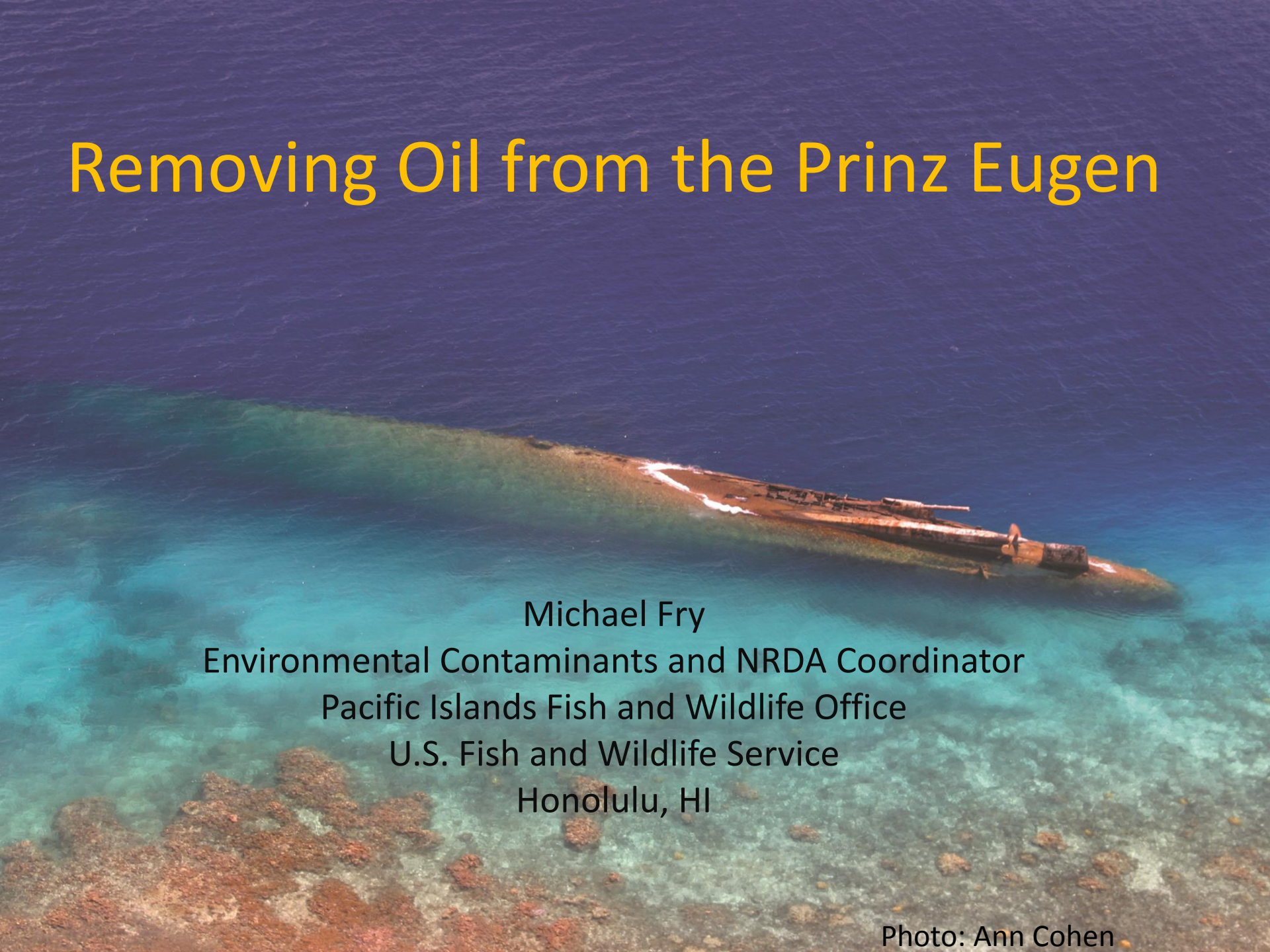
Removing Oil from the Prinz Eugen



Michael Fry
Environmental Contaminants and NRDA Coordinator
Pacific Islands Fish and Wildlife Office
U.S. Fish and Wildlife Service
Honolulu, HI

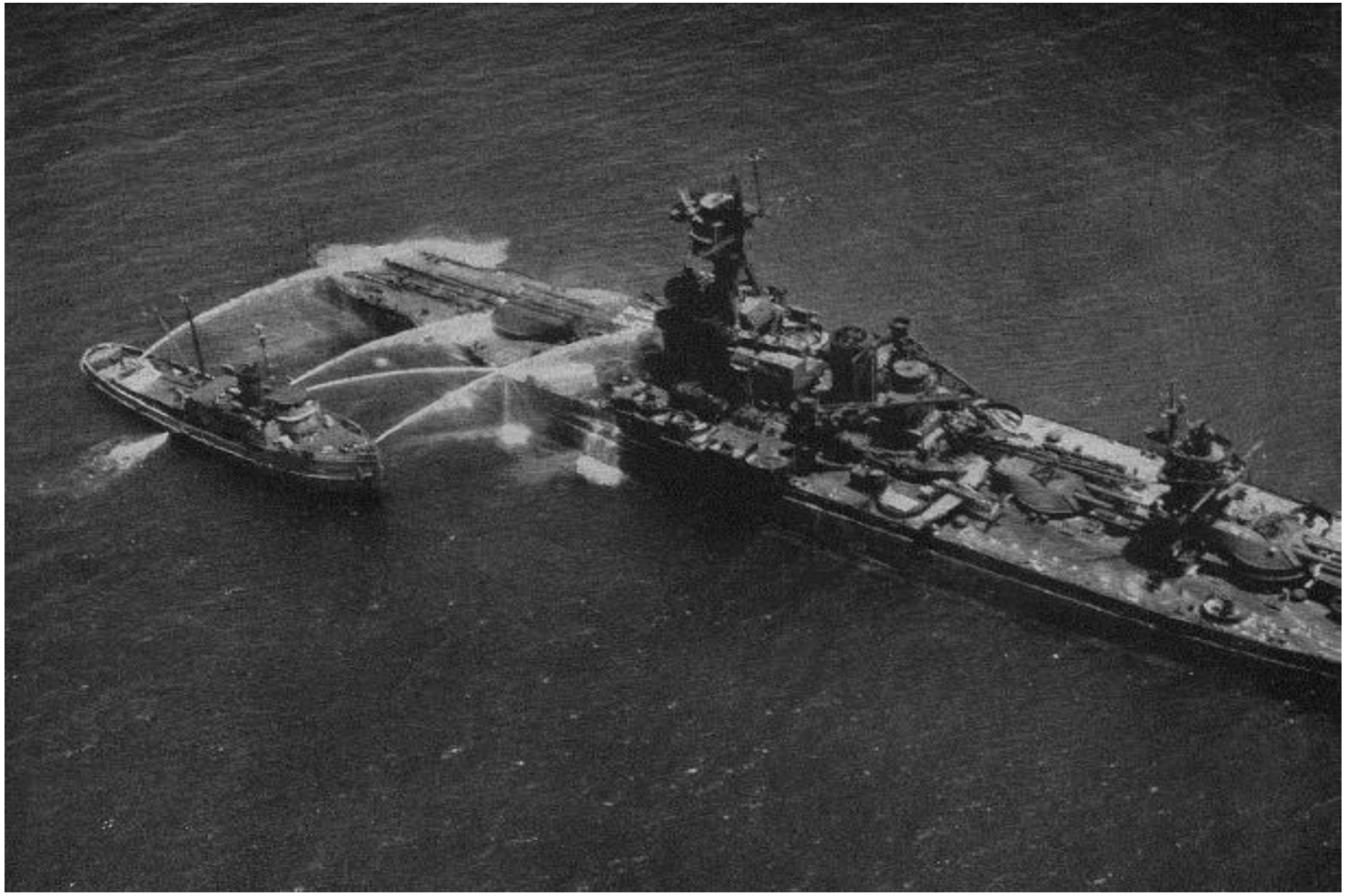
Photo: Ann Cohen

Prinz Eugen's Crest

The *Prinz Eugen* anchored in the Baltic in the spring of 1941.

1946 Baker Test at Bikini, Prinz Eugen Damaged

Baker Test, view from Bikini, Prinz Eugen at Right



Fireboats Attempted to Clean Radioactivity from Ships after Baker Test
Battleship New York

Sailors scrubbing down the German cruiser Prinz Eugen with brushes, water, soap, and lye. Five months later, the ship was still too radioactive to permit repairs to a leak, and she sank in Kwajalein Lagoon.

James P.Delgado, Ghost Fleet: the Sunken Ships of Bikini Atoll, Honolulu, 1996

Chronicle of the Prinz Eugen

1945: Ownership to U.S. after World War II

1946: Operation Crossroads, Bikini Atoll: Able (1 July) and Baker (25 July)

1946, 22 December: Sinking at Carlson Islet

1974: U.S. Navy report on oil spill risk, recommends remove oil within 30 years

1986: Ownership transfer to Republic of Marshall Islands (RMI)

2010: RMI request to US for technical and financial assistance for oil removal

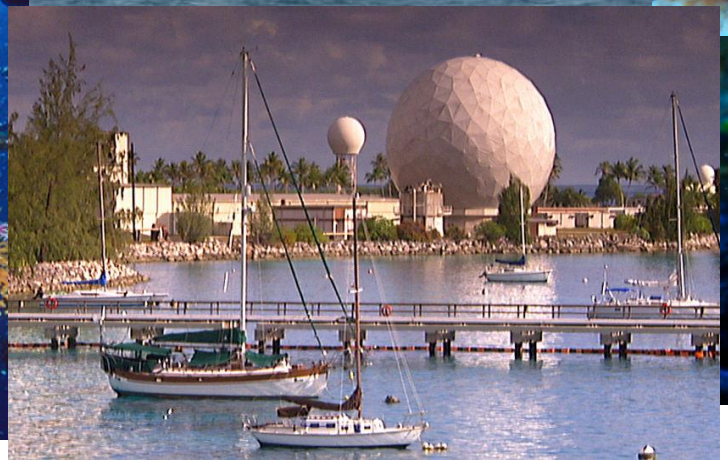
2012: US response:

- Oil removal funding is responsibility of RMI
- Suggest using Compact Funds
- $50,000- $100,000 for costs of survey and feasibility study
- No estimate of oil removal costs

Resources at Risk from an Oil Spill

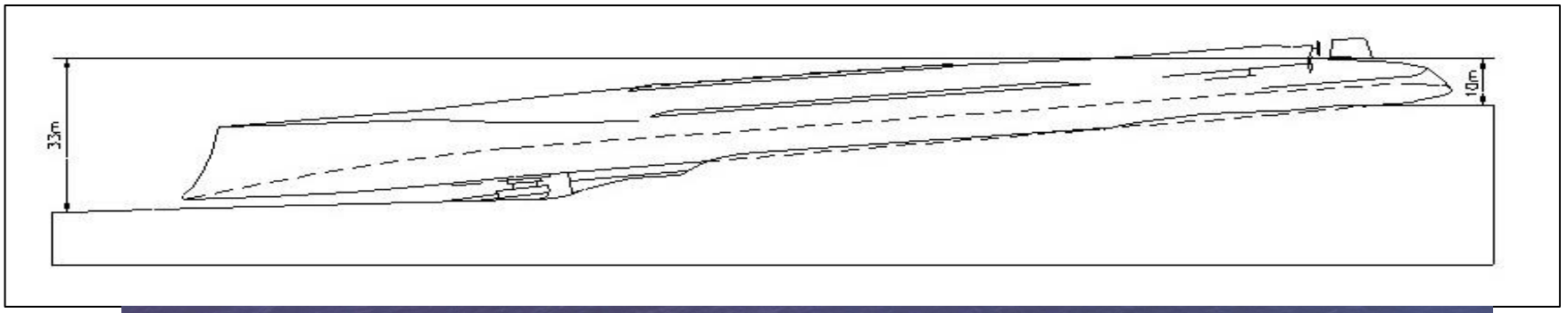
Prinz Eugen wreck rests 200 yards offshore from Carlson Islet (Enubuj) near Kwajalein and Ebeye

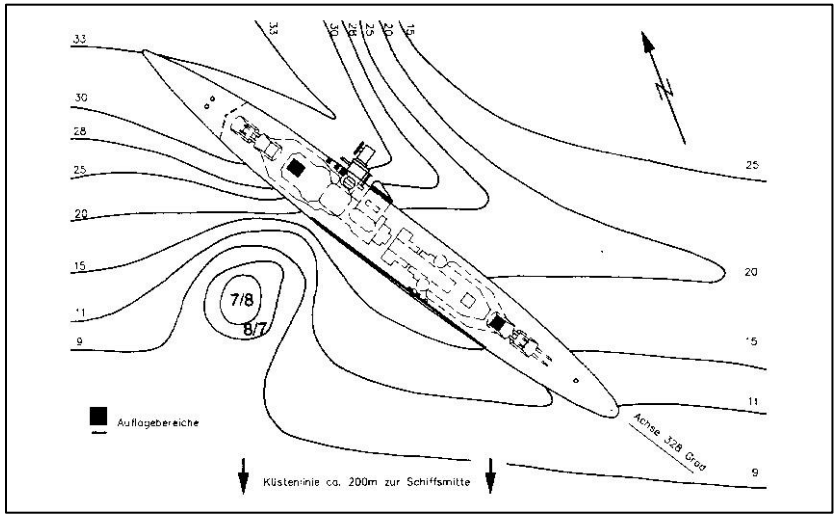
RESOURCES AT RISK IN KWAJALEIN LAGOON

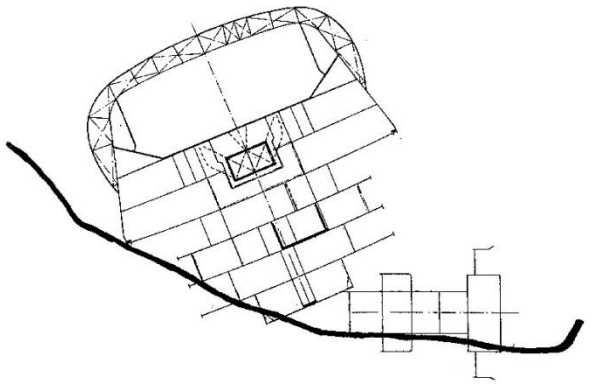


http://www.smdc.army.mil/rts.html

Prinz Eugen Position on Reef

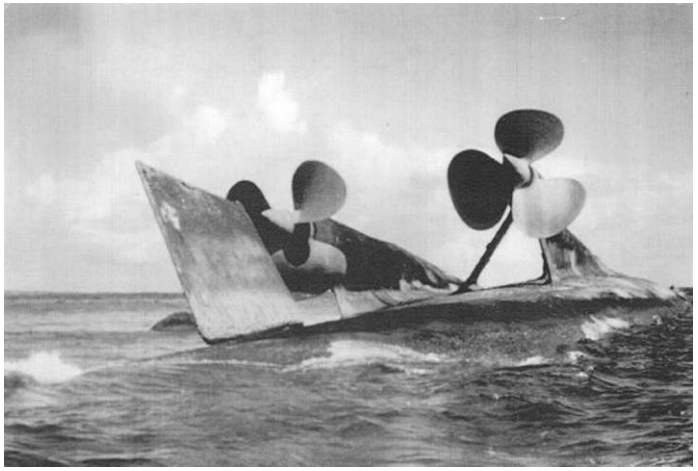






? Schmalenbach, Paul (1971). "KM Prinz Eugen".

Prinz Eugen Wreck in Kwajalein Lagoon

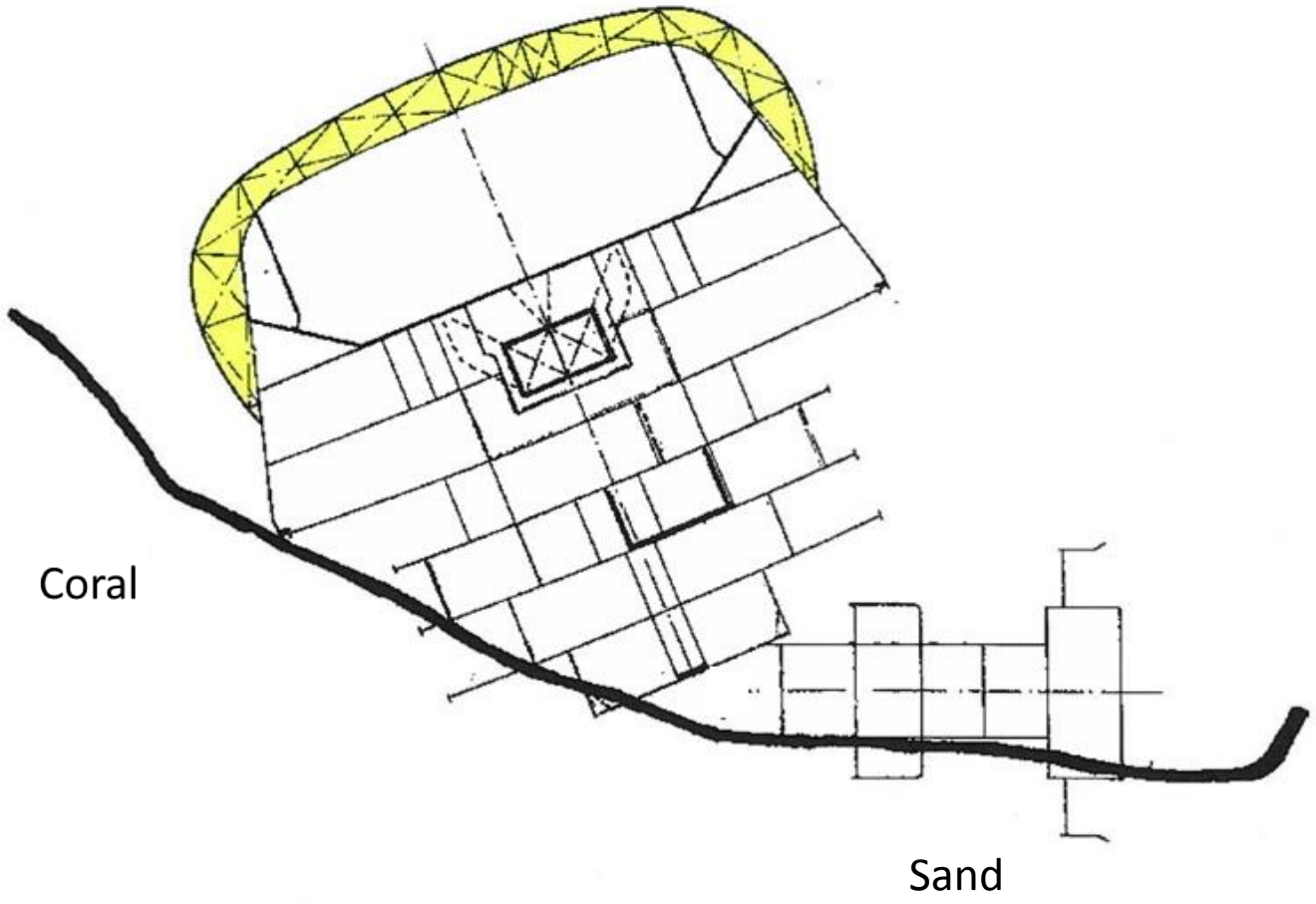


Before propeller removal in 1978

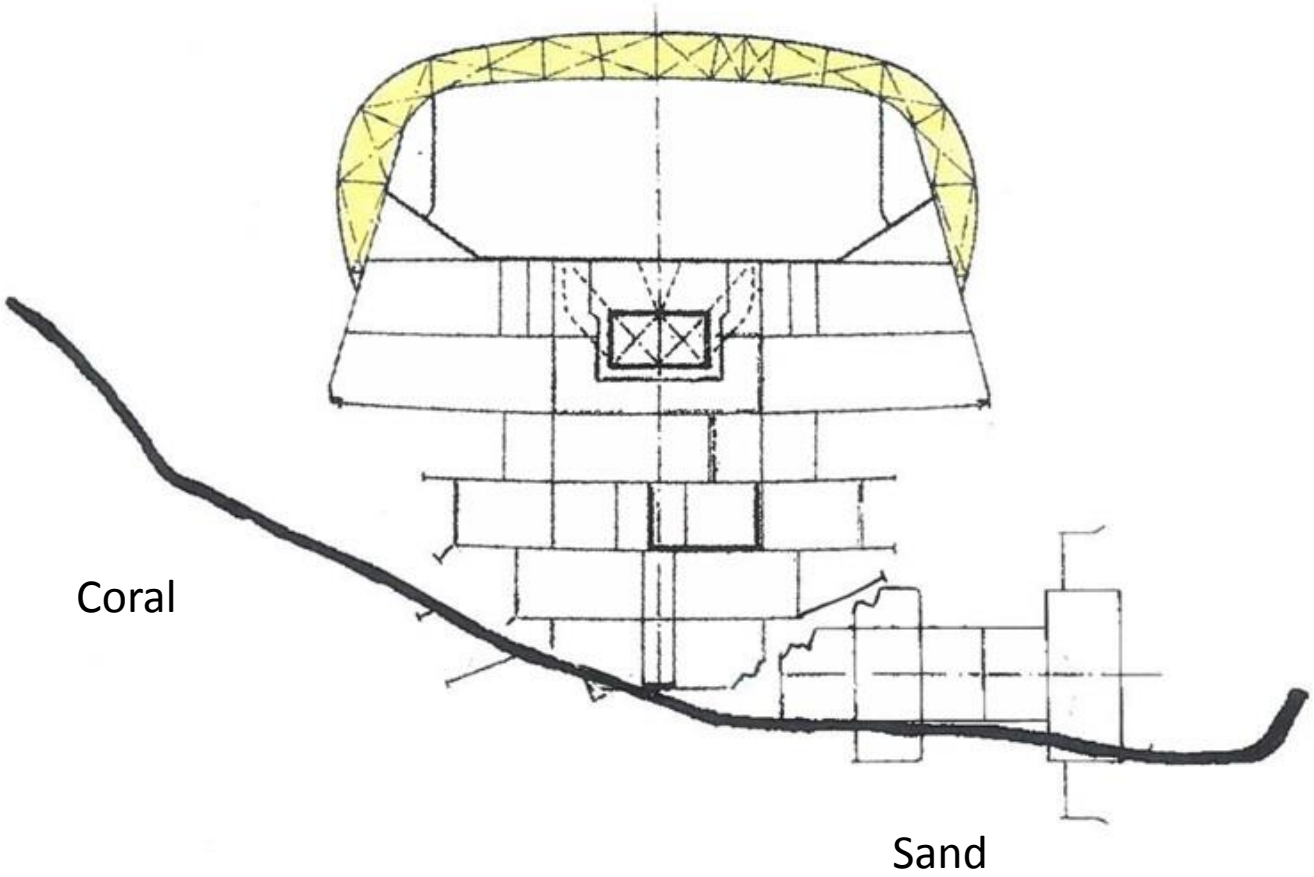
NPS photo 1989

November 2014

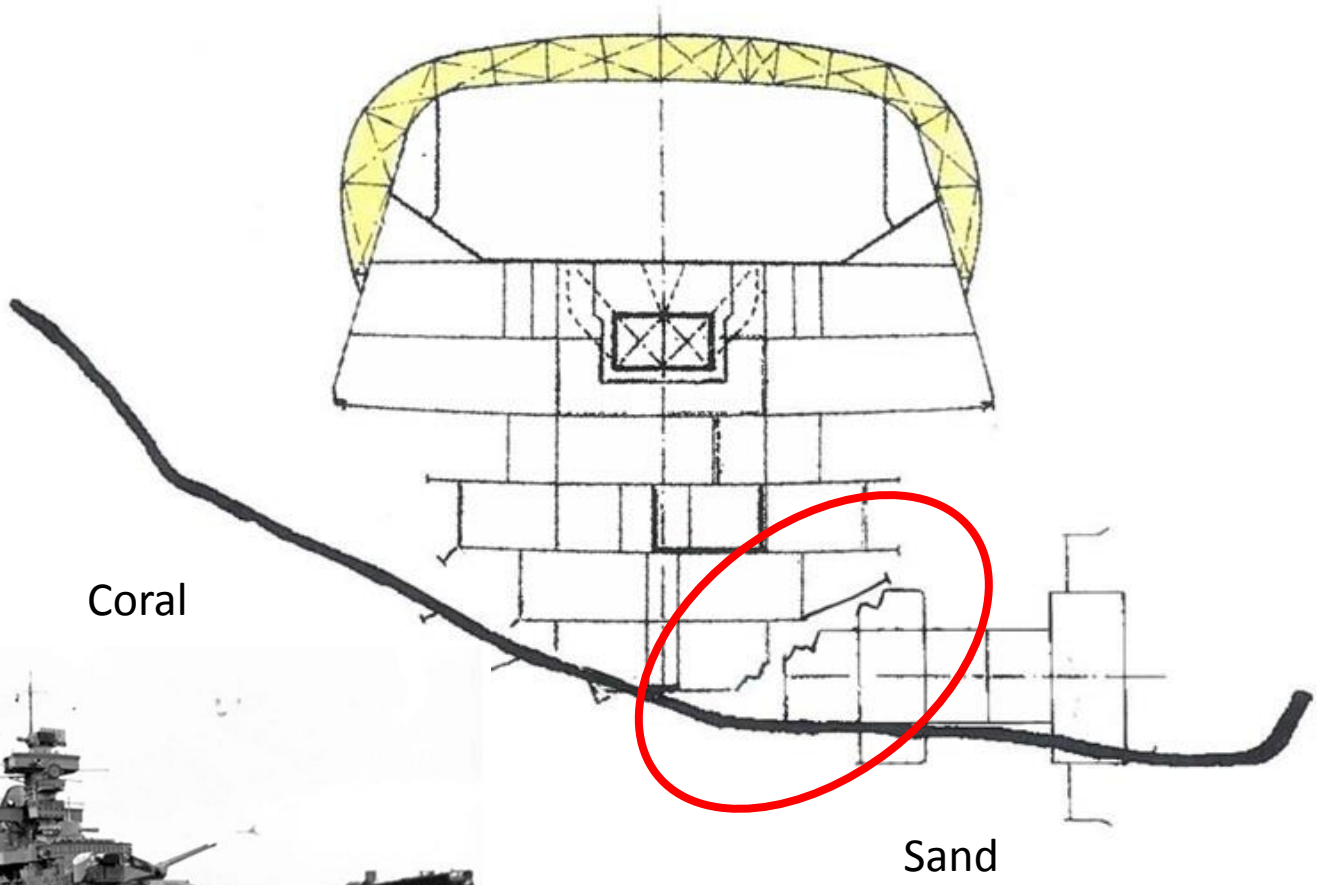
November 2014



Wreck inclination 1971. Probably stable 1946-1989.



Wreck inclination 2014

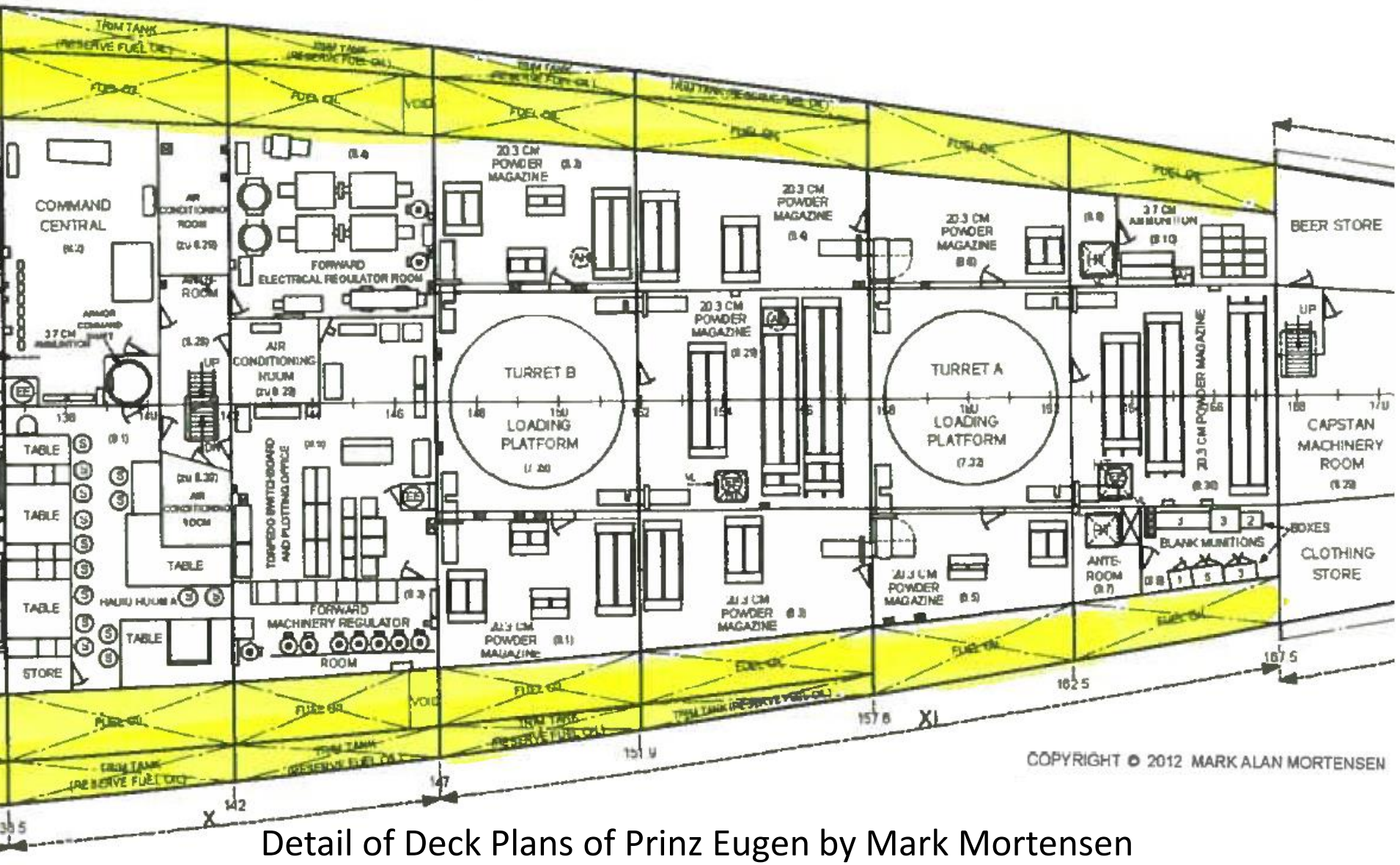


The *Prinz Eugen* anchored in the Baltic in the spring of 1941.

Superstructure Corrosion and Collapse?
Coral Reef Degradation?

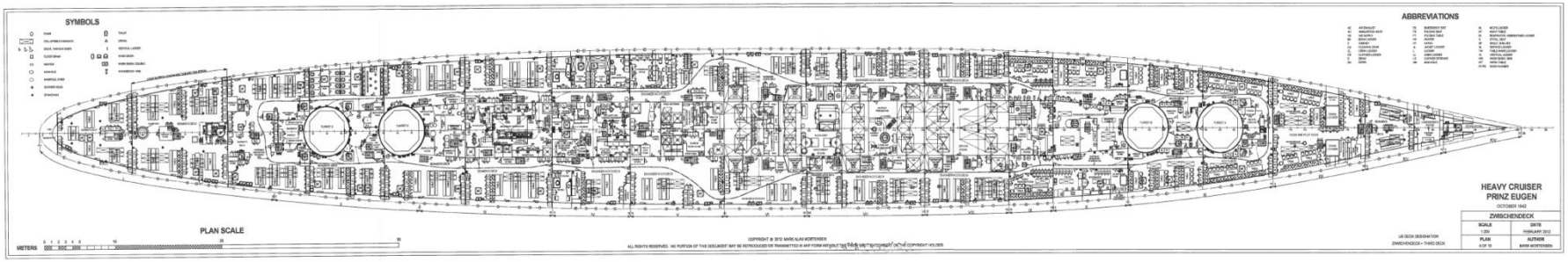
Locations of Fuel Tanks on Prinz Eugen

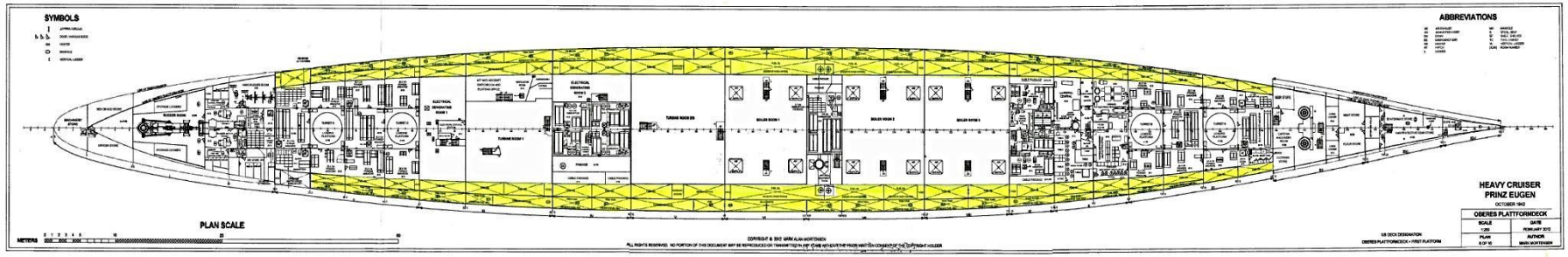
Determination of Oil Tank Locations in Prinz Eugen

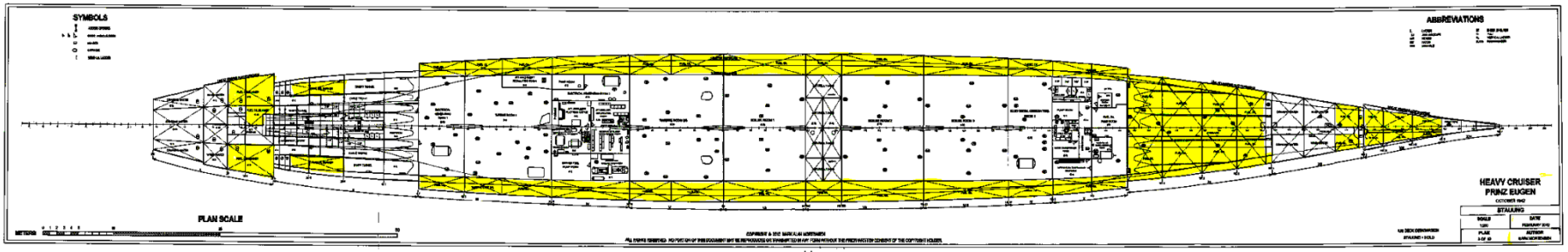


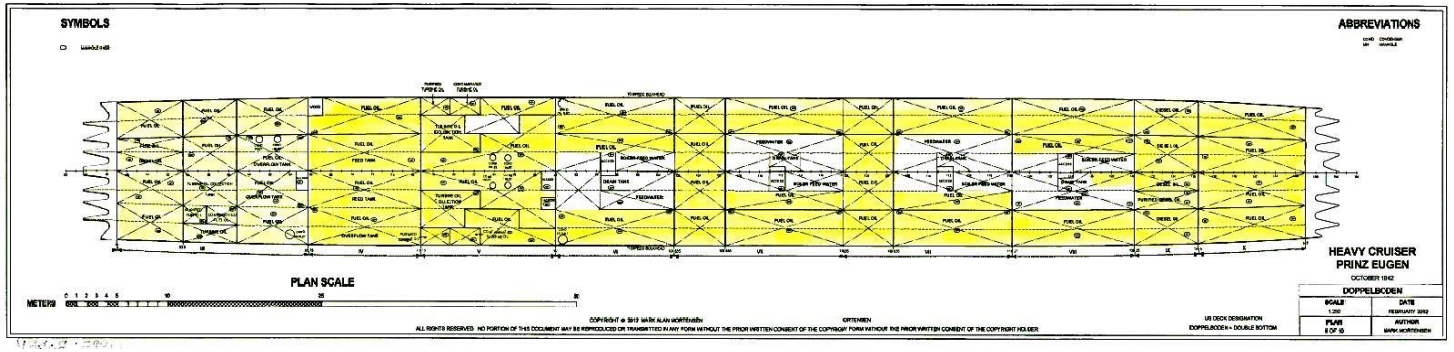
Detail of Deck Plans of Prinz Eugen by Mark Mortensen

Prinz Eugen deck plans, Mortensen 2012

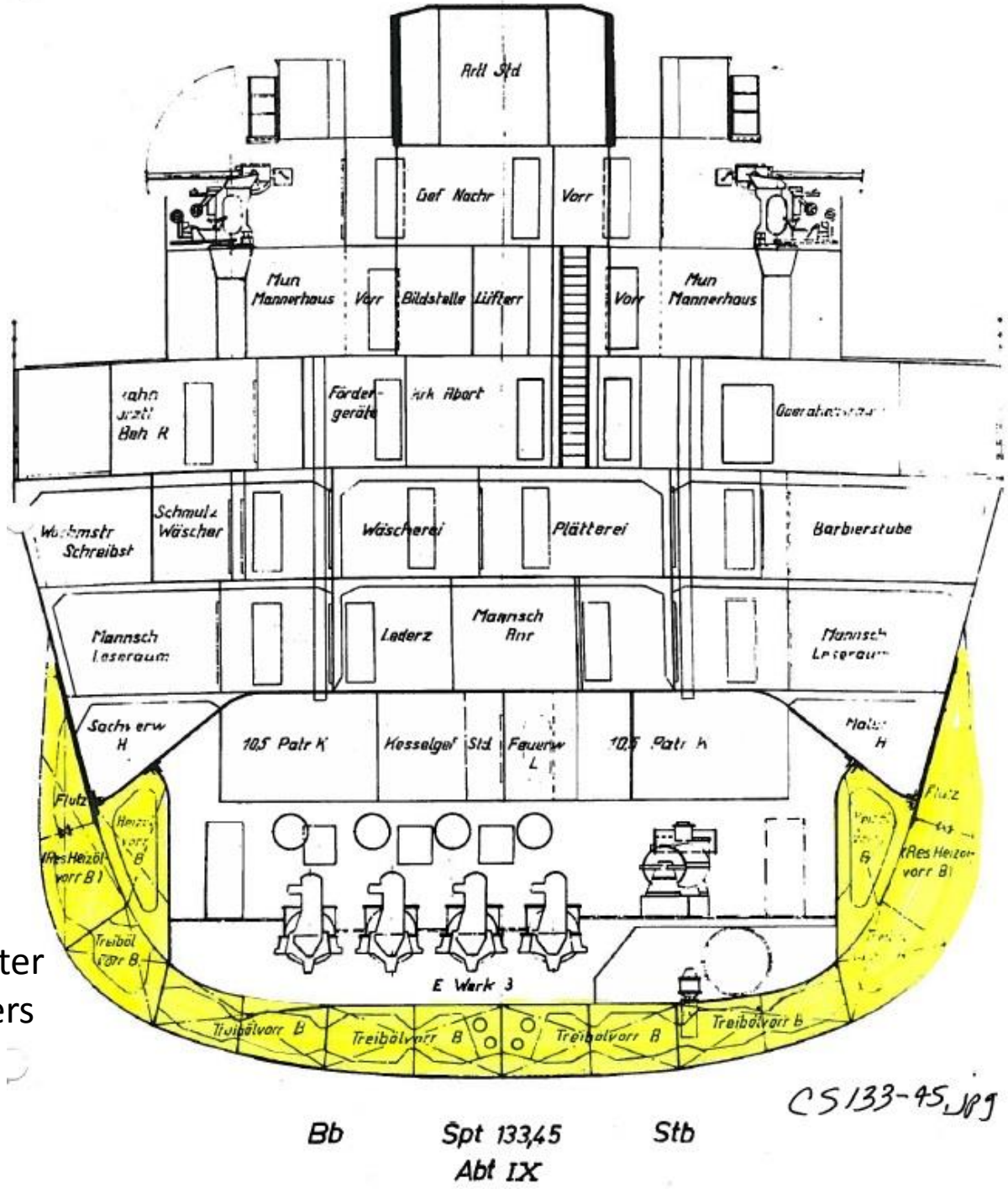


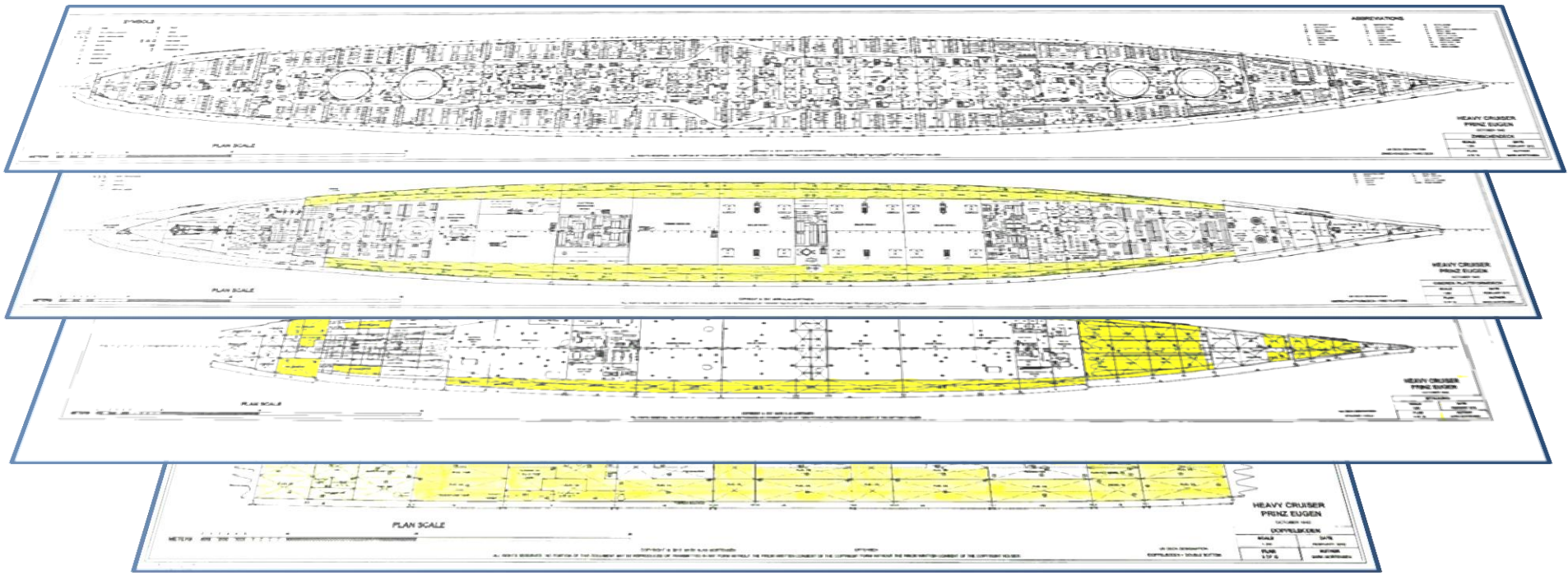


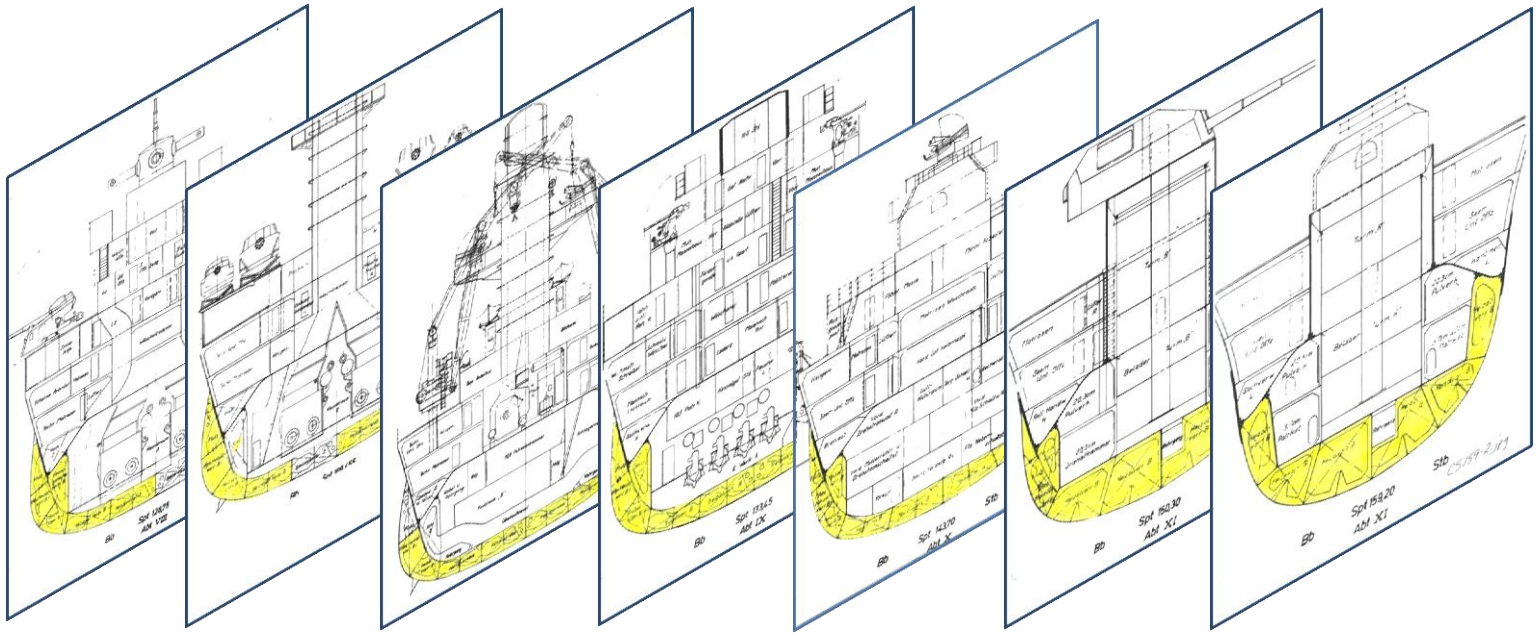




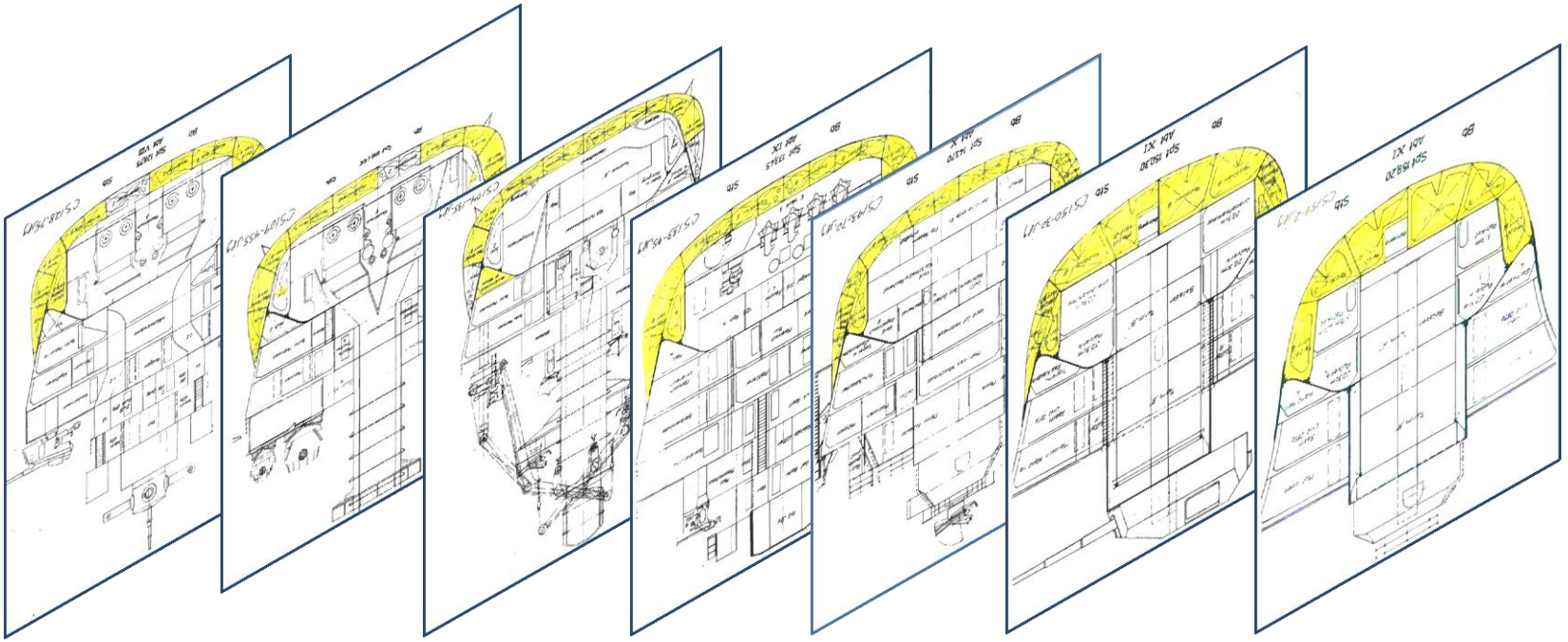
Tanks are “Skin-tanks” i.e. the ship’s hull is the outer wall of bunkers




PLAN SCALE
HEAVY CRUISER
PRINZ EUGEN
DOPPELBODEN


Bb
Spt 133,45
Abt IX
Bb
Spt 143,70
Abt X
Stb
Bb
Spt 150,30
Abt XI
Bb
Spt 159,20
Abt XI
Stb

2014 Position of Bunker Fuel Tanks



Number of Fuel tanks: about 120. Connections between tanks requires research

Oil Spill Risk Factors

SITE WRECK RISK ASSESSMENT CRITERIA AND RATINGS

RISK ASSESSMENT CRITERIA, QUESTIONS	HIGH RISK	MED. RISK	LOW RISK	PRINZ EUGEN
SIZE, TYPE AND CONSTRUCTION	>10,000 TONNES	1000-10,000 TONNES	<1000 TONNES	17,000 TONNES
QUANTITY OF OIL	>1000 TONNES	100-1000 TONNES	<100 TONNES	2767 TONNES
ACCESSIBLITY FROM SHORE	NEARSHORE OR LAGOON	OFFSHORE, ACCESSIBLE	OPEN SEA	NEARSHORE LAGOON
WATER DEPTH, ACCESSIBILITY	< 50 M	40-60 M	ROV ONLY	0-10 M
HISTORY OF OIL RELEASES	YES	UNKNOWN	NO	YES
PERSISTANCE OF OIL IN WRECK	VERY PERSISTENT	MEDIUM GRADE OILS	NON-PERSISTENT	VERY PERSISTENT
SUBJECT TO SEVERE WEATHER	HIGH RISK	MODERATE	LOW	MODERATE
STABILITY OF SEABED	UNSTABLE	RELATIVE STABLITY	KNOWN TO BE STABLE	UNSTABLE CORALS
CONDITION OF WRECK	SIGNIFICANT DETERIORATION	MODERATE DETERIORATION	MOSTLY INTACT	COLLAPSING
HYDRODYNAMIC FORCES ON SEABED	HIGH SUB-SEA CURRENTS	MEDIUM CURRENTS	LOW LEVEL CURRENTS	LOW

Adapted from Michel et al (2005) Potentially Polluting Wrecks in Marine Waters

SITE WRECK RISK ASSESSMENT CRITERIA AND RATINGS

RISK ASSESSMENT CRITERIA, QUESTIONS	HIGH RISK	MED. RISK	LOW RISK	PRINZ EUGEN
SIZE, TYPE, CONSTRUCTION	**>10,000 TONNES**	1000-10,000 TONNES	<1000 TONNES	17,000 TONNES
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STABILITY OF SEABED	**UNSTABLE**	RELATIVE STABLITY	KNOWN TO BE STABLE	UNSTABLE CORALS
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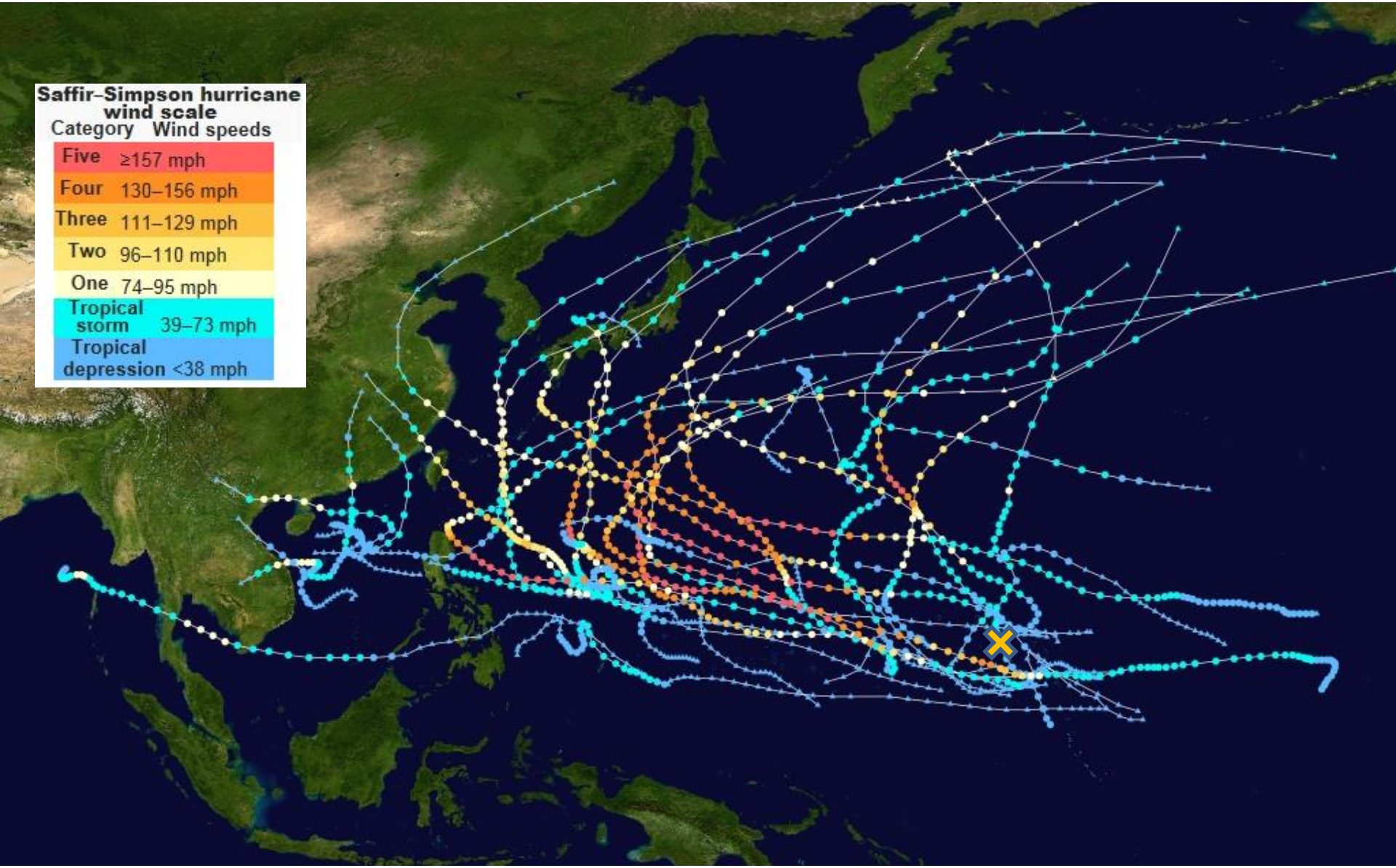
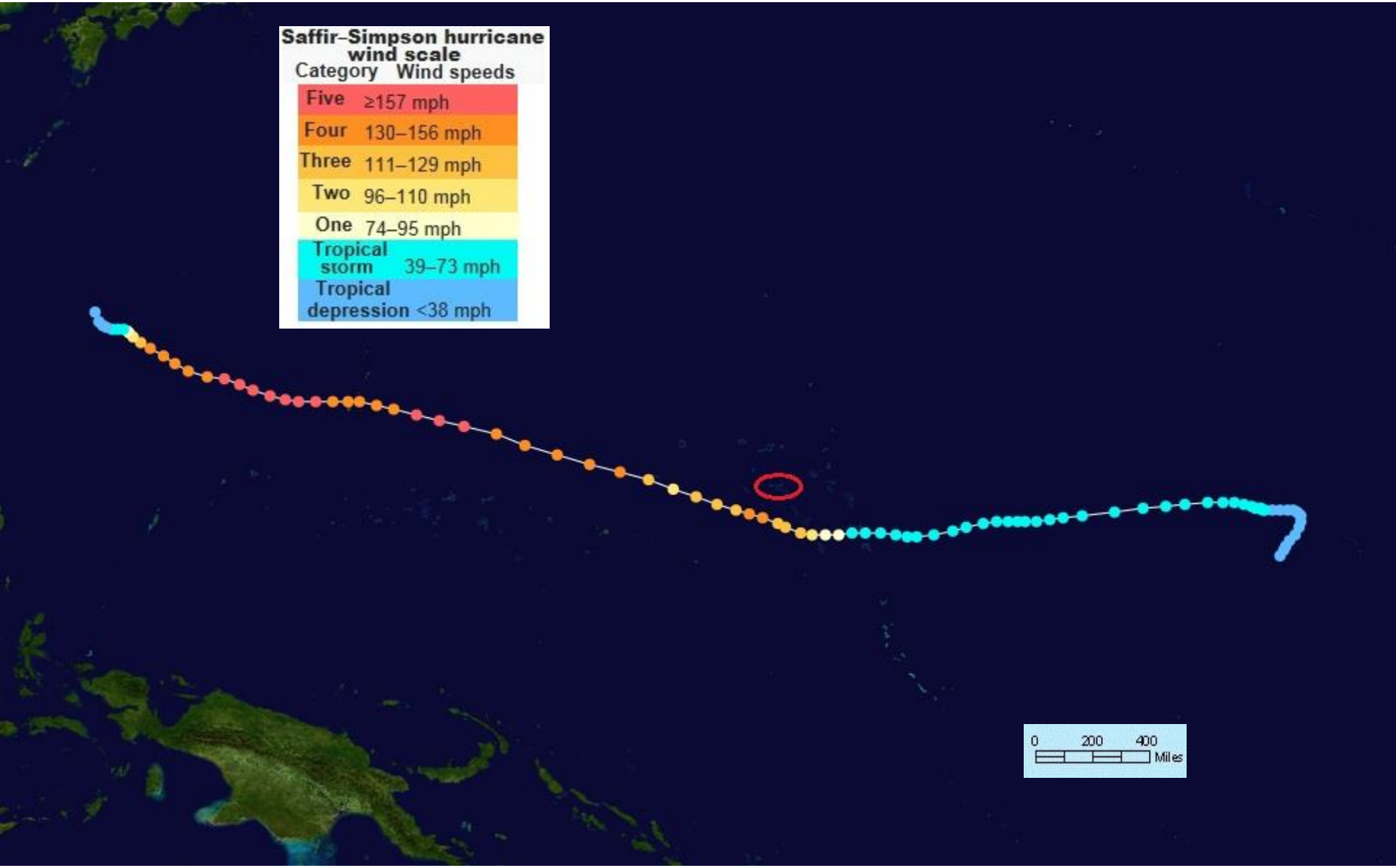
HYDRODYNAMIC FORCES ON SEABED	HIGH SUB-SEA CURRENTS	MEDIUM CURRENTS	**LOW LEVEL CURRENTS**	LOW

I997 Western Pacific Tropical Cyclones



1997 Hurricane Paka proximity to Kwajalein



Oil Removal Cost Analysis

RANGE OF RELATIVE COSTS OF OIL RECOVERY FROM AVERAGE WRECK

COMPLEXITY	COST FACTORS	COST RANGE (US $)
SIMPLE	SHALLOW DEPTH (<20M) LOW VISCOSITY OIL PROTECTED WATER LOCAL MOBILIZATION	$ 1-3 MILLION
MODERATE	MODERATE DEPTH (20-50M) MODERATE OIL VISCOSITY WEATHER, SEAS, VISIBILITY REGIONAL MOBILIZATION	$ 2-5 MILLION
COMPLEX	DEEP DEPTH (50-250M) HIGH VISCOSITY OIL POOR WRECK CONDITION OPEN WATER WEATHER LONG MOBILIZATION	$5-20 MILLION

Adapted from Michel et al (2005) Potentially Polluting Wrecks in Marine Waters

COST FACTORS AND COMPLEXITY OF OIL RECOVERY FROM PRINZ EUGEN

COMPLEXITY	COST FACTORS	COST RANGE (US $)
SIMPLE	SHALLOW DEPTH (<20M) LOW VISCOSITY OIL PROTECTED WATER LOCAL MOBILIZATION	$ 1-3 MILLION
MODERATE	MODERATE DEPTH (20-50M) MODERATE OIL VISCOSITY WEATHER, SEAS, VISIBILITY REGIONAL MOBILIZATION	$ 2-5 MILLION
COMPLEX	DEEP DEPTH (50-250M) HIGH VISCOSITY OIL POOR WRECK CONDITION OPEN WATER WEATHER LONG MOBILIZATION	$5-20 MILLION

Cost Factors and Complexity of Oil Recovery from USS Mississinewa, Ulithi Lagoon, Yap, FSM, 2003

COMPLEXITY	COST FACTORS	COST RANGE (US $)
SIMPLE	SHALLOW DEPTH (<20M) LOW VISCOSITY OIL PROTECTED WATER LOCAL MOBILIZATION	$ 1-3 MILLION
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NAVSEA
NAVAL SEA SYSTEMS COMMAND
Supervisor of Salvage and Diving

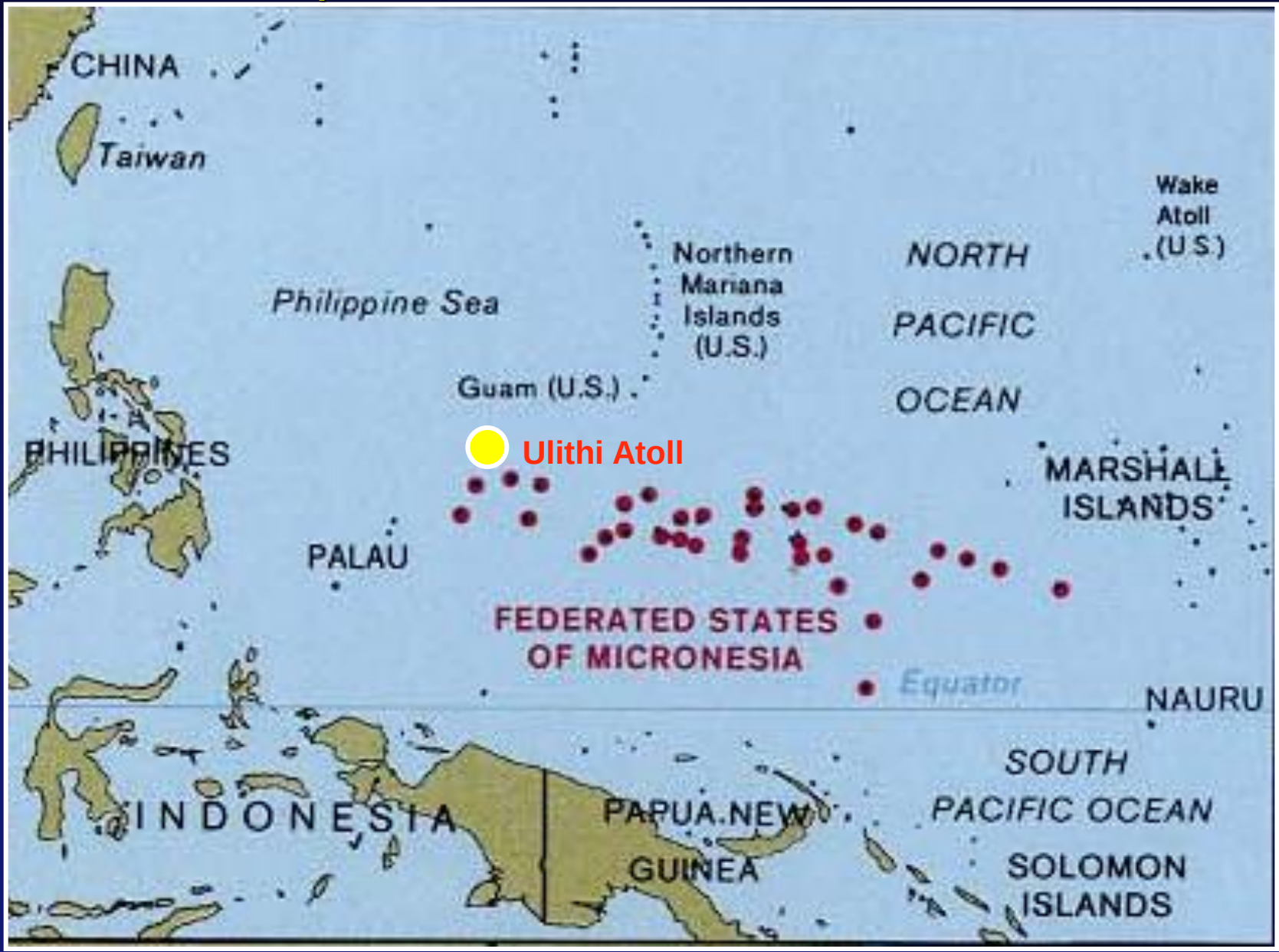
Sinking of the Mississinewa

- November 20, 1944
- 63 U.S. personnel lost
- 3,780,000 gallons of oil on board at sinking
- Sunk in 130 feet

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Supervisor of Salvage and Diving

USS Mississinewa at Ulithi Atoll

Yap State, Federated States of Micronesia



NAVSEA
NAVAL SEA SYSTEMS COMMAND
Supervisor of Salvage and Diving

Resources

- **Vessels**
  - **USS Salvor (ARS 52) – Navy diving support platform**
  - **Primary support barge & tug**
  - **Additional barge and tug**

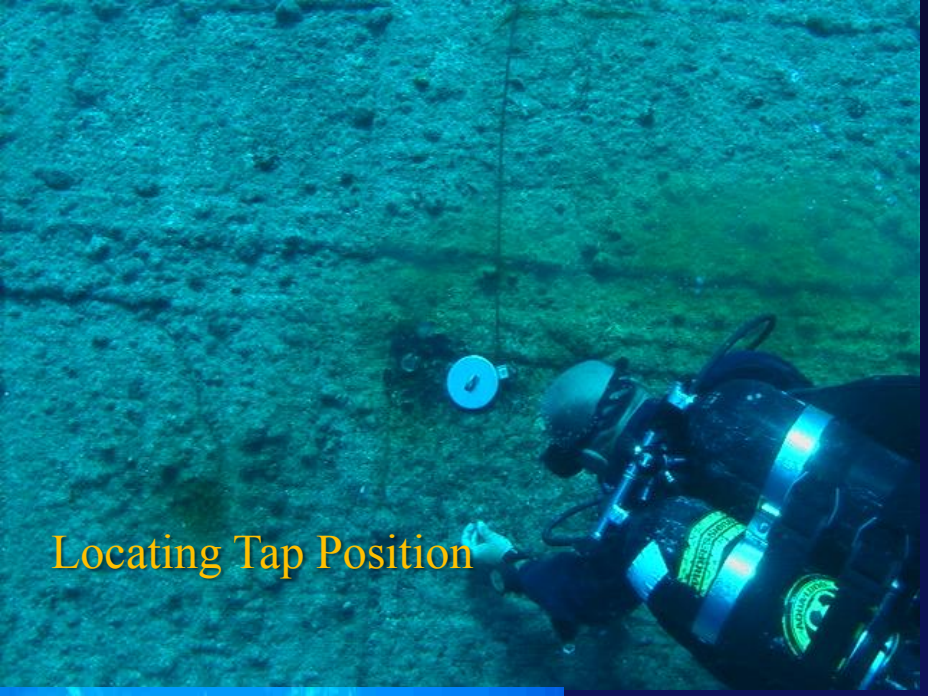
- **Personnel – Salvor, MDSU, EODMU, SUPSALV & contractors**
- **Equipment - supplied by ESSM (hot taps, pumps, etc.)**
- **Diving - surface-supplied; recompression chamber; communications (Salvor, MDSU, & EOD MU 5)**
- **Pollution response equipment (ESSM)**

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Supervisor of Salvage and Diving

Oil Spill Mitigation

- Spill Response Plan
- Containment
- Oil Recovery
- Dispersant Plan
- Wildlife Plan
- Storage & Disposal

Underwater Operations



Locating Tap Position

Installing valve Flange

Drilling through Hull

Cutting Access Holes

Installing Pump and Hose

Operational Summary

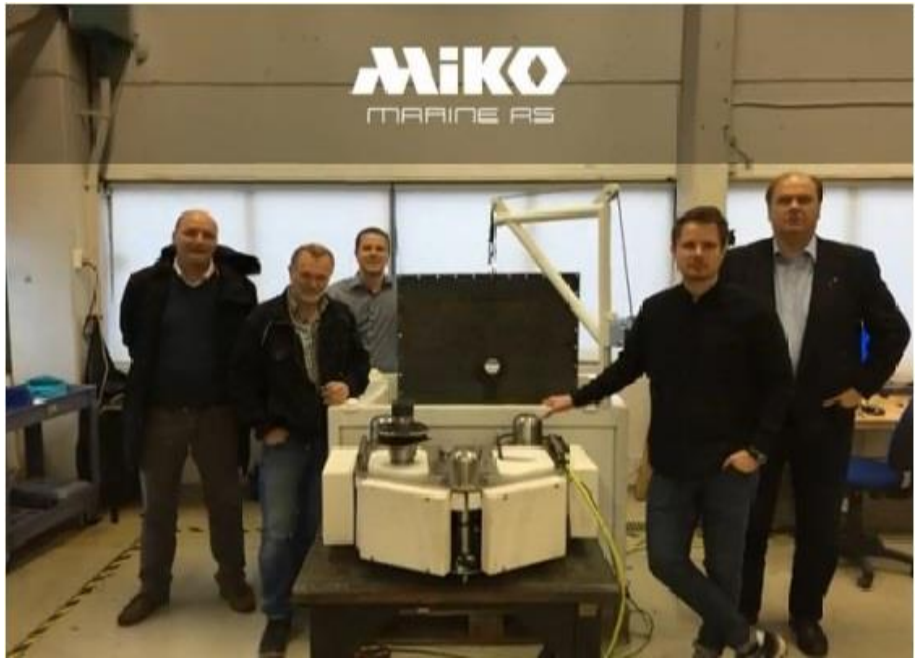
- Installed 20 Hot Taps & Secured with Caps after Pumping
- Cut Access into Two Tanks for Internal Tank Access (& Secured)
- Removed All Accessible Oil from 21 Tanks, Engine Room, Pump Room, and Previously-Leaking Piping
- Transferred Approximately 1.95 Million Gallons of Oil from Mississinewa to Barge, including approximately 7% Free Water
- Successfully completed ahead of schedule
- Est. less than 5 gallons of Oil Released – No Environmental Impact
- Mississinewa Oil to be Sold in Singapore and Recycled

- Cost of Oil removal: $3-4,000,000
- Ships on Site in Ulithi Lagoon for 26 Days
- Oil tapping, pumping, striping and closure took 21 Days

Advances in Hot Tap Technology

Miko Marine “Moskito” Hot Tap

- 2015 Patent in Norway
- Computer controlled
- Neutral buoyancy
- Electro-Magnetic Clamps
- Automatic cutting
- Automatic valve seating
- 30 Minute operation



“Moskito” Hole Saw with Valve Flange and Valve as Integral Unit

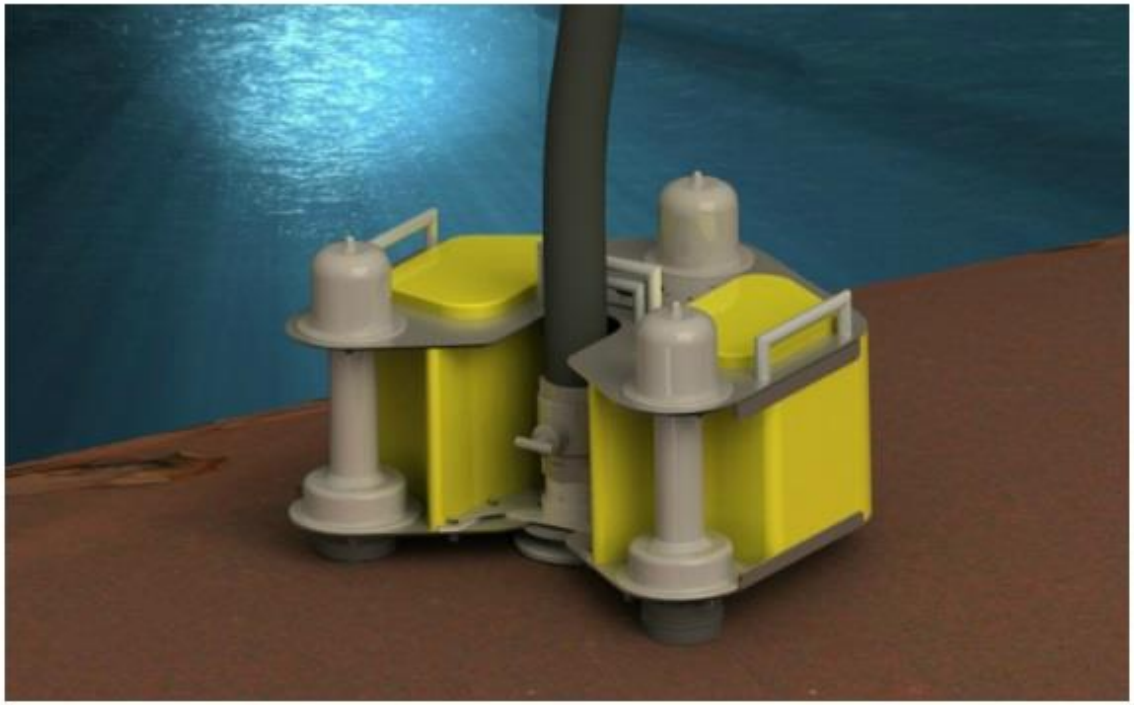
On ship computer screen controls and monitors valve attachment

Miko Marine Video: https://www.youtube.com/user/mikomarine

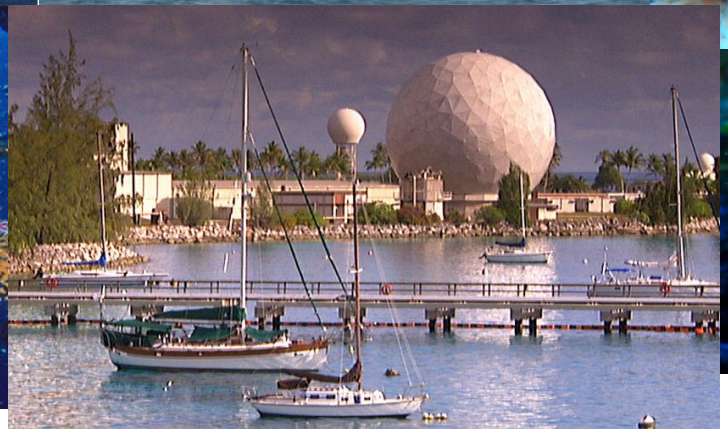
Miko Press Release

The Moskito biting back against oil pollution

March 4, 2015



WILL COST OF CLEANUP AND MISSION DISRUPTION EXCEED PE-EMPTIVE OIL REMOVAL COSTS?



http://www.smdc.army.mil/rts.html

Questions?

michael_fry@fws.gov
808-792-9400
U.S.Fish and Wildlife Service
300 Ala Moana Blvd, RM 3-122
Honolulu, HI 96850

Photo: Ann Cohen