Use of Herding Agents to Facilitate In-Situ Burning

Presentation Overview

- Two experiments performed in 2015, 2016
- First involved “ice”; second involved open water
- Brief reference to companion study:
  - Windows of opportunity

ISB Experiment in “Ice” Objectives

- Validate use of herders in conjunction with ISB
- Validate use of helicopter-borne
  - herder application system; and
  - igniters

Summary of testing

Test	Oil volume	Herding agent	HeliTorch Fuel	Max Slick Area	Burn Efficiency		Herder success	Aerial ignition success?
					By weight*	By area**		
1	70 L	1 L OP40	60%diesel/ 40%gas	101 m^2	86%	--	Yes	No
2	75 L	4 l OP40	100%gas	193 m^2	59%	--	Yes	No
3	151 L	5 L OP40	20%diesel/ 80%gas	185 m^2	94%	73 to 79%	Yes	Yes
4	155 L	1 L TS6535	20%diesel/ 80%gas	277 m^2	73%	--	No	Yes***
5	155 L	4 L TS6535	20%diesel/ 80%gas	157 m^2	86%	74 to 84%	Yes	Yes

*Quantifies mass burn efficiency of free floating slick burning + sidewall-associated slick burning
**Quantifies volumetric burn efficiency of free floating slick burning only; not converted to mass since inherent measurement errors and burn rate assumptions preclude accuracy required for meaningful comparison
***Test 4 slick was ignited from the air, but only after slick was herded by wind against the sidewall

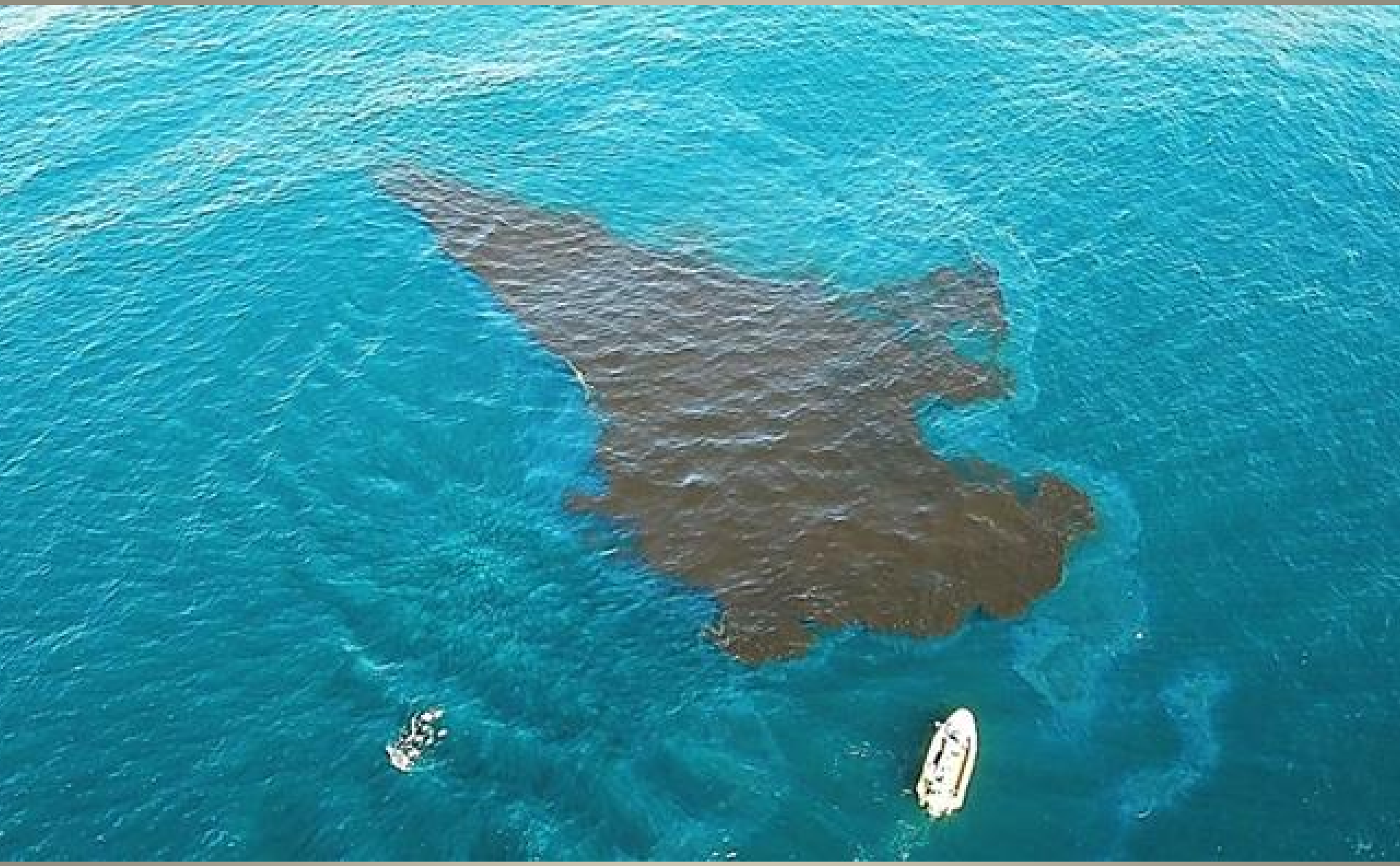
Experiments at Sea with Herders and In-Situ Burning

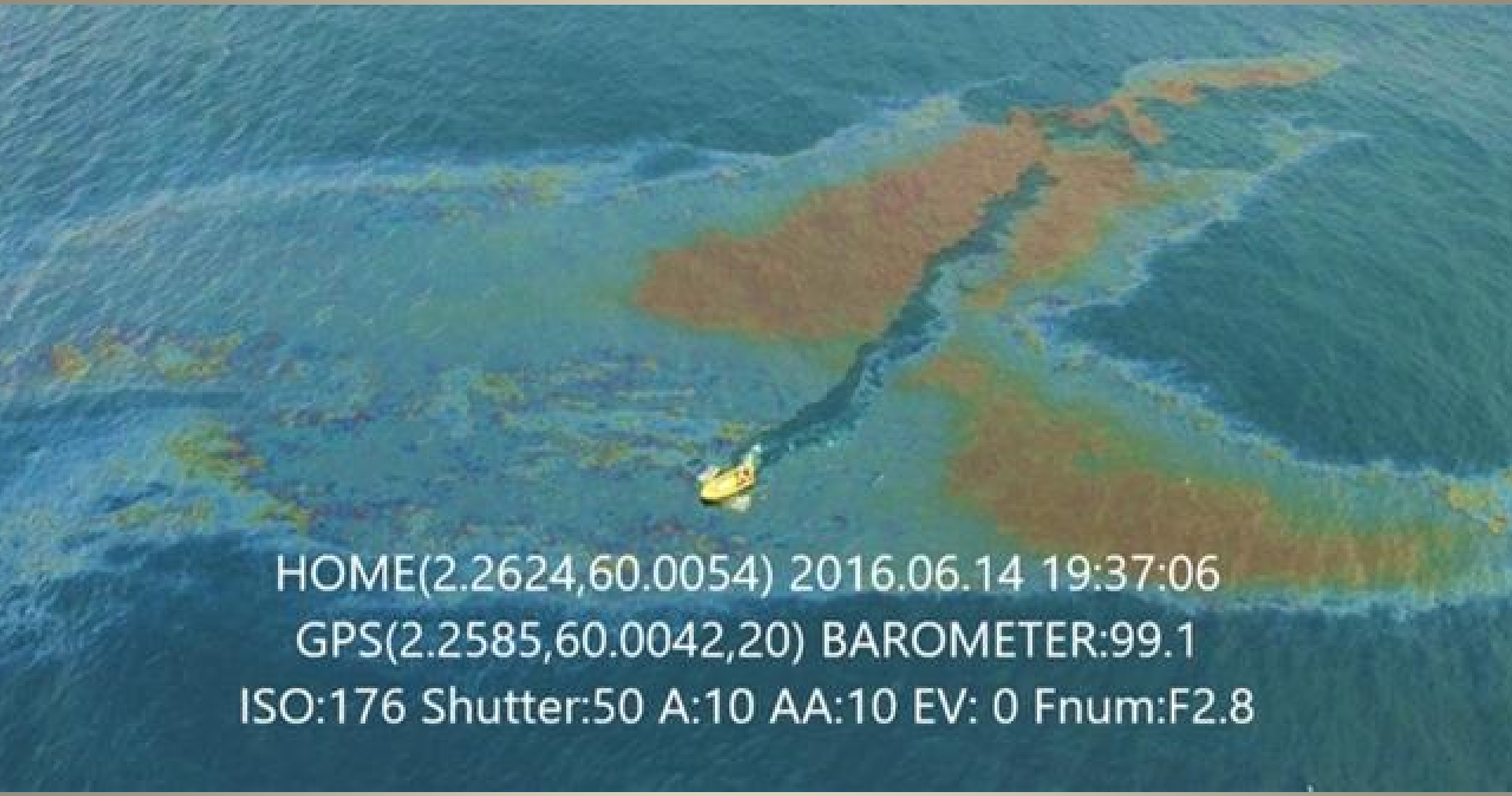
Primary objective:

Validate findings of an earlier study re: herders in open water

Methodology

- Three spills: 4 m^3 to 6 m^3
- One spill reference slick: no herder applied
- Herder applied from small boats
- Igniters manually applied approx. one hour after oil release
- Aerial imagery used to document experiments

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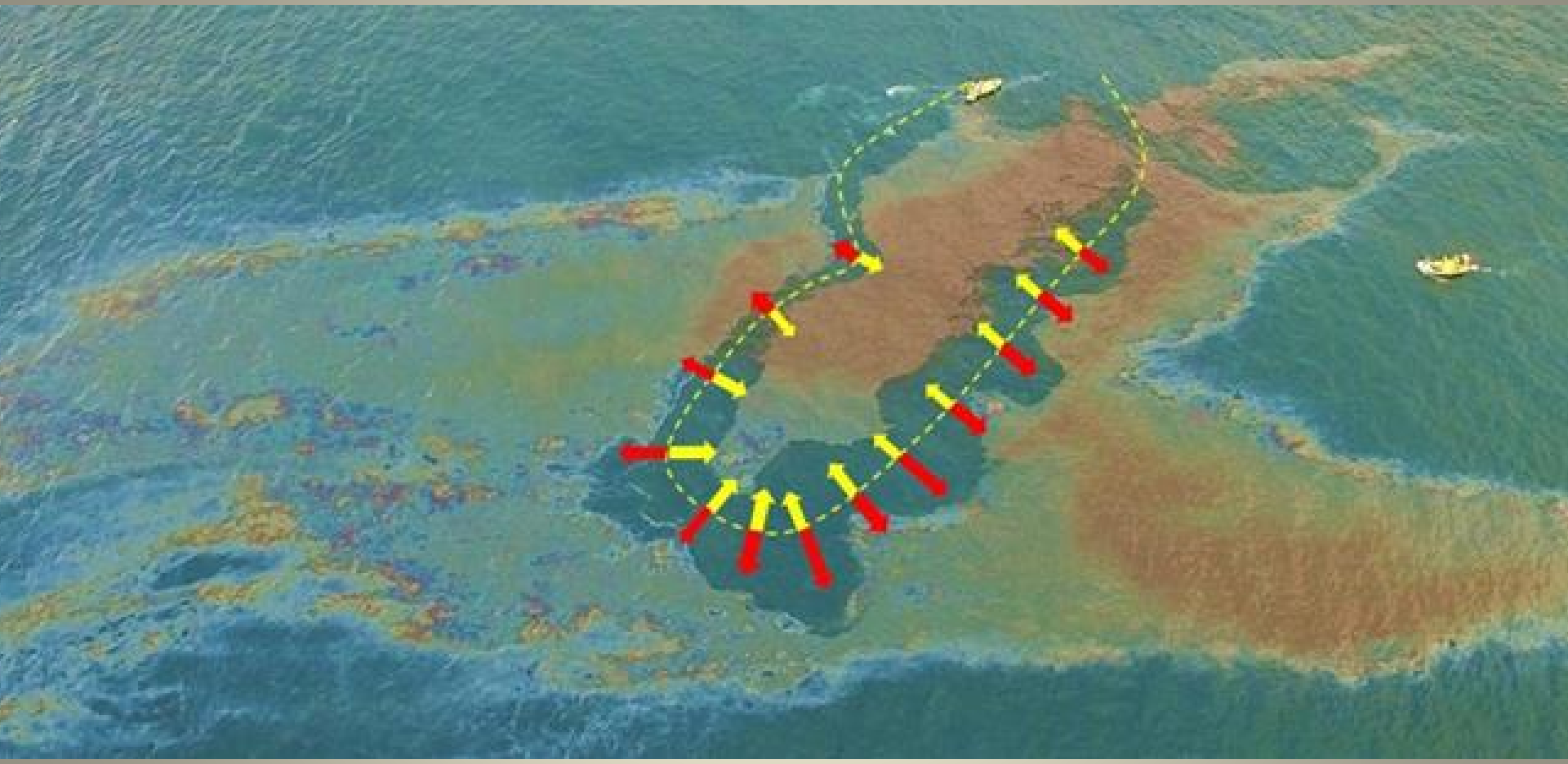


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Results

Test	Burn duration, minutes	Volume burned, litres
1	20	3390
2	13	1226
3	8	770

Conclusions

- Successfully demonstrated open water HISB
- Higher wind speeds in test 3 may indicate an upper limit in open water of 4 to 5 m/s (10 kts)
- Reference slick, without the use of herder, was also partially ignited

Windows of Opportunity Research

- “If oils will flow, herders will work”
- At temperatures >10C below pour point herders are ineffective
- As an oil emulsifies there is a loss of herder effectiveness

Conclusions

- Helicopter delivery system is being developed for application of herder and igniter
- In-situ burning should be considered a viable technique in:
  - Remote areas
  - Regions with partial ice cover
  - Inland areas with poor access