

Cooperative unmanned vehicles for persistent monitoring of the oceans (Atlantic+Indian)

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Motivation



- Unmanned vehicles are essential for monitoring oceans
  - Habitat mapping
  - Oceanography
  - Many other examples
- Unmanned vehicles along with existing marine infrastructure
- State-of-the-art unmanned technologies in the universities and industry (Portugal)



LSTS at FEUP



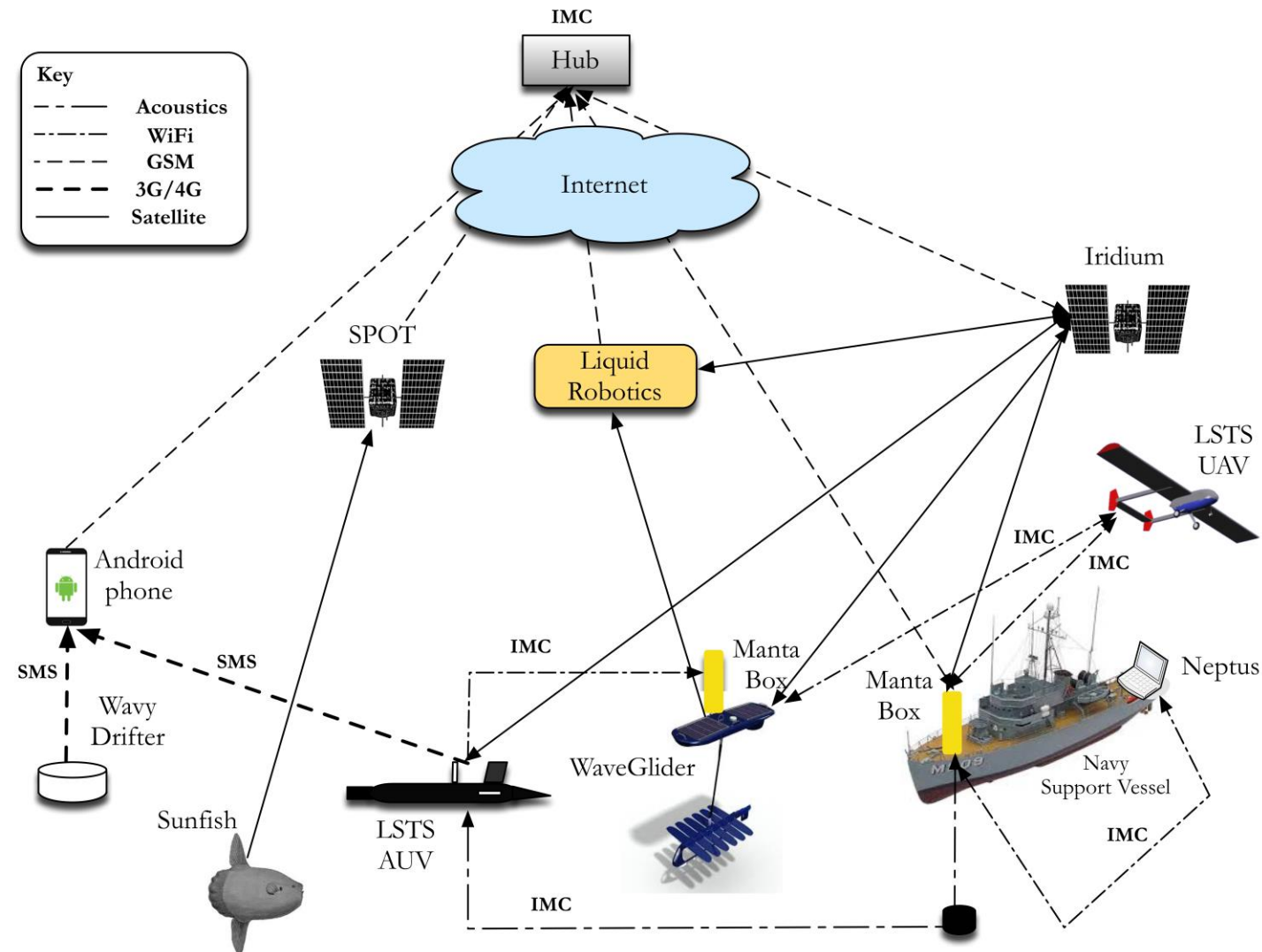
DSOR at IST Lisbon

- Any application in the sea is large
  - Algal blooms
  - Eddies and fronts
  - Illegal fishing
  - Marine mammal tracking (whale, shark, sunfish)
- Single vehicle is not good enough
- Multiple unmanned assets are required
  - Low cost systems
  - Mission control systems for easy deployments
  - Cooperation between vehicles
  - Human-operator interaction

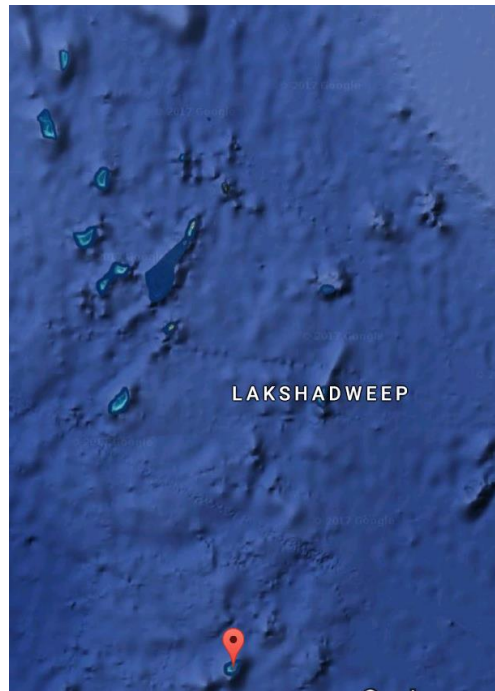


Red tide (IPIMAR, Portugal)

Networked vehicle system



Where can these system to be used?

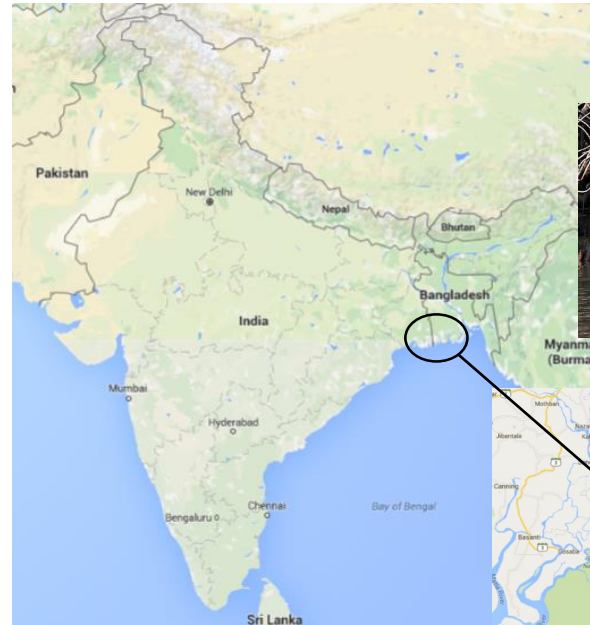
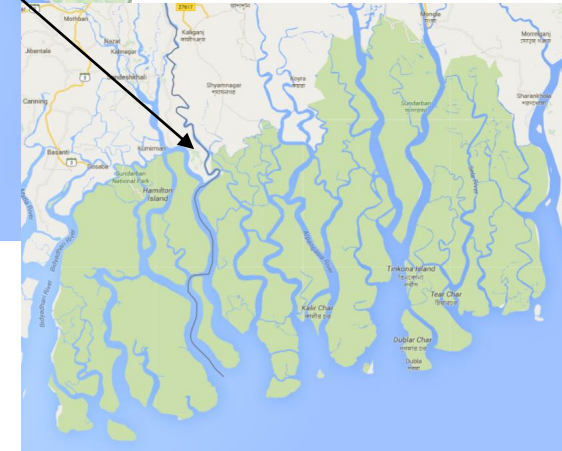


Sunderbans

Sunderbans – habitat mapping



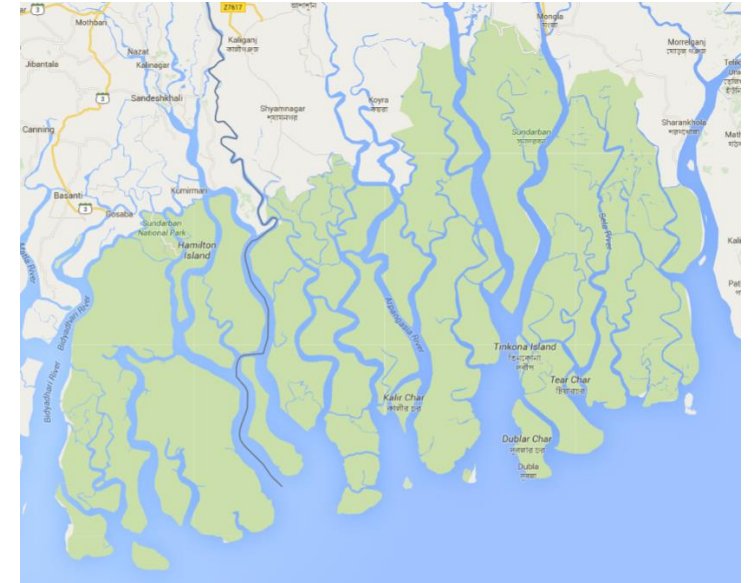
- Beautiful Mangroves
- Several thousands of Sq. Kms
- Remote and hostile
- Very little is known
- Unmanned vehicles can provide the desired information
- Issues?



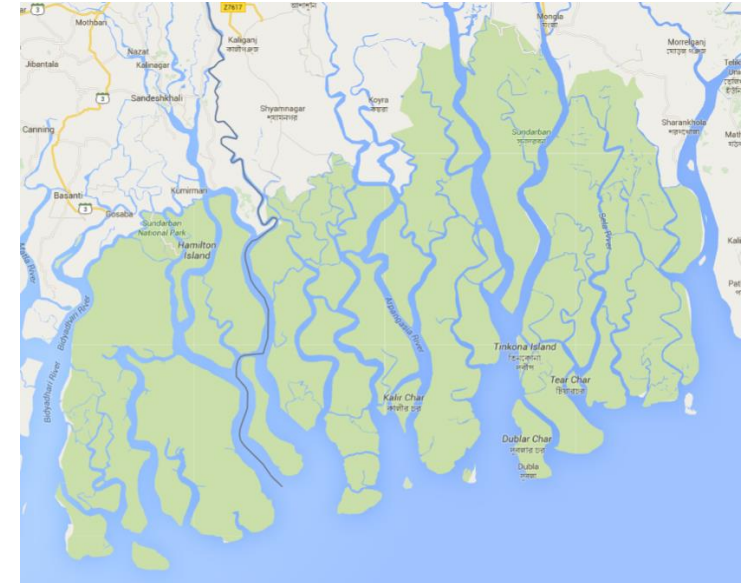
Issues in habitat monitoring



- No route on land, only water canals



- Jun 27, 2014 - The danger of venturing into the prohibited areas of **Sunderbans** was ... time that a human was **killed** by a tiger in the **Sunderbans** this year.



Issues in habitat monitoring



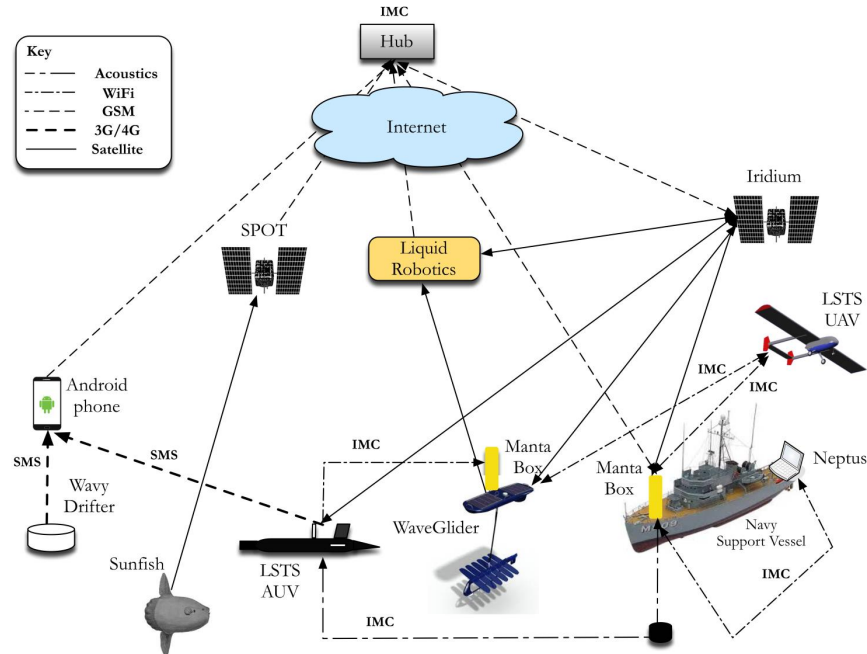
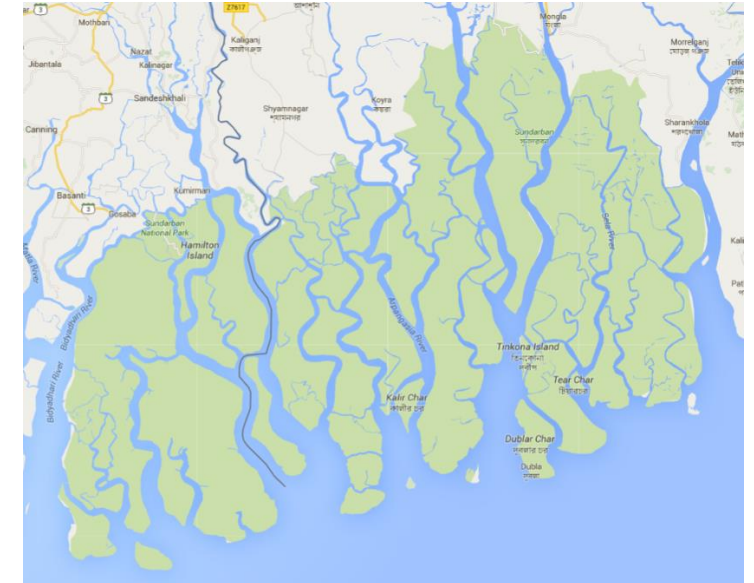
- No route on land, only water canals

Tiger snatches man off boat, leaps back into Sunderbans jungle ...

timesofindia.indiatimes.com > City ▼

Jun 27, 2014 - The danger of venturing into the prohibited areas of **Sunderbans** was ... time that a human was **killed** by a tiger in the **Sunderbans** this year.

- Study of bio-diversity of essential



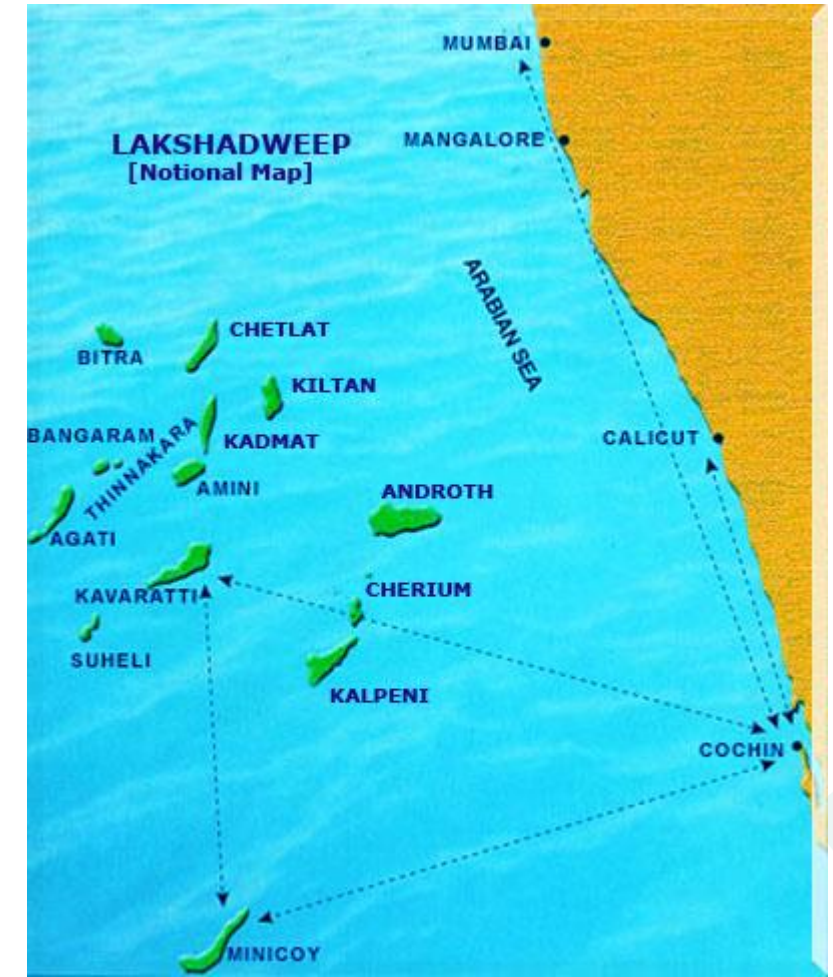
Lakshadweep



- Coral reef monitoring
- Spore studies
- Recent bleaching of the reef
- AUV-ASV and UAV teams!



Ncf-india



Lakshadweep



OpenROV

- Coral reef monitoring
- Spore studies
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Lakshadweep



- Effect of climate change
- Effect of increases tourists and population



- Greater flamingo migration
- Water quality assessment
- Restricted vehicular movement
- ASV can play a key role
- UAV -> images
  - Sound?



Conclusion



- Technologies exists that can be exploited
- New low cost technologies need to be developed for large scale deployments
- Science question!!
- India-Portugal partnership is ideal
  - Expedite the process of acquire information
  - Bilateral transfer of knowledge
  - Unmanned technologies (Portugal -> India)
  - Challenges science + societal + fascinating problems (India -> Portugal)