

Effective for all Gen-4 ERC Site Visits

NATIONAL SCIENCE FOUNDATION  
DIRECTORATE FOR ENGINEERING  
ENGINEERING RESEARCH CENTERS PROGRAM

FY2021 GUIDELINES FOR  
PREPARING ANNUAL REPORTS  
AND RENEWAL PROPOSALS

FOR THE  
ENGINEERING RESEARCH CENTERS

CLASS OF 2020

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## i. Introduction

The purpose of this document is to provide information to Gen-4 Engineering Research Centers (ERCs) in the Class of 2020 regarding the requirements for the preparation of annual performance reports and renewal proposals. The function of the Annual Report (submitted as a renewal proposal in the case of Centers in their 5<sup>th</sup> years) is to communicate the ERC's vision, plans, activities, achievements and potential impacts in all aspects of Center operations. Because a renewal proposal has the same general structure and content as the Annual Report, in these Guidelines the term "Annual Report" will also refer to the renewal proposal. Where there are differences, they will be noted. The Annual Report is an opportunity for each Center to present a unified picture of the strategic scope of the convergent research, engineering workforce development, diversity and culture of inclusion, and innovation ecosystem programs; details about individual research projects and how they fit into the Center's vision, progress the ERC is making and milestones achieved. The Annual Report also contains plans for the next year and, for renewal proposals, plans for the next five years.

### 1. Planning for the Annual Report

Although the on-line database system [ERCWeb](#) aids in producing the required tables and charts, producing the Annual Report itself is still a major undertaking and one of the main responsibilities of the Center Director(s) and Administrative Director during the reporting year. The Center leadership team should meet several months before the report is due to develop a plan and schedule for the preparation of the document, and assign chapter and section responsibilities. The Center Director(s) must be directly involved throughout the process by writing sections and supervising the preparation of the content for the remaining sections, reviewing drafts, and ensuring the integration of all portions. The goal is a final document that is a strong, accurate, and a complete reflection of the Center's activities and accomplishments during the reporting year. The better the report and data quality, the easier it is for the reviewers to understand a Center's progress, and for the NSF Program Director to prepare a recommendation for the next year's funding or renewal approval recommendation.

#### 1.1 Report Preparation Steps

The Center's Administrative Director should review the important documentation that establish the ERC reporting requirements when planning for the Annual Report begins. These include the following documents:

- The Center's Cooperative Agreement. The Center's Cooperative Agreement is the mechanism by which the ERC is funded, and it is updated periodically to reflect major changes in Center personnel or research plans and testbeds. It includes the Center's responsibilities and NSF's responsibilities and describes annual reporting and performance review procedures and requirements.

- [NSF Proposal and Award Policies and Procedures Guide](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg), [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=pappg](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg)
- The [ERCWeb Library](https://www.erc-reports.org/public/library) at <https://www.erc-reports.org/public/library> contains the following documents plus others useful to the operations of the Center
  - o [FY2021 Guidelines for Preparing Annual Reports and Renewal Proposals](#) (this document)
  - o [FY2021 Guidelines for ERCWeb Data Entry](#). Contains screen by screen instructions for data entry into the ERCWeb Annual Report Data Entry System organized by data entry “tabs” as seen on the entry screens. It also contains a complete glossary of terms contained in this document.
  - o [FY2021 Gen4 ERC Performance Criteria](#). The criteria define the characteristics, behaviors and results that describe high-quality performance and low-quality performance as a function of the age of the Center. The site visit team and NSF staff use these criteria to perform their evaluation of the Center.
- [ERCWeb Annual Report Data Entry System](https://www.erc-reports.org) at <https://www.erc-reports.org> contains data entry screens, associated explanations and help screens. Log in with user ID and password and select Data Entry for your Center.

## 1.2 Requirements for New ERCs

### 1.2.1 Development of a Data Collection System

Each ERC must develop a data collection system and associated timeline to ensure that all necessary data are collected from the lead, partner, and collaborating institutions in time to compile and enter the data into the ERCWeb database. This process is described more completely in the [FY2021 Guidelines for ERCWeb Data Entry](#). It is important to review the ERCWeb input screens and the [FY2021 Guidelines for ERCWeb Data Entry](#) so that the requirements for data are understood. The sources of data needed should be identified early in the process and a system of collecting that data should be developed. When it is time to assemble the Annual Report, the Center inserts several tables produced by the ERCWeb database, as well as Center-created tables and figures, into the Annual Report as directed in this document. The Center needs to base its timeline for producing the Annual Report on the end of its Reporting Year. Any changes in NSF required data should be noted and adjustments/additions made to the data collection process. Figure 1 gives a visual depiction of the information and the data entry screens.

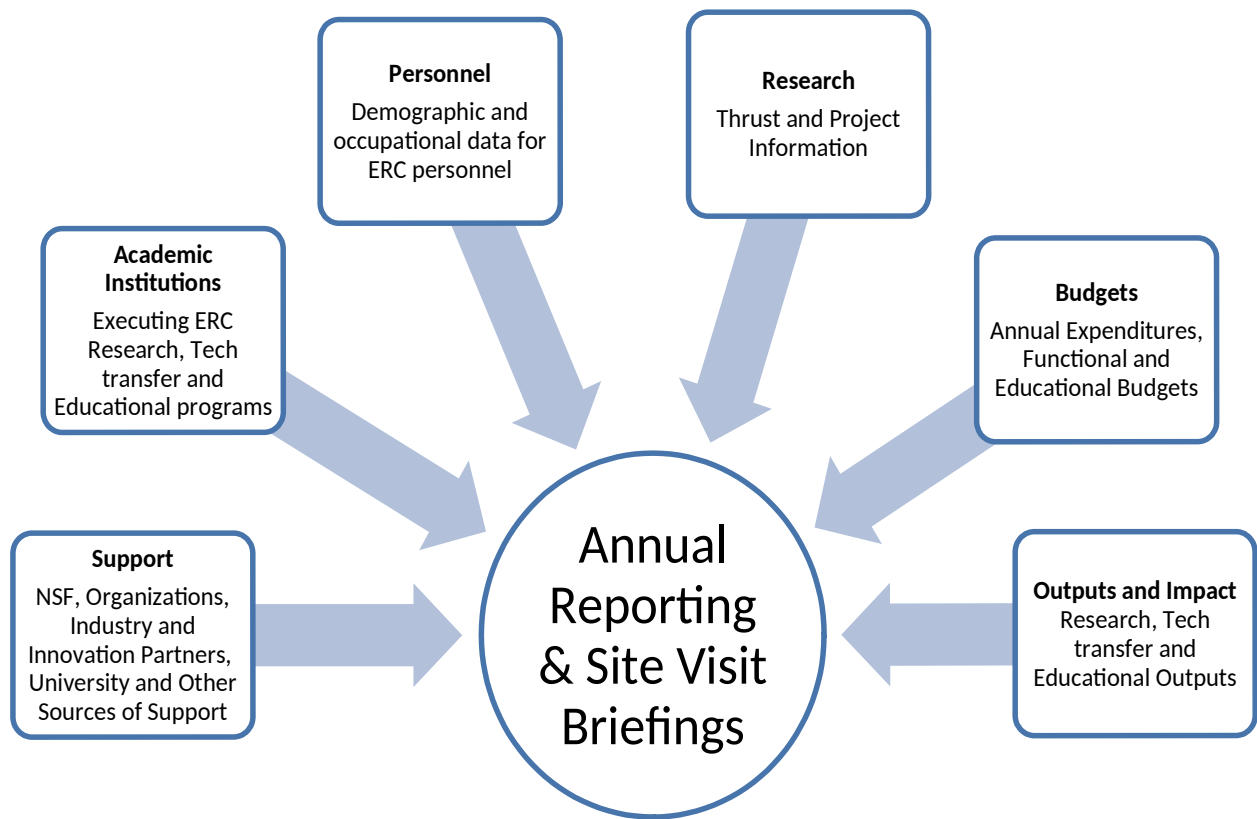


FIGURE 1 ERCWEB INPUT SCREENS HAVE SIX DATA ENTRY TABS TO ENTER THE REQUIRED DATA

### 1.2.2 Financial Management System

One of the first things that new Centers must contend with is establishing a financial management system. As soon as the first year of ERC support reaches the lead institution, the Center must be ready to begin allocating and spending it. All funding from NSF, industry member fees, and other sources of direct support, such as industrial sponsored project support or a Research Experiences for Teachers site awarded to the Center should be placed in an account(s) controlled by the Center. A Center's sponsored projects office may be able to split large awards from other sources in which the ERC is one of multiple recipients so that the Center's funds go into the Center's cost center or account. This allows the Center to get "credit" for receiving the support and gives the ERC control over the funds. At the lead institution, the Center's financial management system must include a plan to manage all sources of support including methods to account for cost-share and sub-contract budget proposals, approvals, fund allocations, expense approvals, and payment and budget allocation expectations/timeframes. The financial management system must be able to manage cost-share across the Center and at the subcontract level (budgets and expenses; institutionally and at the project level) and also be able to manage sub-contract budget proposals and allocations both institutionally and at the project/test bed level. The Center must also collect financial information about associated

projects that are key to achieving the ERC's strategic goals. This is discussed further in the [FY2021 Guidelines for ERCWeb Data Entry](#).

Given the magnitude of NSF ERC Program support, all ERCs must have financial management systems that can successfully pass an audit by NSF auditors from the Office of the Inspector General (OIG), or the Division of Institution and Award Support (DIAS), which is connected with the unit that oversees the awarding of ERC cooperative agreements. Any questions about **financial management** may be posed to Denise Robinson, [drobinso@nsf.gov](mailto:drobinso@nsf.gov), 703-292-8293 from Division of Grants and Agreements. She has extensive experience helping ERCs improve their cost accounting and financial documentation and is available to help.

## 2. Content and Structure of an Annual Report

The body of the Annual Report provides reviewers and NSF with an integrative summary of the evolution of the vision and strategic plan, infrastructure, activities, outcomes and potential impacts of the Center. This narrative section of the report should communicate the full scope of the Center with sufficient technical depth that the reader fully understands the breadth, depth, and value added of the Center. It contains data representing Center outputs, personnel, sources of support, and expenditures. The associated appendices provide further in-depth information to support the narrative through brief updates on the progress of individual projects and other supporting information. Some **required tables, figures and participant lists** are provided from the ERCWeb database system, see <https://www.erc-reports.org>.

The Annual Report should be developed in a manner that best suits an individual Center's strategic research plan and accomplishments within the structure outlined in this document. It should describe how the support provided to the Center has resulted in a synergy of convergent research, engineering workforce development, diversity and culture of inclusion, and innovation ecosystem; and their potential impacts that could not be achieved by a collection of single awards. This guidance represents the baseline information to be included; beyond that, the ERC may include other pertinent information to yield an informative document that will communicate in the best fashion for that Center.

**Report Outline.** Each component is described in further detail in Section 3.

- Cover Page
- Table of Contents
- Project Summary
- Participant Tables
- Executive Summary
- Narrative
  1. Vision and Impact
  2. Strategic Plan
  3. Management and Organization
  4. Convergent Research (CR)



5. Engineering Workforce Development (EWD)
  6. Diversity and Culture of Inclusion (DCI)
  7. Innovation Ecosystem (IE)
  8. Evaluation
  9. Financial Support and Infrastructure
- Budget Request
  - Appendices
  - Summary List of Appendices
    1. Appendix I: Glossary and Acronyms
    2. Appendix II: ERCWeb Personnel Summary
    3. Appendix III: Agreements and Certifications
    4. Appendix IV: Board, Council, Committee Charters
    5. Appendix V: ERC Projects List
    6. Appendix VI: Project Updates
    7. Appendix VII: Bibliography of Center Publications
    8. Appendix VIII: Data Management Plan
    9. Appendix IX: Biographical Sketches
    10. Appendix X: Current and Pending Support (for Renewal Proposals)

### 3. Annual Report Requirements

This section contains the body of the report (or renewal proposal for Centers in their 5th year) and should be **100 pages in length or less**. This recommended page count excludes the required NSF graphics and tables, required NSF forms, budget pages, and appendices. This section contains narrative interspersed with required NSF tables and charts produced by ERCWeb. The ERCWeb tables and charts should be placed within the narrative after the first time they are discussed and must be sized and presented to be easily readable. This is especially important for the ERCWEB tables that may be returned to the ERC in small font sizes. Also, the font color must be readable against the background color of a row.

#### 3.1 Cover Page

The report cover page should include the title of the Center, list the lead and any core partner institutions involved, and list the names of the Director(s). It should also indicate the following information:

- The Award Year of the Site Visit for which the Annual Report is submitted, e.g. Year 2 Annual Report (or the year of the renewal proposed, e.g., Year 5 Renewal Proposal);
- The Due Date of the report (i.e., day, month, year); and
- The ERC Cooperative Agreement number.

## 3.2 Table of Contents

The Table of Contents should indicate the page numbers and titles of all the sections and appendices. The Table of Contents should also list the title and page number for each ERCWeb table or figure under the relevant section.

## 3.3 Project Summary

The Project Summary is a one-page summary of the goals, programs, and achievements of the ERC. The summary should be updated annually, contain an overview, and address intellectual merit and broader impacts. This summary must be prepared according to the instructions in the [NSF Proposal and Award Policies and Procedures Guide](#). The summary must provide specific information relevant to the NSF Intellectual Merit and Broader Impacts review criteria. The summary should be written in the third person and in a style that will be easily understood by an educated lay audience. NSF should be able to use the narrative in documents for the public without having to rewrite it or request clarification from the Center before using it. NSF ERC program staff also use the Project Summary as part of the documentation taken forward to NSF approval boards for renewal proposals, so it is important that this page be accurate and up to date.

## 3.4 Participant Tables

This section should include the following tables downloaded from ERC Web. All tables and figures in the Annual Report should be numbered and formatted to enhance the overall readability of the report.

- Academic Institutions
- Leadership Team
- Research Thrust Participants
- ERC Partners
- Advisory Boards

## 3.5 Executive Summary

The Executive Summary contains a high-level reporting of achievements in the reporting year and response to the previous year's site visit report, and should be **5 pages in length or less**.

**Achievements in the Reporting Year.** List up to three top achievements in the Reporting Year, in bulleted form, for each one of the following categories – provide reference to the appropriate section number where additional information can be found in each category:

- i. Convergent Research
- ii. Engineering Workforce Development
- iii. Diversity and Culture of Inclusion
- iv. Innovation Ecosystem
- v. New partnerships/collaborations formed; domestic or foreign

**High-Level Response and Status to SWOT (Strengths, Weaknesses, Opportunities, and Threats) Findings of Previous Year’s Site Visit.** List actions and progress toward resolution, during the reporting year period, in response to major weaknesses and threats identified in the previous year’s site visit report; in the case of new ERCs, in the pre-award site visit report and subsequent reviews. Please use bullet form and provide references to the appropriate section number where additional information can be found.

### 3.6 Narrative

The reference point for the narrative is the reporting year in the context of the age of the Center. There are different levels of expectation for Centers in their beginning years of operation than for Centers in the last years of NSF/ERC support. This can be seen in the ERC performance criteria that can be found in the [ERC Library](#). The narrative text should provide information for NSF and the reviewers to assess the extent and quality of the ERC’s progress and plans within the context of the ERC performance criteria.

The Annual Report should focus on results which were made in the previous reporting year. For renewal proposals and where otherwise noted, it must be clear to the reader which results were made in the previous reporting year and which were made in earlier years. In addition to the required ERCWeb Tables and Figures for each section, Centers are encouraged to use any extra figures, tables, charts, pictures, etc. to communicate useful information. Analyses of the data and trends in the data should be presented in the narrative at the point where the corresponding table or figure is presented.

In addition, each section of the report must address future plans, including descriptions of how any requested growth in funding will be expended and how the project(s) to be supported by the additional funds fit within the strategic plan and benefit the Center overall.

**Renewal Proposals.** For renewal proposals, clear statements of the plans for the renewal period and any new directions proposed in convergent research, engineering workforce development, diversity and culture of inclusion, and innovation ecosystem must be provided. In addition, trend charts, to show progress over the previous years of funding, on diversity, total financial support, and the number of industrial/practitioner members must be provided. Only data on member firms that have signed a membership agreement with the ERC and provided the requisite membership fees (these must be cash or in-kind support) should be shown in these trend charts. Inclusion of firms that have promised support but not delivered puts the Center at risk for misrepresenting information to obtain Federal funds, a serious offense. For 5th-year renewal proposals, data for the current year and each of the previous years should be included in the trend charts.

**Foreign Collaboration.** For collaboration with foreign entities, either through university to ERC partnerships governed by a formal agreement, or as faculty-to-faculty collaborations, the Center should discuss how the partnership/collaboration adds value to the Center’s programs. The Center should discuss: (a) how the foreign collaborations/partnerships provide expertise complementary to that provided by the domestic partners; (b) how the partnerships/collaborative projects fit under the ERC’s vision and strategic plan; and (c) how the partnership provides

cross-cultural research and educational experiences for U.S. and foreign partners' students and faculty.

**Reporting on NSF Supplemental Funding.** Centers that received NSF supplemental funding to the base ERC funding, such as ERC Translational Research Awards (SECO), C2C Supplements, REM Supplements, or closely-related NSF awards such as REU/RET Sites, should report on the results of the awards in the appropriate section of the Annual Report. For example, Centers receiving testbed or translational research awards would report on the progress in the Research Program section; Centers receiving awards related to innovation or technology transfer would report on the progress in the Innovation Ecosystem section. For each award, the goals and objectives should be summarized along with the progress made toward achieving those goals.

### 3.6.1 Vision and Impact

**Vision.** This section should provide the reader with a clear statement of the holistic vision for what the Center would like to accomplish, including goals for a transformative engineered system, the engineering workforce of the future, diversity and a culture of inclusion, and technology advancement and innovation, noting any refinements in the vision and the purpose of those refinements.

**Center Integration.** This section should provide the reader with an understanding of the Center's overall approach to integrate all 4 foundational components of the ERC (convergent research (CR), engineering workforce development (EWD), diversity and culture of inclusion (DCI), and innovation ecosystem (IE)) and clear examples of the interdependence among aspects of the Center's programs.

**Impact.** This section should summarize progress toward the overall impact of the ERC's programs on the Engineering Community, Scientific Enterprise, and Society.

### 3.6.2 Strategic Plan

**Strategic Plan.** The ERC strategic plan must define the engineered system and describe how the features of the ERC will be integrated to achieve the vision, in particular the cohesive plan for involving participants at all levels in the four foundational components. The Strategic Plan must have the flexibility to evolve over time. An ERC needs to continually refine its vision to focus on core advances, prune less compelling ERC elements, and refine as necessary the level of detail of its Strategic Plan over time.

This section should provide the reader with steps taken within the previous year to achieve the Center vision, along with a summary of progress towards Center goals or milestones. This section must also include direct actions actually taken (not just planned) by the ERC in response to major weaknesses and any threats regarding the vision or strategic plan that were identified in the Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis of the prior annual or renewal review site visit report; in the case of new ERCs, in the pre-award site visit report and subsequent reviews.

**Convergence.** The ERC strategic plan should demonstrate how the Center supports convergent research that takes a deeply collaborative approach to team-based research with the goal of defining and solving complex societal challenges. This section should provide the reader with the ERC’s overall approach to supporting convergence, including any specific efforts or changes made to the Center’s strategic plan within the previous year, and the purpose of those changes.

**Stakeholder Engagement.** The ERC strategic plan should demonstrate how the Center supports stakeholder engagement to include all parties who may contribute to the ERC or may be impacted by the ERC along its capacity-building and value creation responsibilities. This section should provide the reader with ERC’s overall approach to supporting stakeholder engagement, including any specific efforts or changes made to the Center’s strategic plan within the previous year, and the purpose of those changes.

**Team Formation.** The ERC strategic plan should demonstrate how the Center supports team formation which includes intentional strategies for bringing together all necessary disciplines, skills, perspectives, and capabilities. This section should provide the reader with ERC’s overall approach to supporting team formation, including any specific efforts or changes made to the Center’s strategic plan within the previous year, and the purpose of those changes.

The narrative discussion in this section should be supported with data from the following ERCWeb tables and figure: **Outputs Table, Average Metrics Table, Investigator Discipline Figure.**

**Logic Model.** Gen-4 ERCs are expected to develop a logic model of the overall ERC that illustrates key components of the integrated strategic plan, including inputs, activities, expected outputs and outcomes, desired long-term impacts, and connections among logic model elements. This section should provide the reader with a figure that shows the Center-level logic model or high-level representation of the logic model, as well as any changes made to the Center logic model within the previous year, and the purpose of those changes.

### 3.6.3 Infrastructure (Management and Organization)

The management and organization of the ERC is expected to support the participating domestic university partners and affiliates and foreign collaborators through a strong leadership team, well-integrated and active advisory boards, and well-coordinated management systems to achieve the Center’s vision and goals through effective teaming. This section should provide the reader with information on the leadership and management, team organization, and institutional configuration of the ERC.

Advisory boards are formed to reinforce and support the proper functioning of the ERC’s foundational components. This section should define the ERC’s assembled advisory boards and functional roles. This section should also include any changes made to any advisory board membership within the previous year, and a high-level summary of advisory board meetings and recommendations within the previous year.

This section should also include discussion of the ERC’s methods for: (1) determining which programs/projects are needed to achieve the Center’s strategic plan; (2) determining funding

allocation to implement the strategic plan; (3) assessing the quality and impacts of the programs/projects; (4) the role of the advisory boards in program/project review and assessment, (5) identifying associated programs/projects that are needed by the Center to achieve the strategic plan; (6) effectively managing the ERC team, including the roles of participants from partner and collaboration institutions.

**Organizational Chart.** This section should include an updated organizational chart that demonstrates diverse representation among the leadership of the ERC.

The narrative discussion throughout the previous sections should be supported with data from the organizational chart and the following ERCWeb tables and figures: **Partner Table, Partner Map, Foreign Partner Map, and Foreign Personnel Map.** A Center may also produce maps locally if preferred.

### 3.6.4 Convergent Research

This section describes the Center's overall research program, a description of the engineered system of interest, and the interdisciplinary approach taken to achieving the goals of the Strategic Plan. A rationale should be provided as to why the systems technology is transformational, and how the ERC's interdisciplinary approach enables outcomes and potential impact that would not otherwise be achieved by independent research projects.

Briefly describe what has been accomplished in the previous year in terms of the ERC planning three-plane strategic chart and the milestone chart. What projects have been successful? How do the project successes enable other projects to move forward? If a milestone has been missed, what is the catch-up plan? How does the team plan to revise the strategic plan or shift the milestones in response? Is there a need to de-scope the original strategic plan? In addition, any major new research directions for the proposed year(s), such as new thrusts and/or testbeds, should be described. Detailed project-level information is provided in Appendix VI.

**ERC Planning Three-Plane Strategic Chart.** Each ERC is required to customize their own three-plane strategic chart to illustrate how the Center's systems-level goals, and barriers in the way of achieving those goals, motivate and drive the research plan and how these goals integrate fundamental, enabling technology, and systems-level research, as well as proof-of-concept testbeds, to address barriers and to deliver discoveries, advances in knowledge, and new technology.

**Milestone Chart.** This section must also include a Milestone Chart that depicts major goals and deliverables over the 10-year time frame of NSF support. Greater detail is expected within a five-year time horizon. The Milestone Chart should contain the following information about the research program of the Center:

- Deliverables and milestones as a function of the age of the Center with more detail within the five-year time horizon.
- An indication of the plane of the three-plane chart in which the deliverable or milestone predominantly resides (e.g. fundamental, technology or systems-level).

- The discussion of the Milestone Chart should include a discussion of progress made on previously identified deliverables and milestones including achievements as well as delays and setbacks. Any changes to the original milestones and deliverables as the Center matures and new barriers or opportunities are uncovered should also be discussed.

**Response to previous SWOT.** To bring the reader up to date on the progress from the last site visit, this section must include actual responses (not just planned, and not just repeated from the response to the previous year's site visit report) indicating direct actions taken in response to major weaknesses and any threats regarding the strategic research plan resulting from the SWOT analysis in the prior annual or renewal review site visit report; in the case of new ERCs, in the pre-award site visit report and subsequent reviews..

ERCWeb **Estimated Budgets Table** should be inserted at the end of this section. This table is used by reviewers to understand the staffing/funding strategy for the allocation of direct support to Center projects and the indirect support derived from associated projects. The Estimated Budgets Table can be used to gauge the level of support in terms of personnel and cash devoted to the different research and technology efforts needed to achieve the Center's mission. This table includes data on the disciplinary makeup of the team as well as allocation of people and funds to each project receiving direct support and indirect support. It also enables the reviewers to understand the roles of the different institutions in the ERC's research. The data in the Estimated Budgets Table should be reported in such a way that it aggregates projects devoted to the same goal so that the result shows interdisciplinary teams conducting cluster-level research. It should not show a list that represents the budgetary allocation of funds to individuals. This table also shows the current year budgets at the project, cluster, and thrust levels; and the proposed budget at the thrust level only. Proposed growth or reduction in funds will have been justified earlier as discussed above.

#### *3.6.4.1 Research Program by Thrust and Testbed*

This section should be organized by research thrust area. Each subsection describing a particular research thrust or testbed should begin with a brief table that shows the names of faculty participants, their institutional and departmental affiliations, and identifies the thrust leader. The Research Thrust Participants tables may be inserted here.

Briefly describe what has been accomplished in the previous year by research thrust area. What achievements over the previous year have contributed to meeting the goals of the ERC? How do the thrusts address specific, updated knowledge gaps and barriers? How are the research thrusts integrated? What translational research or associated projects have contributed to the goals of each research thrust?

As for each thrust, for major integrative systems-level testbeds, there should be a separate section. Enabling technology testbeds that reside in a thrust can be reported within that thrust. For systems-level integrative testbeds, report on progress made towards the goals of the testbed and advances toward the Center vision, how the testbed integrates enabling technology to



demonstrate system functionality, how the research in the thrusts feeds into the testbed and how testbed results feed back into the thrusts.

**Response to previous SWOT.** Each thrust's/systems testbed section must include actual (not just planned, and not just a repeat of the response to the site visit report from the previous year), direct actions taken since the last site visit by the ERC in response to major weaknesses and any threats regarding the thrust resulting from the SWOT analysis in the prior annual or renewal review site visit report; in the case of new ERCs, in the pre-award site visit report and subsequent reviews.

### 3.6.5 Engineering Workforce Development

This section should provide an updated summary of the Center's strategy for human resource capacity development aligned with the targeted engineered system. The EWD program should strengthen a robust spectrum of engineering education pathways and technical workforce opportunities. This section should describe the EWD program goals and strategies for workforce development at all levels of the Center and opportunities for engagement by all ERC members including students, faculty, and external partners as appropriate. This section should also demonstrate alignment of EWD program goals, evidence-based activities, outcomes and desired impact.

This section should describe all educational activities associated with the ERC, including REU programs supported by Center funding, as well as any programs supported by supplemental funding including REU Sites, RET Sites, REM, veteran research supplements (VRS), or other related educational supplements.

The narrative discussion should include specific evidence of program accomplishments, including ERC participant engagement, partnerships and recruitment/retention strategies, curricular and other educational product development and implementation, and evidence of cross-institutional activity. The discussion should include key successes and challenges over the previous year and how the Center intends to respond.

**Response to previous SWOT.** This section must include actual (not just planned) direct actions taken since the last site visit by the ERC in response to major weaknesses and any threats resulting from the SWOT analysis in the prior annual or renewal review site visit report; in the case of new ERCs, in the pre-award site visit report and subsequent reviews.

The narrative discussion in this and the previous sections should be supported with data from the following ERCWeb tables: **Educational Impact Table**, **Educational Impact Figure**, and **Student Ration Table**. The Center are recommended to aim for a Graduate to Undergraduate (non-REU students) ratio of 2 or less of Center funded students by Year 3 (note: the student ratio is calculated using all Center non-ERC students, including those funded by associated projects).

### 3.6.6 Diversity and Culture of Inclusion

This section should provide an updated summary of the Center's strategy to promote a culture of inclusion where faculty, students, and staff from all backgrounds have the opportunity to



contribute and succeed in research, education, innovation, and administration, including leadership. The ERC will report on the diversity and culture of inclusion program, executed in collaboration with the chairs of the departments and deans of the schools providing the ERC's faculty.

The narrative discussion should include specific evidence of working towards a culture of inclusion and diversity, including recruitment and retention plans, mentoring and training strategies, and other plans for achieving engagement of underrepresented groups at all levels, including leadership.

The discussion should include key successes and challenges over the previous year and how the Center intends to respond. This section should discuss Center diversity benchmarked against engineering academic averages. Centers may not include quantitative diversity targets according to guidance from the NSF Office of the General Counsel.

**Response to previous SWOT.** This section must include actual (not just planned) direct actions taken since the last site visit by the ERC in response to major weaknesses and any threats resulting from the SWOT analysis in the prior annual or renewal review site visit report; in the case of new ERCs, in the pre-award site visit report and subsequent reviews.

The narrative discussion throughout the previous sections should be supported with data from the following ERCWeb tables and figures: **ERC Personnel Diversity Table, Women Figure, URM Figure, Hispanic Figure, Disability Figure, Institutional Diversity Figure.**

### 3.6.7 Innovation Ecosystem

In this section, the Center should discuss the industrial/practitioner collaboration, technology transfer/technology innovation, and social innovation portion of its strategic plan. This narrative should summarize results from the previous year regarding industrial/practitioner collaborations and partnerships and plans for the future. This section should briefly describe what has been accomplished in the previous year in terms of developing and fostering industrial/practitioner memberships and involvement, filling gaps in the value chain, defining roles of the stakeholder community, supporting technology transfer and the development of an entrepreneurial culture.

#### 3.6.7.1 Membership and Stakeholder Community

This section should present the Center's goals for membership in terms of number of firms, composition of firms of different sizes (e.g. percentages of large corporate, medium firm, small or startup) and cite the strategy for developing their industrial membership in light of the ERC's industry value chain. The narrative should discuss relevant industry sectors that are targeted for participation by members and make note of missing types of firms. This section should briefly describe what has been accomplished in the previous year regarding membership policies and agreements, roles of the members and stakeholder community, and any efforts in addressing gaps in the value chain.

**Value Chain Chart.** This section must also include a Value Chain Chart that depicts member organization involvement along the ERC's technological and social innovation value chain.

### 3.6.7.2 Technology Transfer

This section should present the Center’s strategy to move ERC-developed technologies to market, and progress demonstrated by results from the previous year. The Center should place a marker on the technology transfer chart described below, for each major technology or methodology expected to be transferred and discuss what has been accomplished in the previous year in terms of technology transfer. What activities have been successful? What roadblocks have slowed technology transfer? How does the team plan to revise the approach in response? This section should briefly describe all technologies transferred from the Center to industry and other users over the previous year, and their impacts such as market impact or benefits to society.

**Technology Readiness Chart.** This section must also include a technology readiness chart (see Figure 2 below) to depict major technologies or methodologies that the ERC expects industry/practitioners to adopt over the 10-year time frame of NSF support. The technology readiness chart is a qualitative chart that plots the maturity level of a particular technology or methodology along a spectrum. The technology maturity level range is from “idea stage” to “technology transferred to industry” (this is similar to the NASA Technology Readiness Level, TRL, scale, see [https://esto.nasa.gov/files/trl\\_definitions.pdf](https://esto.nasa.gov/files/trl_definitions.pdf)).

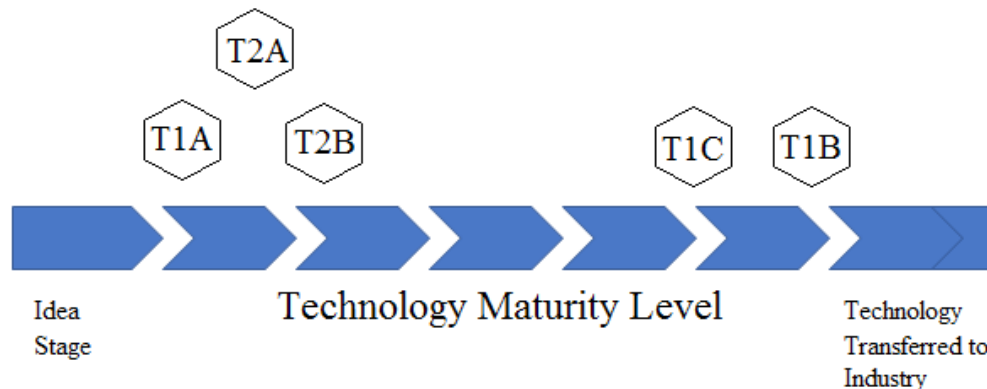


FIGURE 2 TECHNOLOGY READINESS CHART EXAMPLE (T1A=THRUST 1, PROJECT A, ETC.)

This section should briefly describe the Center’s strategy to develop a culture that links discovery to innovation through an innovation ecosystem and what has been accomplished in terms of an entrepreneurial culture. How do interactions among entities enable innovation? What strategies were used to form partnerships for innovation? How does the team plan to revise the approach in response to any roadblocks? In addition, any concrete accomplishments that specifically enhanced the ERC’s innovation ecosystem and entrepreneurial culture during the previous year should be discussed, such as events that educate Center personnel about entrepreneurship, events that link researchers with industrial users or potential investors, communication strategies, formation of start-up firms, or associated technology translation innovation awards.

**Response to previous SWOT.** This section must include actual (not just planned) direct actions taken by the ERC in response to major weaknesses and any threats regarding industrial

collaboration and technology transfer resulting from the SWOT analyses prepared by the IAB and in the prior annual or renewal review site visit report. For new ERCs this section should update the reviewer on progress in response to the pre-award site visit report and subsequent reviews of the ERC.

The narrative discussion throughout the previous sections should be supported with data from the following ERCWeb tables and figures: **Supporting Organization Table, Organizational Involvement Table, Member Support Table, Technology Transfer Activities Table, Member History Figure, Member Total Figure, Member Support Figure, Intellectual Property Table, Technology Transfer Table, and Start-up Firms Table.**

### 3.6.8 Evaluation and Assessment

This section should provide an updated evaluation plan that describes how the outputs, outcomes, and long-term impacts of the Center will be evaluated. The evaluation plan should include formative aspects that allow the Center to make evidence-based decisions about changes in its activities and summative aspects to provide evidence of impact across all foundational components of the Center. This section should briefly describe how the evaluation and assessment program was implemented, the formative and summative outcomes from the assessment, and how any of the assessment outcomes were used to update and/or improve the Center's programs. This section should also discuss how the ERC logic model has informed evaluation and assessment planning and implementation, and how evidence collected is fed back into the strategic planning of the Center.

### 3.6.9 Resources and Institutional Commitment

The headquarters space, its facilities for research and collaboration, and its proximity to the lead institution's ERC research space should be described. Communications equipment to facilitate cross-campus communication should be presented. A discussion of how the lead university and the core partner universities support the ERC's interdisciplinary, team culture should be presented. This should include a description of factors considered for tenure; for example, how the Center encourages and supports young investigators in interdisciplinary research in light of concerns about how tenure and promotion committees view it. In addition, in this section the Center must discuss training and laboratory procedures that have been implemented to ensure the safety of the students, faculty, and staff working in the ERC labs.

This section should also include information on how the participating partner universities are rewarding faculty and students for their efforts in mentoring university faculty, students, and postdocs, and pre-college students and teachers. ERC cross-university partnership agreements facilitating collaboration in research and education also will be explained.

#### 3.6.9.1 Financial Management

In this section, the Center should describe the financial management of the ERC – its financial support, budget allocation, expenditures and fiscal planning. The required tables listed below will be used as a basis for an analytical discussion of trends in financial support and budget

allocations and the reasoning behind them. Information on major sources of cash and in-kind support such as facilities, buildings or shared equipment should be provided. Major expenditures in the past year (three years if this is a renewal proposal) that are not discussed elsewhere in the Annual Report should be discussed here. Additional charts, tables or figures may be added if the ERC feels it is necessary to present the full financial picture of the Center.

The following tables should be inserted and discussed as appropriate in the previous narrative sections: ERCWeb **Functional Budget Table** including current award year data only, **Direct Support Table**, **Associated Project Table**, and **Education Budget Table**. A Table entitled “Allocation of Current Award Year Budget, by Institution, FY 20--,” should be developed and presented by the Center (it is not an ERCWeb table) according to the format shown below. This table shows the portion of direct cash (unrestricted and restricted) and associated project support in the current year budget by institution. This includes the lead, core partner(s), and, collectively, all other institutions reported in the Partner Table receiving direct Center cash and associated project support.

**SAMPLE TABLE. ALLOCATION OF CURRENT AWARD YEAR BUDGET, BY INSTITUTION, FY 20--**

Institutional Distribution of Current Award Year Budget					
Institution	Direct Cash	Associated Projects	Total Cash and Associated Projects	Percent of Total Direct Cash	Percent of Total Associated Projects
Lead					
Core Partner 1					
Core Partner 2					
etc.					
All Other Institutions					
Grand Total					

The ERCWeb **Sources of Support Table** should be inserted next. The amount of money contributed to the Center’s mission from the foreign university partners should be displayed in the appropriate “foreign university” row. For example, projects conducted at the foreign university that support the ERC should be reported as associated projects funded by a foreign university.

A table entitled “History of ERC Funding of the Center,” should be developed and presented by the Center (it is not an ERCWeb table) according to the format shown below. This table chronologically lists every separate award from the ERC Program: base award, each increment, renewal award, and supplement (e.g., REU, RET, diversity program support, etc., Graduate

Research Supplement (GRS) Award, ERC/SBIR Translational Research Award), and special purpose awards (e.g. connectivity, equipment, Innovation etc.) In addition, this table should also include the NSF RET and NSF REU site awards that have been made to the Center outside of the ERC Program.

Search for this information on [Fastlane\Award and Reporting Functions\View\Print Award Documents\Active Awards](#). <https://www.fastlane.nsf.gov/>

**SAMPLE TABLE. HISTORY OF ERC FUNDING OF THE CENTER**

Award Number	Award Type	Award Title	Award Duration	Amount	Status	Final Report Approved?
	Base	Center for Widget Systems Research	5 years	\$18,500,000	In progress	N/A
	REU Site Award	Building Widget Systems	3 years	\$350,000	Completed	Yes
Total				\$XX,XXX,XXX		

A table entitled “Cost Sharing by Institution,” should be developed and presented (it is not an ERCWeb table) according to the format shown below to include each year of the Center. The Cost Sharing Table and the university cost sharing amount placed on line M of the NSF budget form (NSF form 1030) in the Budget Request section should reflect the Center’s university cost sharing requirements specified in the Center’s cooperative agreement. The purpose of this table is to show the committed cost sharing, based on the original proposal or the last renewal proposal and the cooperative agreement, for the lead and core partner institutions for the current year and all prior years of operation.

The cost sharing commitment does not apply to non-partner institutions, RET/REU supplements or other special awards funded by the ERC Program, but it does apply to other supplements. All cost sharing must be provided from non-Federal sources, including both university and non-university sources. If the projected annual university cost sharing has not been met, a plan should be provided that explains how it will be met by the end of the current award period. A certified copy of the Cost Sharing Table must also be submitted as an Appendix. For more information, the cost sharing reporting terms in the present cooperative agreement template should be consulted along with the NSF requirements in the [Proposal and Award Policies and Procedures Guide](#).

**Renewal Proposals.** The Cost Sharing Table should be extended to show the proposed university cost-sharing commitments for the extension of the support requested. Thus, for a 5th year renewal, the cost sharing table would be extended through year 10.

**SAMPLE TABLE. COST SHARING BY INSTITUTION**

Institution	Award Year 1...		... Current Award Yr		Cumulative Amount Transferred to ERC Account
	Committed	Amount transferred to ERC Account	Committed	Amount transferred to ERC Account (to date)	
Lead University					
Core Partner #1					
Core Partner #2					
...					
TOTAL					

All ERCs with university level foreign partnerships, governed by a formalized partnership agreement between the ERC and the university, need to create another funding table entitled “Funding by International Partner Universities” to show the amount of funding provided by the foreign university partner institutions toward the foreign institution’s projects that are directly contributing to the Center’s strategic plan, as well as faculty and students’ involvement.

**SAMPLE TABLE. INTERNATIONAL PARTNER UNIVERSITIES--FUNDING AND COLLABORATION ACTIVITIES**

International Partner University	Foreign Funding Entity	Current Award Year Foreign Funding	Type of Activity	Number of ERC Foreign Faculty (FF) and ERC Faculty (ERCF)	Number of U.S. ERC Students working in foreign research labs for more than 30 days	Number of Foreign Students working in ERC Lab for more than 30 days
Helsinki University of Technology	Finnish Government	US \$250,000	Student Exp.	3 (FF) 2 (ERCF)	6	
Hannover Medical School	German Government	US \$20,000	Research	1 (FF) 5 (ERCF)	5	

ERCs with faculty-to-faculty foreign collaborations (as opposed to a formal ERC-university agreement) need to create another funding table as shown below.

**SAMPLE TABLE. COLLABORATION ACTIVITIES WITH INTERNATIONAL PARTNER UNIVERSITIES**

Foreign University	Type of Activity	Number of ERC Foreign Faculty (FF) and ERC Faculty (ERCF)-	Number of U.S. ERC Students Involved in Foreign Research Labs for more than 30 days	Number of Foreign Students Working in ERC Lab for more than 30 days


ERCWeb Tables, **Annual Expenditures Table** and **Modes of Support Table**, should be inserted next. An analysis of these tables should be provided in the narrative that discusses their implications for the financial health of the ERC, especially for Centers in their fifth year or later as they plan for graduation.

A table entitled “Unexpended Residual in the Current Award and Proposed Award Year” should be developed and presented by the Center (it is not an ERCWeb table) according to the format shown below. This table presents information regarding unexpended (residual) funds that were moved into the current award year at the end of the preceding award year. In the event that the Center is planning to move residual cash at the end of the current award year into the proposed award year, the Center should distinguish between (1) residual funds that are committed, encumbered, or obligated for specific uses from (2) residual funds for which the Center has no plans. The current year spending plans for the residual funds moved into the current year at the end of the preceding year should be discussed in the narrative. A certified copy of the Unexpended Residual Table must also be submitted as an Appendix.

**SAMPLE TABLE. UNEXPENDED RESIDUAL IN THE CURRENT AWARD AND PROPOSED AWARD YEAR**

	Previous Award Year to Current Award Year	Current Award Year to Proposed Award Year
Total Unexpended Residual Funds		
Committed, Encumbered, Obligated Funds		
Residual Funds Without Specified Use		

*3.6.9.2 ERC Self Sufficiency Business Plan*

Starting in the fifth year, the Annual Report and Renewal Proposal must include a strategic business plan for self-sufficiency as a subsection of this section, which is up to five pages in length. If the full strategic business plan exceeds five pages, it may be added as an Appendix and a five-page (maximum) synopsis of the plan should be placed here. It will include the envisioned features of the post-graduation ERC, cost and income projections, plans for gaining sources of support and plans for expenditures. Cost projections will include support for planned core staff. This plan will be updated in each subsequent Annual Report.

Centers in years eight and nine in which a change in the Center’s configuration upon graduation is under consideration or already decided should describe the reconfiguration plans and provide an explanation of the changes. All Centers should discuss their strategy and any actions

associated with obtaining increased support from industry and other sources after the ERC Program funds cease. Also, the long-term commitments from lead and core partner institutions to help ensure the continuation of the Center's administrative, industrial, and education components and retention of the research and office space should be presented.

### 3.7 Appendices

#### 3.7.1 Appendix I – Glossary and Acronyms

Appendix I is the glossary of acronyms and special terms used in the Annual Report.

#### 3.7.2 Appendix II – Agreements and Certifications

Appendix II is the Agreements and Certifications portion of the Annual Report and it contains the following documents. The certifications listed here (items 4,5,6,7) must be certified by an Authorized Organizational Representative (AOR) in the sponsored projects office of the lead institution. The lead institution is responsible for reporting and obtaining certifications for the entire Center.

1. ERC's Current Center-wide Industrial/Practitioner Membership Agreement.
2. ERC's Center-wide Intellectual Property Agreement (if not part of the Generic Industrial/Practitioner Membership Agreement).
3. A copy of the Human Subjects approval from the relevant Institutional Review Boards (IRBs) or Animal research approval from the relevant Institutional Animal Care and Use Committees (IACUCs) from *each* institution where animal and/or human subjects are used. This must be obtained prior to the submission of the Annual Report/Renewal proposal. The appropriate box on the cover page of the report should be checked if there is a project(s) supported that involve animal or human subjects. If data are collected on the performance of ERC' students (REU or regular and the impact of programs on students) and these data are presented to the public through a publication or talk at a conference, an IRB Human Subjects approval is required.
4. Certification of the Industry/Practitioner Membership list that includes the total number of memberships paid since the last Annual Report, certified by an AOR. The private sector firms should be separated from the non-private sector organizations. Firms or agencies that have not signed the membership agreement or have not paid their membership fee must not be included in the list, even if they have satisfied one but not all of the industrial/practitioner membership requirements. This certification list should be consistent with the members reported in the ERCWeb **Supporting Organizations Table**.
5. Certification of Cumulative and Current Cost sharing, certified by an AOR. In addition to reporting the certification here, the AOR must submit the cost sharing certification via the standard Notifications/Requests portion of FastLane within 90 days of the end of the award year. If the submission of the certification is delayed, the processing of annual funding increments or renewal awards will also be delayed. If there is an error in a prior year cost-sharing amount, FastLane will not allow correction of the amount. Instead, the Center should adjust the current year amount so that the cumulative total cost sharing is accurate; please make a note if there has been an adjustment in the current year amount.
6. A listing of all industry or firm conflicts of interest (COIs) for Center faculty and students and the ERC Lead Institution's Conflict-of-Interest Policy, certified by an AOR. The



ERC should collect and maintain on file certified copies of COI policies from all the partner institutions.

- Specific COI policy information from the ERC lead institution regarding ERC faculty or student involvement in start-up firms or small businesses. In particular, the lead university’s oversight policies with respect to COI for the following circumstances should be explained:
- Situations where ERC faculty or students spin-out start-up firms
- Situations where it is necessary for the ERC to purchase products from a firm for which ERC faculty have fiduciary interests

#### 7. Certification of Unexpended Residual Funds Table, certified by an AOR.

##### 3.7.3 Appendix III – Personnel Summary Table

Appendix III is the ERCWeb **Personnel Summary Table** which lists personnel at both the Center-wide summary level and institutional levels. The table should be sized so that it can be easily read.

##### 3.7.4 Appendix IV – Board, Council, Committee Charters

Appendix IV includes all charters developed for advisory boards and other key committees formed to provide feedback to the ERC.

##### 3.7.5 Appendix V – Highlights of Significant Achievement and Impact

The Center is to provide a Table of Contents for the “Highlights of Significant Achievement and Impact” including page numbers for Appendix V grouped by Research, Engineering Workforce Development, Innovation Ecosystem, and Culture of Inclusion. “Nuggets” or “Highlights” of Significant Achievement and Impact that are a result of the integrative, interdisciplinary construct of the ERC are included in Appendix V and should be formatted as presentation slides. Each highlight must include a title, and an image that illustrates the concept or shows the technology that anyone can understand. Each submitted highlight should be accompanied by an NSF Photo Submission and Copyright Release Form, NSF Form 1515 (<https://www.nsf.gov/pubs/forms/nsf1515.docx>). The better the examples and accompanying text are, the more effectively the Center will communicate its impacts to its reviewers and to NSF. A sample highlight slide is shown in Figure 3.

Each highlight should include text addressing the following two points:

- Outcome/Accomplishment. Describe the outcome using language anyone can understand; all highlights should emphasize major impacts achieved because of the interdisciplinary construct of the ERC, especially those things that could not have been achieved by a single investigator type project alone;
- Impact and Benefits. Describe the benefits to society, economy, industry, nation, region, science & engineering in a style that is intended for the educated lay reader and tells a story about what happened, why it is significant, what its impact has been or will be.

## NASCENT Innovation Ecosystem Highlights: SandBox Semiconductor (2016-2017)

- NASCENT's first start-up company
- Founded by graduate student Meghali Chopra and her advisor Roger Bonnecaze
- Provides software solutions for semiconductor chip and tool manufacturers
- Accelerates process development using patent-pending method and software, RODEo
- Optimal etch and deposition recipes 3x faster



Meghali Chopra (center), NASCENT PhD student and founder of SandBox Semiconductor, with her \$10,000 first prize check from the Fall 2016 Texas Venture Labs Investment Competition given by organizers Harlan Beverly (left) and Rob Adams (right).

*Image courtesy of UT-Austin*



FIGURE 3 SAMPLE ERC HIGHLIGHT PRESENTATION SLIDE

### Additional Highlights Reporting Requirements:

- The highlights reported should cover achievements made during the Reporting Year; and for a renewal, during the last three years, with the year of achievement marked.
- There is no explicit requirement for, or limit on, the number of highlights, but they should have the following characteristics: 1) be accomplishments of major significance; and 2) have passed a significant milestone or have come to fruition during the Reporting Year—and not be simply a report of incremental advancement of a “work in progress.”
- Highlights should be reported in the following categories: Research/Technology Advancements (including large databases that function as a national resource, large test beds and new facilities that resulted from the ERC investment), Engineering Workforce Development, Innovation Ecosystem (including successful spinoff/start-up companies), and Culture of Inclusion.
- Highlights used in a previous report may not be repeated unless they provide background for major recent advances or impacts that have taken place since the highlight was first reported.

### 3.7.6 Appendix VI – List of ERC Projects

The Center will provide a list of all projects across all ERC foundational components, in the Center’s strategic plan that are funded by direct support from the Center and all associated projects that are supported by indirect support. The Center should provide on this list the names of the projects, the names and departmental/institutional affiliations of the faculty members, and the names of the sponsoring organization(s). The research projects should be listed by thrust, then by the engineering workforce development projects, then by culture of inclusion projects,

and then by the innovation and technology transfer projects. This project list should cover all the research projects listed in ERCWeb **Estimated Budgets Table** plus the engineering workforce development projects, culture of inclusion projects and innovation and technology transfer projects. Within each section, the projects should be grouped by the type of support—direct or indirect, and then grouped by content. If listing an associated project would compromise the sponsor’s interests, the project should be listed by title if possible with no mention of source of support.

### 3.7.7 Appendix VII – Project Updates

Updates on project status should be included for all projects with direct support, organized by research thrust, engineering workforce development, culture of inclusion, innovation and technology transfer, and associated projects. Project updates do not have to be included for proprietary projects where such a summary would compromise the sponsor's interests. A project update should also be included for each ERC Program supplementary and special-purpose award such as NSF-funded Translational Research awards (e.g. SECO awards), ERC Innovation Awards, Graduate Research Supplements (GRS), etc.

Project updates should be formatted as quad charts (see Figure 4, although ERCs are not required to follow any specific quad cart format), and may include the following:

- Project title;
- Names of ERC team members involved with the project (project leader, other faculty and their departments, students from undergraduate through postdoctoral) and industrial participants;
- A statement of the project goals (what the work is intended to accomplish);
- The project's role in support of the strategic plan;
- A discussion of fundamental research, educational, institutional or technology advancement barriers and the methodologies used to address them;
- A short description of achievements in the past year.

# Thrust Project No. P-2A: Reliable Processes for Controlled 2D Nanomaterials

## Project Goals:

- Develop mechanical models of dry transfer printing of graphene
- Develop novel polymers for roll-to-roll transfer of graphene
- Characterize the adhesive interactions between graphene and substrates
- Develop a predictive model for uniform graphene transfer and eventual scale-up of roll-to-roll transfer.
- Develop a test bed for roll-to-roll transfer of graphene

## Barriers:

- Defining the factors affecting the dry transfer printing of graphene (knowledge plane)
- Unknown adhesion mechanisms between graphene and target substrates (knowledge plane)
- Developing suitable polymers for roll-to-roll transfer and plastic electronics (knowledge plane)
- Lack of predictive models for roll-to-roll transfer of 2D nanomaterials (technology plane)
- Lack of high speed, high yield transfer of 2D nanomaterials (systems plane)

## Methodologies to Overcome Barriers

- Develop analytical and numerical models for the stress analysis of dry transfer printing
- Develop direct and iterative methods based on fracture mechanics principles to determine the adhesion energy, strength and range of interactions between graphene and growth or target substrates
- Use analytical and numerical stress analytical tools to develop models of roll-to-roll transfer
- Build a roll-to-roll transfer test bed for 2D nanomaterials

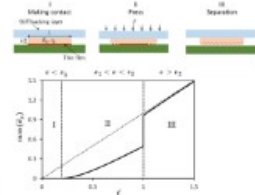


Fig. 1: (a) Schematic of dry transfer and (b) maximum film stress during compression

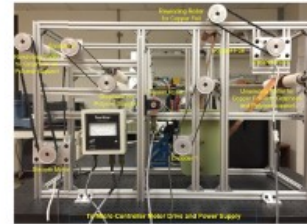


Fig. 5: Prototype of R2R graphene transfer system

## Research Achievements:

- Mechanical analysis of dry transfer of graphene
- Adhesion and strength of graphene interactions with substrates
- Delamination of graphene for high-performance plastic electronics
- Simulation of dry peeling of graphene
- Roll-to-roll graphene transfer machine design

Kenneth Liechti<sup>d</sup> (Project Lead), Roger Bonnacaze<sup>a,c</sup>, Wei Li<sup>a,f</sup>, Nanshu Lu<sup>a,d</sup>, Grant Willson<sup>a,c</sup>, Shruti Jain<sup>c,e</sup>, Kevin Martinez<sup>c,d</sup>, Seung Na<sup>b,d</sup>, Danny Sanchez<sup>c,f</sup>, Xiohan Wang<sup>c,e</sup>, Hao Xin<sup>c,f</sup>, Tianhao Yang<sup>c,d</sup>  
<sup>a</sup> Faculty, <sup>b</sup> Postdoc, <sup>c</sup> Graduate Student - <sup>d</sup> Aerospace Eng., <sup>e</sup> Chem. Eng., <sup>f</sup> Mech. Eng.

FIGURE 3 SAMPLE PROJECT UPDATE QUAD CHART

In addition to the Project Update Quad Charts, Centers should submit an additional 1-2 page Project Summary Brief. The project summary brief is expected to provide additional detail that is not contained in the update quad chart, such as an abstract. The project summary brief may also include additional discussion points, such as the project’s role in support of the strategic plan.

### 3.7.8 Appendix VIII – Bibliography of Publications

A bibliography of Center publications should be included for all foundational components of the ERC: Research, Engineering Workforce Development, Diversity and Culture of Inclusion, and Innovation Ecosystem. Research publications should be grouped by Thrust/Testbed. These must be complete listings that include only publications in print at the time of submission of the report and do not include manuscripts in preparation, in review, awaiting publication, or previously reported in an Annual Report, except for Renewal Proposals. Renewal proposals should include a bibliography that covers the previous three years.

All Gen-4 ERCs are required to adhere to the NSF Public Access Policy in communication of research results, see [https://www.nsf.gov/news/special\\_reports/public\\_access/](https://www.nsf.gov/news/special_reports/public_access/).

**Digital Bibliography Submission.** In addition to the printed bibliography included in this section, Centers are asked to submit a digital file of publications. Centers may choose the file format; BibTeX is encouraged. This file may be submitted on the same thumb drive as the Annual Report pdf as described in Section 4.2.1.

### 3.7.9 Appendix IX – Data Management Plan

The [NSF Proposal & Award Policies & Procedures Guide \(PAPPG\)](#) contains a clarification of NSF's long-standing data policy. All NSF awardees must comply with NSF data sharing policy, see <http://www.nsf.gov/bfa/dias/policy/dmp.jsp> . In addition, ENG grantees must follow the ENG Directorate specific data management guidelines available at [http://nsf.gov/eng/general/ENG\\_DMP\\_Policy.pdf](http://nsf.gov/eng/general/ENG_DMP_Policy.pdf) . All renewal proposals must describe plans for data management and sharing of the products of research, or assert the absence of the need for such plans. Specifically, the basic level of digital data to be archived and made available includes (1) the analyzed data and (2) the metadata that define how these data were generated. These are data that are or that should be published in theses, dissertations, refereed journal articles, supplemental data attachments for manuscripts, books and book chapters, and other print or electronic publication formats.

- Analyzed data are (but are not restricted to) digital information that would be published, including digital images, published tables, and tables of the numbers used for making published graphs.
- Necessary metadata are (but are not restricted to) descriptions or suitable citations of experiments, apparatuses, raw materials, computational codes, and computer-calculation input conditions.

### 3.7.10 Appendix X – Postdoc Mentoring Plan

Appendix X includes plans for mentoring activities for postdoctoral researchers as required by the [NSF Proposal & Award Policies & Procedures Guide \(PAPPG\)](#).

### 3.7.11 Appendix XI – Biographical Sketches

Appendix XI contains two-page Biographical Sketches of each member of the ERC's faculty and leadership team should be included per instructions specified in the [NSF Proposal & Award Policies & Procedures Guide \(PAPPG\)](#).

### 3.7.12 Appendix XII – Current and Pending Support

Appendix XII contains the current and pending support documentation, NSF Form 1239, for the ERC Leadership team, and for any faculty receiving \$80,000 or more from the ERC should be included.

### 3.7.13 Appendix XIII – NSF Form 1030 Budget Request

Appendix XIII is the Summary Proposal Budget provided on the official NSF budget form 1030 available in FastLane. For an Annual Report, the budget request is required for the following Award year. Growth along the prescribed trajectory up to the maximum funding amount must be justified in the appropriate section of the Annual Report by explaining how the additional funds will be used and how they would benefit the strategic plan and the Center overall. Any NSF forward funding received in the prior award year must be deducted from the subsequent annual budget request.

Except for the renewal proposal, the annual budget request will be submitted into Fastlane each year as a *supplement* request at the same time the Annual Report is due. This is necessary to properly process the budget requests, given the NSF systems. All budget requests also will include the subaward budgets, which must be submitted each year in the annual budget request along with justification from the subawardees.

**Renewal Proposals.** An NSF Budget Form 1030 is required for each of the years of support requested along with a summary of the total support requested (years 6-10 for a 5<sup>th</sup>-year renewal). FastLane will calculate the summary or cumulative budget. All annual subawardee budgets must be provided, regardless of size, and all budgets must be signed by the AOR at each institution. For renewal proposals, the request for the last two years of support should reflect a phased down level at the rate of 67 percent of the prior year. The actual level of phased-down support will depend upon performance and availability of funds.

**Cost Sharing.** For awards where the cost sharing amount reflected on Line M of the cumulative award budget is \$500,000 or more, it is the awardee's obligation to submit annual and final cost sharing notifications via FastLane, even if no cost sharing was provided during that particular reporting period. Such notifications must be submitted within 90 days prior to the end of the current budget period to meet the annual notification requirement and within 90 days following the expiration of the award to meet the final notification requirement. The cost share notification is considered due during the 90-day period. The notification becomes overdue the day after the 90-day period ends.

Failure by the awardee to comply with the requirement to submit an annual or final cost share notification will impact the processing of any incremental or supplemental funding action. It also will impact the ability of program staff to process, for final action, any of the PI's or Co-PI's new or renewal funding projects until the necessary notification has been submitted. Due and overdue reminder e-notices for annual and final cost share notifications are automatically sent to Sponsored Projects Offices, thus helping to ensure timely submission.

## 4. Formatting and Submission Requirements

### 4.1 Formatting

The Center should comply with the following guidelines when preparing the Annual Report.

- Standard letter-sized paper with one-inch margins.
- Times New Roman font size 12, Arial font size 10, or equivalents:
  - Tables, the list of participants, references, biosketches, and non-narrative text may be provided one font size smaller but must be readable.
- Single-line spacing for the narrative.
- One-or two-column text.
- Insert tables, figures, photos and charts in appropriate places in the text, not at the end of the report.
  - Number tables in a logical manner corresponding with the section number
  - Graphics, photographs, etc. may be numbered and labeled as the Center wishes.



- Do not alter the content of ERCWeb-produced tables; however, the font size can be increased so that the tables are readable.
- Report pdfs should include section bookmarks for ease of navigation.
- Printed reports should include tabs for sections and subsection. Label the tabs with the names of the sections, not numbers.
- Use both sides of a page when producing copies. If a color illustration bleeds through the page, a one-sided page may be used.
- Printed copies should be spiral bound and double-sided; do not submit the Annual Report or Renewal Proposal in a 3-ring binder.

## 4.2 Submission

The Annual Report or Renewal Proposal is **due five weeks prior to the Site Visit** which has been scheduled with the NSF/ERC Program Director (PD). PDs use the internal NSF “eJacket” system to process the report. Centers do not have access to this system, therefore printed and/or electronic copies of the Annual Report must be submitted to the ERC Program Office, Fastlane.gov, Research.Gov, and ERCWeb Document Depo as described below.

### 4.2.1 National Science Foundation ERC Program Office

Mail three printed copies and four USB Flash drives with PDF files of the report. Each USB drive must be labeled with the name of the Center and the calendar year of the report. The electronic copies will be uploaded to eJacket for review by Program Directors.

Mail to:

ERC Program Specialist  
Engineering Research Centers Program  
Division of Engineering Education and Centers, E143  
National Science Foundation  
2415 Eisenhower Avenue  
Alexandria, VA 22314  
Phone: (703) 292-8380  
Facsimile: (703) 292-9051

### 4.2.2 Fastlane

Submit the Cover Sheet, budget and fill out the required fields per the following ERC Renewal and Increment Submission Protocol Table.

Year	Center submits at Research.gov under original Award Number that Annual Report has been submitted to NSF	Renewal / Increment Due	Submit Cover Sheet & Budget in FastLane *	Action to submit in FastLane	Wording for "Project Summary" field within FastLane	Wording for "Justification for Supplement" field within FastLane	Wording for "Bio Sketch" field	Cost Sharing Cert in FastLane under original Award Number	Updated IRB approvals for submitted in supplementary documents section
1	Annual Report due 5 weeks before site visit to ERC program staff for manual upload into eJacket	CAGR Increment	Yes; yr 2 budget and all subaward budgets	supplement	"This action is to request the 2nd yr increment"	"This action is to request the 2nd yr increment"	"No Bio Data Provided"	Yes	if applicable
2	Annual Report due 5 weeks before site visit to ERC program staff for manual upload into eJacket	CAGR Increment	Yes; yr 3 budget and all subaward budgets	supplement	"This action is to request the 3rd yr increment"	"This action is to request the 3rd yr increment"	"No Bio Data Provided"	Yes	if applicable
3	Renewal Proposal due 5 weeks before site visit to ERC program staff for manual upload into eJacket	CAGR Increment	Yes; yr 4 budget and all subaward budgets	supplement	"This action is to request the 4th yr increment"	"This action is to request the 4th yr increment"	"No Bio Data Provided"	Yes	if applicable
4	Annual Report due 5 weeks before site visit to ERC program staff for manual upload into eJacket	CAGR Increment	Yes; yr 5 budget and all subaward budgets	supplement	"This action is to request the 5th year increment"	"This action is to request the 5th year increment"	"No Bio Data Provided"	Yes	if applicable
5	Annual Report due 5 weeks before site visit to ERC program staff for manual upload into eJacket	<b>RENEWAL (yrs. 6-10)</b>	Yes; yrs 6-10 budget and all subaward budgets	Renewal	"This action is to request 5 <sup>th</sup> year renewal and 6 <sup>th</sup> year increment. See annual report for annual report and renewal documents"	NA	"No Bio Data Provided"	Yes	if applicable
6	Renewal Proposal due 5 weeks before site visit to ERC program staff for manual upload into eJacket	CAGR Increment <b>OR</b> <b>RENEWAL (yrs. 7-10)</b>	Yes; yr 7 or yrs 7-10 budget and all subaward budgets	supplement or Renewal	"This action is to request the 7th year increment." <b>OR</b> "This action is to request the 6th year renewal and year 7 increment"	"This action is to request the 7th year increment." <b>OR</b> "This action is to request the 6th year renewal and year 7 increment"	"No Bio Data Provided"	Yes	if applicable
7	Annual Report due 5 weeks before site visit to ERC program staff for manual upload into eJacket	CAGR Increment	Yes; yr 8 budget and all subaward budgets	supplement	"This action is to request the 8th year increment."	"This action is to request the 8th year increment."	"No Bio Data Provided"	Yes	if applicable
8	Annual Report due 5 weeks before site visit to ERC program staff for manual upload into eJacket	CAGR Increment	Yes; yr 9 budget and all subaward budgets	supplement	"This action is to request the 9th year increment."	"This action is to request the 9th year increment."	"No Bio Data Provided"	Yes	if applicable
9	Annual Report due 5 weeks before site visit to ERC program staff for manual upload into eJacket	CAGR Increment	Yes; yr 10 budget and all subaward budgets	supplement	"This action is to request the 10th year increment."	32 "This action is to request the 10th year increment."	"No Bio Data Provided"	Yes	if applicable



It is important to include the number of participants in the main budget as well as in the sub award budgets. (This causes problems when the Specialist imports the budget and the numbers are not there. They must back out of the budget import and read the justification section of the budget.

**Annual Cost Sharing Notification.** For ERCs that cost share, the lead institution’s AOR must submit the cost sharing certification via the Notifications/Requests portion of FastLane within 90 days of the end of the award year. Delaying submission of the certification holds up the processing of annual funding increments or renewal awards.

#### 4.2.3 Research.gov

The ERC Annual Report must be submitted directly to the ERC Program Office. The submitted report is then uploaded into the NSF eJacket system by the NSF ERC Program staff. The Annual Report will be reviewed and approved by the cognizant NSF ERC Program Director within eJacket. The Center does not use [Research.gov](https://www.research.gov) to submit the contents of its Annual Report, but it does use [Research.gov](https://www.research.gov) to indicate that the Report has been submitted, as described below.

Submit notification as follows:

**Cover Tab:**

Review all the information displayed in the Cover tab within the Annual Project Report section of [Research.gov](https://www.research.gov). Please verify the information in the Cover Tab within the Annual Project Report section of Research.gov. If any corrections are required, contact the Research.gov Help Desk 7 AM - 9 PM Eastern Time, Monday through Friday (except federal holidays) at [rgov@nsf.gov](mailto:rgov@nsf.gov) or 1-800-381-1532.

**Accomplishments Tab:**

Under the Accomplishments tab, insert the following statement into the first box that asks “What are the major goals of the project?”

- “In accordance with the instructions provided to the Engineering Research Centers (ERC) in the ERC Annual Reporting Guidelines document, the Annual Project Report has been submitted separately directly to the ERC Program Office and includes the content specified in the Guidelines. The report is uploaded into the NSF eJacket system by the ERC Program Staff. The cognizant ERC Program Director will approve the report within the NSF eJacket system.”
- Next, there are four boxes under the question, “What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?” In the first box, Major Activities, insert the same statement identified above: “In accordance with the instructions provided to the Engineering Research Centers (ERC) in the ERC Annual Reporting Guidelines document, the Annual Project Report has been submitted separately directly to the ERC Program Office and includes the content specified in the Guidelines. The report is uploaded into the NSF eJacket system by the ERC Program Staff. The cognizant ERC Program Director will approve the report within the NSF eJacket system.”
- Leave the next three boxes blank.

- The last three boxes have a “nothing to report” or “no change” checkbox. Do not enter any text, just mark the “nothing to report” or “no change” checkbox for each question.

**Products tab:**

Under the products tab, do not enter any information. Mark the “nothing to report” checkbox for each question.

**Participants tab:**

The section “What individuals have worked on the project?” will be pre-populated with the names of the PIs for the ERC. Review and edit as appropriate. Note: The Center may have to enter the names of some of the leadership team. There should be information on the Center Director, Deputy Director, Thrust Leader(s), Campus Leader(s), Industrial Liaison Officer, Administrative Director, and Executive Director or other center leadership position. The title (e.g. Center Director, ILO, etc.) should be entered in the “contribution to the Project” box.

- For the “What other organizations have been involved as partners?” question, mark the “nothing to report” checkbox.
- For the “Have other collaborators or contacts been involved?” mark No.
- For the REU required field, check “nothing to report” and type “N/A” in the comments field.

**Impact tab:**

Mark the “nothing to report” checkbox for all of the questions.

**Changes/Problems tab:**

Mark the “nothing to report” checkbox for all of the questions.

**Special Requirements:**

Mark the “nothing to report” checkbox.

**Certify and submit:**

Check the Certification checkbox and click on the “Submit Report” Button.

Note: All of the information regarding the center’s accomplishments, contributions, publications, products, etc. must be contained within the Annual Report that is submitted directly to NSF/ERC program office. Entering “nothing to report” in the Annual Report submission in [Research.gov](https://www.research.gov) does not imply that the center did not make progress or contributions during the reporting period.

4.2.4 ERCWeb Document Depot

Upload the Annual Report pdf file to the ERCWeb Document Depot, <https://www.erc-reports.org/centers/document-depot>.

## 5. Resources

### 5.1 NSF Resources

The [NSF Proposal and Award Policies and Procedures Guide](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=papp):  
[https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=papp](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=papp)

**Cooperative Agreement.** Fastlane <https://www.fastlane.nsf.gov/>

Proposals, Awards and Status – login - Award and Reporting Functions\View\Print Award Documents\Active Awards

**History of Funding.** Fastlane <https://www.fastlane.nsf.gov/>

Proposals, Awards and Status – login - Award and Reporting Functions\View\Print Award Documents\Active Awards or Expired Awards

### 5.2 ERCWeb

The complete glossary of ERC terms can be found in the Guidelines for ERCWeb Data Entry, available at the ERC Library site <https://www.erc-reports.org/public/library>.

ERCWeb Technical Assistance: Toll-free phone (800) 981-2852 (9am-5pm M-F EDT);

e-mail: [support@erc-reports.org](mailto:support@erc-reports.org);

Documents regarding ERC planning information, reports, and site visits can be found at the ERCWeb Library site: <https://www.erc-reports.org/public/library>