U.S. Coast Guard
Arctic Response Workshop

Anchorage, Alaska
April 23, 2010

"Mitigation on Water"
(with & without ice)

Alan A. Allen

Spiltec


Topics
Key Factors Affecting Response
Spill Source Considerations
Environmental Factors
Logistical Support

Spill Response Options

- Mechanical Recovery
- Controlled ("*In-Situ*") Burning
- Application of Chemical Dispersants
- Surveillance & Monitoring




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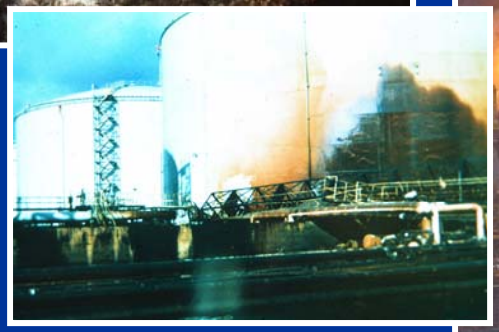
Spill Source Considerations

- Nature & Magnitude
- Location
- Wind & Sea
- Ignited vs. Unignited
- Visibility
- Oil Type & Condition
- Ice/Debris (Concentration & Type)



Key Factors Affecting Response

- Exposures – Potential Spill Sources
  (location, nature of release, ignited or not, etc.)
- Environment
  (wind/sea, visibility, water depth, debris/ice, etc.)
- Oil Volume, Type & Condition
  (°API, pour point, water content, volatility, etc.)
- Time to Respond– Proximity to Shore/Resources
  (onsite, offsite, staged, cascaded backup, etc.)
- Available Resources
  (trained personnel; mechanical, burning & dispersant capable)
- System Performance
  (known strengths & limitations, sustainable operations)
- Backup Support (logistics, storage, surveillance, spotting)

Of "most" significance are factors that affect:

- **Oil Encounter Rate**
  (slick thickness, system swath & speed)
- **Water Uptake**
  (oil type & agitation causing emulsification)
- **Safe & Effective Access**
  (visibility, wind/sea, currents & ice)

Important Issues Involving the Selection & Assessment of Response Options

OIL RELEASE

Over Surface
On Surface
Under Surface

CURRENT

Dynamic (< 1 kt) (> 1 kt)
Static (No Current)

WIND / WAVES

Calm: (0-2 kt) / [0-1/2 ft]
Light: (<10 kt) / [<2 ft]
Moderate: (10-20 kt) / (3-5 ft)
Strong: (>20 kt) / (>6 ft)

ICE CONDITIONS

SUMMER

Open Water (< 10% ice)

Potential Incursions (multi-year ice, all concentrations)

FREEZE-UP

Thin, Continuous

Thin, Broken/Slush

Thick, Continuous (or large floes to broken cakes, all concentrations)

Nearshore, Grounded

WINTER

Thick, Pack Ice with Ridging

Shore Fast Ice

Rapid Transition of above Conditions

BREAKUP

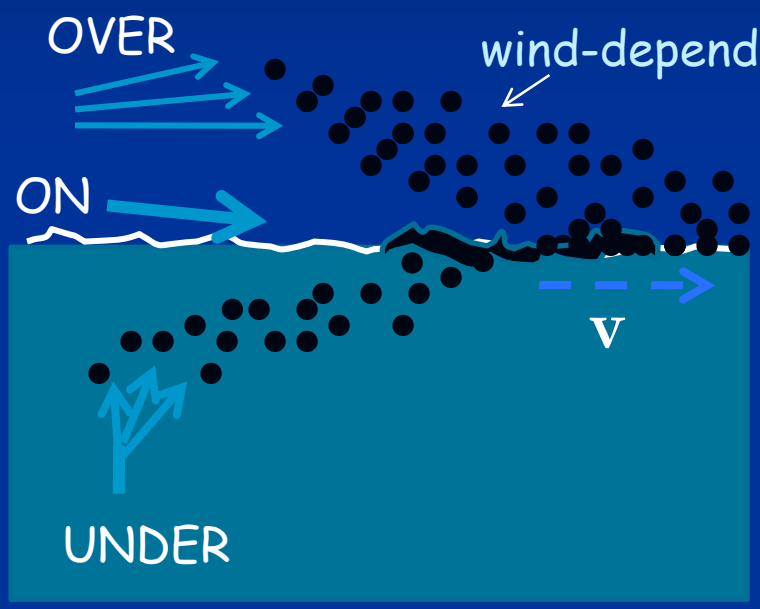
Early Melt (rotting)

Advanced Melt (broken ice)

Rapid Open Lead and Polynya Formation

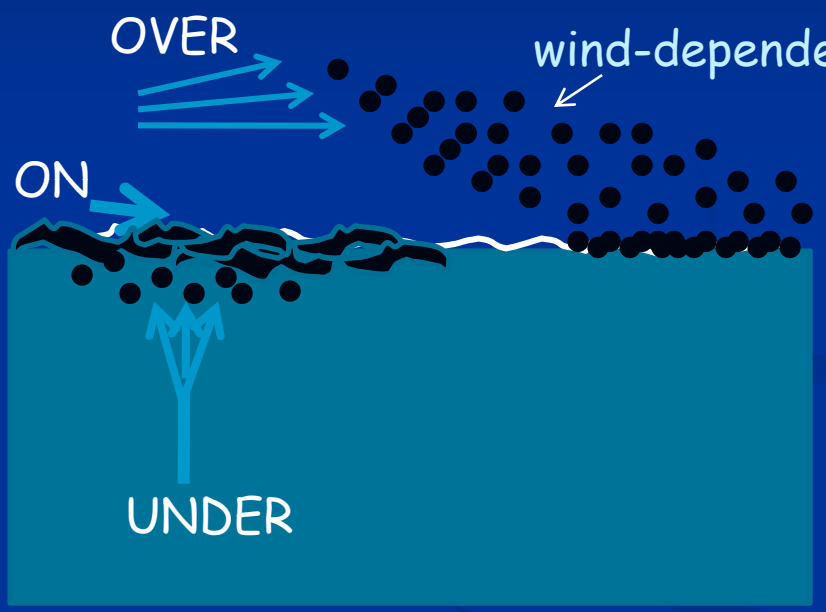
Modes of Oil Release
(Over, On & Under Open Water)

DYNAMIC
(with current)



Oil spread & distributed downstream of its source. Distribution dependent upon water depth, gas release (if blowout), atomization, wind speed, etc.

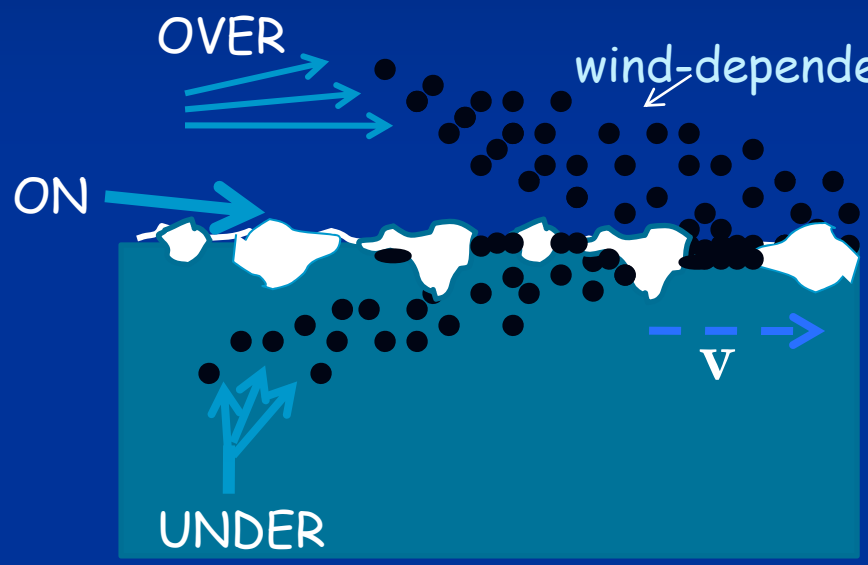
STATIC
(no current)



Oil allowed to accumulate & thicken at/near its source. Water depth, atomization, wind speed, etc. will affect distribution.

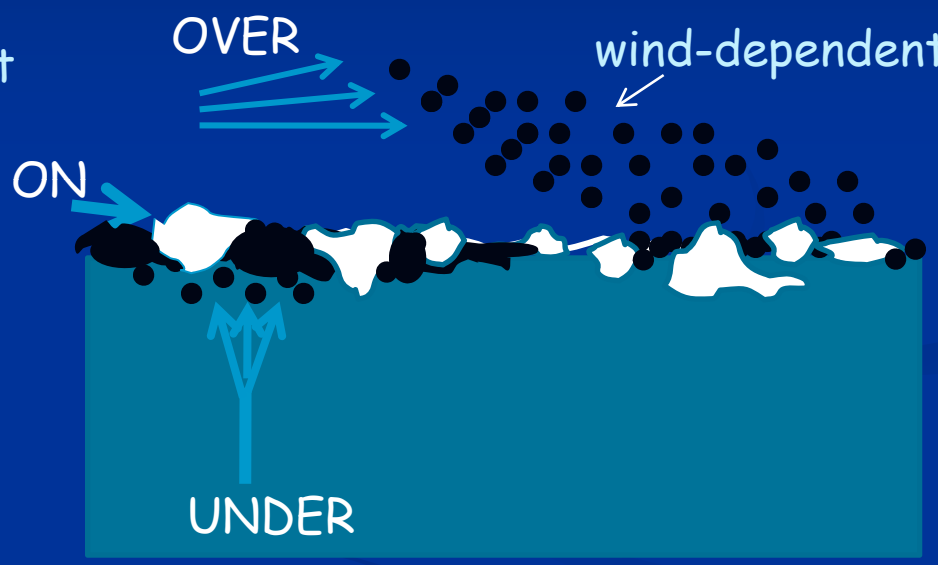
Modes of Oil Release
(Over, On & Under Broken Ice)

DYNAMIC
(with current)



Oil distributed on water between ice cakes downstream of the source. Some oil over/under ice depending on the nature & amount of ice, water depth, atomization, etc.

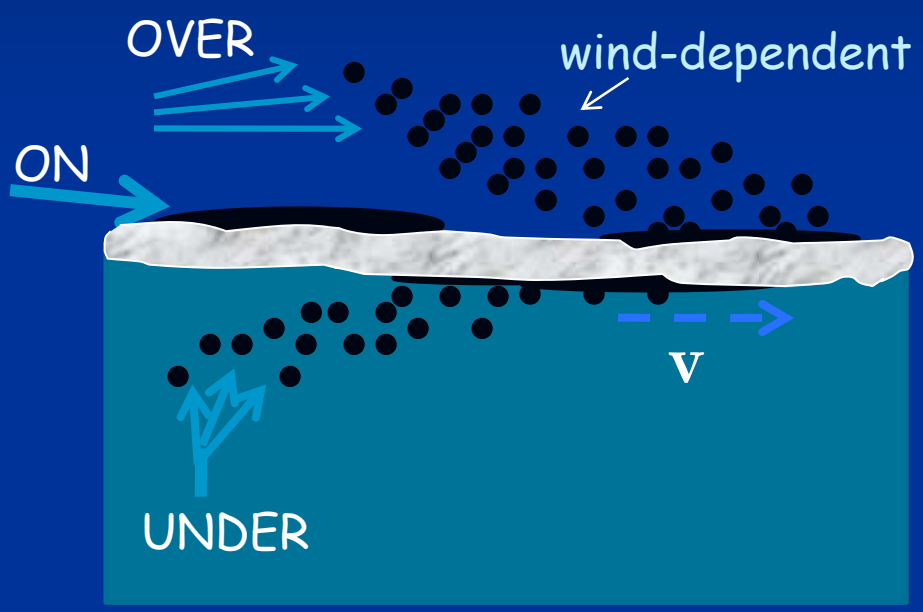
STATIC
(no current)



Oil allowed to accumulate & thicken in pockets between ice cakes at/near the source. Some oil over/under ice depending on the nature & amount of ice, water depth, atomization, etc.

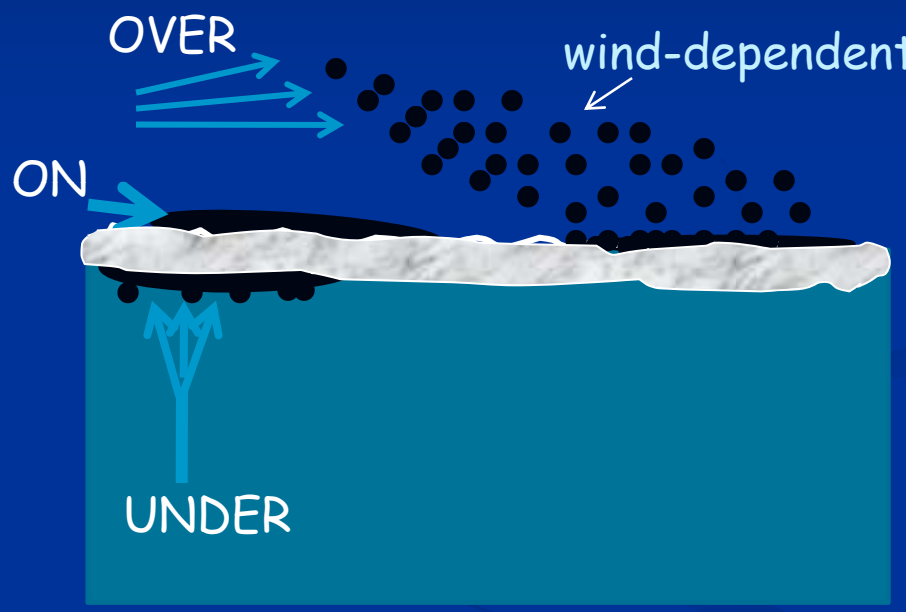
Modes of Oil Release
(Over, On & Under Solid Ice)

DYNAMIC
(with current)



Oil distributed on or below ice downstream of the source. Accumulations dependent upon wind & currents, water depth and degree of atomization.

STATIC
(no current)



Oil allowed to accumulate & thicken at/near the source. Heavy accumulations and/or gas pockets (if blowout) may crack ice and allow oil/gas transit to the surface.

Vessels

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Barges

Airboats

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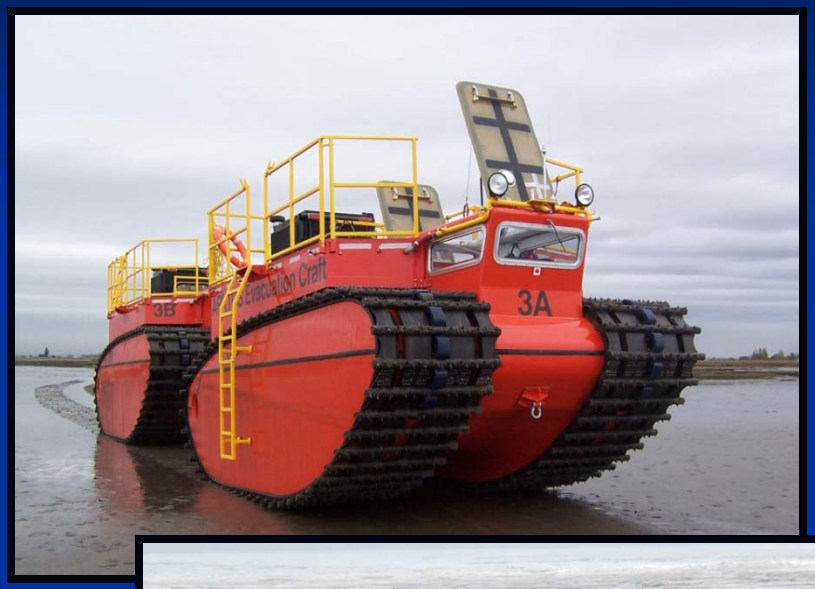
ACV's

Amphibious Craft - ARKTOS



Transition Zone and Shallow-water Capable

Has potential to assist:

- Mechanical Recovery
- Controlled Burning
- Dispersant Application

Vehicles
(landfast ice & onshore)

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Fixed-Wing Aircraft

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Helicopters

Airships - SkyHook

40-Ton Lift Capability

200- Mile Range

Speed: 70 kts

Max. Alt.: 9,000'

Unmanned Aerial Systems

GENERAL ATOMICS MQ-1C SKY WARRIOR *

ALTUS II (GENERAL ATOMICS)

"FUNDAMENTAL TRUTH"

You can't : **Recover** →

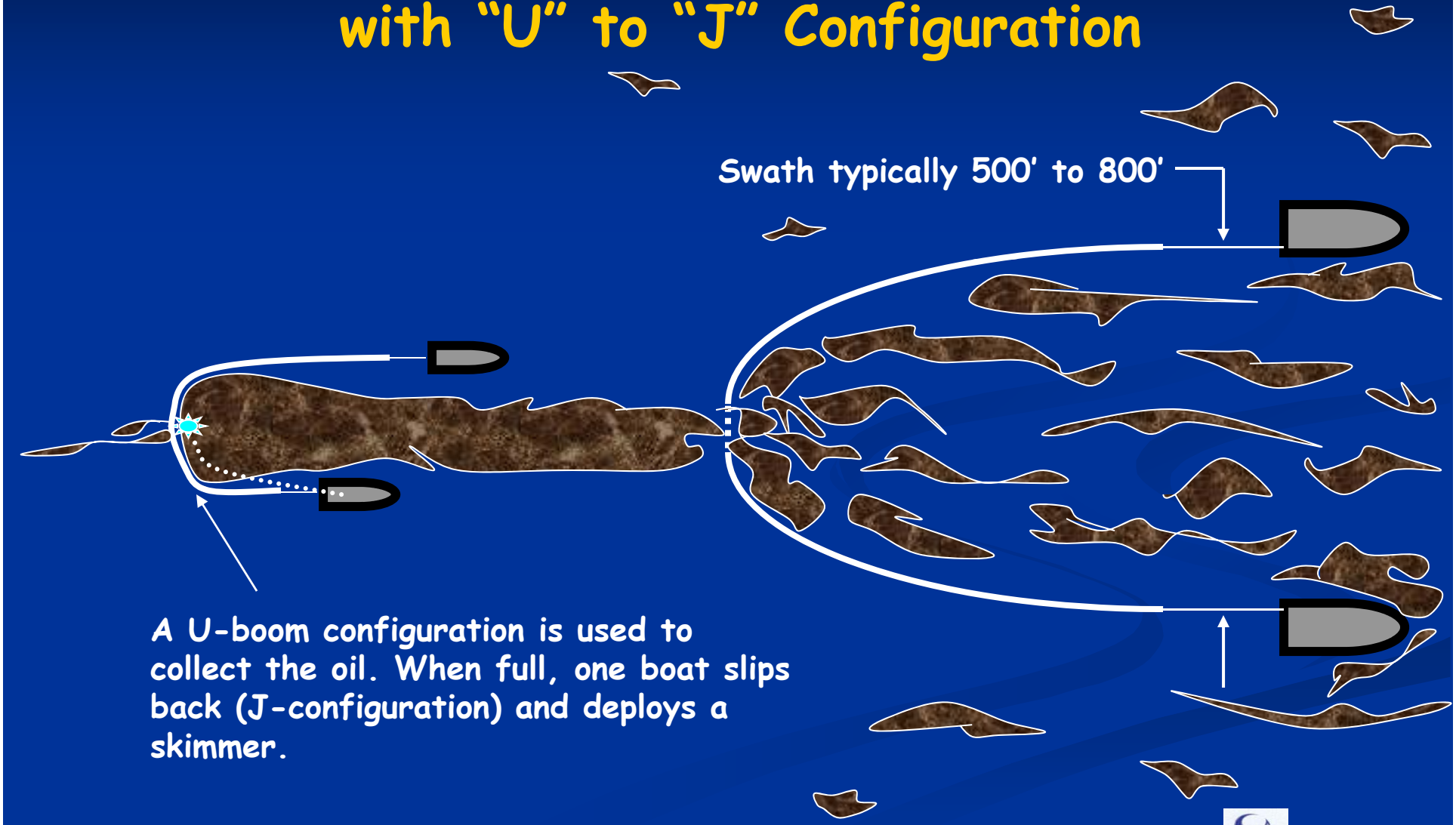
Burn →

or **Chemically Treat** →

more oil than can be accessed.

Concentration of Oil with Open Apex

Physical Recovery with "U" to "J" Configuration



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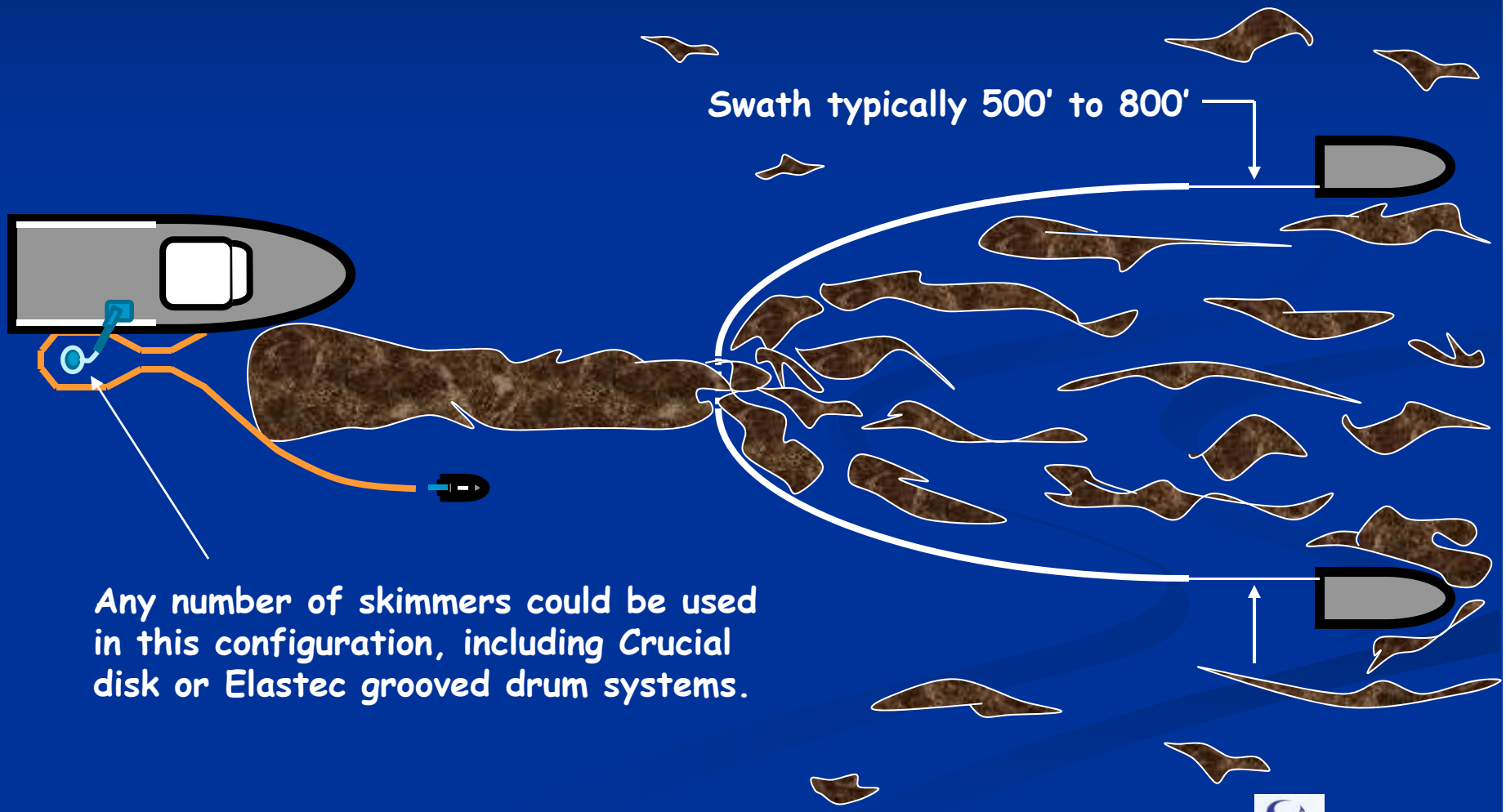
Concentration of Oil with Open Apex

Physical Recovery with Ocean Buster & TransRec Skimmer



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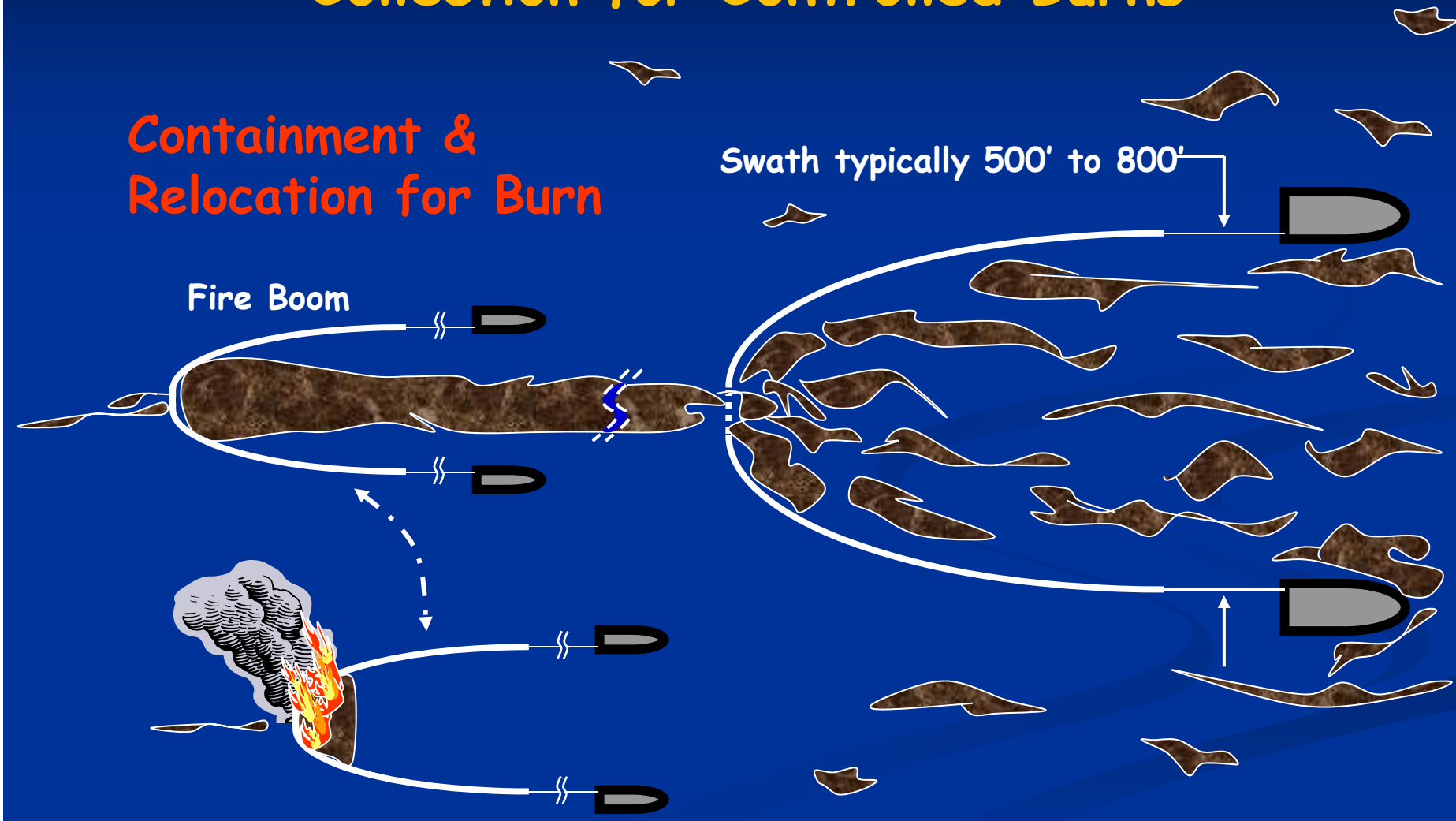
Concentration of Oil with Open Apex

Collection for Controlled Burns



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Concentration of Oil with Open Apex

Dispersant Application Downstream

Swath typically 500' to 800'

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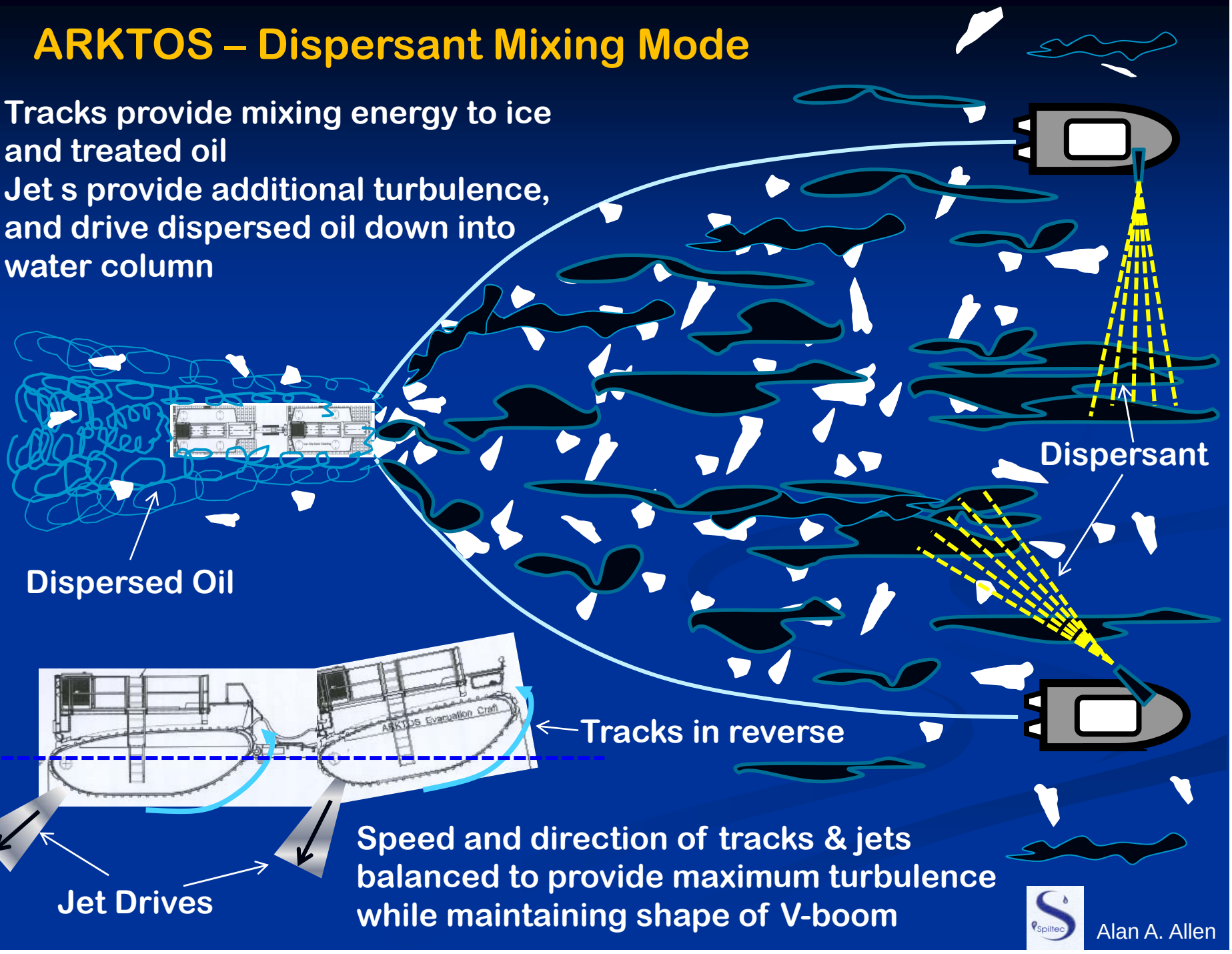
ARKTOS – Dispersant Mixing Mode

Tracks provide mixing energy to ice and treated oil
Jet s provide additional turbulence, and drive dispersed oil down into water column



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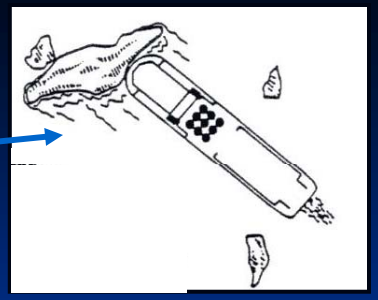
Oceanic Tests

Deflection/Management of Ice



Movement and/or breakup of large ice floes

Breaking of continuous light ice cover to enhance deflection

With a cross-wind, oil might be herded against one side of the ice-cleared wake, thereby enhancing burning or recovery downstream

Barge or OSRV

Semi-cleared Wake

Buffer

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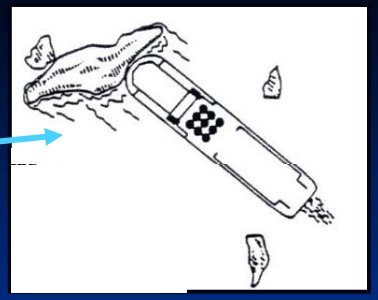
Deflection/Management of Ice



Movement and/or breakup of large ice floes

Breaking of continuous light ice cover to enhance deflection

With a cross-wind, oil might be herded against one side of the ice-cleared wake, thereby enhancing burning or recovery.

Ice Breakers

Semi-cleared Wake

Buffer

Vessels "station-keep" with a safe and effective separation

Spill Source

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Lessons Learned

- Update and expand equipment resources and logistical support to match/exceed Worst Case Discharge
- Assess and anticipate "gaps" in response capability due to darkness, wind/sea conditions, etc.
- Maintain response equipment/personnel in a constant state of readiness, staged at key shoreline locations and as close as possible to potential spill sources.
- Be pro-active in educating local communities, regulatory groups, the press, etc. regarding spill prevention and control, performance expectations, and the pros/cons of all response options.
- Establish clear pre-authorization guidelines for controlled burning and chemical dispersants.

Lessons Learned

- Preferred response options are highly situational, depending on:

  Timing Wind & Sea State Visibility Ice Conditions

  Batch/Continuous Spill Oil Vol./Area/Thickness

- Windows of opportunity and environmental tradeoffs need to be thoroughly understood and anticipated for all response options. Plan for sustained operations.

- Timely & Effective response depends upon "Aerial Observations" with highly trained personnel to track, characterize & "spot".

- Response operations require frequent adjustments reflecting:

  Environmental Changes
  Oil Distribution and Weathering Processes
  Oil Proximity to Shore & Shallow Water
  Personnel Fatigue
  Resource Availability
  etc.