



Maritime Border Control

**SCI-174 Workshop “Tactical Decision Making and
Situational Awareness for Defence Against Terrorism”**

Turin, 8 May 2006

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Homeland Security Mission

- The mission of **Homeland Security** systems is to minimize a Nation's vulnerability through the most effective defense: it is not possible to protect any infrastructure or to control a single visitor, but it is possible to reduce risks at a tolerable level, not to have any meaningful impact on society and economy
- However, should a risk come into effect, systems will have to allow an effective crisis management and recovery
- **Selex SI is capable to optimize the effectiveness of the SOS* through:**
 - Requirements analysis
 - Functional analysis
 - Architectural definition
 - Risk analysis
 - Value analysis
 - Modeling and Simulation

allowing and complete plan definition and management

***SOS: System of Systems**

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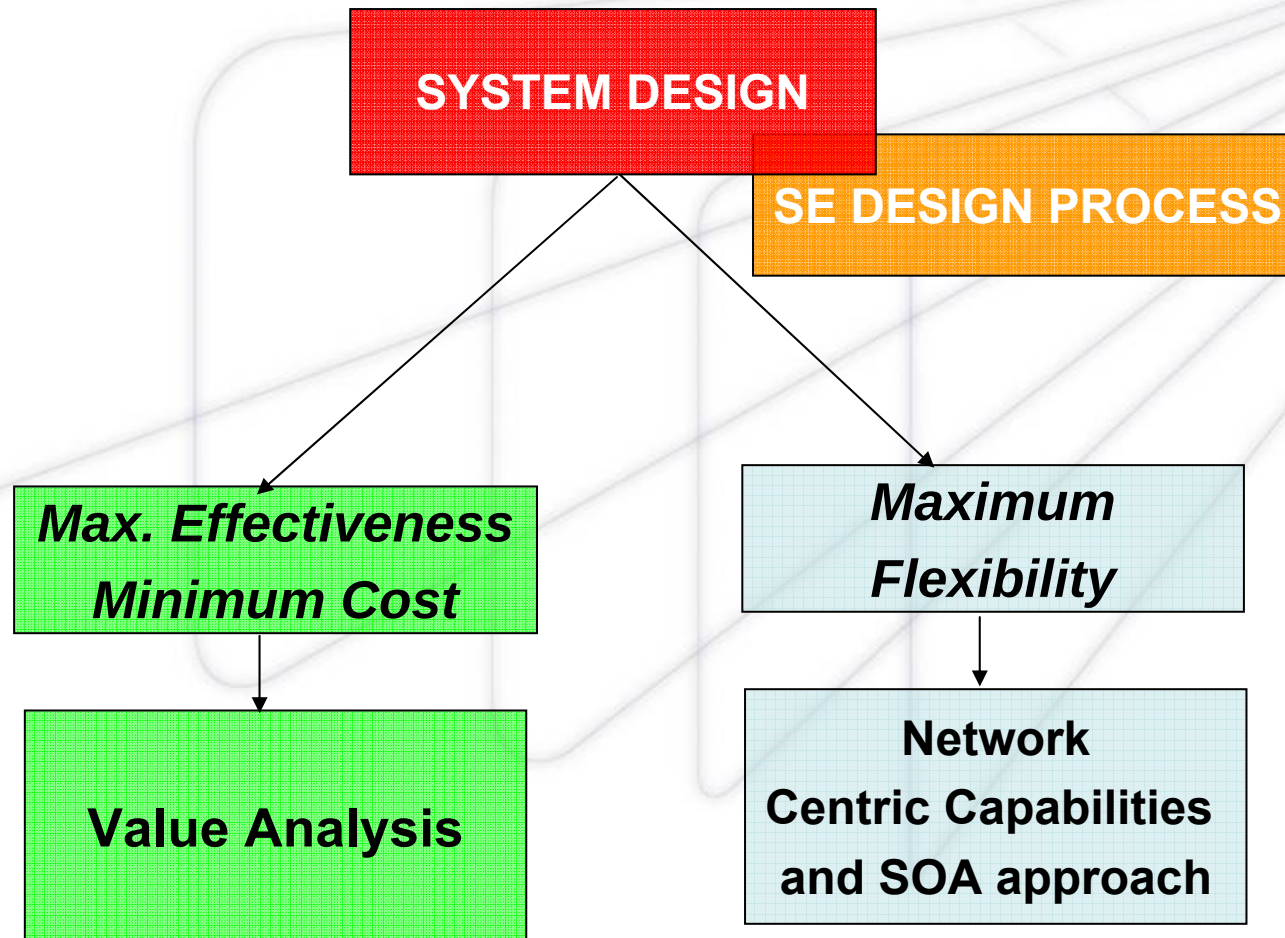


Selex-SI System Design Approach for Maritime Border Control

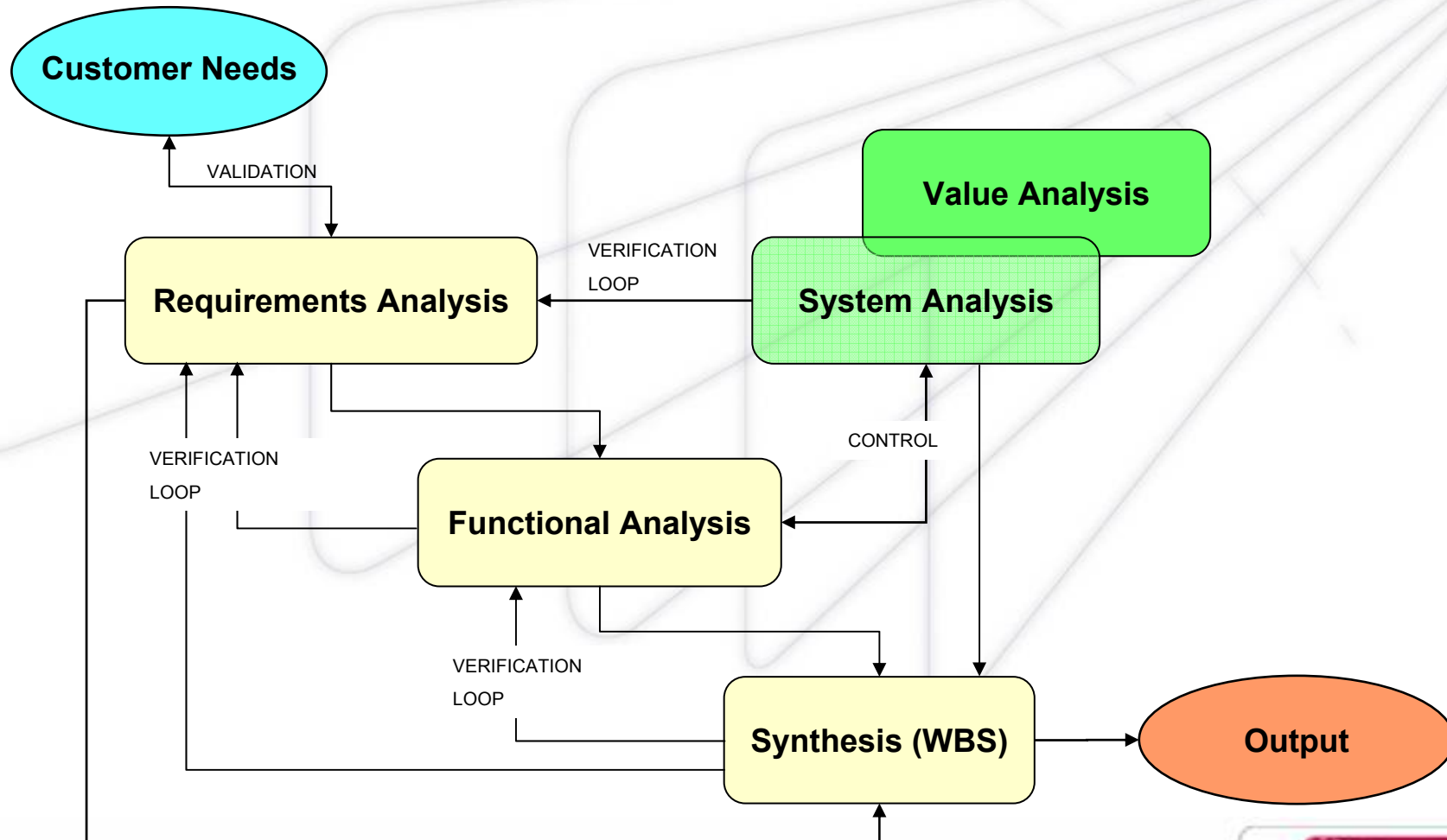
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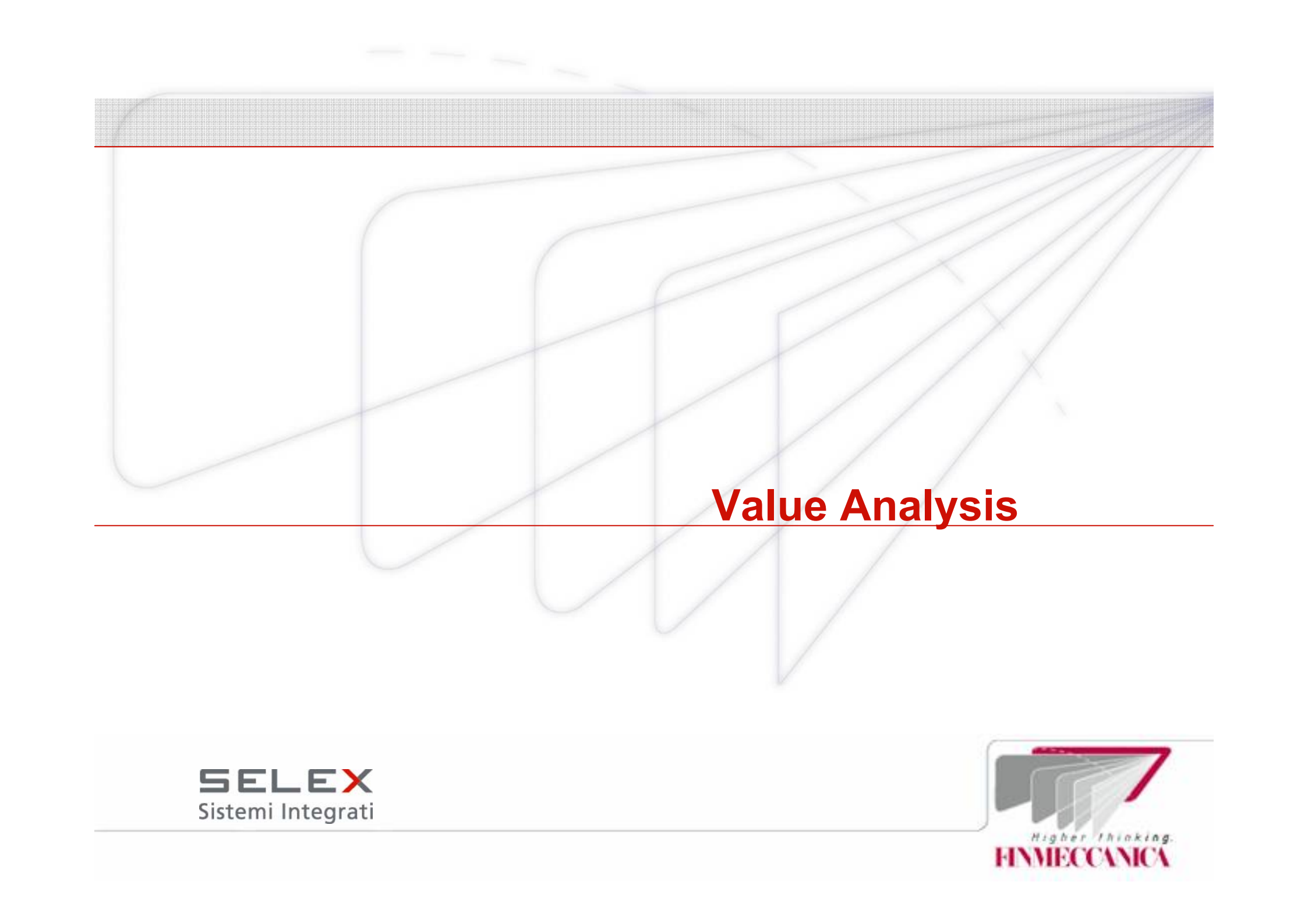


Selex-SI Approach



System Engineering Design Process



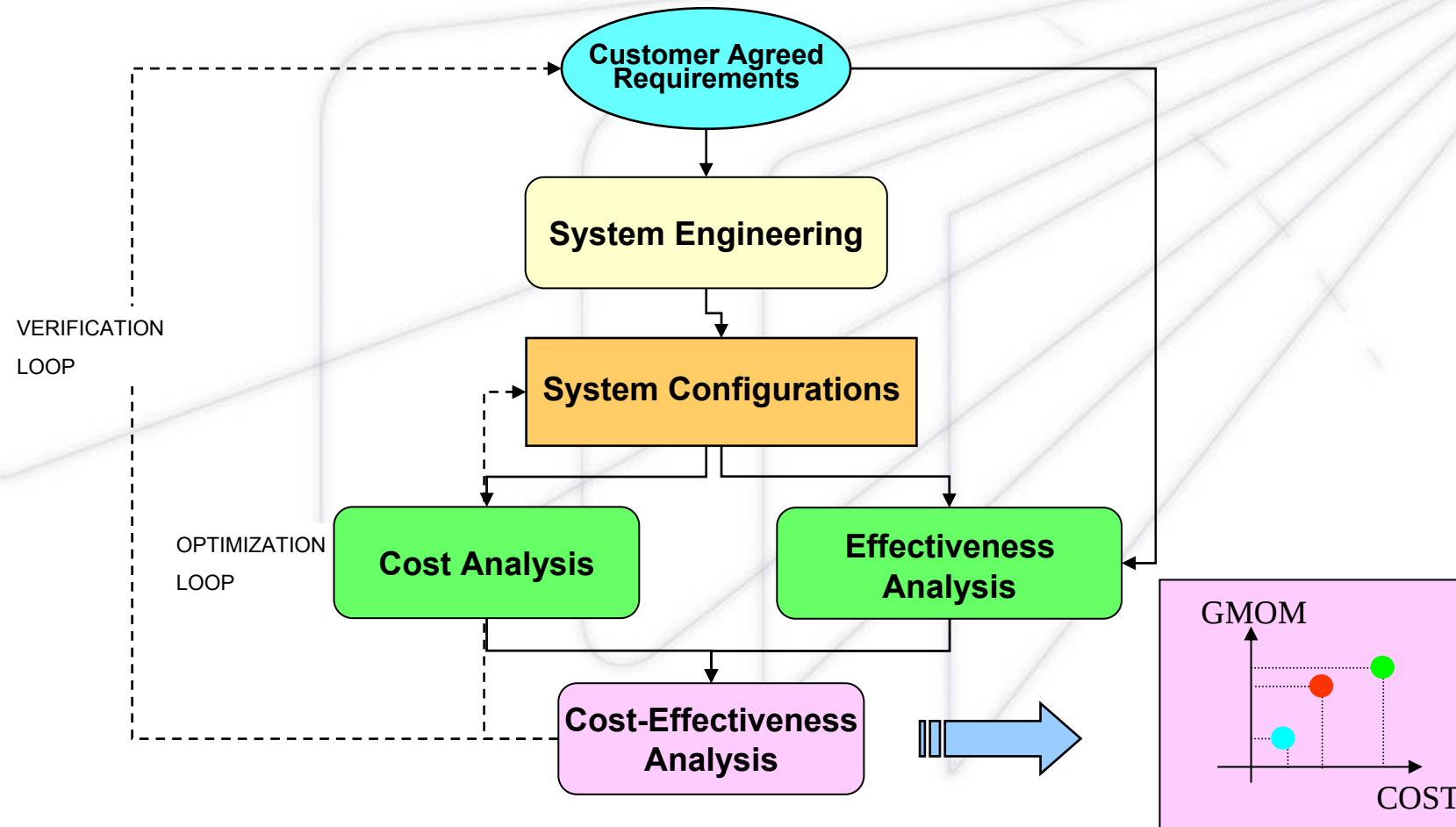


Value Analysis

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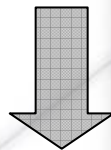


Value Analysis



Value Analysis – Effectiveness Analysis

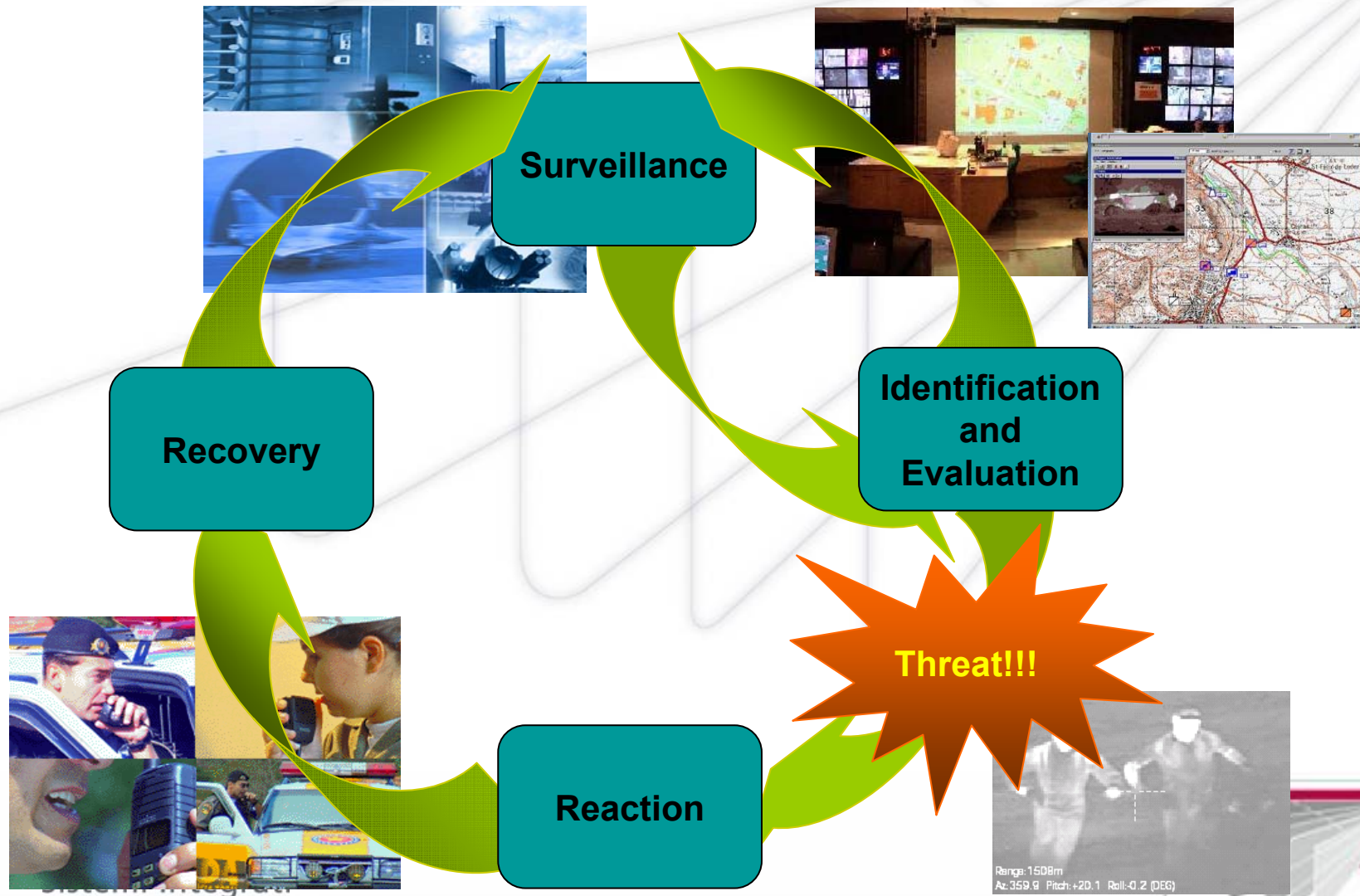
- The main mission of the CSS System is to provide surveillance and protection of the Area of Responsibility.
- The **Effectiveness** of this mission is the capability of intercepting suspected intruding targets at a suitable distance from the coastline border.



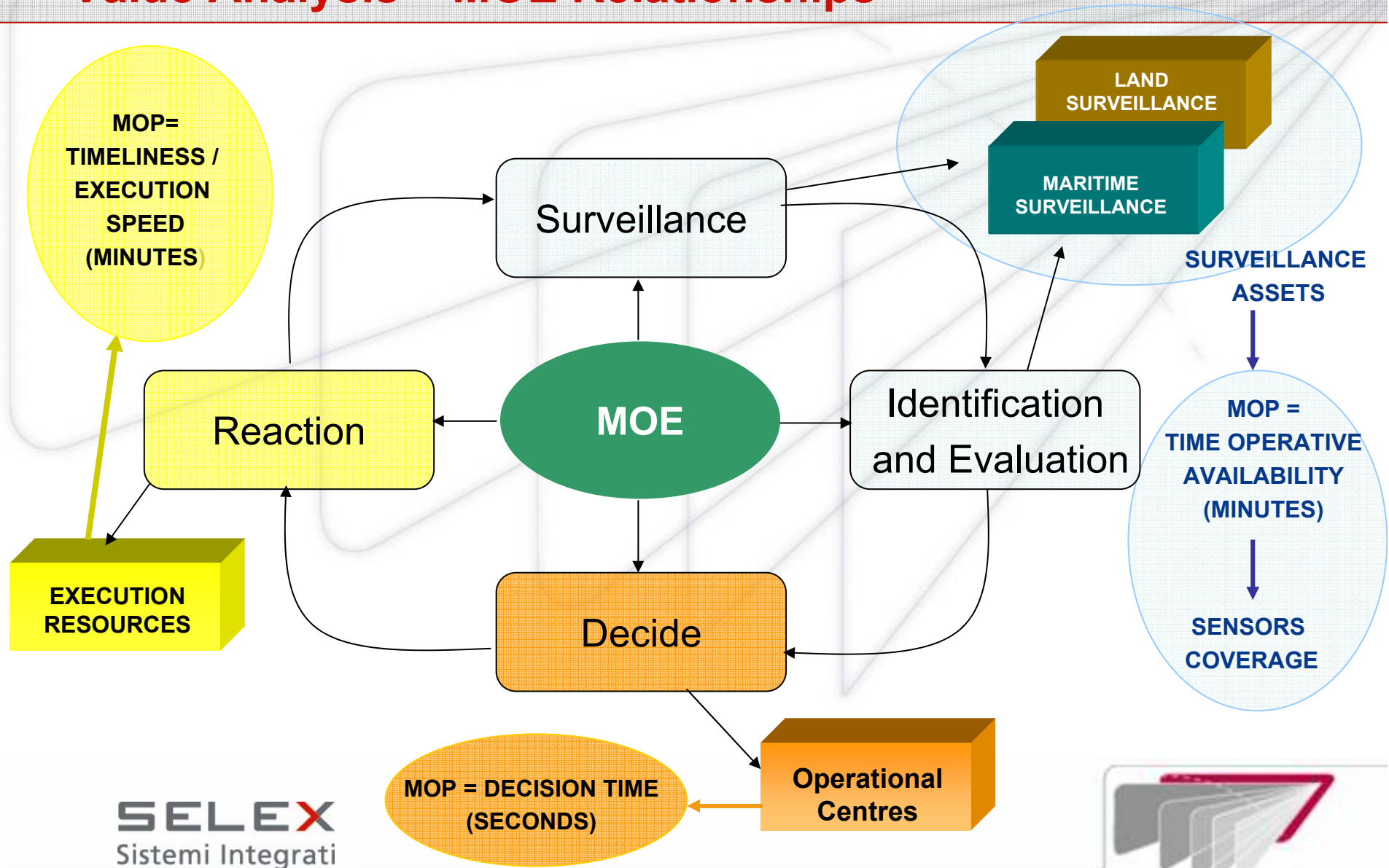
MOE

Threats to Homeland Security

The cycle of Surveillance



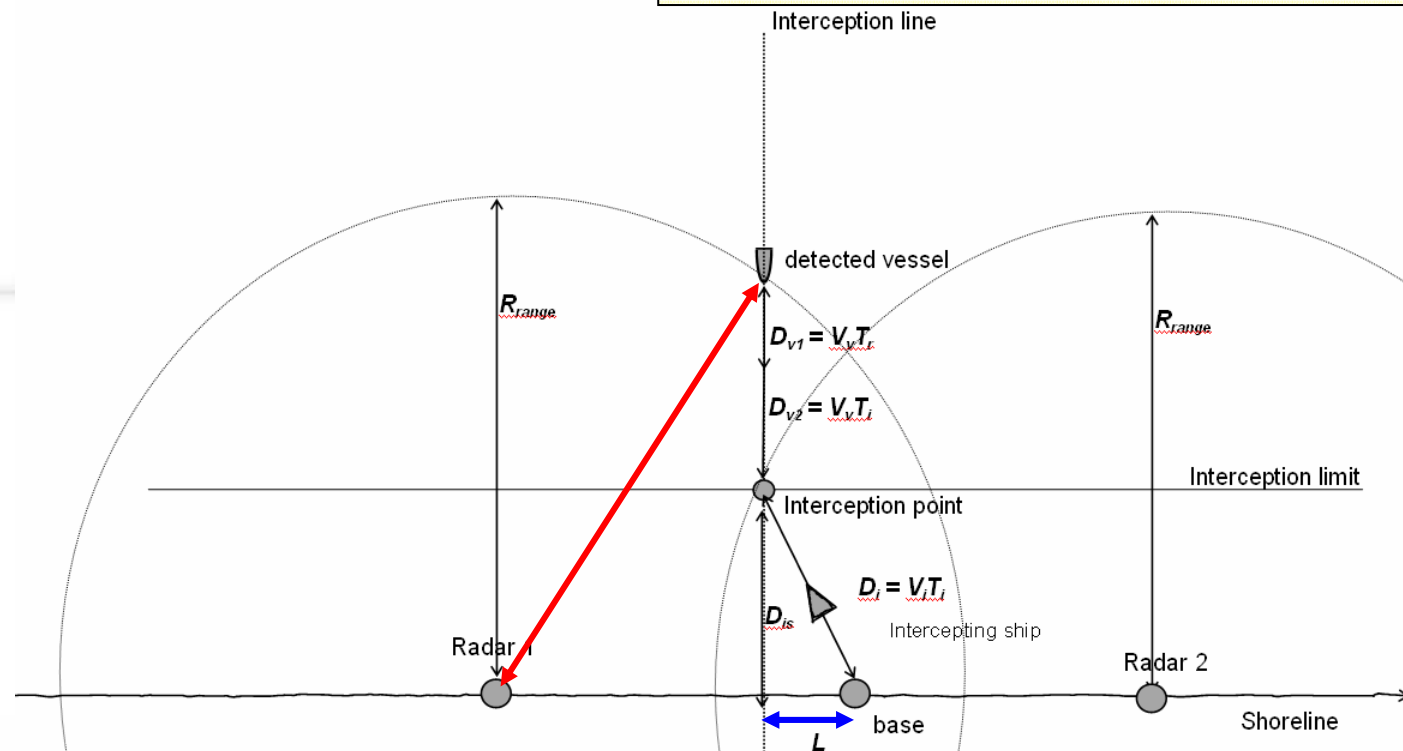
Value Analysis – MOE Relationships



Main Functions Modelling

MOP

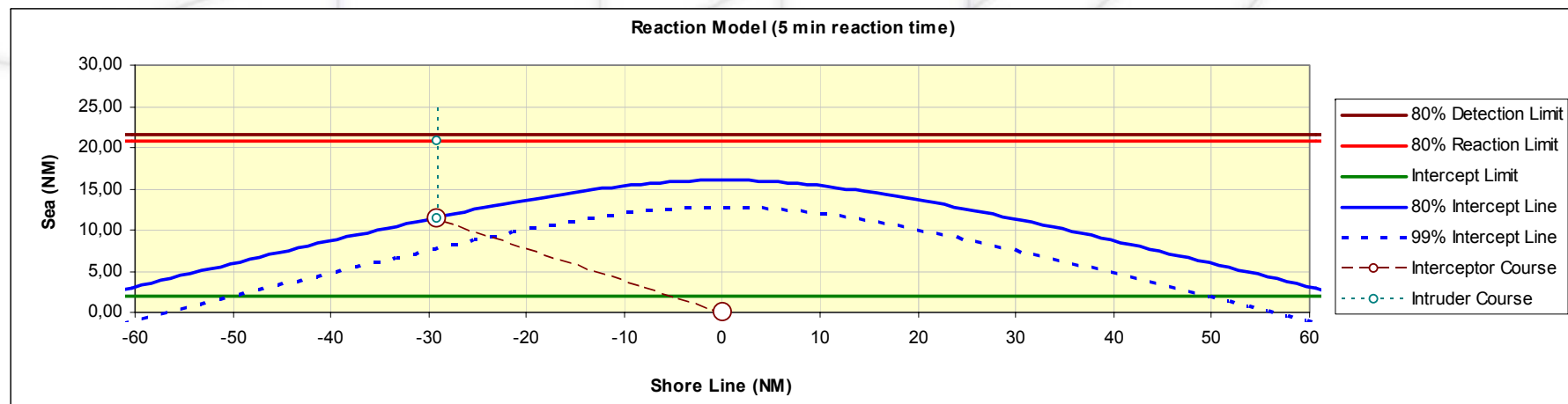
- Distance base-interception line
- Intruder/Interceptor speed ratio
- Detection Range → Time Operative Availability



Main Functions Modelling

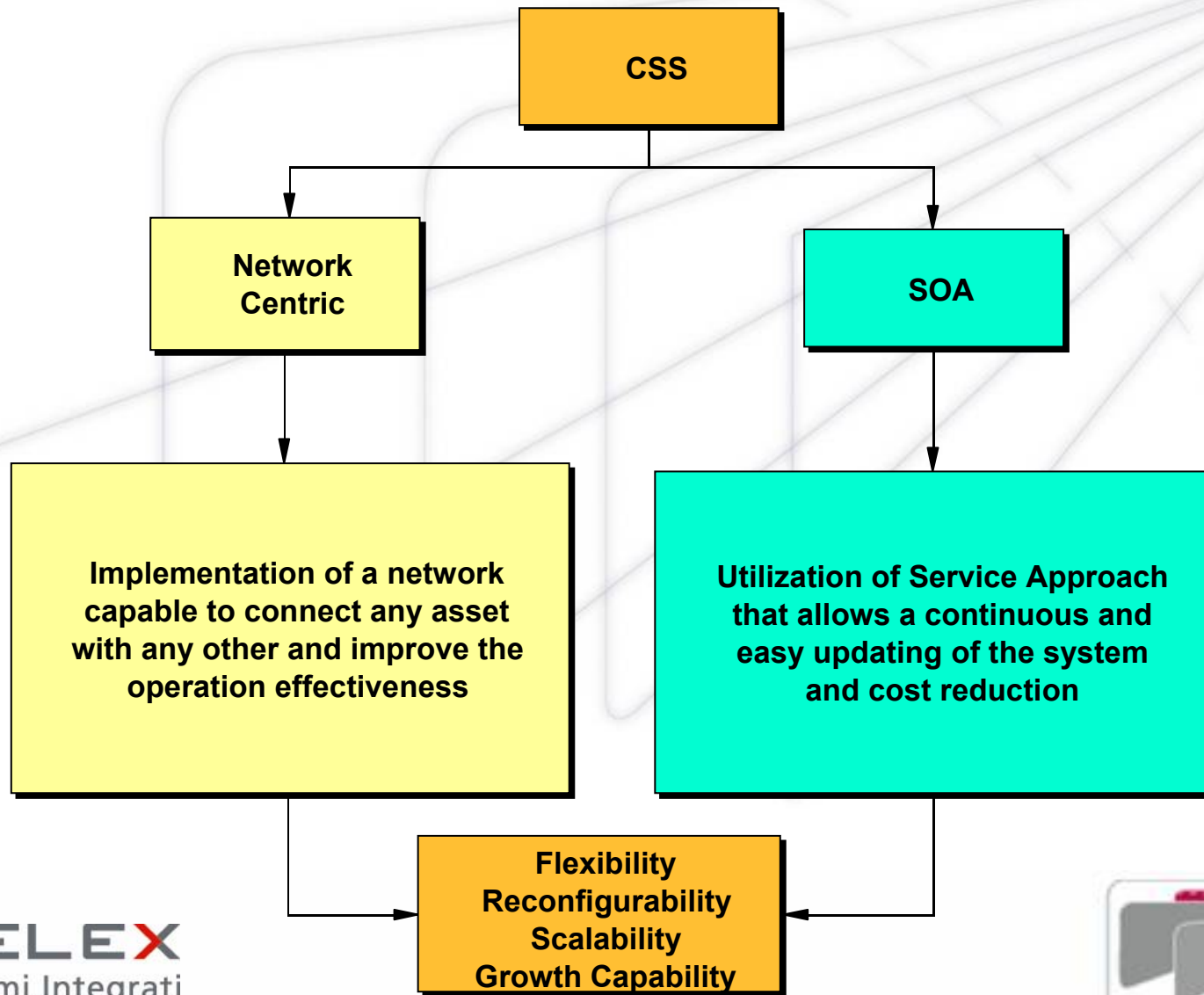
Detection and Reaction Capabilities Results

Considering a reaction time of 5 minutes a 80% interception is guaranteed for intrusions displaced from the interceptor location up to 63 nm, while a 99% interception is guaranteed for intrusions displaced from the base up to about 50 nm from the interceptor location

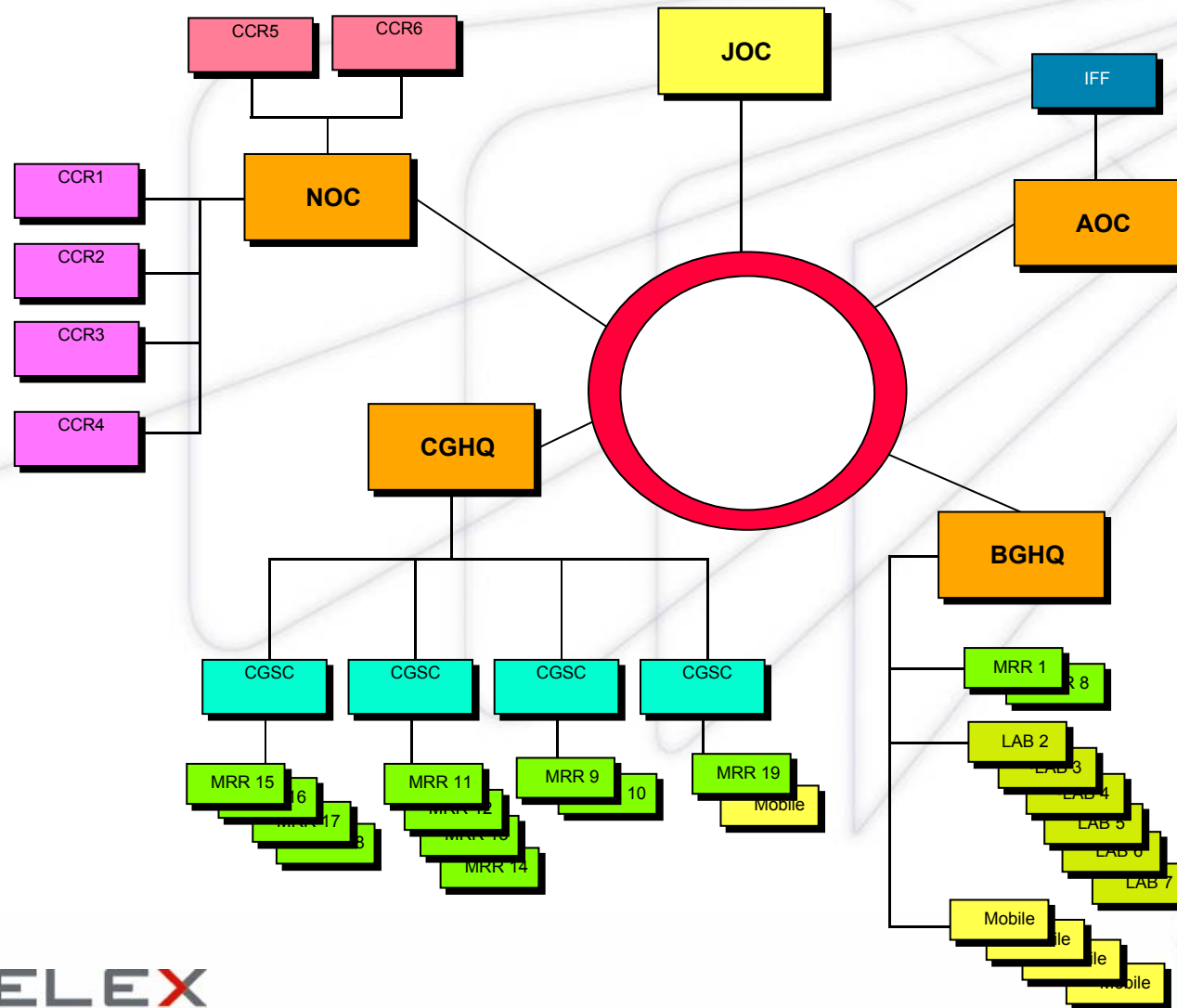


Network Centric Capability and SOA Approach

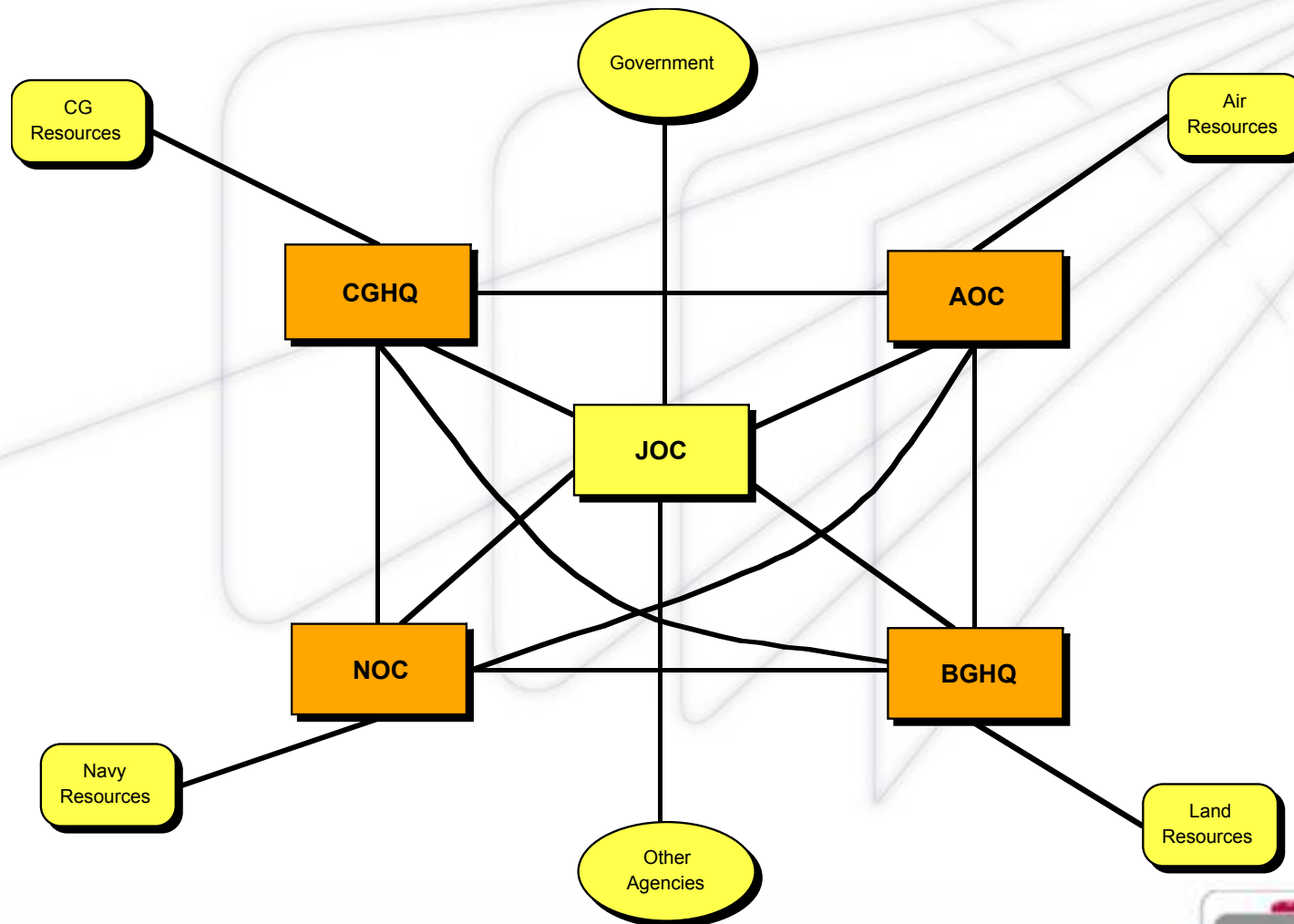
Network Centric Capabilities

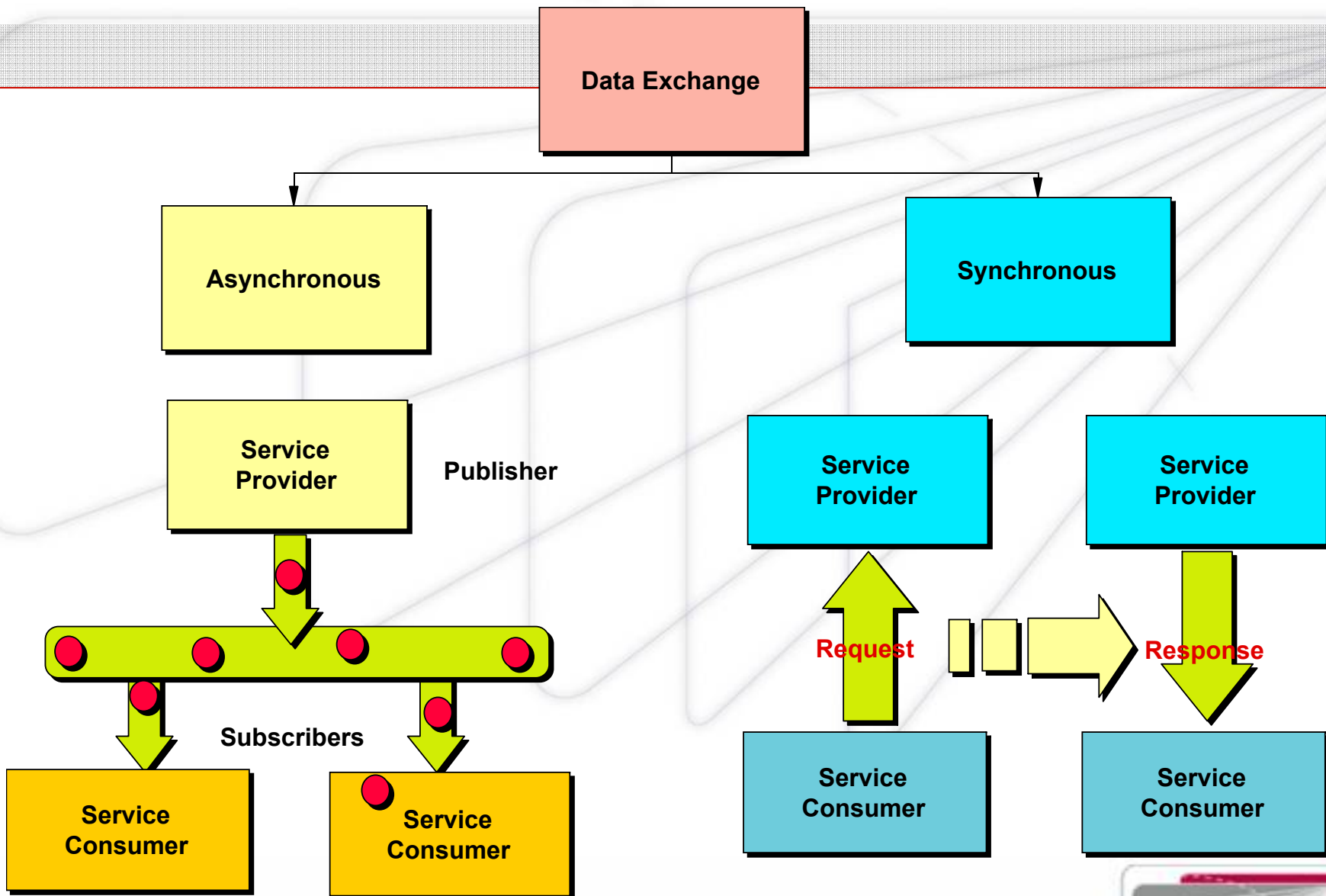


Network Centric Capability: System Architecture



Network Centric Capability: Interconnectivity





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Ex: Radar Tracks

Ex: Mission Plans



National Borders

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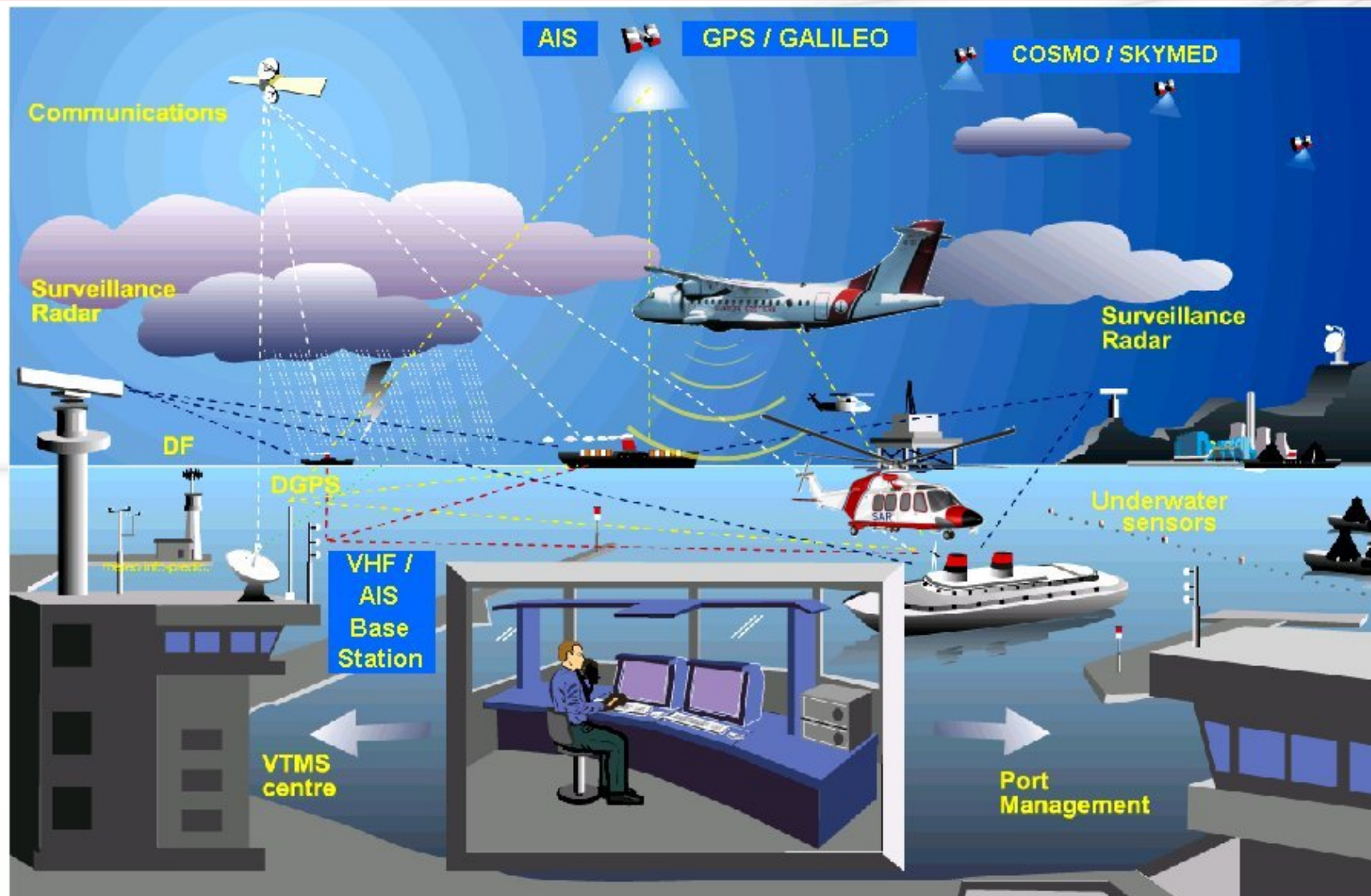
Typical CSS Scenario



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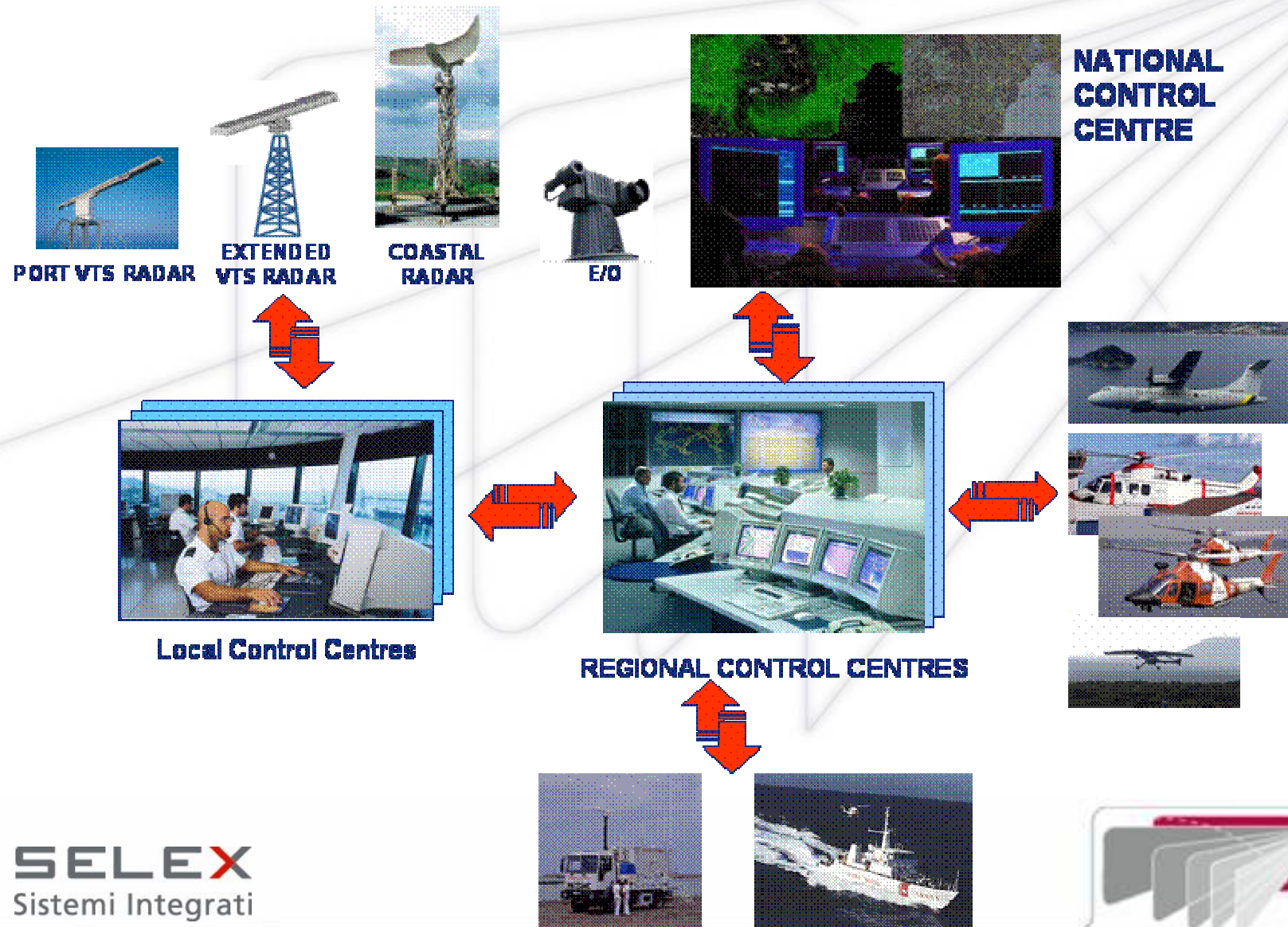
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Typical CSS Scenario

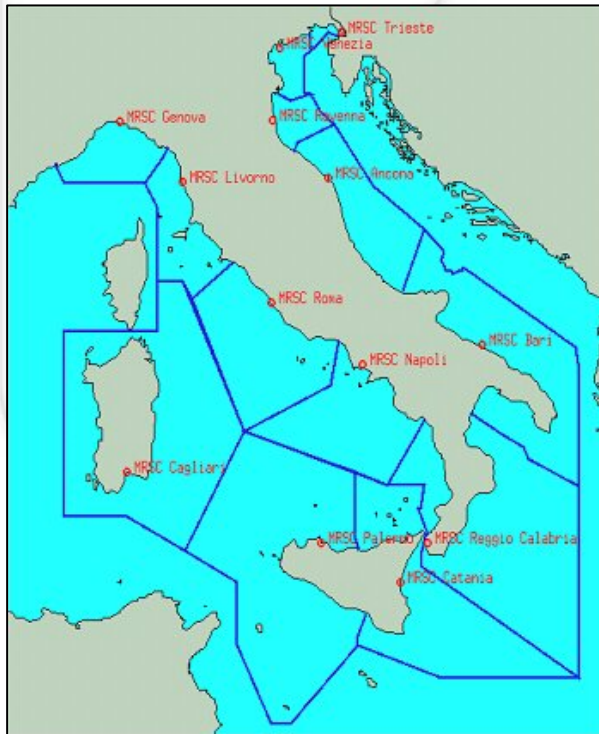


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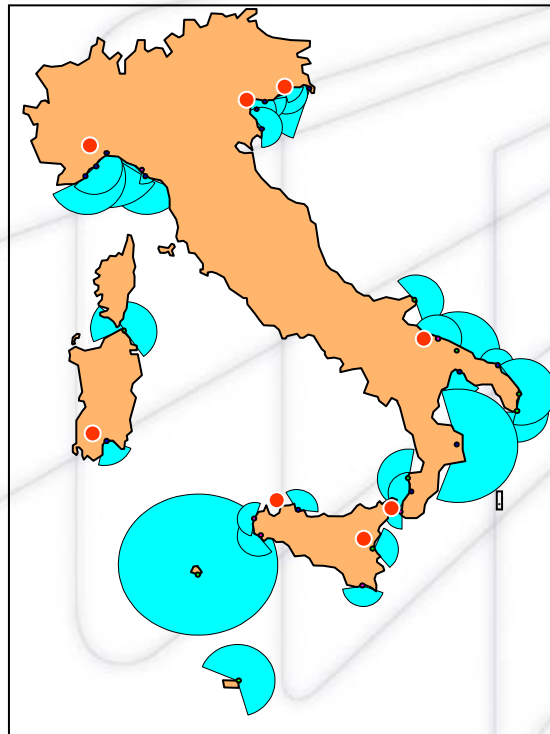
CSS: Coastal Border Surveillance System



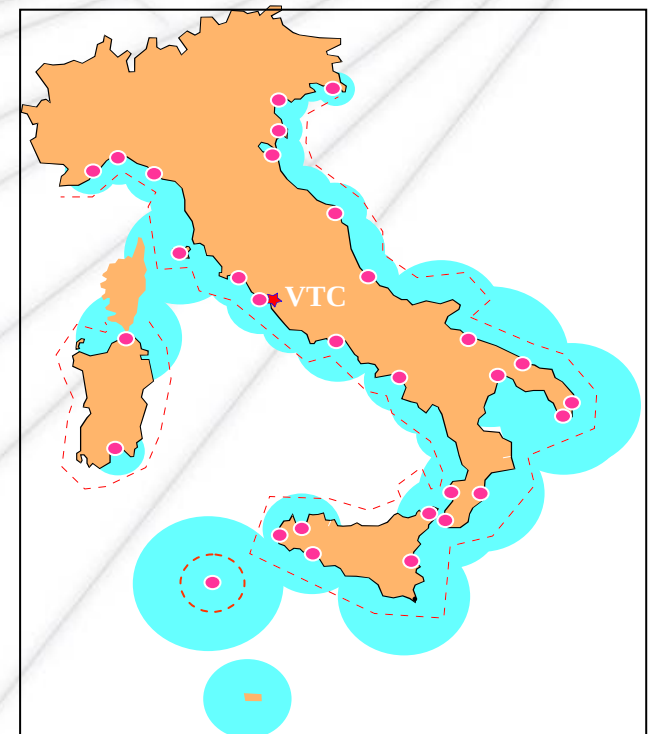
System sensors coverage



**The 13 Italian
Maritime Directions**

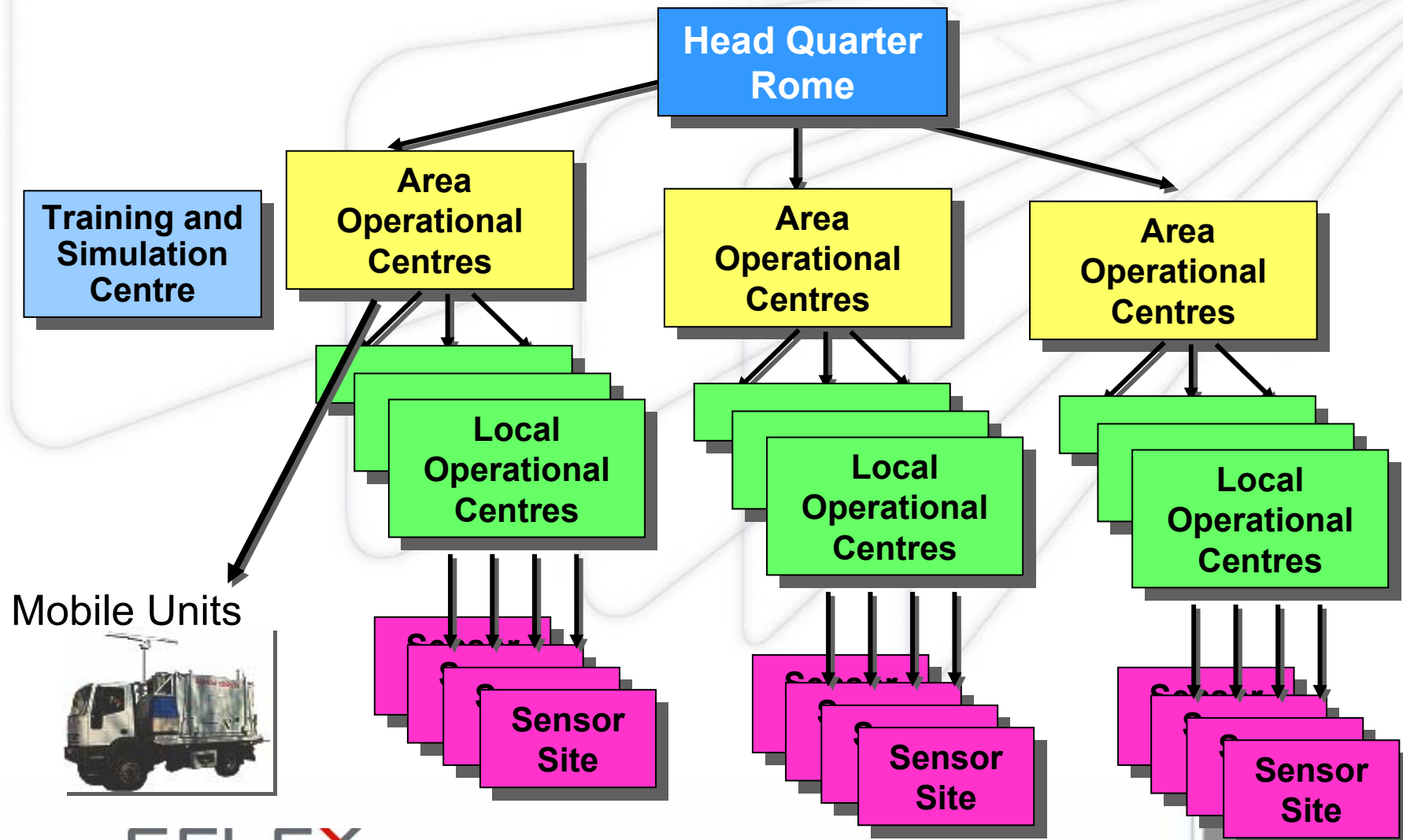


**The initial
coverage**



**The final
coverage**

System Configuration



System Tasks



LOC

- Data fusion of local sensors
- Interaction with traffic within VHF coverage
- Port management
- Local actions planning



AOC

- Fusion of Local Operational Centre data
- Contiguous Hand-over
- Interaction with traffic out of VHF coverage
- SAR planning



HQ

- Nation and world wide traffic image compilation
- Central archive
- Overall SAR coordination

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LA MADDALENA



GENOVA



HEAD QUARTER



TRIESTE



BARI



TARANTO



TRAPANI



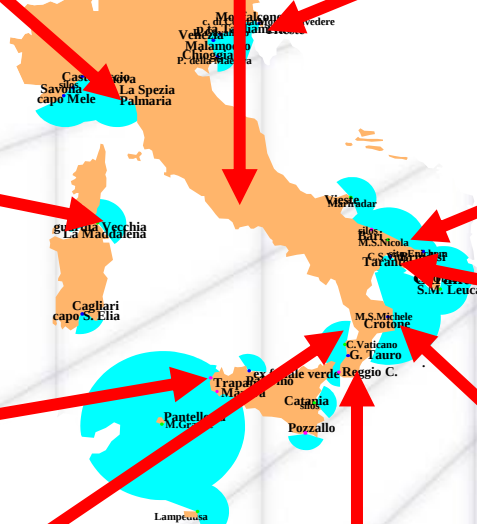
**GIOIA
TAURO**

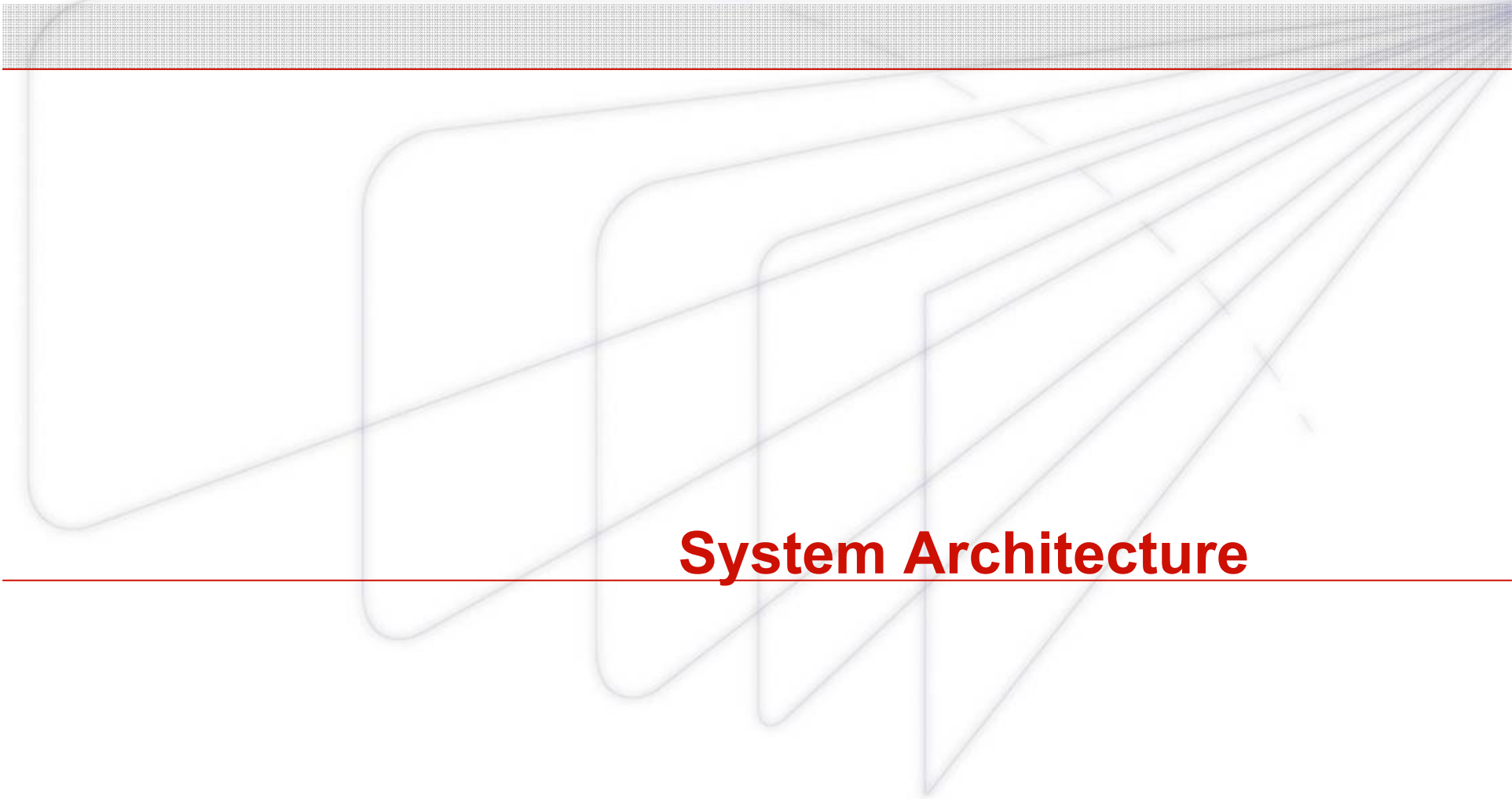


REGGIO CALABRIA



CROTONE





System Architecture

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General Architecture



Unmanned Remote Sensor Sites



Local Control Centres



Mobile Sensor Sites

Regional Traffic Centres

SAR Coordination Centre

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National Control Centre

Vessels

Port Authority

Shipping Companies

Coast Guard

Pilots

Main Components

✓ Target Detection Sensor:

- High Resolution Radar
- Automatic Identification System (AIS)
- Radio Direction Finder
- Electro-Optical Video Camera (TV, Low Light TV, I/R)



✓ Voice

- VHF and HF Radio
- GMDSS

✓ Data Communications

- Microwave Digital Radio Link
- Dedicated Optical Fibre
- Leased Data Lines



Main Components (continue)

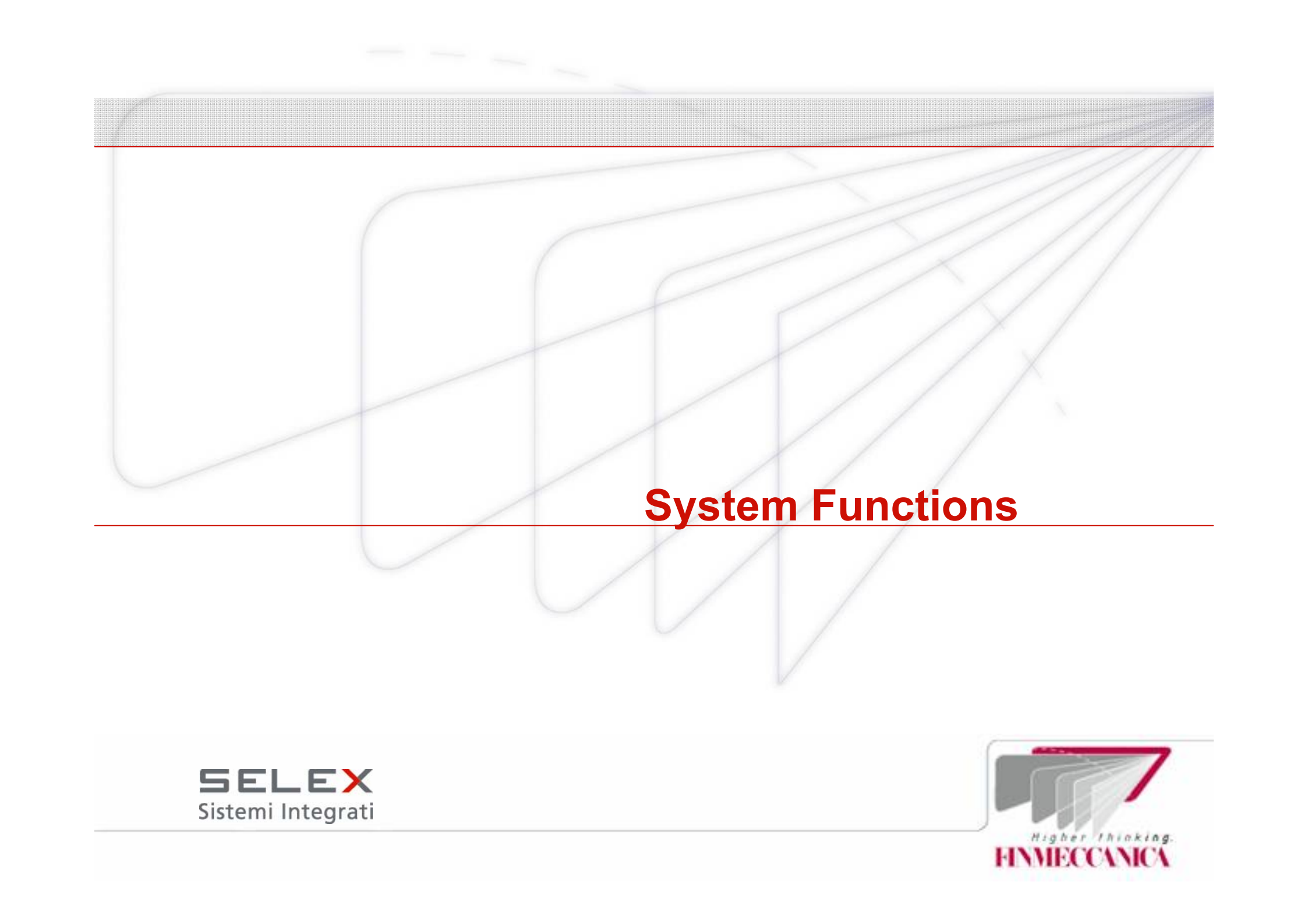
✓ Data Processing:

- Traffic image build-up through multi sensor correlation
- Navigation controls
- Sensor management
- Data-Base

✓ Human-Machine Interface

- Traffic image presentation
- ECDIS
- Radar raw video
- TV





System Functions

Safety at Sea and Traffic Management

- Prevention of accidents and environment protection
- Navigation rules control
- Support to navigation in narrow waters
- Support to search and rescue
- Port approach control
- Regional traffic control

Prevention of accidents and environment protection

- Collision and Grounding Avoidance
- Support to the operations of pollution cleaning
- Coordination of cleaning means
- Prediction of the drift movement of the floating stains due to winds and currents



Control of Navigation Rules

- Transit control into zones forbidden to navigation
- Speed limit control
- Traffic Separation Scheme control
- Control of the ships which stop inside zones forbidden to anchorage



Support to Navigation in Narrow Waters

- Control of Traffic Separation Schemes
- Control of safety distance between vessels
- Control of meetings, crossings and over-takings
- Warning at turning points inside navigable fairways
- Traffic direction inside one-way channels
- Blind pilotage



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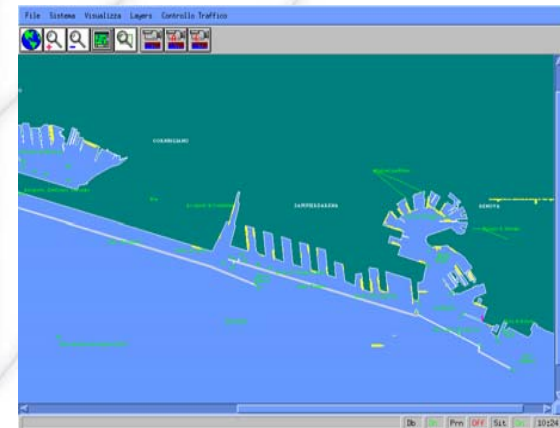
Support to Search and Rescue

- Detection by radar of small floating objects
- Continue listening on all the radio frequencies assigned by international conventions (SOLAS)
- Radio-Emissions source localization
- Patrol boats and helicopters leading
- Coordination of SAR operations



Port Approach Control

- Detection, identification and track of the ships incoming and outgoing
- Collisions and grounding prevention
- Support to pilots
- Information transmission
- Traffic optimization
- Anchored ships and buoy surveillance
- Platform management
- Loading and unloading automatic documentation



Regional Traffic Control

- Participation to a large area traffic control
 - Send local tracks
 - Receive regional tracks
- Vessel Data Base
- IMO/IALA rules enforcement
- Connection with governmental authorities
- Connection with international authorities
- Strategic Planning and Supervision



Security and Law Enforcement

- Anti-intrusion coastal surveillance
- Anti-piracy surveillance
- Support to actions of contrast
- Fishery control
- Dangerous cargo monitoring

Anti-Intrusion Coastal Surveillance

- Early detection of small targets in all weather conditions
- Control of transit in forbidden zones
- Un-authorized landings control
- Alarm when two targets merge (likely rendezvous)
- Alarm when a target splits (likely small boat lowered)
- Alarm when a target detected by radar does not reply to AIS
- Cross check of received AIS code against data-base and intelligence



Anti-Piracy Surveillance

- H24 listening to Security Alert System emergency signals (as per latest SOLAS rules) and localization of call
- Ship tracking and alarm when a track deviates from the planned route
- Alarm when an unidentified track approaches another ship (likely boarding)
- Control of approaches to off-shore platforms



Support to actions of contrast

- Continue knowledge of position and readiness state of all the available means
- Mission planning
- Support to the Coast Guard operations (Aid to the decision process of the operators by simulations of the intercept actions)



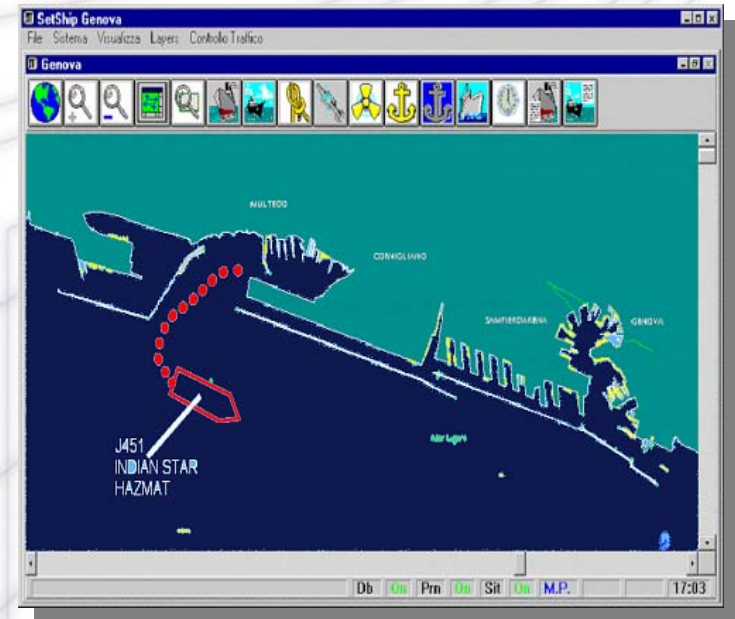
Fishery Control

- Identification by means of AIS of domestic fishing ships
- Alarm when an unknown track enters a zone closed to transit
- Alarm when an unknown track moves at low speed inside a fishing reserve
- Same as above, but extended to any unauthorized track, in case of zone protected for environmental **reason**



Dangerous Cargo Control

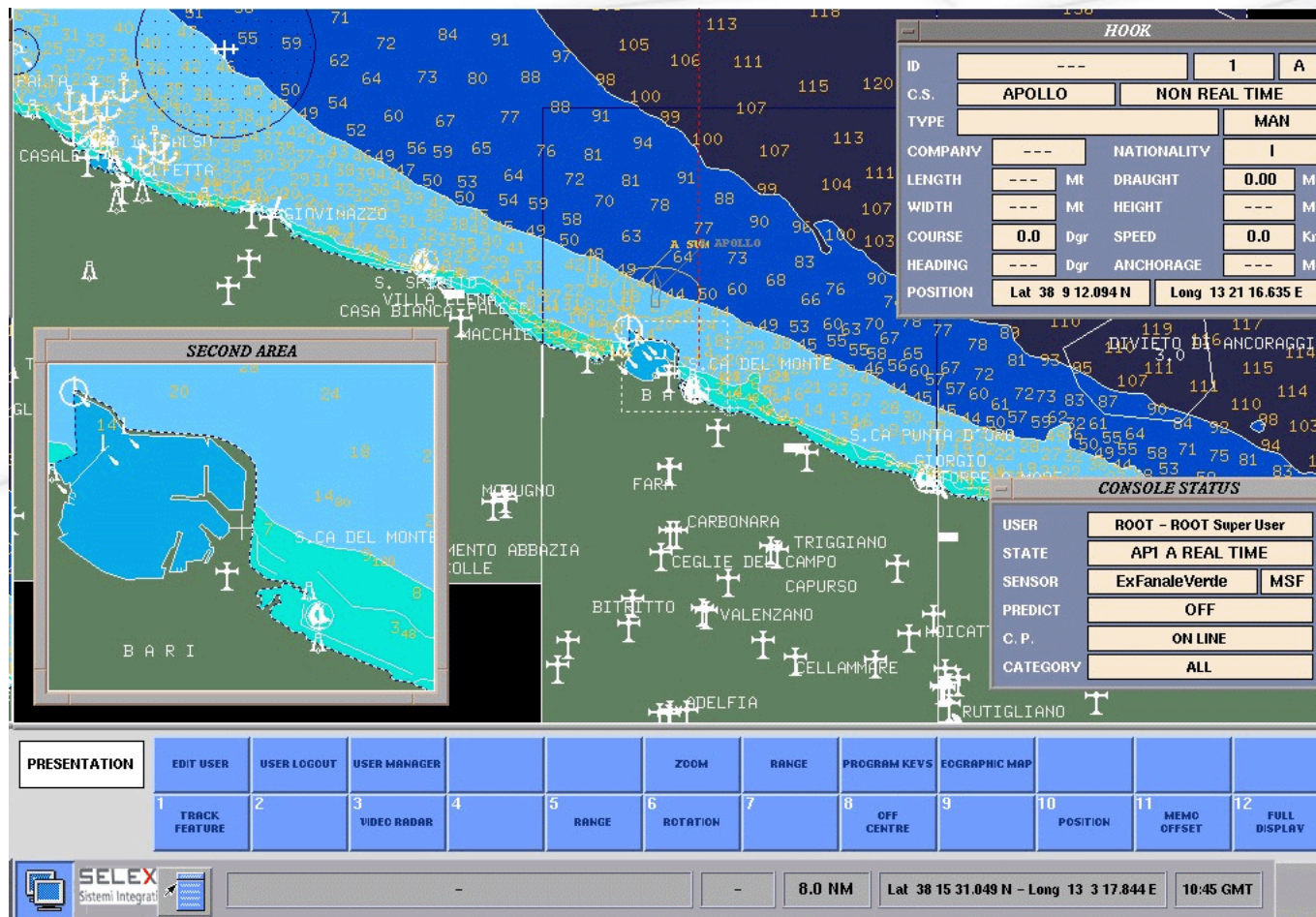
- Tight connection between System and Port Community System (PCS)
- Fully automatic management of all information (from first communication of maritime agent up to HAZMAT data sending to Ministry of Transportation)
- Dangerous cargo tracks are specially marked as long as they stay inside CSS area, tracked and controlled by means of parameters more severe than normal





Operative Mission Example

Real System Display



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A MISSION EXAMPLE: 1 - A NEW SEA SURFACE TARGET IS DETECTED



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A MISSION EXAMPLE: 2 - A NEW SYSTEM TRACK IS INITIALIZED (UNKNOWN)



A MISSION EXAMPLE: 3 - AN IDENTIFICATION REQUEST IS SENT TO THE TARGET THAT DOES NOT PROVIDE AN ANSWER



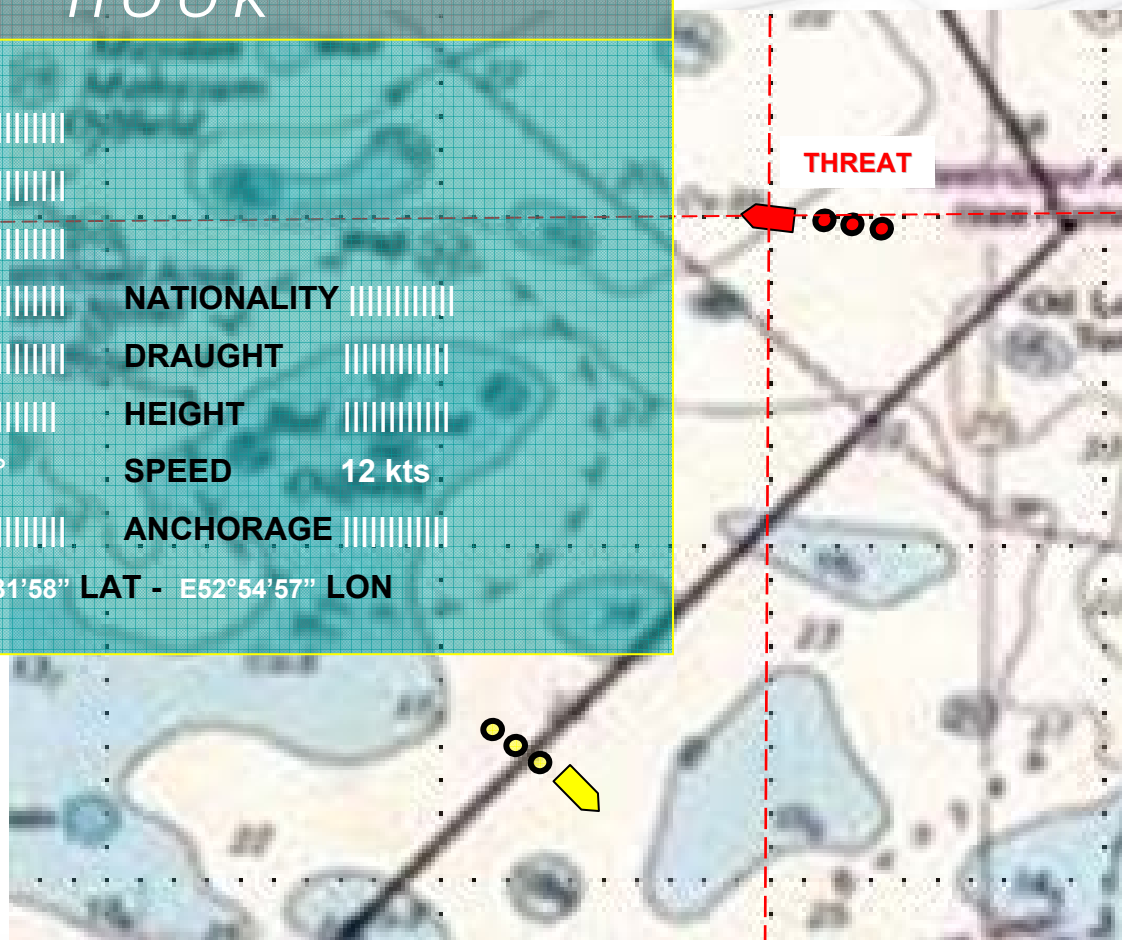
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A MISSION EXAMPLE: 4 - THE NOC OPERATOR ARISES AN AIR SUPPORT REQUEST FOR IDENTIFICATION MISSION

HOOK

ID		
C.S.		
TYPE		
COMPANY		NATIONALITY
LENGTH		DRAUGHT
WIDTH		HEIGHT
COURSE	273°	SPEED 12 kts
HEADING		ANCHORAGE
POSITION	N25°31'58" LAT - E52°54'57" LON	



A MISSION EXAMPLE: 5 - THE JOC OPERATORS ASSIGN THE MISSION TO AN HELO SELECTED AMONG THE AVAILABLE ONES

AIR Support Request

TARGET ID



SEARCH & RESCUE



SURVEY



THREAT COURSE 273° - THREAT SPEED 12 kts

THREAT POSITION N25°31'58 LAT - E52°54'57" LON

TIME TO INFRINGEMENT 240 MIN

ACK STATUS → ----

SEND

THREAT

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A MISSION EXAMPLE: 6 - THE TASKED HELO STARTS FOR THE MISSION

AIR Support Availability

HELOs	STATUS	LAT LON	AUTONOMY	TIME TO TARGET
1	ON DUTY	N24°44'30" E50°54'28"	300 NM	---
2	IN FLIGHT	N25°19'51" E51°40'54"	280 NM	40 MIN
3	READY 8 MIN	N25°15'50" E51°33'58"	400 NM	52 MIN

COURSE 273° SPEED 12 kts
POSITION N25°31'58" LAT - E52°54'57" LON
TIME TO INFRINGEMENT 240 MIN

ACK STATUS → ---

SEND

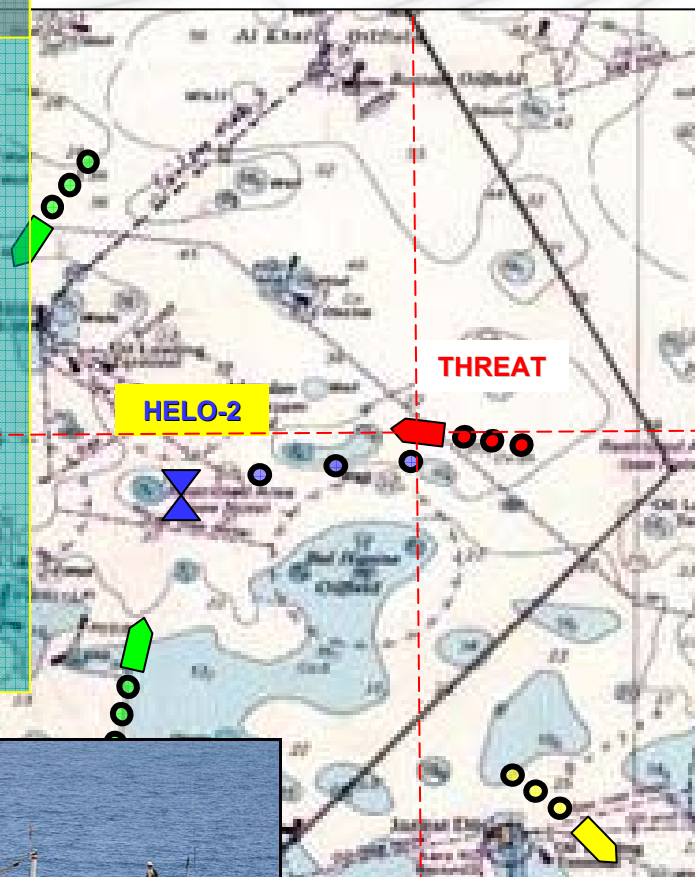
A MISSION EXAMPLE: 7 - A VISUAL INSPECTION IS PERFORMED AND THE SUSPICIOUS BEHAVIOUR IS CONFIRMED;
THE RELEVANT DATA (IMAGINES INCLUDED) IS REPORTED



A MISSION EXAMPLE: 8 - THE NOC OPERATOR ARISES A COAST GUARD SUPPORT REQUEST FOR INTERCEPTION MISSION

AIR Support Identification Message

ID	UNKNOWN	
C.S.	UNKNOWN	
TYPE	FISHING	
COMPANY		NATIONALITY
LENGTH	18 mt	DRAUGHT
WIDTH		HEIGHT
COURSE	242°	SPEED 12 kts
POSITION	N25°27'43" LAT - E52°15'50" LON	
BEHAVIOUR	→ SUSPECT	
ACK →	IMAGE → YES	



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A MISSION EXAMPLE: 9 - THE JOC OPERATORS ASSIGN THE MISSION TO A PATROL BOAT SELECTED AMONG THE AVAILABLE ONES

Coast Guard Request

TARGET ID

SEARCH & RESCUE

INTERCEPT

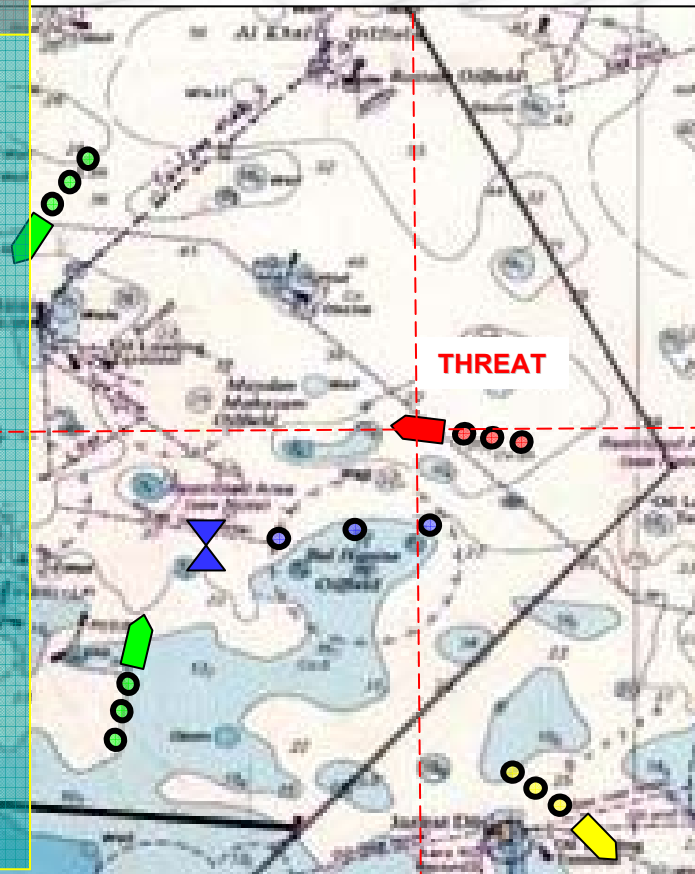
THREAT COURSE 242° - THREAT SPEED 12 kts

THREAT POSITION N25°27'42" LAT - E52°15'50" LON

TIME TO INFRINGEMENT 190 MIN

ACK STATUS → ----

SEND



A MISSION EXAMPLE: 10 - THE TASKED PATROL BOAT STARTS FOR THE MISSION AFTER A CERTAIN TIME
COMPUTED TO THE SCOPE OF OPTIMIZING THE USE OF RESOURCES

Coast Guard Availability

UNITs	STATUS	LAT LON	AUTONOMY	TIME TO TARGET
6	PATROL 10 MIN	N25°12'45" E51°49'27"	500 NM	75 MIN
9	PATROL 10 MIN	N25°35'07" E51°46'15"	250 NM	71 MIN
11	PATROL 10 MIN	N25°17'32" E51°34'68"	340 NM	60 MIN

COURSE 267° SPEED 12 kts
POSITION N25°31'58" LAT - E52°44'57" LON

TIME TO INFRINGEMENT 188 MIN

ACK STATUS → OK TIME TO START 70 MIN

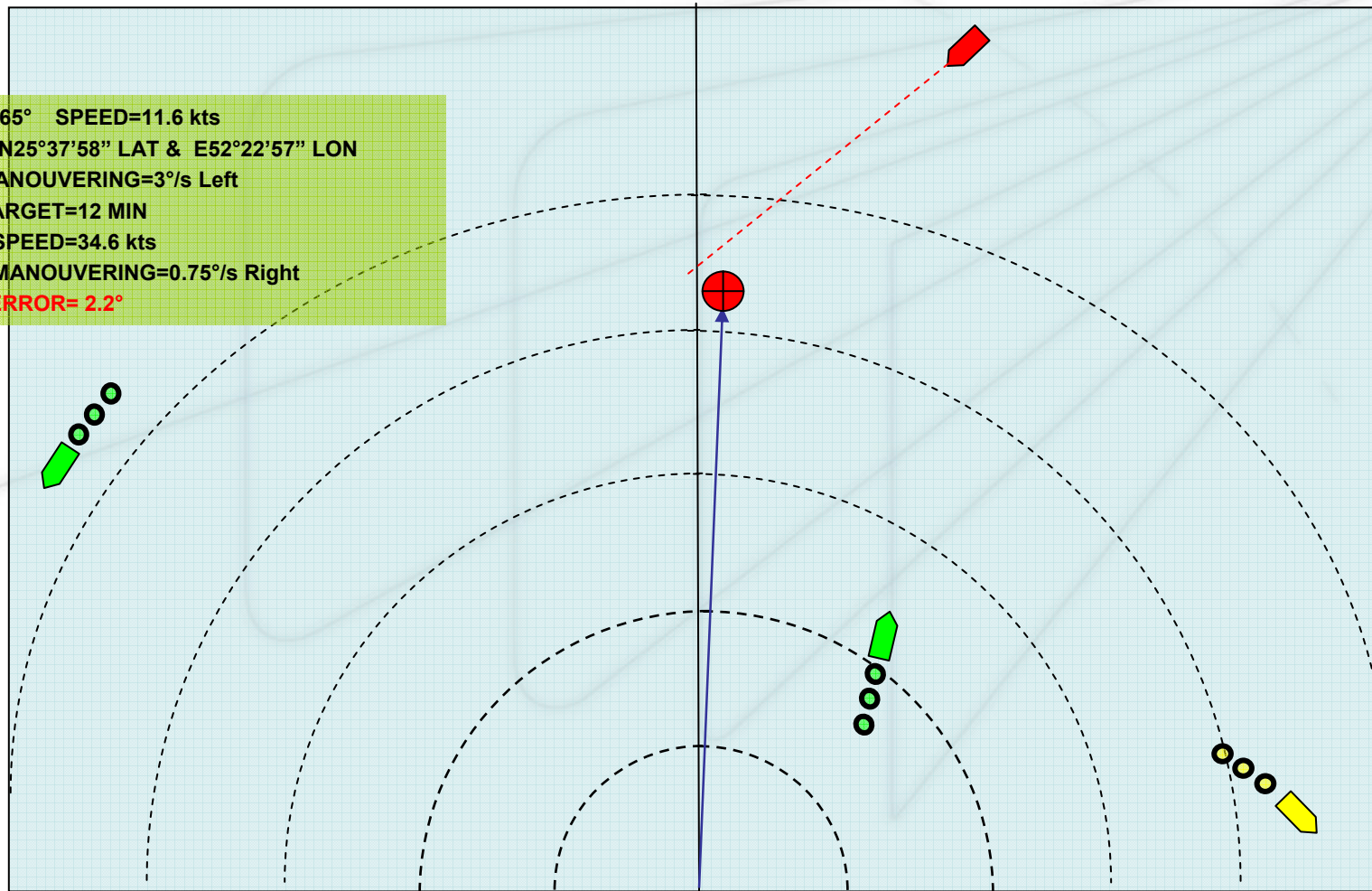
GUIDANCE → ✓ ORDER SEND

A MISSION EXAMPLE: 10 - THE TASKED PATROL BOAT STARTS FOR THE MISSION AFTER A CERTAIN TIME
COMPUTED TO THE SCOPE OF OPTIMIZING THE USE OF RESOURCES



A MISSION EXAMPLE: 11 - A LOCAL CROP IS PROVIDED TO THE INTERCEPTOR FOR PURSUIT GUIDANCE

COURSE=265° SPEED=11.6 kts
POSITION=N25°37'58" LAT & E52°22'57" LON
THREAT MANOUVERING=3°/s Left
TIME TO TARGET=12 MIN
OWNSHIP SPEED=34.6 kts
OWNSHIP MANOUVERING=0.75°/s Right
HEADING ERROR= 2.2°



Maritime Border Control

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