ENABLING THE BLUE ECONOMY THROUGH SPATIAL INFORMATION SYSTEMS

The South African National Oceans and Coasts Information System as a Case Study

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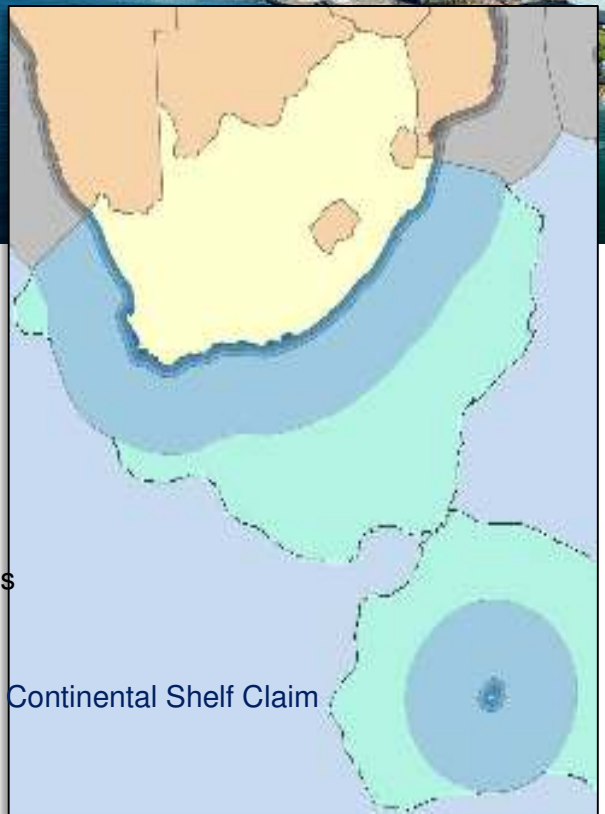
South Africa’s ocean economic potential ranges between US$129 and US$177Mn by 2033*, with between 800 000 to 1 million jobs* created

Africa – 38 Coastal States.
AU Integrated Maritime Strategy 2050 – Estimates $1 Trillion/annum

South Africa Oceans Challenge



Land Size:

1.2 million km²

Exclusive Economic Zone (EEZ) Size:

1.5 million km²

South Africa Oceans Challenge

With such a large ocean jurisdiction, effective governance will be challenging given the size and complexity

~3,900 kilometres of coastline

~20 key departments and institutions in the marine environment with distinct roles and maritime policies

~50 national acts regulating marine governance

4 coastal provinces with their own socio-economic context and development goals

Ocean Observations | Introduction

More and More … data is processed and represented in some form of map, however the pace and change in the real-world requires enhanced processing to provide real-time and real-world context to the observations.

The South African shelf seas, the South Atlantic, Indian and Southern Oceans are a vast, remote and in some places inhospitable domain. Effective governance requires the availability of a broad range of information for this large, remote and rapidly changing area.

Satellites are the only way of quickly and routinely providing such information

Ocean Observations| strategic view

- Monitoring of the Southern Oceans, in the 1.3m Km² that form the SA EEZ, has been a concentrated effort for many years though not systematically or co-ordinated
- A range of **remote sensing analytics and in-situ measurements** are performed regularly, though not yet operationally in the oceans around the South African coastline and in the oceans between South Africa and the Antarctic
- **Localised Mature and demonstrable solutions** exist for
    - Monitoring Marine and Coastal ecosystems
    - Operational Maritime Domain Awareness (ship traffic, pollution, security)
    - Understanding the Oceans role in the Carbon Cycle
    - Observing the biological and biogeochemical marine and freshwater ecosystems

Ocean Observations| strategic view

With this range of national capabilities and the supporting ICT infrastructures the technological base exist to provide

- **Vessel monitoring** through direct physical detection of all vessels ±10m or larger with Synthetic Aperture Radar (SAR),
- **Vessel monitoring** through Automatic Identification System (AIS) type systems, i.e. ship-based transponders,
- **Oceanographic data** (real time and decadal historical) including wind, waves, currents, ocean temperature, frontal maps for fishing zones, phytoplankton, sediment and others,
- **Ocean based pollution monitoring**, using a combination of SAR and ocean colour sensors to detect oil and other visible pollutants,

Ocean Observations| strategic view

- **High resolution coastal habitat**, change detection, elevation/bathymetry and coastal vulnerability maps,
- **Forecast (and historical) modelled data**, i.e. predicted winds, waves, currents, storm surges, temperatures, etc,
- **Available in situ data,** e.g. from gliders, buoys, ships and weather stations, in addition to resource-based information such as fisheries and shipping,
- A powerful IT system, able to integrate, analyse and visualise products from the above and other data sources, and **disseminate simple, user-focused products through web and other digital media** e.g. cellular.

Cost Benefit Analysis | Maritime Domain Awareness

Sector	Annual Value	EO Value Add	EO Value Add (%)	Annual Return	Decadal Return
SA Navy	Operational budget of ±US$308M or ±ZAR3B[14]	Vessel detection & reaction, MREA ability, MDA for risk management	6.7 % [a/1]	ZAR 200M	ZAR 2B
SA Merchant Navy	ZAR 5B[a/2]	Vessel routing & risk minimisation	2 % [a/3]	ZAR 100M	ZAR 1B
SAMSA mandate: safety at sea	SAMSA budget ±ZAR300M, capital & life value not calculated	Avoidance of vessel casualty, search & rescue	n/a	ZAR800M[a/4]	ZAR 8B

Cost Benefit Analysis | Fisheries & Aquaculture

Sector	Annual Value	EO Value Add	EO Value Add (%)	Annual Return	Decadal Return
Illegal Fishing	ZAR 1B [b/1]	Monitoring, compliance, increased vessel effectiveness	12% [23]	ZAR 120M	ZAR 1.2B
Potential Fishing Zones	ZAR 2.7B [b/2]	300% CPUE increase, compliance, move to eco management	6.7% [b/3]	ZAR 181M	ZAR 1.8B
Aqua-culture	ZAR 379M – 850M (proj 2020)	Farm siting, operations, HAB risk	2% - 4%	ZAR 17M – 34M	ZAR 250M

Cost Benefit Analysis | Environmental Management & Forecasting

Sector	Annual Value	EO Value Add	EO Value Add (%)	Annual Return	Decadal Return
Seasonal /Long range Forecasting	ZAR 10B [24]	Multi-sector: Increased forecast skill	1% [c/2]	ZAR 100M	ZAR 1B
Coastal Vulnerability & Extreme Event Risk	ZAR 76B [c/1]	Increased habitat/land mapping, forecast skill & risk mapping	1% [c/2]	ZAR 760M	ZAR 7.6B

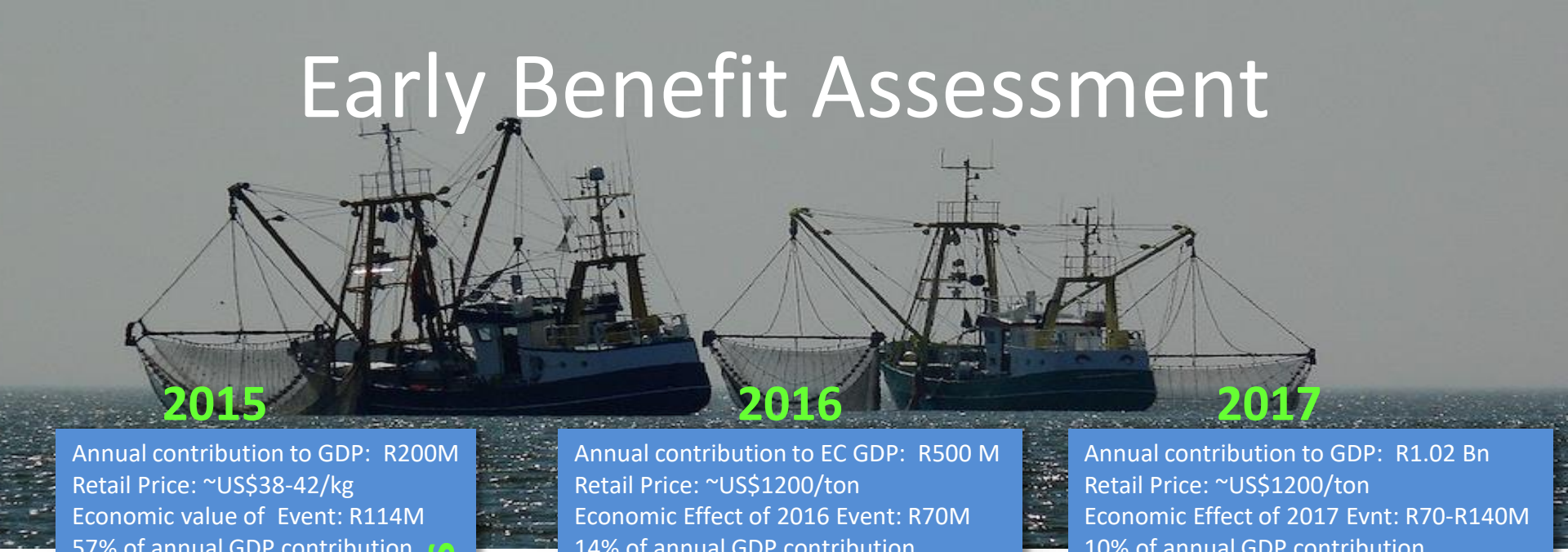
Cost Benefit Analysis | Earth Observation and Sensing Data

Ocean and Coastal Information System: Approximate Costs

	Required	Current	delta
Data:. SAR + AIS and high resolution optical	ZAR14 – 18 M/annum	R500K/annum – 2 years	R12-14M
Operational IT Systems:	R5 - 6 M/annum	0	R5-6M/annum
R&D:	ZAR 15 – 20M /annum	R5-6M/annum	R10-15M/annum
Total costs:	ZAR34 – 44M/annum	R7M	R35M/annum

Estimated Annual Cost:	Estimated Annual Value	Estimated Benefit: Cost
ZAR 39 million	ZAR 2.3 billion	58.9

Early Benefit Assessment



2015

Annual contribution to GDP: R200M
Retail Price: ~US$38-42/kg
Economic value of Event: R114M
57% of annual GDP contribution

200 tons

2016

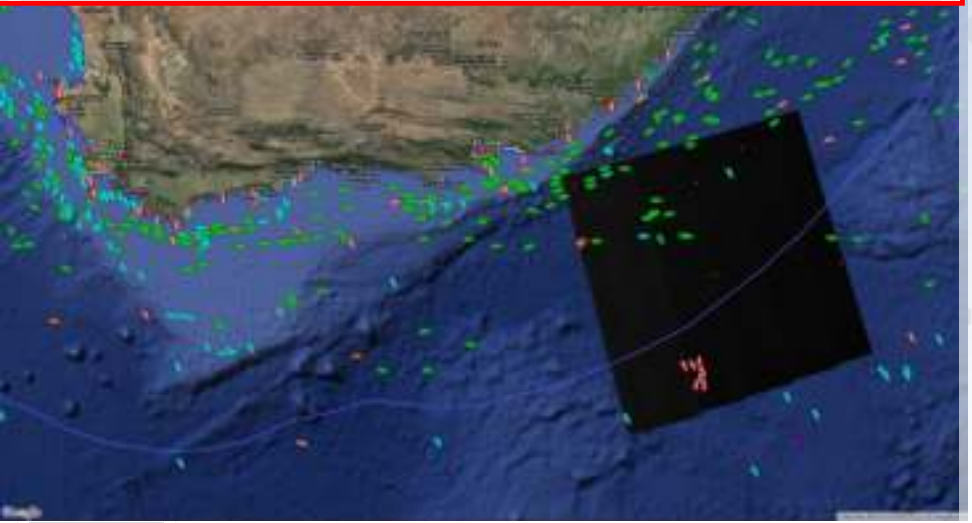
Annual contribution to EC GDP: R500 M
Retail Price: ~US$1200/ton
Economic Effect of 2016 Event: R70M
14% of annual GDP contribution

2017

Annual contribution to GDP: R1.02 Bn
Retail Price: ~US$1200/ton
Economic Effect of 2017 Evnt: R70-R140M
10% of annual GDP contribution

Protecting the fishing industry

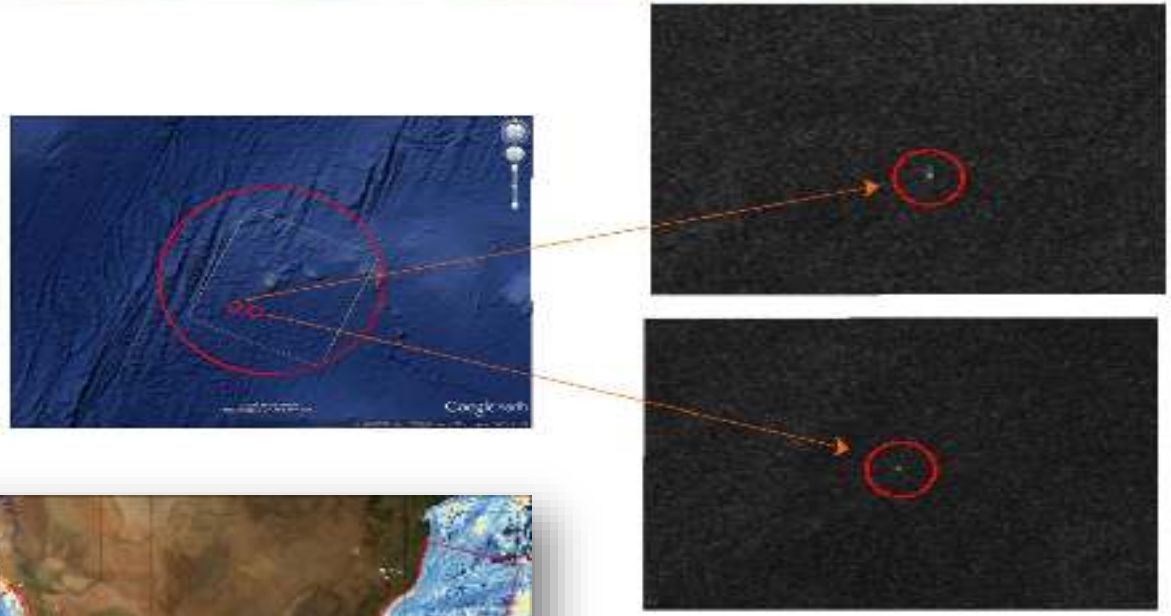
Annual contribution to Provincial GDP: $50 Million
Retail Price: ~US$3000/ton
Economic Effect of 2016 Event: $2M 4% of annual GDP contribution

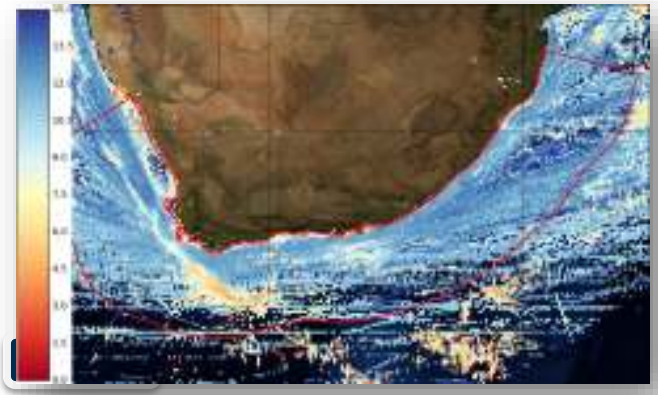


- Vessels detected in SA EEZ using AIS
- Remote Sensing analytics flagged the vessels as being unauthorised and violating RSA regulations
  - AIS Spoofing
  - No fishing permits
- Radio interaction with Ship led to them turning AIS off and trying to flee SA EEZ
- SAR data used to detect Dark targets in the area
- Spatial Notification System fed locations to intercept vessel

AI Detection of Vessels

Dark vessels detected on 10/07 200km South of Island





10/06 – 12/07

10

Total number of dark vessels (no AIS) detected within the Marion Island EEZ

Marion Island is a declared special nature conservation park and Sovereign South African Territory

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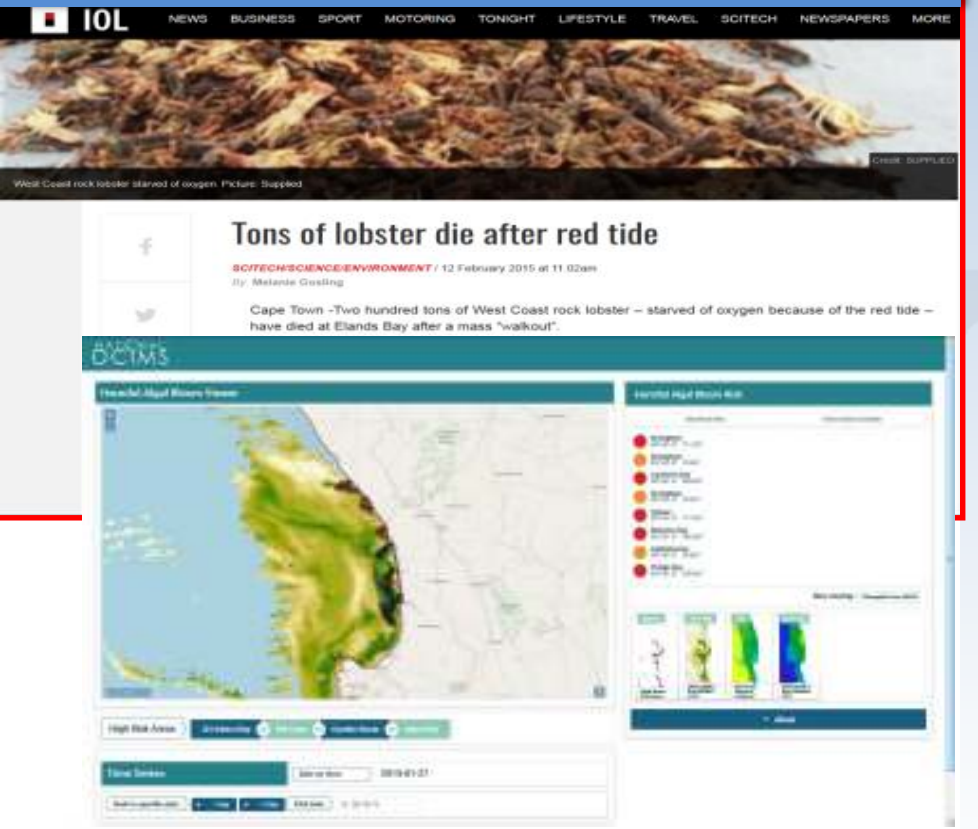
Preserving the Rock Lobster

Annual cont to GDP: $20M Retail Price: ~US$38-42/kg
Economic value of Event: $11.4M 57% of annual GDP cont



- Remote Sensing algorithms using a fused product of Sea Surface Temperature, Met Data and Ocean Color
- Routine ingest of satellite data and local processing
- Automated spatial notification system constantly forecasts for intercepts between the HABs and Marine Spatial Plans to determine risk levels
- Alerts sent to end users eg Aquaculture (fish farms), Env Protection Agencies, Local Municipalities

Preventing Economic loss to Aquaculture

Business Day

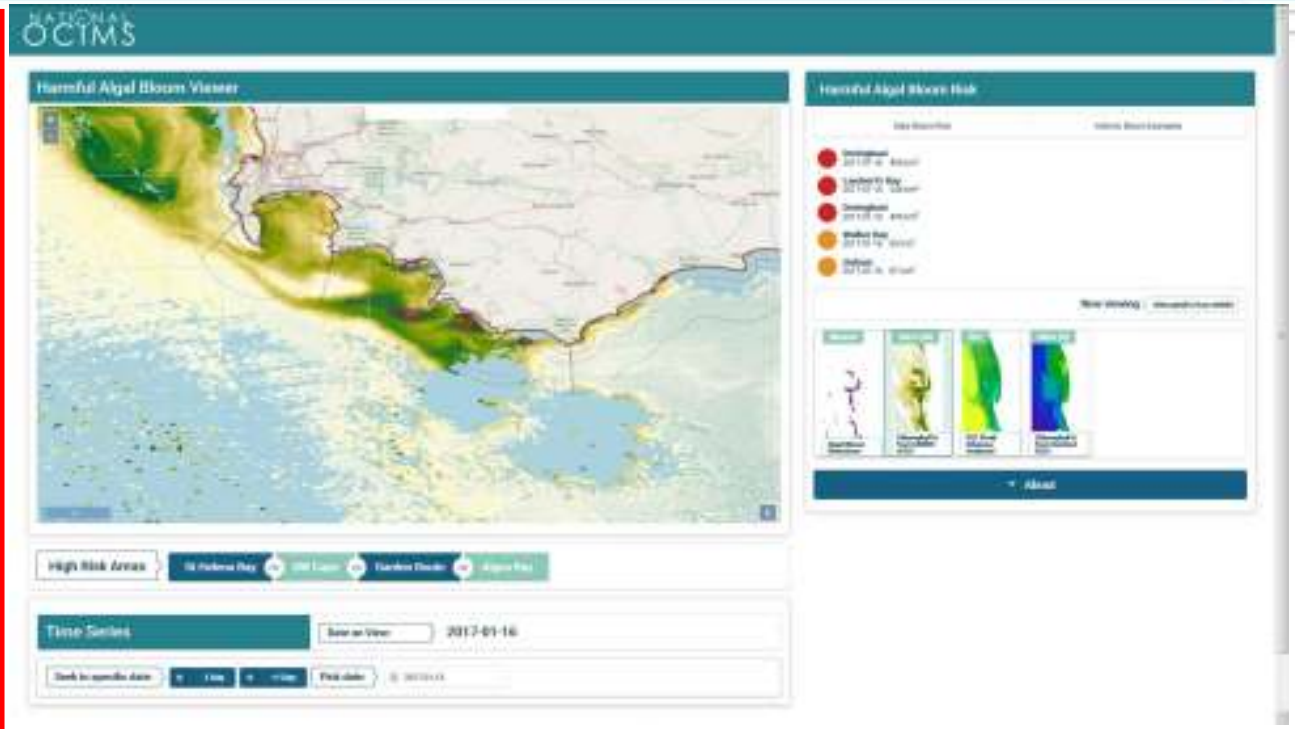
COMPANIES

DIVIDEND SKIPPED

Abagold in red tide sales alert

The abalone farming venture warns shareholders it is still assessing red-tide impact

Unlisted abalone farming venture Abagold has warned shareholders it is still assessing the effect of a recent red-tide



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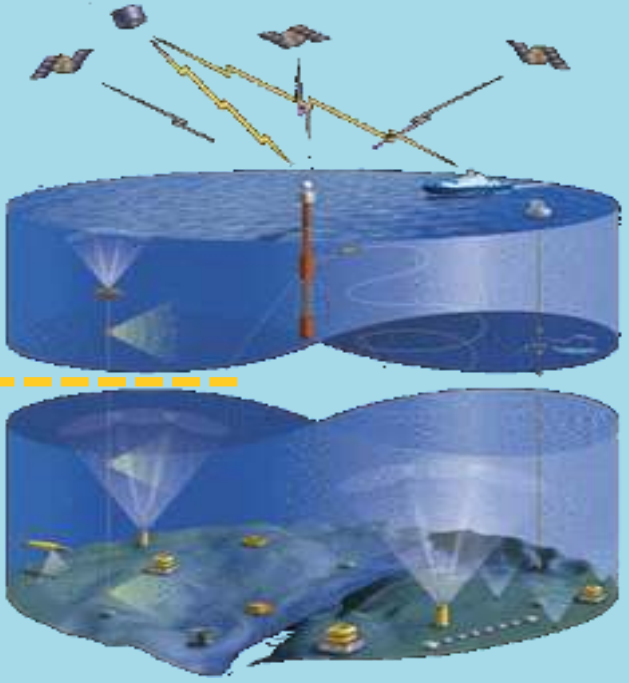
Decision Support Value Chain

underpinned by operational linked sensing and modelling systems

CYBERSPACE



VALUE TO END USERS

DeSTs
Decision Support Tools

SENSING in THE REAL WORLD


sansa
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S.A. AGULHAS


SA's ocean robotics capabilities:
Southern Ocean Seasonal Cycle Experiment (SOSCEx)
Many many contributors
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CSIR
SOCCO

EO/Spatial Data | Advanced SDI | Analytics | User Experience

Geo-Spatial Processing Platform

SDI

Data Repository

Security

HABs

MPA Alerting

Hazard lines

Environmental Variables

Near Shore Ops at sea

Vessel Tracking

Oily Bilge detection

Media Monitoring

OCIMS and SEAFAR

Scale Up
Towards achieving the Africa Blue Economy
Supported by GMES-Africa

co-designed decision-making services to promote
sustainable management of marine resources,
improve marine governance, and
stimulate growth of the blue economy in the South and East
African regions

Blue Economy | Conclusion

- We need to remain deeply concerned with the protection and management of the Oceans and Coasts while promoting enhanced utilisation of the resource
- The regional research community is consistently growing its capacities and capabilities to respond to the protection and management of this crucial natural resource
- We are ready to move from experimental and Proof of Concepts to Operational Systems
- Broader Governmental support and endorsement is required to leverage current investments.