

THE PORT
OF LOS ANGELES **LA**

America's Port

Port of Los Angeles
ALTERNATIVE MARITIME POWER – AMP™
Connecting Ships to Shore Power

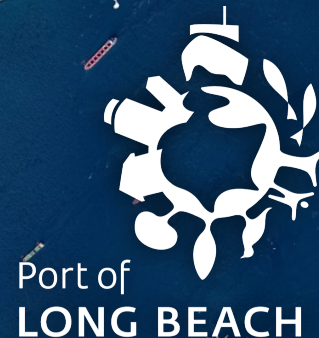


San Pedro Bay Port Complex



9,337,632 TEU

CY - 2019



- Harbor Department founded in 1907
- State Tidelands Trust granted 1911
- Non-Taxpayer Supported
- Hybrid Port Model
- Handles Cargo to & from every corner of the U.S.
- By the Numbers:
 - 4,300 acres land
 - 3,200 acres water
 - 43 miles of waterfront
 - 270 berths, 27 terminals

TEU Volume – Port Ranking

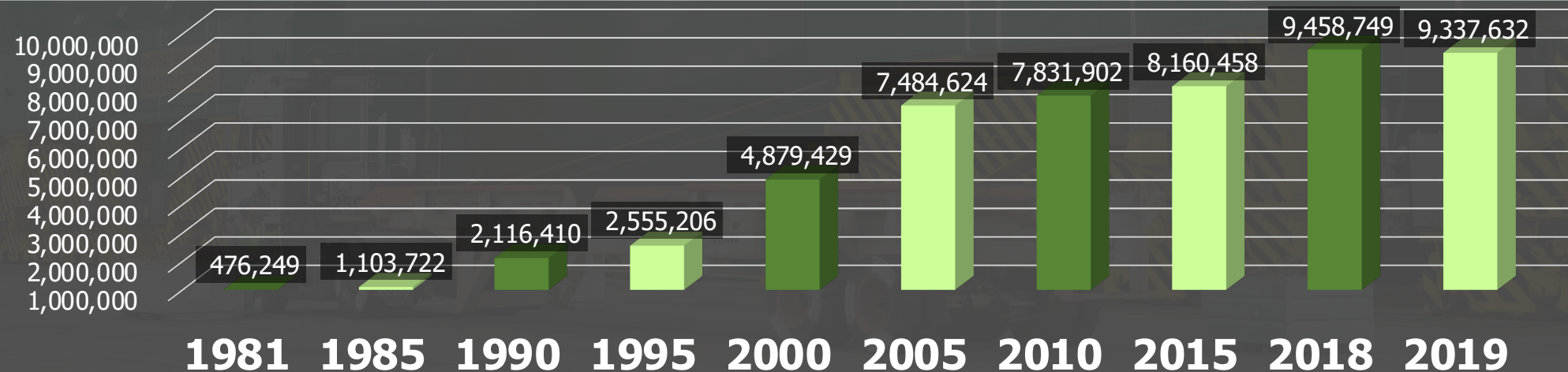
Global Ranking (2017)

1. Shanghai, China	40.2	6. Busan, South Korea	20.5
2. Singapore	33.7	7. Guangzhou, China	20.4
3. Shenzhen, China	25.2	8. Qingdao, China	18.3
4. Ningbo, China	24.6	9. LA & LB (as of 2018)	17.5
5. Hong Kong	20.8	10. Dubai, Arab Emirate	15.4

North American Ranking (2018)

1. Los Angeles	9.4	6. Tacoma/Seattle	3.8
2. Long Beach	8.1	7. Vancouver	3.4
3. NY/NJ	7.2	8. Manzanillo	3.1
4. Panama (AMP)	7.0	9. Hampton Roads	2.9
5. Savannah	4.4	10. Houston	2.7

PORT OF LOS ANGELES - TEU COUNT





34%

VEHICLES

156,091 Units



8.4%

**LIQUID
BULK**

90,624,559 Barrels



1.1%

STEEL

2,101,856 MT

OTHER LINES OF BUSINESS



4.6%

VISITORS

3.14 Million People



8%

FRUIT

80,892 MT



26%

SCRAP METAL

905,886 MT



1.8%

CRUISES

111 Calls

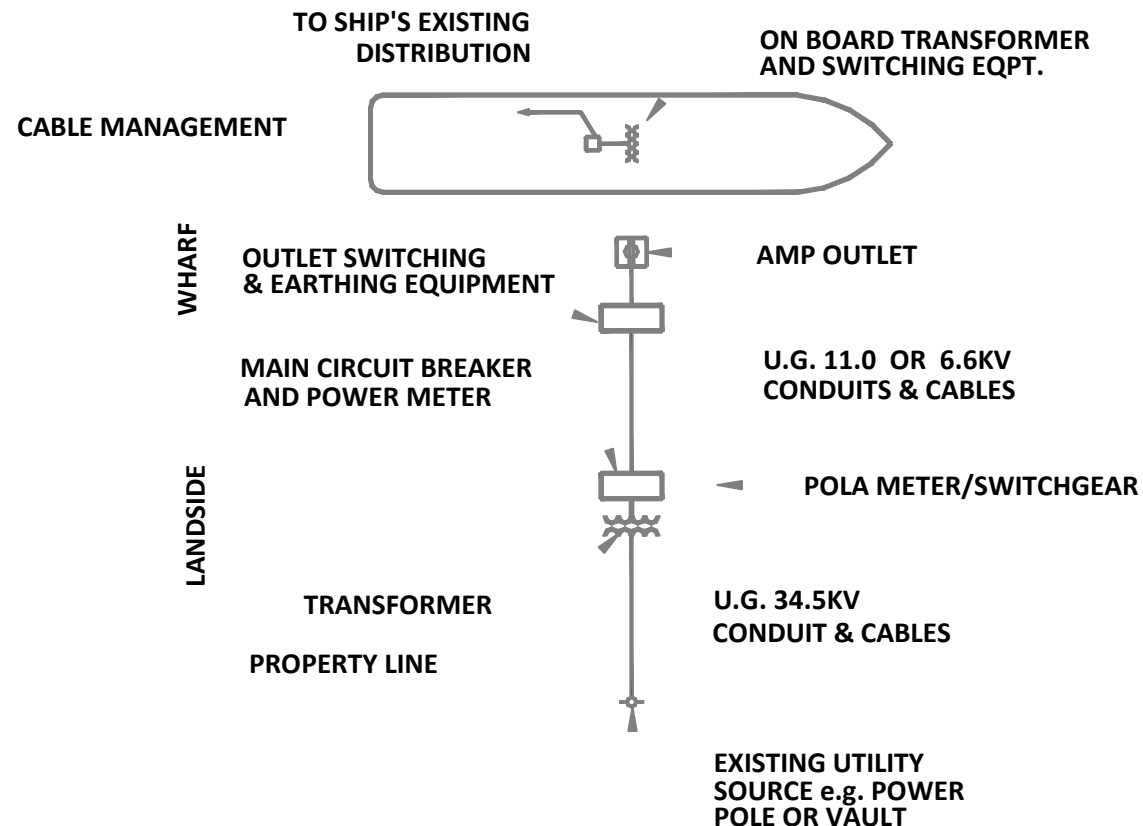
Air Quality – South Coast Air Basin

- The “100” Year War
- Diesel Emissions
- Identified as Air Toxic by the California Air Resources Board (CARB)



Alternative Maritime Power (AMP™)

Connecting vessels to
Shore Power while at
berth.



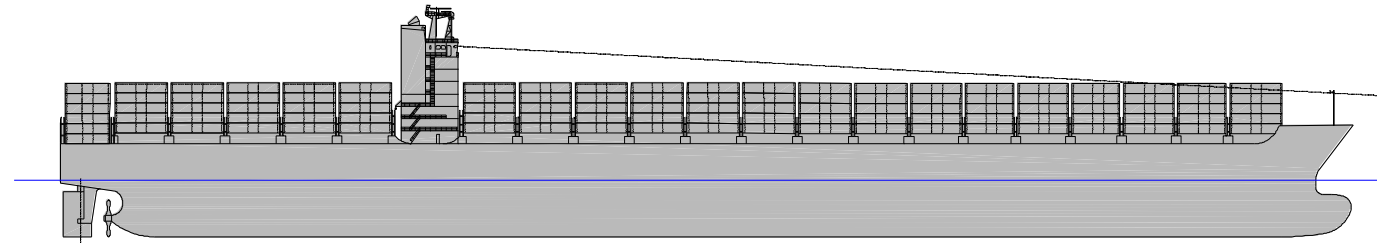
AMP: The Challenge



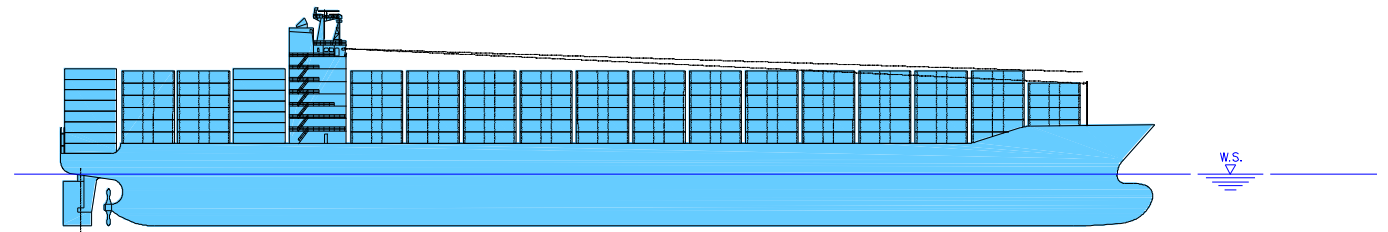
Container Ship Particulars

On-Board Electrical Systems

- Newer larger container vessel's on-board voltage is 6.6 kV
- Balance are 440 Volt vessels
- Ship's power demand is widely variable:
 - Average 1.5 MW)
- Power Demand Examples:
 - 2 MW at 6.6 kV = 1 power cable
 - 2 MW at 440 V = 9 power cables



> 6,000 TEU = 6600 Volt (6.6 kV)

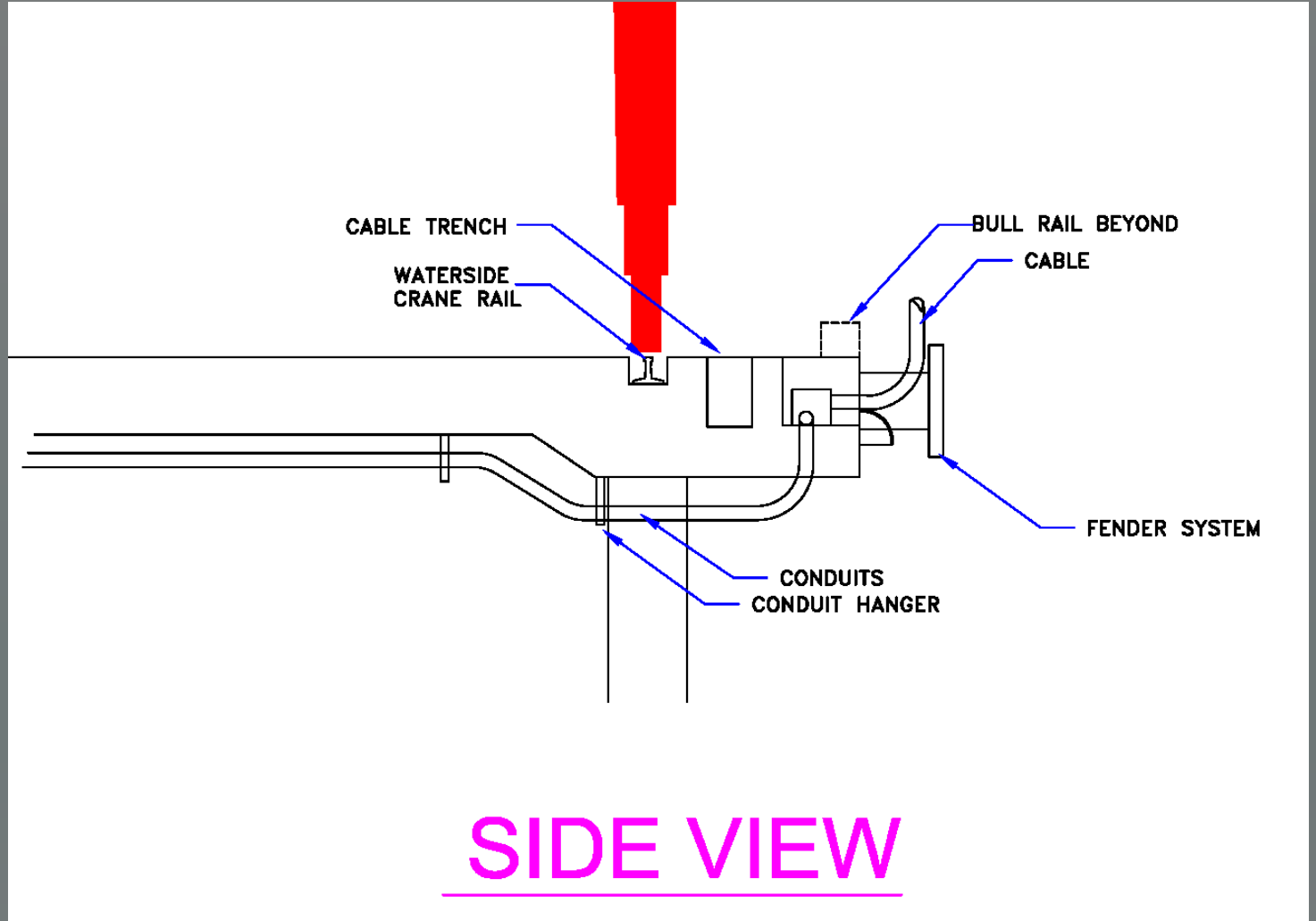


< 5,900 TEU = 440 Volt

High Voltage in Tight Locations



AMP Construction



Conduits and Wires



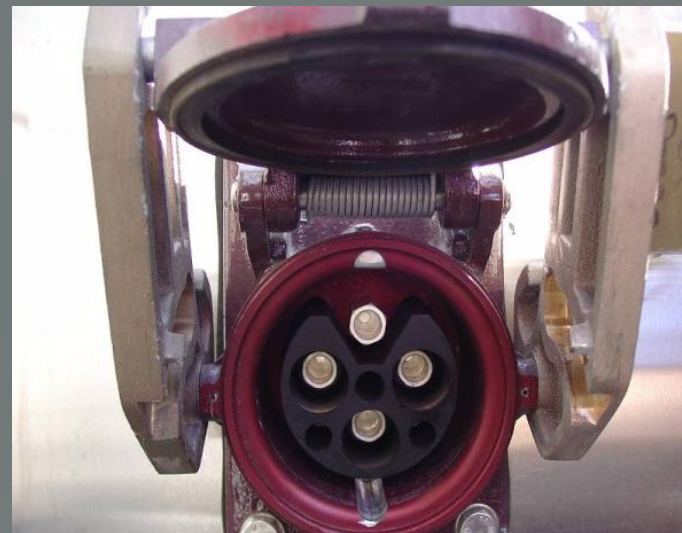
AMP - Power Vault



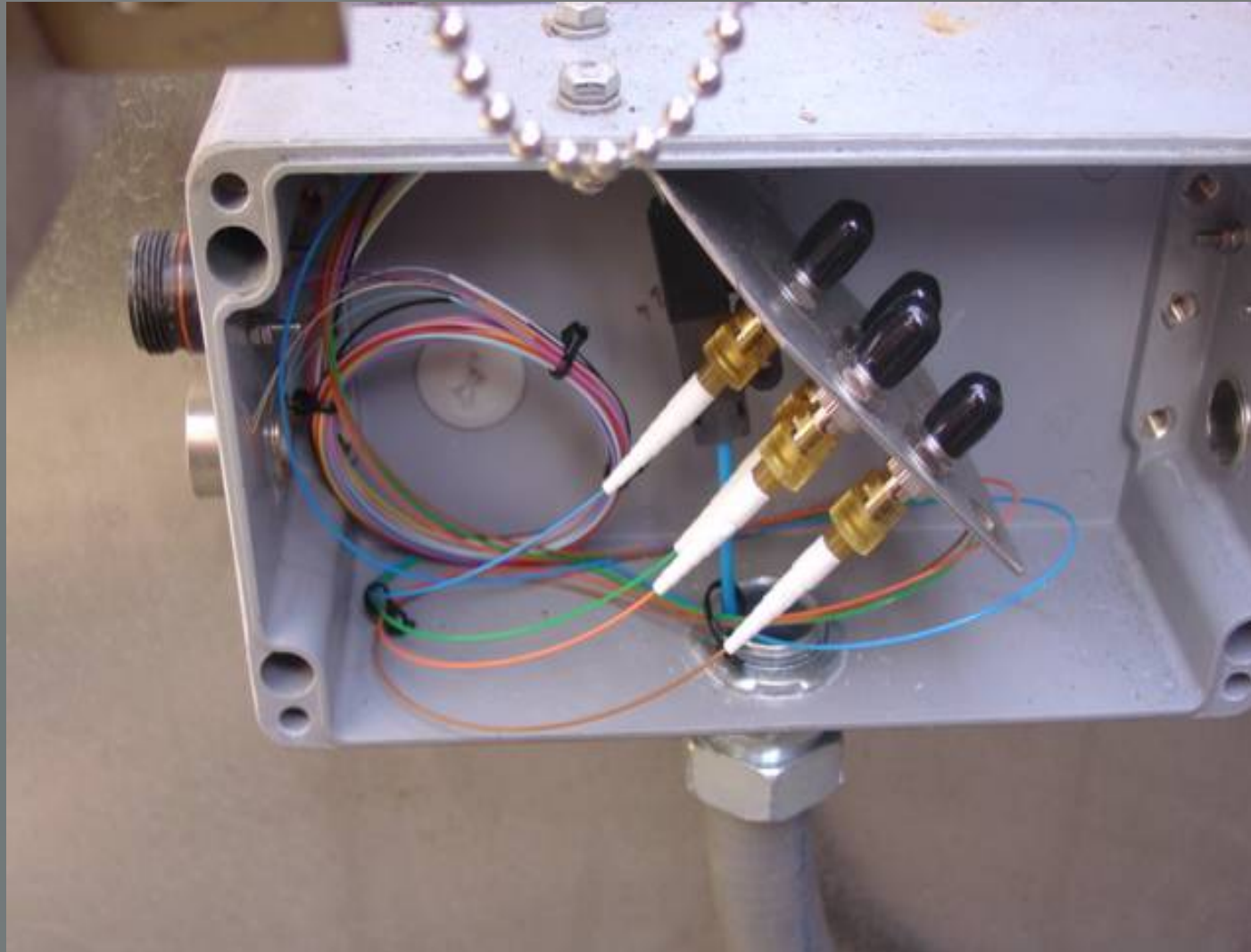
Bull Rail Cutout



Vault and Receptacle



Fiber Optics Wiring



AMP – Switchgear & Transformer



AMP – First Generation – Berth 100

Barge Power Transfer:

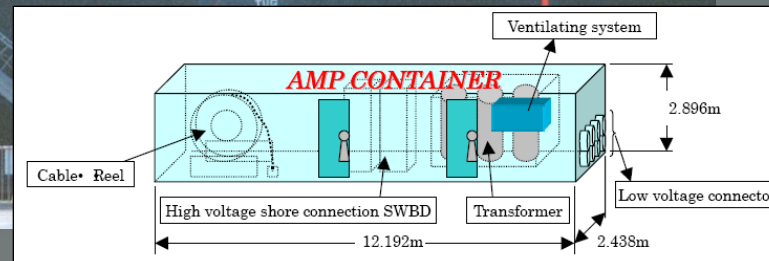
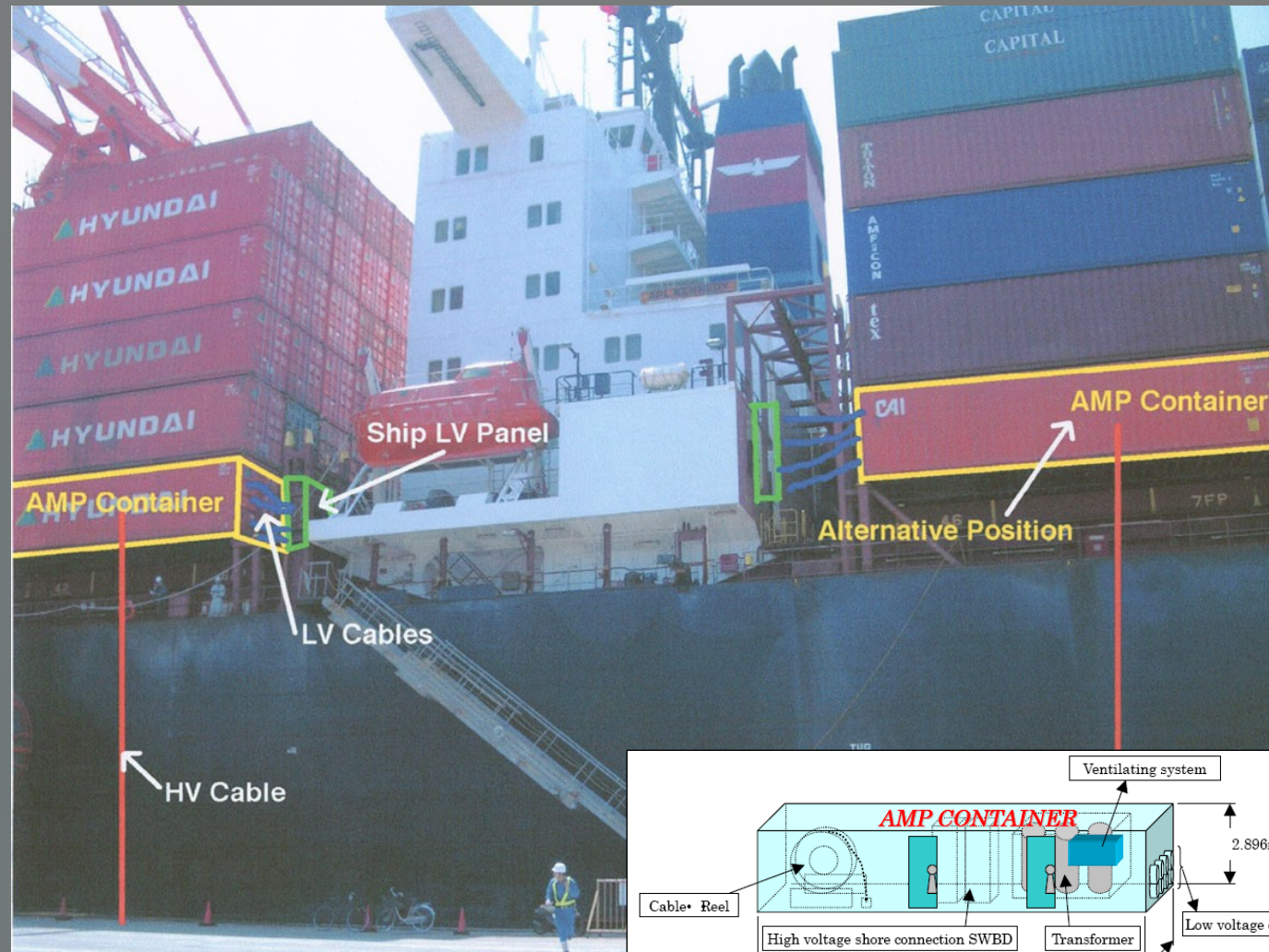
- 440 Volt to 6.6 kV
- Barge based cable management system, transformer and switchgear



Container Vessel Cable Management



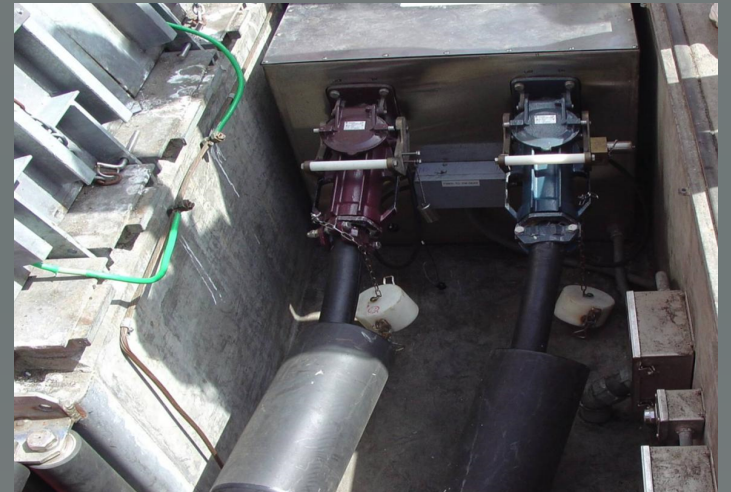
Moveable Ship Board Cable Management



Moveable Ship Board Cable Management



Container- AMP Vessel Connection



On-Board AMP Equipment

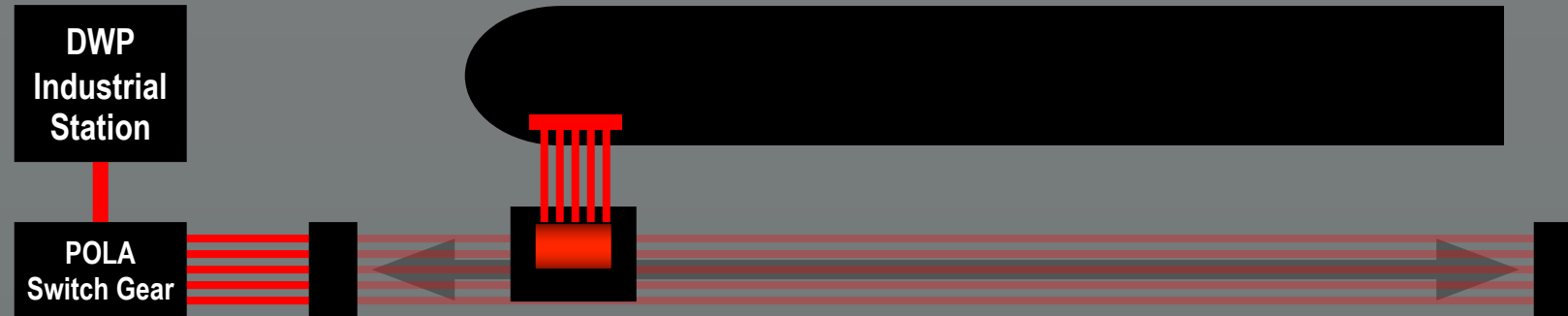


Port of Los Angeles Cruise Terminal

- 11 kV System construction 100% complete
- 6.6 kV construction 100% complete
- Both systems @ 60 Hertz - 20 MVA
- Synchronized Power Transfer
- Four Connectors + 1 Isolated Neutral
- Flexible Shore Based Cable Management
- Total cost \$30 million



The “AMP Mobile”



AMP Power Vault – Cruise Vessel Connection



AMP - System Features

- Container: 7.5 MVA xfmr
- Cruise: 18.0 MVA xfmr with automatic load tap change
- 6.6 or 11 KV, 3-ph, 60 Hz
- One transformer per berth
- Neutral Gnd resistor connection
- Auto sync and power transfer
- Fiber optic connection (optional)
- PLC controller (optional)
- Vacuum circuit breakers on main and feeder circuits

AMP - System Features (continued)

- Ground check double loop
- Connect/Disconnect procedures
- Earthing switch
- On-board vessel cable management systems
- On-board vessel xfmr
- Digital relay with protection functions:
 - Reverse power
 - Under/Over voltage
 - Under/Over frequency
 - Over current

Installations at the Port of Los Angeles



New Challenge: Moveable Connection Points



THANK YOU

**THE PORT
OF LOS ANGELES**

