Exceptional service in the national interest

Sandia National Laboratories

SAND2015-0296PE

IDC Reengineering Phase 2

Inception Iteration I2 Status

J. Mark Harris

26 January 2015

SAND2015-XXXXX

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND NO. 2011-XXXXP

IDC RP2 SOW Summary

- Scope: Specify and design a new IDC architecture using Rational Unified Process (RUP)

- RUP Phases
  - Inception – scope the system ← The current SNL project
  - Elaboration – architecture/analysis
  - Development – software development
  - Transition – deploy the system

  } Future work being specified

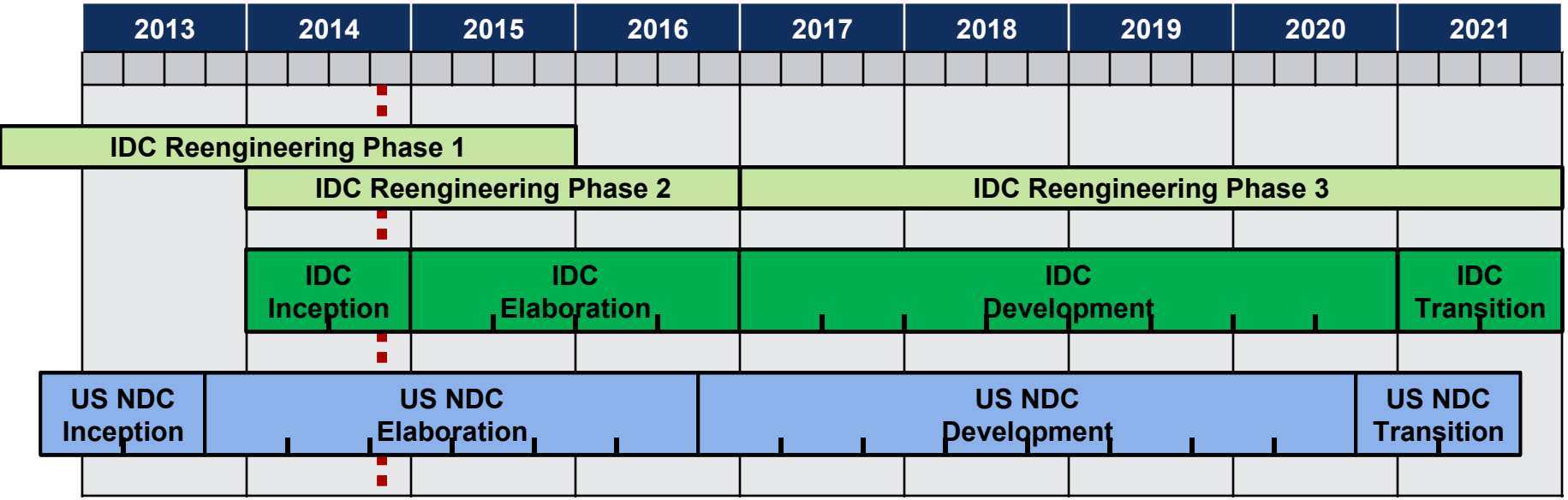
	13	CY14		CY15		CY16		CY17-TBD
Phase	Inception (Requirements)			Elaboration (Architecture)				Development-Transition
Iteration	Plan	I1	I2	E1	E2	E3	E4	TBD

IDC

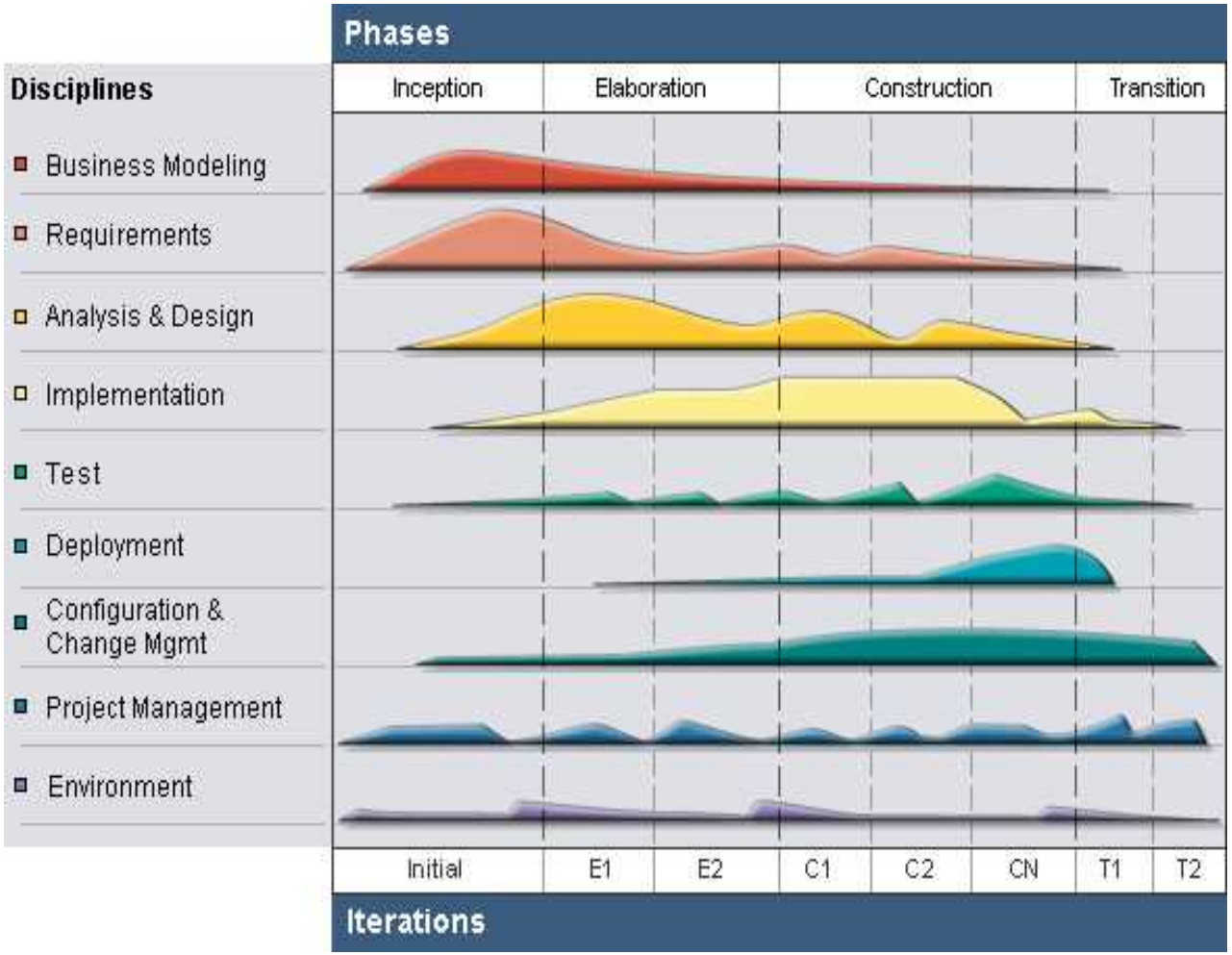
NDC

IDC Reengineering Project

- The IDC recognized the need to reengineer their waveform processing system in 2011
- IDC Reengineering Phase 1 project addresses some needed capability enhancements, planned to complete in 2015
- IDC Reengineering Phases 2 and 3 were defined to extend reengineering to a full USNDC-leveraged development effort



RUP Effort by Discipline



Best Practices

- Develop iteratively to reduce risk
- Manage requirements
- Employ a component-based architecture
- Model software visually
- Continuously verify quality
- Control changes

Key Principles

- Adapt the Process
- Balance Competing Stakeholder Priorities
- Collaborate Across Teams
- Demonstrate Value Iteratively
- Elevate Level of Abstraction
- Focus Continuously On Quality

Leveraging US NDC Modernization

- IDC RP2 project is supported by US Contribution-in-Kind performed by Sandia National Laboratories (SNL)
- The SNL IDC RP2 project is executed in conjunction with the US NDC Modernization project
  - The two systems overlap substantially in required capabilities, and have historically shared a common system design
  - The modernization goals of both systems can be achieved at lower cost through development of a shared core architecture
- IDC RP2 will leverage US NDC Modernization SNL staff, processes, and other resources to realize cost savings
  - Substantial effort is still required to adapt US NDC products to IDC

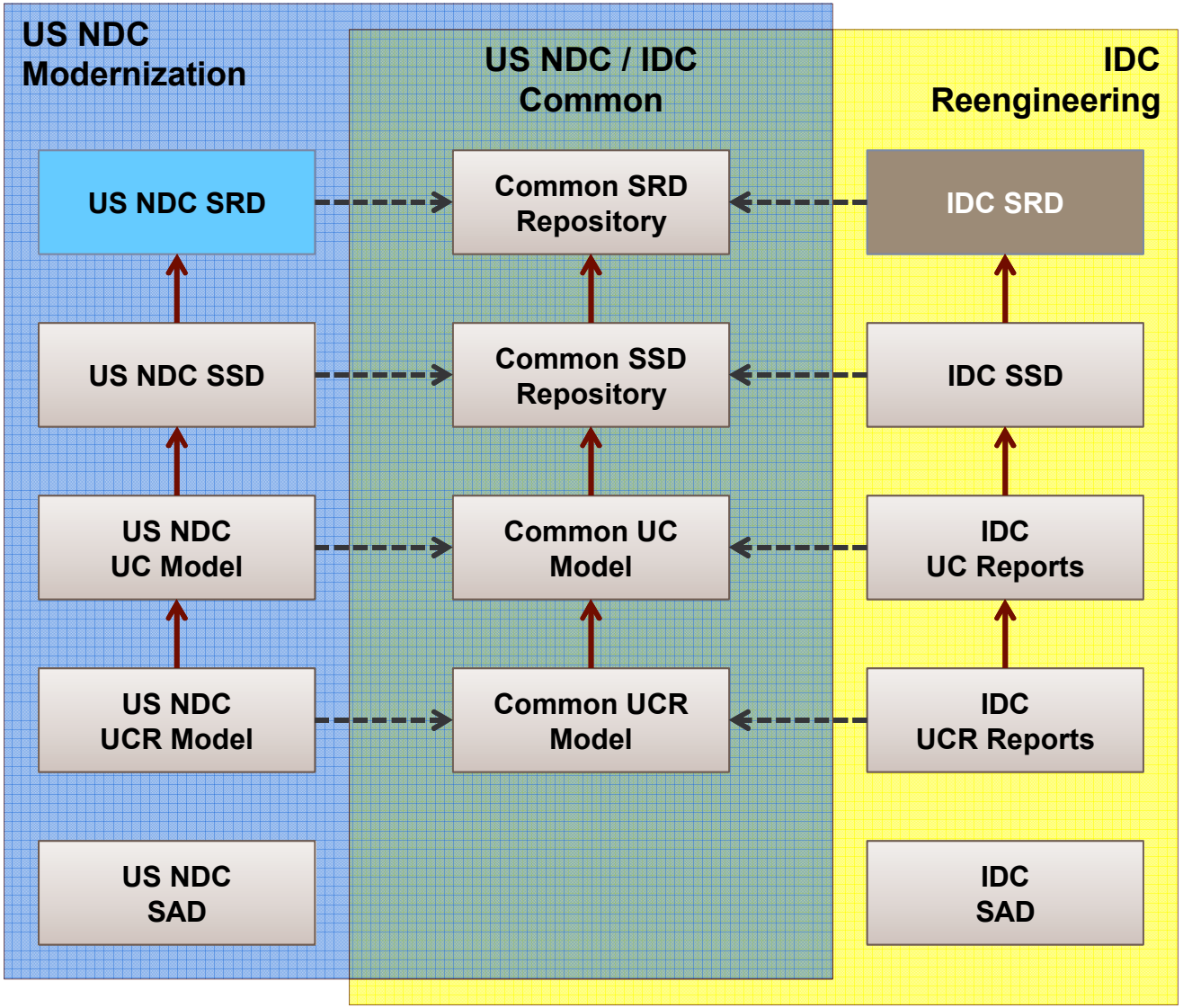
Inception Phase Deliverables

Sandia National Laboratories

Inception Phase Deliverables as specified in SOW:

1. **Project Scope Document**: clearly defines the scope of re-engineering effort (the included system components and interfaces to other systems) [I2]
2. **Integrated Master Plan (IMP)**: documents the plan for the entire re-engineering effort, including a nominal plan for Construction and Transition phases [I2]
3. **Draft Integrated Master Schedule (IMS)**: documents the schedule for the entire re-engineering effort, including a nominal schedule for the Construction and Transition phases [I2]
4. **System Requirements Document (SRD)**: baseline system requirements developed by the IDC with SNL assistance [I1]
5. **System Specification Document (SSD)**: detailed specification statements, with traceability to the IDC System Requirements Document [I1 draft, I2 baseline]
6. **Risk List**: documents project risks, including estimated probability and impact [I2]
7. **Use-Case Model Survey**: contains brief descriptions of the Use Cases defined for the IDC system, including identification of the architecturally significant Use Cases [I1 draft, I2 baseline]
8. **Glossary**: defines technical terms used in other deliverables [I1 draft, I2 update]
9. **Architectural Prototype Demonstration**: demonstration of risk reduction prototypes in progress [I2]
10. **Cost estimates**: for the two-year follow-on IDC Elaboration phase and the five-year Construction/Transition phase (project completion), both with and without leverage of the common USNDC modernization components [I1 draft, I2 update]

Leveraging Analysis & Design Artifacts



Provided by the US NDC

Developed by the Modernization Team

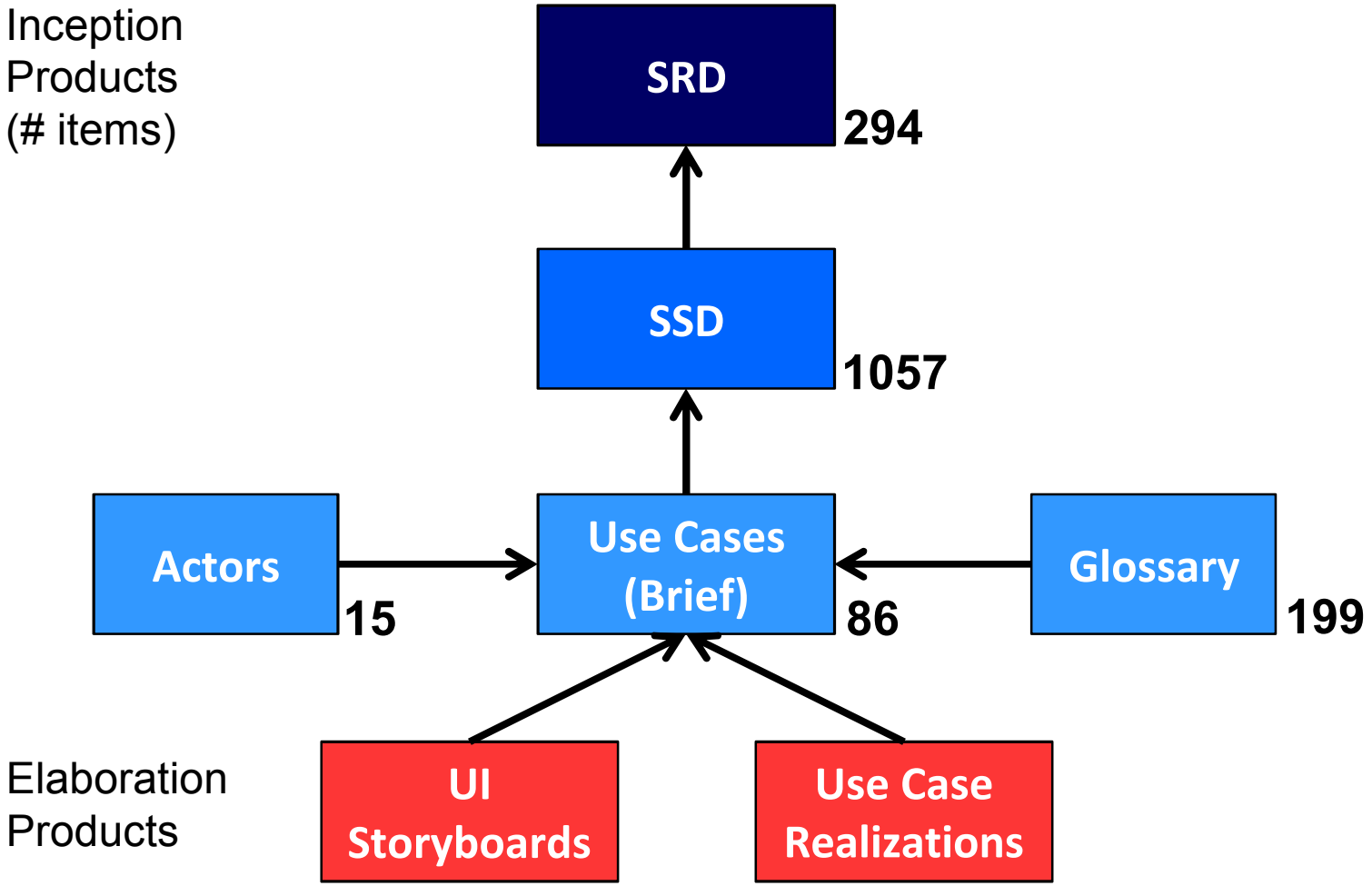
Provided by the IDC

SRD – System Requirements Document
SSD – System Specification Document
UC – Use Case
UCR – Use Case Realization
SAD – System Architecture Document

Traceability Relationship

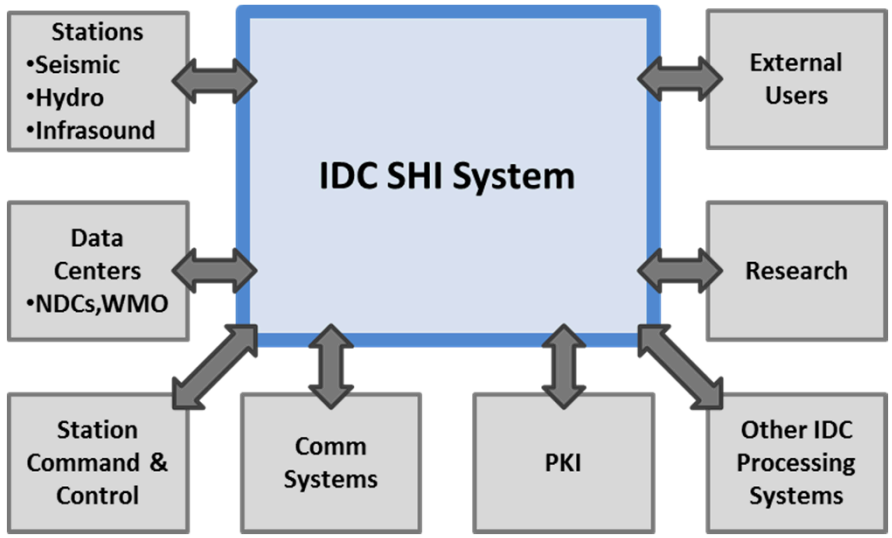
Dependency Relationship

Architecture Products



Project Scope Document

- Statement of Need, Goals, Objectives
- Process for System Definition
- Discussion of Technical Scope
  - System Context
  - System Functions
  - Users
  - Subsystems
  - Security Levels
  - Scaling Expectations
- Project Assumptions and Constraints



Interfaces to the IDC System

Integrated Master Plan (IMP)

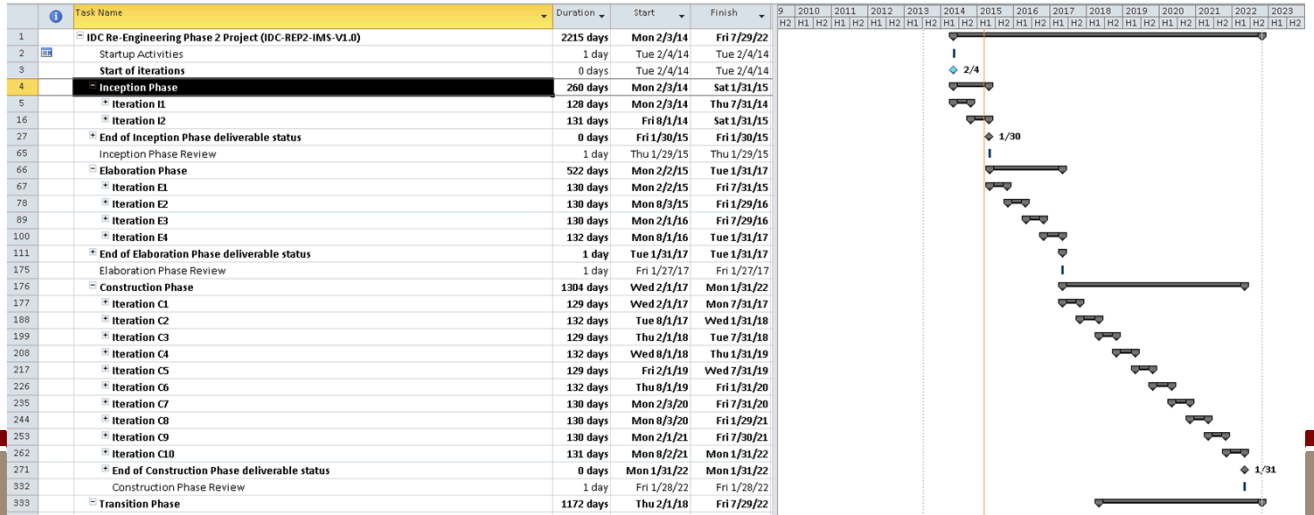
Sandia National Laboratories

- IMP includes:
  - Integrated Master Schedule reference
  - IMP (Events, Accomplishments Criteria)
    - Accomplishment Criteria (AC) - high-level goals of the project
    - Evaluation Criteria (EC) to be complete at each milestone
    - Defines the state of each EC at each major milestones on the project
    - Major milestones are:
      - End of Inception phase
      - End of Elaboration phase
      - Beginning of Transition phase
      - End of Development phase
      - End of Project or End of Transition
  - IMP Narratives
    - Discussion of RUP process

Accomplishment Criteria	Essential Artifacts	State at milestone
AC: Requirements, key features, and main constraints are documented and baselined.	Project Scope	EC: Project Scope is the Delivered state
	Glossary	EC: Glossary is in th Completed state
	System Specification Document	EC: System Specification Docum (based on the SRD) in the Delivered stat

Integrated Master Schedule (IMS)

- High-level project schedule (in MS Project)
  - Distributed as PDF file
- Tightly coupled to the content of the IMP
  - Contains overall iteration plan and high-level tasks in each iteration
  - Contains the AC/EC status defined in the IMP
- Shows overlap of Development tasks and Transition tasks
  - Shows the incremental deployment starting in iteration 3 of the Development phase



	Task Name	Duration	Start	Finish
1	IDC Re-Engineering Phase 2 Project (IDC-REP2-IMS-V1.0)	2215 days	Mon 2/3/14	Fri 7/29/22
2	Startup Activities	1 day	Tue 2/4/14	Tue 2/4/14
3	Start of iterations	0 days	Tue 2/4/14	Tue 2/4/14
4	Inception Phase	260 days	Mon 2/3/14	Sat 1/31/15
5	Iteration I1	128 days	Mon 2/3/14	Thu 7/31/14
16	Iteration I2	131 days	Fri 8/1/14	Sat 1/31/15
27	End of Inception Phase deliverable status	0 days	Fri 1/30/15	Fri 1/30/15
65	Inception Phase Review	1 day	Thu 1/29/15	Thu 1/29/15
66	Elaboration Phase	522 days	Mon 2/2/15	Tue 1/31/17
67	Iteration E1	130 days	Mon 2/2/15	Fri 7/31/15
78	Iteration E2	130 days	Mon 8/3/15	Fri 1/29/16
89	Iteration E3	130 days	Mon 2/1/16	Fri 7/29/16
100	Iteration E4	132 days	Mon 8/1/16	Tue 1/31/17
111	End of Elaboration Phase deliverable status	1 day	Tue 1/31/17	Tue 1/31/17
175	Elaboration Phase Review	1 day	Fri 1/27/17	Fri 1/27/17
176	Construction Phase	1304 days	Wed 2/1/17	Mon 1/31/22
177	Iteration C1	129 days	Wed 2/1/17	Mon 7/31/17
188	Iteration C2	132 days	Tue 8/1/17	Wed 1/31/18
199	Iteration C3	129 days	Thu 2/1/18	Tue 7/31/18
208	Iteration C4	132 days	Wed 8/1/18	Thu 1/31/19
217	Iteration C5	129 days	Fri 2/1/19	Wed 7/31/19
226	Iteration C6	132 days	Thu 8/1/19	Fri 1/31/20
235	Iteration C7	130 days	Mon 2/3/20	Fri 7/31/20
244	Iteration C8	130 days	Mon 8/3/20	Fri 1/29/21
253	Iteration C9	130 days	Mon 2/1/21	Fri 7/30/21
262	Iteration C10	131 days	Mon 8/2/21	Mon 1/31/22
271	End of Construction Phase deliverable status	0 days	Mon 1/31/22	Mon 1/31/22
332	Construction Phase Review	1 day	Fri 1/28/22	Fri 1/28/22
333	Transition Phase	1172 days	Thu 2/1/18	Fri 7/29/22

SRD Status

- Based on US NDC Scope and SRD (Nov 2013)
- IDC–SNL–USNDC worked to create IDC RP2 SRD (Feb-May 2014)
  - Several new SRD items identified as common by US NDC
- Discussed with community at the “Technical Meeting on SHI software engineering at the IDC” (June 2014)
- IDC distributed to community (July 2014)
- IDC finalized (November 2014)
- IDC SRD is a baseline for SSD and UC development

SSD Status

Sandia National Laboratories

- Based on US NDC SSD (971 items) (July 2014)
- SNL identified areas of IDC unique requirements
    1. ALT operation, OPS to ALT switching [6 new]
    2. Auxiliary station data access [3 new]
    3. Reporting (number of users, requests, content amount) [20 new]
    4. Event consistency (Bull QC)
    5. Event screening
    6. Collecting meteorological data
    7. Infrasound events and associations with met data
    8. CATS
    9. Interface with the station SOH data source
    10. Remote analysis
- For I1 – SNL developed preliminary SSD items for first 3 areas
- For I2 – SNL developed full IDC SSD baseline (1057 items)

Risk List

Sandia National Laboratories

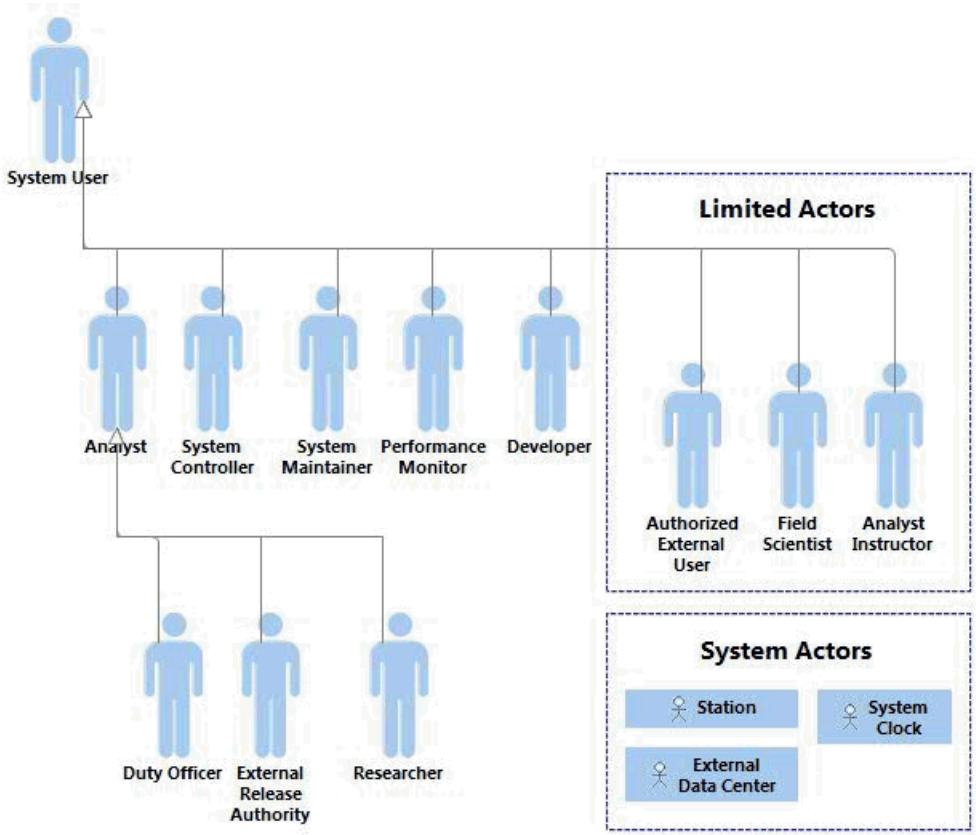
ID	Title	Prob	Impact	Exposure	Risk Strategy
006	If the IDC level of System Engineering support is not adequate to provide clear guidance during the Inception and Elaboration phases, then the architectural design will not meet the needs of the IDC.	0.5	0.4	0.20	Mitigate
005	If approval (internal or external) of IDC technical artifacts is delayed, then the project will lose the required momentum to leverage the design and development effort from US NDC Modernization project.	0.3	0.4	0.12	Mitigate
007	If core IDC requirements are not compatible with the core US NDC requirements, then the IDC Reengineering effort will lose the cost advantage of leveraging the design and development effort from US NDC Modernization.	0.3	0.4	0.12	Mitigate
009	If the IDC requires reuse of legacy software in a way that conflicts with a common architectural design, then the IDC Reengineering Phase 2 project will lose the cost advantage of leveraging the design and development effort from US NDC Modernization.	0.3	0.4	0.12	Mitigate
012	If the IDC Reengineering project doesn't meet the needs of the analysts for data presentation and responsiveness, then the IDC Modernization system will not be accepted for operations.	0.3	0.4	0.12	Mitigate
011	If the IDC does not engage the state parties for the IDC Modernization project, then the IDC Reengineering system will not be approved for operations.	0.1	0.8	0.08	Mitigate
014	If the IDC software is not designated to be an Unlimited Release and a valid export by the US government, then the IDC Reengineering system will not be delivered.	0.1	0.8	0.08	Mitigate
015	If the IDC has additional certification requirements (e.g. Information Surety requirements) beyond the US NDC requirements, then the cost of the IDC Reengineering Phase 2 project will be increased.	0.1	0.4	0.04	Mitigate

Use Case Model Status

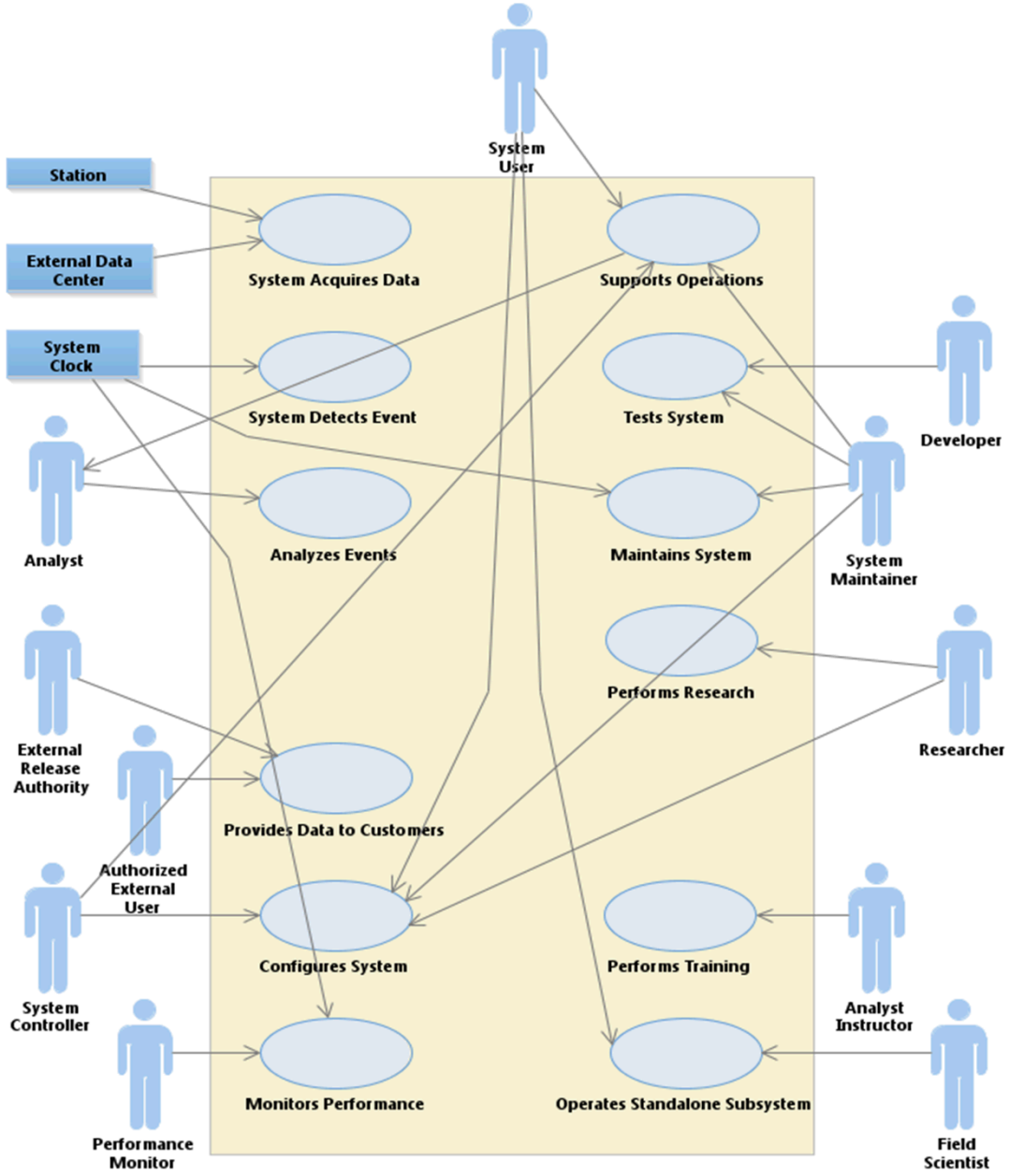
Sandia National Laboratories

- Based on US NDC Use Case Model Survey (UCMS) (Nov 2013)
  - Use Case Hierarchy
  - Actors (16)
  - Use Case brief descriptions (85)
- Considered scope of the IDC system contained in the SRD
- For I1 - proposed changes to hierarchy and use cases
  - New IDC-unique use cases (5)
  - Modifications to common use cases (6)
  - Determine if any new architecturally significant use cases
- For I2 – updated Actors (15) and UC brief descriptions (86) for IDC

Actor Hierarchy



Use Case Hierarchy – Top Level



Glossary

Sandia National Laboratories

Contains common term definitions for all architecture products.

Examples:

1.170 Station

An installation where monitoring sensors are installed. Multiple sensors can be installed at the same station (see channel). An array is a group of stations, but is sometimes referred to as a station.

1.171 Station Data

Data sent to the System by contributing stations. This includes both the ground-motion data (see waveform) as well as state-of-health (SOH) station data.

1.172 Station Magnitude

See event magnitude, station.

1.173 Station Magnitude Detection Threshold

The geographically-varying event magnitude below which a station is not expected to detect events. This can be empirically estimated as the magnitude at which a station's signal detections no longer follow the Gutenberg & Richter frequency-magnitude relationship predicting that for every decrease in size of 1 magnitude unit the number of events detected should increase by a factor of 10. The highest magnitude at which a station's detected events deviate from this prediction indicates the threshold below which the station does not detect events presumed to have occurred.

1.174 Station Processing

Processing of data from a station that is independent of processing of data from any other stations. Types of station processing include: waveform quality control, waveform filtering (see filter, waveform), beamforming, signal detection, signal characterization, and phase grouping.

1.175 Station State-Of-Health (SOH)

An assessment of how well a station is functioning for a specified time interval. Station SOH is based on station SOH data, which may include any type of data that can be time indexed and that can be used to determine the capability of a station to meet mission requirements. E.g., status of sensor channels, site temperature, power status, security status, etc.

Architectural Prototype Reports

Sandia National Laboratories

- Delivered seven reports of system prototyping work completed as part of the US NDC Modernization project
  - *US NDC Modernization: Service Oriented Architecture Study Status*
  - *US NDC Modernization: Service Oriented Architecture Proof of Concept*
  - *US NDC Modernization Iteration E1 Prototyping Report: Common Object Interface*
  - *US NDC Modernization Iteration E1 Prototyping Report: Processing Control Framework*
  - *US NDC Modernization Iteration E1 Prototyping Report: User Interface Framework*
  - *US NDC Modernization Iteration E2 Prototyping Report: OSD & PC Software Infrastructure*
  - *US NDC Modernization Iteration E2 Prototyping Report: User Interface Framework*

Cost Estimates

- Delivered two cost estimates:
  - A. Additional effort to deliver IDC Reengineering system if leveraging a fully-funded, SNL executed US NDC Modernization project
    - $45M
  - B. Full effort to deliver IDC Reengineering system if executed as independent, industry executed project
    - $124M

Elaboration Phase Plans

Sandia National Laboratories

- Planning 2 year, 4 iteration Elaboration Phase
- Strongly leveraging US NDC products
- Primary technical products:
  - Use Case Model
  - User Interface Storyboards
  - Use Case Realizations
  - System Architecture Document
- Working with US Government to identify funding

Summary

- IDC RP2 Inception Iteration I2 (and Inception Phase) is complete
- Completed all deliverables
- Progress is reported on all Inception artifacts
- Planning Elaboration Phase