OSD AMCPR Long-Term Roadmap

AMCPR Advanced Manufacturing - Crisis Production Response

Deloitte.

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Executive Summary

Program Background

The Advanced Manufacturing Crisis Production Response (AMCPR) program arose from a coordinated effort, led by America Makes, to respond to the global COVID-19 pandemic in the United States. The initiative worked with the U.S. manufacturing ecosystem, including government agencies, designers, and manufacturers, to supply critical products to combat COVID-19. Now, as supply continues to stabilize, the AMCPR has increased its focus on structuring and developing new facets of the program to enhance U.S. capabilities, not only in future times of crisis but in non-crisis times, as well. The program's explicit goal is to advance the cause of U.S. manufacturing responsiveness and competitiveness while simultaneously preparing the nation for future, as yet unknown, crises.

The Dwight D. Eisenhower National System of Interstate and Defense Highways is a prime example of a federal program that aimed to serve the nation in crisis and non-crisis times. Not only did the program address the need for a connected highway system to promote domestic travel and trade, but it was also simultaneously designed to enhance national security, used as an evacuation method in the instance of a foreign attack on major U.S. cities1. Similarly, programs such as the AMCPR can be crucial for national and regional crisis response and promote national manufacturing competitiveness, spurring economic growth.

As the AMCPR continues to establish itself as a trusted voice in the manufacturing community and looks to build an enduring infrastructure dedicated to crisis management and beyond, a structured plan is required to transition to this effort's recovery and resiliency phases effectively.

AMCPR Long-Term Roadmap

With the support of America Makes, the National Center for Defense Manufacturing and Machining (NCDMM), the Office of the Secretary of Defense (OSD), and Deloitte Consulting, LLP, this long-term Roadmap has been developed to guide and prioritize future AMCPR development and test initiatives.

The Roadmap is an actionable, dynamic plan that considers the program's future vision and goals, with activities that will drive impact and value for stakeholders, both in times of supply disruption and in a steadier, more certain supply state. The Roadmap is structured into four main initiatives (i.e., swim lanes):

1. Regulatory & Policy Management – Track evolving regulatory landscape, and develop and execute a plan that aids manufacturers in navigating IP and legal concerns;
2. Ecosystem Cultivation – Empower, grow, and mobilize the AMCPR network and greater ecosystem through strategic communications, capability mapping, and education & workforce development;
3. Capability Expansion – Develop program capabilities through crisis scenario execution and lessons-learned, to advance AMCPR's readiness in the time of crisis; and
4. Platform Improvement & Sustainment – Evolve the AMCPR enabling technology platform (the AMCPR Exchange) to operationalize and automate essential design and transactional activities.

The Roadmap, in conjunction with the AMCPR Playbook and AMCPR Impacts Report, considers critical insights and lessons learned from the COVID-19 pandemic and demonstrates the value of the program, as well as a path forward to enhance its capabilities and reach in advanced manufacturing communities. AMCPR sponsors see this Roadmap as a valuable tool for those who support the mission and choose to invest in its success and sustainability.

[1] Department of Transportation: Dwight D. Eisenhower National System of Interstate and Defense Highways

AMCPR Phase 2 Deliverables

The Roadmap, Playbook, and AMCPR Impacts Report **consider key insights and lessons learned** from the ongoing COVID-19 pandemic response, and **demonstrate the value of the program** as well as a path forward to enhance its capabilities and reach in advanced manufacturing communities

Impacts Report

After Action Report from Phase 2 efforts

Demonstrates value and accomplishments of the AMCPR program for external stakeholder consumption. Includes success stories, vignettes, key insights, lessons learned, and impacts

Roadmap

Actionable, dynamic path forward

Considers the future vision and goals of the AMCPR and outlines activities that will drive impact and value for stakeholders. Includes interdependencies, proposed governance structure, and KPIs to track progress and encourage accountability

Playbook

Guide outlining a repeatable process

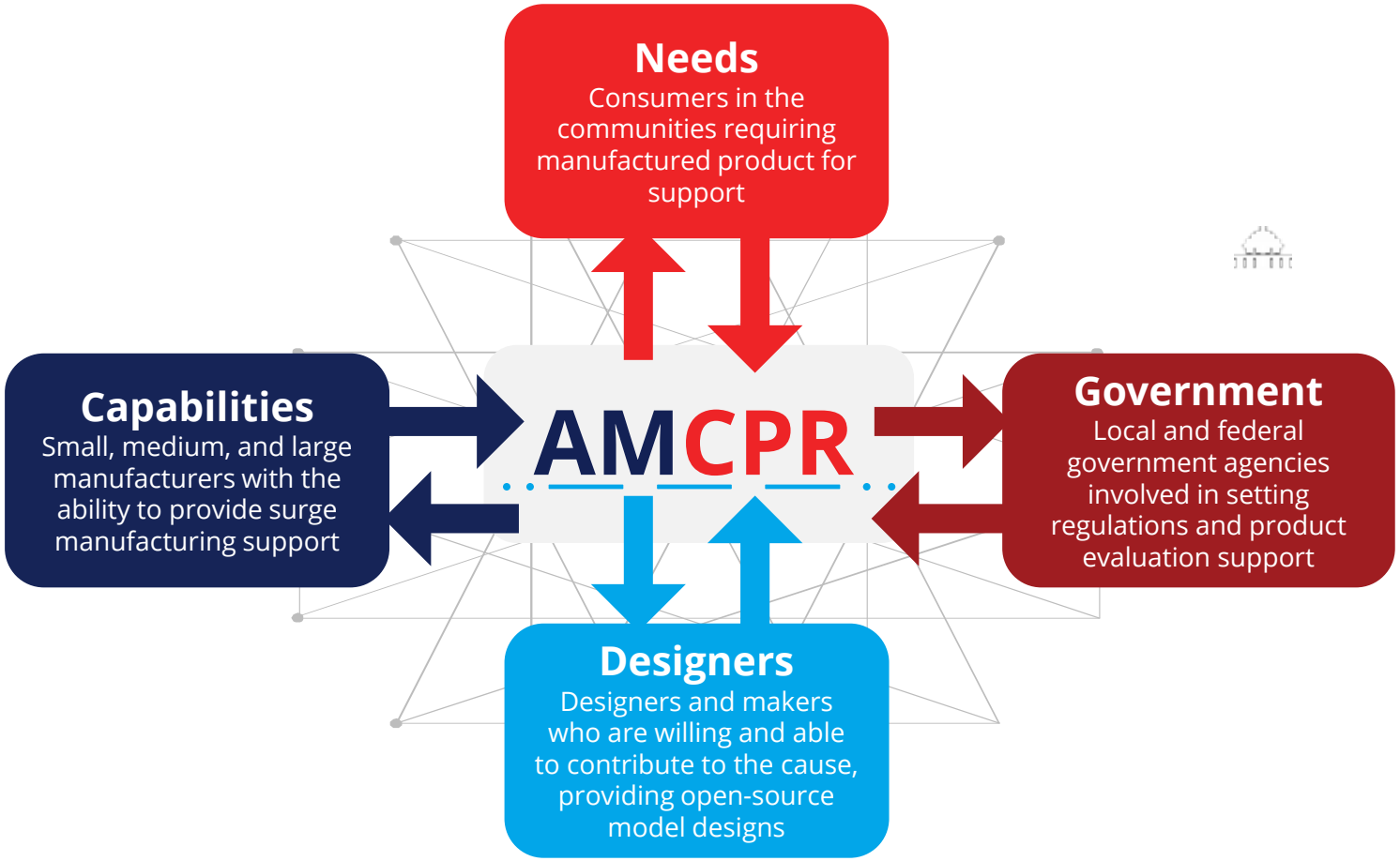
Captures the steps required at each decision point for organizations preparing and/or responding to a future crisis. Incorporates a framework by which to structure efforts for effective rollout

AMCPR Overview

Advanced Manufacturing Crisis Production Response (AMCPR) Overview

The AMCPR seeks to create an **enduring strategic infrastructure** for advanced manufacturing crisis response capabilities that includes workforce readiness, regulatory awareness, and access to supply chain and designs.

This strategic infrastructure can help prepare the U.S. for **future crises** and enhance overall **national economic competitiveness and security**.



Roadmap Overview

Roadmap Overview and Key Considerations

The Roadmap outlines an actionable path forward, with the goal of continuing the growth and sustainment of the AMCPR program

Inputs

- America Makes Leadership Vision & Interviews
- AMCPR Ecosystem Feedback
- Scenario Planning
- AMCPR Exchange Development Requirements
- Phase 1 Lessons Learned

Considerations*

Time
Resources
Value
Cost

Roadmap

Themes (Swim Lanes)
Enabling activities, tactical tasks

Desired Future State
Goals, future vision

Impact
Program impact, external impact

Stakeholders
Collaborators, beneficiaries

Roadmap activities **drive value** for stakeholders in **times of supply disruption and certainty.**

*While these factors were considered during roadmap development, in-depth business case and cost analysis were not in-scope for this deliverable.

Roadmap Swim Lane Overview

Regulation & Policy Management

Definition:

- Track evolving regulatory landscape, and develop and execute a plan that aids manufacturers in navigating IP and legal concerns

Justification:

- Policy and guidance identification and distribution to the network will strengthen AMKs position as a trusted source for regulatory-related information

Key swim lane activities:

- Regulatory sensing, policy insight collection, policy and guidance distribution to AMCPR network

Ecosystem Cultivation

Definition:

- Empower, grow, and mobilize the AMCPR network and greater ecosystem through strategic communications, capability mapping, and education & workforce development

Justification:

- Engaging and cultivating the AMCPR network through identification of needs, motivations, and capabilities

Key swim lane activities:

- Ecosystem expansion, ecosystem capabilities assessment; strategic communication and marketing; education & workforce development (EWD)

Capability Expansion

Definition:

- Develop program capabilities through crisis scenario execution and lessons-learned, to advance AMCPR's readiness in the time of crisis

Justification:

- The AMCPR's aptitude in responding to the next crisis will come from the groundwork effort to build out its capabilities and toolset

Key swim lane activities:

- COVID scenario execution lessons learned, crisis taxonomy, crisis readiness prioritization approach, future scenario execution

Platform Improvement & Sustainment

Definition:

- Evolve the AMCPR enabling technology platform (the AMCPR Exchange) to operationalize and automate essential design and transactional activities

Justification:

- Continuous enhancement to the AMCPR Exchange is critical to sustain the digital infrastructure the AMCPR network will utilize to interact and transact

Key swim lane activities:

- Collect requirements for improvement, prioritization and tracking of enhancements, phased feature development & deployment

Ecosystem Stakeholders

Ecosystem stakeholders* will help to drive execution of the roadmap, some in direct collaboration or as funding vehicles, and others as beneficiaries of these initiatives

Technology Integrators

Companies that specialize in system integration. Prime candidates for helping SMMs implement new AMT

Academia & Workforce Education Development Org.

Universities, academia, and educational organizations concerned with research, scholarship, and education which will develop the skills of the US workforce

State & Local Government

Governing bodies that assist SMMs through location-based funding, grants, tax laws, and policy

Federal Government Agency Partners

Agencies that support the manufacturing ecosystem through funding, grants, procurement contracts, and policy

Manufacturing Innovation Institutes

A network of research institutes in the United States that develop AMT through public-private partnerships among U.S. industry, universities, and federal agencies

Economic Development Organizations

Organizations dedicated to the economic growth and sustainability of a region. Support the adoption of new technologies and improvement of employment opportunities

Manufacturing Extension Partnerships (MEPs)

Public-private partnerships dedicated to growing SMMs. Have connections to and a strong understanding of the SMM environment

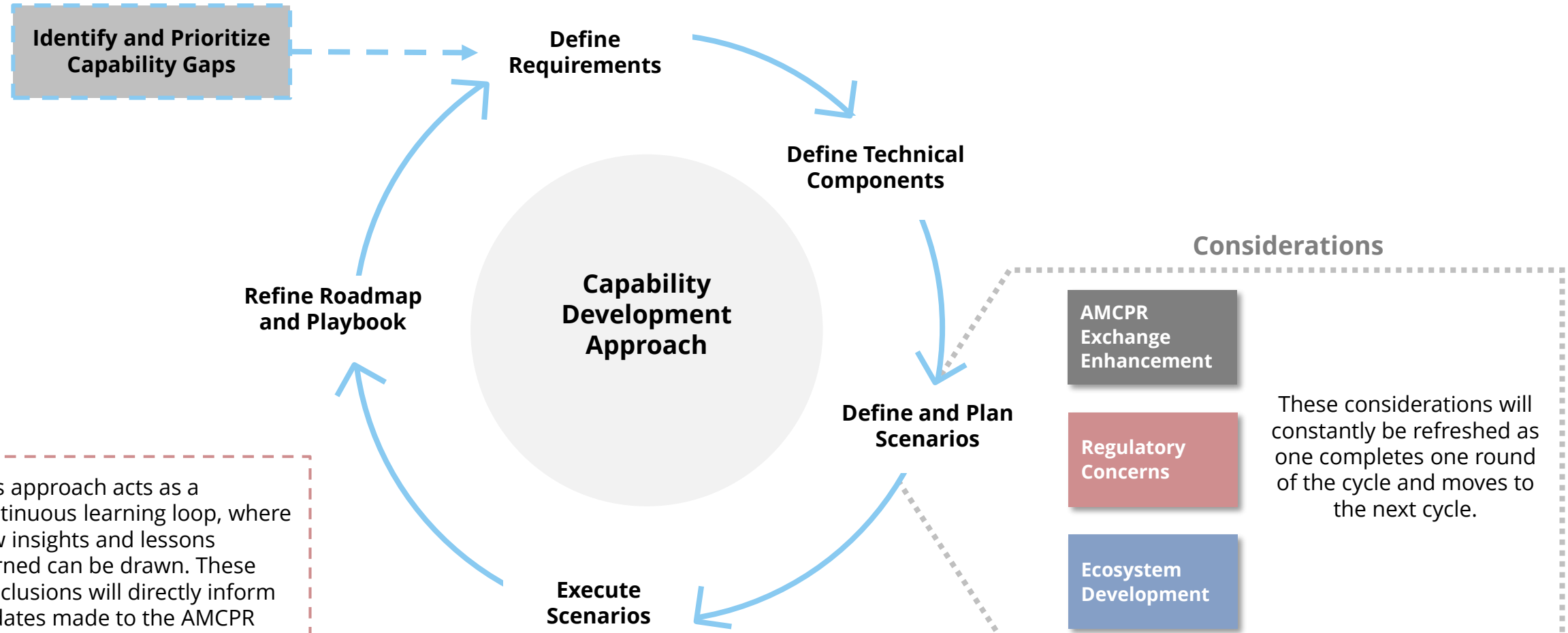
Manufacturers/OEM (Large, Medium, Small, & Makers)

Larger companies that contain small and medium-sized manufacturers in their supply chains

*Stakeholders may fall under one or more of the ecosystem groups listed.

Capability Development Approach

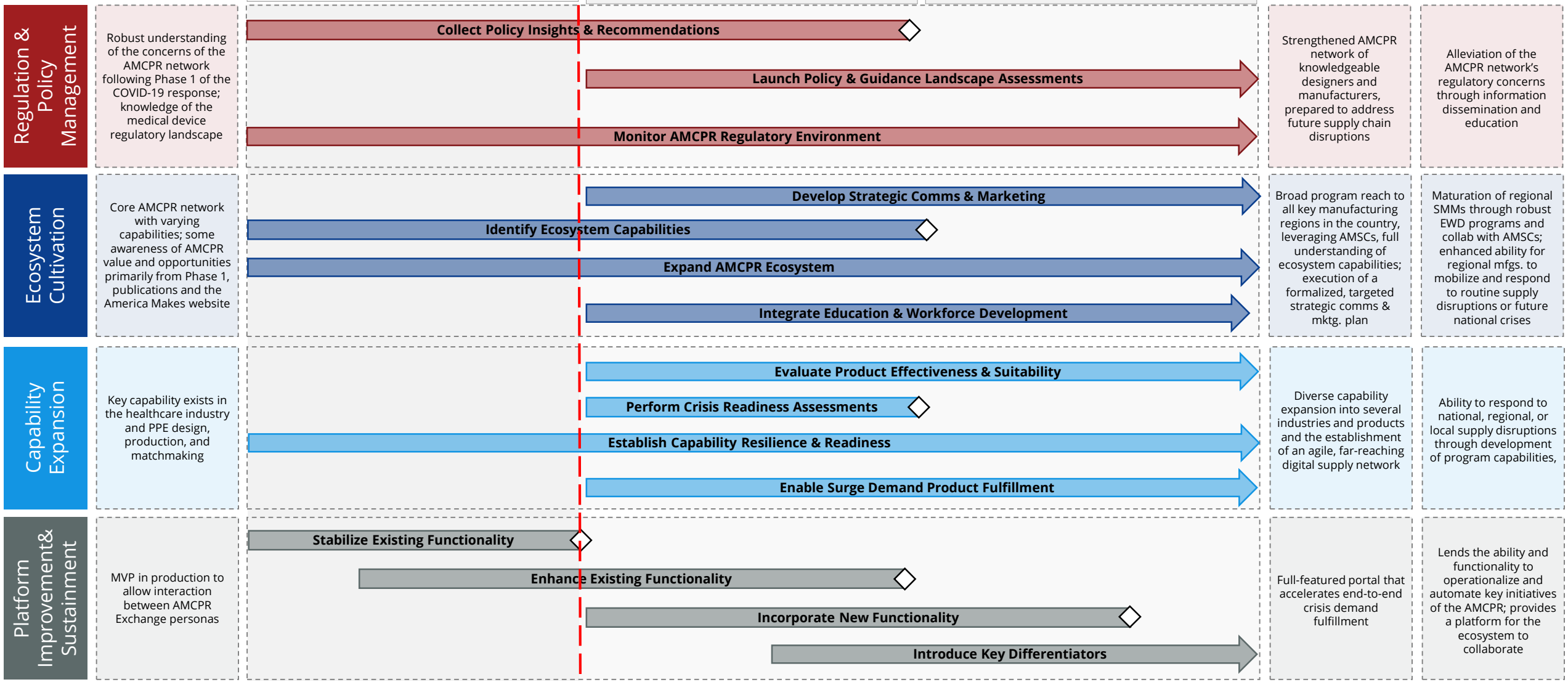
This iterative framework incorporates activities that cut across the swim lanes established in the roadmap. This process can continuously be executed, past the timeline defined on the roadmap, to address capability gaps



Roadmap Activities

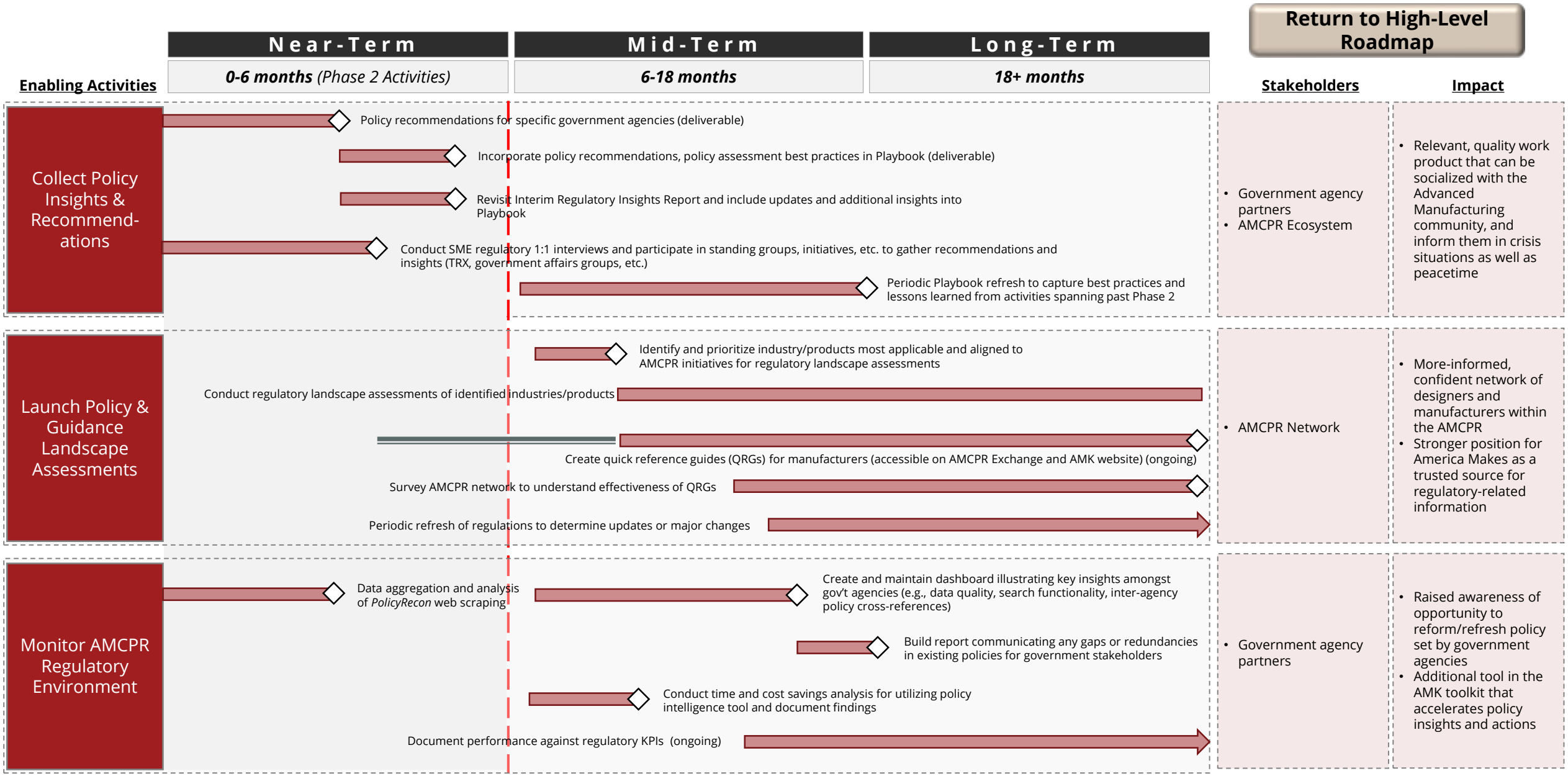
OSD AMCPR Roadmap

The Roadmap timeline begins on 02/05/2021 (at month '0'), approximately halfway through Phase 2 of the program. Activities occurring in the 'Near-Term' (0-6 months) timeframe are funded as part of Phase 2. The 'Mid-Term' (6-18 months) and onward include activities past Phase 2 that require additional funding.

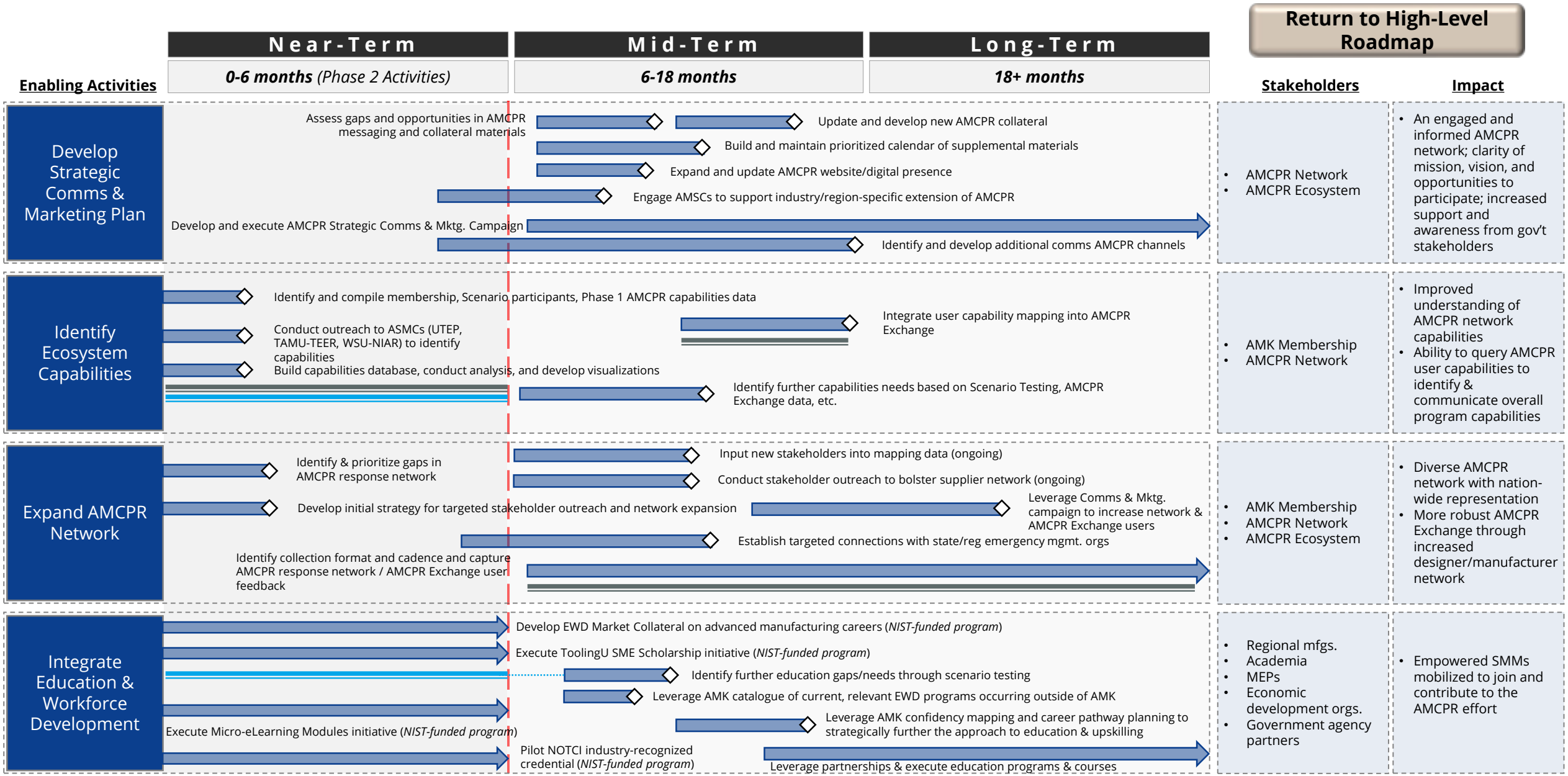


*Timelines throughout this deck are notional

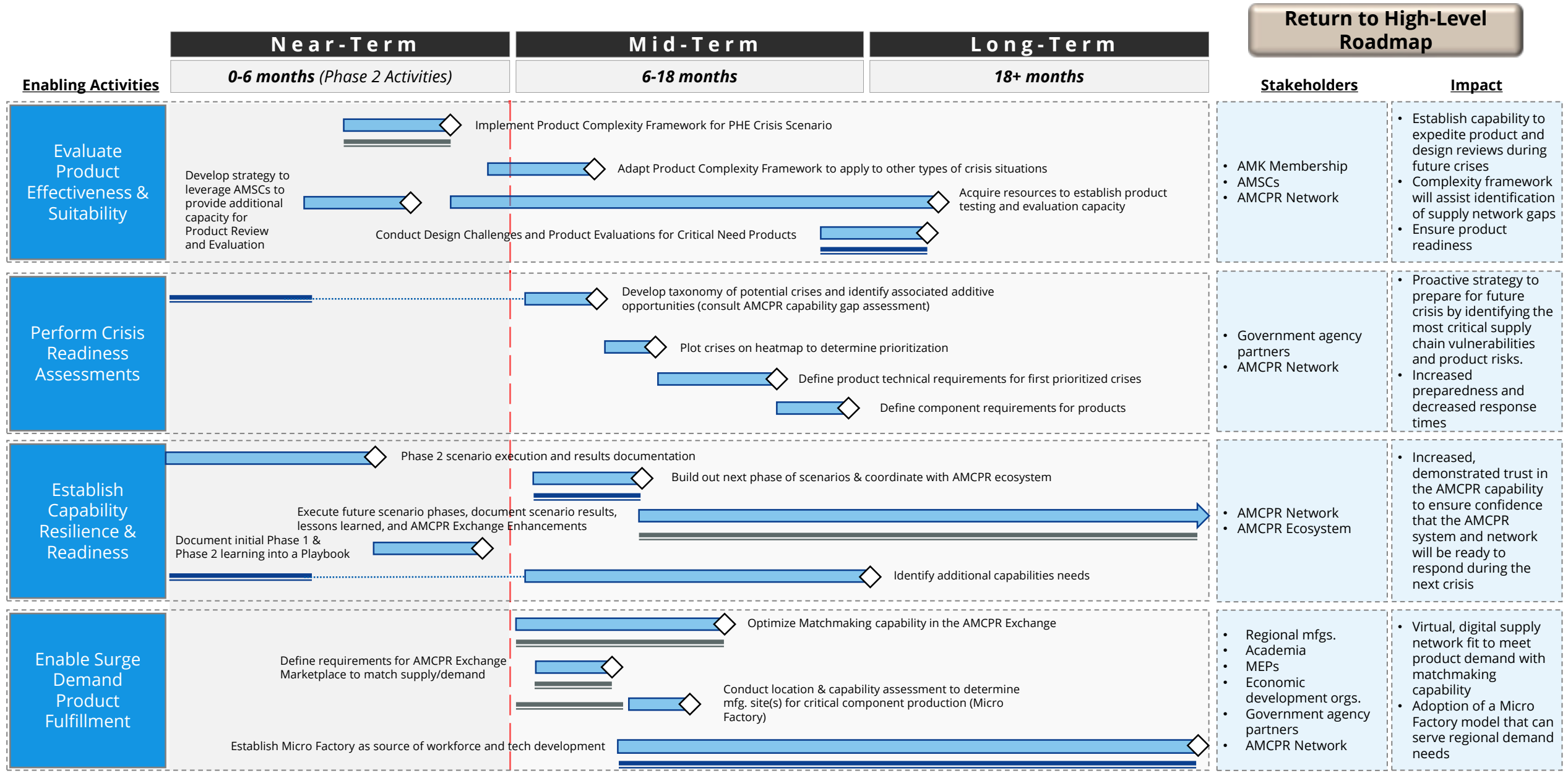
OSD AMCPR Roadmap – *Regulation & Policy Management*



OSD AMCPR Roadmap – *Ecosystem Cultivation*



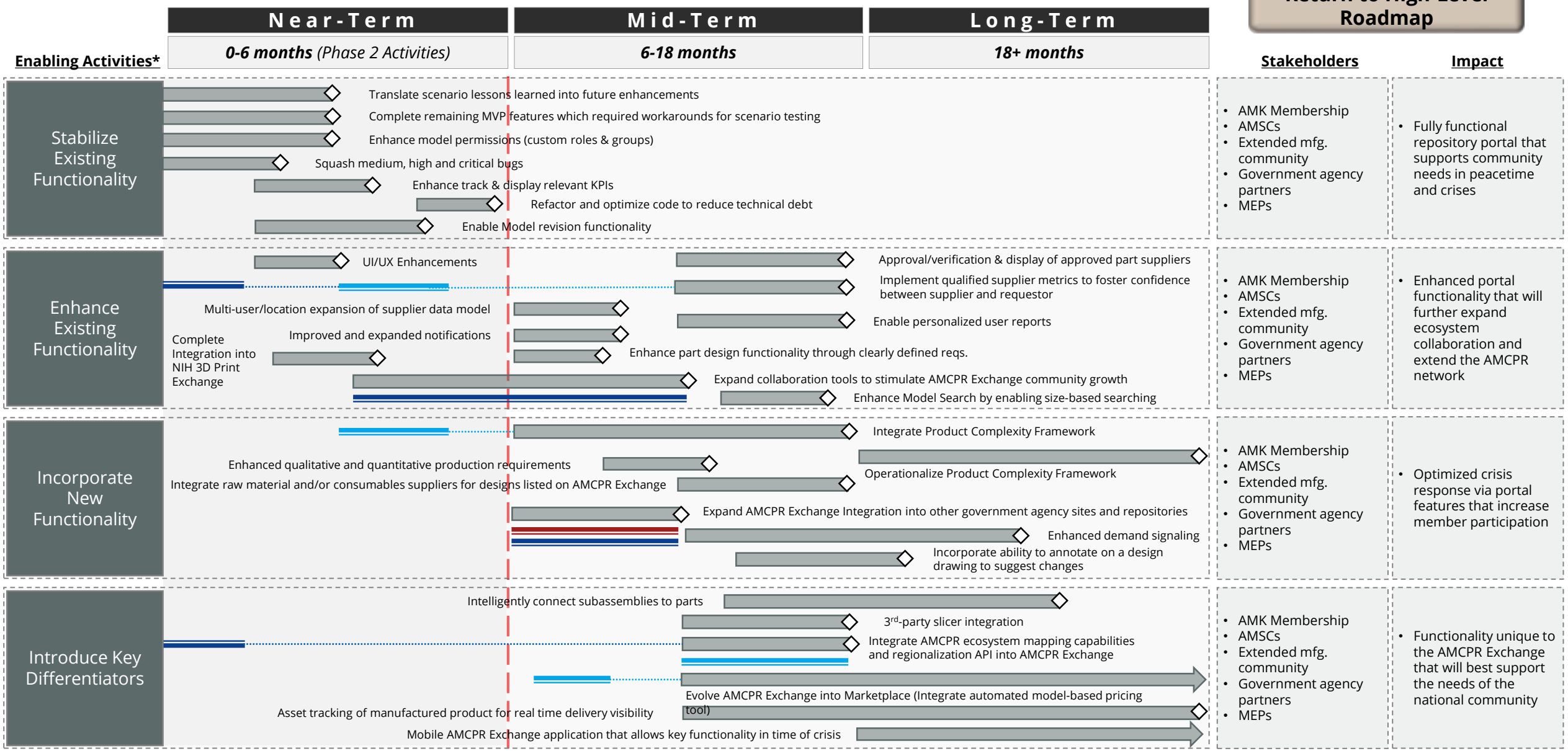
OSD AMCPR Roadmap – *Capability Expansion*



OSD AMCPR Roadmap – *Platform Improvement & Sustainment*

*Refer to Appendix C for complete list of AMCPR Exchange features

Return to High-Level Roadmap

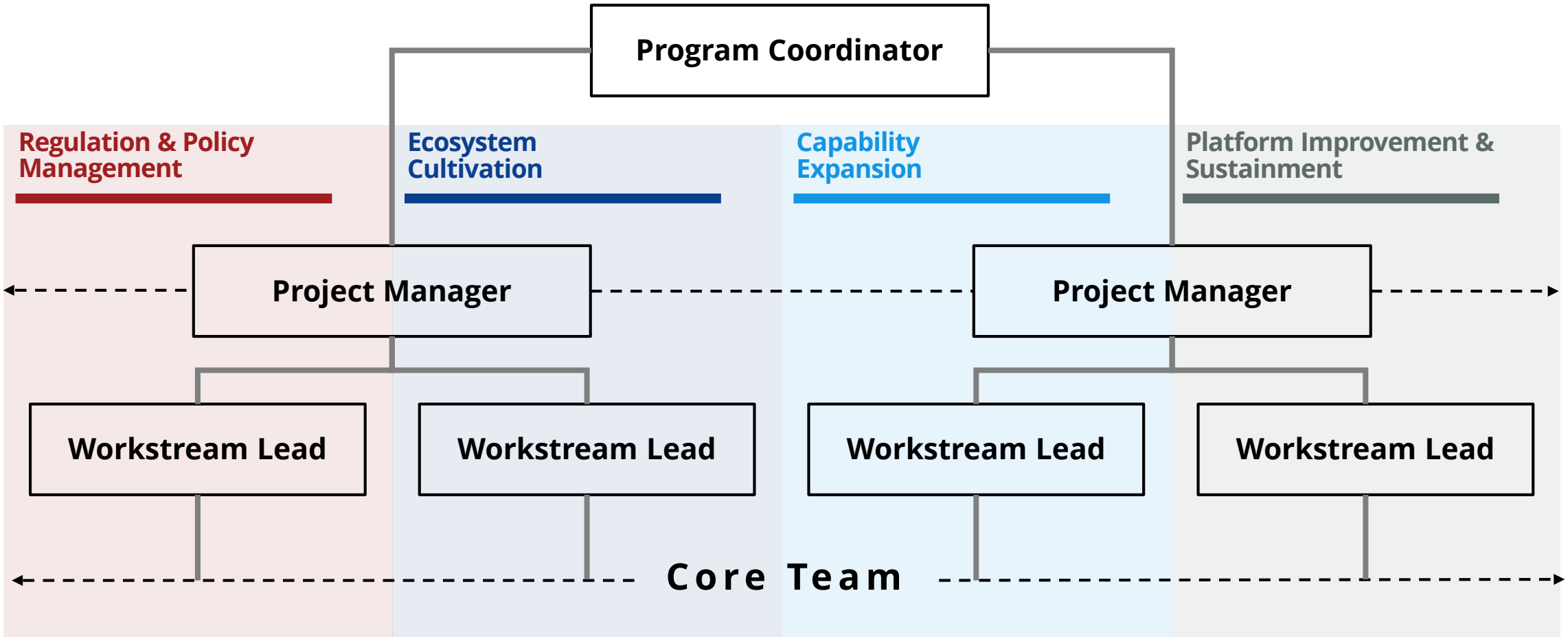


Governance for Roadmap Execution

Governance for Roadmap Execution

Swim lane interdependencies demonstrated in the Roadmap require cross-coordination and communication among workstreams, overseen by a program coordinator during the next phase of work

AMCPR GOVERNANCE STRUCTURE*



*Governance structure is a visual representation of the cross-coordination required to execute activities in the next phase of work.

Key Performance Indicators

Key Performance Indicators

Tracking performance and execution is key in achieving roadmap objectives. KPIs help to demonstrate measurable value of roadmap activities and aid in reporting, both internally and externally to roadmap stakeholders

ROADMAP KPIs*

Regulation & Policy Mgt.

Swim lane KPIs:

- % of AMCPR membership with increased level of confidence in operating under government agency regulations (through survey)
- % of AMCPR designers who agree to AMCPR Exchange IP/privacy policy
- Cycle time of Regulatory Tool web scraping
- Cycle time of Regulatory Tool data analysis

Capability Expansion

Swim lane KPIs:

- Supply Disruption Readiness Approach sprint cycle time
- # of products with completed complexity assessments
- # of suppliers with score

Ecosystem Cultivation

Swim lane KPIs:

- % growth in AMCPR membership; industry and regional diversity
- # and Breadth of supplier capabilities
- Design challenge participation
- Engagement through social and digital channels
- Level of participation/impact of EWD initiatives

Platform Improve & Sustain

Swim lane KPIs:

- # of end users requesting products
- # of products by type that can support crisis response
- # of manufactures identified in each geographic ecosystem that can support the crisis response
- Sprint burndown
- Cycle time
- # of feedback tickets submitted by users

*List of KPIs per swim lane is not exhaustive

Appendices

Appendix A: List of Acronyms

Acronym	Definition
AMCPR	Advanced Manufacturing Crisis Production Response
AMK	America Makes
AMSC	America Makes Satellite Center
DoD	Department of Defense
EWD	Education & Workforce Development
KPI	Key Performance Indicator
MVP	Minimum Viable Product
NCDMM	National Center for Defense Manufacturing & Machining
OEM	Original Equipment Manufacturer
OSD	Office of the Secretary of Defense
PHE	Public Health Emergency
PPE	Personal Protective Equipment
QRG	Quick Reference Guide
SME	Subject Matter Expert
TAMU-TEES	Texas A&M University – Engineering Experiment Station (Satellite Center)
TRX	America Makes Technical Review & Exchange
UTEP	University of Texas at El Paso (Satellite Center)
WSU-NIAR	Wichita State University – National Institute for Aviation Research (Satellite Center)

Appendix B: Key Terms Defined

Key Term	Definition
AMCPR Ecosystem	Interconnected network of public and private entities convened to directly and indirectly shape the AMCPR infrastructure to help prepare the U.S. for future crises and enhance overall national economic competitiveness and security.
AMCPR Exchange	Model collection and matching web application that allows the AM community to share data securely during the ongoing COVID-19 crisis and is also a tool that supports future crises that stress the supply chain.
AMCPR Network	Stakeholders from the Needs Requester, Designer, Reviewer / Regulatory, and Manufacturing Supplier communities who have committed to joining the AMCPR and supporting the development of an enduring strategic framework for advanced manufacturing response capabilities. Network organizations and response capabilities will ultimately be tracked and convened through the AMCPR Exchange.
Education and Workforce Development (EWD)	Targeted resources and training to advance the workforce through re-skilling and up-skilling, designed to build up an AMCPR Network better prepared for supply chain disruptions in future crises.
Design Challenge	To address crisis response needs, new product designs are needed that will enable faster production, new functionality, and an increase in potential supply base. A Design Challenge is an open call for new product designs that can meet a defined set of requirements. The designs are reviewed and evaluated by a panel of experts and the top designs are selected. Often, a monetary reward is given to the top design(s) in order to facilitate the continued maturation or scale-up of the new product design.
Matchmaking	Process by which a member of the 'needs' community is connected to a member of the supplier community to obtain critical components or products.
Marketplace	Future-state AMCPR Exchange platform capability where transactions are facilitated directly through the AMCPR Exchange, providing full visibility into the end-to-end process, and therefore better positioning the AMCPR to coordinate future disaster response efforts.

Appendix B: Key Terms Defined (continued)

Key Term	Definition
Micro Factory	Plant or manufacturing site consisting mostly of rapid prototyping and flexible-operations production equipment best-suited for small batch production. In times of emergency, the Micro Factory can be used to manufacture critical need components to supply regional surge demand. During periods of non-crisis, the manufacturing equipment can be used to support regional education, workforce and development needs. Additionally, the physical assets can be used to incubate and mature technology start-ups and the manufacturing readiness levels of critical components.
Mobile Application (AMCPR Exchange)	Application designed to run the AMCPR Exchange on a mobile device (e.g., smart phone, tablet, etc.), allowing users to perform key AMCPR Exchange functions.
NIH 3D Print Exchange	Public-facing website platform developed by NIH, used to house a broad range of 3D printable designs during the initial COVID-19 response. The AMCPR effort leveraged the site as a searchable repository of open-source models in formats compatible for use on a wide variety of additive manufacturing equipment.
Phase 1	The first phase of work in America Makes' response to the COVID-19 crisis, spanning from March 2020 through June 2020, by which the AMCPR was formed and operationalized.
Phase 2	The second phase of work in which the AMCPR was further developed and operationalized, spanning from July 2020 through July 2021. Key activities and deliverables included: ecosystem feedback through workshops, AMCPR capability mapping, scenario planning and execution, AMCPR Exchange development and MVP completion, and development of the Long-Term AMCPR Roadmap, Playbook, and Impacts Report.
Playbook	Guide outlining a repeatable process that captures the steps required at each decision point for organizations preparing and/or responding to a future crisis. Incorporates a framework by which to structure efforts for effective rollout.

Appendix B: Key Terms Defined (continued)

Key Term	Definition
Product Complexity Framework	Tool developed by the AMCPR to assess whether a product is suitable for additive manufacturing and assist in prioritizing which products to pursue for conversion to additive designs. The complexity is assessed across four dimensions: 1) manufacturing complexity, 2) functional complexity, 3) business complexity, and 4) regulatory & legal complexity.
Product Evaluation	Some components are produced by non-conventional manufacturing (e.g., additive manufacturing) to augment traditional supply chains to meet surge demand during a crisis. However, the designs and the components produced by non-conventional methods are often untested or unproven for the applications they are intended for use. “Product Evaluation” is the systematic process to determine fitness for use in the intended applications of the new designs and components produced by non-traditional methods. Depending on the Product Complexity, the rigor and thoroughness of the testing will vary.
PolicyRecon	Tool that leverages automated document scraping, natural language processing (NLP), artificial intelligence (AI), and machine learning, designed to rapidly identify and illuminate applicable policies and regulations and identify gaps or discrepancies in that documentation.
Scenario Execution	Series of action and/or events, in response to a crisis, executed to comprehensively and systematically assess response capabilities of the AMCPR and the effectiveness of the AMCPR Exchange. Involves multiple organizations working together to address the crisis scenario.
Third-Party Slicer Integration	Incorporation of a third-party slicing software into the AMCPR Exchange, allowing for the generation of line-by-line (or layer-by-layer) 3D printer instructions into a file that is uploaded into the AMCPR Exchange.

Appendix C: AMCPR Exchange Features List

Themes		Jira ID	User Story/Description
Stabilize Existing Functionality	Translate Scenario Lessons into Bugs & Future Enhancements	*N/A*	Continuously improve platform through bug fixes, user feedback, and new features.
	Complete MVP Functionality	*N/A*	Finish development of all remaining MVP features which required workarounds for scenario testing
	Enhance model permissions (custom roles & groups)	248	As an admin, I want to be able to reference a master permissions matrix so I can understand permissions and set them for various groups and users appropriately.
	Enhance AMCPR Exchange to track and display relevant KPIs	124, 87	As an admin user from AM team, I want to be able to have access to a dashboard that allows visibility to key indicators providing insight into the use of the AMCPR Exchange.
	Enable saved searches	69	As a registered user, I want to be able to save all of the conditions of my search so that I can easily perform an identical search in the future without having to enter all the criteria again. *Note: this has been rolled up into "Complete MVP Functionality" and will be implemented as part of that effort.*
	Squash medium, high, and critical bugs	N/A	Get rid of all bugs pre- and post-MVP.
	Refactor and optimize code to reduce technical debt	N/A	Improve technical efficiency of platform.
	Enable Model revision functionality in the AMCPR Exchange	118	As a designer, I want the ability to revise or update my design so my most current and up to date design is available on the AMCPR Exchange.

Appendix C: AMCPR Exchange Features List (continued)

Themes		Jira ID		User Story/Description
Enhance Existing Functionality	UI/UX Improvements	*N/A*		Scoping, create UI mockups, elicit feedback, make updates; evaluate critical processes and user pain points, improve processes, make updates.
	NIH 3D Print Exchange Integration	218		As an AMCPR Exchange user, I would like to be able to view designs from the NIH 3D Print Exchange.
	Multi-user/location expansion of supplier data model	N/A		Expand supplier data model to accommodate multiple users from a single supplier with multiple locations.
	Improved and expanded notifications	237		Enhance notifications with direct links to models and review date visibility.
	Enhance part design functionality through clearly defined requirements	*N/A*		As a designer, I need a definition of requirements to be provided to me before I start working on my design so that I can respond correctly to a need (RFP document was mentioned here, so a fair amount of detail was being expected in requirements).
	Expand collaboration tools to stimulate AMCPR Exchange community growth	179		As a user, I want to be able to interact with other members of the AMCPR community via a set of forums and other social features.
	Enhance AMCPR Exchange Model Search capability by enabling size-based searching	103		As a user, I want to be able to search for parts based on size and dimensions. *Note: This has been pushed back on the timeline and may be cost prohibitive to implement.*
	Approval/verification & display of approved part suppliers	*N/A*		Implement supplier approval/verification process to improve requester's confidence in supplier.
	Qualified supplier metrics	*N/A*		As a requester, I want to have confidence in my suppliers that they will be able to meet deadlines. Suppliers should be pre-qualified/vetted when possible. In crisis times: Pre-existing supplier qualification process goes out the window when the only consideration is "can the supplier actually deliver?"
	Enable personalized user reports	*N/A*		Persona-specific metric reports allowing users to determine their performance specific to their AMCPR Exchange role.

Appendix C: AMCPR Exchange Features List (continued)

Themes		Jira ID	User Story/Description
Incorporate New Functionality	Integrate and operationalize product complexity framework	*N/A*	As an AMCPR Exchange user and designer, I want to be able to see product complexity framework so that I can understand what is required for each level of design.
	Enhanced qualitative and quantitative production requirements	*N/A*	As a supplier, I want clearly defined requirements as they related to part production including equipment required, estimated printing time, estimated cost to print, best practices for printing this particular model (e.g., does this part require supports?), and feedback from people who have already printed this model. For feedback, I want to know how many people printed the model so far, and whether there were any issues associated with the production process.
	Expand AMCPR Exchange Integration into other government agency sites and repositories	*N/A*	As an AMCPR Exchange user, I would like to be able to view models from various government agency repositories. I would also like to be able to connect the AMCPR Exchange to government agency sites so that AMCPR Exchange can be more widely used.
	Integrate raw material and/or consumables suppliers for designs listed on AMCPR Exchange	*N/A*	As a registered supplier on the AMCPR Exchange site, I want to have a place on the AMCPR Exchange where I can find vendors that can provide consumables/additional materials required for a model so that I can address a consumables shortage if it occurred. Perhaps consumables connected to a design and Vendors listed with ability to provide those consumables.
	Enhanced demand signaling	*N/A*	As a designer, I want a listing or some type of signal of designs needed in the community so I can focus my efforts on those specific needs.
	Intelligently connect subassemblies to parts	*N/A*	Enable suppliers to build single components or entire subassemblies that connect to a part uploaded to the AMCPR Exchange.
	3rd-party slicer integration	*N/A*	As a supplier, I want slicer software integration to allow for the shortcutting of the file conversion process.

Appendix C: AMCPR Exchange Features List (continued)

Themes		Jira ID	User Story/Description
Introduce Key Differentiators	Integrate AMCPR ecosystem mapping capabilities and regionalization API into the AMCPR Exchange	*N/A*	As an AMCPR Exchange user, I want to be able to export my ecosystem capability information by region from the AMCPR Exchange.
	AMCPR Exchange evolves to marketplace (integrate automated model-based pricing tool)	*N/A*	Future enhancements to allow for on-platform pricing and transactions.
	Asset tracking of manufactured product for real time delivery visibility	*N/A*	As a requestor of products on the AMCPR Exchange, I would like to see a live delivery status of the manufactured product on the AMCPR Exchange.
	Mobile AMCPR Exchange application that allows key functionality in time of crisis	*N/A*	As an AMCPR Exchange user, I would like to have a mobile app where I can view, upload files and scan parts to provide 3D scans of parts that may be useful in times of crises.