PMAR
Piracy, Maritime Awareness & Risks

Maritime Situational Awareness for Counter-Piracy

European Commission – Joint Research Centre
Key elements for maritime governance:

1. Situational awareness
2. Intervention capacity
3. Legal framework

Maritime awareness tools for authorities in piracy-affected regions (Africa)

PMAR project “Piracy, Maritime Awareness & Risks”

Gulf of Guinea
Horn of Africa
PMAR project

- The capacity for Maritime Awareness in the hands of maritime authorities in Africa
  - Horn of Africa (HoA) and Gulf of Guinea (GoG)
- Local ownership
  - Tailored to the region’s needs (practical, cost-effective)
  - Capacity building aim
- Regional approach
  - Civilian, data sharing
- As a key enabler for fighting piracy
  - Beyond piracy, also for wider maritime safety and security – Illegal fishing, immigration, pollution, etc.
  - Toward better maritime governance in general
- EU initiative, but internationally coordinated
  - With IMO, UN, U.S., ...
The space-based tools

- **Navigation** – GNSS, positioning, timing
- **Communication**
  - Ship reporting systems
    - Broadcasting: AIS
    - Point-to-point: LRIT, VMS
- **Observation**
  - Optical imagers – Many
  - RADAR imagers (SAR) – EU:
    - Sentinel-1 – Medium resolution, “always on”, free
    - TerraSAR-X, Cosmo-SkyMed, Paz – High resolution, on demand, costly

Continuous, global tracking of reporting (medium-large) ships

Regular but still sparse sampling of non-reporting medium-large ships

Very incidental sampling of also small ships
Data sources
(based on practical, affordable, regional, ...)

• **Ship reporting systems (cooperative)**
  • AIS (merchant ships >300 GT, and wider)
  • LRIT (merchant ships >300 GT)
  • VMS (fishing ships)
  • Call-in reports from ships
  • Piracy incident reports

• **Observation systems (non-cooperative)**
  • Satellite images, radar (“SAR”) & optical

• **Auxiliary data**
  • Maps, Ship registers, Met/ocean data

• **Not in PMAR (regional concept) but also needed**
  • Coastal radar (+ cameras & sightings)
  • Patrol assets (boats, aircraft)
Data sources used in trials

- **Ship reporting systems (cooperative)**
  - AIS – coastal & satellite; government & commercial
  - LRIT From EU Flags
  - VMS through EMSA
  - Call-in reports from ships
  - Piracy incident reports from IMB

- **Observation systems**
  - Satellite images, radar (“SAR”) & optical

- **Auxiliary data**
  - Maps, Ship registers, Met/ocean data

- **Not in PMAR (regional concept) but also needed**
  - Coastal radar (+ cameras & sightings)
  - Patrol assets (boats, aircraft)
Building the Maritime Situational Picture

- **Cooperative Ship Positions** (AIS, LRIT, VMS)
- **Non-cooperative Ship Positions** (VDS)
- **Ship Register**
- **Vessel Tracking**
- **Fusion Algorithm**
- **Maritime Situational Picture**
- **Ship Tracks**

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GIS Display

- **Ship Traffic Density Layer**
- **Risk Maps**
Ship reporting data
West Africa / Gulf of Guinea

14, 15, 16 March 2013

14-16 Mar 2013 (3 days - RGB)
413,000 Messages/day
# Ships: 3,028
Average 135 msg/ship/day

Data sources:

Satellite AIS: exactEarth, LuxSpace, OrbComm, SpaceQuest, Norwegian (8 satellites)

Terrestrial AIS: MSSIS
Live ship traffic picture in Gulf of Guinea (PMAR project)

Data sources:
- Satellite AIS: exactEarth, LuxSpace, OrbComm, Norway
- Terrestrial AIS: MSSIS
Ship density maps (I)

Horn of Africa, Jan 2012
6 satellites
2.2 mln ship positions

Satellites: exactEarth, SpaceQuest, LuxSpace, Orbcomm, Norway

Gulf of Guinea, Jan 2013
8 satellites
7.7 mln ship positions
Ship density maps (II)

Cargo ships
6 months, Oct 2012 – Mar 2013

Fishing ships
6 months, Oct 2012 – Mar 2013
Performance of AIS satellites

Gulf of Guinea, Jan 2013

Individual performance

Incremental performance

Satellites: exactEarth, SpaceQuest, LuxSpace, Orbcomm, Norway
Satellite SAR image

Gulf of Guinea
20 Jan 2013
17:45 UTC

Radarsat-2
Wide Fine mode
8 m resolution
150 km swath

360 Targets
(HH+HV !)

Oil spills

Radarsat-2 image
© MDA 2013
Sampling non-reporting ship traffic

Data sources:
TerraSAR-X
Cosmo-SkyMed
Radarsat-2

reporting 460
not reporting 571
Non-cooperative: Satellite SAR

Gulf of Guinea, Jan-Mar 2013
139 Scenes

- Cosmo-Skymed Provided by Italian Space Agency
- TerraSAR-X Provided by DLR
- Radarsat-2 Commercial from MDA/KSAT
Non-cooperative: Satellite SAR

Gulf of Guinea, Jan-Mar 2013
6670 SAR targets

Cosmo-Skymed  Provided by Italian Space Agency
TerraSAR-X  Provided by DLR
Radarsat-2  Commercial from MDA/KSAT
Non-cooperative: Satellite SAR

Gulf of Guinea, Jan-Mar 2013
3300 Correlations SAR target – Reporting ship (50 %)

Cosmo-Skymed Provided by Italian Space Agency
TerraSAR-X Provided by DLR
Radarsat-2 Commercial from MDA/ksat
Joint Research Centre (JRC)

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