

## NOAA Science Advisory Board

### Research and Development Portfolio Review Task Force Additional Information

#### Scope

The functional scope of this study should include those activities commonly referred to as “research and development,” through which NOAA improves the conduct of its mission, i.e., through which NOAA innovates. It should also consider the transfer of knowledge and technology that results from R&D to its intended application. The study is not scoped by the activities of “science” per se, and thus will not focus on scientific activities that are part of regular NOAA operations (e.g., producing a weather forecast, collecting tide measurements). The study may consider the use of operational activities and infrastructure that also support R&D as necessary to answer the questions above.

Research and development (R&D) at NOAA is defined consistent with the definitions used by the National Science Foundation (NSF, 2009), and as originated by Vannevar Bush (1945) in *Science: The Endless Frontier*. NOAA has adopted the official NOAA/NSF definitions to conform to government-wide practices, but discourages the distinction between basic and applied research, which derives from an oversimplified, linear model of innovation from the post-war era. Instead, NOAA encourages use of Stokes’s (1997) more contemporary model of innovation, *Pasteur’s Quadrant*, for framing analysis (see figure below), in which research can be directed toward fundamental understanding (“pure basic”) ultimate use (“pure applied”), or both (“use-inspired”).

Quest for Fundamental Understanding?	Yes	Pure basic research (Bohr)	Use-inspired basic research (Pasteur)
	No		Pure applied research (Edison)
		No	Yes
		Considerations of Use?	

R&D includes research, development, demonstration, and R&D plant. Research, development, and R&D plant include all direct, incidental, or related costs resulting from, or necessary to, performance of research and development, and costs of R&D plant (as defined in Appendix 2, below), regardless of whether the research and development are

performed by a Federal agency (intramurally) or performed by private individuals and organizations under grant or contract (extramurally). R&D excludes routine product testing, quality control, mapping and surveys, collection of general-purpose statistics, experimental production, and the training of scientific personnel.

NOAA’s extended “R&D enterprise” includes but is not limited to internal laboratories, science centers, Cooperative Institutes, grant recipients, Sea Grant Programs, and contractors.

**Approach and Timing**

A Portfolio Review Task Force of the SAB (hereafter referred to as the PRTF) will take a two pronged approach to answering the questions above (detailed steps for answering each question are given below.)

	<i>Step a. Establish Framework</i>	<i>Step b. Review Baseline</i>	<i>Step c. Assess Needs &amp; Opportunities</i>	<i>Step d. Recommend Changes</i>
<u>Question 1: Analyze R&amp;D Portfolio</u>	How do we describe/assess the NOAA R&D portfolio?	What R&D portfolio does NOAA currently have?	What portfolio of R&D activities does NOAA need?	What changes should be made? What changes take priority?
<u>Question 2: Analyze Organization and Management</u>	How do we describe/assess organization and management of NOAA R&D?	How is NOAA R&D organized and managed now?	How should NOAA’s R&D portfolio be organized and managed?	What changes should be made? What changes take priority?

Question 1: Analyze R&D Portfolio

*Establish Framework:* To describe and assess NOAA’s R&D portfolio, the PRTF should first establish the relevant attributes with which to describe and assess it. Methods for collecting and analyzing information and evaluating progress and performance should also be defined. This step may require literature reviews and consultation with subject matter experts.

*Review Baseline:* Per the framework established in step 1.a, this step would yield a baseline of NOAA’s portfolio of current investments (including linkages to NOAA programs, the academic community and broader stakeholder community). This task would entail a review of the baseline R&D portfolio, and would incorporate discussions with the NOAA scientific community as appropriate.

## FINAL

*Assess Needs and Opportunities:* Based on the results of steps 1.a and 1.b, this step is intended to identify both needs and opportunities for NOAA R&D, in terms of portfolio investments. These will include both short and long term needs. The PRTF will draw extensively from NOAA's scientific community, seek additional input external to NOAA, and critically evaluate NOAA's portfolio.

*Recommend Changes:* Based on current and projected resources and needs and opportunities, the PRTF will recommend changes in the composition of NOAA's research portfolio. Recommendations will be designated as being of higher or lower priority.

### Question 2: Analyze Organization and Management

*Establish Framework:* To describe and assess how NOAA conducts R&D, the parameters for organization, management, and expertise will be established. Methods for collecting and analyzing information and evaluating progress and performance will also be defined. This step may require literature reviews, consultation with subject matter experts, and comparisons with cognate R&D-intensive organizations with multiple business lines.

*Review Baseline:* Per the framework established in step 2.a, this step would yield a baseline review of how NOAA is currently organized to manage its R&D portfolio.

*Assess Needs and Opportunities:* Based on the results of steps 2.a and 2.b, this step will identify both needs and opportunities for NOAA R&D, in terms of organization, management, and expertise. These will include both short and long term needs. The PRTF will seek additional input external to NOAA for this step.

*Recommend Changes:* Based on current and projected resources and needs and opportunities, the PRTF will recommend potential adjustments to the organization, management, and expertise in &D. Recommendations will be designated as being of higher or lower priority.

### **Appendix 1: Issues to Consider**

Criteria for assessing activities within NOAA's R&D portfolio will be determined in steps 1.a and 2.a, but the PRTF may find that the following types of questions are useful for assessing any type of activity at the agency:

- Is it required to achieve NOAA's strategy (near-term objectives or long-term goals)?
- Is it required by an external authority (compelled by statute or executive order)?
- Is it non-substitutable (if it isn't done by NOAA, will it be done at all)?

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- What is the scale, scope, and immediacy of impact of the activity on society?
- What is the scale, scope, and immediacy of impact of the activity on other NOAA capabilities?
- If not done, how severe would the risk be for NOAA's capacity to adapt as a resilient organization?
- If not done, how severe would the risk be for NOAA's identity and reputation?
- If not done, how severe would the risk be for political stakeholders at NOAA, the Department, the Administration, and Congress?

Beyond these general criteria, a review of an R&D portfolio should answer additional questions that are unique to R&D, such as how (and how well) do R&D activities fit together as a system of innovation, and how (and how well) are R&D activities balanced across a number of dimensions:

- Alignment to strategy (*by Goal, Objective*) i.e., “What R&D will help make oceans healthier? Our nation more weather-ready? Our coasts more resilient? What R&D is applied to all goals?”
- Disciplinary specialization (*Natural, Social, Multi-, Inter-, and Trans-disciplinary*), i.e., “What expertise, or combinations of expertise, do we need? How does NOAA acquire expertise over time? What is the pipeline of new experts?”
- Time horizon for result (*Short-term to Long-term*), i.e., “Do we need to understand this phenomenon right now? Can deploying that technology wait a few years?”
- Degree of change (*Incremental to Radical*), i.e., “Should we ‘change paradigms or ‘solve puzzles?’ To satisfy current stakeholders or create new ones? Radical science or radical benefits?”
- Driver of change (*Push and Pull*), i.e., “Should it be investigator-driven? Should this research responding to stakeholder needs? Is it use inspired? Is it used?”
- Who Executes (*Internal and External*), i.e., “Is this inherently governmental? A core NOAA capability? Core of another organization? Should NOAA fund it through a grant? Cooperative institute? SBIR?”
- How it is Organized (*Centralized and Distributed*), i.e., “If NOAA should conduct this, should it be through OAR? Should it be in one of the service lines? What are the mechanisms for cross-boundary exchange?”
- Level of Risk (*High to Low*), i.e., “How certain are we that different activities will pay off? How much risk is the agency willing to assume, given its mission?”

- Type of Product (*Knowledge and Technology*), i.e., “For a given mission domain, should we be generating scientific knowledge or technological applications? Can we do both simultaneously?”
- Type of Process (*Creation and Transfer of Knowledge and Technology*), i.e., “Should we develop new technology or transfer technology already developed? Should we invest in lab/field work or training, publication, education?”

## Appendix 2: Definitions

Research and Development (R&D): Research, development, and R&D plant include all direct, incidental, or related costs resulting from, or necessary to, performance of research and development, and costs of R&D plant as defined below, regardless of whether the research and development are performed by a Federal agency (intramurally) or performed by private individuals and organizations under grant or contract (extramurally). R&D excludes routine product testing, quality control, mapping and surveys, collection of general-purpose statistics, experimental production, and the training of scientific personnel (NSF, 2009).

Research: systematic study directed toward fuller scientific knowledge or understanding of the subject studied (NSF, 2009).

Development: systematic use of the knowledge or understanding gained from research, directed toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes. It excludes quality control, routine product testing, and production (NSF, 2009).

Demonstration: activities that are part of research or development (i.e., that are intended to prove or to test whether a technology or method does, in fact, work) should be included. Demonstrations intended primarily to make information available about new technologies or methods should not be included (NSF, 2009).

R&D plant (R&D facilities and fixed equipment, such as reactors, wind tunnels, and particle accelerators): acquisition of, construction of, major repairs to, or alterations in structures, works, equipment, facilities, or land for use in R&D activities at Federal or non-Federal installations. Excluded from the R&D plant category are expendable or movable equipment (e.g., spectrometers, microscopes) and office furniture and equipment. Also excluded are the costs of pre-design studies (e.g., those undertaken before commitment to a specific facility). These excluded costs should be reported under total conduct of research and development. Obligations for foreign R&D plant are limited to Federal funds for facilities located abroad and used in support of foreign research and development (NSF, 2009).

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Innovation: The implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations (OECD, 2005).

Operations: Sustained, systematic, reliable, and robust mission activities with an institutional commitment to deliver appropriate cost-effective products and services.

Portfolio: A set of investments that yield benefits, have costs and associated risks.

## **References**

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