Know the Earth…Show the Way

"Delivering the Future NOW"

presented to

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Acquisition's Mission & Challenge

- **Mission**
  - Make sure NGA has the systems, supplies and services, and business solutions to advance its national leadership role in geospatial intelligence
- **Challenge**
  - Move NGA into the future without interrupting its mission

Deliver the future NOW!

Acquisition Strategy Framework

Architect/Planner

Builder/Prime Contractor
(Design & Create)

Maintain & Support

Enterprise Engineering

GeoScout

TEAM e NTERPRISE OPERATIONS
A PARTNERSHIP FOR MISSION SUCCESS

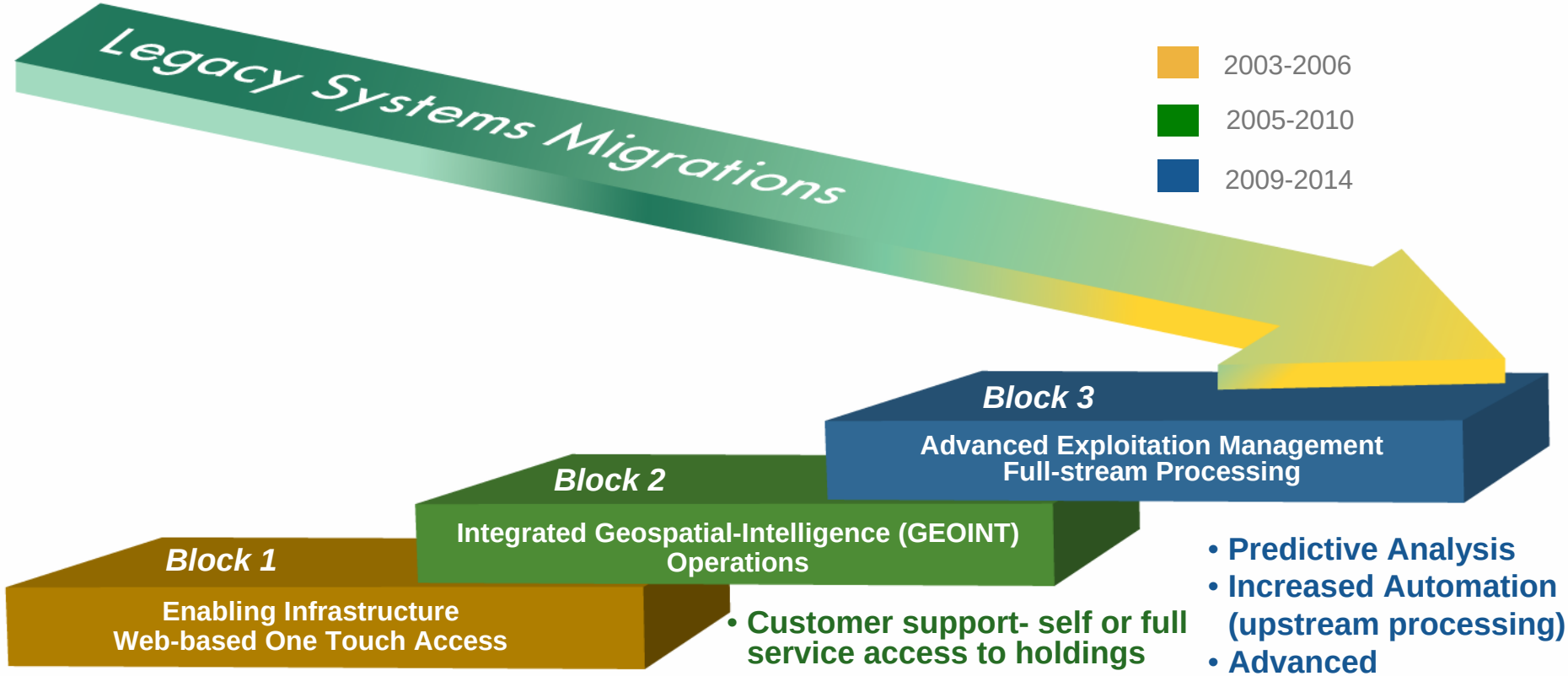
Operations & Sustainment

Strategic View and Planning for:
- Corporate Business Processes
- Mission Requirements & Systems
- Enterprise Architecture (conceptual data model)
- Migration Planning
- Enterprise Risk & Readiness

Integrate, Develop, & Implement:
- System Architecture Definition, Development & Implementation
- Infrastructure Modernization
- Logical & Physical Data Model
- Technical Insertion / Prototyping (NPE)
- System Migration
- Corporate and Mission BPR
- Integration and Testing
- Training

Assurance for Operations:
- Overall Systems Operations
- Hardware & Software Maint
- License & Inventory Mgmt
- Enterprise Services
- Legacy Migration Plan
- Configuration Management

GeoScout Delivery Plan for *Inclusive TPED*



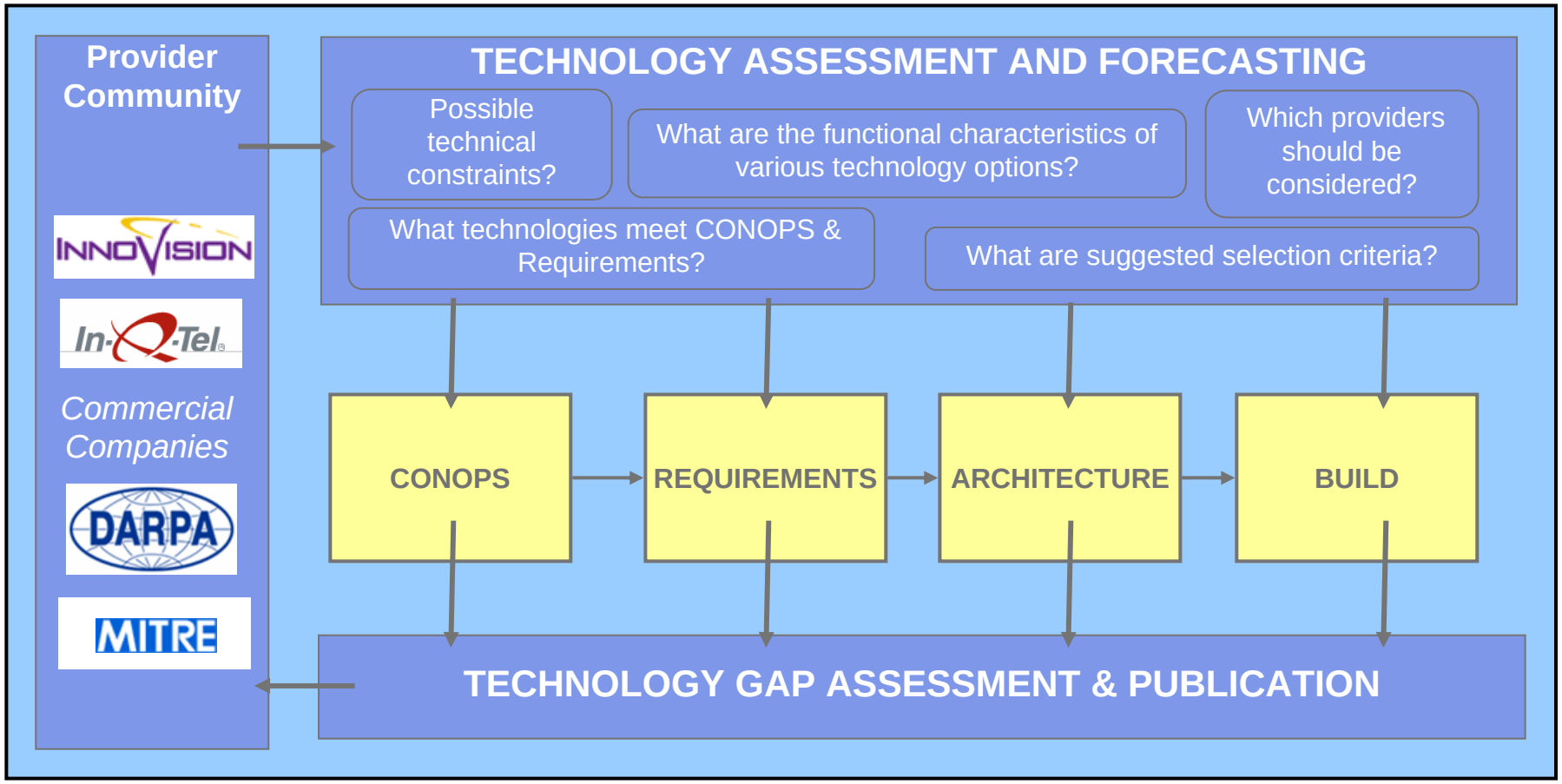
- Single log-on/query via NSG portal ("one-stop shop" access to NGA holdings)
- Analytical tool suite for posting GEOINT
- Accelerated system retirements
- Robust, reliable infrastructure across multiple security domains

- Customer support- self or full service access to holdings
- Integrated needs management
- Source marketplace
- Interoperable with DCGS 10.2
- Retire legacy/heritage (L/H) information management systems

- Predictive Analysis
- Increased Automation (upstream processing)
- Advanced exploitation/spectral analysis tools
- Visualization
- Complete L/H systems retirement

Technology Assessment Overview

Forecasting, Assessment, Insertion



Technology forecasting offers insights at all stages of system engineering.

Gap Analysis at each stage of engineering should be used to help guide R&D efforts

Challenges & Opportunities Block 3 Era

Tools Enrichment

Acquisition

- Automated Feature Extraction
  - As-is Condition:
    - Generally a manual and time consuming process
    - Current automated tools are highly specialized, slow, and/or non-accurate
  - To-Be Vision:
    - Automatic identification of a wide range of key features
    - Exploitation of multiple product formats
    - Machine error rates that are lower than human error rates
    - Rapid insertion of new feature types and categories
    - Automated meta-data labeling and entry into NGA libraries
  - Challenges
    - Multiple image conditions (brightness, angle of collection, proximity…)
    - Multiple feature forms (orientation, color, etc…)
    - Identify robust set of objects (any user defined type of object ?)
    - Achieve fast AFE processing rates
    - Extract partially hidden items
  - Remove/reduce false identification
    - Remove/reduce failure to identify items

Tools Enrichment

Acquisition

Challenges & Opportunities Block 3 Era *(con't.)*

- Automatic surveillance video clipping
  - As-is Condition:
    - Video surveillance difficult because of the thousands of non-relevant items that appear in most video
  - To-Be Vision:
    - Non-relevant items removed or shaded light in video allowing clear & easy viewing of object(s) of interest
    - Ability to define shading or removal patterns for what gets filtered away
    - Ability to define representation of items of interest and/or define items not of interest
  - Challenges
    - Automatic (or semi-automatic) identification and tracking of items of low interest
    - Automatic (or semi-automatic) identification and tracking of items of high interest
    - Ability to maintain identification of high and low interest items at speed of video
    - Provide to shade and/or remove entire items of high or low interest at speed of video

Tools Enrichment

Acquisition

Challenges & Opportunities Block 3 Era *(con't.)*

- Full site/target 3d model creation with attribution & multi-sensor signature characterization
  - As-is Condition:
    - Most 3D modeling tools (Keyhole, Skyline, World Wind) offer poor or no feature attribution or sensor signature characterization
  - To-Be Vision:
    - Extend Keyhole Markup Language "(KML) type" technologies to incorporate extraction, attribution, and reporting (visualization) of multiple sensor reporting information
    - Allow users to "turn on" or "turn off" various sensor representations to customize 3D representation experience
    - Intelligently determine which sensor representations under various situations will be of key interest to users under various situations
  - Challenges
    - Establish/Extend existing senor representation and 3D models for sensor representation in 3D representation environments
    - Automatically incorporate and optionally display multi-sensor signature information in a 3D modeling environment
    - Automatically determine which forms of sensor information will be most relevant and display only those that are most relevant

Challenges & Opportunities Block 3 Era *(con't.)*

Matching Data to Problem

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- Dynamic GeoSpatial Ontologies
  - As-is Condition:
    - Limited ability to correlate knowledge and information needs through time
  - To-Be Vision:
    - Automatically store or present relevant geospatial information for a given analyst problem
    - Use existing knowledge to automatically guide task and analysis operations for better knowledge through time
    - Automatically link relevant geospatial perspectives through time to provide a better overall perspective of current and likely future conditions
  - Challenges
    - Automatically filter for relevant information/products from large repositories of information for dynamic geospatial ontology development
    - Automatically connect and align correlated geospatial information products through time
    - Reformat different information sources into a common format framework so they can be shown in a single easily understood perspective across time
    - Highlight likely key items of interest in a given temporal perspective so analysts can visualize, understand key changes through time

Challenges & Opportunities Block 3 Era *(con't.)*

Matching Services to Problem

- Advanced Reasoning Meta Services
  - As-is Condition:
    - Difficult and highly labor intensive to know and call all relevant "services" that will contribute to a given information need
    - Most requests therefore apply only a small subset of available information services available to any given problem
  - To-Be Vision:
    - Automated, behind-the-scenes identification of available services
    - Automated identification of which services will contribute to a particular information request
    - Automated execution and integration of "lower level" services into higher level information content
  - Challenges
    - Automatically determine which information services (change detection, ATR, geo-registration, etc.) should be called to address a given information need
    - Automatically maintain an enterprise wide services catalog that matches enterprise users with enterprise systems & services
    - Automatically integrate results from multiple services to establish higher level knowledge representations
    - "Learn" from historical service calls and the resulting degree of success to improve future service use

Create Intelligence

Acquisition

Challenges & Opportunities Block 3 Era *(con't.)*

- Phenomenology Based Intelligence
  - As-is Condition:
    - Limited ability to automatically use observed environment conditions to construct situational intelligence
  - To-Be Vision:
    - Automatically gather and connect relevant environment conditions (temperatures, patterns of behavior, presence of certain chemicals, …) to establish knowledge of conditions of interest to the IC community (i.e. existence of a nuclear fuels factory)
    - Automatically look for and report conditions of interest
    - Explain reasoning applied and statistical degree of certainty
  - Challenges
    - Automatically identify conditions of interest
    - Automatically identify and establish rules for identifying conditions
    - Automatically identify which information sources are needed Identify probable conditions given available information
    - Map needed information sources against existing information sources and report gaps (what could be determined with additional info)
    - Analyze predictive quality and report reasoning applied

Create Intelligence

Acquisition

Challenges & Opportunities Block 3 Era *(con't.)*

- Multi-sensor alert notification and change detection for broad area search
  - As-is Condition:
    - Most sensors remain autonomous and cover limited geospatial or spectral limits hindering broad area search
  - To-Be Vision:
    - Sensors automatically share their needs and available data
    - Data generated in two or more sensors combine to show what neither alone can demonstrate (1+1=4)
    - Improved sensor abilities for change detection
    - Automated, real time reporting when combinations of sensor data indicate key change
  - Challenges
    - Improved/new means for inter-sensor communication among similar and disparate type sensors
    - Improved means for generating "meaning" when differing data is matched against each other
    - Improved/new means for reporting change detection with multiple sensor types (for example, chemical and heat changes, but no discernable visible change – how to report)
    - Improved/new means for reporting, holding, correlating, analyzing, & reporting multiple sensor conditions using large intelligence libraries

Challenges & Opportunities Block 3 Era *(con't.)*

Create Intelligence

Acquisition

- Enterprise Ontologies
  - As-is Condition:
    - Increased knowledge needed for optimal design of enterprise ontology layers, semantic mapping paradigms, and domain mapping techniques
  - To-Be Vision:
    - Better research validated guidance in the design of analyst-facing knowledge bases for analyst alerts, automated intelligence production, meta services, and other geospatial gathering, processing and information reporting
  - Challenges
    - How should enterprise knowledge bases be partitioned? (topic, issue, target, …)
    - Is OWL representation and DL inferencing adequate?
    - How many ontology layers should exist (upper, mid-level, and/or domain)?
    - What type of semantic linking/mapping approach should be considered (compose/merge, mapping to upper level, or direct domain mapping)?
    - Can an enterprise ontology be factored into manageable, shareable pieces?
    - What are performance considerations of various ontology options?

Create Intelligence

Acquisition

Challenges & Opportunities Block 3 Era *(con't.)*

- Prior Behavior Guided Reasoning[1]
  - As-is Condition:
    - Human reasoning outperforms automated systems in many areas but humans don't/can't instruct automated systems to replicate this reasoning
  - To-Be Vision:
    - Automatically identify the behavior patterns displayed by highly effective analysts - particularly against large databases
    - Automatically analyze and replicate these reasoning patterns for autonomous analysis or to serve as an automated "assistant" to improve analytical performance
  - Challenges
    - Automatic identification of the "meaning" of behavior patterns that lead to quality analysis research, analysis, and reporting
    - Automated replication of useful reasoning behavior patterns, applied to new similar problems
    - Assessment of behavior patterns that indicate strengths and/or weakness of reasoning applied by analysts and automated tools
    - Recommendations for optimal integration and coordination of various pockets of reasoning resources - whether automated or human

1. Adopted from ARDA's Novel Intelligence from Massive Data initiative. See http://www.ic-arda.org/Novel_Intelligence/index.html

NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

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