

# Industry Technical Advisory Committee

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## *Session Introduction* **Autonomous Systems**

*Sarah Hall*  
*Oil Spill Response Ltd*

# What is Autonomy?

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*‘The ability of a system to achieve operational goals in complex domains by making decisions and executing actions on behalf of or in cooperation with humans’*

- 💧 What this means...computers are trusted with tasks previously carried out by humans, and also tasks beyond human capacity such as keeping a ship in fixed position or allowing unstable airplanes to fly safely

# Applying Autonomous Systems

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- ◆ The Oil & Gas industry stretching the limits of what can be achieved with current technology
- ◆ Autonomous systems represent an emerging new system category that can provide solutions to meet these challenges
- ◆ Other industries are already utilising autonomy in order to execute tasks that cannot be performed by humans alone
- ◆ Efforts mainly been driven by aerospace/military i.e. deep space robots, unmanned aircraft and vehicles, smart monitoring systems
- ◆ There are challenges in oil spill response that could be solved with similar solutions



# Autonomous Systems



Meteorological instruments are sent into the hostile upper atmosphere to better understand weather and climate



UAVs fly over glaciers to monitor changes recorded by autonomous sensor nodes implanted within the ice

LiDAR imaging measures forest canopy heights improving understanding of nutrient uptake



The technology allows us to monitor crop productivity, control pests and pathogens, and ensure the efficient use of resources such as water and nitrogen



Eye in the sky surveillance, inside or outside, provides information for defence and national security



Multispectral cameras map areas burned by wildfires and estimate vegetation fuel load and consumption



Sensors can locate victims and monitor natural disasters



Floating sensors map oceans to understand (and eventually predict) changes in atmosphere and ocean chemistry



Sensors on drones can analyse fires on ships to guide firefighters and rescuers



Platoons of driverless vehicles would cut accidents by 95% and save fuel



Chemical and seismic sensors mounted in deep boreholes record realtime changes in geothermal systems to better understand the causes of earthquakes



Sensors mounted on ships, buoys or at sea level monitor weather, sea state and ship movements to improve fuel consumption and safety and transmit data to scientists about any changes



Sensors mounted on autonomous underwater vehicles can make 4-D maps of oil leaks from submarine pipelines or find deep sea hydrothermal vents



4-D mapping of ash clouds and CO<sub>2</sub> emissions informs responses to volcanic hazards and the impact of volcanoes on climate



Multi-agent coordination allows operators to form agile teams of autonomous vehicles so rescuers and operators can safely carry out situational awareness tasks in dangerous situations



# Potential Benefits of Autonomous Systems

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## 💧 **Reduced risk:**

- Reduced human exposure to danger i.e. reduce or eliminate people working on-site

## 💧 **Reduced cost:**

- Less need of costly human supervision
- Increased up-time
- Reduce dependence on resources required to support humans i.e. expensive vessel time (require limited resources to deploy and recover)

## 💧 **Optimal operations:**

- Increased situational awareness = improved decision making i.e. near real time and long term datasets, large spatial resolution datasets

## 💧 **Simultaneous operations:**

- Co-operating robot teams i.e. joint asset integrity and environmental compliance surveys, pipeline day to day monitoring and spill response

## 💧 **Time/schedule improvements:**

- Operate one or more systems independently or in parallel

## 💧 **New areas:**

- Enables surveys of previously inaccessible areas
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# Challenges of Autonomous Systems

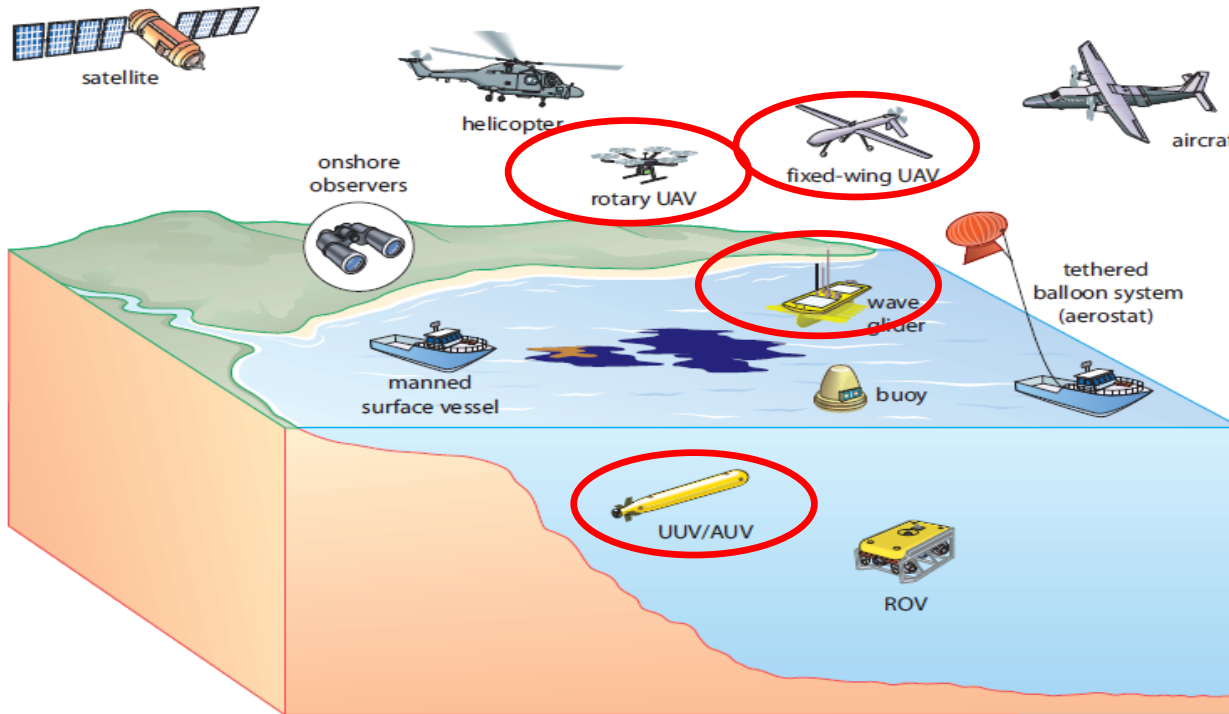
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- 💧 Overreliance on new technology – recognising limitations
- 💧 Regulatory acceptance and support i.e. safety standards
- 💧 Human trust of the systems - crucial that people trust the systems
- 💧 Public perception
- 💧 Data security
- 💧 Dual use
- 💧 Risk of vehicle loss – high value assets
- 💧 De-confliction i.e. marine vessels, manned aircraft
- 💧 Service companies still maturing



# Application of Autonomous Systems in oil spill response

💧 Preparedness    💧 Response



💧 Unmanned Aerial Systems (UAS)

💧 Marine Autonomous Systems (MAS)

The OSR-JIP represents the oil industry's consensus view on good practices related to oil spill preparedness and response <http://www.oilspillresponseproject.org/>

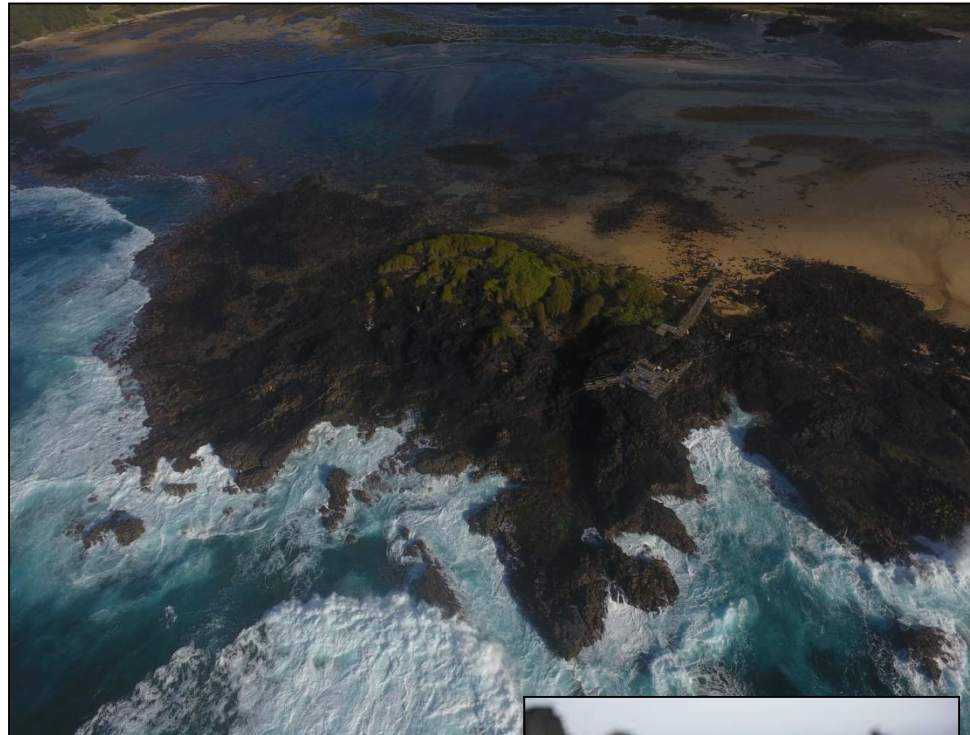
# Unmanned Aerial Systems in oil spill response

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Response – salvor/shoreline clean-up support  
(efficiency and safety)



- Surveying oil in the lagoon/shoreline/boom
- Surveying during the re-floating operations
- Photos/video
- Challenges





# Unmanned Aerial Systems in oil spill response

## Response – SCAT support (safety/efficiency)

- Segmentation
- Scaling the incident
- Oiled Shoreline Assessment form



# Unmanned Aerial Systems in oil spill response

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Response - improve encounter rates (efficiency)





- 💧 WCMRC (purchased UAS):
  - Shoreline site assessments
  - Shoreline response plan development
  - Equipment training
  - Offshore to improve encounter rates
- 💧 ECRC (hired UAS): placing river protection booms



# Marine Autonomous Systems in oil spill response

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Response – next generation fluorometry, plume mapping, baseline surveys





# Autonomous Systems: Session Focus

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- ◆ Primary focus of this session is Marine Autonomous Systems;
  - Current and future developments in Marine Autonomous Systems
  - OSRL Oil on Water exercise 2017
  - Marine Autonomous Systems for oil spill response: The NOC-OSRL autonomy project and reflections on the 2017 Oil on Water Exercise

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# Possible uses of UAVs

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## Response - shoreline

- Baseline surveys
- Segmentation
- Scaling the incident (basic oiling levels)
- Completion of the 'Oiled Shoreline Assessment' form
- Completion of 'Shoreline Treatment Recommendation' (STRs)
- Post treatment inspection and evaluation
- Long term monitoring
- Wildlife surveying
- Booming plans
- Gas monitoring
- Site security (equipment and people)

## Response – offshore

- Improving encounter rates
- Gas monitoring

## Preparedness - shoreline

- Habitat surveys
- Booming plans
- Wildlife surveys