



**Executive Summary of the FY2015 National Space Grant  
College and Fellowship Program Technical Assistance  
Project**

**Task 9.1.1 Modification  
Technical Assistance for Program Assessment**

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## BACKGROUND INFORMATION

The National Aeronautics and Space Administration (NASA) Office of Education (OE) is responsible for the development and implementation of the agency's education programs that strengthen student involvement and public awareness about its scientific goals and missions. Through NASA's unique mission, workforce, facilities, research and innovations, the NASA OE inspires students' interest in science, technology, engineering and mathematics (STEM) education (100th Congress, 101 STAT. 860, Public Law 100-147 - October 30, 1987)<sup>1</sup>.

The NASA Space Grant College and Fellowship Program (Space Grant, or SG) is one of two components of the NASA Office of Education Higher Education Aerospace Research and Career Development (ARCD) Program. Space Grant is administered at the national level by an Office of Education Program Manager. Space Grant is a state-based program operating under cooperative agreements with a lead university in each of the respective consortia and managed by a common director at that level. NASA funds a Space Grant *consortium* in each of the 50 states as well as each of the District of Columbia and the Commonwealth of Puerto Rico. Congress authorized Space Grant in 1987, under Title II of the National Aeronautics and Space Administration Authorization Act (PL 100-47) to increase understanding, research, development, and utilization of aerospace science and technology through the nation's universities. Space Grant provides a comprehensive federal-university partnership in the tradition of the Land-Grant Universities and the Sea Grant Colleges. Space Grant's national network presently includes over 850 active affiliates from universities, colleges, industry, museums, science centers, and state and local agencies. Although primarily a higher education program, Space Grant activities encompass the entire length of the education pipeline, from K-12 to higher education to informal education. Notably, a Strategic Plan issued in 2012 by the Space Grant State Director Goals and Objectives Subcommittee identifies actions Space Grant consortia assert they should take to improve their effectiveness over the next decade.<sup>2</sup> In its enabling legislation the National Space Grant Act in 1987, Public Law 100-147, Congress stated the goal of Space Grant Program to be to "contribute to the nation's science enterprise by funding education, research, and public service projects through a national network of university-based Space Grant consortia". The following are the objectives of Space Grant, as derived from the legislation:

- i. Establish and maintain a national network of universities with interests and capabilities in aeronautics, space and related fields;
- ii. Encourage cooperative programs among universities, aerospace industry, and Federal, state, and local governments;
- iii. Encourage interdisciplinary training, research, and public service programs related to aerospace;
- iv. Recruit and train U.S. citizens, especially women, underrepresented minorities, and persons with disabilities, for careers in aerospace science and technology; and,
- v. Promote a strong science, mathematics, and technology education base from elementary through secondary levels.

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<sup>1</sup> Source: NASA Education Strategic Coordination Framework: A Portfolio Approach, June 2009, NASA Office of Education, NASA Headquarters, Washington DC

<sup>2</sup> <http://national.spacegrant.org/meetings/presentations/Fall20112/SRuffin.pdf>

The time period under study for this project is FY 2010-2014. The National Space Grant College and Fellowship FY 2010 NASA Training Grant Announcement (OMB Approval Number 2700-0085) identified the following *Areas of Emphasis* for Space Grant Consortia:

- “Authentic, hands-on student experiences in science and engineering disciplines – the incorporation of active participation by students in hands-on learning or practice with experiences rooted in NASA related, STEM focused questions and issues and the incorporation of real life problem-solving and needs as the context for activities;
- Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise. Capabilities for teachers to provide authentic, hands-on middle school student experiences in science and engineering disciplines;
- Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges;
- Aeronautics research – research in traditional aeronautics disciplines; research in areas that are appropriate to NASA's unique capabilities; directly address the fundamental research needs of the Next Generation Air Transportation System (NextGen); and
- Diversity of institutions, faculty, and student participants. These areas of emphasis, as well as the others, will be used as categories for classifying state consortium activities and then sampling state consortium for the evaluation.” (Education, FY 2010 NASA Training Grant Announcement)

Space Grant base awards have historically operated on five-year proposal cycles. NASA also provides Space Grant cooperative agreements and grants outside of the traditional base awards. These other opportunities vary in length and performance periods. When the proposals are approved, each Space Grant consortium receives funding to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure; education; public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Subsequent funding is contingent upon satisfactory annual progress reporting throughout the five-year cycle. The 52 consortia are grouped into three types of consortia based on capacity, merit, and programmatic focus – *Designated*, *Program Grant*, and *Capability Enhancement*. Designated and Program Grant consortia focus on all three main components of the Space Grant program – education, research, and public service, while Capability Enhancement consortia are directed to place more emphasis on education and research activities. Each consortium is required to provide 1:1 non-federal cost share for all non-fellowship/scholarship program dollars. Consortia submit annual progress reports, program plans, budgets, and enter activity and outcome data into the web-accessed Office of Education Performance Measurement (OEPM) database.

## PURPOSE

This executive summary highlights key elements and findings in the process of providing technical assistance in the planning of a future evaluation of activities funded through the National Space Grant College and Fellowship Program FY 2010 NASA Training Grant Announcement (OMB Approval Number 2700-0085). The evaluation technical assistance activities were executed across

two Phases extending from October 2014 through September 2015. The technical assistance project had three primary objectives:

- i. To fully document the current SG program model, including inputs, strategies/activities, outputs, and short-, intermediate-, and long-term outcomes in consultation with the SG stakeholder community;
- ii. To conduct an assessment of performance data, reporting and program documentation held by SG Consortia and the NASA Office of Education to ensure that appropriate, valid and reliable data are collected to document SG strategies/activities, outputs, and outcomes at the consortium and national levels;
- iii. To prepare a design and plan for an external evaluation study and make formal recommendations to improve NASA's performance monitoring and preparedness for future SG program evaluations based on a thorough review of previous evaluations, consultation with the SG community, and the results of the assessment of performance data, reporting, and program documentation.

Relevant to the third objective, the NASA Office of Education also proposed evaluation questions for a future external evaluation study of the Space Grant program and requested that the contractor assess the viability of these questions. The draft evaluation questions are presented below.

1. Are Space Grant activities being carried out in compliance with Public Law 100-147 and in alignment with the priorities of NASA Education and NASA research and technology development?
2. To what extent are funded activities engaging the intended populations (i.e., diverse students, faculty, and institutions) and meeting program goals as defined in the 2010 solicitation?
3. To what extent do the methods of soliciting applications or requests, review of those requests, and awarding and distributing SG funds support the quality of the results?
4. What effective practices exist in consortia partnerships among universities, federal, state, and local governments, and aerospace industries to encourage and facilitate the application of university resources to aerospace and related fields? To what extent do these practices ensure the quality of results?
5. What have been the SG's major contributions to NASA's education mission?
6. Given the national investment in the SG program, what, if any, new approaches to the management of the SG program should NASA consider for the future?
7. In all, what are the challenges, barriers, and constraints encountered in ensuring high-quality results?

## SPACE GRANT PROGRAM MODEL AND EVALUATION QUESTIONS

In order to document the current Space Grant program model and prepare a design and plan for an external evaluation study and make formal recommendations to improve NASA's performance monitoring and preparedness, the contractor consulted with Space Grant stakeholders. Community consultation was instrumental in producing a logic model that documents the Space Grant program model, revising the draft evaluation questions, and preparing recommendations to streamline

performance monitoring. Community consultation was conducted in two distinct phases. A summary of methods and findings for these two phases is described below.

#### PHASE 1: METHODS (OCTOBER 2014 – MAY 2015)

NASA Space Grant leadership identified four key stakeholder groups for inclusion in discussion groups: (1) Space Grant Affiliates; (2) NASA Education Coordinating Council (ECC); (3) National Council of Space Grant Directors; and (4) National Space Grant Foundation. The intent of the discussion groups were to gain a better understanding of the position of the Space Grant program in NASA's broader educational agenda, identify the measurable goals and objectives of the Space Grant program, and to affirm or revise evaluation questions for each goal and objective to be used for Space Grant evaluation later. Over the course of two weeks, between late January and early February 2015, recommendations of 59 discussion group participants were received. Based on the review of criteria, 32 participants were selected for participation. Prior to the discussion group, NASA staff and affiliates who were asked to participate in the groups were sent an e-mail from the contractor describing the purpose of the groups and obtaining pertinent scheduling details needed to schedule the groups. A protocol including open-ended questions was developed to encourage stakeholder participation in the discussion groups on the following topics:

- Space Grant program model, including goals, objectives, key strategies/activities, outputs, and anticipated short, intermediate, and long term outcomes;
- Space Grant performance monitoring and evaluation methods, data sources, instruments (including rubrics), reporting and program documentation, including factors affecting the success of performance monitoring and evaluation activities;
- Proposed evaluation questions prepared by the Office of Education; and
- Data sources relevant to the evaluation questions, particularly those that are different than data used for past assessment studies.

The discussion guide was developed to ensure the moderators' ability to obtain information from participants around each topic area without asking the same questions more than once. Each group was scheduled to last no longer than two hours. The actual duration of these groups ranged from 60 minutes to 98 minutes, depending on the participants knowledge of Space Grant and other topics areas discussed. The average length of the groups was 79 minutes. Each discussion group interview was audio recorded and a third-party transcription service was used to provide transcripts for the group discussions. Hand written notes were also taken at each group.

#### PHASE 1: FINDINGS (OCTOBER 2014 – MAY 2015)

The following is a summary of the results of Phase I organized by discussion topic.

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##### Topic 1: Program Model, Goals, Objectives, Key Strategies, Activities, and Outcomes

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Many of the participants, across discussion groups, noted that Space Grant has evolved over time into a diverse and unique program that supports a multitude of activities producing outcomes specific to each state's NASA focal area. In the words of one participant, *Something that's most*

*unique about the Space Grant Program is that it's a national program with shared goals across the country where each state consortium contributes in a unique way to meeting the goals of the National Space Grant and that sets up very different program models across the country to utilize some state resources to best meet individual state needs all in the arena of working with NASA education to meet NASA program goals.* Specific program activities, with the exception of NASA sponsored research and under-represented student and workforce recruitment and development, were noted as being difficult to identify across Space Grant due to the diversity across state consortia. Specific outcomes mentioned included increased graduation rates of underrepresented populations in STEM related degrees, entrance into STEM employment and increased NASA research efforts and presence in states including those without NASA centers.

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### Topic 2: Space Grant Performance Monitoring and Evaluation.

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Altogether, discussion group participants had numerous thoughts and recommendations regarding monitoring and evaluation. Many participants agreed that a great deal of data is collected and it is unclear how all of those data are utilized. In the words of one participant, *One current experience that I think that all of us have appreciated is that the progress reports are an opportunity to tell some of the personal success stories and such that we aren't able to tell in an OEPM database reporting instrument, but the most current guidelines for the progress report limited submissions to eight pages long with many, many, many things that are supposed to be included in each section of the report to report adequately. I know that through time with many of the types of review reports and such that we have written, we spend a huge amount of time trying to cut content to make page limits.* They also suggested that more people per grantee site be granted to access OEPM in order to enter data as well as allowing data entry year-round. Requests were voiced for the ability to make additions and modifications to OEPM reports after the fiscal year in order to update information occurring after the reporting period ended. It was also suggested that OEPM might be extended with the capacity to provide grantees a comparison between their respective states as well as to the national standard. Pursuant to this, a number of participants suggested that incorporating Geographic Information System (GIS) technology into the OEPM would improve Space Grant's capacity at data management, data mining, and geographic representation. Additionally, it was opined by many participants across discussion groups that aligning the reporting schedule to the academic school year would streamline the reporting process, particularly if grantees had the ability to pre-populate data entered from previous years. Finally, participants expressed a desire for NASA to clearly articulate changes to mandatory reporting to all individuals involved in data collection and reporting.

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### Topic 3: Proposed Evaluation Study Research Question Review

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It should be noted that there was consensus across discussion participants that it would be both difficult and unnecessary to rank or prioritize the evaluation questions as they were all deemed equally important. The first major result of discussion was the development of suggestions for additional questions as well as revisions to the existing questions. For example, one participant wanted the questions reworded so they *are not posed in such a way that they asking if we do comply with these things, we have no choice in complying with these things. It's required.* Although, this particular group observation certainly carried the assumption that all stakeholders do everything that is required of them, the point was articulated that it would be more politic to ask "how" – as

opposed to “whether” – grantees were in compliance. Furthermore, it was argued that the multipart nature of question 1 was problematic. Multiple participants noted that evaluation questions 2, 4, and 5 help measure program impact. Likewise, participants noted numerous challenges that may arise when answering evaluation question 7. Time constraints for reporting and conversations were identified as challenges; as was funding (e.g., uncertainty and sustainability). Each of these was recommended to be considered in future external evaluation.

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#### Topic 4: Performance Data Reporting and Data Sources for Evaluation

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Although participants generally reported no major issues with data definitions and reporting, a few definitions and selected data elements were identified as causing some confusion. One participant lamented that *the same information is being requested in three different ways when one would do so maybe a review of the data being requested from the vantage point of potential redundancy or to what is the data being used and why is it relatively important*. Another definitional issue was the dual role of university faculty (teaching and research): some discussion group participants expressing difficulty in making distinctions between higher education and research infrastructure reporting. There was also uncertainty regarding whether any given publications were the direct result of Space Grant. Other issues included the formal definition of a fellow as well as how to document federal funding from sources other than NASA. Discussion also touched upon the possibility that some demographic data currently required may be too intrusive to gather from volunteers. Overall, commentary from participants described that more effective, timely, and more frequent transparent communication was needed moving forward. Some participants noted wanting and needing to know more about the Space Grant activities so they could provide answers to simple questions whereas others wanted more responsive communication from NASA and the Office of Education to assist them with Space Grant efforts in their state. In each of the groups, the strength of collaboration across states, consortia, and industries was noted as having a positive and lasting effect on Space Grant.

#### PHASE 2: METHODS (JUNE-SEPTEMBER, 2015)

During the second phase of information collection for this technical assistance task, Paragon TEC talked with NASA Space Grant Education staff to learn what Space Grant Program looked like for the grant cycle FY 2010-2014 award. Four Space Grant staff were contacted and requested to participate in a two-hour interview to assist Paragon TEC to help: 1) refine NASA’s evaluation questions for the 2010-2014 National Space Grant College, 2) further develop a Logic Model reflecting Space Grant program’s goals, objectives, key strategies, activities, outputs, and outcomes, and 3) learn more about Space Grant Performance Monitoring and Evaluation. Following this interview, five of the 52 SG consortia were contacted for interviews. Consortia directors and other key staff offered their feedback on the Logic Model and how it mapped to outcomes and program strategies of Space Grant Program and their OEPM data system experiences. A final follow-up interview was conducted with two NASA Space Grant staff to provide clarity on information garnered from consortia interviews. These conversations, along with the 2010 Space grant solicitation and the data reported to OEPM system, informed development of a Logic Model and evaluation plan.

## PHASE 2: FINDINGS

In summary, the evaluation questions included above were found to be relevant, appropriate, and tractable, and were, therefore, not revised as a result of this technical assistance. However, key comments made during Phase 2 interviews are included here to help better understand staff perceptions of these questions and context for future evaluations.

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### Topic 1: Evaluation Questions

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Evaluation Question 1. It was noted that EQ1 may be difficult to answer because priorities changed annually during this time period. One comment was: *“In order for the program to remain relevant year to year, we would provide what would be the priorities or key areas of emphasis on an annual basis because those would shift and change as the Agency shifted.”* Staff also stated that priorities had to comply with the strategic coordination framework<sup>3</sup> (Outcomes 1-3 at the time), although Space Grant shifted away from these in 2015. The federal government also switched its focus from PART measures to performance goals and annual performance indicators (APIs) during this time.

Evaluation Question 2. It was stated that the definition of “diverse” should be clarified because diverse “does not just mean under-represented and underserved populations and it did not just mean women”; diverse also refers to the type of institutions and whether a range of institutions were represented by faculty and students in the consortium. It was stated that assistance is provided for consortia who have challenges recruiting and training underrepresented minorities, including a) providing a mentor, b) offering more one on one time, and c) matching consortia that are weaker in this area with those that have been very successful and are willing to share best practices and strategies. It was also mentioned that there are national meetings where panels focus on sharing diversity strategies.

Evaluation Question 3. One staff member stated it was unclear whether this question was referring to: a) the solicitation and proposal review process at the headquarters level as it relates to base awards, multi-year renewal, annual renewals, and additional opportunities, or b) identifying successful processes or approaches that a consortia would use as they look at competitively awarded funds. Another staff member commented that, “It is Important to have questions at the national *and* the consortium levels, looking at the intake for proposals and then looking at the consortium level – assuming this process is different.”

Evaluation Question 4. The NASA Education staff stated that they had not done anything related to effective practices, and that the last five year evaluation period covered the period of 2003-2007. All data collected from consortia were self-reported, including the self-evaluation that covered whether their practices were effective. In addition, the Annual Performance Document (APD) documents that consortia completed annually included self-reported anecdotal data. For the award, the consortia submitted APDs to the program office, and the APD compared their proposal with their reached goals.

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<sup>3</sup> Source: NASA Education Strategic Coordination Framework: A Portfolio Approach, June 2009, NASA Office of Education, NASA Headquarters, Washington DC

Evaluation Question 5. There were no comments or suggestions.

Evaluation Question 6. Staff suggested an “improvement practice,” where Space Grant would look into the progress of consortia at the mid-year point to provide struggling consortia iterative feedback and a chance to improve their performance prior to the 5- year assessment period. Staff also commented that they would like the opportunity and resources to do more site visits.

Evaluation Question 7. There were no comments or suggestions directly related to this evaluation question. However, when asked to operationalize what was meant by “high quality results”, the NASA staff members viewed this term differently, with responses including: (a) publications, presentations, conferences, (b) dosage and exposure, (c) student engagement in hands-on activities, and (d) success of students in STEM majors and careers.

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## Topic 2: Logic Model / Program Model

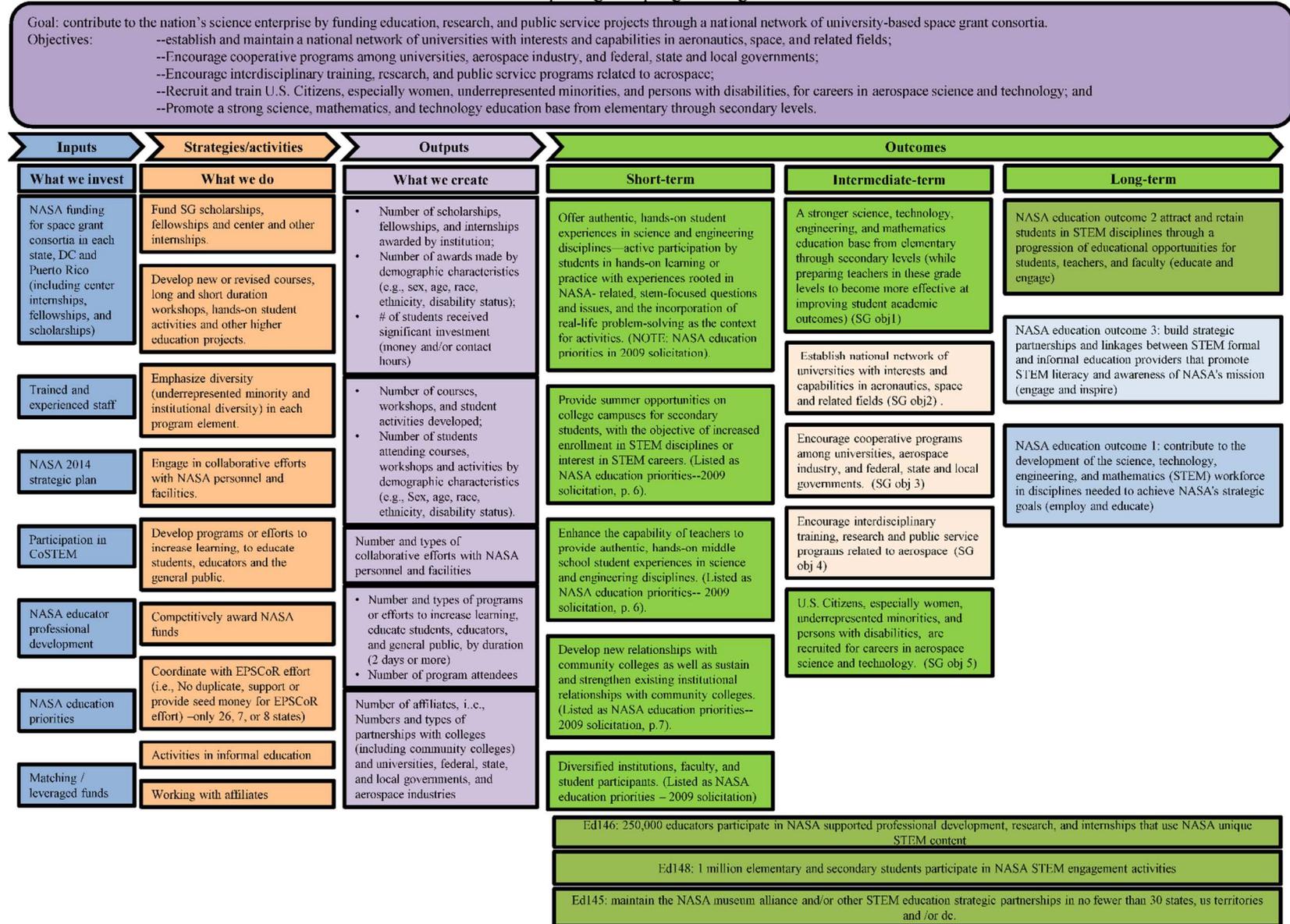
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A Logic Model was developed based on feedback received during interviews and the review of relevant SG documents; the Logic Model immediately follows this topic section. It is important to note that this Logic Model reflects the 2010-2014 Space Grant program. The text that is included within the Logic Model includes relevant comments and feedback from Phase 2 interviews that contributed to the development of the Logic Model. Input was also sought concerning cost sharing and leveraging Space Grant investments. One participant informed us that feedback would vary by consortia, indicating that “While we all deal with certifying the required match, I think [we] may be somewhat unique in our more entrepreneurial approach to Space Grant funding, our desire to grow our program through additional match or external funding, and our ability to take such an approach.” Another participant further clarified that this matching equals 74% for both designated and program awards, and that “All Space Grants must plan for/attract and certify through reporting processes that at least the 74% level of matching funding is met.” This participant indicated that the matching requirement is detailed in the last five-year RFP in “Section E: Funding and Cost-Sharing (Matching)”. Overall, stakeholders agreed to the elements of the Logic Model on the next page. However, there were some specific elements with additional caveats, which follow.

### Objectives

Space Grant staff cautioned that objectives vary by consortia and by consortium type (i.e., designated consortia, program grant consortia, and capability enhancement consortia). One staff member stated, “All consortia have the freedom to operationalize goals differently... Consortia have the flexibility to emphasize some objectives more than others.” One exception that was frequently noted was the requirement for consortia to have fellowships and scholarships. It was also noted that there were shifts in priorities during this time period. For example, the Summer of Innovation program led to more consortia focusing on middle schools for designated and program grant consortia, while capability enhancement consortia never had to focus on K-12.

NASA space grant program logic model



## Strategies/Activities

Space Grant offered potential additions to the strategies/activities that were embedded in the Logic model. One consortium recommended adding “**collaboration with non-profit groups and community organizations**” and “**collaboration with museums**” to the types of programs currently in the Logic Model. Another director mentioned adding “**minority serving institutions to include Indian Nation members.**” Another mentioned a heavy “**focus on research**, especially research with topics connected with a NASA center” and believed that should be reflected in strategies and activities along with the inclusion of “research infrastructure.” Finally, one consortium mentioned adding strategies that “emphasize excellence, and recognize that NASA curriculum elevates the level of discussion, inspiring students...there’s also more at stake for the students, faculty, institutions, the state [because] NASA activities are of a higher quality and standard... strategies should promote excellence and acknowledge exceptional performance.” He suggested that measures that track impact should be highlighted. All stakeholders agreed that qualitative measures were absent from the Logic Model and OEPM.

## Outputs

According to them, the consortia made their own decisions about what to emphasize in every category except for fellowships and scholarships, and there is a minimum amount of funding that must be applied to that component. Consortia directors agreed; not all strategies apply to all consortia; consequently, the outcomes may vary by consortia. Some additional outputs and noted by consortia included: number of students taking part in group hands-on projects; senior design courses and competitions; students in interdisciplinary group projects; design and engineering competitions; number of students involved in research projects; and longitudinal track of percentage of students who continue further into academia or a STEM career.

## PERFORMANCE MONITORING

This section presents findings from a review of data and documentation that were collected through report forms, Survey Monkey, and the OEPM system during the years of interest (2010-2014). The primary purpose of the review was to assess the viability of the data and documentation for use in performance monitoring and evaluation. The assessment of data quality revealed only a small number of data elements may be used for external evaluation purposes because only a handful of data elements were consistently collected across multiple years; can be validated by other sources; and use data definitions consistently applied by Space Grant consortia. Before presenting these data, we first describe the reasons why data were not consistently collected and reported by Space Grant consortia during the FY2010-2014 cycle. Second, we examine how these inconsistencies affected data quality and limitations of the data elements that can be used for an external evaluation.

## PERFORMANCE MONITORING SYSTEM DURING FY2010-2014 GRANT CYCLE

A review of documents (data samples, Annual Performance Data Report, etc.) and interviews with NASA Office of Education staff, consortia directors, and community stakeholders indicated data collection and reporting were not consistent over the years due to internal and external factors to

the Space Grant Program. Consortia projects varied by focus area based on state needs and interests but also due to proximity to NASA centers; affiliate involvement; and the existence of the Experimental Program to Stimulate Competitive Research (EPSCoR). Variation in the focus area of consortia projects, differences in grant categories, and differences in student demographics are internal factors that shaped the programming of each consortium during this time period. The external factors included changes in policy and priorities within NASA and changes in data requirements from the Office of Management and Budget. For example, when the current grant cycle began in 2010, the consortia selected and reported on program contributions to Performance Assessment Rating Tool (PART) measures, but the measure was discontinued in 2012.

While the consortia have been required to report many types of data, not many data types were collected consistently over the five years of interest. Also, as the interviews with selected consortia directors indicated, consortia varied as to how they collected and validated data. A major cause of the inconsistencies was the change of data collection systems during this grant cycle from Survey Monkey to the OEPM system. The Office of Education used Survey Monkey to collect program performance data for FY 2010 and FY 2011. OEPM was used starting with FY 2012 reporting. Survey Monkey and the OEPM collected different levels of data. For example, while Survey Monkey collected program information at the aggregated number for each sub-element, such as the number of Research Infrastructure projects a consortium provided during FY 2010, the OEPM system collected information at the project activity level, which is a smaller unit than sub-element. This change creates a problem for documenting program outputs and outcomes longitudinally because the aggregated numbers cannot be broken down into outputs of individual programs. The way OEPM collects data is better because it links outputs and outcomes with each project activity. Also, the change from Survey Monkey to the OEPM system resulted in the change of the relationship between program activity and program outcomes. While Survey Monkey captured outcomes, such as publication and technology transfer, as a result of the all activities that lead to Outcome I (Fellowship/Scholarship, Research Infrastructure, and Higher Education Program), OEPM is structured to capture the same outcomes as a result of project activities that are marked as Research Infrastructure and Higher Education. For example, if Fellowship/Scholarship students produced papers, the OEPM system did not count them.

Finally, the data submission due dates of Survey Monkey and OEPM systems did not align with the program cycle. The Space Grant Program performance period varied by consortium because award dates varied. Some consortia reported the performance for their project year. Other consortia reported their performance based on the OEPM due date, and others set their own cut-off date so affiliates would have enough time to collect and compile data. This misalignment presents a challenge for external evaluation because the data collected by Survey Monkey and the OEPM system do not necessarily cover a specific project year, thus comparison between consortia is difficult. The Annual Performance Data Report aligned with the program performance period; however, since the award date varied and the consortia period of performance varied, the data reported did not reflect the same reporting period for the consortia.

Only a small number of data elements collected in Survey Monkey and/or the OEPM system over at least a two year period were considered as being of relatively high quality, meaning the data are possibly valid and reliable across consortia. The following data elements were rated valid because the aggregated number reported can be traced back to the raw data, the data were reported by using standardized methods, or the data can be validated by using other sources. These data are as follows:

- Institution type of affiliates and if they are Minority Serving Institutions (MSIs) in Survey Monkey (by cross referencing with information reported in Annual Performance Data Report) and in the OEPM system.
- The number of fellowship/scholarship recipients and their demographic and other information in the OEPM system.
- The number of students who received a significant investment and their demographic and other information in the OEPM system.
- The number of new or revised courses in the OEPM system. As for FY 2010-2011, only aggregated numbers were available in Survey Monkey.
- Publications, invited papers, papers presented, patent, technology transfer, additional grant and their amount were saved in the OEPM system. As for FY 2010-2011, only aggregated numbers were available in Survey Monkey.

Another consistently collected data element was tracking data of students who received a significant investment, which was reported in Student Tables. However, since they are aggregated numbers, the evaluator will need to find out how each consortium collected and validated the data. It is important to note that these data were self-reported by the consortia, and some consortia had more thorough data collection and validation processes than others. For example, from an interview with a consortia director, we learned that when consortium personnel changed, this consortium had a difficult time tracking students who received a significant investment and if these students advanced to STEM employment (Student Data Table). Consequently, this consortium might have under-reported the number of students who had advanced in the STEM pipeline. In addition, from a data quality perspective, the current data entry procedures of the OEPM system may not be the best way to collect sensitive information, such as disability status. Some people may not want to disclose sensitive information not knowing who will be entering the data into the OEPM system, consequently, there may be underreporting of personal information.

## RECOMMENDATIONS

### DATA COLLECTION

The NASA Office of Education (OE) will need to prioritize data collection required for Agency-level performance reporting as there is limited amount of core data elements that are comparable across Space Grant consortia in order to capture program activity, outputs and outcomes. The following data are required by the 2014-2016 NASA Strategic Plan:

- For each fellowship/scholarship recipient and student who received a significant investment, the following information: gender, race, ethnicity, disability status, and institution name.
- The number and type of direct participants to each of Space Grant project activity.

To ensure the reported information is valid and comprehensive, NASA OE should consider the following recommendations:

- NASA OE should use the Space Grant logic model and data quality assessment presented in this report to revise Space Grant data collection and reporting forms in the OEPM system. The purpose for the revision is to reduce data collection burden while focusing on collection of data elements that align with key inputs, outputs and outcomes. The stakeholders reported redundancy and burden of data collection and reporting (as described in topic 4, Performance Data Reporting and Data Sources for Evaluation, page 6), NASA OE should respond and streamline data collection and reporting.
- NASA OE should review whether it is possible to require access to student demographic information for fellowship scholarship and funding awardees for all consortia and affiliates. At a minimum, NASA OE should establish data collection agreements subsequent to awards so that all awarded students' demographic information can be collected.
- NASA OE should require consortia to report their respective definitions of "significant investment" used for each student reported. Interviews revealed variation in definition of "significant investment." For example, one consortia director reported their definition of significant investment was students receiving \$2,500 dollars or more, while another consortia director reported significant investment as for a specific program for minority institutions, students who received funds to purchase textbook were counted as students received significant investment because for this specific project, it is a critical support for those students to continue with the study.
- NASA OE should require all consortia report their data collection methods including any uncertainty, such as potentially missing data.
- NASA OE should institute uniform data collection with respect to direct participant attendance for all project activities. For example, NASA might require a sign-in sheet that should be signed by participants on the day of the activity in order to provide verification for the numbers reported. This documentation should be kept on file to support the performance data entered into the OEPM system.
- NASA OE should look into if it is possible to allow year round reporting to the OEPM system and if more people could access to the OEPM system to enter data directly as recommended by the stakeholders during the stakeholder consultation (Topic 2, Space Grant Performance Monitoring and evaluation, page 5).

## PERFORMANCE MONITORING SYSTEM

While additional Space Grant data to be collected are still open to discussion, NASA OE and consortia will need to agree on the Space Grant model, variations, and common objectives in order to effectively implement a performance monitoring system. Consequently, the Space Grant Program may need to decide on the program model or set of models and align the data to be

collected. The present technical assistance made it clear that, without a common objective, each consortium will create its own performance objectives and data to report. At a minimum, Space Grant may need to be delineated into groups of consortia with the same characteristics. For example, consortia that have a NASA Center within their boundaries may share similar challenges, strategies and outcomes; consequently, they may be categorized into one group. Performance monitoring system should be developed based on the program model(s). NASA OE should consider the following recommendations:

- Track participants longitudinally to capture if they are in the STEM pipeline or employed in a STEM field. NASA OE may need to specify a number of years after participation for tracking.
- Continued data collection on affiliates and non- affiliates. This informs NASA OE of affiliate and non-affiliate involvement in project activities and identifies the affiliate as a community college or a MSI, as diversity is an important element of Space Grant goals and objectives.
- While output and outcome data collected during FY 2010-2014, i.e., revised and new courses, publications, presentations, technology transfers, and additional funds are valid and reliable data, NASA OE may want to reconsider whether they are sufficiently related to the Space Grant Program model. The logic model we propose from this technical assistance did not include these outcome or output data. According to the proposed logic model, below are data elements that we recommend to collect to measure outputs:
  - Individual level demographic information and other information, such as institution attending and major of students who received scholarship/fellowship/internship (added recently) and significant investment. These are valid and reliable data as far as they are recorded in Student Award page. As described previously, some consortia may not have comprehensive information.
  - Project activities, names of participating affiliates and non-affiliates and their types and NASA partners. Name and types of organizations are valid and reliable data. The nature of partnership is not systematically documented.
  - Direct participants to each project activity by type. These are currently less valid data as consortia valid the way they collected data.
  - New and revised courses and estimated number of students who will take these courses. The names of new and revised courses are valid and reliable data.
- Consortia should report how their programming reflects their respective state's needs. The current Annual Performance Data Report does not ask this question, but both Office of Education staff and consortia directors mentioned responding to state needs was an important aspect of Space Grant Program. Additionally, NASA OE may catalogue and publish different context, programming, and consequently outputs and outcomes of consortia so that consortia can learn from each other.
- NASA OE should publish a program-level annual performance report in order to inform consortia about the status of the national program. The report should provide a reference point for each consortium about program characteristics, area of focus, outputs and outcomes, to articulate the Space Grant model and the diversity of the consortia. This type of reporting to consortia could be one of the ways to respond to the concern raised by the stakeholders that they were unclear how data they reported were utilized (Topic 2, Space Grant Performance Monitoring and Evaluation, page 5) and they wanted to know more

about Space Grant (topic 4, Performance Data Reporting and Data Sources for Evaluation, page 6). The report also can address the recommendations from the stakeholders to include the national reference points to evaluate consortia's progress and outcomes (Topic 2, Space Grant Performance Monitoring and Evaluation, page 5).

- NASA OE should look into if aligning consortia performance periods is possible to streamline data collection and to make data comparable across year and across consortia.

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## Limitations

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The above recommendations did not include the cases where data would be used for other purposes, such as responding to congressional staff inquiries related to their respective congressional districts. Consortia may need to review if the data are needed for other types of reporting and if the same data collection process is useful. Finally, the above recommendations have not considered what may be future data requirements. Agency or government level requirements may change over the years and make it difficult to continue to collect the same set of data over a period of years.

## LOGIC MODEL

With respect to the Logic Model, NASA should consider the following recommendations:

- Logic Model outcomes should also be in the Agency Performance Indicators (APIs) and/or performance goals.
- The Logic Model should be used with consortia and community stakeholders to illustrate the goals, strategies, objectives, outputs and outcomes of the Space Grant program. The Logic Model can also be used as a guide among consortia for strategic planning.
- Increase the number of site visits to help consortia improve management processes.
- Include qualitative data collection and analyses of report data to obtain more in-depth insight of Space Grant success and impact.

## PROPOSED EVALUATION

Ultimately, the present technical assistance sought to propose a plan by which Space Grant could be evaluated. Specifically, the purpose of the proposed evaluation is to document and assess the implementation, outcomes, and impacts of the Space Grant Program during the five-year period 2010-2014. The proposed evaluation is framed by a series of evaluation questions and a preliminary Logic Model (presented earlier) that identifies critical inputs, activities, outputs, and outcomes as well as their relationships. Based on the feedback received from stakeholders, the following are the evaluation questions (with explanations of why and how they were modified from the original evaluation questions provided).

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### Proposed Questions

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**EQ1a. Were Space Grant activities, as defined in the 2010 solicitation, carried out in compliance with Public Law 100-147?**

**EQ1b. Were Space Grant activities, as defined in the 2010 solicitation, carried out in alignment with the priorities of NASA Education and NASA research and technology development?**

Explanation: EQ1 was modified to address the double-barreled nature of the original question (two questions being asked in one question). Further, stakeholders suggested that the elements of the Public Law, as well as NASA education priorities and NASA research and technology development priorities, be fully defined and operationalized for properly addressing this question. Finally, stakeholders opined that because priorities changed annually during this time period (2010-2014), it may be difficult to measure compliance and alignment.

**EQ2a. To what extent did funded activities engage the intended populations (i.e., diverse students, faculty, and institutions) as defined in the 2010 solicitation?**

**EQ2b. To what extent did funded activities meet program goals as defined in the 2010 solicitation?**

Explanation: EQ2 was modified to address the double-barreled nature of the original question. Further, stakeholders suggested it will be important to operationally define “diversity” as it relates to the student, faculty, and institution.

**EQ3. To what extent did the methods of soliciting applications or requests, review of those requests, and awarding and distributing Space Grant funds at the National as well as consortium levels support the quality of the results?**

Explanation: This question was modified to include a suggestion to examine how the methods employed at the National as well as consortium levels affected results. The term “quality” was also identified as needing definition with suggestions related to outputs and outcomes (e.g., publications, presentations, conferences; dosage and exposure; student engagement in hands-on activities; and success of students in STEM majors and careers).

**EQ4a. What “promising” practices exist in Consortia partnerships among universities, federal, state, and local governments, and aerospace industries to encourage and facilitate the application of university resources to aerospace and related fields?**

**EQ4b. To what extent are these practices related to the quality of results?**

Explanation: EQ4 was modified to address the double-barreled nature of the original question. This question was further modified to change “effective” practices to “promising” as there is no effectiveness data in order to address this question. Finally, the term “quality” was also identified as needing definition with suggestions related to outputs and outcomes.

**EQ5. What have been Space Grant’s major contributions to NASA’s education mission?**

Explanation: No changes were suggested by stakeholders for this evaluation question, yet the term “major contributions” needs definition. One suggestion is to look for changes in NASA Education mission, policies, or practices that may have been influenced by Space Grant activity.

**EQ6. Given the national investment in Space Grant program, what, if any, new approaches to the management of Space Grant program should NASA consider for the future?**

Explanation: No changes were suggested by stakeholders for this evaluation question, yet stakeholders suggested a formative approach to measure consortia annual progress and practice at the mid-year point to provide feedback and permit performance improvement (possibly defining a “promising” practice).

**EQ7. In all, what are the challenges, barriers, and constraints encountered in ensuring high-quality results?**

Explanation: No changes were suggested by stakeholders for this evaluation question, yet the term “quality” requires definition as stated in comments related to EQ3 above.

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Evaluation Framework

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In order to answer these evaluation questions, an evaluation framework will be developed that captures how state consortia will be selected for the clustered multiple case studies (sampling plan), how data to answer the evaluation questions will be collected (and from whom), how the collected data will be analyzed to answer the evaluation questions, and how the findings from the analysis will be reported. Evaluation frameworks serve to organize key elements of an evaluation plan including: evaluation questions and the approach to responding to each question; evaluation design; description of the specific program activities that are the focus of the evaluation study and anticipated outcomes based on existing research evidence; sampling strategy (as appropriate); strategy for engaging stakeholders to participate in the evaluation study; data collection methods; and data analysis methods appropriate to responding to the evaluation questions. The following exhibit presents a preliminary evaluation framework for an external evaluation of Space Grant.

<b>Evaluation Question</b>	<b>Type</b>	<b>Evaluation Approach</b>	<b>Data Collection Approach</b>	<b>Data Analysis Approach</b>
<b>EQ1a. Were Space Grant activities, as defined in the 2010 solicitation, carried out in compliance with Public Law 100-147?</b>	Normative	Discrepancy Evaluation—requires operationalizing PL requirements.	Gather all available Space Grant activity descriptions from APD Reports, OEPM data, and State Consortia records	Qualitative—Comparison of documented Space Grant activities against PL requirements
<b>EQ1b. Were Space Grant activities, as defined in the 2010 solicitation, carried out in alignment with the priorities of NASA Education and NASA research and technology development?</b>	Normative	Discrepancy Evaluation—requires operationalizing NASA education and NASA research and technology development priorities.	Gather all available Space Grant activity descriptions from APD Reports, OEPM data, and State Consortia records	Qualitative—Comparison of documented Space Grant activities against NASA education and NASA research and technology development priorities
<b>EQ2a. To what extent did funded activities engage the intended populations (i.e., diverse students, faculty, and institutions) as defined in the 2010 solicitation?</b>	Descriptive	Descriptive assessment of available program data.	Gather all available Space Grant funded activity descriptions and engaged populations information from Student Data Tables, ADP reports, and selected OEPM data	Quantitative--Descriptive analysis of number/percentage of populations engaged
<b>EQ2b. To what extent did funded activities meet program goals as defined in the 2010 solicitation?</b>	Normative	Discrepancy Evaluation—requires definition of 2010 solicitation goals.	Gather all available Space Grant funded activity descriptions from Student Data Tables, ADP reports, State Consortia records, and selected OEPM data	Qualitative--Comparison of documented activities and 2010 solicitation goals
<b>EQ3. To what extent did the methods of soliciting applications or requests, review of those requests, and awarding and distributing Space Grant funds support the quality of the results?</b>	Descriptive	Multiple Case Study	Gather all available Space Grant funded activity descriptions from Student Data Tables, ADP reports, and selected OEPM data; operationalize “quality of results”	Quantitative—relationship between methods and quality of results; Qualitative—examine association of methods and quality of results as reported by Consortia
<b>EQ4a. What effective practices exist in Consortia partnerships among universities, federal, state, and local governments, and aerospace industries to encourage and facilitate the application of university resources to aerospace and related fields?</b>	Descriptive	Multiple Case Study	Gather all available Space Grant activity descriptions from APD Reports, OEPM data; Interviews with State Consortia Directors	Qualitative--Descriptive analysis of Space Grant Consortia practices identified as “effective” and their relationship to university resources expended
<b>EQ4b. To what extent did these practices ensure the quality of results?</b>	Cause & effect	Multiple Case Study	Gather all available Space Grant activity descriptions from APD Reports, OEPM data	Qualitative—descriptive relationship between effective practices and quality of results
<b>EQ5. What have been Space Grant’s major contributions to NASA’s education mission?</b>	Normative	Discrepancy Evaluation—requires definition of “major” contributions	Gather all available Space Grant activity descriptions from APD Reports, OEPM data	Qualitative—Comparison of documented Space Grant activities against NASA education mission
<b>EQ6. Given the national investment in Space Grant program, what, if any, new approaches to the management of Space Grant program should NASA consider for the future?</b>	Descriptive	Summative Evaluation	Gather all available Space Grant activity descriptions from APD Reports, OEPM data; Interviews with State Consortia Directors	Qualitative—identification of new approaches to the management of Space Grant program
<b>EQ7. In all, what are the challenges, barriers, and constraints encountered in ensuring high- quality results?</b>	Descriptive	Multiple Case Study—requires definition of “high quality” results	Gather all available Space Grant activity descriptions from APD Reports, OEPM data; Interviews with State Consortia Directors	Qualitative—identification of challenges, barriers, and constraints encountered in project activities yielding high quality results

The evaluation plan also includes the formation of an expert stakeholder panel that will serve to help develop and review the progress of the evaluation, including sampling design, data collection tools and field procedures, interim and final results, and reporting.

The proposed evaluation design is a rigorous mixed/multiple methods design, involving secondary analysis and clustered multiple case study approaches to answer the descriptive, normative, and cause-and-effect evaluation questions. This design capitalizes on both the availability of consistently collected data across all participants, as well as in-depth study of smaller groups of selected participants (5-7 state consortia) who are similar on key dimensions (such as program focus). The proposed design emphasizes efficiency and minimizing data collection burden on the state consortium.

Evaluation questions about compliance (EQ1) and engaging the intended populations (EQ2) will be addressed across all 52 state consortia through secondary analysis of common data elements found in OEPM, including (1) Institution type of affiliates and if they are a Minority Serving Institution, (2) The number of fellowship/scholarship recipients, as well as their demographic and other information, (3) The number of students who received significant investment and their demographic and other information, (4) The number of new or revised courses, and (5) Publications, invited papers, papers presented, patents, technology transfers, and additional grants and their amounts. These secondary data will be supplemented with information maintained by state consortia regarding their activities and results (state consortium archival data) and primary data gathered from state consortium staff, affiliates, and partners for the expressed purpose of telling the state consortium's story about activities and results. These more in-depth data, collected across samples of 5-7 state consortia with a common focus, will be used to address questions about effective practices (EQ4), major contributions (EQ5), and challenges, barriers, and constraints encountered in ensuring high-quality results (EQ7).

All in-depth data collection (e.g., staff interviews, archival record review, and focus groups with affiliates and partners) with more than 9 subjects will be reviewed and approved by an Institutional Review Board (for adherence to the Protection of Human Subjects); rigorous informed consent procedures should be utilized. Data analysis will include descriptive statistical analysis for most quantitative data (e.g., counts, percentages, ranges, etc.), as well as content analysis and ethnographic analysis for the qualitative data (e.g., thematic analysis of interview and focus group transcripts and ethnographic analysis that focuses on constant discovery and constant comparison of relevant situations, settings, styles, images, meanings and nuances). The aim is to be systematic and analytic, but not overly rigid as to miss the diversity and uniqueness of state consortium implementation and results.

The proposed evaluation is anticipated to require nine months to implement completely. The first two months will be spent refining the evaluation design with the expert stakeholder group, developing the secondary data analysis models, conducting preliminary interviews with state consortia staff, and preparing primary field data collection protocols and tools for review and approval. The following 4 months will be spent gathering primary and secondary data, and the last three months will be dedicated to preparing the clustered multiple case studies, summarizing the findings from the quantitative and qualitative data, and preparing the final report.