

Dynamic Under Keel Clearance (UKC) Project for the Port of Long Beach

Information Brief to

MARINE BOARD



NOVEMBER 8, 2018















Challenge: Very Large Crude Carriers (VLCCs) entering POLB



1,200' LOA 200' Beam 320,000 DWT Now 69' Draft

Ports of Los Angeles & Long Beach

- 50% of California's oil
- Only 3 5 day supply of oil ashore
- Pier T-121 is the only VLCC berth on the West Coast





- Approach to POLB Channel dredged to 76 feet
- Area of concern: 1. Approach channel
 - 2. Turn at breakwater,
 - 3. Little bit after the turn

concern



Approach to port of Long Beach...

Channel dredged to 76 feet

Area of concern is:

Approach channel,
 Turn at breakwater
 Little bit after turn

History of the 76 foot channel into the Port of Long Beach

In 1998, after years of study, the Port of Long Beach, ACOE, and ARCO Marine partnered to dredge the Long Beach Approach Channel to 76'.

The goal was to allow ARCO's largest tankers at the time, 265,000 DWT (single hull) to transit to berth 121 with a full load which was 69' draft.

UKC + 10% of draft per Harbor Safety Plan



10% UKC Math: 69' draft + 10% of 69' = 76' channel depth

 $69' + 6.9' = 75.9' \sim 76'$

Final dredging of a 76' deep channel from the LB Sea Buoy to Berth T-121 was completed in 2014.

The **<u>Pitch Problem</u>** in a Long Period Southerly Swell



The Past:

The **GO/NO GO** decision was made using:

- ✓ CDIP Swell Warnings ✓ CDIP Buoy Reports ✓ Experience
- ✓ Seaman's Eye
- ✓ Observed pitch & roll far enough offshore to permit "bail-out" before committing to channel
- *Maximum Draft set at 65 feet!



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Rossm

Site 18

Site 19

The Solution: **PROTIDE PROGRAM**

PROTIDE takes predicted:

- water levels,
- currents,
- wave conditions,
- channel depth,
- ship course and speed, and
- ship dimensions...
- Calculates vertical ship motion (Pitch, Roll, and Squat)...
- And then calculates predicted under keel clearance and probability of touching bottom

PROTIDE is used in the following ports in the Netherlands: Rotterdam, Amsterdam & Eemshaven Plus: Antwerp, Belgium





Key Success Factor UKC Feasibility Study *Memorandum of Understanding* Signed Nov-Dec 2014

Interested Parties

<u>& Advisors</u>		<u>Participants</u>	
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INTEGRATED DCEAN DBSERVING SYSTEM	CONSEN PILOT SEAL	By: Wildowsen Name/Date: Jon 5 Janger 10 For the Port of Long Beach 12/2/14 By: Wildowsen Pilot Service For the Jacobisen Pilot Service For the Jacobisen Pilot Service By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention and Response By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention and Response By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention and Response By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confrie, 12/5014 For the Office of OI Spill Prevention By: Michael P. Confried For the Office of OI Spill Prevention By: Michael P. Confried For the Difference of OI Spill Prevention By: Michael P. Confried For the Difference of OI Spill Prevention For the Office of OI S	OSPR Cospective Control Contro
Coastal data information program	 ✓ Purpose, Goals ✓ Study, Evaluation ✓ Desired Outcor ✓ Roles and Resp ✓ \$\$ flows 	, Definitions on, Pilot, & Implementation Phases nes & Measures of Success onsibilities	TESORO & Pier 121 Users
	Projec	t Manager:	

Goals of Dynamic Under Keel Clearance Project

- **1.** <u>Increase safety</u> by reducing the risk of an accidental grounding caused by the pitch or roll of a large vessel.
- **2.** <u>Increase efficiency</u> by enabling ship owners and masters to adjust arrival times based on the pitch and roll program
- **3.** <u>Reduce emissions</u> by enabling larger ships to carry more cargo to enter the POLB, which could reduce overall stack emissions per ton of cargo

Benefit:

Reduce overall risk of transporting oil on West Coast

- 1. SAFETY Reduced personnel exposure & injury
 - a. Line handlers
 - b. Reduces hours crews are in demanding ops
- 2. ECONOMICS More efficient use of port infrastructure & tugs
- 3. ENVIRONMENT Reduce oil spill risk
 - a. Fewer oil transfers
 - b. Transfers in protected harbors rather than offshore lightering
 - c. Reduced emissions due to less loitering and more barrels per movement





Protide only works if it has accurate environmental inputs.
Coastal Data Information Program (CDIP) Wave Buoys are critical
3 CDIP Wave Buoys in local area
68 CDIP Wave Buoys around U.S.





Wave buoy display. Buoys update every 30 minutes 3 CDIP buoys near ports of Los Angeles and Long Beach.



- Old Wave Watch III model under-predicts (red)
- New Nearshore Wave Prediction System (NWPS) launched 1 Jan 2017 much better (green)
- Actual buoy motion is blue

Note reflection off breakwater and difference in wave direction in this small area. Need for 3 buoys validated.

Wave Models and Prediction Systems

- Nearshore Wave Prediction System (NWPS)
 - NOAA National Climate Prediction Centers (NCEP) developed the NWPS model for the San Pedro Bight.
 - Used for planning 2-72 hours in advance of arrival.
- CDIP wave model used within
 2 hours of arrival to assist with final "go/no go" decision.







Bottom Survey by NOAA Ship FAIRWEATHER Fall 2013 Resurveyed by NOAA Ship RAINIER Aug-Sep 2018 Precision navigation requires precise charts and accurate depths

S-L318-RA-18

Approaches to Los Angeles and Long Beach, California *Rainier* coverage as of 22 September 2018



AND ATMOSPH

NOAA

NATIONAL



Operational Process: 2 inputs from each tanker

#1: Data Sheet

Version 20171025

PROTIDE ARRIVAL/DEPARTURE CONDITIONS DATA SHEET Port of Long Beach

Good day Captain

Vessels with a draft greater than 16.7m are required to provide stability information prior to transiting within the POLB.

The following condition values should be submitted for:

 Arrivals:
 Please provide values for your vessel at the arrival to the Long Beach Pilot Station.

 Departures:
 If you vessel's draft will remain greater than 16.7m, please provide values for your vessel at departure from berth or anchorage.

Provide as accurate information as possible as well as a snapshot of the stability program results from the loading computer showing these values.

Ship Details

IMO number:	9271432		
Ship name:	Alaskan Lengend		
Call sign:	WDD2074		
Ship type:	Double Hull Tanker		
Length overall (m):	286.85		
Length between perpendiculars (m):	274.00		
Beam (m):	50.00		
Maximum design dead weight:	193,049.00		
Draft forward (m):	18.47		
Draft middle (m):	18.71		
Draft aft (m):	18.47		

Optional Details

Maximum design draft (m):	19.61
Light ship / light displacement:	39,021 MT
Maximum water displacement:	232,069 MT

Load specific data

Water displacement:	218,943 MT		
(Solid transverse) metacentric height (m):	5.038		
Free fluids surface correction, GG' (m):	0.668		
Roll period (s):	16.85		

Optional load specific parameters

<u> </u>	
Current deadweight (t):	179,922 MT
Center of gravity cargo / KG cargo (m):	15.60
Distance keel to bridge (m):	44.3
Distance aft perpendicular to bridge (m):	56.0

Have you provided a stability snapshot?

Once completed, click 'Submit by Email' below, then attach stability snapshot to the generated email and send to: Protide@mxsocal.org

Submit by Email



#2: <u>Snapshot of Stability Program</u> Results from Loading Computer

Alaska Tanker Co. -- ALASKAN LEGEND (17 Sep 2015) CargoMax 2.1.0280 (14 Sep 2015) Printed at: 12:02 on 09 Oct 2018 Trim and Stability Summary



Loading					
Displacement	218,943	MT	Specific Gravity	1.0250	
Deadweight	179,922	MT			
Avail Deadweight	13,126	MT	190K DWT		
Stability			Trim		
KMt	20.639	m	LCF Draft	18.588	m
VCG (Upright)	15.601	m	LCF	131.905	m-AP
GMt (Solid)	5.038	m	LCB	140.406	m-AP
FS Correction	0.668	m	LCG	140.390	m-AP
GMt (Corrected)	4.370	m	TP1cm	128.2	MT/cm
GMt Required	3.644	m	MT1cm	2,531	m-MT/cm

Validating PROTIDES and the predicted ship motion

- Using Amarcon's "OCTOPUS" system
- Extremely accurate motion sensor:
 - Brought on board by the pilots
 - Placed in exactly the correct location
 - Motion measurements recorded by laptop







Resulting UKC:

Under keel clearance curve diagram

Resulting Under Keel Clearance Predictions Static: About 3.5 meters Dynamic: 2.1 to 2.8 meters







Goals Met:

- 1. Increase Safety
- 2. Increase Efficiency
- 3. Reduce Emissions

OUR SUCCESS IN MEETING THESE GOALS CONTINUES TO BE DEMONSTRATED

As of 17 Oct, 56 tankers with draft greater than 65 feet have safely entered Port of Long Beach

11 at 66' 12 at 67' 12 at 68' 11 at 69' -

= 155 additional draft feet
= Additional > 4 million BBLs
of cargo!!

Bunga Kasturi Empat on first transit at 68 foot draft 15 November 2017 Safer & More Efficient Ship Movements based on precision Science & Technology

- Protide enhances safety
- Jacobsen Pilot Service (Long Beach Pilots) <u>Team Piloting</u> Procedures enhance safety
- Protide reduces or eliminates the number of aborted runs
- If a very deep draft tanker is out of limits, a smaller tanker may still be able to enter.







Ship entering Long Beach with new cranes



Goals of this project are met:

- ✓ Tanker focus
- ✓ Increase safety & efficiency, & reduce emissions

****Future potential applications**:

Unique vessels
Bad weather
Other Ports
Larger Cruise Ships
Larger Container Ships (Pier J Long Beach)

18,000 TEU CMA CGM Benjamin Franklin



Captain Thomas A. Jacobsen President / CEO Jacobsen Pilot Service, Inc. LONG BEACH, CALIFORNIA

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