluation (e.g., Science Council Chair, AA, etc.) should ensure diverse representation of distinguished and expert scientists, science administrators, and stakeholders who are qualified to evaluate the quality, relevance, and performance of the science covered. Each member of the review panel should be a highly reputable expert in the field that is the subject of his/her review; familiar with the applied nature of science that supports an agency's mission and review criteria for Federal R&D programs; experienced in working groups and review panels; and free from any conflict of interest (perceived or otherwise). If NOAA employees are considered for the review panel, they should be employed by a different LO or Financial Management Center (FMC) and have no vested interest in the work within the Program. The diversity of review panels is critical to ensuring that there is a variety of backgrounds and perspectives applied to panel recommendations.

For those Programs with Federal Advisory Committee Act (FACA) committees, the AA should charge that committee with conducting the science evaluation using the guidelines established in this policy, unless elements of this policy fall outside the terms of reference for the committee. The committee should discharge its duties in compliance with FACA and other relevant statutes.

Reviewers should have no financial or professional conflict of interest with the Program being evaluated and must submit a conflict of interest disclosure form prior to participating.

The panel must be chaired by a Federal employee to comply with the FACA, and the individual should also be from outside NOAA to avoid conflicts of interest. Per these guidelines, the panel's final report must summarize panelists' individual findings, rather than seek consensus from the panel. Alternatively, a chair who is not a Federal employee can provide a summary report of review proceedings along with the individual review reports from each panelist.

B. Implementation

Materials presented at the review should allow review panelists to effectively evaluate the Program. Review panelists must be provided with summaries of Program scope and R&D activities, access to project information in the NOAA R&D Database[20] (Chapter 3), any relevant R&D evaluations that have been completed in the period prior to the Program evaluation, access to indicators of preeminence and performance measures, and other appropriate documentation.

LOs should develop general procedures for organizing and conducting Program evaluations. Discretion for who will organize and plan an evaluation is left to the AA, though convening authority rests with the AA.

C. Reporting

[20] The project-level information available in the NRDD can be prepared by the program itself by using the NRDD to retrieve the data they need. For help with the NRDD, programs should contact the NRDD Director.

1. Oral Report

Before the end of the evaluation, the panel must report on their preliminary findings and recommendations to Program, LO, or NOAA leadership (as appropriate).

2. Written Report

a. Reviewers will provide individual evaluations of the topic they are assessing. Evaluations should address what is working well and what needs improvement, along with a list of recommendations. The Federal chairperson will combine individual reports into a summary report for submission to the AA. This report shall not be a consensus report, except where the committee is a FACA-compliant oversight group.

b. The summary report should include at a minimum: an executive summary; an introduction; evaluations and recommendations on quality, relevance and performance by topic; a table or bulleted list of all recommendations; a conclusion highlighting the final assessments.

c. Assessment: Each review panelist may provide a rating for each Program topic evaluated. These ratings may be noted in the final summary report. The panelists may use the following ratings:

   i. Exceeds Highest Expectations – Program goes well beyond expectations and is outstanding in all areas.
   ii. Exceeds Expectations – In general, Program goes beyond what would be required to simply meet expectations.
   iii. Meets Expectations – In general, Program meets, but does not exceed expectations.
   iv. Needs Improvement – In general, Program does not reach expectations. The reviewer will identify specific problem areas that need to be addressed.

d. The review panel chairperson shall provide a final report within 60 days of the end of the review.

3. Program Response

The Program shall develop and submit to the AA or Science Council Chair a formal response to the Review Panel Final Report within 90 days of receiving it. The purpose of the response plan is to describe how the Program intends to respond to the recommendations provided by the review panel. For each recommendation, the Program should indicate what actions they plan to take to implement it, a champion, start and completion dates, and any notes on status. If it is not possible or advisable to implement any particular recommendation, the response plan should indicate why. The response should include further clarifying information where necessary. The AA or the Science Council Chair must approve the Review Panel Final Report and the Program Response.

4. Program Final Report

The Program shall report back to the AA or Science Council Chair as appropriate on completed actions from the response report. The report should include at a minimum: an introduction, the bulleted or tabular list of recommendations and completed actions, a

written response to each recommendation including completed actions. The report shall be due no later than one year after approval of the Program Response actions.

Appendix 2.3: Potential Evaluation Questions for NOAA Portfolio Reviews

A. Progress to Plan

Has NOAA made expected progress toward achieving Research Plan objectives? If not, why; and how can this be improved?

B. Relevance

Is the current set of NOAA R&D portfolio priorities relevant to its mission, strategic plan, administrator priorities, and the state of science and technology? If not, how should priorities be realigned?

Are there gaps that NOAA should be pursuing, but is not?

C. Portfolio Balance

Is the balance of the R&D portfolio aligned to expectations in the NOAA Research Plan?

- Mission Balance: Does the relative balance of R&D among the strategic goals and objectives align with expectations? Among disciplines or topics? Are there portfolio gaps?
- R&D and Transition Balance: Does the relative balance of projects in RLs 1 through 9 align with expectations? Is there an appropriate balance of transition research that addresses priority user needs in the portfolio? What is the relative balance of science for understanding vs. science for application in the portfolio?
- R&D Timeframe: Does the relative balance of short term vs. long term research align with expectations?
- R&D Discipline: Does the relative balance of disciplinary vs. interdisciplinary align with expectations?
- Resources: Does NOAA provide sufficient resources for mission-critical R&D activities (financial, ship/air time)? Are resources appropriately apportioned among competing priorities?
- Extramural R&D: Does NOAA make appropriate use of extramural funding options (grants, contracts, cooperative agreements) to achieve mission objectives? Is intra vs. extramural R&D appropriately balanced; can greater efficiencies be achieved in R&D areas via external funding mechanism.

Appendix 2.4: Further Reading

Evaluating Federal Research Programs (NRC, 1999)

Performance Plans: Selected Approaches for Verification and Validation of Agency Performance Information (GAO, 1999) (PDF)

Thinking Strategically: The Appropriate Use of Metrics for the Climate Change Science program (NRC, 2005) (PDF)

Proposal to Establish Systematic Processes for Regular Peer Review Of NCCOS' Intramural Research (NOAA, 2006) (PDF)

Research and Development at NOAA: Environmental Understanding to Ensure America's Vital and Sustainable Future, A five year plan: Fiscal years 2013-2017 (NOAA, 2013)

NOAA Research and Development Vision Areas : 2020-2026. (NOAA, 2020)

Strengthening NOAA science: Findings from the NOAA science workshop, April 20-22, 2010 (NOAA, 2010) (PDF)

Review of the organization and management of research in NOAA: A report to the NOAA science advisory board by the research review team. Silver Spring, MD: National Oceanic and Atmospheric Administration (NOAA) Science Advisory Board (NOAA, 2004) (PDF)

National Severe Storms Laboratory Response and Implementation Plan Final Report (NOAA, 2010) (PDF)