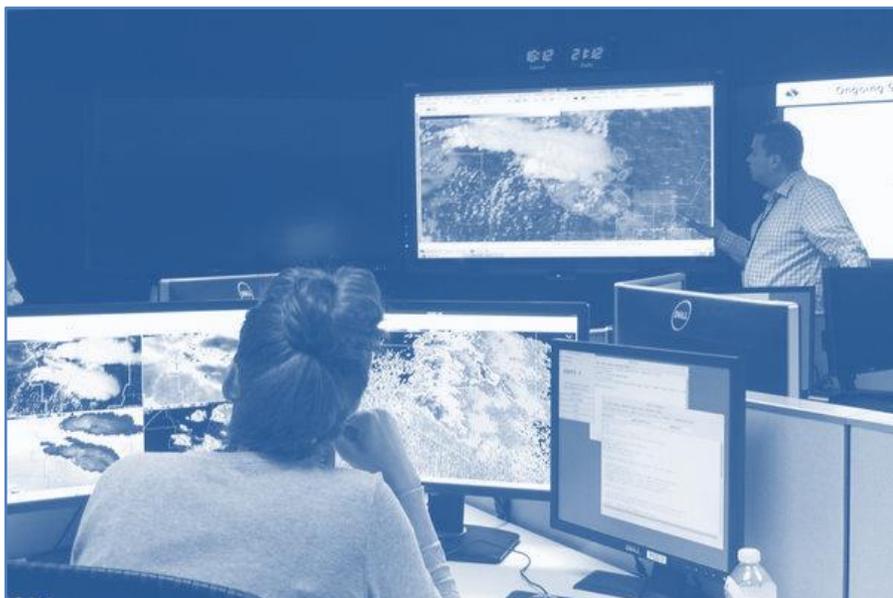




NWS Operations Proving Ground

Governance Charter

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1. Background and Executive Overview

The National Oceanic and Atmospheric Administration (NOAA) supports a network of Testbeds and Proving Grounds (TBPG), which facilitate the orderly transition of applied research capabilities to operational implementation. This transition is accomplished through rigorous developmental testing and pre-deployment evaluation for operational readiness and sustainability. Among the twelve TBPG members, the unique niche filled by the Operations Proving Ground (OPG) is to represent National Weather Service (NWS) field offices in the research-to-operations (R2O) process. The OPG facility has developed the capability to configure itself as any NWS Weather Forecast Office (WFO), or to emulate operational practices for up to three different WFOs simultaneously. Through the OPG, a new tool, data set, forecast technique, or decision aid can be integrated into a WFO production environment to evaluate whether it adds value to the forecast process with no appreciable negative impact on existing systems and practices.

In order to facilitate an accurate assessment for any new potential tool, technique, system or data set, formal Operational Readiness Evaluation (ORE) sessions are scheduled and conducted at the OPG in a realistic operational WFO setting. Candidate capabilities are identified from proposals submitted by authorized sources, including NWS Portfolio Directors, Regional Scientific Services Division (SSD) Chiefs, NOAA TBPGs, the Program Management Office (PMO), or a qualified major acquisition program (e.g., AWIPS, GOES-R, etc.), as appropriate. Prior to acceptance for evaluation in the OPG, new capabilities must achieve endorsement in a developmental testbed environment, or its equivalent. Prioritization and approval for funding are managed through the NWS Annual Operating Plan (AOP) process. Once approved, a specific test plan and associated performance metrics are defined for the candidate capability by the OPG staff, in concert with the Project Team Lead(s).

In addition to traditional performance metrics, OREs examine and document any workflow changes, end-to-end delivery of products and services, effectiveness of risk communication, training needs, quality of internal and external collaboration, etc. Therefore, in addition to NWS forecasters, some evaluation sessions may involve external partners or other subject matter experts (SMEs) who participate as consultants and/or observers to the process.

Specifically, a typical ORE incorporates exercises that evaluate the following critical elements:

- **objective performance** (e.g., accuracy/skill, improved warning lead times, etc.)
- **subjective evaluations of utility** (e.g., usefulness, usability, value in enhancing the forecast process or particular operational decisions)
- **production/engineering readiness** (e.g., systems and communications impacts such as reliability, consumption of resources, backup capacity, data retention)
- **human factors** (impacts on workload, workflow, workforce, ergonomics, ability to assimilate the data into decision making efficiently and effectively, etc.)

These categories are used to establish acceptable performance standards for other types of testing as well. For example, if the OPG is called upon to replicate operations for an experimental service improvement capability, the design and execution of that testing will incorporate considerations for these categories, but with objective metrics and engineering assessments appropriate to its technical maturity level.

2. Types of R2O Projects Involving OPG

Projects adopted for testing and evaluation at the OPG fall into two general categories:

- 1) **Operational Readiness Evaluations** – OREs are typically STI sponsored projects that focus on assessing the operational readiness of promising tools, techniques, or capabilities for implementation in NWS WFOs. When successful, these evaluations represent the final step in the R2O transition. They validate extensive development and refinement work, which has usually taken place in testbed experiments or among a small group of pilot field offices. STI R2O projects almost always involve bringing NWS forecasters into the OPG facility, who go through a carefully planned series of exercises designed to assess whether the candidate tool improves their operational decision making without creating significant adverse impact on their workload or workflow. While STI is usually the primary sponsor, it is often necessary to obtain approval and support from the Central Processing (CP) and Analyze, Forecast, Support (AFS) portfolios, in order to fund system modifications and forecaster participation, respectively. (*Examples: GOES-R User Readiness Evaluations such as those executed in 2015 featuring 1-minute imagery from GOES-14 SRSOR periods; or the follow-on ABI/RGB exercises conducted in 2016 using Himawari-8 imagery as a proxy for GOES-R.*)

- 2) **Service Improvement Projects** – Projects aimed at improving service delivery and/or the forecast process itself are generally sponsored by AFS, in response to priorities and requirements established by the NWS Mission Delivery Council. These efforts include evaluating enhanced forecasting methodologies, risk communication strategies, techniques to improve collaboration and consistency, or the sharing of information both internally and externally. These projects include forecasters, but may also involve core partners. (*Examples: DSS Boot Camp, Enhanced Data Display Focus Groups*) In some cases, the OPG is called upon to assist a NOAA Testbed in their developmental testing efforts. For example, if an experimental process is being tested, and the interaction between a National Center and the field is an important metric, the OPG is available to replicate the WFO activity in that process. (*Example: Digital Aviation Services Collaborative Forecast Process testing, conducted in concert with the Aviation Weather Testbed in 2016 and 2017.*) Occasionally, PMO-sponsored projects may also fall within this second category. In such cases, NWS leadership may decide it is important to use an environment that is safe and controlled but operationally realistic, in order to explore the viability of new organizational operating concepts for the future. By generating experimental products and services at the OPG, and then comparing those results with the official work product of WFOs, initiatives aimed at evolving NWS operations can be evaluated against a valid control group without disrupting the NWS mission. In contrast to most OPG projects, which follow a clear developmental R2O progression, PMO-sponsored “Evolve NWS” projects may be assigned top-down in a relatively untested, immature form. However, as with traditional OPG OREs, they must be endorsed and approved for funding by appropriate portfolios.

3. How Candidate Projects Navigate the R2O Transition Path via OPG

There are multiple avenues through which an applied R2O project may mature and ultimately be selected for evaluation at the OPG. Examples include, but are not limited to, VLab community collaborations, Collaborative Science, Technology, and Applied Research (CSTAR) Program projects, NOAA TBPG experiments, and regionally sponsored innovations that undergo development at a few pilot offices. Regardless of origin and developmental path, projects in both categories – those that represent the “last mile” of the operational transition process and those that involve testing experimental services – must be appropriately vetted in accordance with [NWS Policy Directive 80-8](#), “*Transition of Research and Development Projects to Operations.*”

This process ensures the project:

- meets a bona fide need with a validated requirement,
- aligns with Mission Delivery Council priorities,
- has followed a valid scientific approach,
- has demonstrated technical merit, maturity, and reliability,
- has demonstrated potential for practical operational value,
- represents a non-redundant, sustainable solution that meets mission execution needs, preferably for multiple service sectors,
- has undergone sufficient development and beta testing in an approved R2O transition pathway to warrant a more focused operational implementation appraisal,
- is approved for funding and execution by the Portfolio Integration Council,
- has a clearly identified primary sponsor/beneficiary who underwrites its evaluation. This sponsor – typically a Portfolio Director or equivalent – understands the system(s) to be tested, consents to ORE funding, is identified as the primary recipient of evaluation findings and recommendations, and assumes responsibility for actions taken based on those results.

Each year, candidate projects for testing and evaluation are solicited and reviewed as part of the NWS AOP process, with priority given to proposals that address top NWS service requirements established by the Analyze, Forecast, Support portfolio. Once approved and funded, OPG management works with the project's developers and sponsors to identify and articulate specific objectives, success metrics, system requirements and data collection needs. These elements are then used to construct relevant operational simulation exercises designed to address those objectives. This forms the basis of the formal Test and Evaluation (T&E) Plan, which guides the process of gauging whether the candidate tool is ready to be implemented on the target operational system (most often AWIPS).

An ORE T&E Plan is usually comprised of a combination of historical cases and live data scenarios, in which field forecasters integrate the new tool or capability into a simulated WFO production cycle, and then provide feedback regarding its usefulness, usability, and value. This feedback can range from a list of recommendations and caveats to an unqualified endorsement. It is also possible for participants to reject the subject of evaluation outright, although the process of development and beta testing should make this outcome exceedingly rare.



Fig. 1. - OPG Science Lead and Visiting Scientist from NASA SPORT assist forecasters with satellite interpretation during a 2016 Operational Readiness Evaluation.

4. ORE Candidate Criteria

Candidate projects must fulfill the following prerequisites:

a. Unique Value-Added

The project must exhibit the potential to offer new value to operations in some specific manner. Examples include: adding insight to forecaster decision making; providing notable improvement in generating grids or products; enhancing situational intelligence; or increasing clarity of messaging that leads to more effective risk management decisions by core partners and community leaders. This requirement extends to both usefulness (i.e., degree to which it adds meaningful value to the analysis, forecast, and/or warning process), and usability (i.e., ease with which it can be integrated into operational workflow and/or supplement other existing tools, products, or datasets).

b. Minimal Adverse Impact

It is important that the usefulness of any new operational capability is weighed against its impact on workload, workflow, and other human factors that may affect a forecaster's ability to assimilate the data, make timely, accurate assessments as to its meaning, and communicate that insight to community leaders and other decision makers.

c. Technical Readiness

Project Leads must substantiate that the new capability has undergone a sufficient amount of product development and beta testing to warrant an ORE. Project Leads must substantiate that the new capability is sufficiently mature from a technical standpoint to warrant approval for transition to the operational system. Appropriate "state of maturity" factors include software development (i.e., efficient code that integrates seamlessly into AWIPS), scientific integrity, product and/or display aesthetics, reliability in performance, configuration management, system interoperability, extensibility, sustainability, etc.

d. Broad Applicability

Most projects targeted for OPG evaluations are intended for operational use at many WFOs. While there are exceptions to this rule, ORE projects are not usually limited to application for a specific geographical location or for a single service sector. Thus, tools that demonstrate a broad range of usability for diverse operational tasks and responsibilities are given priority over those with a more restrictive scope.

e. Direct Connection to Strategic Goal(s) and/or MDC Priority Requirements

In order to be granted funding for evaluation at the OPG, project proposals must identify a coherent connection to advancing the NWS Weather Ready Nation initiative, linkage to a validated Mission Delivery Council service requirement, and/or an approved NWS AOP goal.

f. Clearly Identified Sponsor

Each ORE should have a primary sponsor, usually a Portfolio Director, who represents the chief stakeholder and beneficiary of a successful evaluation. The final post-evaluation results will be addressed to the sponsor, and copied to other relevant managers. The sponsor will assume responsibility for accepting and taking appropriate action on findings and recommendations published in the ORE Report. More than one sponsor may be named in situations where risks, investments, incentives, and/or benefits are shared among multiple portfolios. For example, it is often necessary to weigh the value of a new tool's contribution toward enhancing the forecast process against its impact on system performance. In such cases, both AFS and CP may share

equal interest in the overall cost-benefit of the ultimate nationwide deployment decision. These interdependencies may make it prudent for both portfolios to sign off as co-sponsors.

5. NOAA Readiness Levels and OPG Engagement

To gauge the maturity level of a particular science/technology project, the OPG has adopted the NOAA Readiness Level scale, as defined in [NOAA Administrative Order 216-105B](#). The RL scale has a range between 1 and 9, where: 1 through 3 represents basic scientific research, 4 through 7 denotes a higher degree of applied research and initial prototyping, 7 and 8 signify testing and demonstration in a realistic operational environment leading to a rating of RL 9, which is operational deployment.



Fig. 2. Diagram of the NOAA Readiness Level scale as it applies to Operations Proving Ground involvement in the research-to-operations process. Optimally, prospective projects will engage early in the applied development phase, in order to maximize efficiency in the planning and execution of evaluations that result in successful operational implementation. (Specific definitions for each RL are provided in NOAA Administrative Order 216-105B.)

The majority of OREs conducted at the OPG represent projects at the 7 or 8 level, which are attempting to achieve endorsement for transition to field operations. However, it is important for the OPG to engage with prospective project developers at a much earlier stage - preferably at RL 4 or 5. There are two primary reasons for earlier engagement:

- (1) The AOP process requires alignment with strategic objectives, justification for resources, and budget approval from at least three NWS portfolios (e.g., STI, AFS, and CP). About six months prior to the start of a fiscal year, priority goals are identified and discussions begin concerning prospective projects to be funded. The time span from initial proposals through budget approval to concrete planning and execution is typically on the order of 9-18 months.
- (2) Communication of the process by which a candidate tool is undergoing beta testing and product development is critical. This ensures relevance for operational evaluation, validation of readiness level, transparency in the development process, proper identification of evaluation objectives, and a clear understanding of the time and resources needed to prepare and execute an effective ORE.

There may be exceptions to this rule where greater agility and flexibility are required (e.g., a situation where a new tool is in high demand or under a tight deployment schedule). However, these cases are rare. For most projects, a successful transition to operations will be optimized through early engagement with the OPG in the planning and development process.

6. Dissemination of ORE Results

For each ORE, results will be gathered, published, and disseminated to the Project Sponsor(s) and other relevant senior leaders that include recommendations related to:

- Readiness for field implementation (i.e., *Unqualified Approval, Approval with Caveats, Not Ready – Additional Development and Follow-up Testing Required, Rejected*)
- Specific applications, observations, and insights from the NWS forecaster perspective
- System performance issues
- Operational training considerations
- Impacts on workload and other human factors

Once the Final Report is published, the Project Sponsor has responsibility for actions related to addressing Findings and Recommendations.

7. OPG Oversight and Management

OPG governance policies are largely collaborative and designed to follow practices that promote transparency, fairness, efficiency, and effectiveness in producing results that serve the NOAA/NWS mission. Appropriate stakeholder involvement is encouraged, and often solicited, in every phase of the testing and review process.

The following committees are engaged in order to ensure OPG activities are aligned with agency priorities, conducted in full compliance with departmental policy, and managed with effective stewardship of taxpayer resources.

The **OPG Resource Board** is comprised of the NWS STI Portfolio Director, the NWS AFS Portfolio Director, the NWS CP Portfolio Director, and the PMO Director. The OPG Director will serve as an ex-officio member, fulfilling a reporting and advising role to the board.

The **OPG Management Team** is comprised of the OPG Director and the OPG SOO. Additional expertise may be brought in to advise the management team concerning readiness of candidate capabilities for evaluation, development of appropriate evaluation metrics and effective test procedures, etc. The GOES-R Satellite Liaison/Lead Science Coordinator is a good example of how the OPG has utilized this type of expert managerial guidance.

A **Proving Ground Review Panel**, typically made up of 4-8 members, is periodically convened to review proposals received, assess merits and maturity, and determine which projects to forward for ORE consideration in the ensuing AOP cycle. Members contribute individual, non-consensus reviews and recommendations to the OPG Director, who then prioritizes proposals for inclusion in a recommendation to the STI Portfolio Director.

A Review Panel may be reconvened to review results, assess effectiveness of testing, and provide counsel with respect to process improvement. Review Panels normally draw members from the following sources:

- OPG Staff (federal and/or contract employees)
- Field Operations Advisors (MICs, SOOs, WCMs, ESAs, ITOs, SSD or ROC staff, etc.)
- Appropriate Subject Matter Experts (e.g., AWIPS-2, WSR-88D, GOES-R, etc.)
- Relevant external stakeholders (e.g., Emergency Managers, Social Scientists, Media Partners, Academia, etc.)

ORE Project Teams are formed to conduct each ORE Session. Since the ultimate objective is to evaluate readiness for deployment into NWS operations, it is imperative for the OPG test environment to simulate WFO conditions realistically. Thus, the primary participants on a Project Team will be:

- SOOs, ITOs or other SMEs, who have been involved in the project development process. These team members are critical to ensuring the capability is sufficiently mature to warrant an ORE. They are also actively involved in establishing T&E objectives, defining success metrics, and working with the OPG Staff to develop exercises that facilitate those goals.
- Certified forecasters from NWS field offices, selected through NWS Regional SSDs.
- Additional team members may include: OPG research associates; guest facilitators; auxiliary IT specialists and/or systems engineers; collaboration entities (NOC, ROC, WPC, SPC, HWT, AWT, etc.); representatives from core partner agencies (e.g., FEMA, USACE, local EM community, broadcast media, etc.); and relevant observers or assessors (e.g., visiting physical and/or social scientists, NWS managers).

As part of the NOAA TBPG structure, the NWS OPG works in close cooperation with the **Test Bed and Proving Ground Coordinating Committee** (TBPGCC), a group commissioned by NOAA to facilitate communication, coordination, and consistency among the participating facilities. This collaboration involves coordinating science themes, determining development priorities, and identifying major gaps among testbeds and proving grounds. The TBPGCC also assists in the programmatic evolution of testbeds and proving grounds; provides progress reports to the Line Office Transition Managers (LOTMs); advocates for support and resources, including linkage to the NOAA budget planning and execution process; and performs an outreach and education role for the NOAA test bed/proving ground system. The TBPGCC consists of each of the testbed and proving ground managers or their designees, as well as Line Office Focal Points for testbeds, appointed by Line Office Assistant Administrators. Additional details can be found at: www.testbeds.noaa.gov

8. Program Assessment

The primary mechanisms by which the OPG Management Team conveys its progress are:

- Regular meetings with the OPG Resource Board
- Formal ORE Reports, including all findings, recommendations, and readiness for operational implementation
- Active involvement in the STI AOP process, including submitting a prioritized list of project proposals that represent potential solutions to bona fide requirements established by AFS
- Semi-annual input to the OPG Director's Performance Review
- Annual reporting to the TBPGCC

In addition to activities listed above, the OPG Management Team will assess the state of its program in four areas:

- Progress toward transitioning advanced science and technology, and/or service enhancement applications into operations
- Alignment of current science and services priorities with stakeholder needs
- Demonstration of sound testing approaches that provide trustworthy results needed to support evidence-based decisions on tested capabilities
- Effectiveness of connection between development testbeds and the NWS OPG, including demonstrated value in improving the R2O process and O2R feedback
- Efficacy of the OPG organization and procedures, in conjunction with those of other test bed and proving ground operations

This coherent summary of OPG activities, accomplishments, concerns, and priorities for future improvement will be provided to the STI Director annually.