ASSOCIAZIONE ARMA AERONAUTICA
Centro Studi Militari Aeronautici Giulio Douhet

Future J-ISR

CASD – Roma 10 Ottobre 2013

Big Data Processing

Filippo Gemma - GMSPAZIO

Future J-ISR

Future J-ISR

Joint Intelligence, Surveillance and Reconnaissance (JISR) is an activity that synchronizes and integrates the planning and operation of all collection capabilities with exploitation and processing and the dissemination of the resulting information to the right person, at the right time, in the right format, in direct support of current and future operations.

JISR encourages the dynamic, agile and coordinated use of platforms, sensors and systems to support a wide range of staff functions.

NATO determination to improve its capability to operate J-ISR efficiently is evident. The following NIAG Studies demonstrate this interest:

NIAG SG-087
: New Technology for ISR and TA of Terrorists

NIAG SG-113
: NATO ISR Interoperability Architecture in Conjunction with TRIAL QUEST

NIAG SG-118
: Short Range Surveillance and Reconnaissance and Data Fusion for Urban Warfare

NIAG SG-121
: Technologies for Monitoring and Tracking for Situation Awareness in Urban Areas

NIAG SG-147
: New Technologies for Networked Based Still Imagery Dissemination and Exchange Services 1

NIAG SG-161
: Cooperative Civil Military Information and Intelligence Exchange in Support of Consequence Management Ops

NIAG SG-164
: The Industrial Contribution to Joint ISR Trial UNIFIED_VISION_2012

NIAG SG-178
: Improvement and Automation of Processing, Exploitation and Dissemination (PED) of Imagery Products

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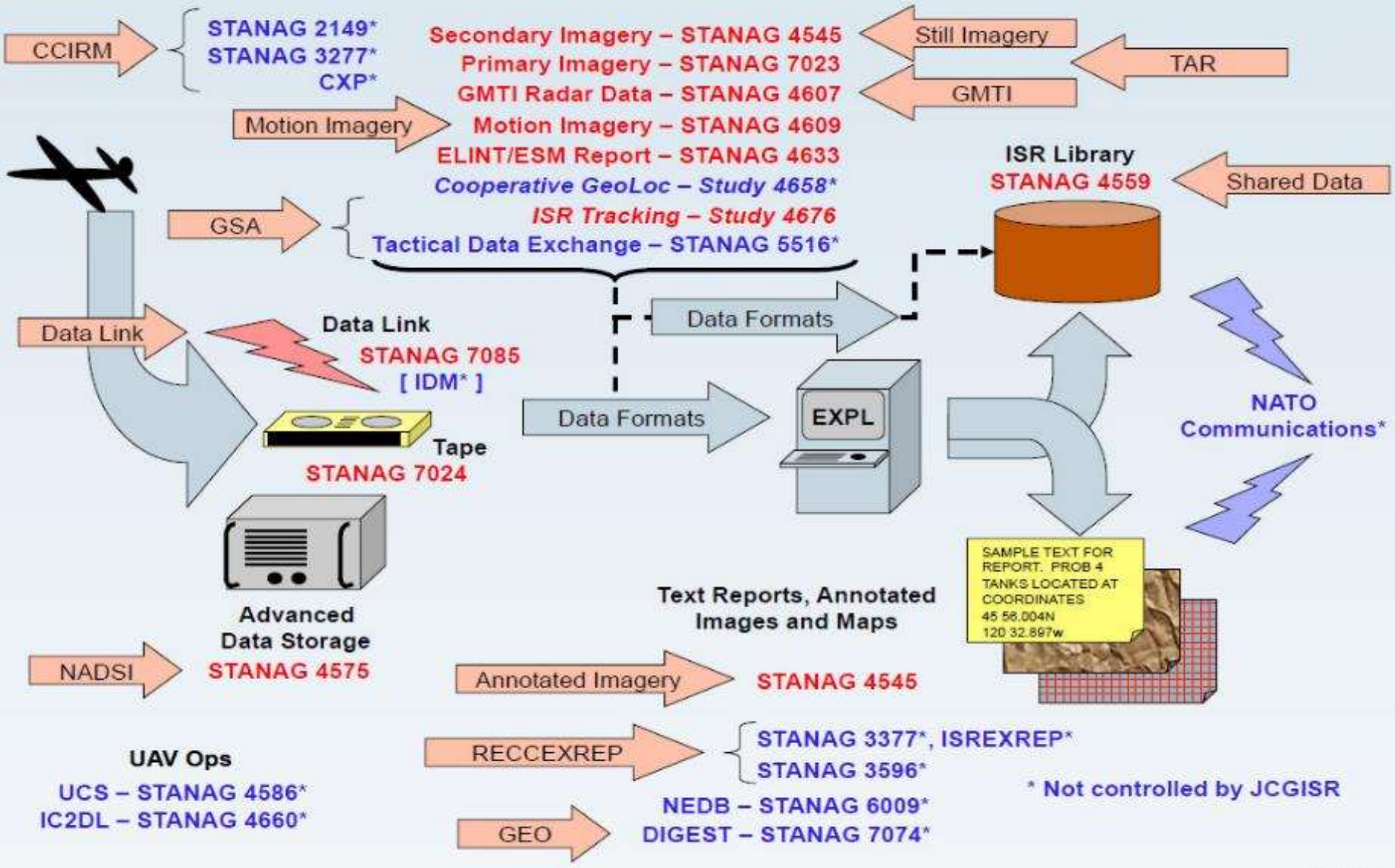
I am honored to be part of NIAG SG-178 team and once obtained the permission to share study progresses from the study Rapporteur Mr. Rob Munday, today's conference speaker, I will run also through them during my presentation.

PED Processes

- **Phase 1**: Rapid, near-real-time callouts of sensor data
  - Combat Information; performed by reconnaissance vehicle crew
  - Analyst callout
  - Correlation with red/blue/green/white forces
- **Phase 2**: Initial sensor data annotated still images and motion video can supplement Phase 1
- **Phase 3**: In-depth analysis of sensor data, possibly fused with other sources, resulting in an intelligence product
- Relevant **imagery**: Still (pan, multispectral, hyperspectral, IR), motion (video), SAR, GMTI radar
- Relevant **platforms**: aircraft, UAS, satellites

Courtesy of NIAG SG-0178 Study Rapporteur – Mr.Rob Munday

Imagery Profile of the NIIA (NATO ISR Interoperability Architecture)



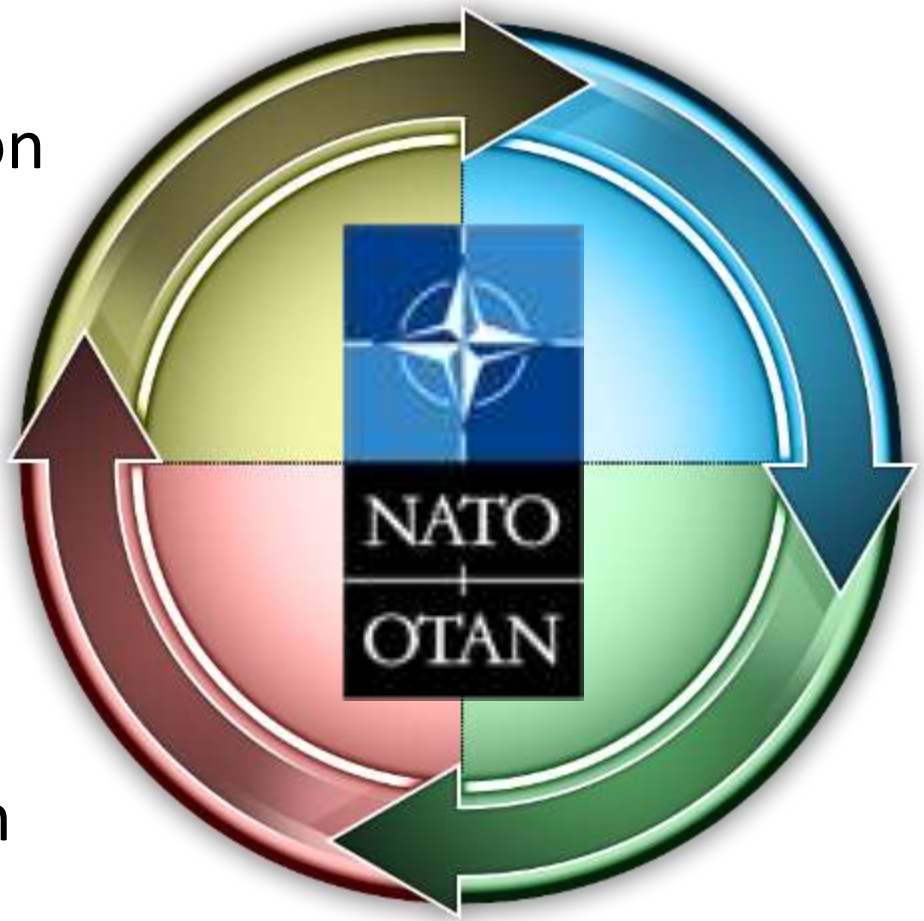
Courtesy of NIAG SG-0178 Study Rapporteur – Mr.Rob Munday

TCPED Model

Tasking Mission

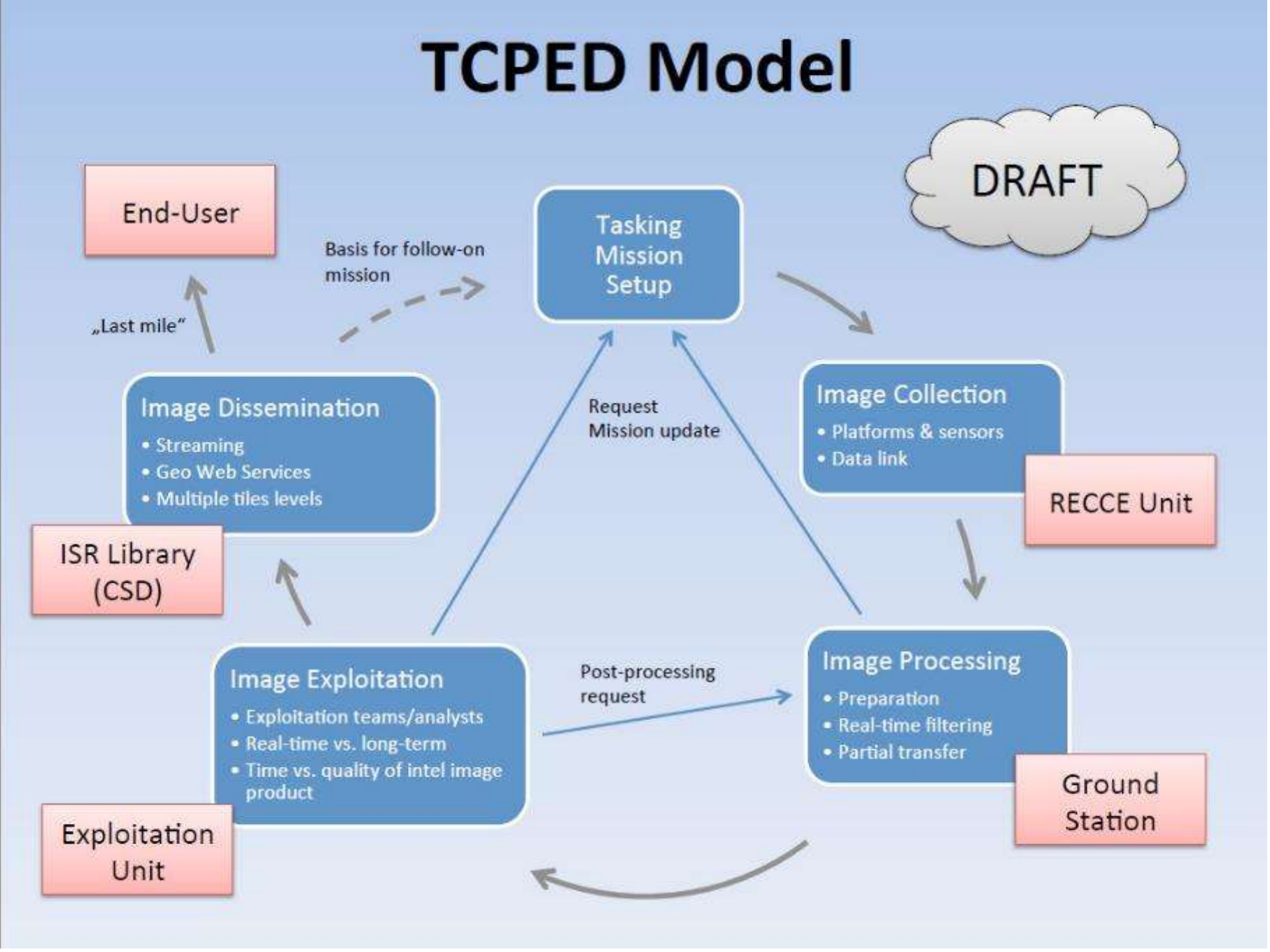
Data Dissemination

Data Collection



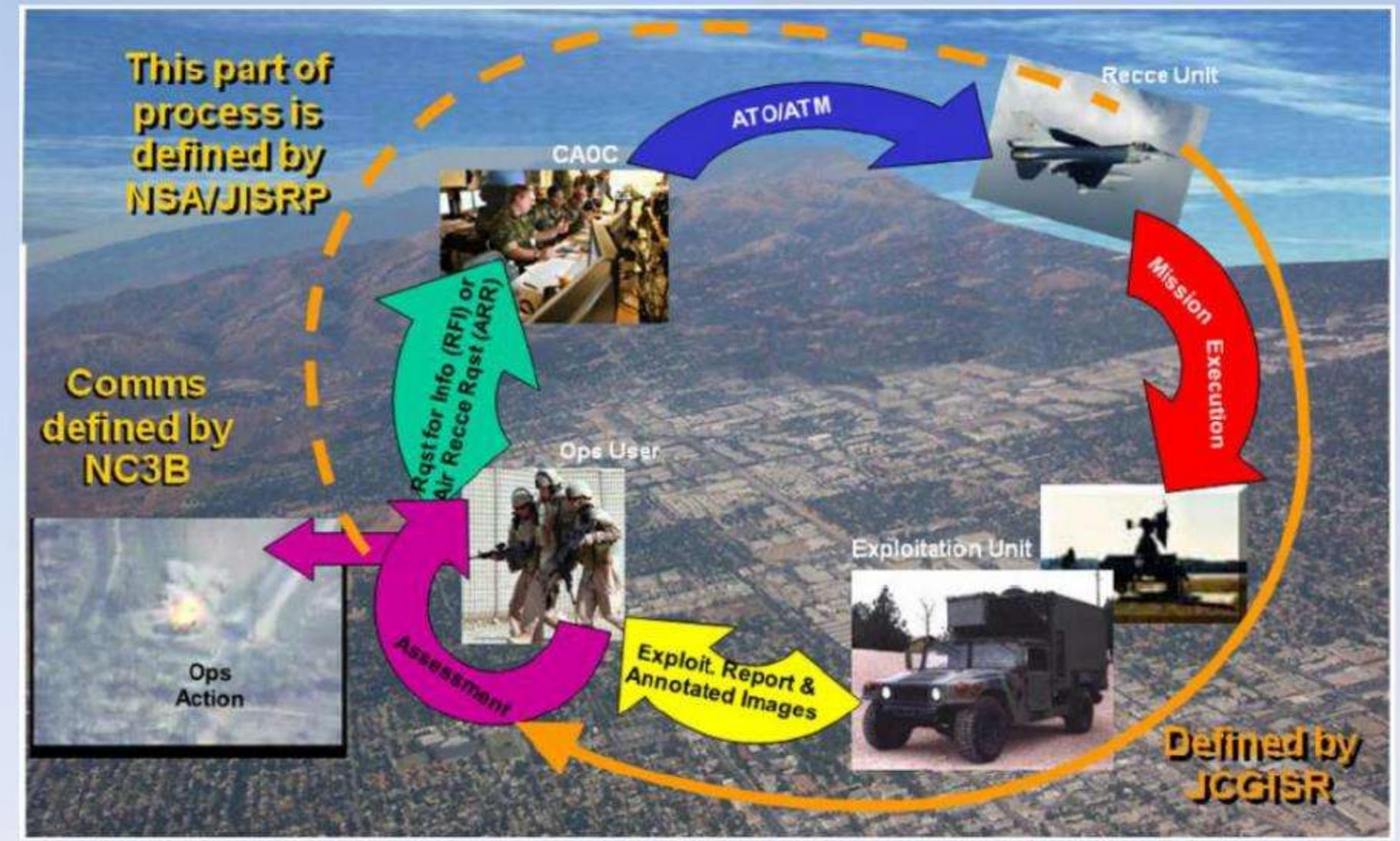
Data Exploitation

Data Processing



Courtesy of NIAG SG-0178 Study Rapporteur – Mr.Rob Munday

NATO Recce Cycle Information Flow



Courtesy of NIAG SG-0178 Study Rapporteur – Mr.Rob Munday

GM SPAZIO

Big Data Processing

Heaven or Hell ? Opportunity or problem ?

and BigData management

GSAT SSA
for Italian MoD

Hundreds of Geobelt
Astro Images

SATM BPC
for Italian
Ministry of Interior

EO Images & Ship detection

SITA Project
Italian Carabinieri

- 100.000 km2 Southern Italy
- 4 full coverages in 1 year
- > 1.000 raw images from 7 Sats
- Orthorectification & Mosaiking
- ISO 19115 XML Metadata

GSC2
Maritime
Surveillance

Millions of AIS data
for real-time
Sea surveillance

UAV Trial
ENEL Distribuzione

- 100 km MLV Power Lines
- > 12.000 UAV images
- Near Real Time GeoRefer.
- Images analysis
- Anomalies Warnings

MISTRALS Project
Campania Region

- 13.500 km2 - 551 Municipalities
- 4 full coverages in 2 years (T0 ÷ T3)
- 3 comparisons for each municpality
- 1.653 layer for new buildings
- 1.653 layer for modified buildings
- More than 30.000 differences

Imaging Sources: Satellite, Aircraft/UAV, Ground

Color Maps

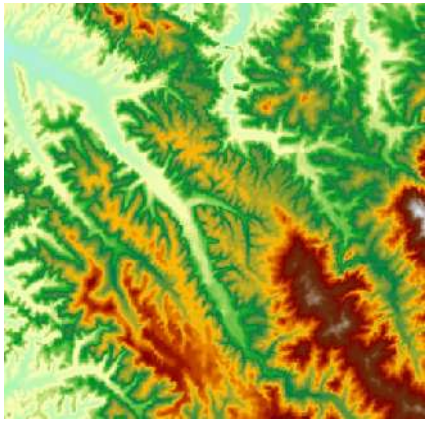
B/W Maps

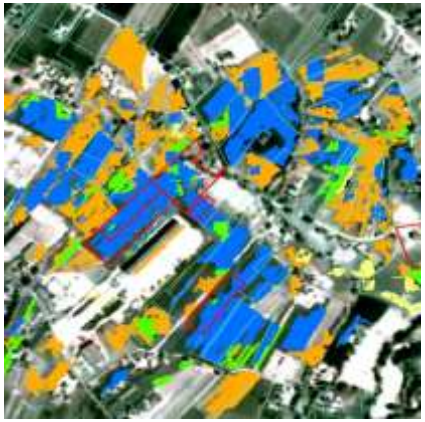
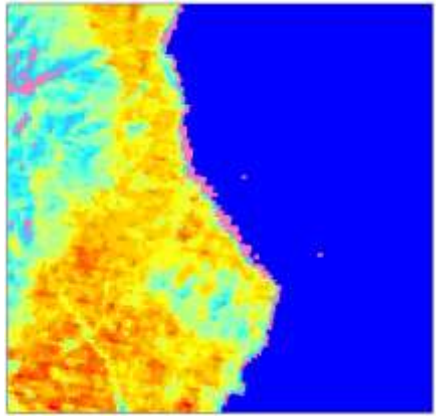
Thermal Maps

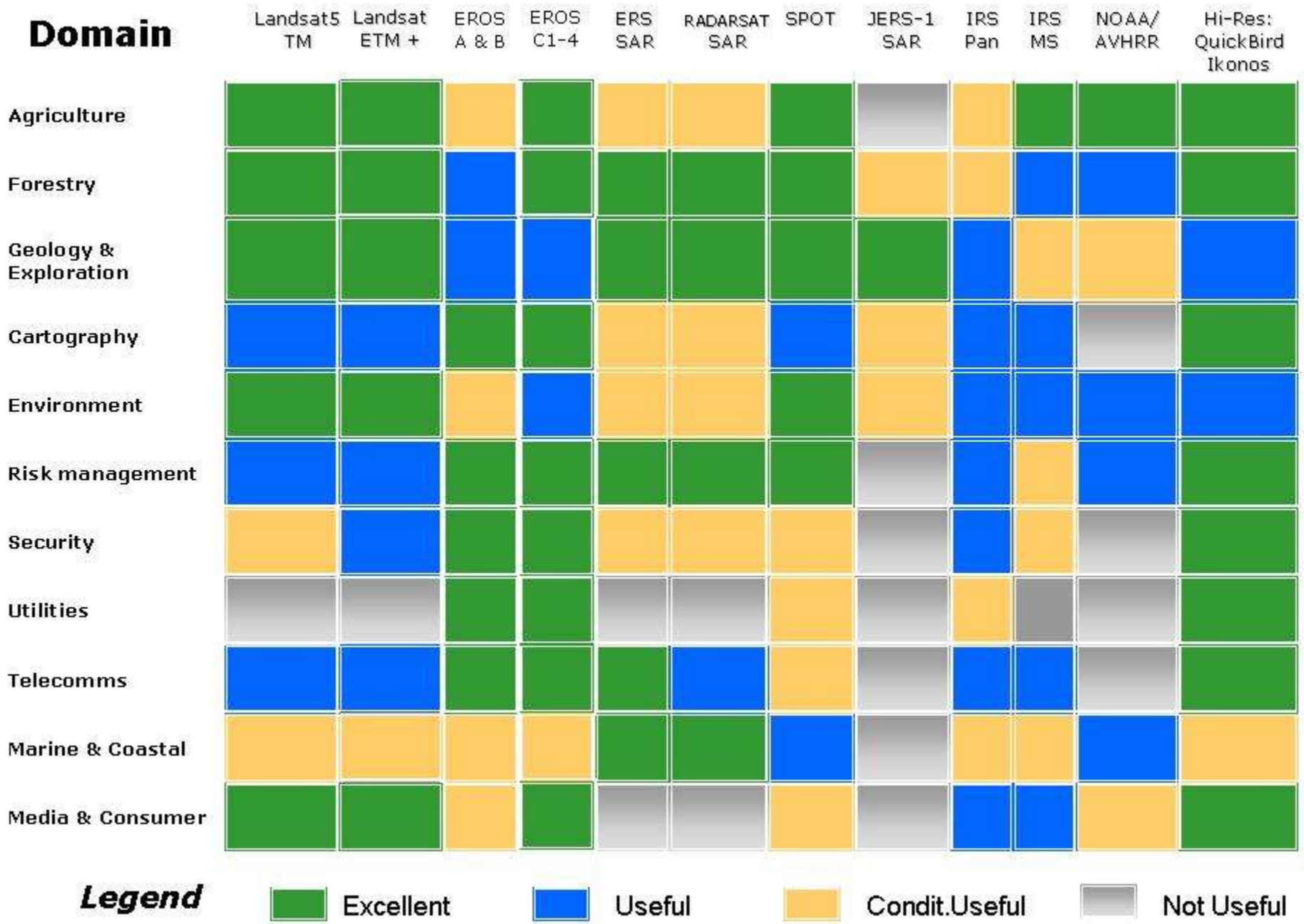
DEMs

VAPs for DEM

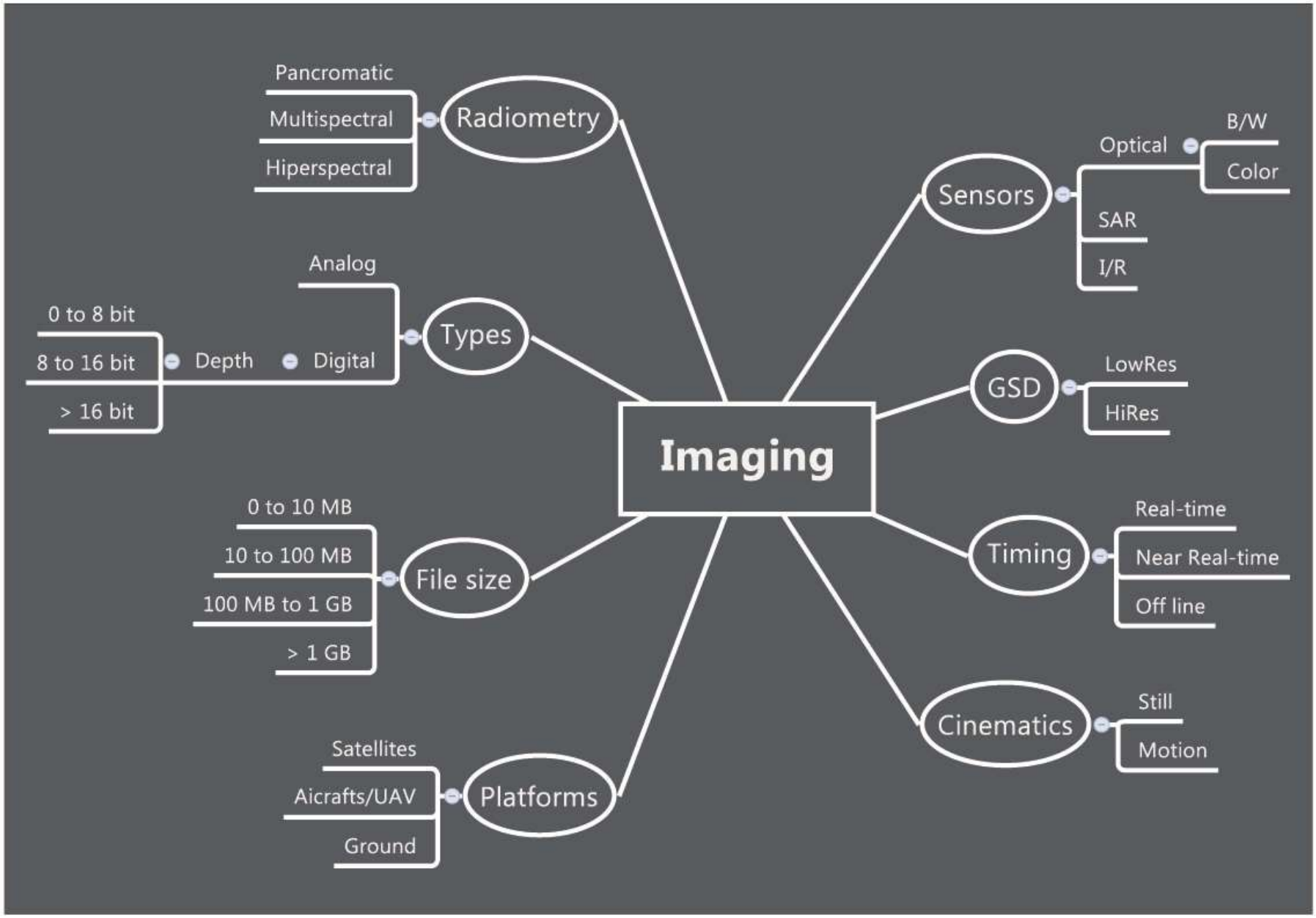
Classification




Domain
Landsat5 TM
Landsat ETM +
EROS A & B
EROS C1-4
ERS SAR
RADARSAT SAR
SPOT
JERS-1 SAR
IRS Pan
IRS MS
NOAA/ AVHRR
Hi-Res: QuickBird Ikonos
Agriculture
Forestry
Geology & Exploration
Cartography
Environment
Risk management
Security
Utilities
Telecomms
Marine & Coastal
Media & Consumer
Legend
Excellent
Useful
Condit.Useful
Not Useful

Big Data Processing



Satellite Images Evolution (Processing & Exploitation)

Years ago	GSD (m)	Average size (Mbytes)	Area Covered (SqKm)	Swat (km)	Syst Proc. (min)	Geo Proc. (min)	V.A.P. Proc. (min)
20	30÷10	400÷60	32400÷3600	180÷60	80÷30	60÷60	240
10	10÷0,5	800÷150	3600÷120	60÷10	20÷15	40÷20	120
today	2÷0,1	6000÷400	1000÷50	30÷5	20÷10	20÷10	60÷10

PRO	CONS
Reduced Processing Time	Greater Image Size
Higher GSD	GCP Shortage
	Higher Storage Capacity

TLC Evolution (Dissemination)

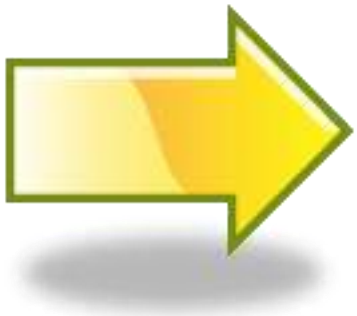
Years ago	Speed (kbps)	Users (millions)
20	1000÷9,6	1
10	20.000÷32	500
today	O.F.÷32	2.000

PRO	CONS
Increased Data Transfer	Greater Image Demand
Quicker Data Availability	Bandwidth Shortage
	Higher Network Complessity

TCPED Evolution

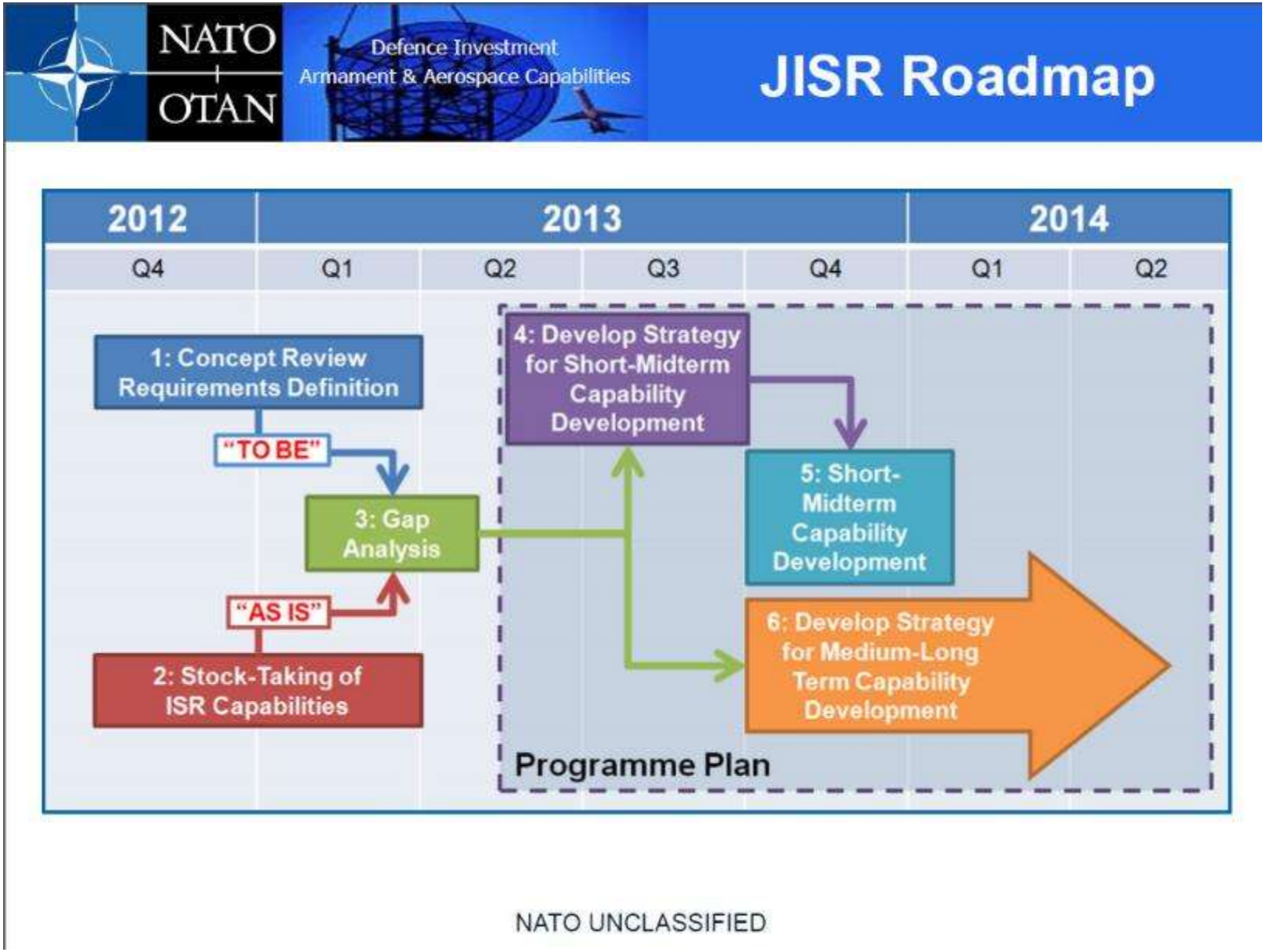
(Tasking, Collection, Processing, Expoitation, Dissemination)

New Needs
Shorter Response Time
Shorter Informage Age
Shorter Revisit Time
Quicker Data Availability



New Results
Contex Sensitive Images
Value Added Products
Quick Repository Access
Quick Image Dowload

Future J-ISR

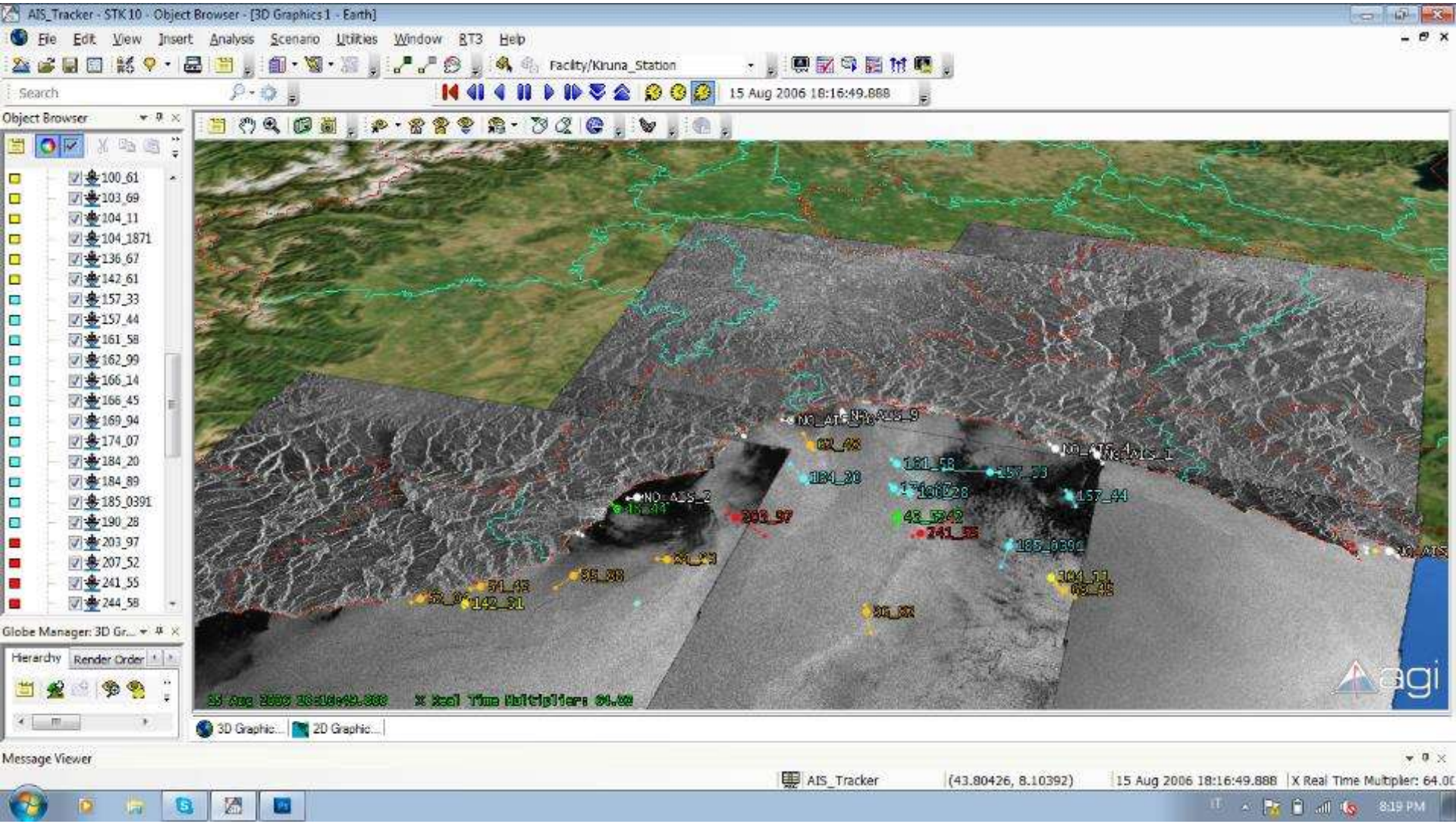


NATO UNCLASSIFIED

Future J-ISR

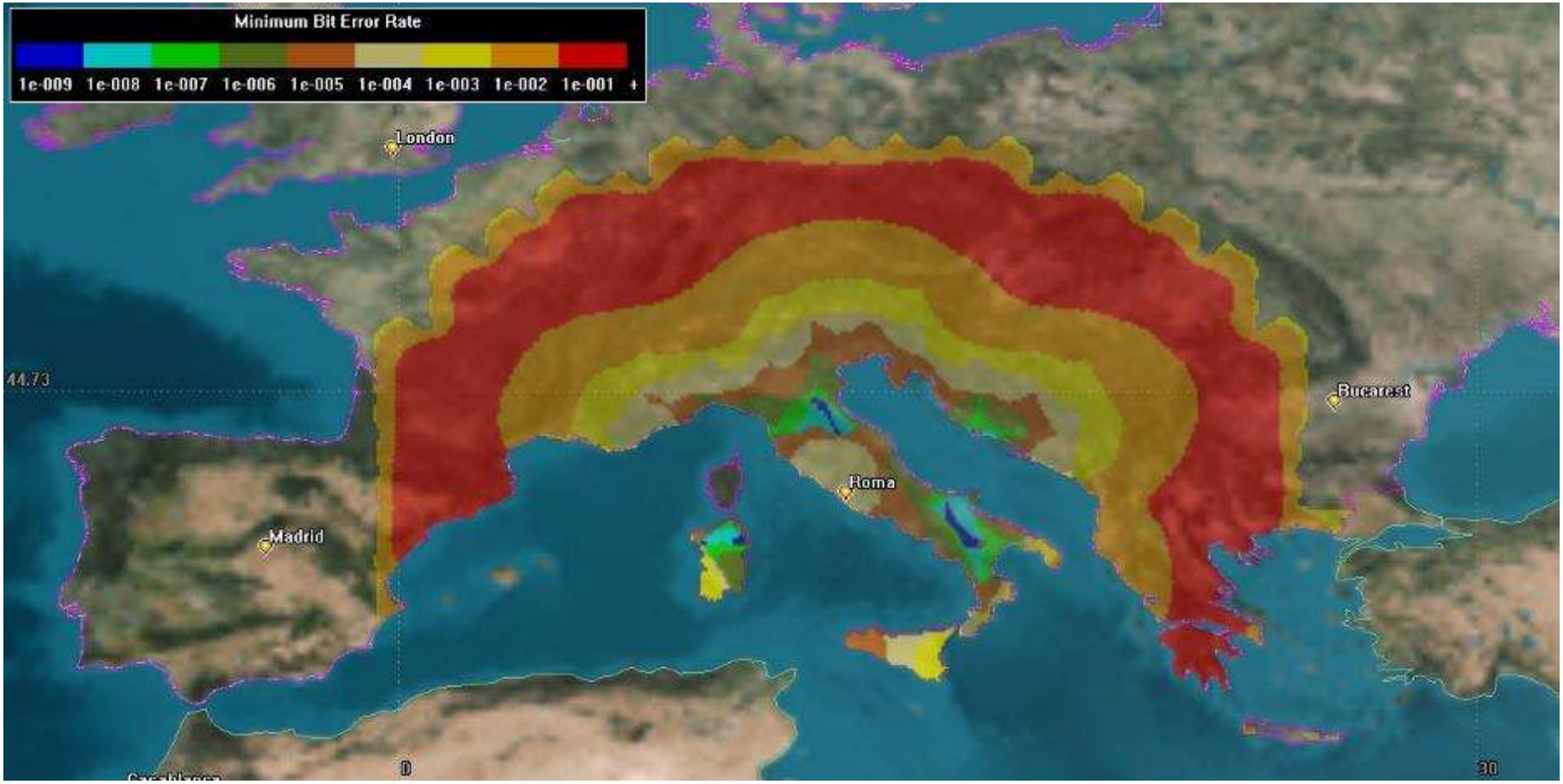
A workbench to help transforming a complex concept into an effective system of systems

Future J-ISR



A workbench to help transforming a complex concept into an effective system of systems

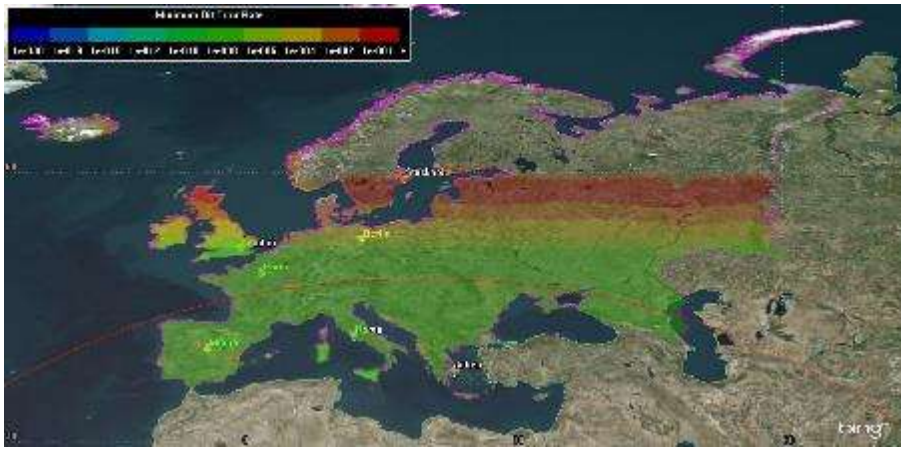
Future J-ISR

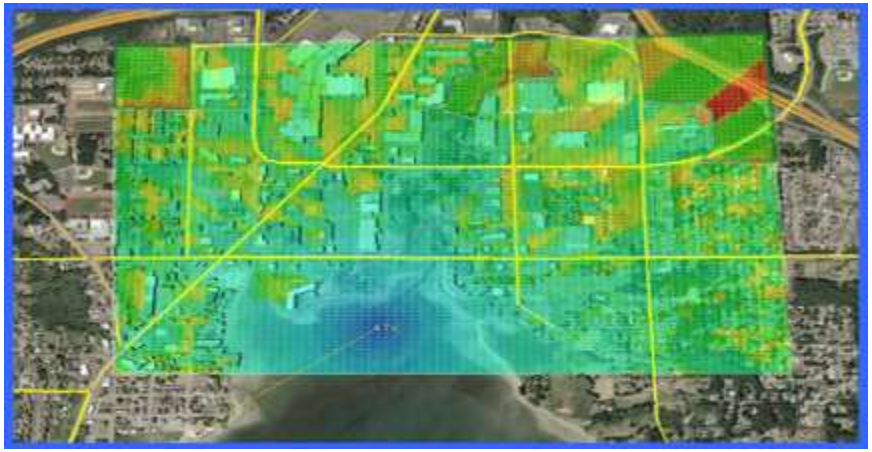


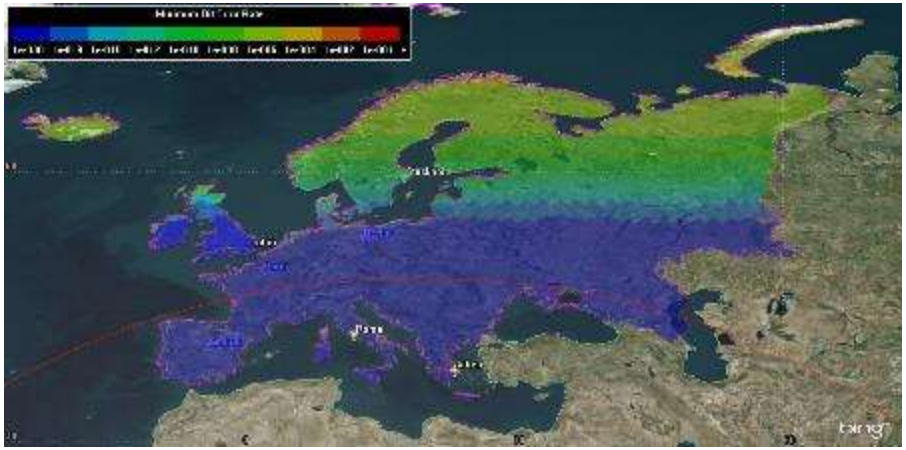
A workbench to help transforming a complex concept into an effective system of systems

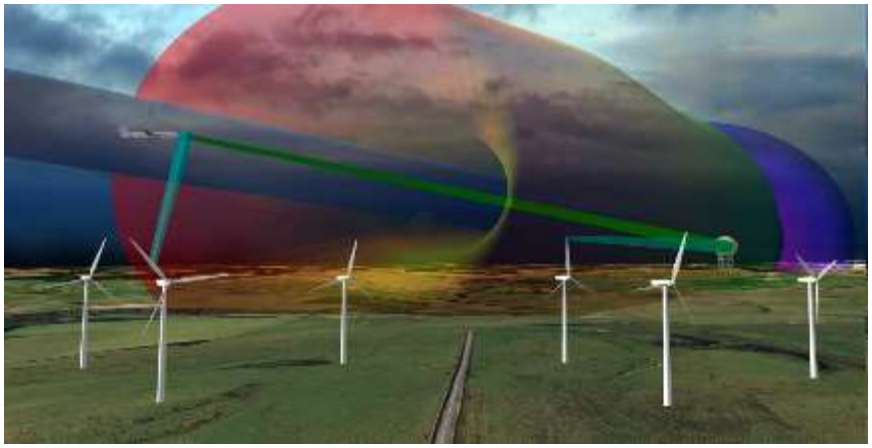
Future J-ISR

From Global to Local Picture









A workbench to help transforming a complex concept into an effective system of systems

Future J-ISR

Motion Video in the Loop

A workbench to help transforming a complex concept into an effective system of systems

Future J-ISR

A Common Operational Picture supporting:

Mission Planning, Mission Management, Mission Analysis

Conclusions

Provided the management of Big Data has too many facets to be fully and deeply analized in a so short time interval, one main conclusion may be produced at the end of this dissertation:

“ Big Data Processing is one of the main challenges for the forthcoming period ”

Using a wider approach Processing doesn’t mean just “elaborate data” but also Exploit and Disseminate.

Several factors have impacts on this activity:

- Processing Time
- Exploitation time (automatic V.A.P. generation + Human contribution)
- Last Mile Dissemination

We must strongly investigate them to find out tips, tricks and technologies to overcome the exting bottlenecks improving the current L.O.S.

In parallel Joint cooperation must reach adequate fluidity

Acronyms used in the Presentation

AGS	Alliance Ground Surveillance
CSD	Coalition Shared Data
GOTS	Government of the shelf
IOC	Initial Operational Capability
NADSI	NATO Advanced Storage Interface
NAF	NATO Architectural Framework
NCIA	NATO Communication and Information Agency
NIIA	NATO ISR Interoperability Architecture
NRF	NATO Response Force
RECCE	Reconnaissance
STANAG	Standardization Agreement
TTP	Tactics, Techniques and Procedures

GM SPAZIO

Thank You
Very much
for
Your kind attention
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