ADCOMM Engineering LLC

Bridging the Gap Between Operations and Technology®

Critical Communications Consulting Services

Complex Projects: Phase 1, 2, 3

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Purpose

This Project Approach: Phase 1, 2, 3 describes the process ADCOMM Engineering LLC follows to ensure complex technology projects are defined, planned, procured, and deployed based on the stakeholders' needs.

Version Control

Date	Name	Version	Comments
2020-02-28	S. Ronning, P.E., PMP	1.0	For release
2020-03-16	S. Ronning, P.E., PMP	1.1	Phase 1 updates

Terms and Abbreviations

ADCOMM	ADCOMM Engineering LLC
CDSM	Complex Systems Delivery Model
FCC	Federal Communications Commission
INCOSE	International Council on Systems Engineering
PMI®	Project Management Institute
PM-SE	project management – systems engineering
QUT	Queensland University of Technology
RFP	Request for Proposal

References

Ryan, M., Wheatcraft, L., "On the Use of the Terms Verification and Validation," INCOSE International Symposium IS2017, July 2017.

1. Background

1.1. Complex Projects

Wireless projects are dynamic and highly complex. They affect field users, dispatch operators, system managers, and maintenance technicians. They involve multiple systems manufactured by various vendors and maintained by different departments and/or organizations for which each system can vary in age or lifecycle.

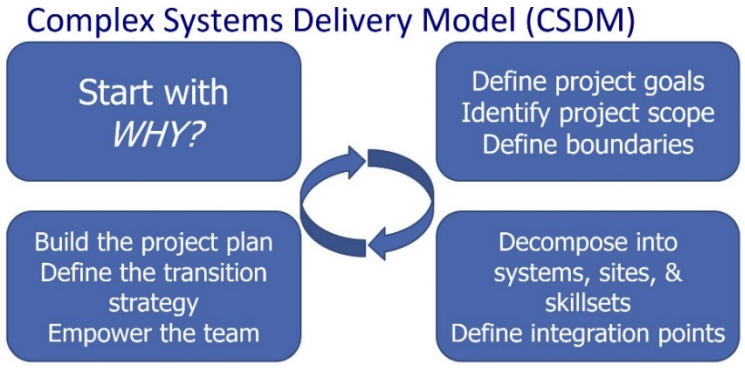
> "Complex projects are characterized by uncertainty, ambiguity, dynamic interfaces and significant political or external influences; and/or usually run over a period which exceeds the technology cycle time of the technologies involved; and/or can be defined by effect, but not by solution."
>
> *- Queensland University of Technology (QUT) in Brisbane Australia*

As defined by the industry (inset), a radio system upgrade or replacement project meets all the criteria of a complex project. Recognizing the complexity of critical communications networks, expert practitioners knowledgeable in Project Management Institute (PMI) project management and International Council on Systems Engineering (INCOSE) systems engineering methodologies are essential resources when upgrading or replacing telecommunications networks. Expert practitioners follow established guidelines to provide predictable, comprehensive, and timely project execution.

At the same time, it is also important to understand that every project is different, therefore requiring a unique application of standard practices in order to realize success. ADCOMM's team of communications professionals have applied their decades of experience to adapt solutions founded on extensive system experience while using standardized industry best practices.

1.2. CSDM Methodology

ADCOMM has defined a "complex systems delivery model (CDSM)" in order to focus the project team, identify priorities, and develop a high-quality and comprehensive plan for project implementation.



A complex systems delivery model (CSDM) is defined as: A model for managing the work effort associated with complex projects. The CSDM should be followed by project managers and systems engineering practitioners when defining, designing, and implementing complex projects.

FIGURE 1
Ronning, Susan, "Leading Complex Technology Projects to Success," Portland PMI Annual Conference, September 2019

Project and system baselines resulting from this process are continually revisited in order to validate results against stakeholder need, goals, and expectations, as described in Figure 2.

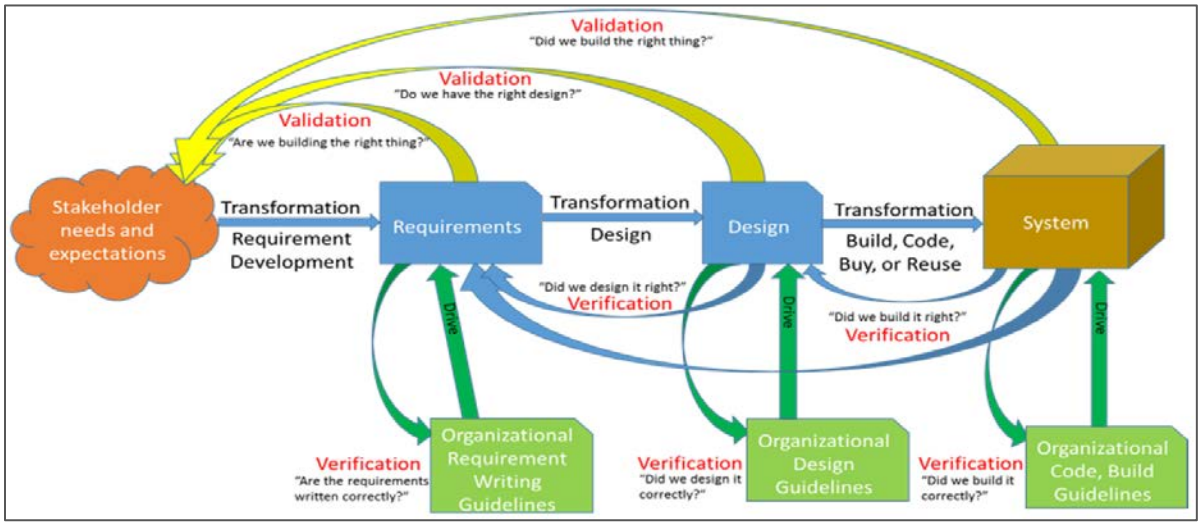


FIGURE 2
Stakeholder Needs and Expectations Must be Validated at Each Project Lifecycle Stage (Ryan, 2017)

1.3. Our Approach

ADCOMM utilizes a combined PM-SE (Project Management – Systems Engineering) approach to delivering complex communication network projects using the "U-P-P" technique.

- Phase 1 – **U**nderstand
- Phase 2 – **P**lan and Procure
- Phase 3 – **P**erform: Design, Build, Test, Deploy

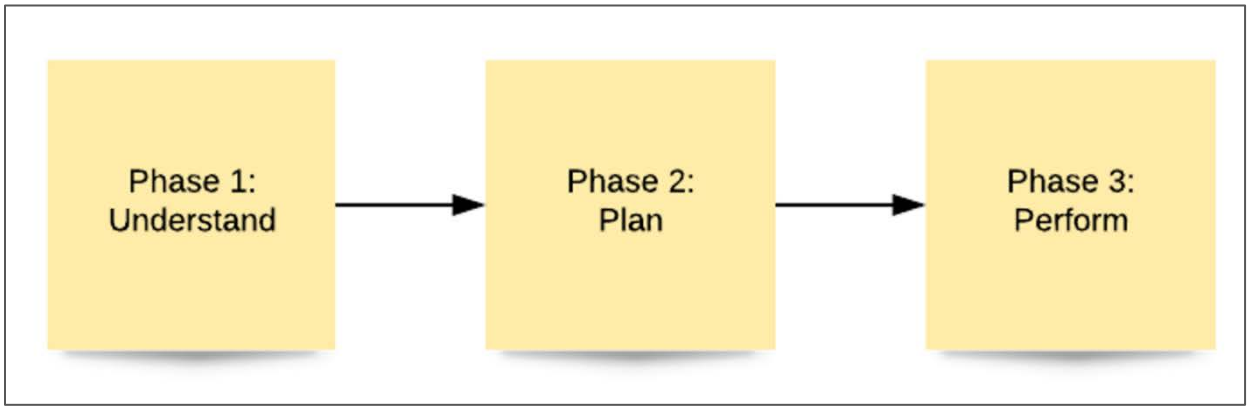


FIGURE 3
U-P-P Methodology

The U-P-P technique expects that stakeholders must be defined, and their needs captured and understood before any plans should be made or any work performed.

2. Project Phases

Complex projects are broken down into three phases for successful delivery.

2.1. Phase 1: Understand

The outcome of Phase 1 is a clear definition of the project scope. It should be a readable document, providing a concept architecture of the existing system(s) and user operations, and the proposed system, detailed in both visual and text descriptions.

Phase 1 brings the core team together in person, consisting of the agency's project lead and key stakeholders and ADCOMM's systems engineering practitioner and project manager. During the initial portion of Phase 1, the project goals and expectations are identified, defined, and documented to serve as the basis for development of the Project Charter, Project Management, and System Engineering Plans.

Once the project management and system engineering plans are developed, data gathering begins. Checklists are created based on the information that needs to be gathered. Any previously gathered or existing documentation is shared and reviewed. Once done, additional information is captured. Site locations are visited to gather site and system information. Additional data is reviewed and researched including FCC frequencies, licenses, and RF coverage. Site reports are developed to capture existing systems, their current configuration, any issues and/or availability for reuse.

Stakeholder data is captured via group interviews, one-on-one interviews, or online surveys. Stakeholder information is captured in a report format to identify stakeholder types, how they currently operate, what's important to them, and how they would like to operate in the future. The information gathered from stakeholders includes end user needs (from a field user, dispatcher, field tech, business leader, and system manager perspective). Additionally, information from a governance perspective is captured. Governance type data includes mutual aid and system operations agreements, site use agreements, system sharing agreements, and financial agreements between agencies. The governance findings are captured as a report in order to solidify the information captured.

Once all [findings] reports have been generated, then all data is analyzed holistically. ADCOMM's technical lead and supporting staff review the findings, develop alternative solutions, and draft concept architectures in order to identify alternatives. Meanwhile, an operational concept document (OCD) is developed to share an understanding of existing systems and operations and desired operations for new proposed systems.

ADCOMM's project team then presents the operational concepts and optional conceptual architectures and their strategic alternatives to the agency's team for a board level review and decision. With this input from the agency, detailed cost estimates, transition strategies, procurement strategies, and concept architecture can be defined and key functionality and

performance criteria may be captured. The conceptual design and strategy include the decisions made with respect to sites, systems, governance, procurement methods, and costs.

This initial phase is the most critical part of the project and is highly dependent upon ADCOMM having access to sites and accurate data describing stakeholders, users, and decision-makers' needs during this timeframe.

The ADCOMM team cannot emphasize enough the importance of the Phase 1 data capture, analysis, and decision-making processes to properly position the project for success.

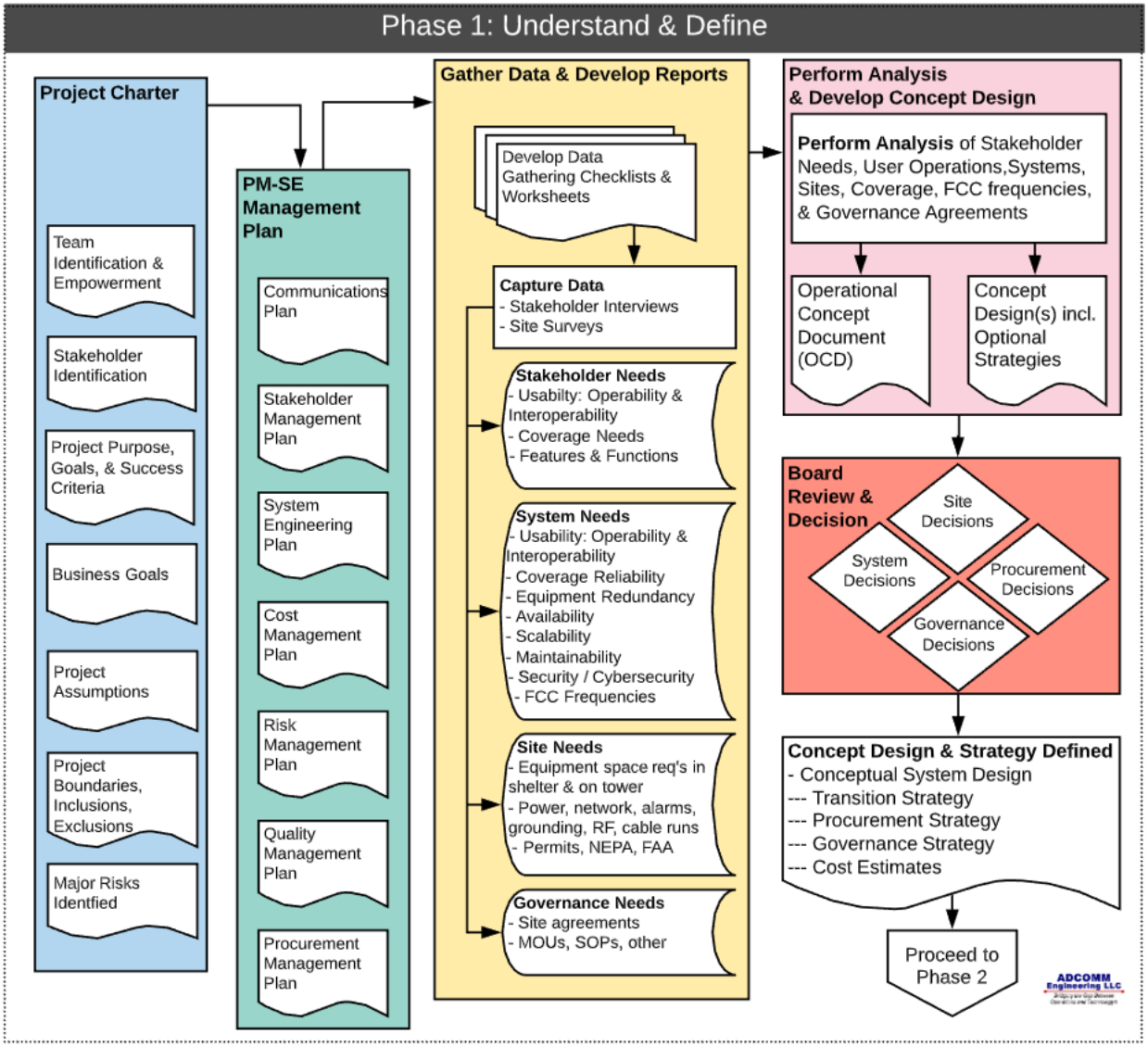


FIGURE 4
Phase 1 Process Diagram

2.2. Phase 2: Plan and Procure

Once the project scope and budgets are defined in Phase 1, the project can then proceed to Phase 2. In Phase 2, site, system, and user needs are transformed into requirements and used as the basis for development of technical and operational specifications. These specifications and scopes of work are developed for procurement packages which may, or may not, go through a formal request for proposal (RFP) process.

While equipment and services procurements are ongoing, the work effort surrounding sites must begin. Site permitting and associated environmental studies are notoriously lengthy, especially on federally owned land. Therefore, site leases, resource sharing, and governance structure discussions begin as early as possible during Phase 2 since inter-agency agreements can be lengthy to execute.

While Phase 1 presents the maximum opportunity to set the project up for success through stakeholder engagement and structured planning, Phase 2 presents the maximum risk for both project schedule and budget due to multiple approval and acquisition processes outside the control of the project team. Risk items include site-related items (including, but not limited to, cultural and historical consultations, environmental approvals, and permitting at the state, local, and federal levels), availability of frequencies and FCC license timelines for two-way radio systems, and the involvement from various vendor teams.

While the project team cannot control the process requirements, timing, or outcomes for these key approvals, ADCOMM mitigates this risk in two ways: (1) by clearly defining strategic packages for phased design delivery in support of early permit application goals and (2) by identifying implementation work packages that can be performed in advance of the major system installations so that all sites are made ready by the time final approvals are received.

Utilizing the traditional single-phase design-bid-build approach can result in significant schedule delays due to permitting and licensing; however, using a phased complex systems delivery model approach allows the team to focus on critical path engineering deliverables while flexing other activities in response to external factors as they arise in the life of the project. Additional risk mitigation can be accomplished by (1) defining design and implementation package expectations for the vendors involved and (2) being in constant contact with the vendors, the approvers, and the stakeholders on an almost daily basis.

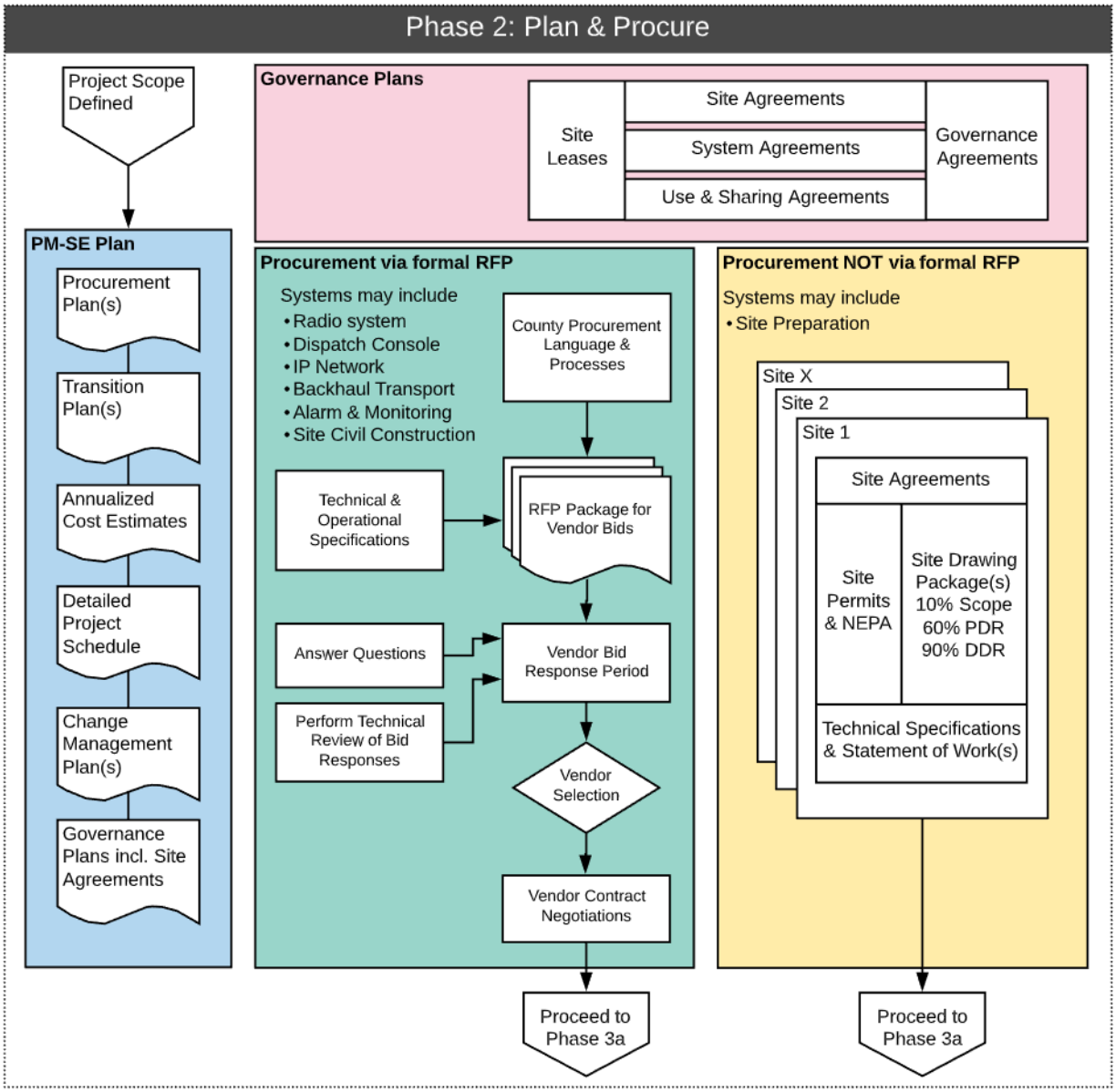


FIGURE 5
Phase 2 Process Diagram

2.3. Phase 3: Perform | Design, Build, Test, Deploy

The scope, duration, cost, and complexity of Phase 3 is highly dependent upon the requirements identified and decisions made in Phases 1 and 2. Phase 3 is broken into two major bodies of work. Phase 3A focuses on the work surrounding site and equipment preparation, before any equipment is moved into the field. Phase 3B focuses on the equipment and testing once the sites are available for equipment installation.

The goal of Phase 3A is to prepare the sites for field equipment installation by performing site "make-ready" work. This work includes shelter and/or tower grounding updates, removing old, unused equipment and feedline, or performing civil updates like strengthening a tower or installing a new generator. Phase 3A cannot start until the work done in Phase 2 with respect to site leases, environmental assessments, and permitting requirements has completed.

ADCOMM highly encourages as many systems as possible be installed and integrated in a lab environment. This approach reduces the risk of field re-work by building the integrated system in a secure, controlled environment. Additionally, a lab environment provides a location to perform failure-mode testing as well as technical and end user training. Changes or modifications to the system in a controlled space better ensures compliance with the schedule and projected costs.

Phase 3A is done once all sites have been acquired and prepared, the radio system and its supporting systems have been installed, configured, tested, and integrated in the lab environment, and appropriate training has been completed.

Phase 3B is dependent upon sites being "made-ready," per Phase 3A with any site systems (space, grounding, power, etc.) being completed to allow for equipment installation. Phase 3B is focused on the final field deployment of the radio system and its supporting systems.

The agency's internal and external stakeholders take on a much larger role in Phase 3. In a radio system project, stakeholders are impacted the greatest by what they see, feel, and touch. For end users, it is the mobile and portable radios. For dispatch operators, it is the dispatch screens. For technicians and system managers, it is the user interaction with the alarm and monitoring notifications and configuration and maintenance screens with which they must interface. Radio system users will be introduced to these 'touchpoints' in the radio system in the lab environment during Phase 3A.

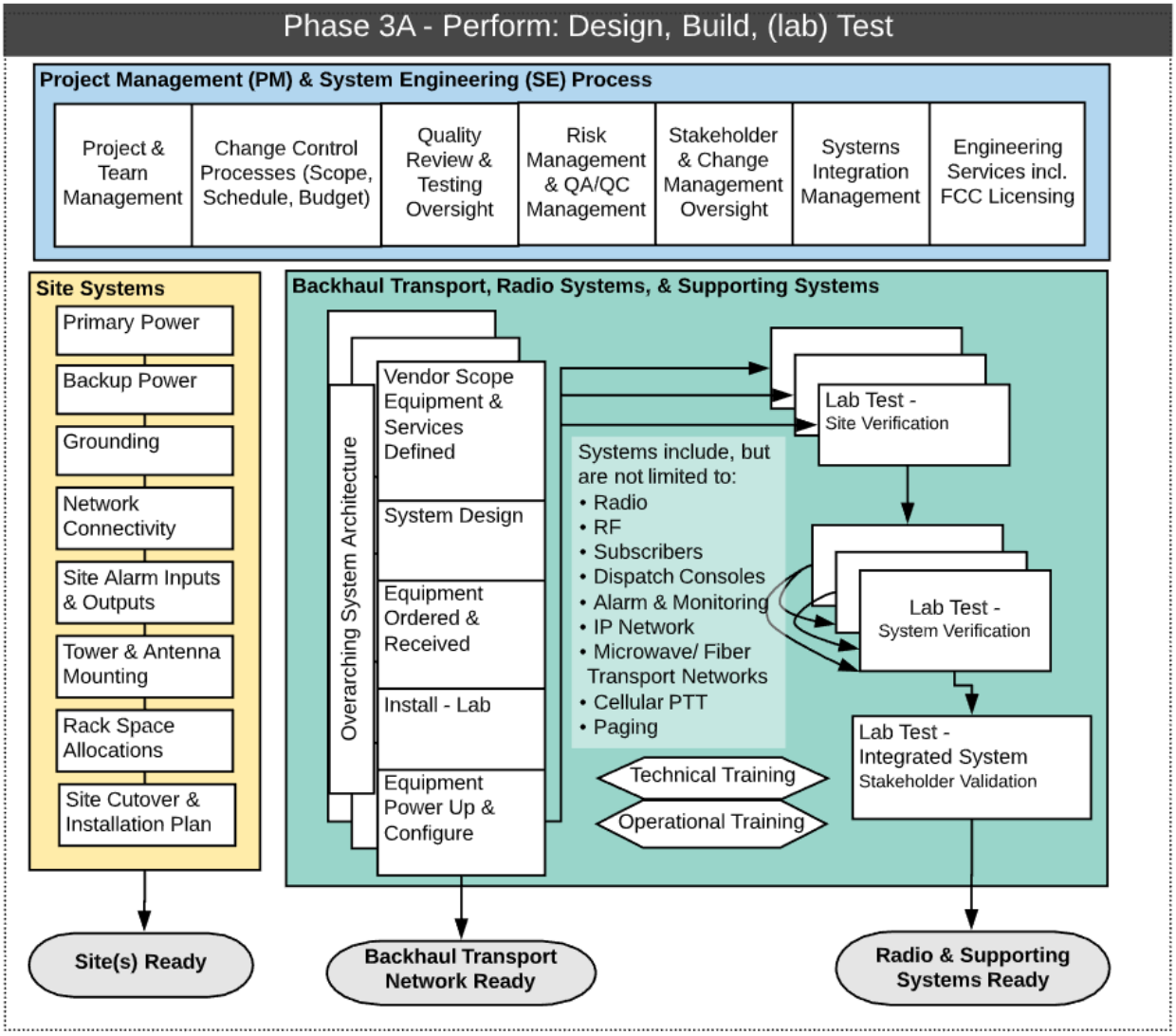


FIGURE 6
Phase 3A Process Diagram

As part of both the engineering approach and the change management strategy, a pilot group of key stakeholders are engaged with system testing in both the lab and field environments and perform initial testing of the radio subscriber equipment when it becomes available to finalize radio system fleet mapping and subscriber configurations. This interaction accomplishes two major goals – buy-in from the end user community and feedback to the vendors for final configurations ahead of system transition.

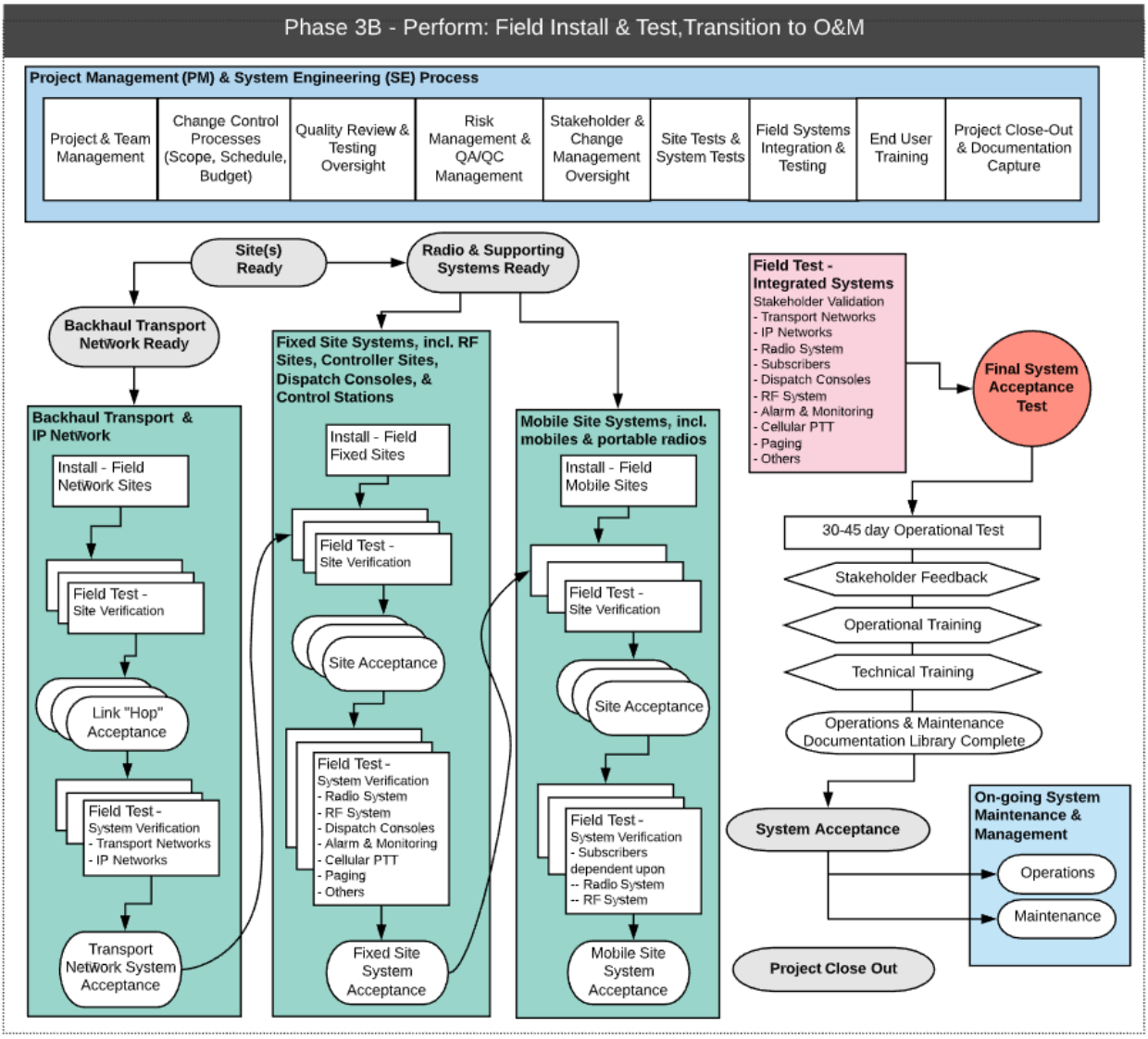


FIGURE 7
Phase 3B Process Diagram

3. Conclusion

Utilizing a complex systems delivery model and three-phased approach to complex systems project delivery reduces the overall project schedule while ensuing the least amount of risk by capturing stakeholder needs at the beginning of the project and validating those needs throughout the project lifecycle process.