RPAS services required for the pollution prevention in Finland
1.11.2016, Kuopio, Finland

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Photo: Panu Hänninen
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# Call for Papers for Proposed Session Themes

International workshop
Organised by
Finnish Environment Institute (SYKE)
Kuopio, November 1 – 2
Finland

Please, check the free registration and propose your paper at:
https://goo.gl/forms/LwGjK5K2W4pMgWBQ2

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<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
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</thead>
<tbody>
<tr>
<td>Tuesday, 1 November 2016</td>
<td>Wednesday, 2 November 2016</td>
</tr>
<tr>
<td>9:30 Opening of the seminar</td>
<td>8:30 Session III: &quot;Case Studies and Lessons Learned&quot;</td>
</tr>
<tr>
<td>10:00 Session I: “Technical &amp; Operational Demands”</td>
<td>12:00 – 13:00 Lunch</td>
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<tr>
<td>12:30 – 13:30 lunch</td>
<td>13:00 – 15:00 RPAS Demos at the Testing field of the College: Fire, SAR, chemical response</td>
</tr>
<tr>
<td>14:00 Session II: “Sensors and Data Handling &amp; Transmission”</td>
<td>17:00 Closing of the Day</td>
</tr>
<tr>
<td>19:00 Dinner in Kuopio</td>
<td>15:00 Transport to the City/Airport</td>
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</table>

Proposed Papers/Registration (free of charge):
https://goo.gl/forms/LwGjK5K2W4pMgWBQ2

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Unmanned Aircraft

UAV - Unmanned Aerial Vehicle

UAS – Unmanned Aircraft System

RPAS – Remotely Piloted Aircraft System

Drone

Model Aircraft

Toy

Rune Storvold 2014
UAV –ARCTIC 2016 - Kemi Arctic 2015 Full Scale Exercises and Trials

https://www.youtube.com/watch?v=C_W5iw3XAbQ

https://www.youtube.com/watch?v=96P72qPedTo
Kemi Arctic 2015

- Kemi Arctic 2015 was a start up for UAV Arctic project:
- Selected systems and sensors were demonstrated during the full-scale trial
- Special session on monitoring was arranged
- Report was made on the status quo of the sensors for oil detection among ice and snow.

Kemi 2015 - Session III: Short and Long Range Monitoring and Survaillance

- Oil Detection among Ice and Snow Lessons learned, Sassi Rytkönen (pdf, 2581 kB)
- Oil spill early warning systems in aquatic environment, S Taurian (pdf, 1233 kB)
- Arctic Seas now and in the future, L Kaiponen (pdf, 866 kB)
- Create the Common Operating Picture for increased oil recovery, R Pearsns (pdf, 3830 kB)
- UAVs for Environmental Monitoring in Finland, S Ehnqvist (pdf, 847 kB)
- Oil spill detection radar and system integration-experiences and challenges, T Airissalo (pdf, 1713 kB)
- Oil detection in icy and open waters with HLIF LiDar, S Babichenko (pdf, 5974 kB)
- Modern Electronic Tools for Oil Spill Preparedness and Response in the Arctic, K Kumenius (pdf, 3679 kB)
- Rikola Hyperspectral Camera New Sensor for UAVs, J Soukkamäki (pdf, 2056 kB)
Airborne Monitoring Tools for Arctic and Baltic Sea Environment

- Especially sensors and oil/chemical detection methods for cold environment
- Project is supported by the IBA funding instrument
- Execution period: 2/2016 – 2/2017
Basin C (15m²): 70% ice, 30% water, 50 l oil.

Basin A (60m²): 30% ice, 70% water, 150 l oil.

Basin B (15m²): 50% ice, 50% water, no oil.
Case: chemical tanker grounding

- Services of MAR-ICE network were tested by SYKE at 23rd September 2013
- Scenario was based on grounding of a chemical tanker some 15 miles off the Porvoo oil terminal
- Accident took place 11.35am local time
- A set of chemicals leaked out of the ruptured tanks. Additionally 50 tons of bunker heavy fuel oil leaked.
Chemicals causing threat for nuclear power plant ??

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Finnish ports in the Gulf of Bothnia and in the Archipelago Sea</th>
<th>Finnish ports in the Gulf of Finland</th>
<th>Finnish ports total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol</td>
<td>0</td>
<td>746 141</td>
<td>746 141</td>
</tr>
<tr>
<td>Sodium hydroxide solution</td>
<td>233 703</td>
<td>146 628</td>
<td>380 331</td>
</tr>
<tr>
<td>Pentanes</td>
<td>0</td>
<td>315 978</td>
<td>315 978</td>
</tr>
<tr>
<td>Xylenes</td>
<td>0</td>
<td>161 894</td>
<td>161 894</td>
</tr>
<tr>
<td>Methyl tert-butyl ether (MTBE)</td>
<td>3 158</td>
<td>156 502</td>
<td>159 660</td>
</tr>
<tr>
<td>Aromatic free solvents (e.g.</td>
<td>155 363</td>
<td>0</td>
<td>155 363</td>
</tr>
<tr>
<td>white spirit and NESSOL)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethanol and ethanol solutions</td>
<td>27 650</td>
<td>94 369</td>
<td>122 018</td>
</tr>
<tr>
<td>Parafines</td>
<td>0</td>
<td>111 079</td>
<td>111 079</td>
</tr>
<tr>
<td>Phosphoric acid</td>
<td>91 797</td>
<td>0</td>
<td>91 797</td>
</tr>
<tr>
<td>Phenol</td>
<td>0</td>
<td>87 359</td>
<td>87 359</td>
</tr>
<tr>
<td>Propane</td>
<td>78 392</td>
<td>5 634</td>
<td>84 027</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Out-flowed oil type</th>
<th>Tank size/remaining onboard the ship [m3]</th>
<th>Estimated out flow to the sea [m3]</th>
</tr>
</thead>
<tbody>
<tr>
<td>vegetable oil, 8002-13-9</td>
<td>200 m³, float stopped</td>
<td>5 m³</td>
</tr>
<tr>
<td>phosphoric acid, 7664-38-2</td>
<td>200 m³, still floating out</td>
<td>50 m³</td>
</tr>
<tr>
<td>sodium hydroxide, 1310-73-2</td>
<td>200 m³, still flowing out</td>
<td>5 m³</td>
</tr>
<tr>
<td>ethanol, 64-17-5</td>
<td>200 m³</td>
<td>200 m³</td>
</tr>
<tr>
<td>phenol gas oil, 108-95-2</td>
<td>1000 m³</td>
<td>200 m³</td>
</tr>
<tr>
<td>heavy fuel oil HFO-380</td>
<td>500 ton</td>
<td>50 ton</td>
</tr>
</tbody>
</table>
Coast Guard and Rescue Services were on the site, crew was evacuated and two officials with chemical suits stayed onboard the damaged ship and followed the development of the situation.

Alert to MAR-ICE service was made at 1.50pm local time by e-mail and fax using the MAR-ICE Contact Form and annex giving more detailed information on the case.

Prior the alert telephone discussions were carried out between Syke and MAR-ICE regarding the alert exercise’s character.
Test Scenario of LNG release in Hamina 2015

- In order to illustrate possible danger of the LNG outflow a scenario was formed where LNG coastal carrier will run with too heavy speed into the existing LPG pier of the HaminaKotka’s terminal in Hamina.
- As a result one of the three LNG tanks, each 7 000 m3, will get a rupture and the instant LNG gas outflow.
- The rupture is above the waterline in the mid-section of the ship.
- During the accident the south-western wind speed is 12 m/s and the prevailing temperature close to +1 oC.
- See the following map/illustration of the accident site.

LNG concepts by Wärtsilä
EXERCISE - EXERCISE – EXERCISE – EXERCISE – EXERCISE - EXERCISE

Wind velocity 12 m/s
LNG gaz release case from
LNG Feeder’s one storage
tank having size 7 000 m³
LNG in temperature -163 oC
in 0.7 bar storage pressure.
Rupture in ship’s hull close
to the waterline
Lessons learned

- Three bodies were alerted in the Exercise: MARICE, FIOH and FMI.
- Response was rapid and first instructions were achieved in a short notice.
- Calculations using propane or hydrogen sulfide overestimated the plume drift. Methane gives perhaps more realistic view (note however cryogenic character with LNG!)
- LNG is not included into MARICE & FMI modelling toolbox.
- Spill quantity affect significantly on the evaluation of the flammable zone. In a real situation the estimation of the quantity of the spill outflow may be difficult!
- Correct pool formation on the water surface and the real impact of the outdoor temperature need to studied later.
The scenario 2016

- A container vessel approaching Helsinki "Vuosaari" harbour had a black-out and started to drift and eventually grounded. Cargo was both hazardous and non-hazardous substances.

- After the grounding a leakage of bunker oil (500 m3 of IFO 180).

- Due to the grounding there were problems with the stability of the containers: three containers fell to sea and some damaged containers were on the deck of the vessel.

- During the night following the accident the damaged containers had structural damages and started to leak unknown substances. The containers that fell to sea had sunk.
Chemical response

- Equipment: 2 recovery ships, 1 tug boat, 1 target ship, containers, barrels, helicopter
- MIRG group and chemical divers from Helsinki Rescue Department. Chemical experts.
- Finnish Meteorological Institute, MAR-ICE, the Centre of Excellence for Serious Chemical Threats. Chemical experts onsite
- Tasks:
  - Helicopter winching of MIRG-group to casualty
  - Helicopter transfer of chemical divers to vessel Turva
  - Boat transfer of chemical divers to casualty
  - Identifying the chemicals – providing chemical divers information on required protection level and response means
  - Recovery vessels: setup decontamination stations, using the gas sensors, using protective water spray, dropping the chemical cloud, using the closed air circuit, working in chemical protection suits
Chemical scenario

- Ammonia anhydrous 20 000L on the deck; leaked instantaneously 3500L. Pool formation on the deck, cloud.

- Chemicals on containers that had sunk: ethylenedichloride, styrene and phenol (molten). In exercise we used 200 L barrels (to enable testing of the operation of that KART)

- Chemicals inside the damaged containers on the deck: epichlorohydrine (small leak), benzene (small leak later on) and acrylonitrile. Volumes of the containments were 200-1000L. Chemical divers stop the leak
Remotely Piloted Aircraft Systems (RPAS) workshop for Civil Protection experts

Borschette Centre, Brussels - 21 – 22 January 2016

- EU Commission will support RPAS capacity building to support EUCP-operations. There are a lot of lessons learned in many fields.
- A special pool will be formed. All national partners can inform their national preparedness in order EU can to form USAR type of groups for international missions.
- For example UK and France already have RPAS capacity as a normal procedure to support some SAR and rescue missions.
- Finnish expert(s) joined the next meeting in the end of June (Brussels)
The objective is to provide surveillance services through Remotely Piloted Aircraft Systems (RPAS) for the maritime environment.

They should have a high level of deployability and availability that should permit EMSA to offer operational capability and provide additional data streams to European Union Member States, Iceland, Norway, to the European Commission, to European Union Agencies and to governmental organisations.

The RPAS services should be more cost effective compared to manned patrol aircraft and should be used as a complementary tool in the overall surveillance chain, including satellite imagery, vessel positioning information and surveillance by maritime patrol aircraft and vessels.

EMSA – focus

- Marine Pollution Monitoring
  - oil spill detection,
  - oil spill monitoring and support to response operations

- Emissions monitoring

- Vessel detection and identification
  - Vessel detection, monitoring and tracking
  - Vessel identification
OIL-ON-WATER 2015

NOFO Oil-on-Water 2015 was carried out in the period 8 - 12 June.

Following arrival at the Frigg field, the various trials were carried out in accordance with the Norwegian Environment Agency’s discharge requirements.

The purpose of each trial has been stated in the application for a discharge permit.

The objective of Oil-on-Water 2015 was the following:

General

As part of the work of verifying, maintaining and continuous development of the national oil spill preparedness network, together with the Norwegian Coastal Administration, arranges an annual realistic exercise involving discharge of oil. An oil-on-water exercise, and documents implementation of this. Oil-on-water 2015 was carried out during the period 8 - 12 June.

Exercise area

The exercise was carried out in the Frigg field within 10 nm of position 59° 59’N 002° 27’E.
Chemical trial – Kuopio November 2016

- Main focus is to detect airborne chemical plumes/vapour using RPAS and sensors
- Identification
- Sample taking
- Support/tool for MIRG group
- Support/tool for rescue officials

- Partners: sensor manufacturers, RPAS companies, Army, Rescue centres etc.

- 2-day long event
Workshop – proposed for 1/2017

- A special workshop will be arranged in 2017 by SYKE
- The main focus will be directed to RPAS for the Arctic use
- Possibility to have demos will be studied
- The planned form will be two days long seminar
- H2020
- SYKE’s R&D plan
MOSPA

- US facilitated MOSPA Table Top Exercise in June 8 in Montreal
- Finland will have the responsibility to facilitate the next MOSPA during the Finnish Presidency.
- Sensors, RPAS’s, Meto services, SAR and Mechanical oil recovery tools for pollution prevention may form the baseline tools for that exercise
- Planning need to be started in November 2017
- Execution period 2/2018 in Gulf of Botnia jointly with Sweden and Finnish Border Guard (SAR).
SYKE’s needs for RPAS services

- Environmental monitoring (optical measures); algae blooming, turbidity, sea weed growth, Mining areas.
- Infrared services; oil dridt, animal calculations.
- Hyperspektrometrum – identifying habitats and vegetation, algae, trees, plant diseases, dangerous substances.
- Visible light – situational awareness views of disaster areas and flooding areas.
- Laser – mapping, bathymetric studies, ice conditions
- SAR – synthesits aparture radar – ice conditions, oil slicks
SYKE’s vision for future?

- Fast and reliable situational awareness view – especially for oil and chemical response;
- Forest growth
- Cartography studies
- Ice data & mapping – ice pressure changes
- Sea bottom bathymetry
- Chlorophyll & water quality measurements
- Fulfilling gaps of the satellite observations
- Replacing human efforts of sample taking and observations
- Taking care of emission measurements – EU sulphur directive / CO2 development?
- Cutting down emission control costs (?)
More Information

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RPAS and case of Ammonium
31.10.2016/Kuopio tests. Sensor /Environics Oy