

The background of the slide features a photograph of a rocky coastline. The foreground is filled with large, dark, wet-looking rocks. In the distance, the ocean is visible under a bright sky. A diagonal yellow line runs from the top right corner towards the bottom left, passing behind the text.

Advances in Oil Spill Response Equipment for Application in the Arctic

Andy Crawford

Arctic Oil Spill Presentation for Interspill

1. TECHNOLOGY

2. CASE EXAMPLES

3. DEVELOPMENTS

Unprecedented seasonal retreat of sea ice in the Arctic is a Fact .

This will drastically increase the amount of worldwide marine activity in the Arctic area.

With an increase in shipping of all types of vessels, oil and gas exploration, development and production activities

This presents new considerations and challenges and responsibilities for the industry and arctic nations as the chances spilling oil in these areas increase.



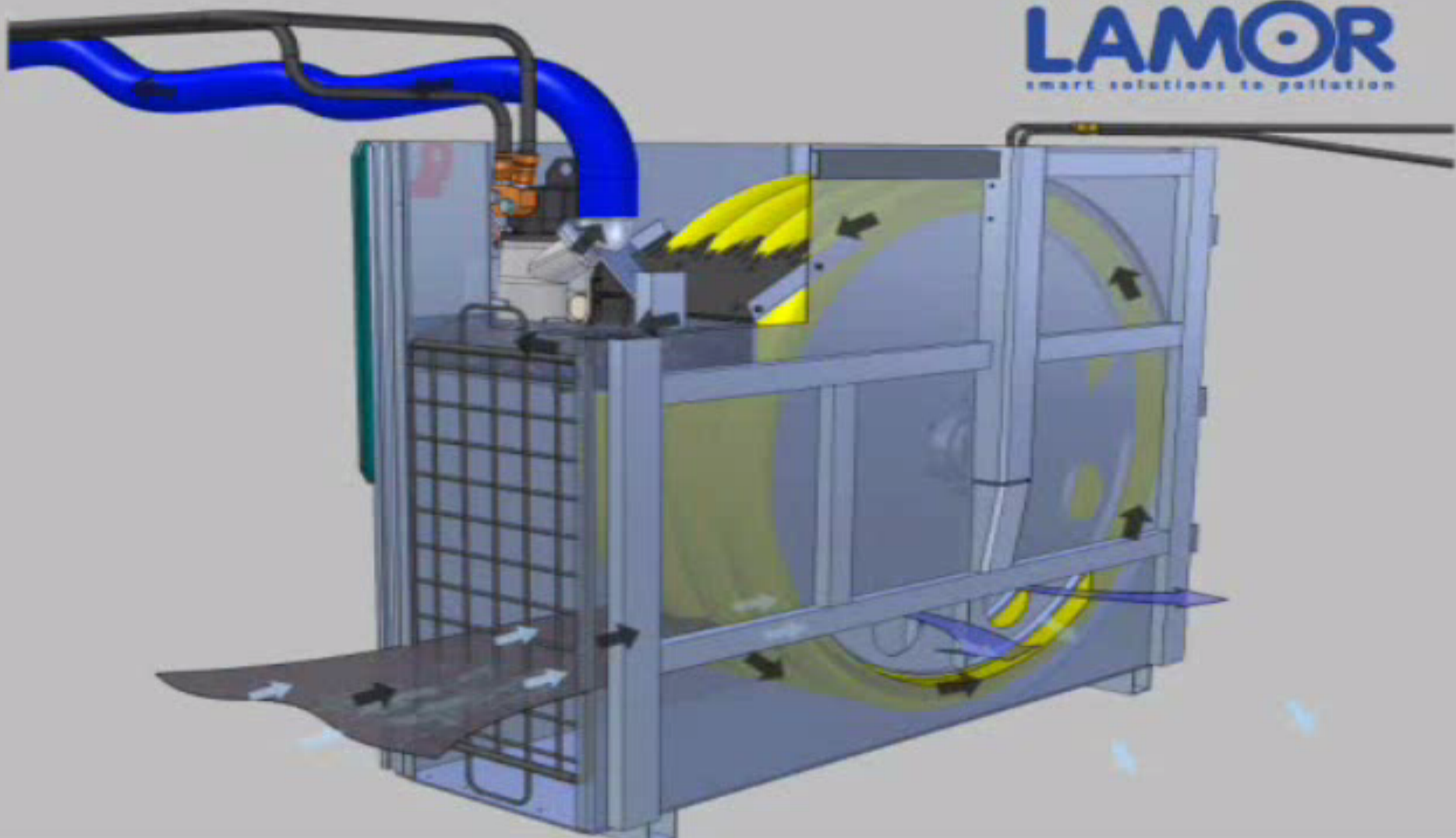
- DISPERSANT
- IN SITU BURNING
- BIOREMEDIATION
- CONTAINMENT TILL THAW
- MECHANICAL OIL RECOVERY

- WEIR
- OLEOPHILIC
- INCLINED PLANE
- VACUUM
- SORBENT

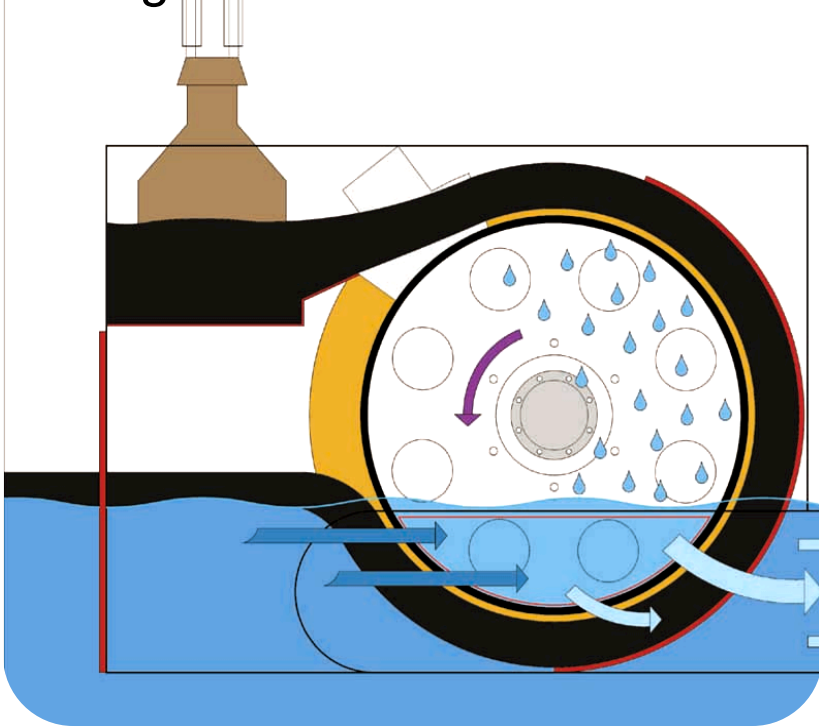
- EXPANDS WINDOW OF OPPORTUNITY
- VERSATILE IN APPLICATION
- TOLERANT OF EXTREME TEMPERATURE
- EFFICIENT
- VISABLE

WE BELIEVE THROUGH OUR
EXPERIENCE THAT AN
**ADVANCING OLEOPHILIC
SKIMMER** IS THE BEST
SOLOUTION TO RECOVER OIL
IN BROKEN ICE CONDITIONS

- BRUSH WHEEL
- BRUSH CHAIN CONVEYER

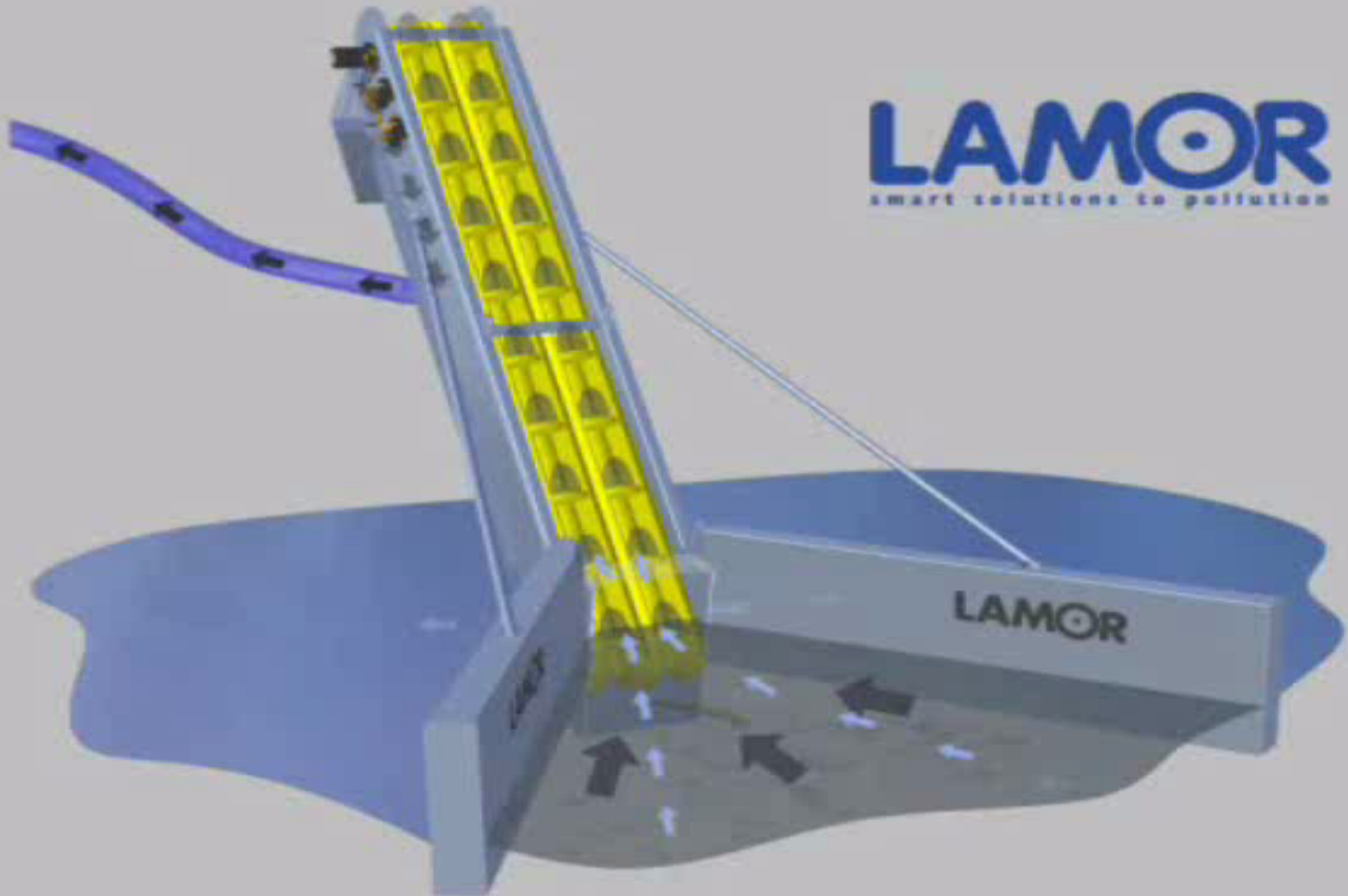


LAMOR developed the stiff brush wheel, which had similar capabilities to recover medium viscosity oils but was far superior on the light viscosity oil. This was achieved by making a tighter brush (more bristles) and rotating the wheel down into the water.

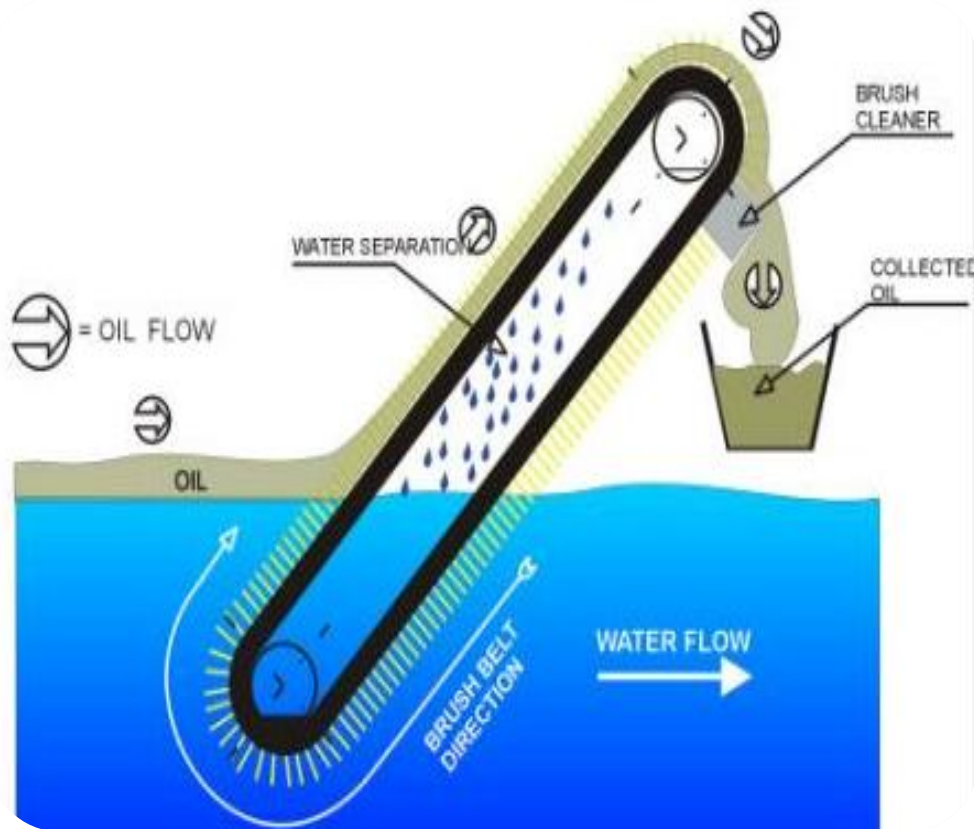


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Brush Chain Conveyor Principal

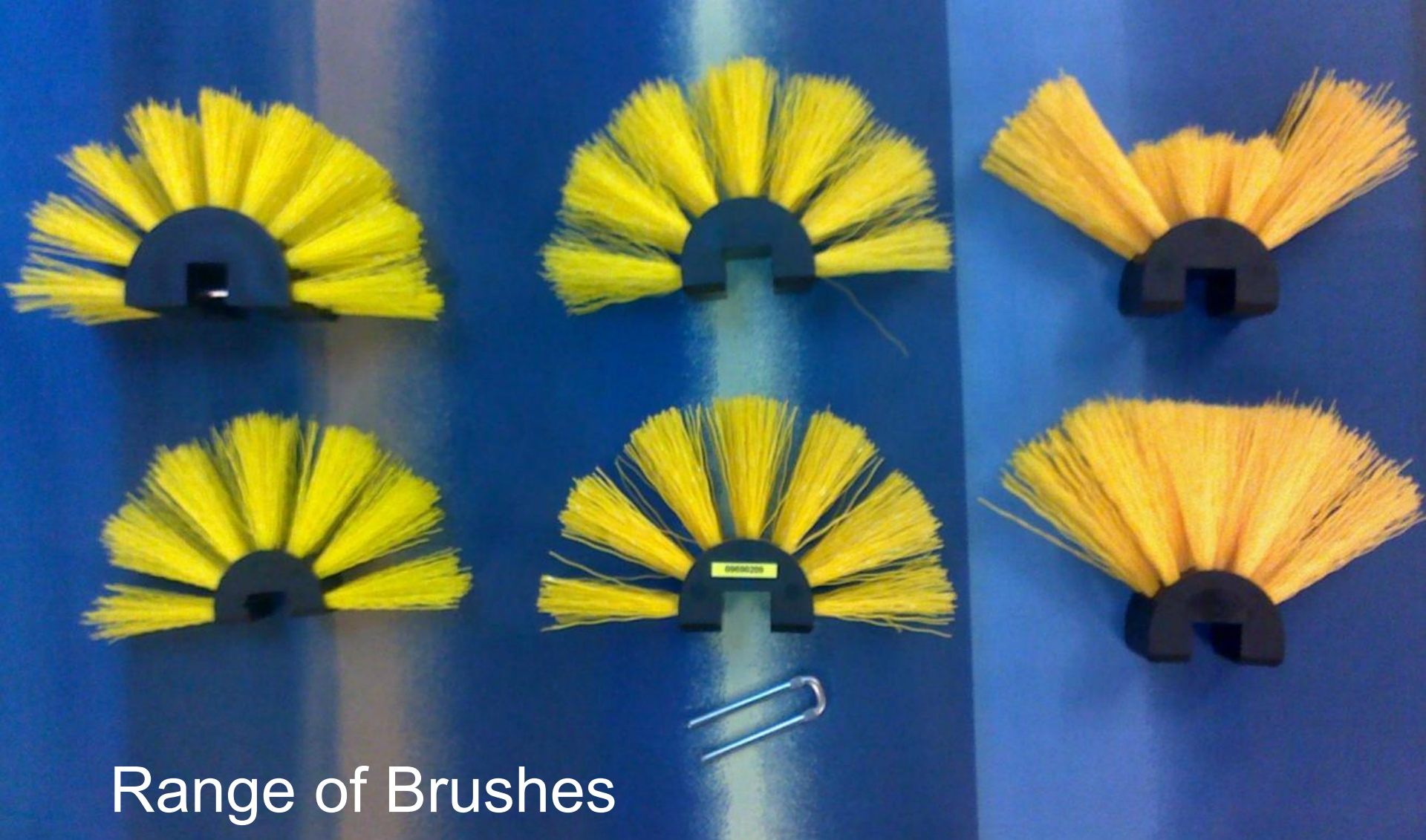


The Brush Chain developed by LORI in the 1980's was an excellent product for recovering medium to heavy oils; the fundamental philosophy was to lift the oil out of the water, let the water drain off and then scrape the oil off.



Different Direction for Heavy and Light Oil Recovery





Range of Brushes



1982
LORI

Heavy oil



2004
LAMOR
MIXED



2005
LAMOR
POCKET



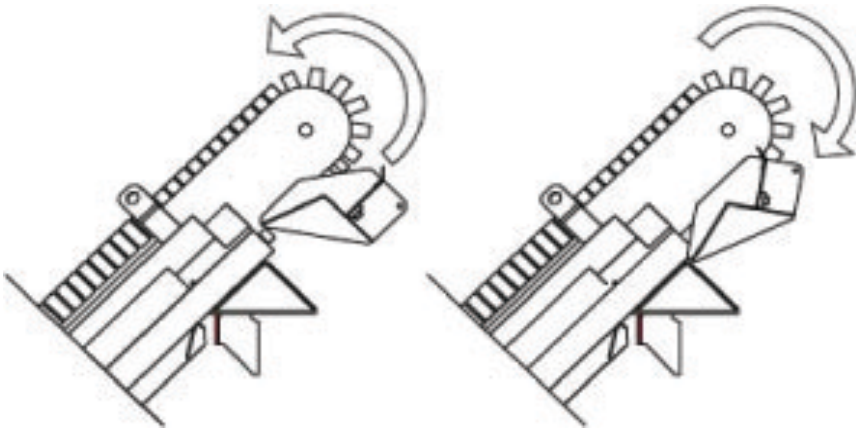
2006
LAMOR
DOUBLE



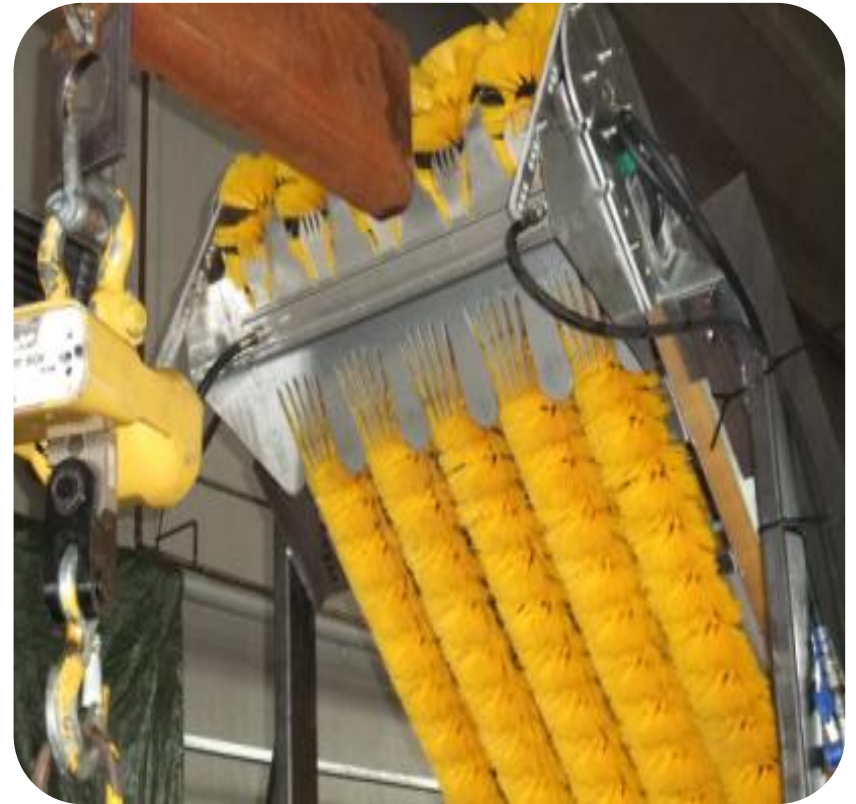
1985
LAMOR

Light oil

Upwards for Heavy Oil



Downwards for Light Oil





Upwards Rotation for Heavy Viscous Oils



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Downwards Rotation for Light Oils



- Size and Weight of Pump
- Pump Performance
- Debris Laden Medium
- High Viscosity Oils and Emulsions

GTA SCREW PUMP

20 m³/hr

30 m³/hr

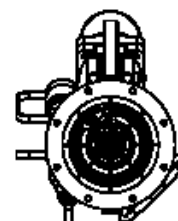
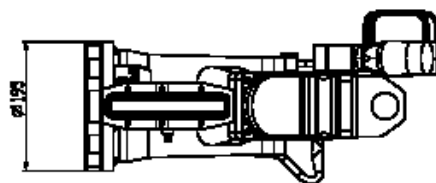
50 m³/hr

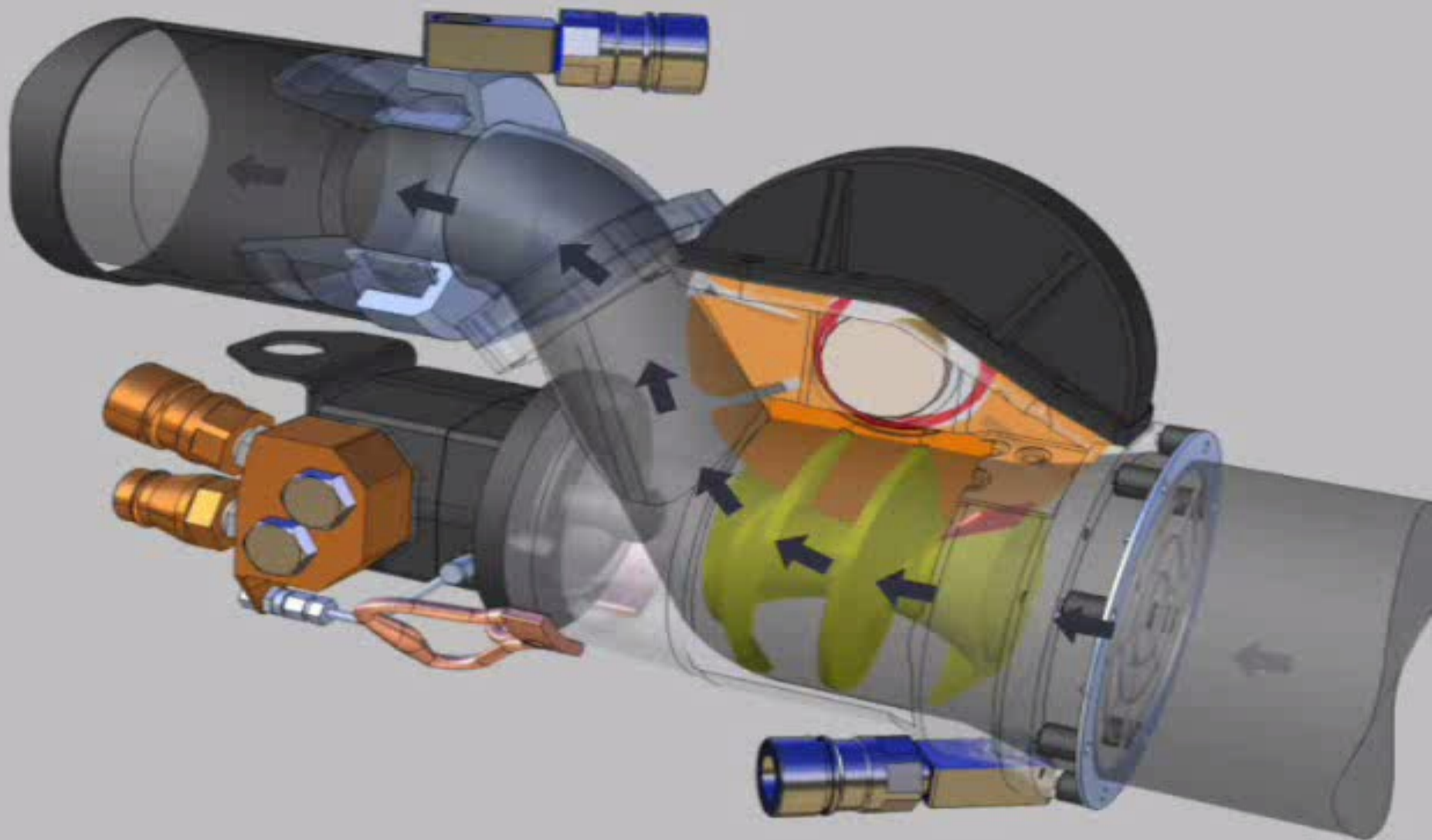
70 m³/hr

115 m³/hr

140 m³/hr

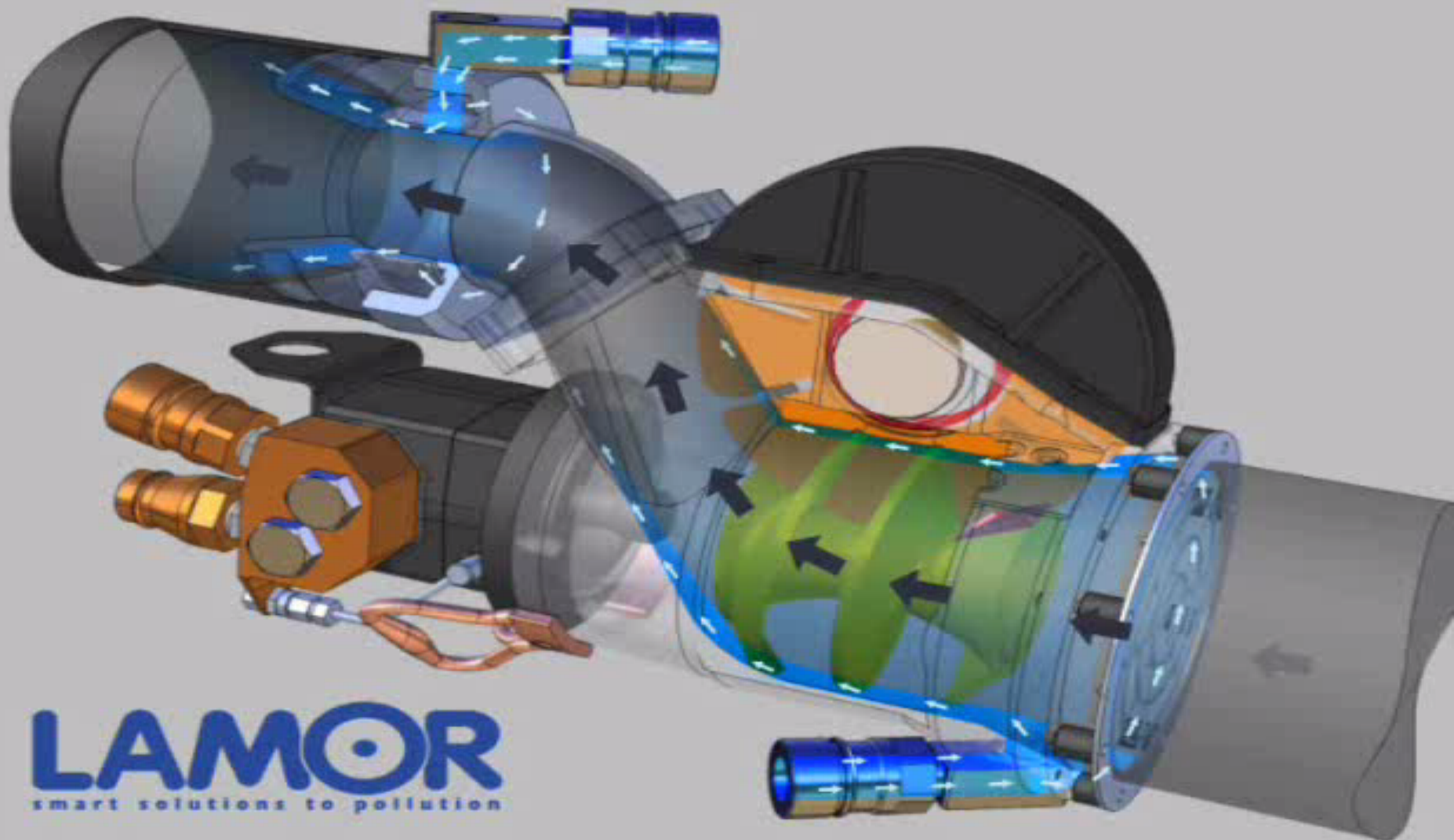


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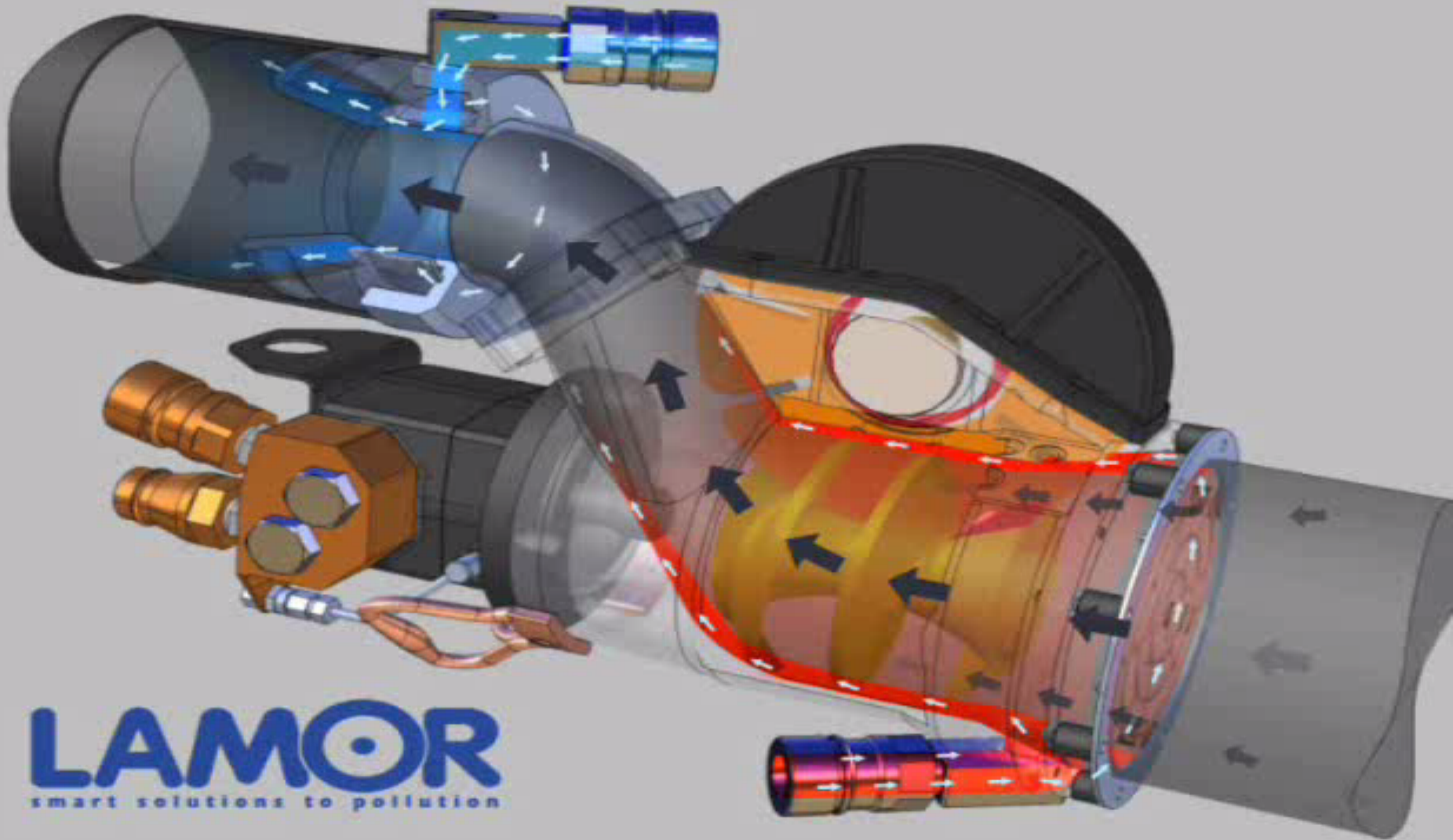
Pump with Cold AWI Inlet and Outlet



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smart solutions to pollution

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Pump with Cold AWI
Outlet and Hot to Inlet



LAMOR
smart solutions to pollution

GT-A 50 Pump JVOPS Results 200,000 cst oil & 6 inch hose

6" Hose length	Viscosity	Inlet lube water	Outlet lube water	Calculated capacity	Drum-fill capacity	Pump pressure
m	cSt	% / °C	% / °C	m ³ /h	m ³ /h	bar
92.6	202,000	0	0	4.5	6.1	11.9
92.6	210,000	4 / 98	4 / 98	46.7	42.7	0.6
92.6	210,000	4 / 99	4 / 14	45.7	40.5	0.6
92.6	210,000	4 / 14	4 / 14	44.8	43.2	2.8

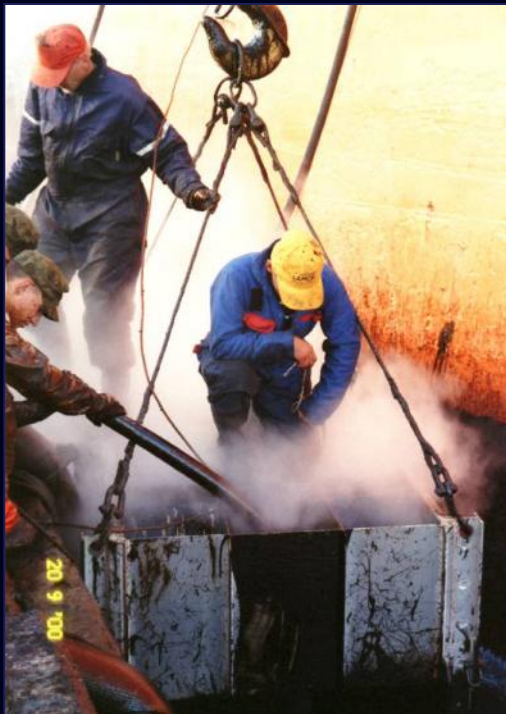
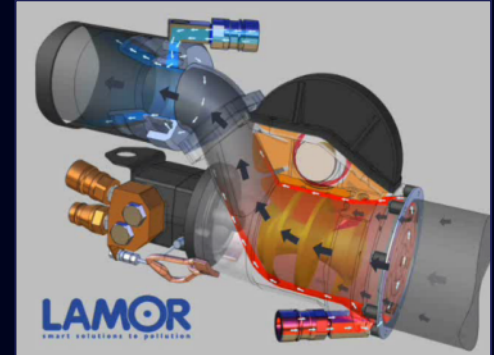
Pump with **NO** Annular Water Injection.

Could pump 50 m³/hr through 23 meters of 6" hose

Pump Fitted **with** Annular Water Injection. Could pump 50 m³/hr through more than 400 meters of 6" hose



- Steam heated hoses
- Steam heated double plated skimmers
- Heated brush cleaners
- Heated Skimmer oil collection hopper
- Heated storage tanks
- Hot water injection for oil transfer pump
- Engine heating
- Hydraulic oil pre heating



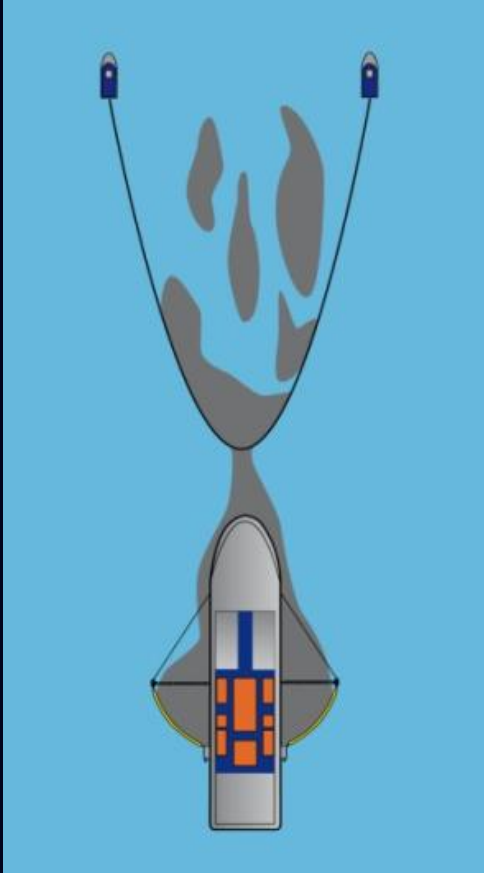
LAMOR

Pump with no AWI





Lamor arctic vessel solutions



Open Water “Deflection”
Booming

Mechanical Recovery, Open Water "Deflection" Booming



Lamor Arctic Skimmer

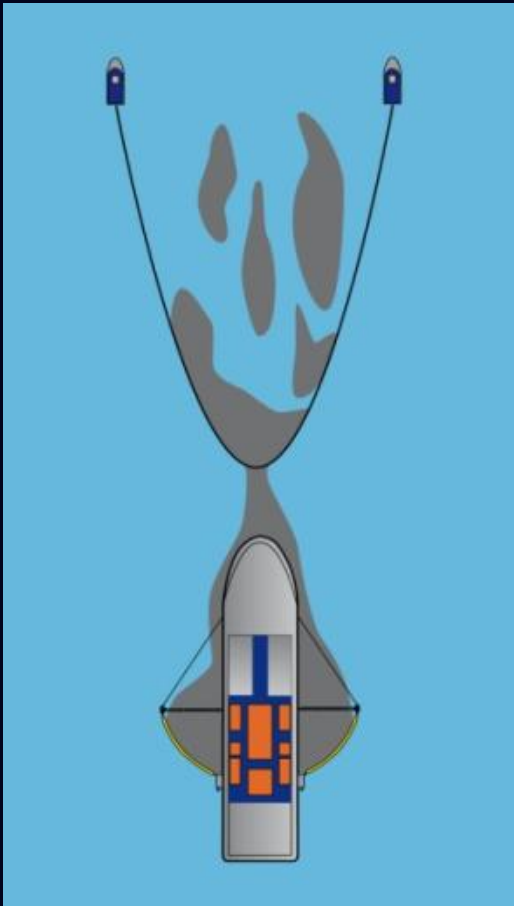


Multipurpose OSR vessel

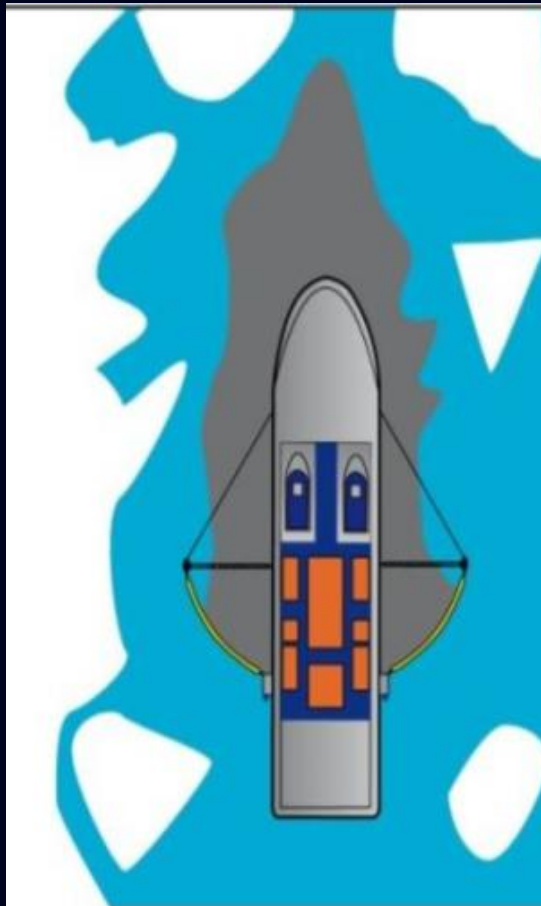


Heavy Duty Oil Boom





Open Water "Deflection"
Booming



Reduced Deflection Boom
In Ice Conditions

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**SIDE COLLECTOR
SMALL**



LAMOR

BUILT IN SYSTEMS
SMALL



LAMOR

BOW COLLECTOR



LAMOR

BUILT IN SYSTEMS LARGE



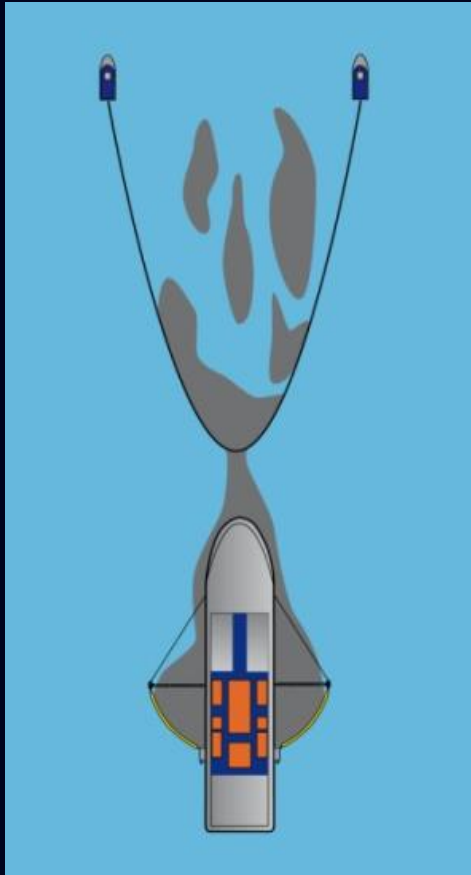
Bucket skimmer

Built-In Advancing System

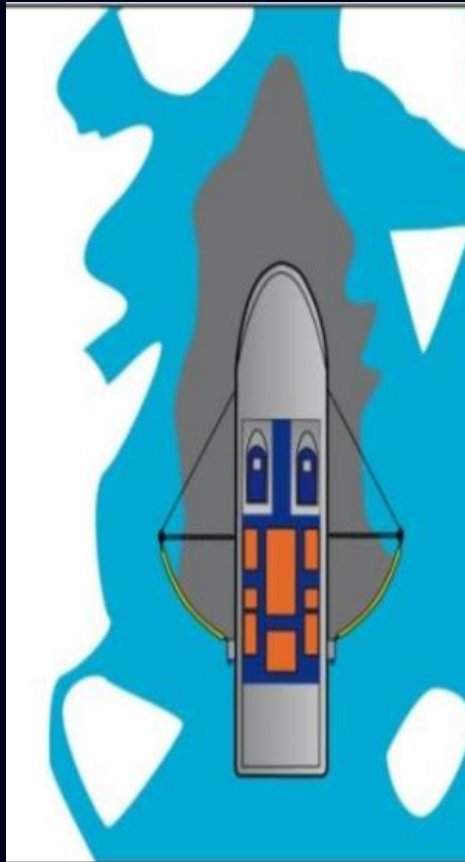
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BUILT IN SYSTEM IN ACTION

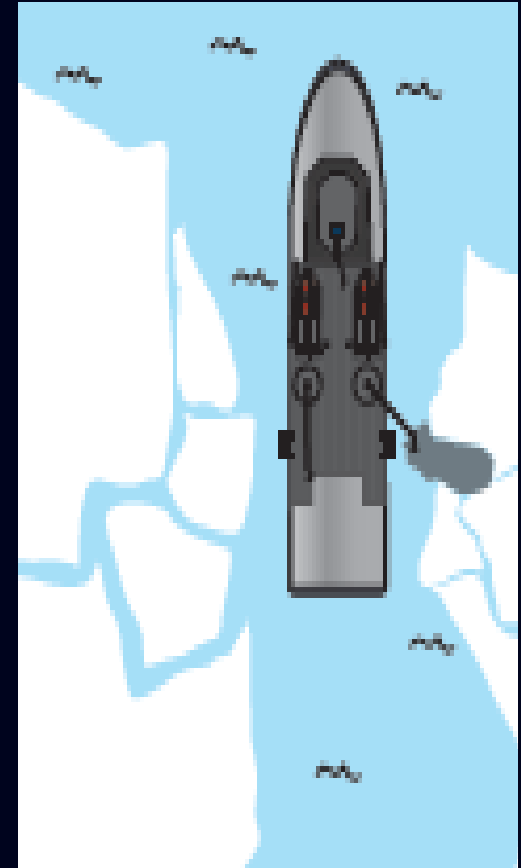




Open Water "Deflection"
Booming



Reduced Deflection Boom
In Ice Conditions



Pocket Oil Collection

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Mechanical Recovery, Pocket Oil Collection



Brush Bucket skimmer

LAMOR

Mechanical Recovery, Pocket Oil Collection



LAMOR

LAMOR BUCKET SKIMMER





LAMOR OIL ICE SEPARATOR

LAMOR

Lamor Arctic Vessel solutions



LAMOR IN ACTION

Case M/V *Runner 4*, Estonia, March 2006, Heavy & Light Fuel Oil Broken Ice Conditions

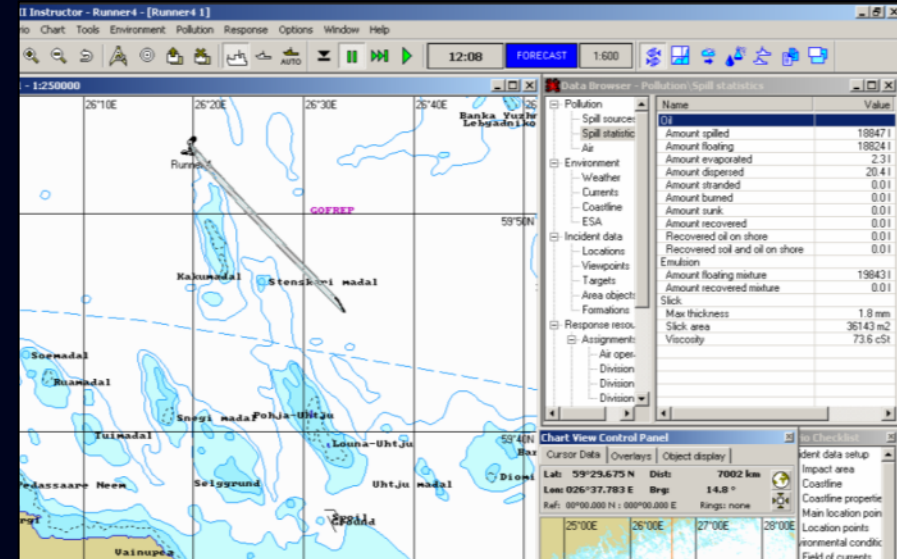
The ship *Runner 4* sank after a collision with another ship, in a convoy following a Russian icebreaker

Vessels Involved in Recovery Operations

Estonian multipurpose vessel
EVA-316

Finnish oil spill response vessels
Hylje,
Halli
Seili.

Summary Est 18 000 liters oil spilled
15 000 liters oil collected



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Bucket Skimmer in Action



VENUE: YTRE HVALER
NATIONAL PARK,
NORWAY

ACCIDENT: 165 m CONTAINER
SHIP GROUNDED

TIME: 17.2.2011 at 8PM

SPILLED: ca. 200 t IFO 380

CHALLENGE: HEAVY OIL IN
FREEZING WEATHER IN
A SENSITIVE AREA

STAFF: SWEDISH COAST
GUARD

EQUIPMENT: 3 OIL RECOVERY
VESSELS WITH
LAMOR LORS
BUILT-IN SYSTEM:

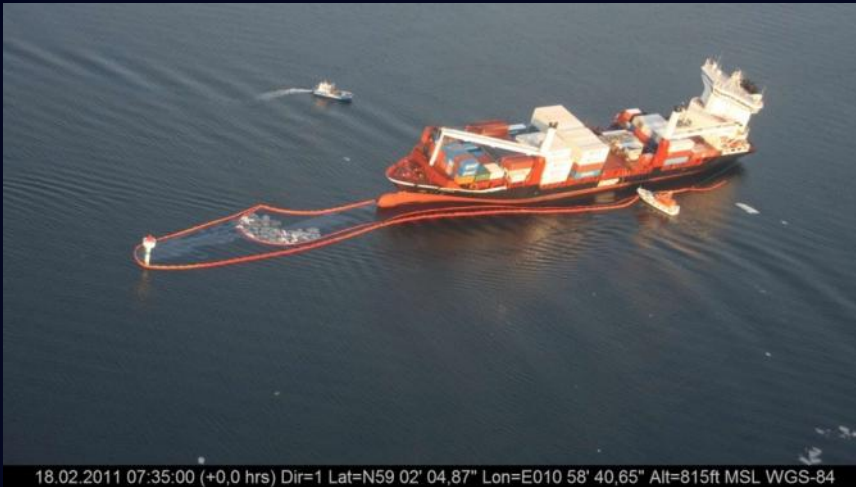
- KBV 050 2xLORS-5
- KBV 051 2xLORS-5
- KBV 001 2xLORS-8



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- Day 1: The grounded leaking vessel was boomed after the accident but a lot of the Heavy Fuel Oil IFO 380 had escaped from the vessel's fuel tanks to the icy archipelago.



- Day 1 Some of the leaking oil was observed as far as 2.5 nautical miles west / southwest of the vessel. The weather was getting colder, rapidly increasing the formation of ice.



18.02.2011 07:39:34 (+0,0 hrs) Dir=1 Lat=N59 01' 01,28" Lon=E010 52' 08,69" Alt=699ft MSL WGS-84



- Day 1: Oil recovery inside the boomed area around the grounded vessel started with weir and belt type skimmers requiring a lot of man power. The sticky oil and increasing ice was a big challenge for the recovery operations carried out using conventional equipment.



- Day 2-3: the new “KBV 001 Poseidon” arrived at night to start her first oil spill recovery operation in a real situation.

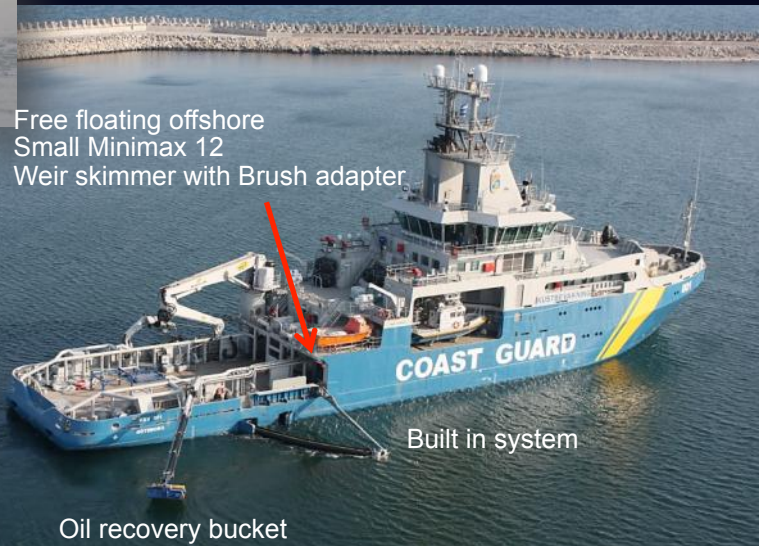


Oil Recovery Equipment selected for operation

- Twin side built in stiff brush system

Oil Recovery Equipment On Board the KBV 001:

- Twin side built in stiff brush system
- Oil recovery bucket
- Free floating offshore skimmer with umbilical hose
- Small Minimax 12 free floating skimmer
- Weir skimmer with brush adapter
- Oil transfer pumps GTA 115



- The brush conveyors in the KBV 001 oil recovery channels on each side of the ship collected the heavy fuel oil from the ice cold water extremely effectively.



- The crew was very happy that the deck remained clean during the whole operation.



- KBV 050 and KBV 051, both built in the late 1980s, once again proved their efficiency and successfully completed their mission till the operation was completed 7 days later on February 24.



SUMMARY

- 110 m³ of the spilled IFO 380 was collected.
- 58 m³ of was collected in open water recovery by the 3 Swedish Coast Guard vessels
- Keys to success:
 - Advancing system, independent vessel operation, excellent maneuverability
 - Skimmers able to collect the heavy oil and avoid ice
 - Heating arrangement from skimmer to tank
 - Skilled and well trained crew
- The brush skimmers worked very well in the demanding conditions.



KBV 050



KBV 001



KBV 051

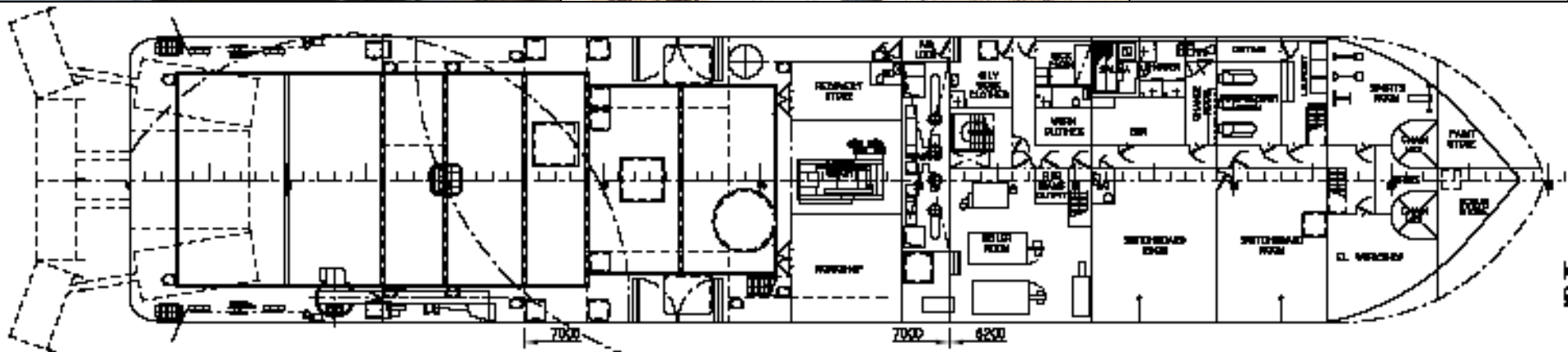


Spillage: Jet Fuel and hydraulic oil spilled in fresh water lake, oil under ice recovery
Duration: Three weeks
Recovery: 1500 liters Jet Fuel and hydraulic oil collected



WORK IN PROGRESS

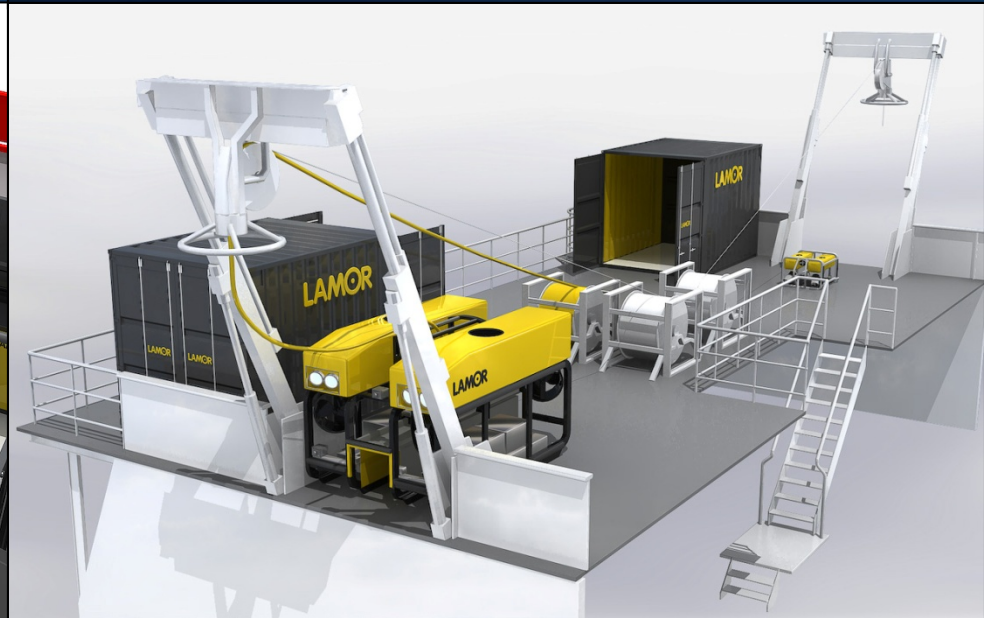
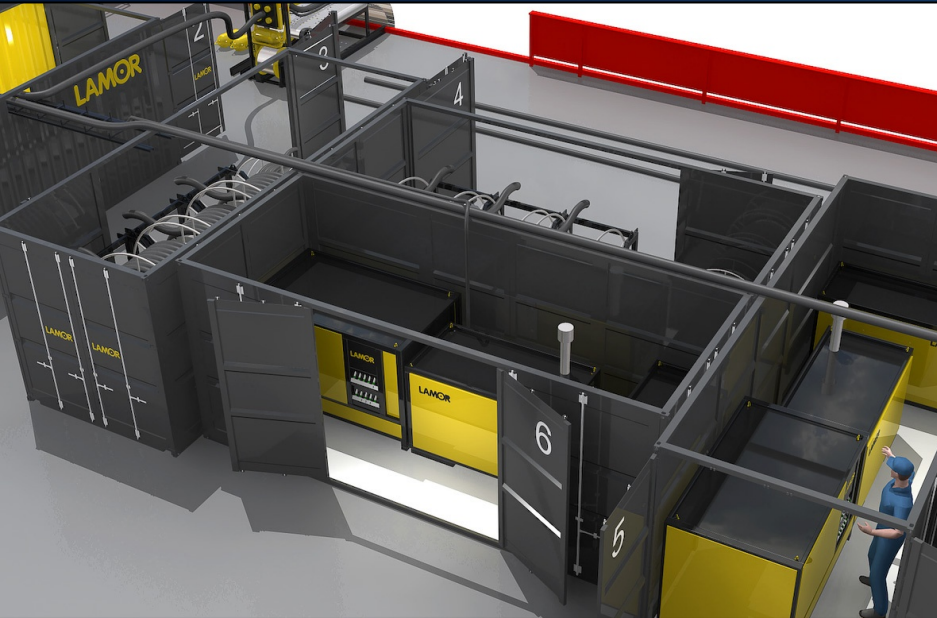
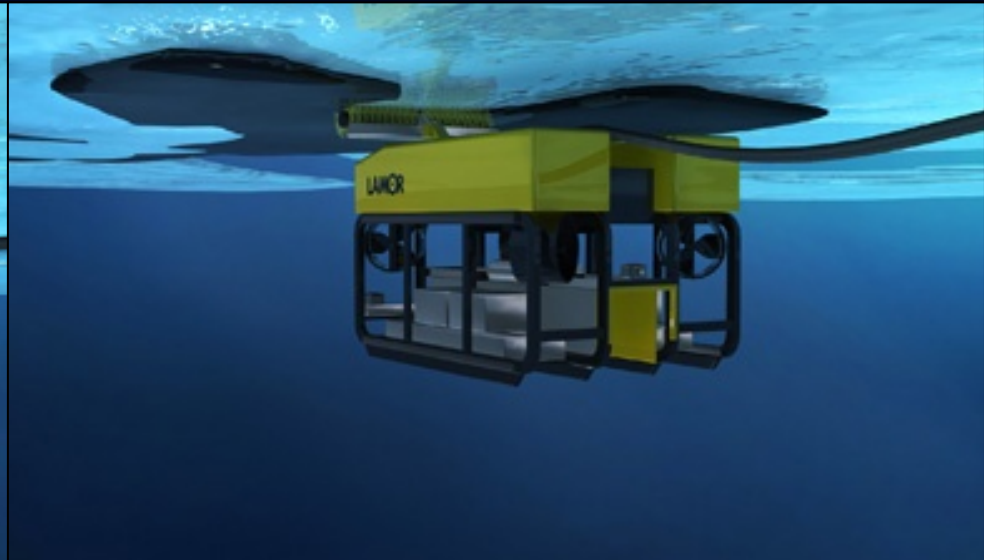
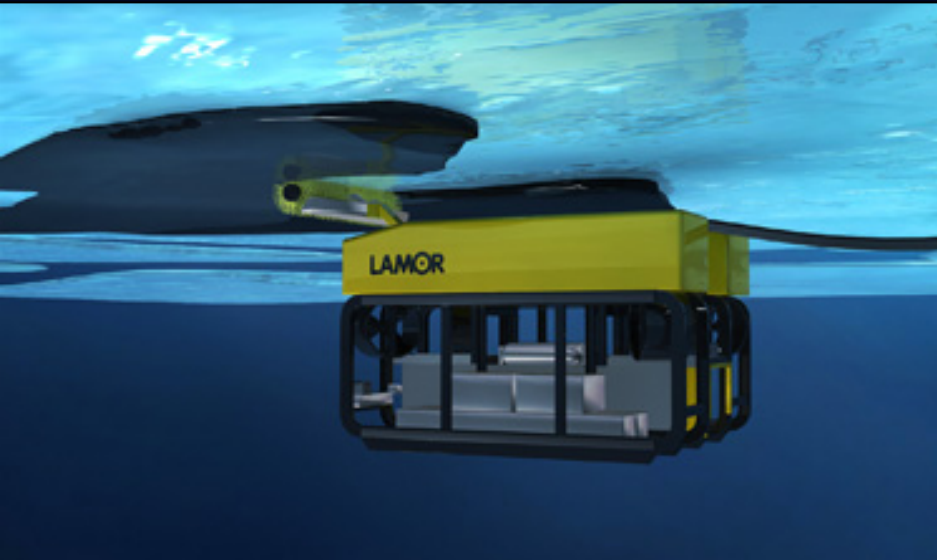
The figure consists of three panels illustrating the HELSINKI autonomous underwater vehicle (AUV) system. The left panel shows the AUV being deployed from a barge. The middle panel shows the AUV being recovered from the water. The right panel is a 3D schematic diagram of the AUV's structure and deployment mechanism.



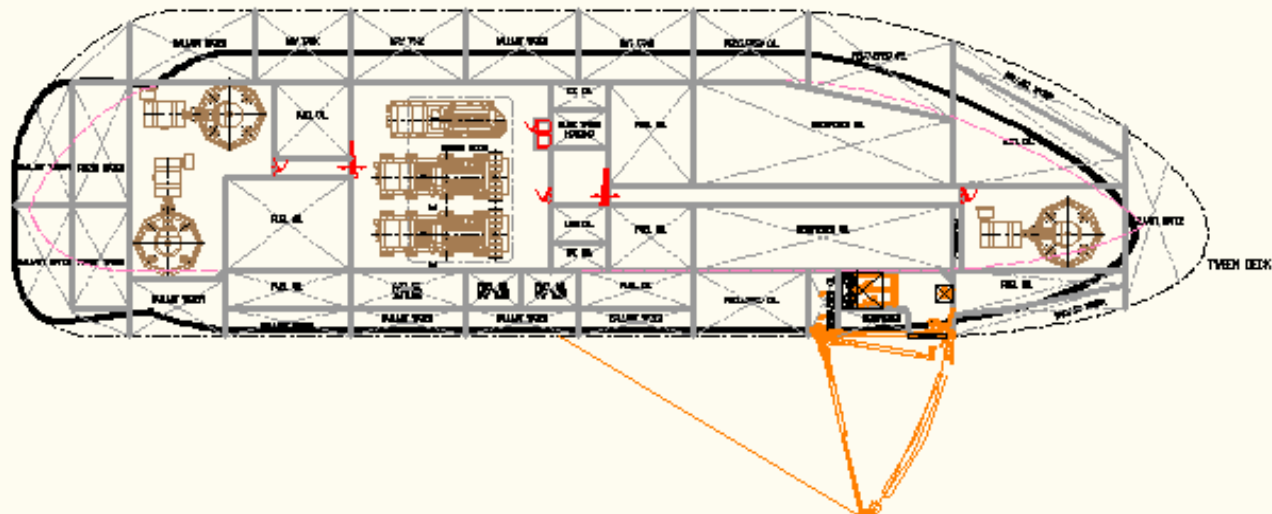
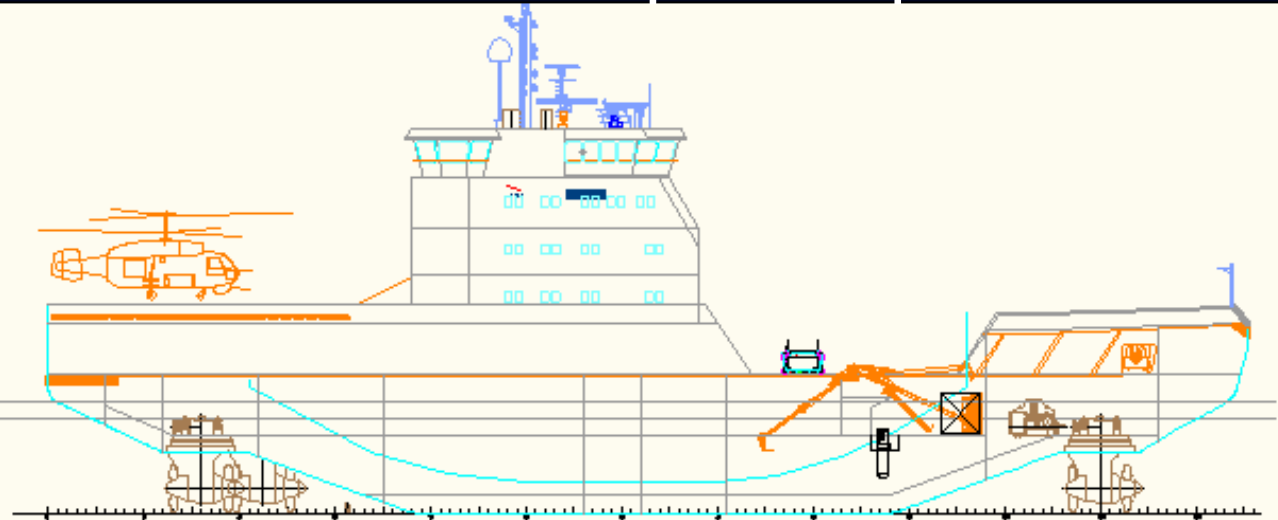
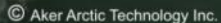
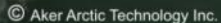
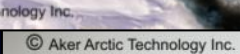


LAMOR

Future Developments Recovery of Oil under Ice



Future Developments Lamor / Aker Arctic next generation Oil Spill Response Vessel





THANK YOU FOR
YOUR ATTENTION