NDSGC EVALUATION PLAN

February 2020 Revision

A. INTRODUCTION TO NDSGC EVALUATION PLAN

The North Dakota Space Grant Consortium (NDSGC) is committed to effective and evidence-based evaluation procedures. The NDSGC will continue to conduct meaningful assessments of the effectiveness of all programmatic elements. The NDSGC aligns all programmatic elements with NASA's Mission Directorates, NASA's STEM Engagement Priorities, NDSGC's overarching goals, and NDSGC's SMART (Specific, Measureable, Achievable, Relevant, and Timely) objectives. **Achievement of SMART goals informs decision-making each year.** Where the NDSGC succeeds in meeting SMART goals, existing methods are continued and expanded upon. Where the NDSGC falls short of attaining SMART objectives, methods are re-examined and improvements are implemented.

The NDSGC presents its Evaluation Plan for FY 2020 – FY 2024 by programmatic element. Programmatic elements are divided into NASA Internships and Fellowships (NIFs), Mission Directorate Aligned Projects (MDAPs), and Competitively Awarded Projects (CAPs). Quantitative and qualitative measures of success are discussed, along with formative and summative assessments. Each programmatic element lists associated SMART objectives and procedures for measuring each one.

Across all programmatic elements, the NDSGC regularly utilizes **social media platforms** to encourage the participation of North Dakota students, teachers, faculty, and the general public, in all programmatic elements. The NDSGC has a robust presence on Snapchat, Instagram, YouTube, Facebook, and Twitter. The continued strategic use of these platforms (e.g. application of hashtags, tagging other users, events, groups, and locations, etc.) better reaches the next generation of students, who are actively engaged in this form of communication. Continued improvements in marketing strategies with social media has aided in the recruitment of talented students for various funding opportunities and participation in hands-on NASA activities. The NDSGC examines the **reach of posts via total *retweets, views, shares, likes* (and other reactions)** as well as **increased attendance at events and an increase in applications to NDSGC programming** as a result of social media use to determine the effectiveness of sharing information via these platforms.

B. NASA Internships and Fellowships (NIFs 1-5)

All students who receive funding of at least $2500 are **longitudinally tracked** through the National Space Grant Foundation. These students include recipients of **NASA Internships (NIF-1), Industry Internships (NIF-2), Graduate Research Fellowships (NIF-4),** and **Undergraduate Research Stipends (NIF-5).** Although student recipients of **Bridge Research Stipends (NIF-5)** do not meet this minimum funding level, they are also longitudinally tracked. This annual survey is an assessment that can aid in determining program impact, as students continue in STEM studies or NASA-relevant careers. Students are surveyed about the impact of Space Grant programming on their academic and career paths, including data on current employment status.

Students who receive funding for internships, fellowship, and/or research funding are also required to submit a final report detailing their research progress and their experiences upon completion of their projects (at the end of each semester for which they receive funding). These **final reports** are used in part to determine the effectiveness of supporting internships and fellowships for student achievement of academic and career goals. An upward trend in the **number of student applications** received by the NDSGC for NASA internships and fellowships each semester is also an indicator of program success.

The NDSGC maintains **communication** with NASA internship, fellowship, and research stipend recipients throughout their award period. An element of this communication includes an **official check-in** between the NDSGC team and student award recipients regarding their research progress and overall experience. This **formative review** aids the NDSGC in determining impactful strategies to promote student learning and helps to identify effective mentors on these projects. This evaluation allows the NDSGC to improve the experience for both current and future students participating in these programs.

As the **Bridge Research Stipend (NIF-5)** program continues to evolve, the NDSGC implemented an **interview process** to identify areas for program improvements. This **summative evaluation** includes an interview following participation in the program, where students are asked about their overall experiences and suggestions for program improvements.

NIF SMART Goals: The following goals align with FY20 – FY24 proposed funding levels. The NDSGC will provide a minimum of 51.1% of NIFs funding to female students and underrepresented gender identities in STEM annually (SO-1).[1] Although available data does not include students who identify outside the gender binary, these gender identities are underrepresented in STEM fields as well. Therefore, the NDSGC will include these students in this goal. The NDSGC will provide a minimum of 11.6% of NIFS funding annually to underrepresented minority students in STEM (SO-2).[2] Each of these percentages are in alignment with the 2017 enrollment in ND higher education institutions (most recent data available). The NDSGC will partially and/or fully fund 5 NASA internships (NIF-1, SO-3), 2 Industry internships (NIF-2, SO-4), 5 graduate research fellowships (NIF-3, SO-5), 4 undergraduate

[1] https://nces.ed.gov/programs/digest/d18/tables/dt18_304.30.asp
[2] https://nces.ed.gov/programs/digest/d18/tables/dt18_306.60.asp

research stipends (NIF-4, SO-6), and 3 bridge research stipends (NIF-5, SO-7).

For example, to assess our goal of awarding 11.6% of NIFs to underrepresented minority students:

$$Goal\ (11.6\%) = \frac{\#\ of\ NIFs\ Awarded\ to\ Underrepresented\ Minority\ Students}{Total\ \#\ of\ NIFs\ Awarded}$$

If we award 19 total NIFs, and 3 of these awards go to underrepresented minority students, we will meet our goal of awarding a minimum of 11.6% of NIFS to underrepresented minority students.

C. Mission Directorate Aligned Projects (MDAPs 1-11)

All students who receive funding of at least $2500 as either **Student Scholarships (MDAP-1)** or **Graduate Assistantships (GA) (MDAP-2)** are **longitudinally tracked** through the National Space Grant Foundation. This annual survey is an assessment that can aid in determining program impact, as students continue in STEM studies or NASA-relevant careers. Students are surveyed about the impact of Space Grant programming on their academic and career paths, including data on current employment status.

Students who receive GA funding are also required to submit a final report detailing their research progress and their experiences upon completion of their projects, at the end of each semester for which they receive funding. These **final reports** are used in part to determine the effectiveness of supporting GAs for student achievement of academic and career goals. The NDSGC maintains **communication** with GA recipients throughout their award period. An element of this communication includes an **official check-in** between the NDSGC team and GA students regarding their research progress and overall experience. This **formative review** aids the NDSGC in determining impactful strategies to promote student learning and helps to identify effective mentors on these projects. This evaluation allows the NDSGC to improve the experience for both current and future graduate students.

STEM Ambassadors (MDAP-3) (college students who are paid hourly to conduct and participate in STEM outreach events across the state) are required to complete multiple forms of assessment. These students submit **data spreadsheets** to the NDSGC throughout the year regarding the impact of their activities including data on the number of K-12 students, teachers, and community members participating in their programming. When appropriate (such as K-12 classroom visits), STEM Ambassadors also distribute **participant evaluations** regarding their experiences and program impact. The K-12 student surveys inform the NDSGC of effective activities, improvements to be made to future lessons, and any further trainings necessary for STEM Ambassadors.

STEM Ambassadors also participate in formative and summative evaluations regarding *their* experiences in the program. Following their training at the start of their appointment, they complete a **survey** that the NDSGC uses to improve programming and support for the STEM Ambassadors throughout the year. STEM Ambassadors also complete a **formative evaluation**

after the first semester of participation for the NDSGC to identify further areas in need of improvement (such as an additional training to refresh STEM Ambassadors on effective teaching strategies). This formative evaluation drives content included at an **in-person meeting** held at the start of the spring semester each year, where STEM Ambassadors participate in supplemental training. A **summative evaluation** is given to STEM Ambassadors following one year of participation in the program to further examine areas in need of improvement. An upward trend in the **number of STEM Ambassador applications** received by the NDSGC each year is also an indicator of program success, especially as these applications continuously come from more affiliate colleges and non-research institutions, increasing the reach of NDSGC programming.

Students who receive funding for **Travel Grants (MDAP-4)** to present research at conferences or attend professional development workshops are required to submit a **final report** detailing their experiences upon return from travel. These final reports include any connections gained through networking as a result of conference/workshop participation and further achievement of academic and career goals. An upward trend in the **number of student applications** received by the NDSGC for travel grants each semester is also an indicator of program success.

Student leads for **High Altitude Ballooning (HAB) Initiatives (MDAP-5)** are required to submit a **final report** following the academic year, documenting team activities throughout the year, participant demographics, resulting publications, outreach activities, successes, and challenges. The HAB team submits **flight reports** to the NDSGC throughout the year and holds **regular meetings** and **launch debriefings** to determine areas in need of improvement. The HAB team must demonstrate continued successful performance (indicated by number of launches, new payload development, improved launch, chase, and retrieval strategies, publications or conference presentations, thesis research, impact of outreach activities, etc.) and on-time reporting to be eligible for funding the following year.

Additionally, under **MDAP-5**, is the Near-Space Balloon Challenge (NSBC) for middle and high school teams. The NDSGC may transform this student competition in future years, yet will employ similar methods of evaluation as described here. After submitting **proposals** at the start of the academic year, teams participate in **multiple design reviews** (NASA Project Life Cycle milestones, including video conference calls with college student mentors and the NDSGC team) to evaluate progress on their payloads and identify any guidance or resource needs for successful completion of the competition. At the competition, NSBC teams **present** their final payload design and research goals. Following the launch and retrieval, NSBC teams submit a **final report** documenting team activities throughout the challenge, participant demographics, outreach activities, research goals, results, and analysis, and both successes and challenges. NSBC teams are evaluated at each stage of the challenge by a panel of faculty and graduate student judges in STEM fields.

All NSBC participants (college student mentors, K-12 teachers, and students) complete an **online survey** following their participation in the challenge. The NDSGC uses this survey to assess the program's impact on students' decisions to pursue STEM degrees and/or NASA-relevant careers as well as programmatic improvements for future iterations of the challenge.

These teams must demonstrate continued successful performance (seen by special awards,

improvements made throughout multiple years of participation and/or one challenge season etc.) and on-time reporting to be eligible for funding the following year. An upward trend in the **number of NSBC team applications** received by the NDSGC each year, and a **more comprehensive geographical representation of the state** by participating school, are both indicators of program success.

Students involved in **Human Spaceflight Laboratory (HSFL) (MDAP-6)** research are required to submit a **final report** following the academic year, documenting activities throughout the year, participant demographics, resulting publications, outreach activities, successes, and challenges. Students working in the HSFL must demonstrate continued successful performance (indicated by number of simulation missions, innovative habitat, rover, and space suit development, improved mission strategies, strengthened NASA, institutional, and industry collaborations, publications or conference presentations, thesis research, impact of outreach activities, etc.) and on-time reporting to be eligible for funding the following year.

In-service, pre-service, classroom, and informal educators participating in the **Special Needs Education Initiative (MDAP-7)** will complete **pre- and post- surveys** on their experiences in the program. These surveys include topics such as: confidence levels in working with audiences and students with special needs or disabilities, awareness of resources, and perceptions of activities, workshop content. Workshop participants will also form a **national network of educators** throughout the duration of the program (proposed to be the period of performance of this award). **Continued communication** with these educators and their experiences will help the NDSGC to determine program impact and identify areas for improvements in future iterations of the workshop.

The NDSGC completes in-depth evaluations of **In-service Educator Workshops (MDAP-8)**. **Pre- and post- evaluations** include items on confidence in knowledge of space sciences and NASA missions, confidence in teaching space sciences, the building of networks with other ND STEM educators, knowledge on the availability of resources, and capabilities to conduct workshop activities with various groups of learners. The NDSGC regularly completes **Institutional Review Board (IRB) approved studies** at long-duration in-service educator workshops and utilizes these results in the development of subsequent professional development workshops. These results also aid the NDSGC in revising evaluations implemented in future programming.

The impact of educator workshops is also assessed through **participant evaluations** and **future participation in NDSGC programs**. At **Pre-service Educator Workshops (MDAP-9)**, the NDSGC distributes surveys to participants aimed at program improvement and evaluation of the achievement of workshop goals (e.g. increased confidence in teaching space sciences). The NDSGC reviews these evaluations in developing future iterations of the workshops.

Faculty, students, and educators participating in **Synergistic Activities (MDAP-10)** will complete a **post-survey** on their experiences along with a **final report**. This information will be used to determine program impact and NDSGC funding decisions for similar activities in the future. **Follow-up communication** with these participants on results of participating in MDAP-10 (e.g. starting their own rocketry programs following attendance at RockOn!) will further

determine the impact of participating in these programs.

The NDSGC conducts **STEM Outreach Events (MDAP-11)** throughout the year. These events are open to K-12, students, teachers, and members of the public. STEM education events (including K-12 classroom visits) are largely conducted by STEM Ambassadors. STEM Ambassadors (or other students, faculty, and staff conducting these visits) submit **data spreadsheets** to the NDSGC throughout the year regarding the impact of their activities such as the number of K-12 students, teachers, and community members participating in their programming. When appropriate, STEM Ambassadors also distribute **participant evaluations** regarding their experiences to gauge program impact and make improvements for future iterations. These surveys inform the NDSGC of effective activities and any further trainings necessary for STEM Ambassadors. The **increasing number of requests** for UND **Aerospace Tours** and of **NDSGC participation in community events** is also used as an indicator of program success.

Space Camps also fall under **MDAP-11**. The NDSGC evaluates the effectiveness of its space camps in **summative surveys** given to participants (K-12 students). The NDSGC uses this survey data to assess the program's impact on students' decisions to pursue STEM degrees and/or NASA-relevant careers as well as programmatic improvements for future iterations of the competition.

MDAP SMART Goals: The following goals align with FY20 – FY24 proposed funding levels. The NDSGC will fund 100 student scholarships (MDAP-1, SO-8), 4 graduate assistantships (MDAP-2, SO-9), 8 STEM Ambassadorships (MDAP-3, SO-10), 6 travel grants (MDAP-4, SO-11), 8 HAB initiatives (MDAP-5, SO-12), 4 HSFL activities (MDAP-6, SO-13), 8 educators in the Special Needs Education Initiative workshops (MDAP-7, SO-14), 20 in-service educators (MDAP-8, SO-15), 200 pre-service educators (MDAP-9, SO-16), and 4 synergistic activities (MDAP-10, SO-17). The NDSGC will engage 20,000 participants in STEM outreach events over the period of performance (SO-18). The NDSGC will participate in an informal education event hosted by a Tribal College affiliate or held in a Tribal Community to encourage STEM and NASA involvement of American Indian students and their families and to encourage participation in subsequent years. The NDSGC will conduct an increased number of informal education events through the connections made with the ND STEM Network. The NDSGC will award 6 student travel grants, with at least one travel grant awarded to a student at a non-research affiliate institution. The NDSGC will expand involvement in the HSFL and HAB programming to include interdisciplinary teams of student researchers, from both UND and affiliate colleges, with the goal of having at least one new ND affiliate institution committed to involvement.

For example, to assess our goal of reaching 20,000 members of the public STEM outreach events over the period of performance (with at least one event being held in a Tribal community):

$$Goal\ (20{,}000) = \#\ of\ community\ members\ at\ STEM\ outreach\ events$$

$$Sub\ Goal\ (1) = \#\ of\ events\ held\ in\ a\ Tribal\ community$$

If we engage 20,000 community members in STEM outreach events with one event being held in a Tribal community, we will meet our goal.

D. Competitively Awarded Projects (CAPs 1-6)

Faculty Principal Investigators (PIs) who have received **Faculty Seed Research Grants (CAP-1)** are required to submit a **final report** at the conclusion of their performance period. These reports must include research progress and results, discussion of accomplishment alignment with proposed outcomes, participant demographics (both faculty and students), resulting publications and conference presentations, outreach efforts, and plans for continued research development. The NDSGC uses these final reports to determine program impact on student preparation for research and careers that support NASA's goals and the high-tech workforce development needs of North Dakota.

Any direct-funded students participating in **CAP-1** projects who receive funding of at least $2500, are **longitudinally tracked** through the National Space Grant Foundation. This annual survey is an assessment that can aid in determining program impact, as students continue in STEM studies or NASA-relevant careers. Students are surveyed about the impact of Space Grant programming on their academic and career paths, including data on current employment status.

Students who receive direct funding through participation in **CAP-1** projects are also required to submit a final report detailing their research progress and their experiences upon completion of their projects, at the end of each semester for which they receive funding. These **final reports** are used in part to determine the effectiveness of supporting stipends for student achievement of academic and career goals.

All faculty members awarded **Faculty Course Development Stipends (CAP-2)** are required to submit a **final report** including details on the student population impacted, andragogy and overall teaching format utilized, metrics used to evaluate the course, inclusion of NASA content, and any research and publications resulting from course development.

All **Student STEM/NASA Competition Teams (CAP-3)** (NASA Robotics Mining, NASA Student Launch, FIRST Robotics, etc.) are required to submit a **final report** following their event, documenting team activities throughout the year, participant demographics, resulting publications, outreach activities, successes, and challenges. These competition teams must demonstrate continued successful performance and/or improved performance (seen by competition placement, special awards, impact of outreach activities, etc.) and on-time reporting to be eligible for funding the following year. These **performance trends** and an increase in the **number of student competition team applications** received by the NDSGC each year are both indicators of program success. In the fall of 2017, the NDSGC implemented a new online application process to accommodate the growing number of student competition team applications and to increase the competitiveness of funding support.

All recipients of **College Student Research Mini Grants (CAP-4)** must submit a **final report** at the end of the semester in which they have been awarded the funding. This report must include research progress and results, discussion of accomplishment alignment with proposed outcomes,

resulting publications and conference presentations, and plans for continued research development. The NDSGC uses these final reports to determine program impact on student preparation for research and careers that support NASA's goals and the high-tech workforce development needs of North Dakota.

All recipients (faculty or staff PIs) of **Affiliate Mini Grants (CAP-5)** must submit a **final report** following the proposed event/program. These reports must include a discussion of accomplishment alignment with proposed outcomes, demographics of program participants, resulting publications and conference presentations (if applicable), and plans for continued program development. PIs must also distribute **participant evaluations** regarding their experiences to gauge program impact and make improvements for future iterations.

All recipients (K-12 and informal educator PIs) of **Educator Mini Grants (CAP-6)** must submit a **final report** following the proposed event/program. These reports must include a discussion of accomplishment alignment with proposed outcomes, demographics of program participants, resulting publications and conference presentations (if applicable), and plans for continued program development. PIs must also distribute **participant evaluations** regarding their experiences to gauge program impact and make improvements for future iterations.

CAP SMART Goals: The following goals align with FY20 – FY24 proposed funding levels. The NDSGC will fund 8 faculty seed research grants (CAP-1, SO-19), 4 faculty course stipends (CAP-2, SO-20), 5 college student STEM/NASA competition teams (CAP-3, SO-21), 4 K-12 student STEM/NASA competition teams (CAP-3, SO-22), 12 college students research mini grants (CAP-4, SO-23), 8 affiliate mini grants (CAP-5, SO-24), and 8 educator mini grants (CAP-6, SO-25).

For example, to assess our goal of awarding funding for XX faculty seed research grants (with at least XX grants led by a PI located at a non-research affiliate institution):

$$Goal\ (8) = \#\ of\ Faculty\ Seed\ Research\ Grants\ Awarded$$

$$Sub\ Goal\ (4) = \#\ of\ Grants\ Awarded\ with\ PI\ at\ non\ research\ institution$$

If we award funding for 8 total faculty seed research grants with 4 of these awards going to a PI at a non-research affiliate institution over the period of performance, we will meet our goal.