

# **IDC RE-ENGINEERING REPORT**

SAND20XX-XYZ  
Unlimited Release  
January 2016

## **IDC Re-Engineering Phase 2 Iteration E1 Use Case Model Survey**

Version 1.0

J. Mark Harris, Dorthe Carr, Jamie Coram

Prepared by  
Sandia National Laboratories  
Albuquerque, New Mexico 87185 and Livermore, California 94550

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.

Approved for public release; further dissemination unlimited.



Issued by Sandia National Laboratories, operated for the United States Department of Energy by Sandia Corporation.

**NOTICE:** This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government, nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represent that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government, any agency thereof, or any of their contractors or subcontractors. The views and opinions expressed herein do not necessarily state or reflect those of the United States Government, any agency thereof, or any of their contractors.

Printed in the United States of America. This report has been reproduced directly from the best available copy.



SANDXXXX-XXXX  
Unlimited Release  
January 2016

# **IDC Re-Engineering Phase 2 Iteration E1 Use Case Model Survey**

Version 1.0

J. Mark Harris, Dorthe Carr, Jamie Coram  
Next Generation Monitoring Systems  
Sandia National Laboratories  
P.O. Box 5800  
Albuquerque, New Mexico 87185-MS0401

## **Abstract**

This document contains the brief descriptions for the actors and use cases contained in the IDC Use Case Model.

## REVISIONS

Version	Date	Author/Team	Revision Description	Authorized by
1.0	12/17/2015	SNL IDC Re-Engineering Team	Initial Release for E1	M. Harris

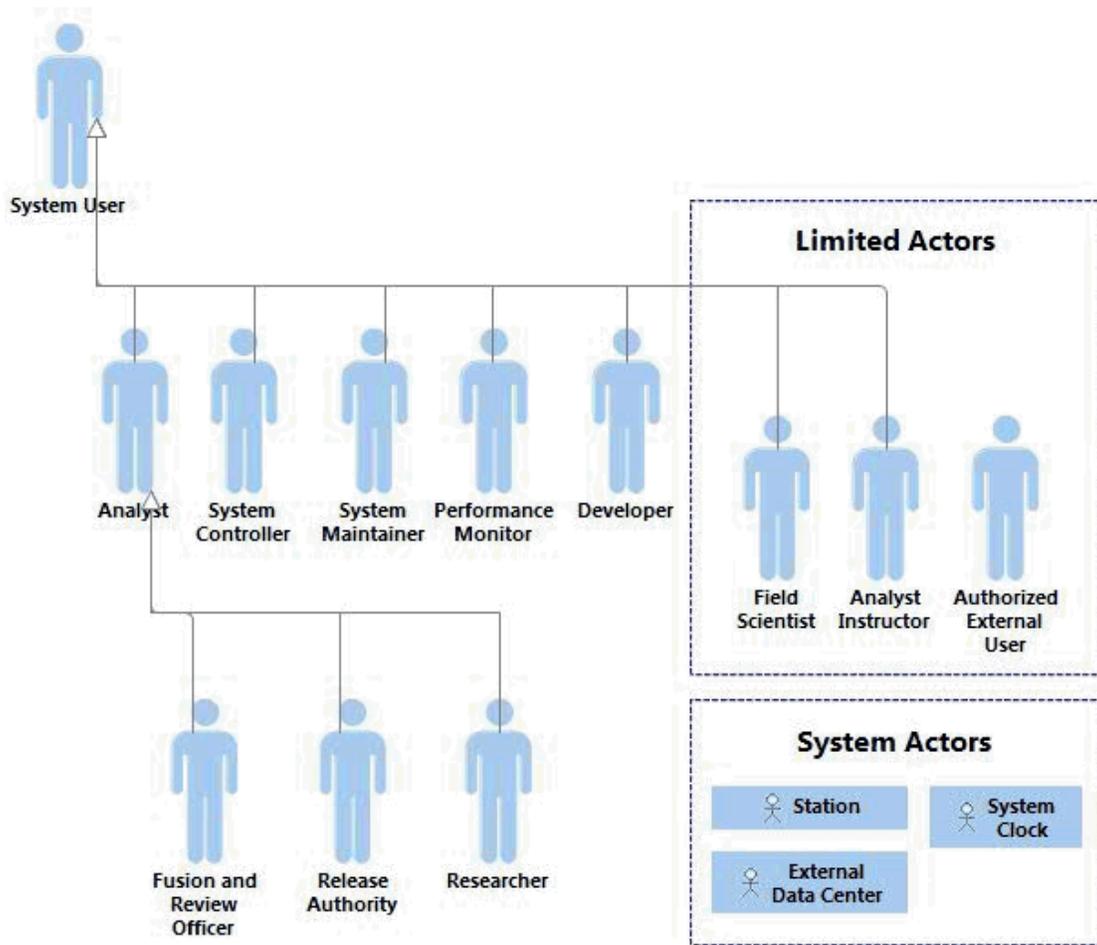
# TABLE OF CONTENTS

1. Actors.....	8
1.1. Actor Descriptions .....	8
2. Use Cases.....	10
2.1. UC-01 System Acquires Data .....	11
2.2. UC-01.01 System Receives Station Data.....	11
2.3. UC-01.02 System Receives Bulletin Data .....	11
2.4. UC-01.03 System Automatically Distributes Data.....	11
2.5. UC-01.04 System Acquires Meteorological Data .....	12
2.6. UC-01.05 System Synchronizes Acquired Station Data.....	12
2.7. UC-01.06 System Synchronizes Processing Results .....	12
2.8. UC-02 System Detects Events.....	12
2.9. UC-02.01 System Determines Waveform Data Quality .....	13
2.10. UC-02.02 System Enhances Signals.....	13
2.11. UC-02.03 System Detects Events using Waveform Correlation.....	14
2.12. UC-02.04 System Detects Signals.....	14
2.13. UC-02.05 System Measures Signal Features .....	14
2.14. UC-02.06 System Builds Events using Signal Detections.....	15
2.15. UC-02.07 System Resolves Event Conflicts.....	15
2.16. UC-02.08 System Refines Event Location .....	16
2.17. UC-02.09 System Refines Event Magnitude .....	16
2.18. UC-02.10 System Evaluates Moment Tensor .....	16
2.19. UC-02.11 System Finds Similar Events .....	16
2.20. UC-02.12 System Predicts Signal Features.....	17
2.21. UC-03 Analyzes Events .....	17
2.22. UC-03.01 Selects Data for Analysis .....	17
2.23. UC-03.02 Refines Event .....	17
2.24. UC-03.02.01 Determines Waveform Data Quality .....	18
2.25. UC-03.02.02 Enhances Signals .....	18
2.26. UC-03.02.03 Detects Signals .....	18
2.27. UC-03.02.04 Measures Signal Features.....	18
2.28. UC-03.02.05 Refines Event Location.....	18
2.29. UC-03.02.06 Refines Event Magnitude.....	19
2.30. UC-03.02.07 Evaluates Moment Tensor.....	19
2.31. UC-03.02.08 Compares Events .....	19
2.32. UC-03.03 Scans Waveforms and Unassociated Detections.....	19
2.33. UC-03.04 Builds Events.....	19
2.34. UC-03.05 Marks Processing Stage Complete .....	20
2.35. UC-04 N/A .....	20
2.36. UC-05 Provides Data to Customers.....	20
2.37. UC-05.01 Requests System Data.....	20
2.38. UC-05.02 Approves Events for Release .....	21
2.39. UC-05.03 Views System Results.....	21
2.40. UC-06 Configures System .....	21

2.41.	UC-06.01 Controls Data Acquisition.....	21
2.42.	UC-06.02 Configures Station Usage .....	21
2.43.	UC-06.03 Defines Processing Sequence.....	22
2.44.	UC-06.04 Configures Data Acquisition.....	22
2.45.	UC-06.05 Configures Processing Components.....	22
2.46.	UC-06.06 Configures System Messages.....	22
2.47.	UC-06.07 Views System Configuration History.....	22
2.48.	UC-06.08 Configures Analyst Interfaces.....	23
2.49.	UC-06.09 Configures System Permissions .....	23
2.50.	UC-07 Monitors Performance .....	23
2.51.	UC-07.01 Analyzes Mission Performance.....	23
2.52.	UC-07.02 Monitors System Performance .....	23
2.53.	UC-07.03 Monitors Station State-of-Health .....	24
2.54.	UC-07.04 System Monitors Mission Performance.....	24
2.55.	UC-07.05 Monitors Mission Processing .....	24
2.56.	UC-08 Supports Operations .....	24
2.57.	UC-08.01 Accesses the System.....	24
2.58.	UC-08.02 Controls the System.....	25
2.59.	UC-08.03 Exports Data.....	25
2.60.	UC-08.04 Imports Data.....	25
2.61.	UC-08.05 Views Event History.....	25
2.62.	UC-08.06 Maintains Operations Log.....	25
2.63.	UC-08.07 Provides Analyst Feedback.....	26
2.64.	UC-08.08 Views Analyst Feedback.....	26
2.65.	UC-08.09 Views Analyst Performance Metrics .....	26
2.66.	UC-08.10 Views Security Status .....	26
2.67.	UC-08.11 Views Messages .....	26
2.68.	UC-09 Tests System .....	26
2.69.	UC-09.01 Performs Software Component Testing.....	26
2.70.	UC-09.02 Creates Test Data Set for Replay .....	27
2.71.	UC-09.03 Replays Test Data Set.....	27
2.72.	UC-09.04 Replays Analyst Actions.....	27
2.73.	UC-10 Maintains System .....	27
2.74.	UC-10.01 Performs System Backups .....	27
2.75.	UC-10.02 Performs System Restores .....	28
2.76.	UC-10.03 Installs Software Update.....	28
2.77.	UC-10.04 System Monitors Security.....	28
2.78.	UC-11 Performs Research.....	28
2.79.	UC-11.01 Analyzes Research Events .....	28
2.80.	UC-11.02 Develops New Algorithms and Models.....	29
2.81.	UC-11.03 Determines Optimal Processing Component Configuration.....	29
2.82.	UC-11.04 Performs Multiple Event Location .....	29
2.83.	UC-12 Performs Training.....	29
2.84.	UC-12.01 Configures Data for Training Subsystem .....	29
2.85.	UC-12.02 Trains Analysts.....	30
2.86.	UC-13 Operates Standalone System.....	30

2.87.	UC-13.01 Conducts Site Survey.....	30
2.88.	UC-13.02 Performs Standalone Analysis .....	30
2.89.	UC-14 IDC Unique .....	31
2.90.	UC-14.01 System Assesses Event Consistency .....	31
2.91.	UC-14.02 Assesses Event Consistency.....	31
2.92.	UC-14.03 System Screens Event.....	31
2.93.	UC-14.04 Controls Monitoring Stations .....	31
2.94.	UC-14.05 Performs Expert Technical Analysis .....	31

# 1. ACTORS



This diagram shows the hierarchy of actors in the system.

## 1.1. Actor Descriptions

**Analyst** - The Analyst is a System User who analyzes events. This actor includes all the traditional analysis roles. Any Analyst can access all System event analysis capabilities from a Use Case perspective. Individual analyst capabilities may be further specified by operations procedures.

**Analyst Instructor** - The Analyst Instructor actor is a System User who trains new Analysts using the Training Subsystem.

**Authorized External User** - The Authorized External User actor is an external user who has limited access to request and receive System data, view System results, or provide data for import into the System.

**Developer** - The Developer actor is a System User who develops and tests System components.

**External Data Center** - The External Data Center actor is an external system that sends waveform data and bulletin data to the System or receives waveform data and bulletin data from the System.

**Field Scientist** - The Field Scientist actor is a System User who conducts site surveys of potential sensor locations using a Standalone Subsystem.

**Fusion and Review Officer** - The Fusion and Review Officer actor is an Analyst who performs expert technical analysis.

**Performance Monitor** - The Performance Monitor actor is a System User who monitors performance of the System.

**Release Authority** - The Release Authority is an Analyst who reviews and approves event data for release.

**Researcher** - The Researcher actor is an Analyst who performs research to optimize performance of the System, to provide more detailed information about events of interest, and to develop new algorithms.

**Station** - The Station actor is an external system that sends waveform data to the System.

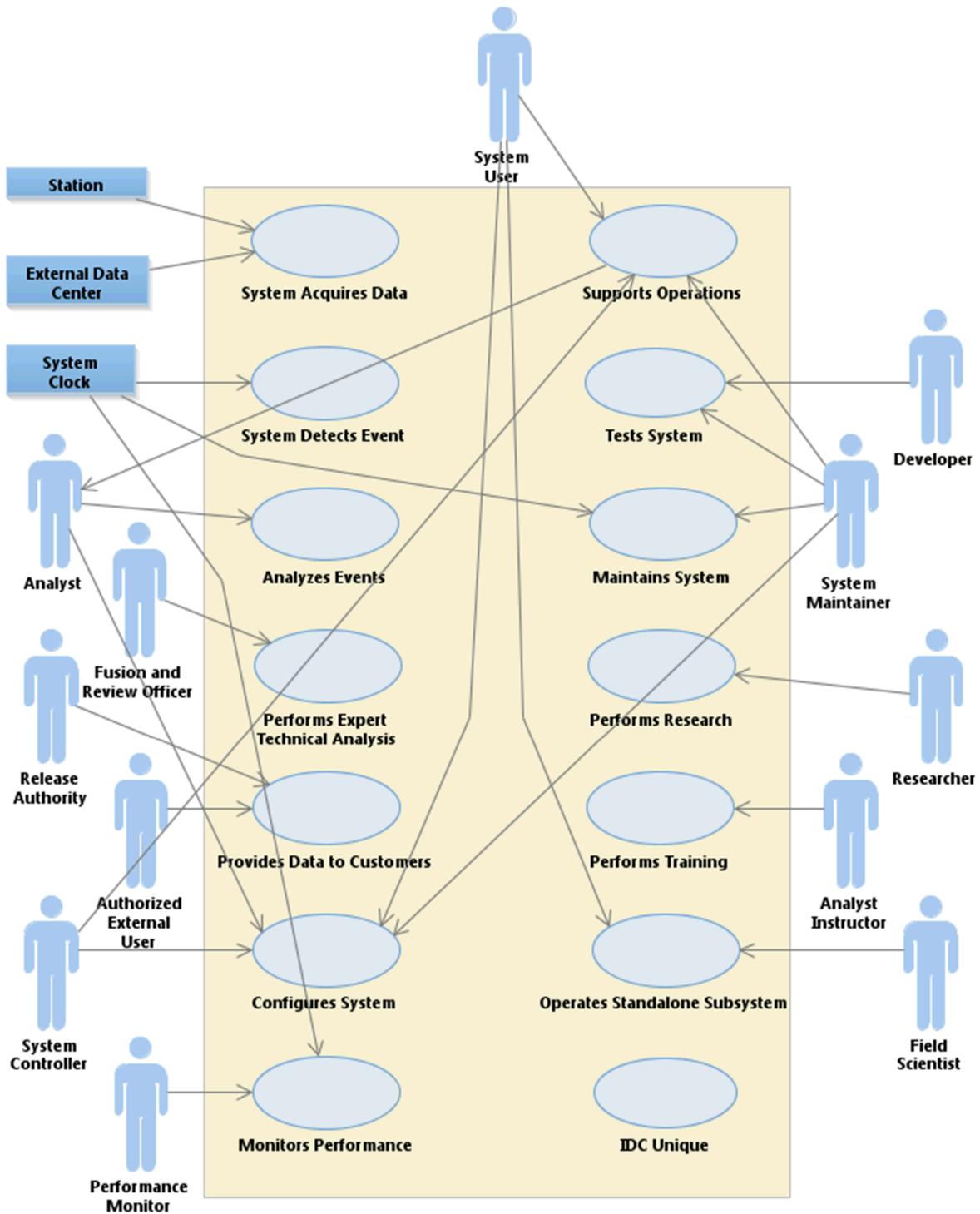
**System Clock** - The System Clock is an internal clock that provides the system with the ability to periodically execute activities.

**System Controller** - The System Controller actor is a System User who monitors and controls the System and external data connections.

**System Maintainer** - The System Maintainer actor is a System User who installs, tests, and configures the System.

**System User** - The System User actor is any internal user who accesses the System.

## 2. USE CASES



This diagram shows the top level use cases the System provides. Each of these top-level use cases are further subdivided into smaller use cases (not depicted on the diagram).

## **2.1. UC-01 System Acquires Data**

This use case describes how the System acquires waveform, station state-of-health (SOH), event bulletin and meteorological data. The System receives seismic, hydroacoustic and infrasound waveform data and SOH data from Stations. The System confirms that it receives the data from the different sources, authenticates the data and converts it into a standard format (see 'System Receives Station Data' UC). The System also receives event bulletin data see 'System Receives Bulletin Data' UC) and meteorological data (see 'System Acquires Meteorological Data' UC) from External Data Centers. The Data Acquisition Partition moves the waveform, SOH, event bulletin and meteorological data to the Data Processing Partition for automatic and interactive processing. The System forwards waveform and event bulletin data to External Data Centers that are authorized to receive the data (see 'System Automatically Distributes Data' UC). The System synchronizes acquired station data (see 'System Synchronizes Acquired Station Data' UC) and processing results (see 'System Synchronizes Processing Results' UC) in near real-time in order to maintain synchronicity between the Primary and Backup.

## **2.2. UC-01.01 System Receives Station Data**

This architecturally significant use case describes how the System acquires continuous station data or requests data and puts it into the correct formats for automatic and interactive processing. Stations send seismic, hydroacoustic and infrasound data to the System in a variety of formats. The System converts the data into the internal format and authenticates the data. The System parses the data into waveform data, station data, and state-of-health (SOH) data and puts it in the data storage format. The Data Acquisition Partition moves the data to the Data Processing Partition for automatic and interactive processing. The System Controller can request retransmission of data from the Data Acquisition Partition to the Data Processing Partition.

This use case is architecturally significant because it deals with the storage of data in the internal format and the timeliness for transferring data to the Data Processing Partition.

## **2.3. UC-01.02 System Receives Bulletin Data**

This use case describes how the System acquires bulletin data and puts it into the correct formats. External Data Centers provide event bulletins and event messages. The System converts the information to the data storage format. The Data Acquisition Partition moves event bulletin data to the Data Processing Partition where it is stored with the bulletins.

## **2.4. UC-01.03 System Automatically Distributes Data**

This use case describes how the System forwards station data to External Data Centers authorized to receive the data. The System sends station data in CD1.1 format. The System sends bulletins authorized for release to External Data Centers. The system forwards station data to the SUS/TST Subsystem.

## **2.5. UC-01.04 System Acquires Meteorological Data**

This architecturally significant use case describes how the System acquires meteorological data to build atmospheric models used in automatic and interactive processing of infrasound data. The System requests the latest available high-resolution global meteorological data from external data centers and puts it into the correct formats for generation of infrasound propagation models. The system moves the meteorological data from Data Acquisition Partition to the Data Processing Partition and stores the meteorological data. The System builds a new atmospheric model based on the meteorological data.

This use case is architecturally significant because it deals with acquisition, storage and processing of meteorological data.

## **2.6. UC-01.05 System Synchronizes Acquired Station Data**

This use case describes how the System synchronizes acquired station data between the Primary and Backup. The System synchronizes acquired station data in Near Real Time when communications are functional. Following a communication outage, the System backfills acquired station data feeds without impeding the ongoing Near Real Time synchronization.

## **2.7. UC-01.06 System Synchronizes Processing Results**

This use case describes how the System synchronizes processing results between the Primary and Backup. The System synchronizes processing results in Near Real Time when communications are functional. Following a communication outage, the System backfills processing results without impeding the ongoing Near Real Time synchronization.

## **2.8. UC-02 System Detects Events**

This use case describes how the System pipeline processes the raw seismic, hydroacoustic, and infrasound waveform data from a time interval to form event hypotheses. The System first checks the quality of arriving waveform data and creates data quality control masks for waveform sections containing data that is unsuitable for processing (see 'System Determines Waveform Data Quality' UC). The System then processes waveforms to enhance signal content while reducing noise (see 'System Enhances Signals' UC).

The System detects signals (see 'System Detects Signals' UC), measures features on the signal detections (see 'System Measures Signal Features' UC), and then uses the signal detections and feature measurements to build both single station and network event hypotheses (see 'System Builds Events using Signal Detections' UC). The System uses channel based waveform correlation techniques to form single-station or network event hypotheses (see 'System Detects Events using Waveform Correlation' UC). The System measures signal features for the event hypotheses on waveform channels across the network (see 'System Measures Signal Features' UC). The System predicts signal detections and their features for events (see 'System Predicts

Signal Features' UC). The System uses similarity parameters to search for historic events similar to the new event hypothesis (see 'System Finds Similar Events' UC).

After forming event hypotheses, the System resolves conflicting event hypotheses (see 'System Resolves Event Conflicts' UC) and then refines each event hypothesis' location (see 'System Refines Event Location' UC) and magnitude (see 'System Refines Event Magnitude' UC). The System evaluates the moment tensor for an event (see 'System Evaluates Moment Tensor' UC).

The System pipeline follows a sequence configured by the System Maintainer when pipeline processing raw waveform data to form event hypotheses (see 'Configures Processing Sequence' UC).

## **2.9. UC-02.01 System Determines Waveform Data Quality**

This use case describes how the System determines quality of waveform data. The system masks data with data quality errors, including data authentication problems. Depending on configuration settings, the System repairs, uses as-is, or excludes from processing data with quality errors. (see 'Configures Processing Components' UC).

## **2.10. UC-02.02 System Enhances Signals**

This use case describes how the System processes waveform data to enhance event signals while suppressing background noise. The System creates derived channels from input channels using signal enhancement techniques including filtering, rotation and beaming. The System also resamples channels and deconvolves instrument response to convert raw channel sample counts to earth displacement.

The System filters raw channels to isolate frequency content in the presumed bandwidths of arriving signals. The System uses various filter configurations to both optimize the enhancement of different signal arrival types and to account for the unique characteristics of individual raw channels.

The System rotates raw channel data from 3-component seismic stations to align the data's axes to a specific azimuth and slowness rather than to the physical instrumentation's coordinate system. Rotation produces derived channels corresponding to an arriving signal radial, transverse horizontal and transverse vertical (3-dimensional rotation only) ground motion components.

The System forms continuous and non-continuous beams for array stations using array element channel data. The System computes beams for each array providing targeting on specific areas of interest, specific event hypotheses, and wide area coverage.

The System uses default signal enhancement parameters configured by the System Maintainer for pipeline processing (see 'Configures Processing Components' UC) or override parameters set by the Analyst (see 'Enhances Signals' UC).

### **2.11. UC-02.03 System Detects Events using Waveform Correlation**

This architecturally significant use case describes how the System detects both single station and network event hypotheses using waveform correlation. The System forms an event hypothesis corresponding to a historical event when the waveform data from one or more channels has high correlation with the same channels' waveform data from the historical event. The System uses the historic event's associated signal detections to create and associate signal detections to the new event hypothesis.

This use case is architecturally significant due to large amounts of waveform data being processed and the impact on waveform data storage and management.

### **2.12. UC-02.04 System Detects Signals**

This use case describes how the System detects signals in waveform data. The System automatically and continuously detects signals on raw and derived channels (see 'System Enhances Signals' UC) with an acceptable data quality (see 'System Determines Waveform Data Quality' UC). Multiple signal detection algorithms are used to detect signals. The System declares detections when these time series signals exceed a threshold value. The System refines the onset time of the detections. The System uses threshold values for signal detectors configured by System Maintainer (see 'Configures Processing Components' UC). Threshold values are configurable by type of detector and channel. The System stores all detections and respective attributes (such as type of detector).

Signal detections and events may be provided as input to this use case and will help guide the signal detection process. This functionality supports iterative, feedback-based processing sequences.

### **2.13. UC-02.05 System Measures Signal Features**

This use case describes how the System measures signal detection features on waveform data. Several types of feature measurement are possible depending on the type of station making the detection (seismic, infrasonic, and hydroacoustic). For all types of stations, on a station-by-station basis, the System forms groups of signal detections that correspond to different events. The System measures general time and frequency domain features of signal detections for all types of stations. The System extracts polarization features for 3-component seismic station signal detections. For signal detections from seismic and infrasound array stations, the System measures azimuth and slowness, as well as cepstral features. For hydroacoustic stations, the System makes a variety of specialized time domain, frequency domain, and cepstral domain measurements and groups signal detections from multiple hydrophones at the same station to determine azimuth. For all types of stations, the System assigns preliminary phase labels to signal detections using available signal features.

Signal detections and events may be provided as input to this use case and will help guide the signal feature measurement process. This functionality supports iterative, feedback-based processing sequences.

The System uses default signal detection feature measurement parameters configured by the System Maintainer (see 'Configures Processing Components' UC) or override parameters set by the Analyst (see 'Measures Signal Features' UC).

#### **2.14. UC-02.06 System Builds Events using Signal Detections**

This architecturally significant use case describes how the System uses signal detections and features measured from those signal detections to build single station event hypotheses, build network event hypotheses, and associate previously unassociated signal detections to existing event hypotheses.

To build an event hypothesis, the System associates signal detections from one or more seismic, hydroacoustic, or infrasound stations. The System builds event hypotheses meeting predefined event formation criteria and associates previously unassociated signal detections to existing event hypotheses using signal detections, feature measurements based on those signal detections (see 'System Measures Signal Features' UC), and single station signal detection groups. The System references empirical knowledge from past events and geophysical models when forming event hypotheses and when associating previously unassociated signal detections to existing event hypotheses. The System makes signal detection phase assignments using information available when considering signal detections in the context of event hypotheses. The System validates event hypotheses and phase assignments using empirical and geophysical model based parameters. The System computes quality metrics for all event hypotheses.

The System Maintainer configures the phase assignment parameters, signal detection association parameters, and event hypothesis quality metric parameters (see 'Configures Processing Components' UC). The Analyst has the option to select values for these parameters during interactive review (see 'Builds Event' UC).

This use case may initiate reprocessing of earlier analysis steps such as signal enhancement (see 'System Enhances Signals' UC), signal detection (see 'System Detects Signals' UC) and signal feature measurement (see 'System Measures Signal Features' UC) if an iterative, feedback-based processing sequence is implemented.

This use case is architecturally significant due to the potential of integrating new algorithms to build events.

#### **2.15. UC-02.07 System Resolves Event Conflicts**

This use case describes how the System uses conflict resolution to reconcile event hypotheses built by multiple association processes (see 'System Detects Events Using Waveform Correlation' UC and 'System Builds Events Using Signal Detection' UC). During conflict resolution the System forces signal detections to be associated to at most one event hypothesis,

corrects erroneously associated signal detections, and merges duplicate event hypotheses. The System verifies all event hypotheses formed or modified during conflict resolution meet the event hypothesis formation criteria (see 'System Builds Events Using Signal Detection' UC) configured by the System Maintainer (see 'Configures Processing Components' UC). The System stores full provenance data, including for events that are discarded by this use case.

## **2.16. UC-02.08 System Refines Event Location**

This use case describes how the System refines event hypothesis location solutions using single event or multiple event algorithms. Event locations can be absolute or relative. The System locates events by finding the event location minimizing the difference between signal detection feature measurements and signal detection feature predictions (see 'System Measures Signal Features' UC). The System references both empirical knowledge from past events and geophysical models to form the signal detection feature predictions. The System also computes an uncertainty bound for each event hypothesis location solution describing a region bounding the event hypothesis' hypocenter and origin time at a particular confidence level. The System creates a variety of location solutions for each event hypothesis. These location solutions vary from one another in either the input parameters the System uses or in the location solution components the System restrains to fixed values (e.g. depth) during event location calculations. The System computes location solutions using input parameters configured by the System Maintainer (see 'Configures Processing Components' UC). The Analyst has the option to override input parameters originally configured by the System Maintainer (see 'Refines Event Location' UC).

## **2.17. UC-02.09 System Refines Event Magnitude**

This use case describes how the System estimates event hypothesis magnitudes. The System determines magnitude as a function of amplitude measurements at detecting and non-detecting stations (see 'System Measures Signal Features' UC), event hypothesis to station distances, and knowledge of the Earth structure (e.g. signal attenuation factors and geometric spreading).

## **2.18. UC-02.10 System Evaluates Moment Tensor**

This use case describes how the System evaluates the moment tensor for an event. The System inverts observed ground motion data from the event to determine the moment tensor. The System decomposes the moment tensor into deviatoric and isotropic components. The System decomposes the deviatoric component into best-fitting double couple and compensated linear vector dipole (CLVD) components.

## **2.19. UC-02.11 System Finds Similar Events**

This use case describes how the System finds events that are similar to a specified event. The System uses event parameters (e.g., latitude and longitude), patterns of associated signal detections, or waveform correlation as similarity metrics. The System uses default similarity parameters configured by the System Maintainer (see 'Configures Processing Components' UC) or override parameters set by the Analyst (see 'Compares Events' UC).

## **2.20. UC-02.12 System Predicts Signal Features**

This architecturally significant use case describes how the System predicts signal features in order to accomplish key monitoring tasks. Signal features include phase identification, probability of detection, arrival time, azimuth, slowness, amplitude and spectral content. The System references both empirical knowledge from past events and geophysical models, including time-varying geophysical models, to predict the signal features. The System applies empirical corrections to predictions. The System provides uncertainties for predictions as appropriate. The System uses default signal prediction parameters configured by the System Maintainer (see 'Configures Processing components' UC) or selected by the Analyst (see 'Refines Event' UC).

This use case is architecturally significant due to the processing and memory resource consumption of 3D earth model calculations.

## **2.21. UC-03 Analyzes Events**

This use case describes how the Analyst analyzes event hypotheses created by either pipeline processing or a previous Analyst and builds new events. The Analyst selects data to analyze (see 'Selects Data for Analysis' UC), refines event hypotheses for selected events (see 'Refines Event' UC), reviews waveforms and unassociated detections (see 'Scans Waveforms and Unassociated Detections' UC) and builds new event hypotheses for events missed by the System or previous Analysts (see 'Builds Event' UC). When finished with the analysis, the Analyst marks the processing stage as complete for the selected data (see 'Marks Processing Stage Complete' UC) to prepare the event hypotheses for further analysis in subsequent processing stages.

### **2.22. UC-03.01 Selects Data for Analysis**

This use case describes how the Analyst selects data for analysis consistent with the current processing stage. The Analyst creates an Analysis Time Interval based on an actual time interval or an Event Set. The Analyst selects the Analysis Time Interval to facilitate the analyzing of waveform data, unassociated detections, and system-built and Analyst-reviewed events within an Analyst specified time frame. The system updates relevant displays to indicate the selected data is being analyzed.

### **2.23. UC-03.02 Refines Event**

This architecturally significant use case describes how the Analyst refines an event hypothesis. The Analyst checks waveform quality (see 'Determines Waveform Data Quality' UC). For waveforms of sufficient quality, the Analyst enhances signals and suppresses noise on waveforms for relevant stations (see 'Enhances Signals' UC), adds and associates missing detections, and modifies or unassociates detections already associated with the event hypothesis (see 'Detects Signals' UC). The Analyst rejects event hypotheses that are invalid. For valid event hypotheses, the Analyst measures signal features associated with the detections (see 'Measures Signal Features' UC) and evaluates the moment tensor ('Evaluates Moment Tensor' UC). The

Analyst uses these signal features to refine the location (see 'Refines Event Location' UC) and magnitude (see 'Refines Event Magnitude' UC) of the event hypothesis. The Analyst compares events to determine how similar events were constructed (see 'Compares Events' UC). The Analyst repeats these steps until satisfied with the results. Analysts may provide feedback for previous Analysts during any of these steps (see 'Provides Analyst Feedback' UC).

This use case is architecturally significant because it captures the interplay between all of the Analyst activities.

#### **2.24. UC-03.02.01 Determines Waveform Data Quality**

This use case describes how the Analyst determines the quality of the waveform data being analyzed. The Analyst reviews waveform data to determine data quality. The Analyst masks waveform data of insufficient quality that should not be used during event processing. The Analyst modifies or removes masks created by the System (see 'System Determines Waveform Data Quality' UC).

#### **2.25. UC-03.02.02 Enhances Signals**

This use case describes how the Analyst processes waveforms to enhance event signals while suppressing background noise. The Analyst enhances signals using the same algorithms as pipeline processing (see 'System Enhances Signals' UC), but the Analyst has the option to select the input parameters rather than using the predefined parameters used during pipeline processing.

#### **2.26. UC-03.02.03 Detects Signals**

This use case describes how the Analyst detects new signals and modifies previously created signals in waveform data to refine an existing event. The Analyst detects signals on raw and derived channels or on detection feature maps. The Analyst views, updates and removes signal detections associated to an event. The Analyst associates unassociated signal detections to events. The Analyst assigns phase names to detections.

#### **2.27. UC-03.02.04 Measures Signal Features**

This use case describes how the Analyst measures signal features on waveform data. The Analyst measures the same signal features as are measured in pipeline processing (see 'System Measures Signal Features' UC), but the Analyst has the option to select the input parameters rather than the predefined parameters used during pipeline processing.

#### **2.28. UC-03.02.05 Refines Event Location**

This use case describes how the Analyst refines event hypothesis location solutions. The Analyst generates event hypotheses using the same algorithms as pipeline processing (see 'System Refines Event Location' UC), but the Analyst has the option to select the input parameters rather than using the predefined parameters used during pipeline processing. The system indicates which measurements are invalidated by the relocation (e.g. beams, magnitudes).

### **2.29. UC-03.02.06 Refines Event Magnitude**

This use case describes how the Analyst refines estimated event magnitudes for an existing event hypothesis. The Analyst invokes the same magnitude algorithms used in pipeline processing (see ‘System Refines Event Magnitude’ UC) or additional magnitude estimation algorithms. The Analyst configures input parameters for estimating magnitude.

### **2.30. UC-03.02.07 Evaluates Moment Tensor**

This use case describes how the Analyst evaluates the moment tensor for an event. The Analyst determines which observed waveforms, stations, location depths, and frequency bands to use to calculate the moment tensor inversion. The Analyst invokes the system to calculate modeled waveforms and the moment tensor (see ‘System Evaluates Moment Tensor’ UC). The Analyst evaluates the waveform fits and the moment tensor results and recalculates the moment tensor with adjusted parameters as needed

### **2.31. UC-03.02.08 Compares Events**

This architecturally significant use case describes how the Analyst compares events to determine how similar events were constructed. The Analyst compares waveforms from comparison events by visually inspecting an overlay of the waveforms to determine if the events are from a similar source. The Analyst searches for comparison events or creates agglomerative hierarchical clusters of waveforms from events (see ‘System Finds Similar Events’ UC) and determines that the events are from a similar source if the correlation coefficient is above a selected threshold.

This use case is architecturally significant due to the introduction of the capability to compare events within an operational context.

### **2.32. UC-03.03 Scans Waveforms and Unassociated Detections**

This architecturally significant use case describes how the Analyst scans waveforms or detection feature maps and unassociated signal detections to build new events. The Analyst scans unassociated signal detections to find signal detections that should be associated to existing event hypotheses, and scans waveforms and detection feature maps to find signal detections missed by prior processing. The Analyst uses two data scanning methods. The Analyst scans waveforms through time to detect new signals and associate unassociated signal detections to existing event hypotheses (see ‘Detects Signals’ UC).

This use case is architecturally significant due to the user interface design considerations for displaying and interacting with waveforms and unassociated signal detections.

### **2.33. UC-03.04 Builds Events**

This use case describes how the Analyst builds a new event hypothesis missed by prior processing. The Analyst builds event hypotheses using the following methods: manual signal

association, invoking waveform correlation algorithms, invoking signal association algorithms, and specifying an event time and location to build a virtual event hypothesis.

The Analyst manually builds a new event hypothesis by finding collections of signal detections representing observations of the same event and associating those signal detections as a new event hypothesis.

The Analyst invokes waveform correlation and signal association algorithms, including the same algorithms used in pipeline processing (see ‘System Detects Events using Waveform Correlation’ UC and ‘System Builds Events using Signal Detections’ UC), but the Analyst has the option to select the input parameters rather than the predefined parameters used during pipeline processing.

The Analyst builds a virtual event hypothesis for a specified time and location by first creating an event hypothesis with no associated signal detections and then using Analyst tools (see ‘Refines Event’ UC) to find evidence supporting existence of an event at that time/location.

The System indicates to the Analyst if an event hypothesis does not meet event formation criteria configured by the System Maintainer (see ‘Configures Processing Components’ UC). The Analyst views event quality metrics computed by the System for all Analyst built event hypotheses.

#### **2.34. UC-03.05 Marks Processing Stage Complete**

This architecturally significant use case describes how the Analyst marks a processing stage complete upon completing analysis of an Event Set or an Analysis Time Interval. The Analyst marks an Event Set or Analysis Time Interval complete to allow the Event Set or Analysis Time Interval to proceed to the next processing stage.

This use case is architecturally significant due to expected changes to the analysis process (including operational concept changes).

#### **2.35. UC-04 N/A**

#### **2.36. UC-05 Provides Data to Customers**

This use case describes how the System provides event bulletins, waveforms, and reports to Authorized External Users. The Release Authority reviews and approves event hypotheses for release to Authorized External Users (see ‘Approves Events for Release’ UC). An Authorized External User requests data from the System (see ‘Requests System Data’ UC) or accesses processing results through a web interface (see ‘Views System Results’ UC).

#### **2.37. UC-05.01 Requests System Data**

This use case describes how an Authorized External User requests data from the System. Authorized External Users access the System to request approved waveform data, reports, station

SOH, station metadata, meteorological data sets, and station data acquisition statistics. The Authorized External User subscribes for data to be sent as it becomes available. The System limits some information provided to Authorized External Users.

### **2.38. UC-05.02 Approves Events for Release**

This use case describes how the Release Authority reviews and approves events for release to Authorized External Users. The Release Authority reviews an event and if it meets specific criteria, approves the event for release.

### **2.39. UC-05.03 Views System Results**

This architecturally significant use case describes how an Authorized External User views current and past reports through the System web servers. An Authorized External User views event reports, event bulletins, station state-of-health (SOH) and event web pages originating from the System. An Authorized External User views event reports and event bulletins from third parties.

This use case is architecturally significant because it provides an interactive interface for Authorized External Users.

### **2.40. UC-06 Configures System**

This use case describes how the System User configures the system. The System Maintainer configures data acquisition, station data usage, processing components, system messages, and system permissions, and defines processing sequences (see 'Configures Data Acquisition', 'Configures Station Usage', 'Configures Processing Components', 'Configures System Messages', 'Configures System Permissions', and 'Defines Processing Sequence' UCs). The System Controller controls data acquisition and forwarding (see 'Controls Data Acquisition' UC). The System User views system configuration history (see 'Views System Configuration History' UC). The Analyst configures analysis interfaces (see 'Configures Analysis Interfaces' UC).

### **2.41. UC-06.01 Controls Data Acquisition**

This use case describes how the System Controller selects to acquire and forward Station Data (waveform data and SOH data) and Event Bulletin data. If more than one data source is available for station data, the System Controller selects which data source to use. The System Controller generates and installs PKI credentials needed for data that requires authentication.

### **2.42. UC-06.02 Configures Station Usage**

This use case describes how the System Maintainer configures station data usage within the System. The System Maintainer configures the usage of each station's data including availability to interactive processing, automated station processing, and automated network processing.

### **2.43. UC-06.03 Defines Processing Sequence**

This architecturally significant use case describes how the System Maintainer defines Processing Configurations, which include Processing Stages, Processing Sequences and Analyst Activities. At the highest level, a Processing Stage is associated with a Processing Sequence. The System Maintainer defines a Processing Sequence to be executed, which includes other Processing Sequences and/or Processing Steps. The System Maintainer defines Analyst Activities which are associated with Processing Stages. Once the system verifies that the configuration is valid, the System Maintainer saves all changes made to the Processing Sequence. The configuration changes do not take effect until they are installed as a software update (see 'Installs Software Update' UC).

This use case is architecturally significant due to the fundamental changes to the system it introduces including the interactive interfaces provided and the specification of the elements that are available for sequence customization.

### **2.44. UC-06.04 Configures Data Acquisition**

This use case describes how the System Maintainer configures the System to receive station data, bulletin data and meteorological data. The System Maintainer can add, remove or modify station parameters, bulletin data parameters and meteorological data parameters. The System validates parameter values before accepting the change.

### **2.45. UC-06.05 Configures Processing Components**

This use case describes how the System Maintainer configures processing components that are part of the pipeline processing sequence (see 'Defines Processing Sequence' UC). The System Maintainer configures the components used for performing QC, signal enhancement, signal detection, signal detection feature extraction, continuous beam formation, signal association, event hypothesis creation, event location, and magnitude estimation.

### **2.46. UC-06.06 Configures System Messages**

This Use Case describes how the System Maintainer configures System messages. The System Maintainer enables or disables messages and configures any modifiable message attributes.

### **2.47. UC-06.07 Views System Configuration History**

This architecturally significant use case describes how the System User views the system configuration change history. The system stores each configuration change and can present a list of configuration changes or a trend display of configuration values over time. The System User can also view the system configuration at a selected time. The configuration history contains information on the user who modified the configuration and when the configuration changed.

This use case is architecturally significant because it covers a new feature of the system to store and view all system configuration information.

## **2.48. UC-06.08 Configures Analyst Interfaces**

This use case describes how the Analyst makes customizations to their System analysis environment. The Analyst configures the default displays provided by the System and their locations in the Analyst workspace on startup. The Analyst configures properties of individual displays. The Analyst configures user interface themes and display synchronization.

## **2.49. UC-06.09 Configures System Permissions**

This use case describes how the System Maintainer enables users to access selected system features. The System Maintainer configures user permission to access and modify selected data and execute selected system functions. The System only allows the authorized users to access the limited system features.

## **2.50. UC-07 Monitors Performance**

This Use Case describes how the System User oversees System performance. The Performance Monitor analyzes mission performance (see 'Analyzes Mission Performance' UC). The System User monitors station state-of-health (see 'Monitors Station State-of-Health' UC). The System User monitors mission processing (see 'Monitors Mission Processing' UC) and system performance (see 'Monitors System Performance' UC). The System computes and stores metrics and statistics and reports on the System mission performance (see 'System Monitors Mission Performance' UC).

## **2.51. UC-07.01 Analyzes Mission Performance**

This architecturally significant use case describes how the Performance Monitor views metrics to verify the correct overall mission processing performance of the System. The trends highlighted by these metrics build confidence in the Performance Monitor that the station processing of signal detections and the network processing and association of these signals into events has been performing correctly over time. The Performance Monitor can drill down into the trended metric data to further investigate potential problems and gather information that informs corrective actions (addressed under the 'Configures System' use cases). The Performance Monitor may also view the usage of the individual Analyst Tools to assess their relative utility and need.

This use case is architecturally significant because it relates data from all parts of the system.

## **2.52. UC-07.02 Monitors System Performance**

This use case describes how the System User monitors the current and historic System performance, including data acquisition, data synchronization, internal network communications, hardware status, system platform and supporting software.

### **2.53. UC-07.03 Monitors Station State-of-Health**

This use case describes how the System User monitors station state-of-health. The System User views current station state-of-health (e.g., state-of-health values reported by the station, timeliness of waveform data intervals, station processing statistics and thresholds, and QC masks) to detect problems with station data quality and availability.

### **2.54. UC-07.04 System Monitors Mission Performance**

This use case describes how the System computes, stores, and reports on System mission performance. The System computes and stores station processing statistics capturing total signal detections, residuals of measured attributes (i.e., signal detection, amplitude, azimuth, slowness, and magnitude), and rate of detections. The System computes and stores empirical station magnitude detection thresholds. The System computes and stores event hypothesis statistics for a geographic region. Station processing statistics, event hypothesis statistics, and empirical station magnitude detection thresholds are captured over a configurable time period. The System reports when measured attributes exceed configurable thresholds indicating a possible need for further station tuning.

### **2.55. UC-07.05 Monitors Mission Processing**

This use case describes how the System User monitors mission processing. The System User views the status of the mission and the information needed to determine if the System processing needs to be transferred. The System User views the processing pipeline status and continuous threshold monitoring.

### **2.56. UC-08 Supports Operations**

This use case describes how the System User supports operations of the System. Various System Users access and control the system (see 'Accesses the System' UC and 'Controls the System' UC), export and import data (see 'Exports Data' UC and 'Imports Data' UC), review event history (see 'Views Event History' UC), maintain the Operations Log (see 'Maintains Operations Log' UC), provide and view analyst feedback (see 'Provides Analyst Feedback' UC and 'Views Analyst Feedback' UC), view analyst performance metrics (see 'Views Analyst Performance Metrics' UC), view messages available on the System (see 'Views Messages' UC), and view security status (see 'Views Security Status' UC).

### **2.57. UC-08.01 Accesses the System**

This use case describes how the System User gains access to a subsystem from a co-located workstation or from a remote workstation. The System User enters their logon credentials, i.e., username and password, to gain access to the subsystem. The System User can access the same capabilities from either a co-located workstation or a remote workstation.

## **2.58. UC-08.02 Controls the System**

This architecturally significant use case describes how the System Controller starts and stops the System, and switches pipeline processing from the Primary to the Backup. When the System Controller starts the System, the System data processing starts and automatically accepts connections for acquiring data. The Primary synchronizes processing results with the Backup (see 'Synchronizes Processing Results' UC). When the System Controller stops the System, the System data processing stops and automatically disconnects all incoming data connections and outgoing data connections. When the System Controller switches pipeline processing to the Backup, the Backup becomes the Primary.

This use case is architecturally significant due to the System's timeliness requirements to start and stop the System and to transfer mission assignment from the Primary to the Backup.

## **2.59. UC-08.03 Exports Data**

This use case describes how the System User selects and exports data (e.g. waveforms, processing results, and configuration) from a Subsystem. Exports support training, standalone analysis, synchronizations between subsystems and provide data to external systems.

## **2.60. UC-08.04 Imports Data**

This use case describes how the System Maintainer imports data (e.g. waveforms, processing results, and configuration) onto the System, including the Training Subsystem and the Standalone Subsystem.

## **2.61. UC-08.05 Views Event History**

This architecturally significant use case describes how the System User observes the change history of a given event. The change history is a series of one or more saved event hypotheses. System Users view all the event hypotheses and the set of location solutions for each hypothesis. The System User views the relationship between event hypotheses including the preferred hypothesis for each processing stage. The event change history persists across work sessions for subsequent review.

This use case is architecturally significant because it covers review of stored versions of event hypotheses.

## **2.62. UC-08.06 Maintains Operations Log**

This use case describes how the Analyst displays and edits the Operations Log. The Analyst edits and saves system status information in the Operations Log. The Analyst views the Operations Log for current or past system status.

### **2.63. UC-08.07 Provides Analyst Feedback**

This use case describes how the Analyst provides feedback for analyzed events. Each subsequent Analyst provides comments on analyzed events as events are analyzed, refined, and ultimately assessed. The System notifies the original Analyst once comments are entered (see 'Views Analyst Feedback' UC).

### **2.64. UC-08.08 Views Analyst Feedback**

This use case describes how the Analyst views feedback provided by Analysts (see 'Provides Analyst Feedback' UC).

### **2.65. UC-08.09 Views Analyst Performance Metrics**

This use case describes how the Analyst views performance metrics calculated from System information for any set of Analysts for a specified time range. The Analyst exports the performance metrics.

### **2.66. UC-08.10 Views Security Status**

This use case describes how the System Maintainer views System security status to support security monitoring. The System Maintainer selects to view security logs (including user logins, successful/unsuccessful user operations, waveform authentication status, and more), and to retroactively authenticate waveform data.

### **2.67. UC-08.11 Views Messages**

This use case describes how the System User views messages available on the System. The System User views messages from sources configured by the System Maintainer (see 'Configures System Messages' UC) or subscribed by the System User. The System User configures message subscriptions and playback sounds.

### **2.68. UC-09 Tests System**

This use case describes how the System User tests the System. The System User tests the SUS/TST and DEV Subsystem processing components individually or in sequence (see 'Performs Software Component Testing' UC). The Developer creates and replays test data sets (see 'Creates Test Data Set for Replay' UC, 'Replays Test Data Set' UC and 'Replays Analyst Actions' UC).

### **2.69. UC-09.01 Performs Software Component Testing**

This use case describes how the Developer executes regression testing of the System processing components individually or in sequence. The Developer tests System processing components

with repeatable regression and unit tests organized into test suites. The Developer maintains a baseline of expected results for comparison against newly generated test results.

### **2.70. UC-09.02 Creates Test Data Set for Replay**

This use case describes how the Developer creates Test Data Sets within the System. The Developer defines the Test Data Set and the required Test Data Set parameters and the System creates the Test Data Set. Test Data Sets may contain waveform data, waveform acquisition time tags, and station information to support tests that replay the waveform data into the System (see 'Replays Test Data Set' UC). The Test Data Set may also contain the steps that an Analyst takes while analyzing the data, including the captured time sequence information to support tests that replay Analyst actions (see 'Replays Analyst Actions' UC).

### **2.71. UC-09.03 Replays Test Data Set**

This architecturally significant use case describes how the Developer replays a waveform Test Data Set into the System processing pipeline. The Developer selects a previously created waveform test data set (see 'Creates Test Data Set for Replay' UC) and initiates the data set replay. The System plays back the waveform Test Data Set using the captured data acquisition time sequence information, substituting the waveform Test Data Set for the actual real time waveform data. The Developer can terminate the playing waveform Test Data Set manually or allow it to self-terminate after it completes its duration time.

This use case is architecturally significant due to the introduction of new capability and the concept of playing back time synchronized captured data.

### **2.72. UC-09.04 Replays Analyst Actions**

This use case describes how the Developer replays a set of Analyst actions into the System. The Developer selects a previously created Analyst action data set (see 'Creates Test Data Set for Replay' UC) and initiates the data set replay. The System inputs the Analyst actions using the captured time sequence information, responding to the Analyst actions as if manually initiated.

### **2.73. UC-10 Maintains System**

This use case describes how the System Maintainer maintains the System and monitors security. The System Maintainer performs periodic system backups (see 'Performs System Backups' UC) in order to recover the System, system restores (see 'Performs System Restores' UC) due to a system failure or catastrophic event, and installs software updates (see 'Installs Software Update' UC) due to OS updates or system-related fixes. The System monitors security (see 'System Monitors Security' UC).

### **2.74. UC-10.01 Performs System Backups**

This use case describes how the System Maintainer performs System backups. The System Maintainer periodically conducts a system backup which copies all system-related data, software

(source and object), and files to a separate storage media enabling System to be restored in the event of a system failure or catastrophic event. The System Maintainer also conducts data backups to recover from data loss, data corruption, hardware failure, etc.

### **2.75. UC-10.02 Performs System Restores**

This use case describes how the System Maintainer performs System restores. The System Maintainer conducts a system restore due to a system failure or catastrophic event enabling the System to return to operational status. The System Maintainer also conducts data restores due to data loss, data corruption, etc., enabling the state of System data to be restored to a specific point in time.

### **2.76. UC-10.03 Installs Software Update**

This use case describes how the System Maintainer installs software versions and software configuration changes on the System, Training Subsystem, and Standalone Subsystems. The System Maintainer periodically installs software due to OS and other COTS software configuration changes, updates or system-related fixes on the System. The System Maintainer periodically installs System software versions on the Training Subsystem supporting Analyst training. The System Maintainer also installs System software versions on the Standalone Subsystems supporting analysis or site surveys.

### **2.77. UC-10.04 System Monitors Security**

This use case describes how the System collects security status to support security monitoring. The System records user logins and security credentials authentication requests. The System notifies the System Maintainer of security related events.

### **2.78. UC-11 Performs Research**

This use case describes how the Researcher performs extended event analysis and research to enhance mission capability. The Researcher analyzes special events outside of the operational processing stages (see 'Analyzes Special Events' UC). The Researcher develops and tests new algorithms and models for potential improvement of the System (see 'Develops New Algorithms and Models' UC). The Researcher tunes existing algorithms for optimal performance (see 'Determines Optimal Processing Component Configuration' UC).

### **2.79. UC-11.01 Analyzes Research Events**

This use case describes how the Researcher analyzes events outside of operations. The Researcher retrieves System data and analyzes the data using Researcher tools without impacting operational performance. A Researcher selects to analyze events in order to conduct a more detailed analysis of any past event or time interval, perform research, respond to requests for information, or perform statistical analysis.

## **2.80. UC-11.02 Develops New Algorithms and Models**

This architecturally significant use case describes how the Researcher develops and tests new algorithms and models for potential improvement of the System. The Researcher retrieves the data needed for developing and testing new algorithms and models. The Researcher compares the output from these tests to the System output. The Researcher recommends updates to the System.

This use case is architecturally significant as the Researcher requires access to System data and algorithm implementations used in pipeline processing and interactive processing through command line interfaces and a Common Object Interface (COI).

## **2.81. UC-11.03 Determines Optimal Processing Component Configuration**

This use case describes how the Researcher optimizes the configuration of pipeline processing component performance. The Researcher optimizes the configuration of processing components to achieve optimal balance of false alarms vs. missed events while ensuring events of interest are not missed during pipeline processing (see 'System Detects Event' UC). The Researcher selects control data (results of waveform data formerly processed and reviewed by Analysts), conducts tests and compares test results to the control data.

## **2.82. UC-11.04 Performs Multiple Event Location**

This use case describes how the Researcher refines locations for multiple events simultaneously to achieve greater accuracy. The Researcher selects a set of events, a multiple event location algorithm and associated parameters, and updates the location of each event (see 'System Refines Event Location' UC).

## **2.83. UC-12 Performs Training**

This use case describes how the Analyst Instructor configures the Training Subsystem and trains Analysts to look at waveform data and interactively find event solutions. The Analyst Instructor imports training data sets to the Training Subsystem and configures the data so it can be accessed by students (see 'Configures Data for Training Subsystem' UC). The Analyst Instructor trains Analysts by demonstrating all components of the Analyst user role, and observing student workstations as they work on training exercises (see 'Trains Analyst' UC).

## **2.84. UC-12.01 Configures Data for Training Subsystem**

This use case describes how the Analyst Instructor configures data on the Training Subsystem for training of students. The Analyst Instructor chooses a representative training data set (raw waveforms, processing results), imports it (see 'Imports Data' UC), and configures the data so students can access it.

## **2.85. UC-12.02 Trains Analysts**

This use case describes how the Analyst Instructor executes an Analyst training scenario, observes and evaluates Analysts, and collects training feedback. The Analyst Instructor executes training scenarios on the Training Subsystem and covers all components of the Analyst user role (see 'Analyzes Event' UC). The Training Subsystem automatically stores all event solutions created by the Analysts. The Analyst Instructor observes and interacts with individual Analyst's computer workstation screens remotely from the Analyst Instructor's computer workstation screen. The Analyst Instructor allows each Analyst to remotely observe the Analyst Instructor's screen. The Analyst Instructor creates and views Analyst training performance reports.

## **2.86. UC-13 Operates Standalone System**

This use case describes how the System User operates the Standalone Subsystem to support site surveys (see 'Conducts Site Survey' UC) and perform standalone analysis (see 'Performs Standalone Analysis' UC). The Standalone Subsystem operates with reduced computing infrastructure enabling single machine operation.

## **2.87. UC-13.01 Conducts Site Survey**

This use case describes how the Field Scientist conducts site surveys using the Standalone Subsystem to assess potential placement of sensors, sensor stations, and sensor networks. The Field Scientist collects waveform data originating from the geophysical hardware deployed for the survey and converts that data to the System Storage Format. The Field Scientist accesses event data for the region from the System or other sources for comparison to events detected at the site. The Field Scientist analyzes the waveform data to assess characteristics of signals and noise at the site. The Field Scientist captures the analysis results and produces a report.

## **2.88. UC-13.02 Performs Standalone Analysis**

This architecturally significant use case describes how the System User performs analysis using the Standalone Subsystem. The Standalone Subsystem acquires station data, external bulletin data and meteorological data (see 'System Receives Station Data' UC, 'System Receives Bulletin Data' UC and 'System Acquires Meteorological Data' UC) or the System User imports data (see 'Imports Data' UC). The Standalone Subsystem detects events (see 'System Detects Events' UC). The System User analyzes events (see 'Analyzes Events' UC) using analysis components that are available on the Standalone Subsystem and exports the processing results (see 'Exports Data' UC). The System User configures, operates, monitors, and maintains the Standalone Subsystem as needed (see 'Configures System' UC, 'Supports Operations' UC, 'Monitors Performance' UC, and 'Maintains System' UC).

This use case is architecturally significant since it requires the System architecture to support configurable software distributions at various scales of data processing, computing hardware, and personnel.

## **2.89. UC-14 IDC Unique**

This use case includes use cases that are unique to an IDC System distribution.

## **2.90. UC-14.01 System Assesses Event Consistency**

This use case describes how the System assesses the consistency of observations for an event with expected observations for an event of comparable size in the same general location. The System calculates any event characteristics needed for assessing event consistency. The System compares event characteristics against expected values and quantifies inconsistencies. The System provides a summary of inconsistencies. The System attempts to correct inconsistencies. The event characteristics that are calculated, the expected values, and the inconsistencies that can be automatically corrected are configured by the System Maintainer (see 'Configures Processing Components' UC).

## **2.91. UC-14.02 Assesses Event Consistency**

This use case describes how the Analyst assesses the consistency of observations for an event with expected observations for an event of comparable size in the same general location. The Analyst selects an event or set of events. The Analyst invokes the system to assess event consistency for each event (see 'System Assesses Event Consistency' UC). The Analyst reviews the summary of inconsistencies and corrective actions.

## **2.92. UC-14.03 System Screens Event**

This use case describes how the System creates a screened event list (ideally containing no non-nuclear events) by processing the list of Analyst-reviewed events. The System automatically calculates event characteristics for all events designated as having completed Analyst review. The System uses these event characteristics to screen events that are non-nuclear. The event characteristics that are calculated and the screening criteria are configured by the System Maintainer (see 'Configures Processing Components' UC).

## **2.93. UC-14.04 Controls Monitoring Stations**

This use case describes how the System Controller controls Monitoring Stations. The System Controller securely issues commands to Monitoring Stations and monitors response to support sensor calibration, authentication key maintenance, and station diagnostics.

## **2.94. UC-14.05 Performs Expert Technical Analysis**

This architecturally significant use case describes how the Fusion and Review Officer conducts an expert technical analysis upon request from a member state. The request could be for expert technical analysis for either a more detailed analysis of a specific event using IMS data and software (see 'Refines Event' UC) or for specified analysis using member state specified data and/or software (see 'Analyzes Research Event' UC).

The Fusion and Review officer creates an updated event bulletin when doing a more detailed analysis of the IMS data using System tools. The Fusion and Review Officer creates a State Requested Methods Report (SRMR) that is based on the results of the extensive analysis using the member state specified data and/or software. Both types of analysis may include but is not limited to geographic location, time, depth, magnitude, waveforms, the signal detection list, a map, phase and depth refinement, and focal mechanism. The Fusion and Review Officer makes the updated event bulletin, SRMR and member-state provided data and software available to all member states (see 'Views System Results' UC).

This use case is architecturally significant due to the inclusion of data and software provided by member states.

This is the last page of the document.