



J2K Migration into the Distributed Common Ground System (DCGS)



DCGS Overview

- The Distributed Common Ground System (DCGS) is an interoperable architecture to correct the Processing, Exploitation, Dissemination (PED) deficiencies identified during DESERT STORM.
 - Defines how IMINT, SIGINT, MASINT and other MULTI-INT data will be tasked, processed, exploited, disseminated and archived across DoD agencies.
 - Encompasses Army, Navy, Air Force, Marine Corps collection platforms.



DCGS Overview

DCGS Challenges

NIMA and DOD Have Identified 10 Challenges to the DCGS Architecture

Challenge	JPEG 2000 Opportunity
1) Cross Platform Capability	
2) Collection and Exploitation Management	✓
3) Mult-INT Exploitation and Dissemination	1/2 ✓
4) Exploitation and Dissemination of Coalition Data	✓
5) TCPED for MTI, MSI, and HSI Data	✓
6) Correlation, conflation and Data Synthesis of I3GI (<i>Data fusion</i>)	1/2 ✓
7) Incorporation of Future Imagery	✓
8) Dissemination of Data from DCGS	✓
9) Security	1/2 ✓
10) Accomplish Real-Time PED	✓



DCGS JPEG 2000 Migration Objective

- Objective: Determine the requirements and impacts of migrating JPEG 2000 into the DCGS Architecture
 - Improve Processing, Exploitation and Dissemination (PED) efficiency
 - Initial task focusing on PED of Tactical sensors
 - Faster product delivery timelines
 - Support the testing of compliance to NITFS 2.1 JPEG 2000 Requirements

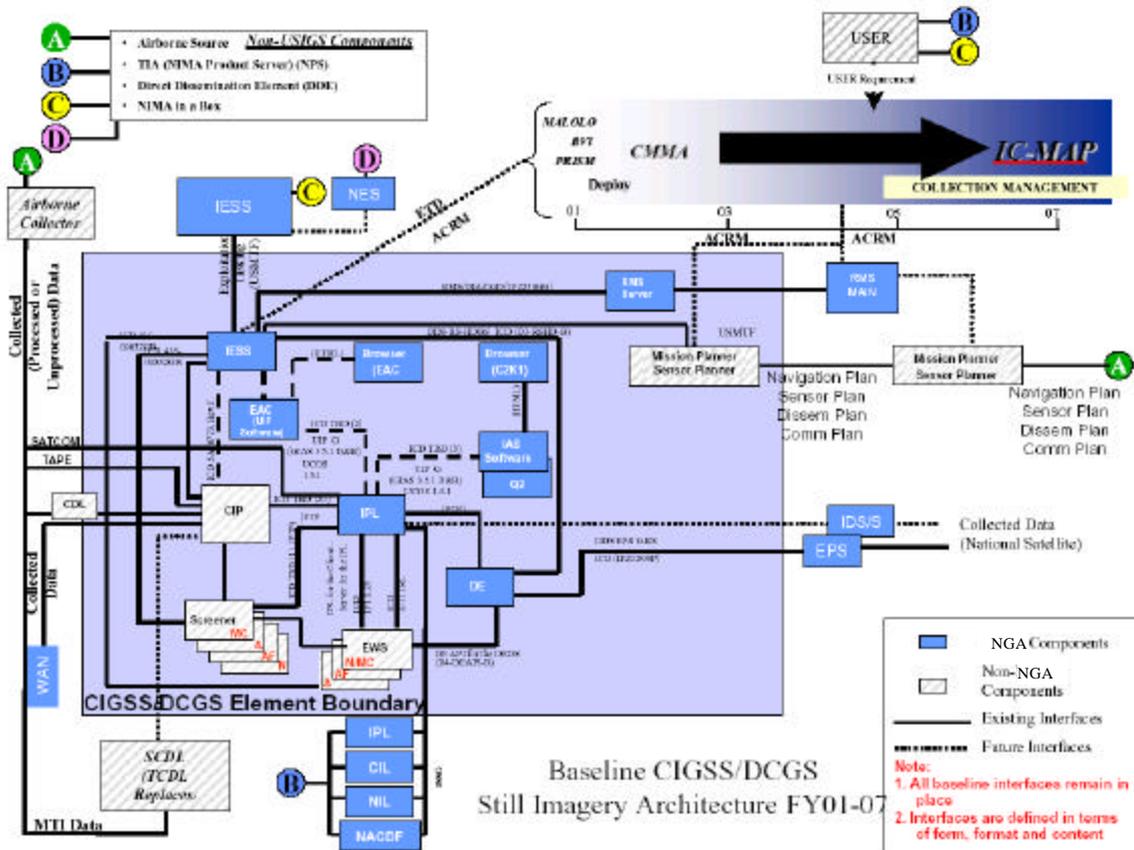


DCGS JPEG 2000 Migration Approach

- Perform extensive research into existing DCGS/tactical architectures
 - Sensor-to-archive image chain analysis
 - Review current and future DCGS architecture
 - Report results into 4 documents
 - DCGS JPEG 2000 Migration Plan
 - First draft delivered 19 Dec 03
 - DCGS JPEG 2000 Migration Technical Requirements
 - First draft delivered 19 Jan 04
 - DCGS Tactical Sensor Flow Diagrams
 - First draft delivered 20 Jan 04
 - Best Practices Document
 - Due 30 July 04



DCGS JPEG 2000 Migration Approach



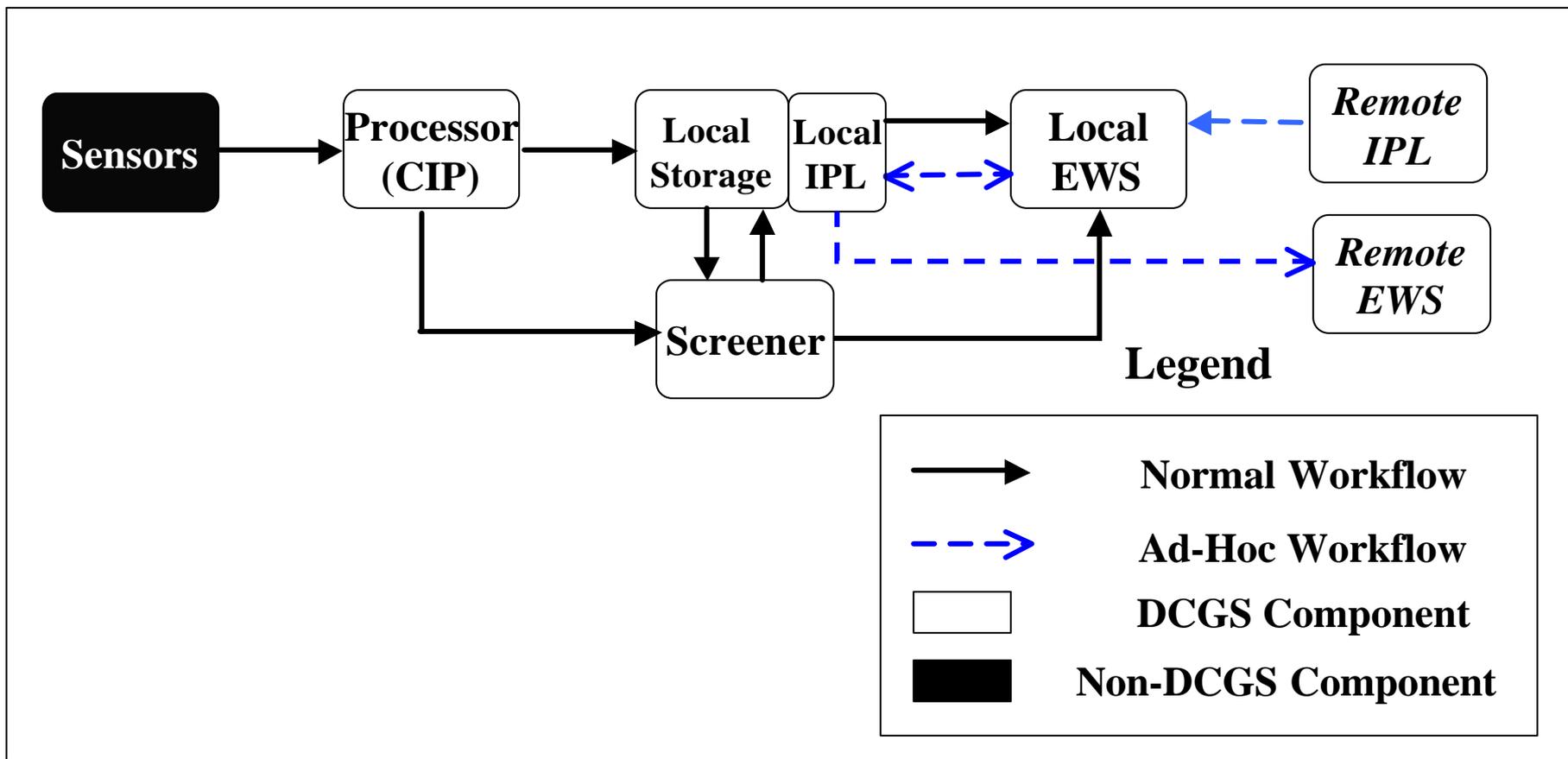
Derived 6 basic blocks that are impacted by JPEG 2000 within the DCGS architecture

Baseline DCGS Architecture



DCGS JPEG 2000 Migration Approach

Six Basic Components





DCGS JPEG 2000 Migration Approach

- Developed a “phased” approach to migrate JPEG 2000 into the DCGS architecture
 - **Phase 1: Enable the DCGS Architecture to use JPEG 2000**
 - Enable DCGS components to ingest/output NITF 2.1 JPEG 2000 file format
 - Lay the ground work for DCGS components to take advantage of JPEG 2000 advanced features (e.g. JPIP)
 - Provide DCGS components with the most efficient methods of implementing JPEG 2000



DCGS JPEG 2000 Migration Approach

- **Phase 2A: JPEG2000 Internet Protocol (JPIP)
Enabled Client/Server Environment**
 - Enable DCGS components to request and decode specific portions of a larger image from a JPEG 2000 image server

- **Phase 2B JPEG 2000 Advanced Features**
 - **On-board sensor hardware support for JPEG 2000 encoding**
 - **HSI/MSI compression**
 - **Motion JPEG 2000**

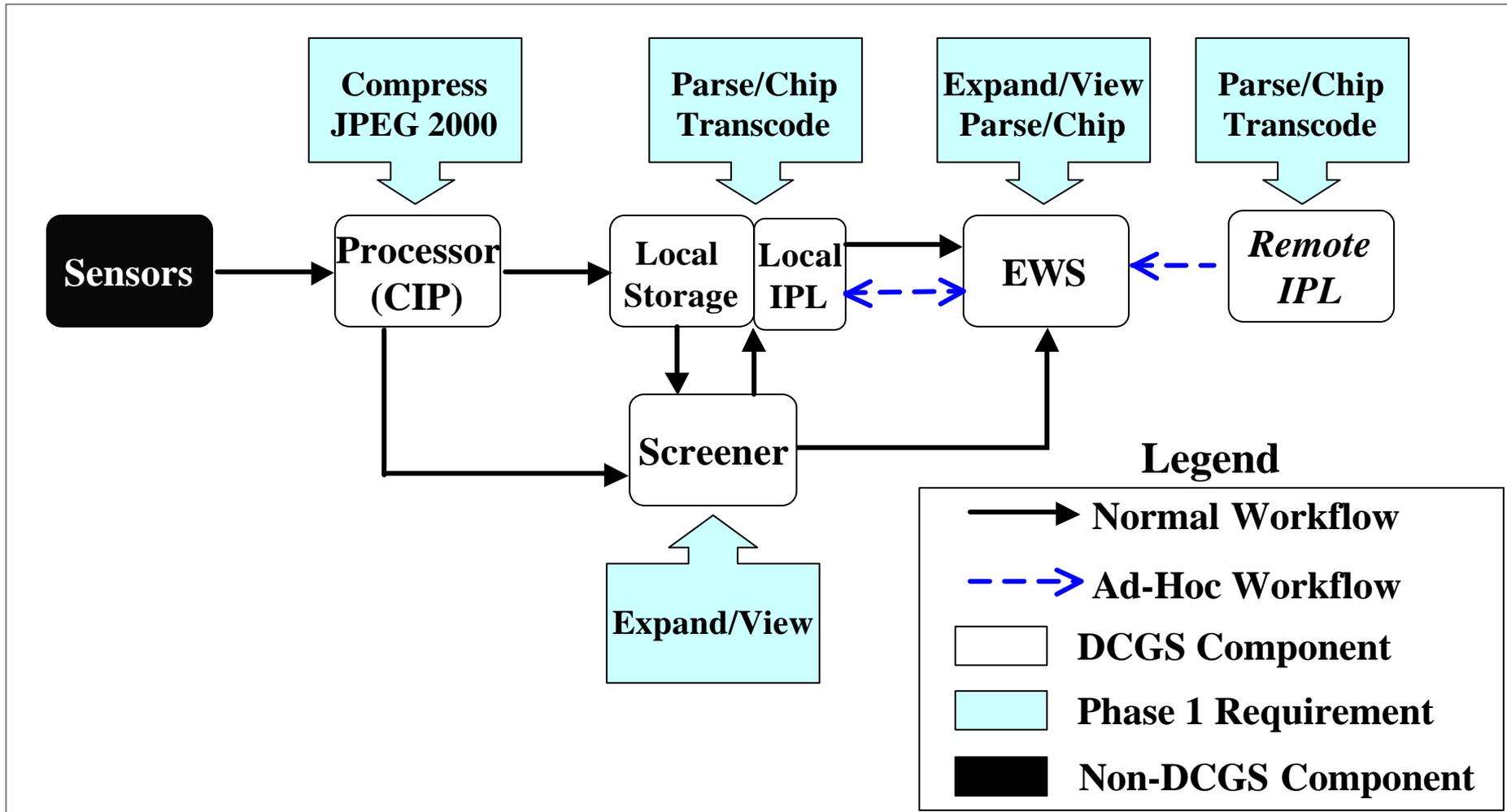


JPEG 2000 Compression Capabilities

- We have broken down the JPEG 2000 functionality into 3 basic capabilities
 - **J2K Compress** – NITF 2.1 JPEG 2000 images should be compliant with the ISO/IEC BIF Profile for JPEG 2000
 - **J2K Parsing/Chipping** – Performing modifications directly on a compressed image file or portions of an image file and extracting images with specified resolution, quality, and region parameters
 - **J2K Decode/Display** – The ability to present an image at various resolutions, qualities, and regions of interest from a JPEG 2000 image reading only the relevant information from the file

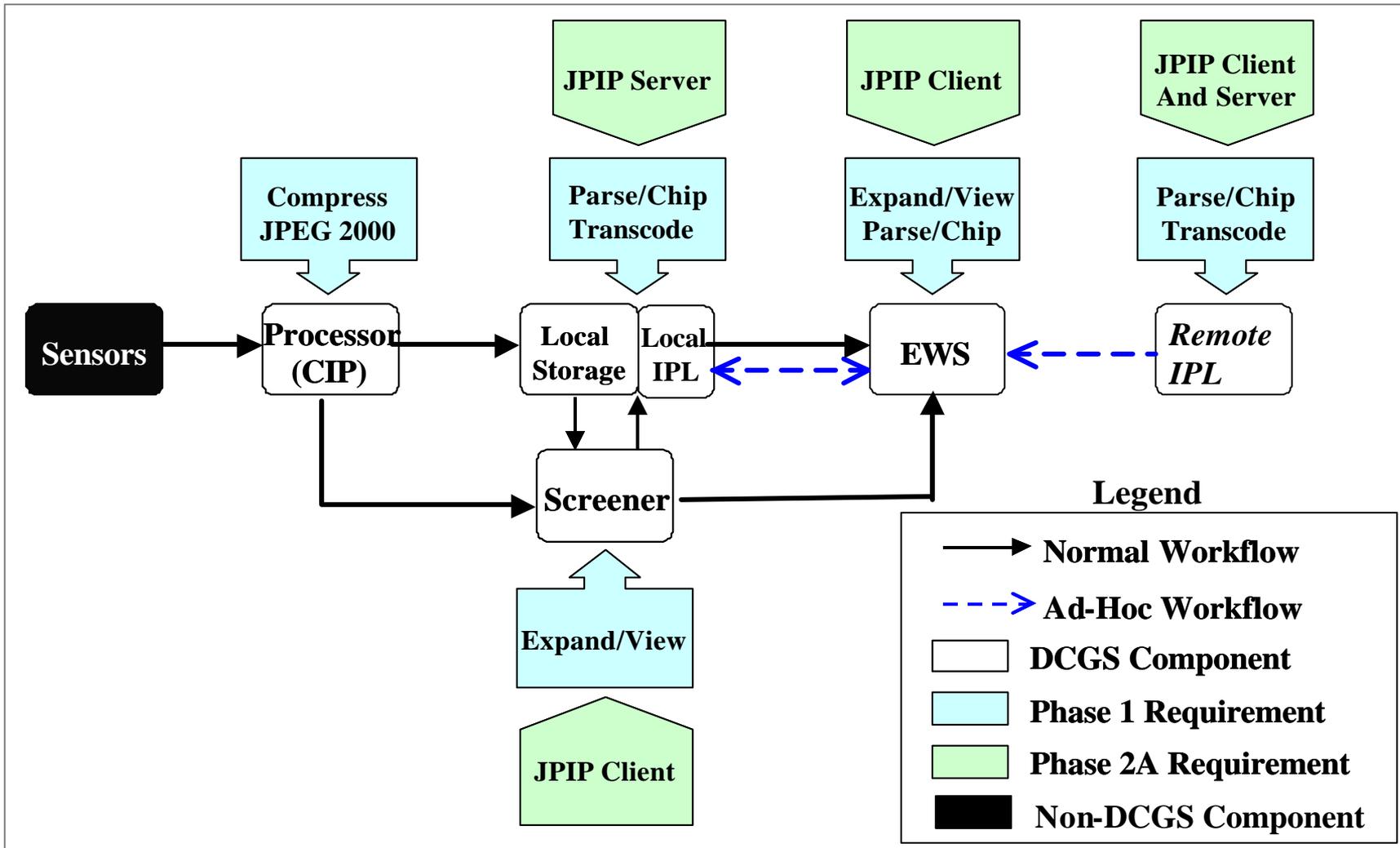


Phase 1: Enabling the DCGS Architecture to use JPEG 2000



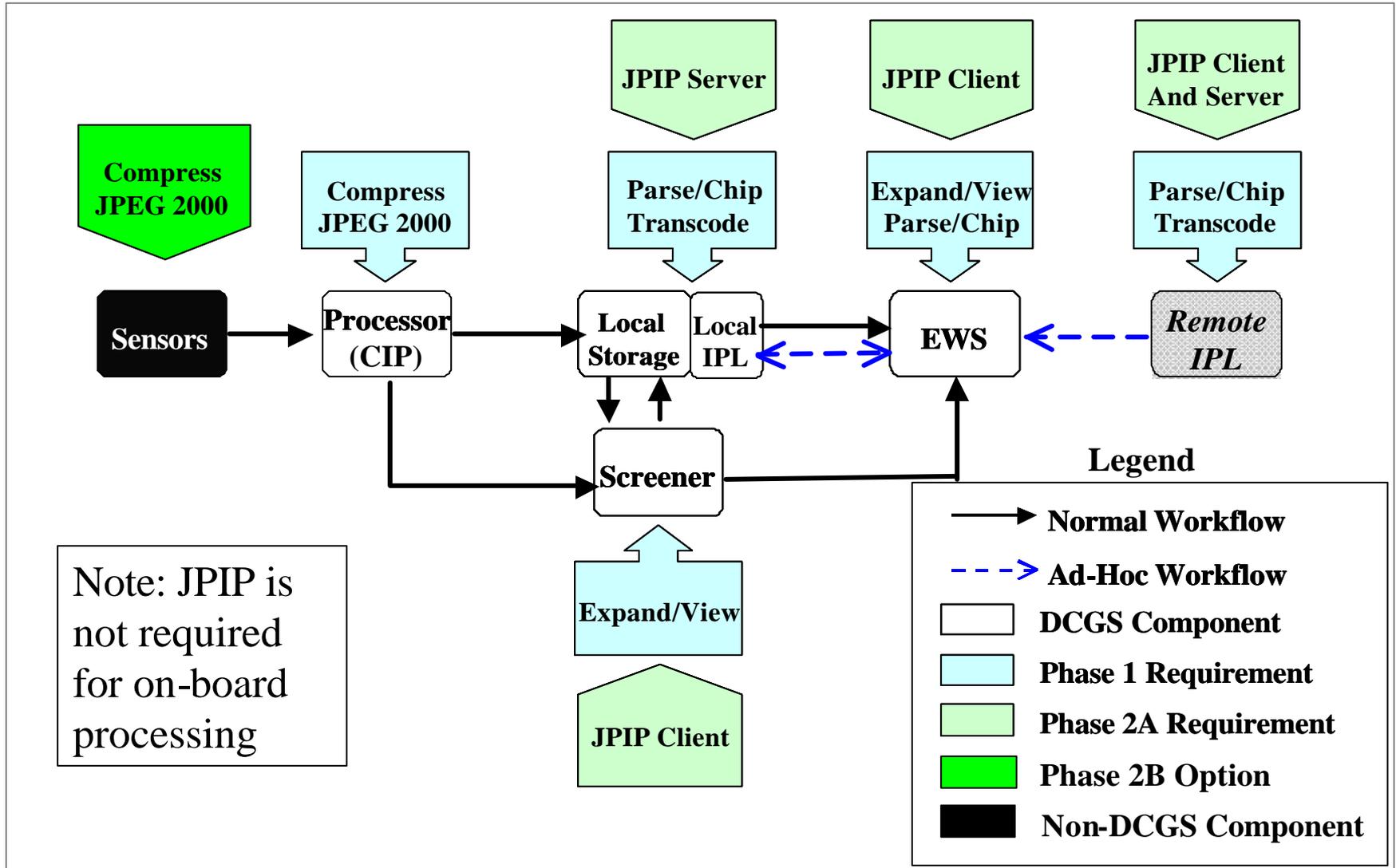


Phase 2A: JPIP



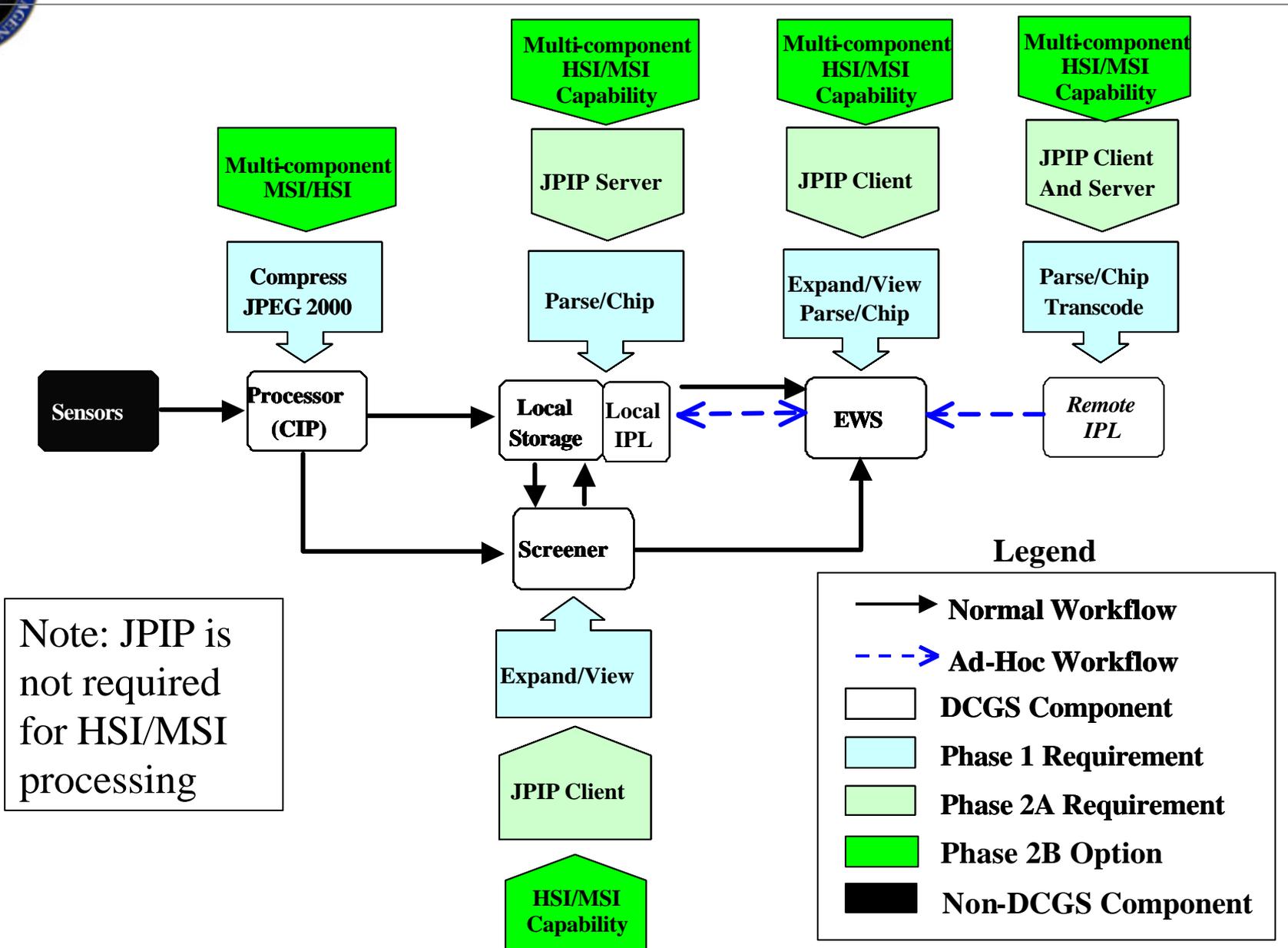


Phase 2B: On-board Processing



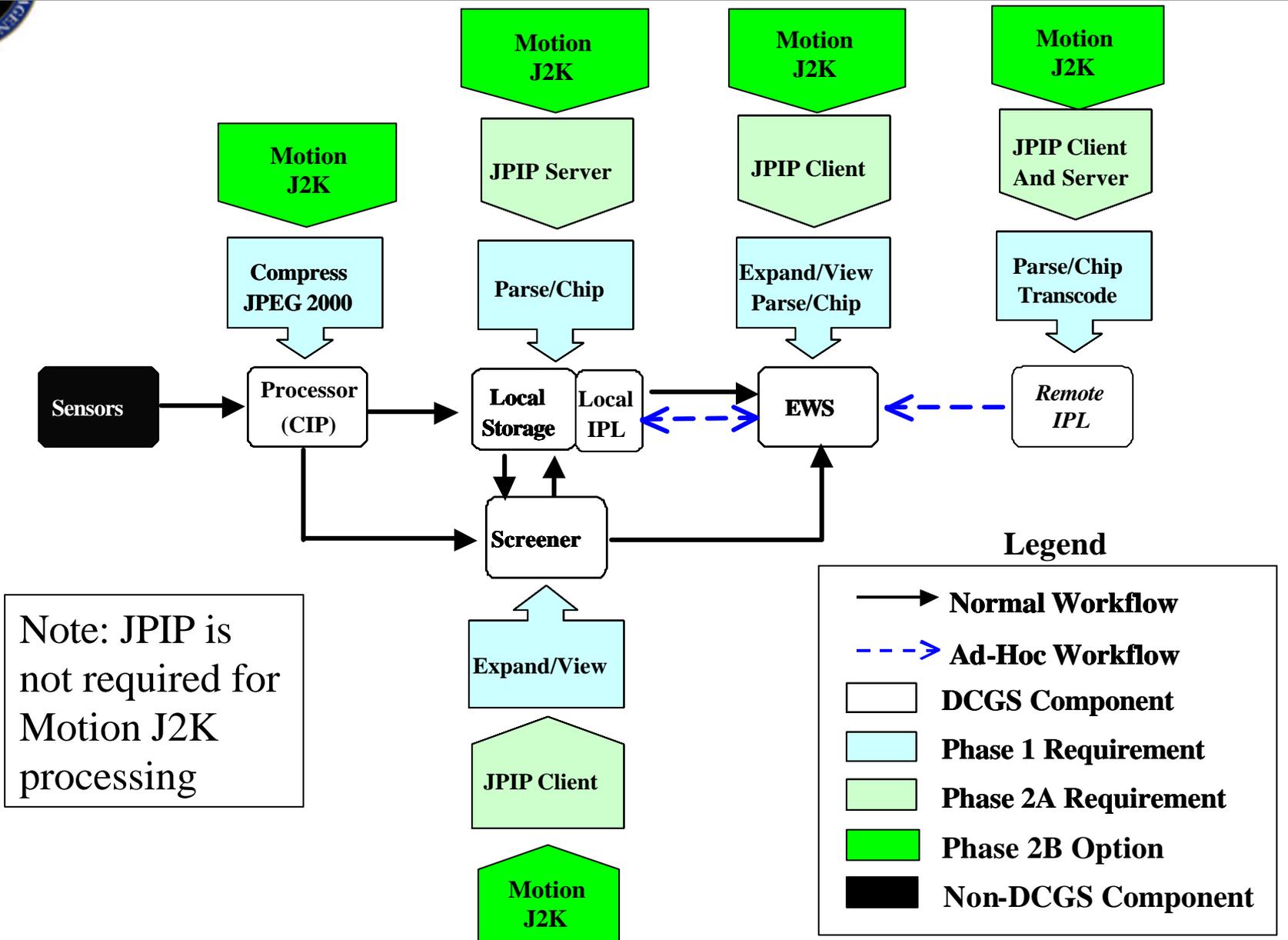


Phase 2B: HSI/MSI





Phase 2B: Motion JPEG 2000



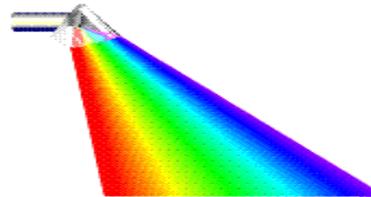


DCGS JPEG 2000 Compliance

- CIP
 - CIP is currently planning JPEG 2000 Compliance
- Library/IPL
 - NGA Library 4.0 Image Product Library 4.0

BAE SYSTEMS

- EWS
 - IEC
 - ERDAS Imagine
 - Mapping Science
 - Paragon ELT
 - Remote View
 - ENVI - IAS



Team-IEC

Leica
Geosystems

Sensor Systems





Back Up charts



CIP: Requirements and Impact

- CIP
 - Requirements
 - Images will be compressed into NITF 2.1 JPEG 2000 format according to the ISO/IEC BIIF Profile for JPEG 2000
 - Impact
 - Increased processing cost for the CIP
 - Decreased processing/bandwidth requirements for all components downstream of the CIP



Screeener Workstation: Requirements and Impact

- Screeener Workstation
 - Requirements
 - Ability to decode NITF 2.1 JPEG 2000 images at various resolution and quality levels
 - Impact
 - Reduced processing requirements
 - Faster viewing of large imagery



EWS: Requirements and Impact

- EWS
 - Requirements
 - Ability to decode NITF 2.1 JPEG 2000 images at various resolution and quality levels
 - Ability to parse and repackage NITF 2.1 JPEG 2000 images for creation of exploited products
 - Impact
 - Improved image quality for exploitation
 - Increase image serving flexibility
 - Decreased processing requirements



IPL: Requirements and Impact

- IPL/Local Image Library
 - Requirements
 - Ability to parse and repackage NITF 2.1 JPEG 2000 images
 - Ability to convert legacy formats to NITF 2.1
 - Impact
 - Only required portions of data are sent to various workstations and end users
 - Reduction in processing and bandwidth requirements
 - Reduced storage requirements
 - Improved image quality for secondary dissemination
 - Ability to handle larger volumes of imagery



Phase 2A: JPIP Incorporation Requirements and Impact

- Screener
 - Requirement
 - JPIP Client Functionality
 - Impact
 - Additional bandwidth and processing savings
 - Interactive browsing and roaming of imagery
- EWS
 - Requirement
 - JPIP Client Functionality
 - Impact
 - Additional bandwidth and processing savings
 - Interactive browsing and roaming of imagery



Phase 2A: JPIP Incorporation Requirements and Impact Cont'd

- IPL/Local Image Library
 - Requirement
 - JPIP client/server functionality
 - Ability to serve JPIP streams to local workstations and secondary users
 - Impact
 - Ability to interactively serve imagery
 - Large additional savings in bandwidth requirements
 - Ability to handle increased amounts of imagery and simultaneous users



Phase 2B: HSI/MSI Incorporation Requirements and Impact

- CIP
 - Requirements
 - Images will be compressed into the NITF 2.1 Hyper/Multispectral JPEG 2000 format according to the processing guide
 - Impact
 - Increased processing cost for the CIP
 - Decreased processing/bandwidth for components downstream of the CIP
- Screener
 - Requirements
 - Ability to decode NITF 2.1 Hyper/Multispectral JPEG 2000
 - Impact
 - Improved bandwidth and processing



Phase 2B: HSI/MSI Incorporation Requirements and Impact Cont'd

- EWS
 - Requirement
 - Ability to decode Hyper/Multispectral NITF 2.1 at various resolutions and quality levels
 - Ability to select quality, resolution, and location as well as chip by simple parsing for image products
 - Impact
 - Improved image quality for exploitation



Phase 2B: HSI/MSI Incorporation Requirements and Impact Cont'd

- IPL/Local Image Library
 - Requirement
 - Ability to decode Hyper/Multispectral NITF 2.1 imagery
 - Ability to select quality, resolution and location as well as chip by simple parsing
 - Ability to convert legacy formats to Hyper/Multispectral JPEG 2000
 - Impact
 - Only required portions of data are sent to various workstations and end users
 - Image does not need to be decompressed or recompressed to change resolution or bit rate, or to chip
 - Large savings and bandwidth requirements
 - Reduced storage requirements
 - Improved image quality for secondary dissemination
 - Ability to handle larger volumes of imagery



Phase 2B: MJ2K Incorporation Requirements and Impact

- CIP
 - Requirement
 - Video will be compressed into the Motion JPEG 2000 format according to the processing guide
 - Impact
 - Increased processing cost for the CIP
 - Decreased processing/bandwidth requirements for components downstream of the CIP

- Screener
 - Requirements
 - Ability to decode Motion JPEG 2000
 - Impact
 - Improved bandwidth and processing



Phase 2B: MJ2K Incorporation Requirements and Impact Cont'd

- EWS
 - Requirements
 - Ability to decode Motion JPEG 2000 at various resolutions and quality levels
 - Impact
 - Improved image quality for exploitation



Phase 2B: MJ2K Incorporation Requirements and Impact Cont'd

- IPL/Local Image Library
 - Requirements
 - Ability to decode Motion JPEG 2000
 - Ability to transcode legacy formats to Motion JPEG 2000
 - Impact
 - Only required portions of data are sent to workstations and end users
 - Video does not need to be decompressed and recompressed to change resolution or bitrate, or to chip
 - Large savings in bandwidth requirements
 - Reduced storage requirements
 - Improved image quality for secondary dissemination