EROS Architecture Study Team (EAST) Overview for Landsat Science Team (LST)

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EROS Tenets

EROS Mission:

… contributing to the understanding of a changing Earth

Vision:

… the world's primary source of remotely sensed land images of the Earth;

… authoritative providers of land change science information & knowledge;

… leaders in understanding how changes in land use, cover, and condition affect people and nature.

In order to:

… monitor relevant land change information and knowledge;

… assess the trends and consequences of land change; and

… provide services and support on the use and understanding of land change monitoring products and future conditions.

EAST Purpose and Objectives

- Purpose: Provide a high level concept for the systems architecture, infrastructure, and processes required to meet EROS strategic objectives
  - A key future objective of EROS is to enable Land Change Monitoring, Assessment, and Projection (LCMAP), a capability to provide data that are "analysis-ready" to users as well as feed a continuous monitoring capability

- Objectives:
  - Define high level concepts, considerations, assumptions, risks and benefits, and alternatives for the future EROS architecture and infrastructure
  - Include consideration of new technology and cost efficient approaches, as well as potential inter-agency, international, and private sector partnerships
  - Consider refined or enhanced capabilities requested by stakeholders and user communities
  - Provide high level system architecture, infrastructure, and process recommendations to the EROS Director by July 15, 2015
    - Include roadmap to achieve vision for future architecture

Measures of Success

- Effectiveness
  - Recommended architecture should be capable of sufficient performance in all areas to meet EROS and stakeholder strategic objectives
- Flexibility
  - Recommended architecture should be scalable, to meet current and future requirements; flexible, to meet a broad variety and scale of EROS requirements; and agile, to be able to provide solutions across EROS with minimum tailoring and re-architecture
- Sustainability
  - Recommended architecture should provide the solution for the long haul, without extraordinary infusions of funds, in a cost-efficient manner, as technology, policies, and vendors change
- Reliability
  - Recommended architecture should be robust and not susceptible to single point failures, and allow EROS to effectively manage risk

EAST Challenge Statement

- Define and assess candidate architectures that support current needs and allow for the expansion of the EROS mission to include providing land change data, information, and knowledge products, along with a path for evolution from current capabilities.
  - Enhance and optimize the EROS As-Is architecture
  - Identify and streamline opportunities for shared services across project activities
  - Prepare for next generation land imaging and like missions
  - Address capability for ready access to EROS data holdings and computing capacity to generate information on land changes as they are detected (i.e. LCMAP)
  - Address evolution of systems and data analytics services needed to enable science from data and modeling

EAST Membership

EAST Team Member	Affiliation	Role
Jim Nelson	USGS EROS	Study Lead
Ken Klinner	USGS EROS	Study Co-Lead, EROS IT infrastructure
Doug Daniels	Aerospace	Systems Engineering
Mike Budde	USGS EROS	User Needs, EROS Science and Applications
Chris Rusanowski / Chris Torbert	USGS EROS	Data access, archive, and distribution
Chris Engebretson	USGS EROS	Science data processing
John Moses / Frank Lindsay	NASA GSFC	EOSDIS, GSFC Science Data Processing
Del Jenstrom / Jeff Masek	NASA GSFC	NASA Sustainable Land Imaging
Dave Alfano / Petr Votava	NASA ARC	NASA Earth Exchange, Advanced Supercomputer
Rich Doyle / Dan Crichton	NASA JPL	Big Data, Distributed Data Architectures
James Holton	NESDIS	NOAA data processing and archive
Tom Sohre	USGS EROS	LSDS Management, business models

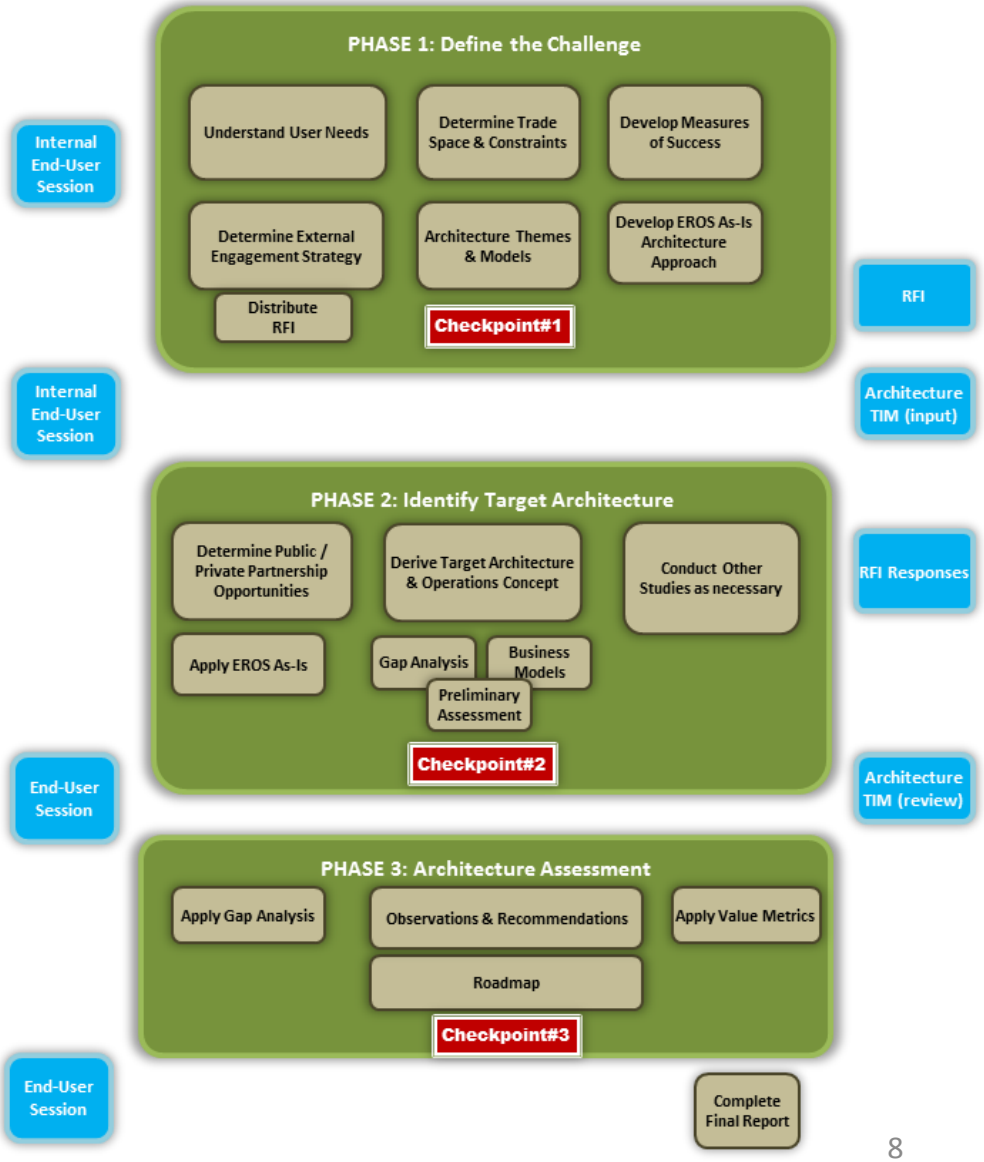
Stakeholders and Steering Committee

Steering Committee Member	Affiliation	Role
Tom Kalvelage	USGS EROS	Steering Committee lead, CRO
Jenn Lacey	USGS EROS	Observing Systems Branch Chief
Doug Binnie	USGS EROS	Data Services Branch Chief
Dave Hair	USGS EROS	Science Applications Branch Chief
Kim Allington	USGS EROS	Administrative Systems Branch Chief
Steve Covington	Aerospace	LRS Representative

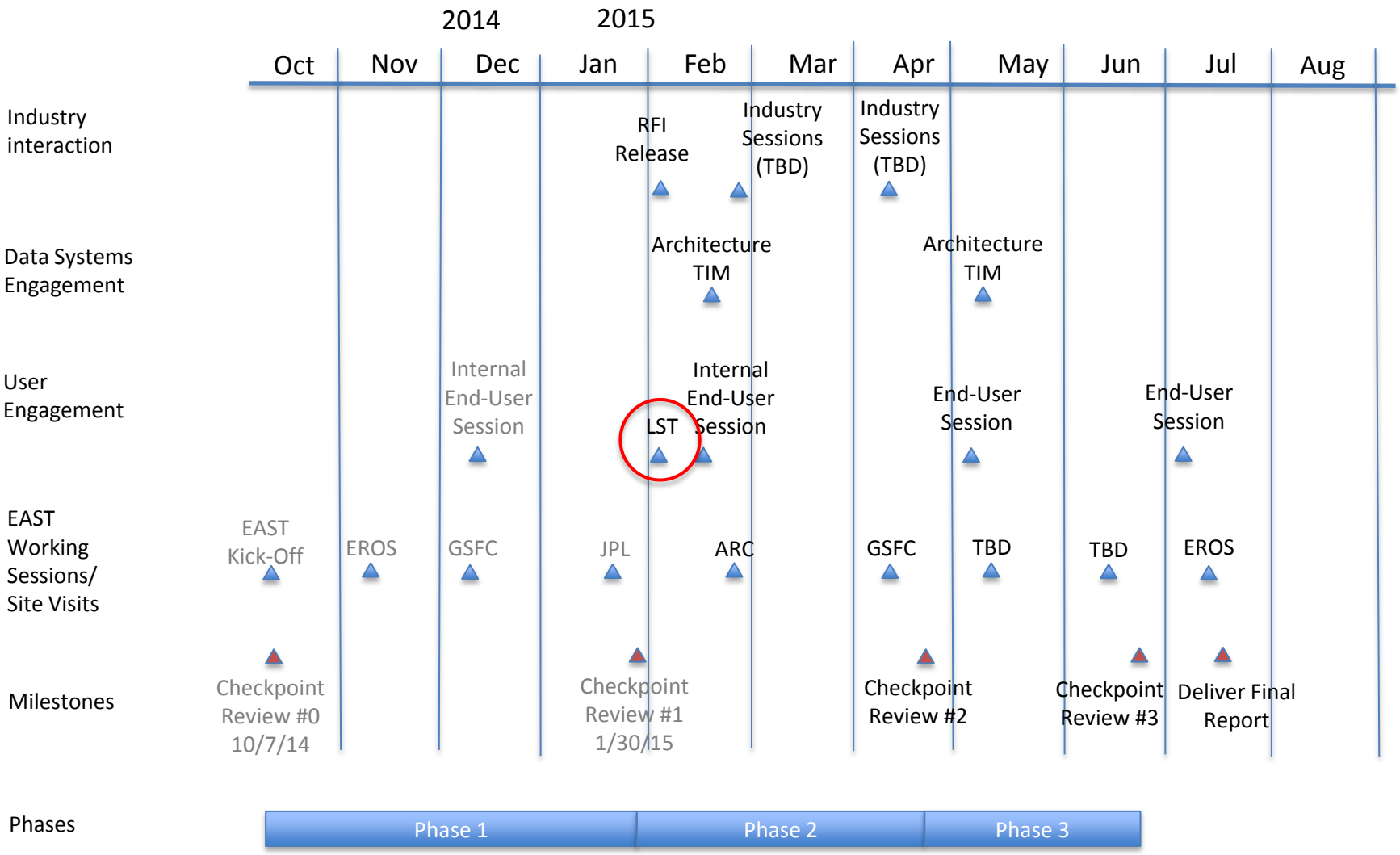
Stakeholder Member	Affiliation	Role
Frank Kelly	USGS EROS	Sponsor, EROS Director
Tim Newman	USGS LRS	LRS Program Coordinator
John Hahn	USGS EROS	EROS Deputy Director
Tom Loveland	USGS EROS	EROS Chief Scientist
Dave Jarrett / Steve Neeck	NASA ESD	NASA ESD Program Management

EAST High Level Study Approach

- Phase 1 – Define the problem
  - Develop inputs, future needs, and define scope and lines of business, and establish current baseline
- Phase 2 – Identify the solution set
  - Assess EROS and industry technologies and capabilities define challenge statement
- Phase 3 – Down-select and create recommendations
  - Apply metrics and down select to specific solution sets; formulate recommendations
- Each phase completes with a Checkpoint Review with sponsor, stakeholders, and steering group



High-Level Timeline



Data User Community Approach

Typical data user classifications:

Affiliation - (academia, private industry, federal/state/local/ government, etc.)
Application - (land use/land cover, agriculture, climate change, fire science, hazards, etc.)

The EROS Architecture Study Team (EAST) strategy for assessing user needs and requirements has certainly considered the typical categories of user classification, but has also paid special attention to current and future uses in terms of data volume, types of science data or information products used, and access/distribution requirements.

We've organized user communities into two groups. Group 1 being those that are most easily identifiable and will constitute our initial focus. Group 2 is less easily represented and will be more thoroughly engaged in phase two.

Group 1 Data User Communities & Attributes

Data User Community	Attributes
1) Large Volume Science Users	High volume – bulk data user Large data storage requirements Broad geographic scope and product range
2) Operational Users	High temporal frequency requirements Routine access to data/products Consistently processed data streams
3) Near Real-time Applications	Rapid access to data is essential Relatively small volumes of data Targeted geographic areas
4) Focus Studies	Local to regional investigations Highly diverse product suites desired High in numbers – low data volume
5)Technique Developers	Heavily academic in nature Large group – small data volumes Hand off to operations
6) Data Providers/Commercial Enterprise	High data volume – bulk data user Broad geographic scope and product range Small GIS-services companies - Agribusiness

Group 2 Data User Communities & Attributes

Data User Community	Attributes
7) Derived Product Users	Primarily GIS analysts More products/information than data users Limited or no RS/Image processing
8) Formal Educators	Broad range of classroom/field applications Land science curricula and RS training Small data volumes (exception of Grad. Res.)
9) Communicators / Primary Educators	Low end manipulation of images Group included media use of image products Probably best served with seamless JPEGs

Representative Use Cases

User Community	Use Case
1) Large Volume Science Users	Global forest gains/losses (Hansen/Loveland) NEX Web-enabled Landsat (WELD) (Votava)*
2) Operational Users	USDA National Ag Statistics Service (Mueller)* USDA Foreign Ag. Service (Reynolds)* USGS FEWS NET – ETa modeling (Senay)*
3) Near Real-time Applications	Monitoring Trends in Burn Severity (Howard)* Emergency Response/Int'l. Charter (Jones)*
4) Case Studies	National Shrub and Grass Fuel Mapping (JV)* Ecology/Vegetation – Nancy French (MTRI)*
5)Technique Developers	Landsat Albedo algorithm (Schaff)* Landsat ET & STAR-FM algorithm (Gao)*
6) Data Providers/Commercial Enterprise	Google/Amazon/ESRI
7) Derived Product Users	Landsat Look / Data Democracy Initiative*
8) Formal Educators	IGETT Program (Jeannie Allen)
9) Communicators / Primary Educators	Landsat Look / Data Democracy Initiative*

* Denotes use cases obtained to date

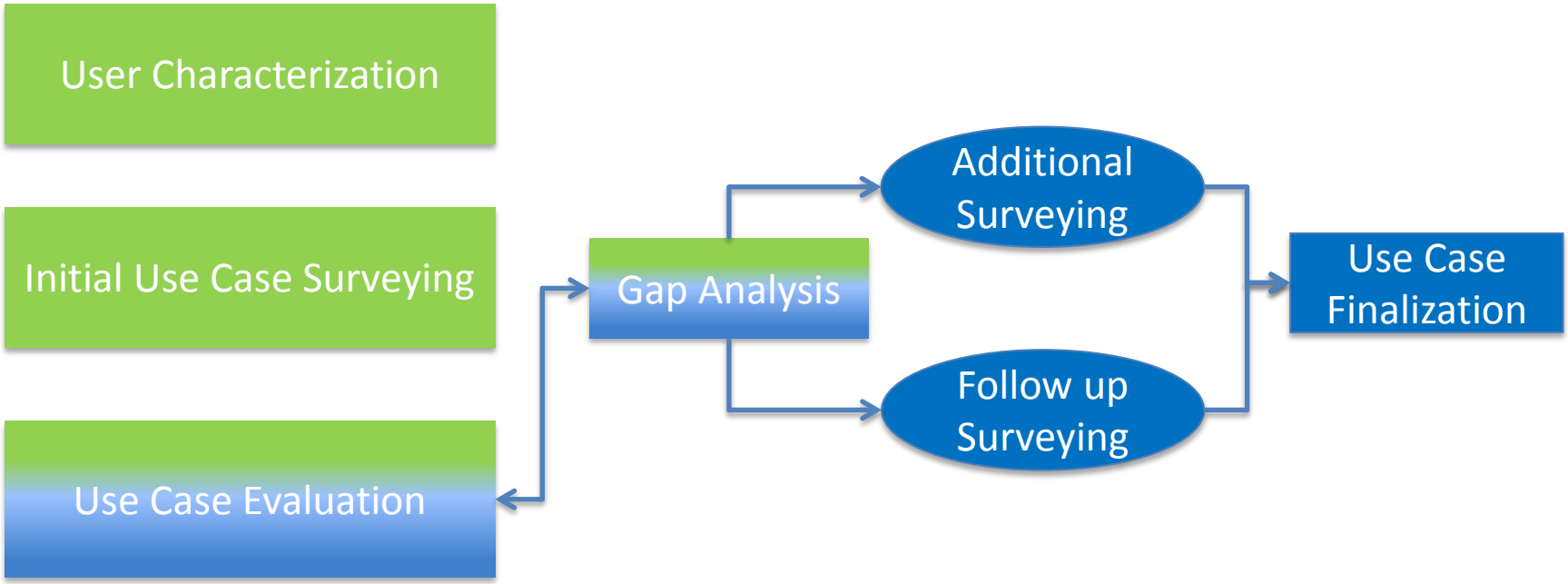
Use Case Template Information

A use case template was developed to solicit information from various user communities. It includes acquisition of general information pertaining to project or application, primary contact, background, and application objectives.

Other major information categories include:

- Data Types Used for the project/application
  - Processing levels, derived products, etc.
- Description of Work Flow or Technical Approach
  - Life-cycle from data input(s) to product development
  - Key interfaces, functionality, applied algorithms, etc.
  - What currently works well and wouldn't change?
  - What are limitations that could be approved upon?
- Application Scale
  - Both temporal (frequency of data) and Spatial (geographic area)
- Future Requirements
  - Related to data inputs, processing, storage, or distribution
  - Including new missions (Landsat 9, Sentinel2, etc.)

Use Case Process Flow



Phase 1 | Phase 2 | Phase 3 | On-Going

External Public & Private Partnerships

- To successfully meet the architecture study objectives, the EAST will explore potential private and public partnerships
- RFI final draft complete – Submitted through Steering Committee to USGS/OAG
- RFI – what do we want to learn?
  - Potential for public and private partnerships
  - Capabilities pertaining to high throughput and performance computing, storage, data analytics, and information visualization
  - Innovations, products, and opportunities for data and information systems
  - Types of data and information architecture system concepts
  - Limitations pertaining to data transfer, computing, storage, hosting, etc.
  - Provenance methods
  - Role of government and industry regarding generation of derived information
- This RFI is open to all types of organizations
  - Including U.S. industry, universities, nonprofit organizations, federal centers, FFRDC's, other U. S. Government agencies, and international organizations
- Timeline
  - February release with 30 day response time
  - Currently planning to hold relevant 1:1 discussions pending responses

What Might Partnerships Provide?

- RFI is intended to inform the EAST on the current status of industry sources, technical capacity, operational capability and business practices for potential augmentation or extension to the Center's data and information system architectures and services

  - Improving access to land imaging data, products, and information
  - Improving land imaging data, product, and information visualization
  - Adding value to land based products and services
  - Enable surge capacity for high throughput computing and storage
  - Brokering land based data and services to new user communities

Current Status and Near Term Activities

- Status
  - Held three EAST working sessions, at EROS, GSFC, and JPL
  - Gathering lessons learned from partner organizations' efforts (NESDIS, GSFC, JPL)
  - Established EAST challenge statement and scope definition
  - Evaluating user community categories and needs and identified initial use cases
  - Developed a draft set of success metrics for evaluation
  - Generating initial as-is architecture and operations concept
  - Developed architecture definitions as well as architecture goals and core principles
  - Completed Checkpoint Review #1

- Near Term Activities
  - Finalize EAST architecture framework process and terminology
  - Refine user characterization and use cases
  - Finalize EAST measures of success and formulate metrics
  - Gather information on state of technology
  - Finalize EROS as-is architecture applications view and operations concept and conduct gap analysis
  - Iterate and revise target systems architecture elements and views
  - Develop initial business model constructs
  - Initiate needed parallel studies in support of target architecture definition

Phase 2 Milestones

• Landsat Science Team Briefing	Feb 5
• RFI Release	Feb 6 (TBD)
• Internal End-User Session	Week of Feb 17-20
• Architecture TIM	Week of Feb 17-20
• Working Session #4 at NASA Ames (TBD)	Feb 24-26
• Industry Sessions Part 1 (TBD)	Feb 24-26
• Working Session #5 at GSFC/NESDIS (TBD)	Mid-Apr
• Industry Sessions Part 2 (TBD)	Mid-Apr
• Checkpoint Review #2	Late Apr