NNSA Safety Roadmap

November 2018

Safe Operations
Effective Infrastructure
Enterprise Services

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FOREWORD

This Safety Roadmap outlines key elements of a redesigned oversight system, including specific milestones for implementation and measures of effectiveness. Importantly, the proposed roadmap remains consistent with the principles and core functions of Integrated Safety Management, the backbone upon which the Department of Energy and National Nuclear Security Administration perform our vital mission safely.

The roadmap identifies the incremental steps we are taking to achieve our strategic objectives:

- Manage Enterprise risks in a holistic approach, using state of the art data science techniques;
- Maximize the effectiveness of safety professionals;
- Increase the consistency of Nuclear Facility Safety Basis reviews; and
- Sustain a mature and effective safety oversight posture.

Approval: _James J. McConnell_   Date: 11/6/2018

James J. McConnell
Associate Administrator
Office of Safety, Infrastructure, and Operations

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ROADMAP CONFIGURATION CONTROL

Date	Version	Major Changes
November 2018	1	• Original Release

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INTRODUCTION

The National Nuclear Security Administration (NNSA) Enterprise is vast and complex, providing the research and production capabilities necessary to meet the Nation's national security needs. The Enterprise exists to execute the nuclear weapons program, naval nuclear propulsion program, defense nonproliferation and counter-proliferation programs, and other assigned programmatic responsibilities such as emergency response. With over 400 nuclear and hazardous facilities and 39,000 laboratory and plant employees, we have the vital national security mission to operate, manage, and sustain the Enterprise safely and efficiently (Figure 1). To assure the safety of our hazardous, complex facilities in a dynamic environment we are challenged to provide technical support to the Enterprise in a resource constrained environment to enable mission success. This requires managing Enterprise-wide risk and maintaining situational awareness in support of NNSA leadership while integrating safety into infrastructure to support our investment decisions.

Figure 1: NNSA Safety, Infrastructure and Operations Overview

NNSA's **national security missions are dependent upon safe operations and effective infrastructure**. Therefore, in January 2015, the Office of Safety, Infrastructure, and Operations was established to address the challenges facing our ongoing nuclear and hazardous mission operations.

The current challenges we are facing include:

- Enabling the safe execution of a growing mission without a commensurate increase in resources;
- Building organizational capacity and employing resources in an integrated, mission-focused manner; and
- Leveraging 21st Century tools and processes and balancing resources across the Enterprise.

Appendix 1, *Challenges Facing Safety Oversight*, provides a comprehensive discussion on the specific encounters we are currently facing and expected to increase in the future. Adapting to this demanding future will not be accomplished by simply doing the same old things harder. This roadmap lays out the direction for a reimagined approach to safety oversight.

PURPOSE OF THE ROADMAP

Given the supreme national interest in executing the nuclear weapons program and associated NNSA and national programs, this roadmap provides direction for implementing key initiatives designed to facilitate an effective and efficient safety oversight program integrated across NNSA safety professionals, both in the field and functional office for safety. Through these initiatives, we are instituting a strategy to maximize the use of operational data to improve situational awareness and allow for efficient, risk-focused oversight activities. This will also provide all of our safety professionals transparent access to data sets, allowing them to be in the best position to make decisions to improve safety performance.

Combined, the initiatives provide Program and Field leadership with awareness of our Management & Operating (M&O) Partners' success in implementing integrated safety management, nuclear safety requirements, and safety management programs across the NNSA Enterprise. This will allow us to build a sustainable operating model focused on enabling mission success while focusing resources on the areas of highest risk, and as close to the actual work as possible.

Integrated Safety Management (ISM) defines the framework for how the Department of Energy (DOE), NNSA, and our M&O partners achieve our mission while protecting the public, the workers, and the environment. ISM provides a consistent systematic approach to establish, implement, monitor, and improve safety.

The role of safety professionals in NNSA is to foster conditions where mission work is accomplished safely (see figure 2).

Figure 2: Creating Conditions Where Mission Work is Accomplished Safely

Figure 3 NNSA Federal Governance Model

Collectively we are required to establish a governance model consistent with the DOE Policy and Order which relies on the effective implementation of Federal and M&O partner oversight (see figure 3). The policy requires that the Administrator, the Cognizant Secretarial Officer, the NNSA Central Technical Authority, and NNSA Field Office Managers provide effective oversight of our M&O partners' operational and business functions through their Contractor Assurance Systems (CAS). CAS is the foundation on which NNSA governance is built. The CAS manages and monitors our M&O's effectiveness in meeting DOE Acquisition Regulations which codify the principles and core requirements of ISM.

Where we are

Figure 4 depicts a simplified model of how information may flow within NNSA. This model is simplified because it only shows information flow in one dimension-between our M&O partners up to the NNSA front office. It does not portray how information flows across field offices, functional offices, or program offices. Nevertheless, it represents the multiple paths information can take through our Enterprise, with potential for time lapse and miscommunication between each path.

From this figure, you can see the complexity and challenges stemming from communication in safety oversight. One negative consequence of the current information flow model is that it does not always drive adequate communication between safety organizations and affected program offices to develop optimal solutions when issues arise. However, the biggest problem with the current model of information flow is that it is not trackable, and therefore cannot be trended, analyzed, or queried across the enterprise, or over time. This makes it difficult for NNSA to integrate safety information, accumulate knowledge, and produce comprehensive safety metrics and insights for management.

It is important to note that NNSA is not only managing our vital and complex mission, we are simultaneously managing the routine impediments from miscommunication and shortfalls in information flow. The success of our Enterprise depends on close collaboration, sharing information, and benefiting collectively as a learning organization.
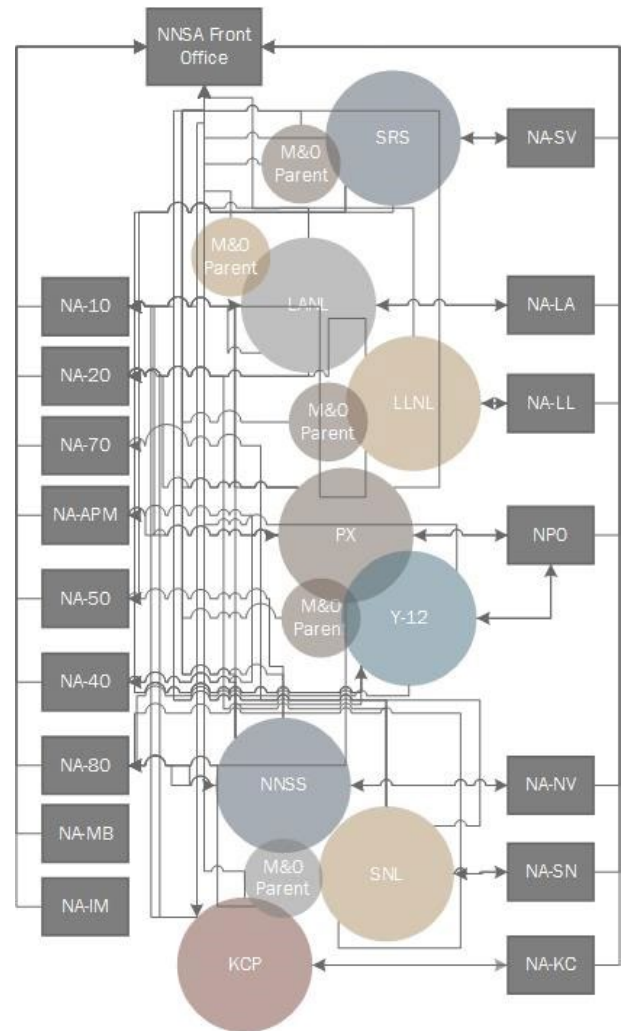

Figure 4: Simplified Model of the Current State of Information Flow

Where we are going

NNSA is deploying new data driven, risk informed, tools, aimed at improving our communication, including the data, analysis, and visualizations we use to inform decision makers. Concisely put, we are building an increased capability for central data management. Central data management provides the first steps toward supporting a cohesive Enterprise, operating from a single source of truth, capable of identifying and maximizing efficiencies to support mission execution. This includes the ability to track, trend, query, analyze, and visualize safety metrics, narrative reports, and issues. The visualization and analysis outputs are central for turning vast amounts of data into actionable insights for NNSA decision makers to manage resources and mitigate risk.
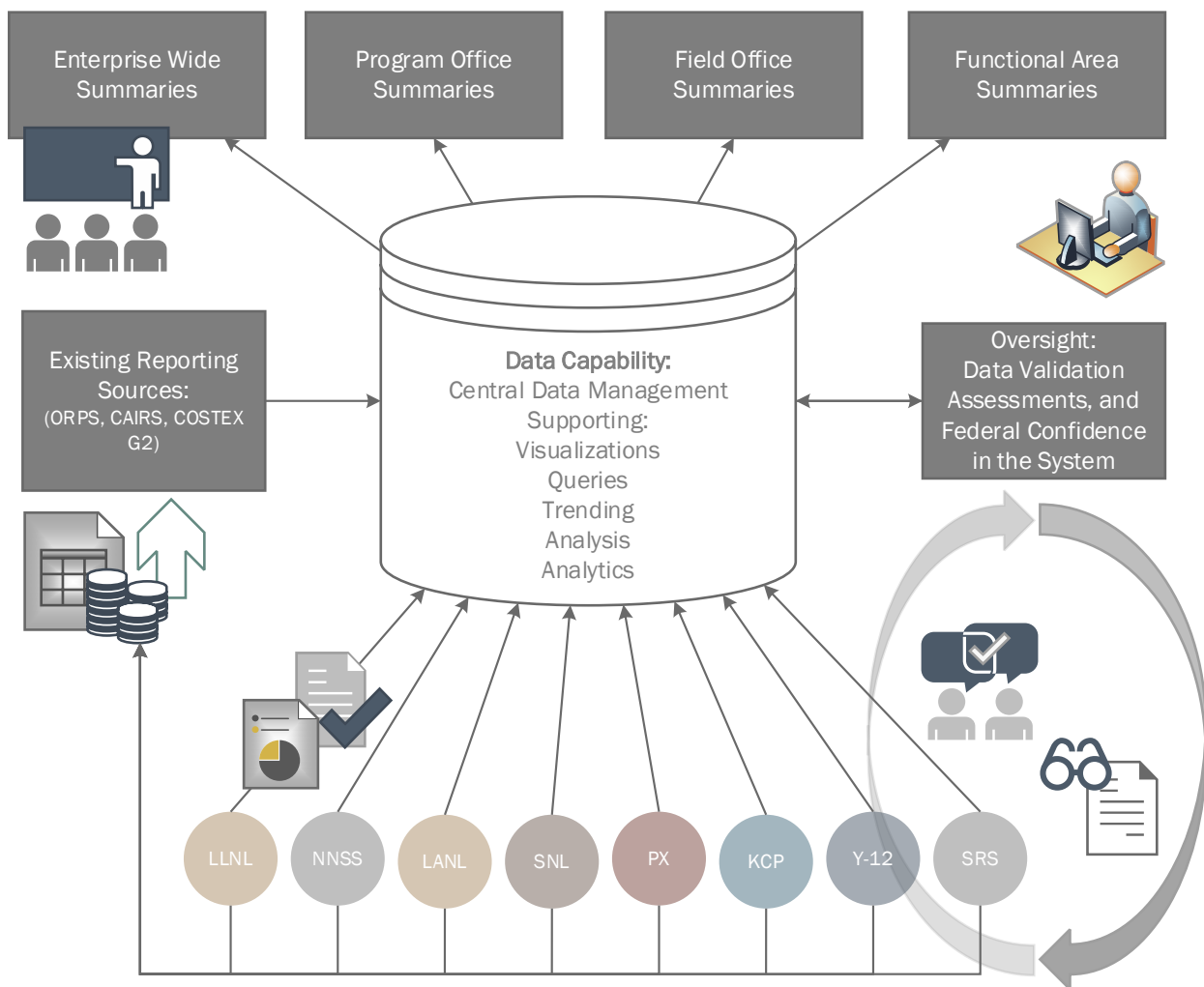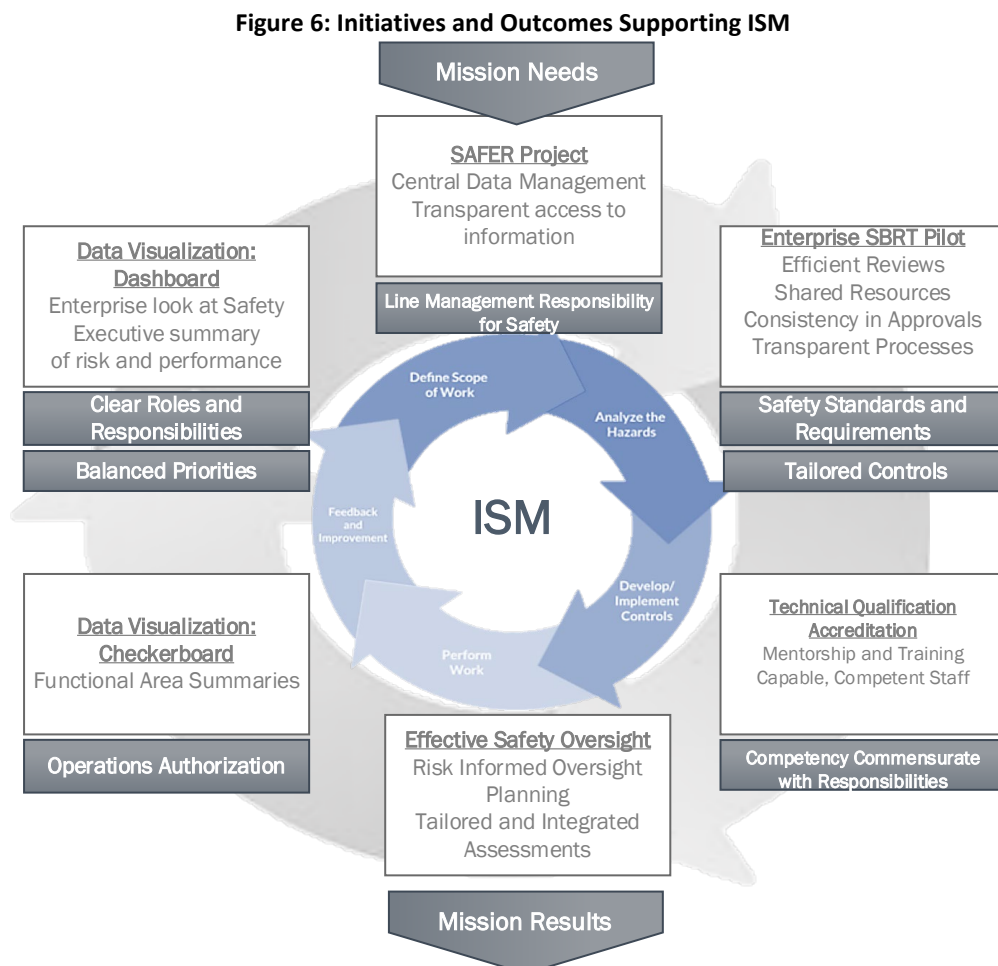

Figure 5 Desired Future State of Central Data Management and Increased Data Capability

What we are building today

Achieving the desired result, depicted in figure 5, will require many process changes. The initiatives below provide the preliminary steps we are taking today in working toward the desired future state.

1. Leading an NNSA-wide Technical Qualification Program (TQP) Accreditation for federal technical staff, resulting in a high level of technical competence, supported by a streamlined and consistent qualification process.
2. Developing a Safety Analytics, Forecasting & Evaluation Reporting (SAFER) solution capable of analyzing CAS information, narrative reports, and structured data sets.
3. Piloting a Safety Basis review and approval process to establish consistency in meeting nuclear safety requirements.
4. Establishing visuals depicting current safety and health program status, summarized by functional area.
5. Establishing summaries of NNSA Enterprise safety risks suitable for engaging Program Office, Functional Office, and Field Office leadership.

Figure 6 depicts how the initiatives and their intended outcomes, support ISM throughout the complex. Each initiative is described further in the following sections.

Figure 6: Initiatives and Outcomes Supporting ISM

Initiative 1: Increased Federal Technical Capabilities

The elements of this roadmap are built on two pillars (1) competent people and (2) clear processes. From this, the first initiative outlined in the roadmap is facilitating increased federal technical capabilities. We are leading an NNSA-wide effort for accreditation of the Federal Technical Capabilities Program (FTCP), with a goal of centralizing and streamlining the FTCP processes for ensuring federal staff are competent and qualified to provide oversight functions. The purpose of accreditation is to strengthen our TQP, developing people with the experience, knowledge, skills, and abilities necessary to perform their work and create processes that execute our mission as efficiently as possible.

Special attention to these actions are necessary now more than ever, to transfer knowledge from experienced safety professionals to newly hired staff and offset the loss of technical capabilities as high numbers of safety professionals near retirement and exit the workforce.

Upon NNSA achieving TQP accreditation, all NNSA organizations under the purview of DOE Order 426.1 (i.e., oversight of defense nuclear facilities) can follow a streamlined and consistent process, achieving a technically competent federal workforce efficiently with negligible subjectivity to program requirements. Additionally, NNSA will work with the DOE FTCP to align TQP expectations and processes with NNSA's expectations for oversight per SD 226.1B. Figure 7 illustrates the Key Milestones and schedule for the Federal Technical Capabilities initiative.

November 2018

Approval of NNSA SD 426.1, NNSA Technical Qualification Program

March 2019

Complete NNSA-wide TQP self-assessments

June 2019

Complete AU TQP Accreditation Evaluation Board

July 2019
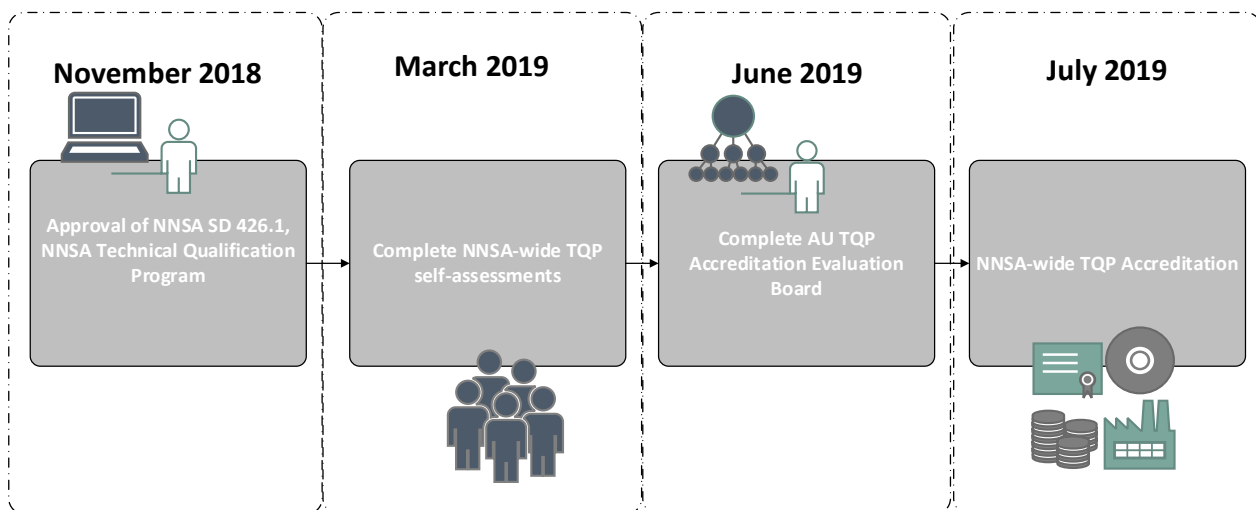
NNSA-wide TQP Accreditation

Figure 7 Federal Technical Capabilities Project Milestones

The efficiencies gained through streamlined, Enterprise wide processes, can ease the demand for limited time and resources of our safety professionals. The streamlined processes will allow them to spend their time and focus on the oversight of their functional areas.

Initiative 2: The Safety Analytics, Forecasting & Evaluation Reporting (SAFER) Project
Central Data Management and Gaining Efficiencies in Safety Oversight

The second initiative focuses on data capabilities to facilitate information sharing, data management, trending, and analysis. The SAFER project team is facilitating the implementation of a process for converting available data into useful information and visualizations for NNSA decision makers. The long-term outcome of this effort will be a decision-making support tool that will provide the identified decision makers with information, along with safety professional knowledge, to leverage resources and support safety oversight decisions. This capability will support decisions about NNSA Federal Safety Oversight optimization to support mission execution.

NNSA Field Offices have the primary role to oversight our M&O partners' safety risk management. The NNSA Central Technical Authority (CTA), the Cognizant Secretarial Officer for Safety (CSO), and the Chief Defense Nuclear Safety (CDNS) have responsibilities to maintain operational awareness of safety functional area system health and to understand the levels of safety risk that could negatively impact the mission across the Enterprise (as described in the Appendix 1 "Challenges Facing Safety Oversight" document). Where safety risks are identified that could negatively impact NNSA missions, communication and coordination with affected program offices is imperative to identify optimal mission-informed solutions to underlying issues. These Federal safety oversight functions have historically been performed by a relatively large cadre of experienced safety professionals; however as previously described, we must find ways to achieve the same levels of oversight with potentially fewer and less experienced technical staff.

Transitioning from a large, expert-based system of oversight to one that is evidence based and supported by data requires an incremental maturation of the NNSA data model. Data management, data governance, data capabilities, data culture, and the physical Information systems will be considered. NA-50 is pursuing opportunities to address the data management, data capabilities, and information systems aspects as described in this roadmap.

Transitioning from a large, expert-based system of oversight to one that is evidence based and supported by data requires an incremental maturation of the NNSA data model.

Data culture is primarily based on an organization's willingness to trust and use the data that is being presented. Data governance will be driven by a need to standardize and maintain data once an organization begins to realize the value of good data. The NNSA does not have a shortage of data. The regulations and directives associated with safety performance of NNSA operations include numerous requirements for development, maintenance, and reporting performance measures, metrics, and status updates. There are also numerous sources of federal oversight assessment results. Realization of these opportunities will allow direct federal oversight to be less resource intensive, but more effective.

The SAFER Project is executed using an iterative project management lifecycle, in a phased approach. The iterative approach allows the project flexibility while producing value added products at the close-out of each phase. Phase I of the project was benchmarking and learning. Phase II was proof of concept. Phase III and beyond include building a data capability, standing up an Enterprise-wide data governance board, and further collaboration beyond the safety functional area as illustrated in Figure 8 below. The data governance board will consist of members across the Enterprise including Field Offices, Functional Offices, Program Offices, and M&O partners, and will be responsible for establishing protocol around data.
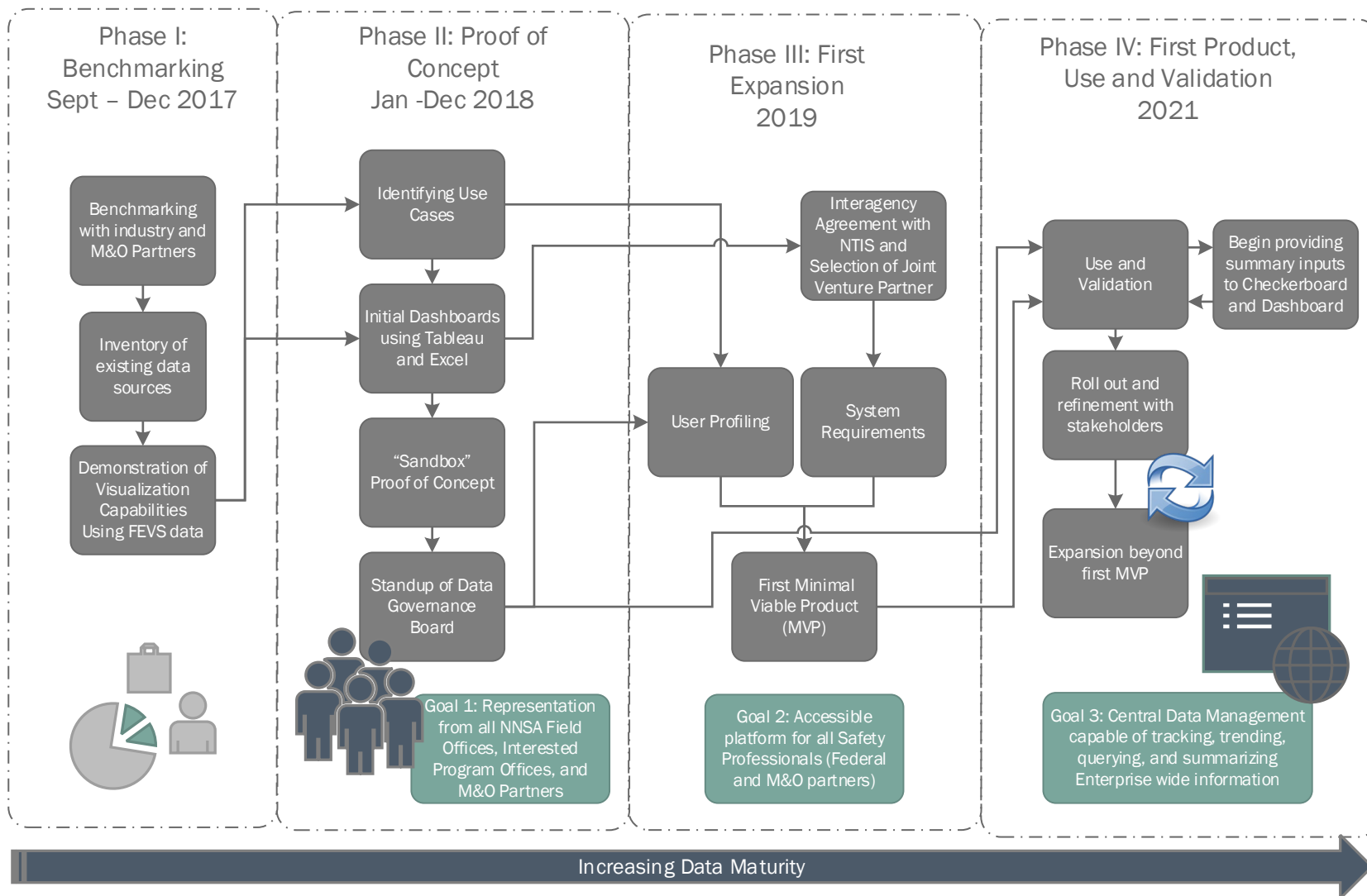
Figure 8 SAFER Project Milestones

Initiative 3: The Enterprise Safety Basis Review Team Project
A Matrixed Approach toward Safety Basis Improvement

Facilitated by the first two initiatives, the third initiative aims at leveraging human resources across the Enterprise from all involved NNSA Organizations, and promoting best in class processes as the standard for doing business. Within the NNSA Enterprise, the timely, effective, efficient, and consistent review and approval of safety basis documentation places high demands on NNSA resources. These include:

The Enterprise Safety Basis Review Team Project aims at leveraging human resources across the enterprise and promoting best-in-class processes as the standard for doing business

- Difficulty in resolving issues identified by review team members
- Multiple cycles to reach resolution on Safety Basis Review Team (SBRT) issues
- Inconsistencies in quality of M&O partner submittals
- Inconsistencies in comment consolidation and resolution by SBRTs in Safety Evaluation Reports (SERs)
- Limited resources to serve on the review teams
- Late issue identification by SBRT members
- Strained relationships between M&O partners/field offices/SBRT
- Lack of resolution of technical issues by SBRT
- Lack of accountability relative to SBRT performance
- Limited continuous improvement and sharing of lessons-learned across the complex
- Inconsistencies in nuclear safety policy interpretations.

Collectively, these traits create inefficiencies that complicate mission execution. To address these issues, NNSA has undertaken an effort to develop a matrixed approach for the review and approval of safety basis documentation. The purpose of this initiative is to alleviate limitations on NNSA resources and provide a centralized approach for scheduling corporate resources. This will provide a consistent approach for review and approval of nuclear facilities safety basis documentation and will strengthen and optimize NNSA technical resources across the complex.

The goal is to provide a consistent, repeatable framework to support:

- Performing safety basis reviews in a matrixed approach
- Training for newly hired staff and development/career progression for existing staff
- Timely review and approval of safety basis actions
- Resolution of SBRT comments/issues
- Successful implementation of safety basis documentation
- Enhanced, optimized scheduling of resources for SBRTs
- Consistent policy/one voice from Federal team interfacing with contractor
- Understanding of SBRT expectations and evaluation of team performance
- Resolving SBRT issues at the lowest levels with a minimal set coming to SBAA

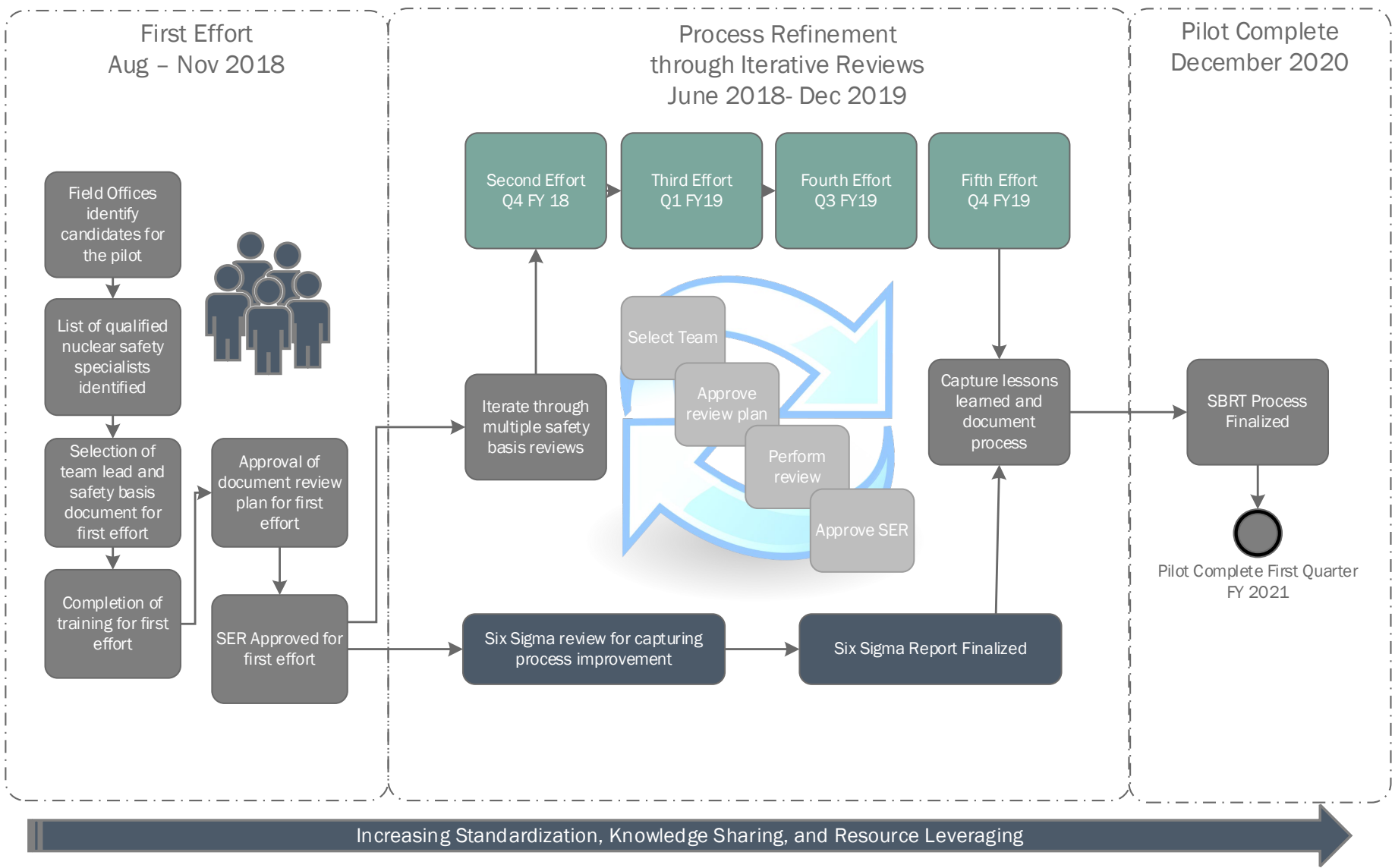Figure 9 illustrates the Key Milestones and Schedule for the SBRT initiative.

Figure 9 Enterprise SBRT Project Milestones

Initiative 4: The Checkerboard
Capturing Current Safety and Health Program Status

NA-50 is creating a formalized safety and health performance measurement system to convey the well-being of safety and health programs throughout the NNSA that are vital to achieving our mission. This includes a reliable, consistent process by which we can depict up-to-date safety and health program status across the Enterprise, based on professional judgement and supported by available data and specific program performance metrics.

The information is displayed in a chart of safety functional areas for each NNSA site, dubbed the "Checkerboard." The overall intent is to drive the physical validation or "checking" of system health by safety professionals (see figure 10). Safety professionals generate qualitative estimates of the status of program performance, confidence level of the performance rating, timeliness of information upon which the performance rating is based, and the consequence associated with the particular program.

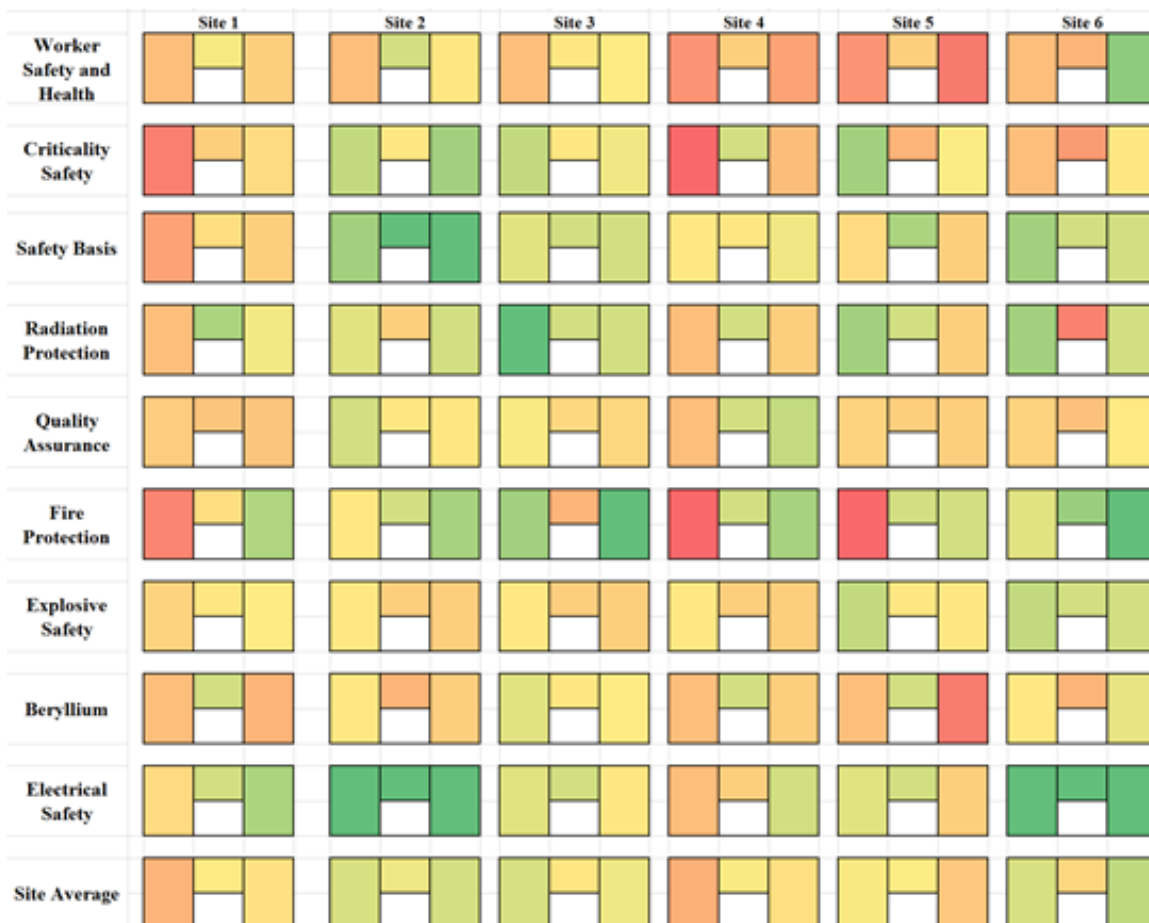| Consequence	Ranking	Health or Confidence
	Low	
	Low Moderate	
	Moderate	
	Moderate High	
	High	

Figure 10: Concept Checkerboard

Figure 11 illustrates the Key Milestones and Schedule for the Checkerboard initiative.

Concept Development
Feb-April 2018

Challenge Presented

Team Formed

Problem Statement Developed

Initial checkerboard designed

NA-51 Staff queried

Information collected and analyzed

First Checkerboard Developed and presented

Concept Refinement
April-Nov 2018

First run reviewed

Improvements Identified

Manual drafted

Design Enhanced

Process document drafted

Rating criteria clarified

Second iteration of Checkerboard

Process Establishment and First Phase of Expansion
Nov 2018- Sep 2019

First cycle completed using documented process

Field Offices familiarized with the process

First Field Office identified to provide input

First iteration of checkerboard using Field Office input

Process improvement using feedback gained from each quarterly cycle

Process documentation completed

Goal 1: First Field Office incorporated by FY 19

Process Expansion
Oct 2019-Sept 2021

Next Field Offices to participate identified

Field Office Input incorporated

Repeatable process established and used for Quarterly Safety Updates

Goal 2: Two Field Offices by FY 2020

Goal 3: All Field Offices by FY 2021

Common Approach for Communicating Federal Evaluation of Safety Programs
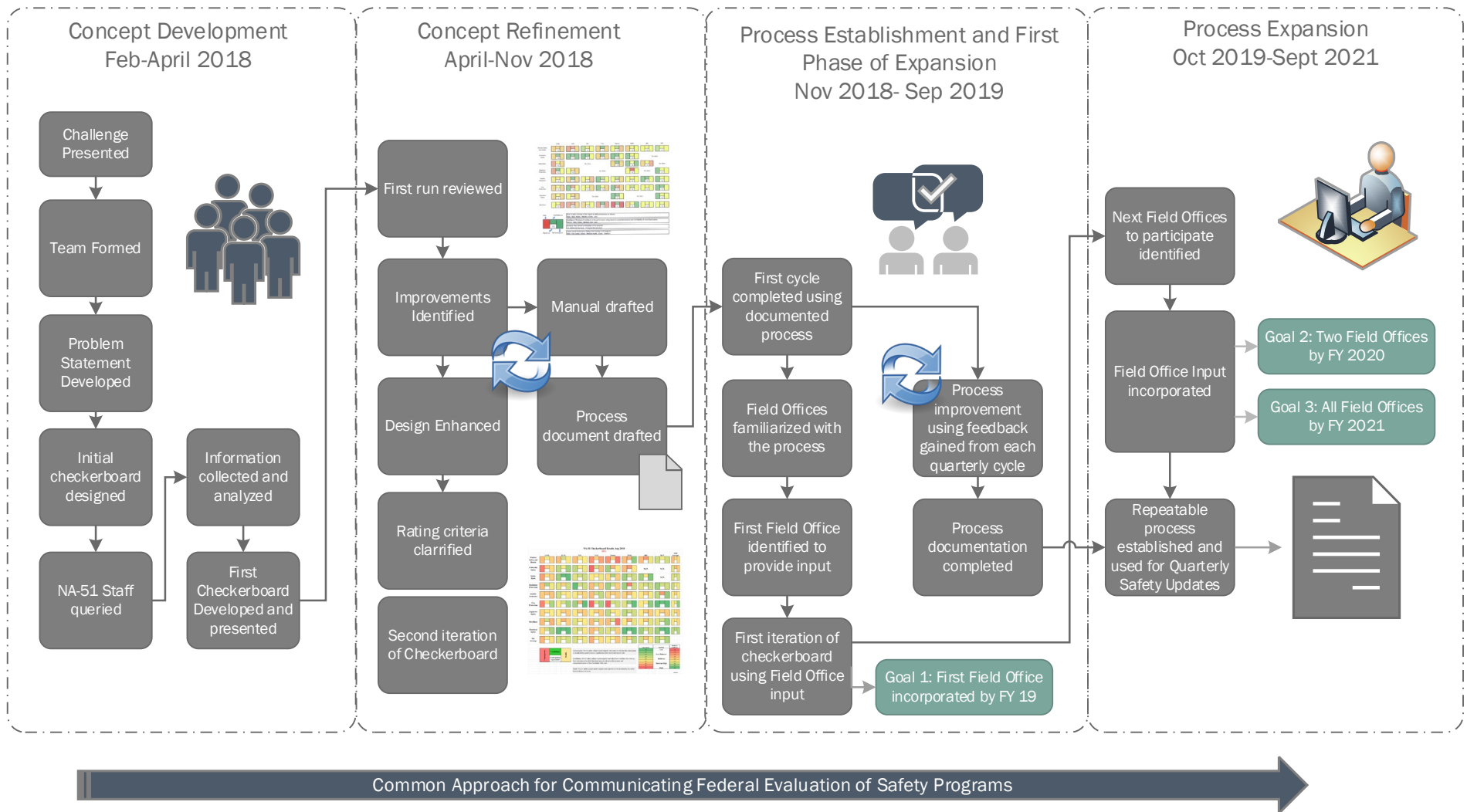
Figure 11 Checkerboard Project Milestones

Initiative 5: The Enterprise Dashboard
Presenting Executive Summaries for Site and Enterprise Safety Risk

Pulling together data from the other initiatives in this roadmap to effectively and concisely present the status of NNSA's safety and health programs is the goal of the Dashboard. The intent is to help senior leadership at HQ and in the field develop an understanding at an Enterprise level of where safety risk exists to support actions including reallocation of resources when appropriate. Currently there is no mature or consistently implemented process to capture that Enterprise perspective of safety risk or to brief in a concise, high level format.

This effort will include all NNSA sites as sources of information and risk analysis, with NA-50 serving as the functional manager to consolidate, assist with analysis, communicate with affected programs, and present Enterprise safety risk information gained. Figure 12 shows an example of the Dashboard.

Site	Baseline Risk	Special operating considerations affecting risk	Infrastructure	Implementation Observations	Overall Risk (Site)	Federal Performance Risk	Staffing Risk (incl. TQP Quals)	Overall Risk (Fed)
	M&O					FEDERAL		
Site 1	High	Moderate-High	Moderate-High	Moderate	Moderate-High	Moderate	Moderate-High	Moderate-High
Site 2	High	High	Moderate-High	Moderate	Moderate-High	Low-Moderate	Moderate	Low-Moderate
Site 3	High	High	High	Moderate	High	Low-Moderate	Moderate	Low-Moderate
Site 4	Moderate	Low-Moderate	Moderate	Low	Low-Moderate	Low-Moderate	Low-Moderate	Low-Moderate
Site 5	Moderate	Moderate	Moderate	Low-Moderate	Moderate	Low	Moderate	Low-Moderate
Site 6	Moderate	Moderate	Moderate	Low-Moderate	Moderate	Low-Moderate	Moderate-High	Moderate

Figure 12 Concept Enterprise Safety Risk Dashboard

Key elements of characterizing risk associated with the dashboard include:

- **Baseline Risk**: The assessor will arrive at an adjectival score based on the results of the risk matrix considering nuclear, chemical, explosive, and worker safety & health hazards. The assessment of nuclear risk is based on the number and level of facilities with a hazard category. The assessment for the other three inputs is based on a risk matrix considering likelihood and consequence.

- **Special operating considerations affecting risk**: This column considers any potential disruptions from the operational baseline, such as increased campaigns (which provides more opportunities for safety mishaps) or contract transitions.

- **Infrastructure:** The Master Asset Plan (MAP) is used as a baseline, and this point focuses on mission essential and high hazard operations. The assessor reviews the narrative for each site and makes a safety determination based on the items noted in the narrative. Deferred maintenance is also considered in this column. Field and Program Office perspective is supplemented by assessments from NA-52.

- **Implementation Observations**: These are informed by assessments at the facility, including by EA or NA-51 safety professionals, including assessments or indications of drifts in organizational safety culture. Specific measures include trends in TSR violations, qualifications of staff, and indications of CAS effectiveness. The checkerboard is a significant input into this risk column.

- **Federal Performance:** This column describes the performance of field offices and the headquarters safety organizations as assessed by senior federal peers primarily through the Chief of Defense Nuclear Safety Biennial Review process. These reviews objectively assess performance through standard criteria. The criteria are drawn from nuclear and other safety responsibilities assigned to the field offices via the FRA, nuclear safety orders, and rules.

- **Federal Staffing:** This objective rating combines two elements. The first element of the rating is staff on-board as compared to the staffing allotments assigned to the particular field office by the Administrator. The second element compares the fully TQP qualified staff to the existing positions in the field office that are designated for TQP qualification in any functional area.

One element of risk not captured in this iteration of the Dashboard is the impact of safety risk on program execution. The Dashboard is a communication tool, and should be used to communicate the impact of safety on program risk.

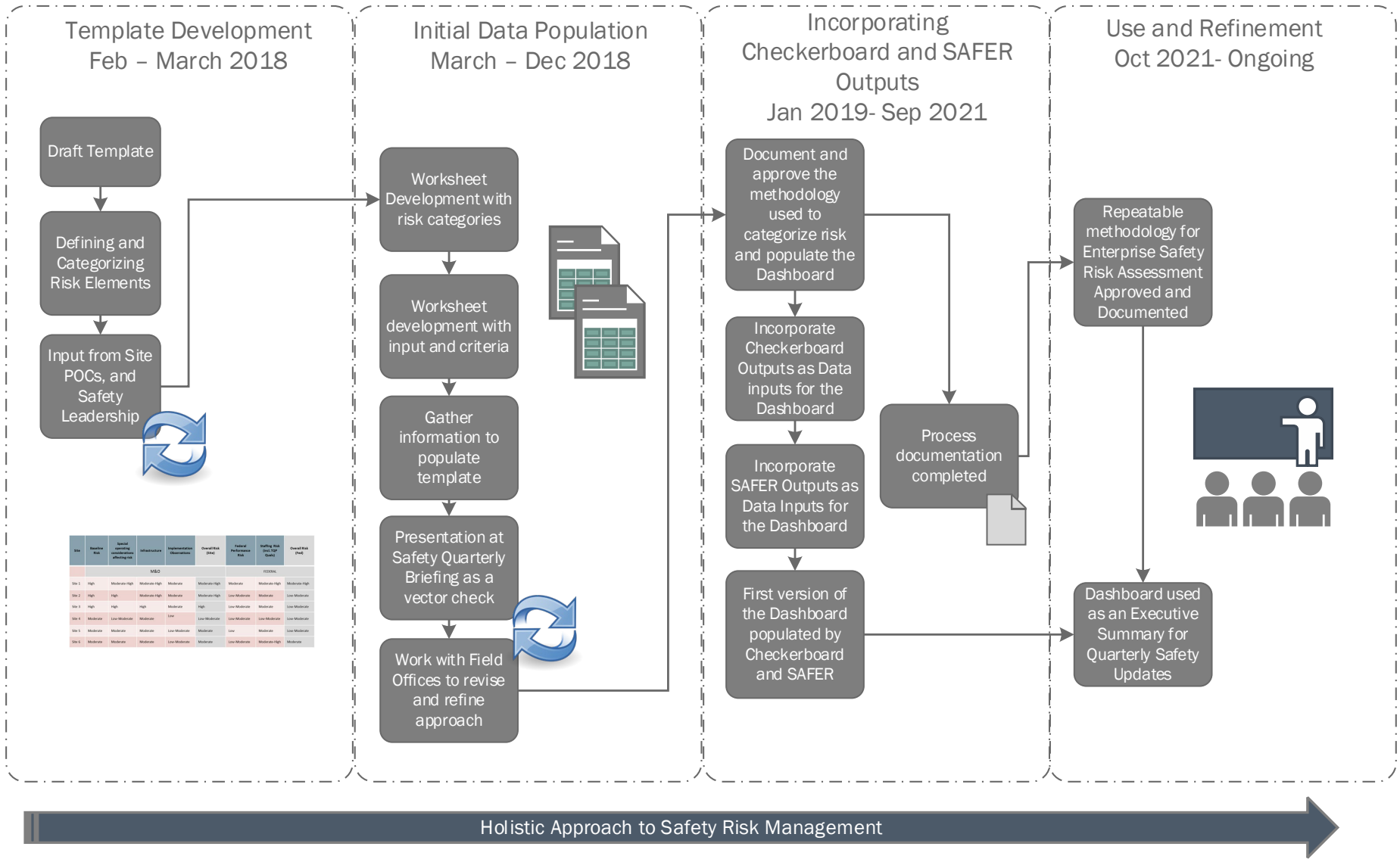Figure 13 depicts the Dashboard's Key Milestones and Schedule.

Figure 13 Enterprise Dashboard Key Milestones

TRACKING PROGRESS AND DEFINING SUCCESS

NA-50 will track the Key Milestones and schedule quarterly in the Safety Roadmap Scorecard. Additionally, NA-50 will track progress using the Objectives and Key Results format outlined in the table below.

Many of the key results focus on efficiencies. However, we are not working toward efficiency at the expense of safety. The objectives listed strive toward increased competency, effectiveness, and performance. As we work through each initiatives, the Key Results will be measured, and adjusted as needed, to keep us on track toward achieving our desired objectives.

Initiative	Outcome	Key Result 1	Key Result 2	Key Result 3
Federal Technical Capabilities	Maintain a highly competent federal workforce, with a consistent Enterprise-wide and rigorous training and qualification process	100% Completion of an NNSA-wide TQP program self-assessment	100% implementation of corrective actions from the program self-assessment	Complete and successfully pass an independent TQP Accreditation Review Board
SAFER Project	Manage Safety Oversight risks in a holistic, Enterprise wide approach using state of the art data science techniques to maximize the effectiveness of safety professionals	Functional data platform that is accessible by all Federal Field Office Safety organizations and M&O partners	Functional data platform to include data necessary for 10% of all functional safety areas	Functional data platform to include 100% of available data for all functional safety areas
SBRT Project	Increase the efficiency and effectiveness of Nuclear Facility Safety Basis Reviews	Develop a program informed enterprise wide schedule for SBRT reviews	Complete all six-sigma reviews to gather lessons learned and inform safety basis review and approval process formulation.	Issue NNSA SBR process that incorporates lessons learned from all pilot SBRT activities.

Initiative	Outcome	Key Result 1	Key Result 2	Key Result 3
Checkerboard	Enable the communication of Safety Management System Health across the Enterprise	Inclusion of all representative Safety Management Programs	Subject Matter Expert input received from 100% of Field Offices	Results from checkerboard are used for planning targeted oversight activities resulting in a 20% overall reduction in assessments planned and conducted.
Dashboard	Enable communication of Enterprise wide Safety Risks	Enterprise wide safety risk assessment methodology documented and approved.	Results from the Dashboard provide information on top enterprise concerns and best practices	Results from the dashboard are used for planning targeted, or reduced oversight activities, with the goal of eliminating low-value reviews by 20% without increasing risk.

Objectives	Outcome	Key Result 1	Key Result 2	Key Result 3
1.	Increase purpose driven oversight and reduce burdensome transactional oversight.	100% tracking of all site assessment activities	Update the Site Integrated Assessment Plan Process document to incorporate interfaces with the SAFER platform	Improve work-off rate for high-risk issues by 20%.
2.	Improve the structure and allocation of Federal oversight tasks to optimize performance	Facilitate reassignment of safety oversight activities to increase Safety Professional's time in facilities by 10%	Facilitate reassignment of safety oversight activities to increase Safety Professional's time in facilities by 20%	Facilitate reassignment of safety oversight activities to increase Safety Professional's time in facilities by 30%

This roadmap describes a set of interrelated initiatives. The identified key results provide a method for tracking progress and help us to determine if we are getting closer to our desired outcome. We have established these objectives based on the philosophy that, we should dare to fail because output tends to be greater when we strive for a level of achievement beyond our immediate grasp. This will also allow us to see results impartially, and not become so enamored with the tools we have created that we are not willing to course correct when necessary. Finally, we learn from our experiences and use them to improve as we progress forward. Successful organizations have an ongoing focus on improvement, and improvement is essential for us to maintain current levels of performance, to react to changes, and to see new opportunities.
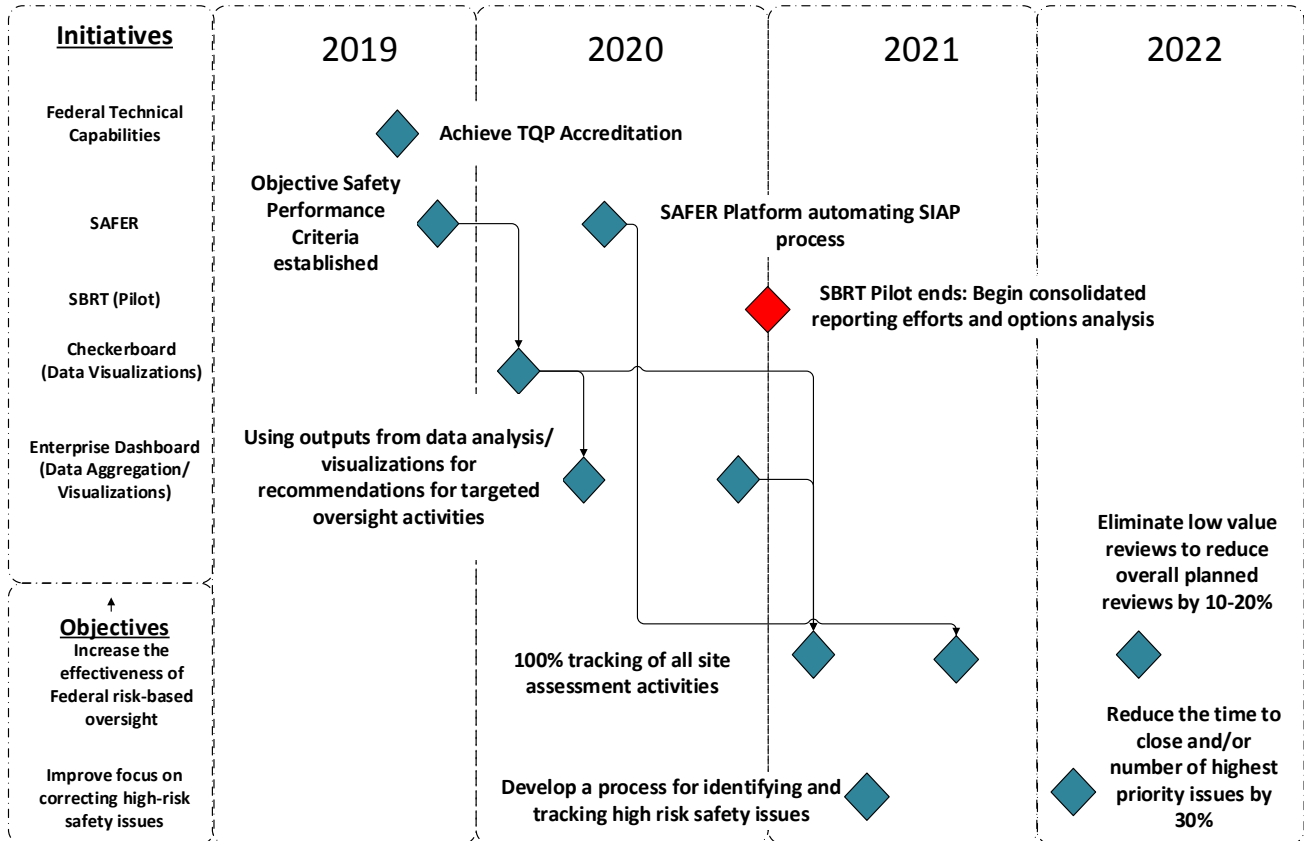

Figure 14 Key Milestones for the NNSA Safety Roadmap

Figure 14 identifies key milestones for each of the Safety Roadmap initiatives and begins to draw the connections to the long-term objectives of increasing the effectiveness of Federal risk-based oversight and improving focus on prioritizing and correcting high-risk safety issues. Future revisions to this document will include specific details for measuring progress and demonstrating accomplishment of the two objectives.

CONCLUSION

NNSA safety professionals execute the important task to foster the conditions where work is accomplished safely. To facilitate this effort, we are building the tools and techniques necessary to leverage human capital and communicate the results of safety oversight with leadership. This allows us to be better aligned, more aware of the challenges we are facing, and closer to our strategic objective of managing risks in a holistic and Enterprise wide approach.

NNSA safety professionals execute the important task to foster the conditions where work is accomplished safely.

The initiatives described in this roadmap represent the first steps toward transforming safety management. The early stages of these initiatives represent an investment period where both human resources and capital resources will increase. Further, in this transition it is possible that immediate impacts may have negative near term outcomes. However, by staying the course on this redesigned process to perform safety oversight we will minimize impacts to mission and safety during the investment period. Commitment to the vision outlined in this roadmap will take us from these discussed initiatives, through the difficult investment period, and ultimately to sustained, mature, and effective safety oversight.

"Good ideas and innovations must be driven into existence by courageous patience"
                    -Admiral Rickover

APPENDIX 1: CHALLENGES FACING SAFETY OVERSIGHT

A New Approach to be Purpose Driven and Mission Focused

PDF Attached

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