Presentation to the Virginia Port Authority

Virginia's Offshore Fairways

Captain J. William Cofer
November 27, 2012

- Virginia's water highways
- Hydrodynamics
- Future global shipping fleets
- Atlantic sea lane and off-shore approaches

Global containerized shipping requires "all weather ports."

Virginia/Hampton Roads Navigation Summit

Mission Statement:

Unrestricted navigation for the Port of Hampton Roads

Maintain Norfolk Harbor Channel and Craney Island O&M

UNRESTRICTED NAVIGATION FOR THE PORT OF HAMPTON ROADS

"WIDER DEEPER SAFER"

MAERSK LINE

AURORA EMERALD

HUAL
HUAL

Carnival Destiny

69
E

Hydrodynamics

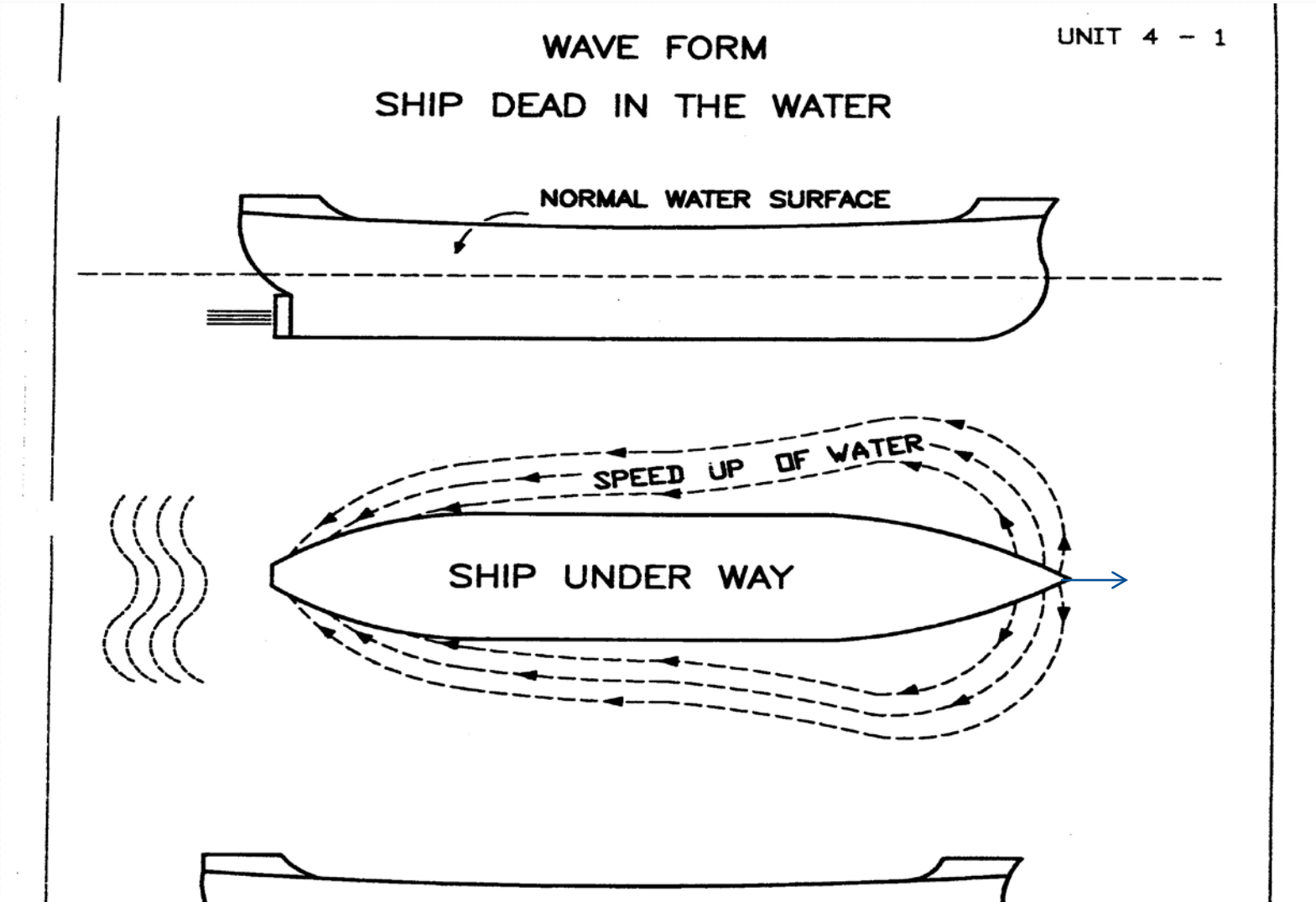
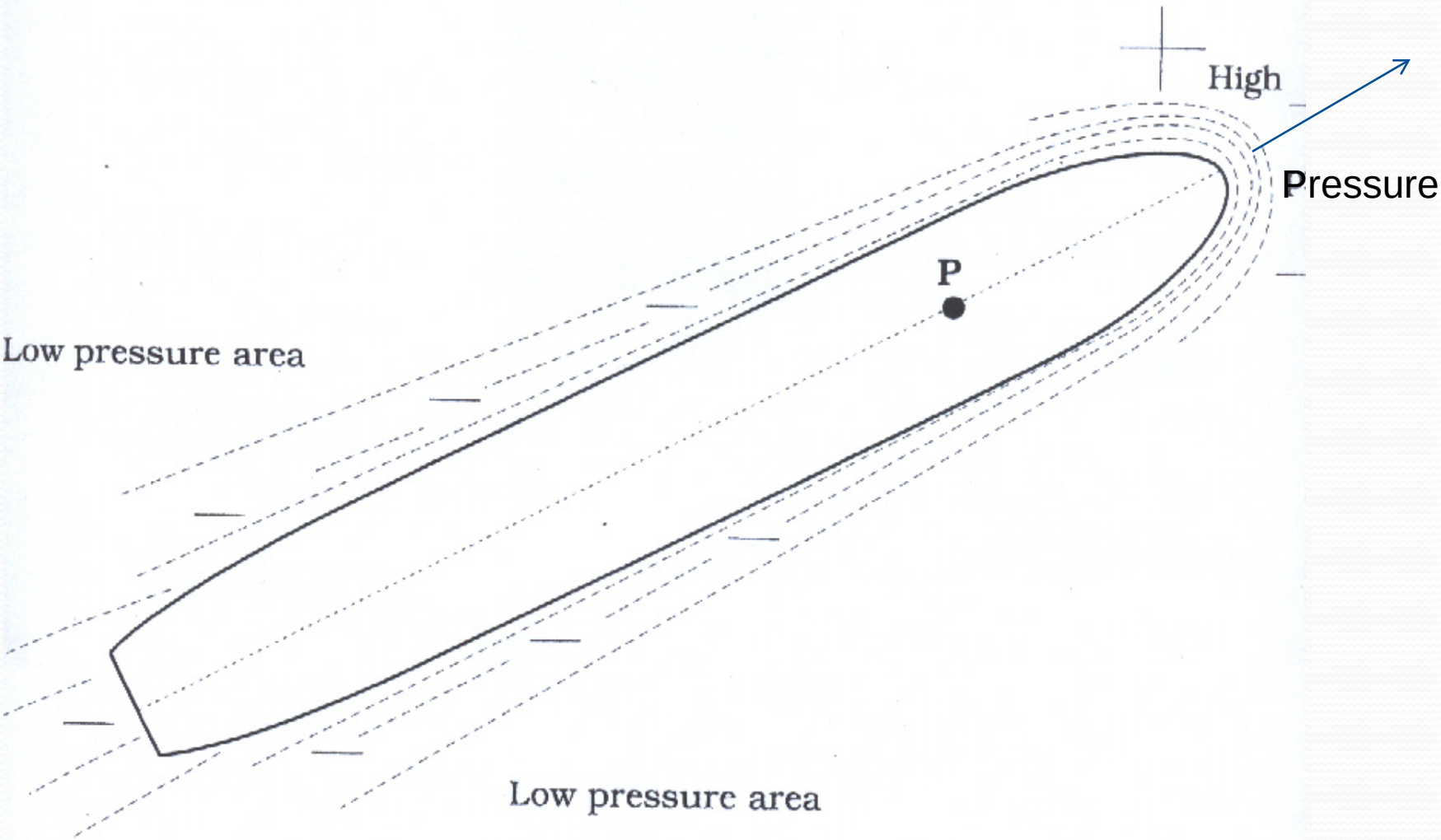
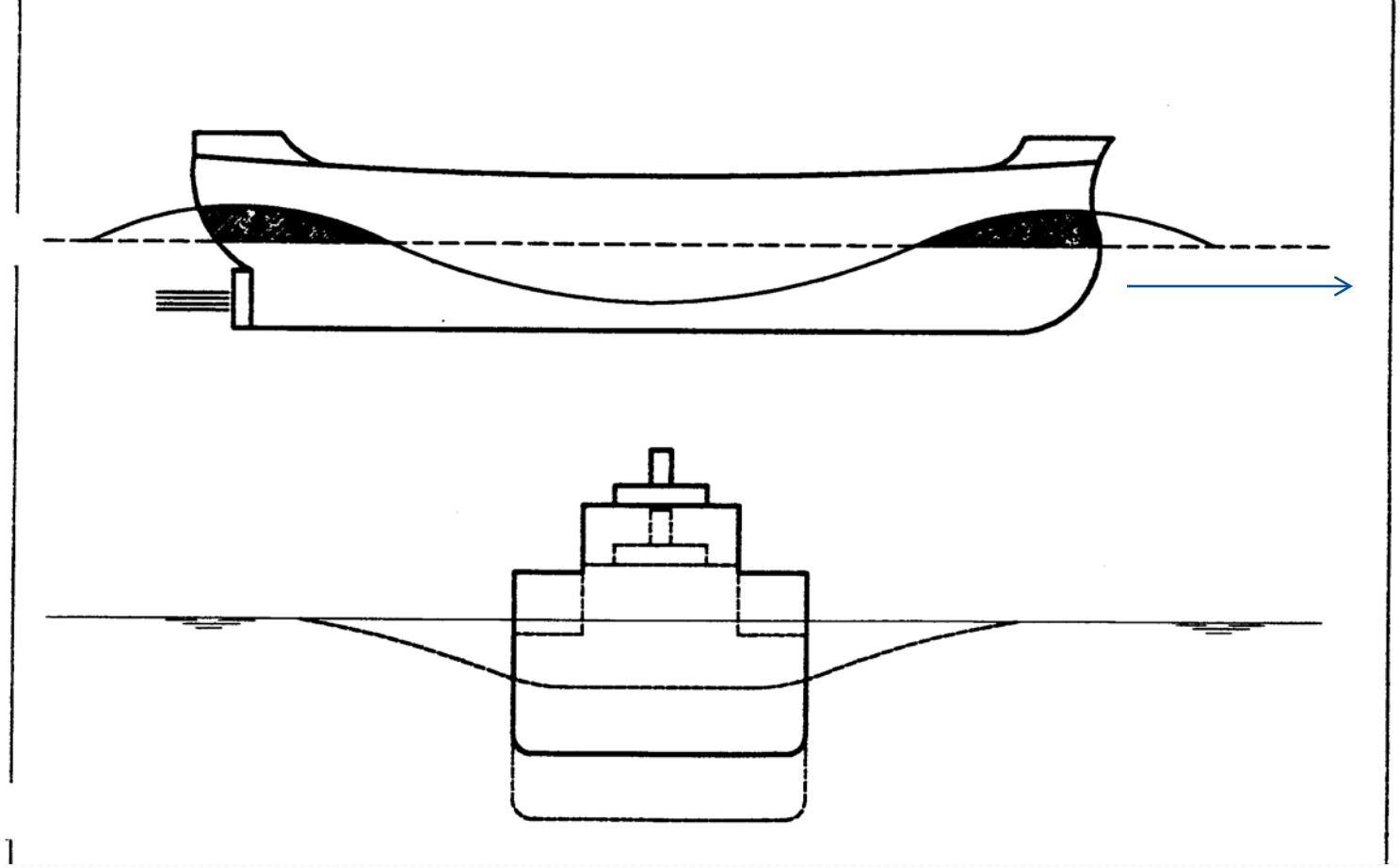


Fig. 24 Pressure Zones



HUAL ASIA

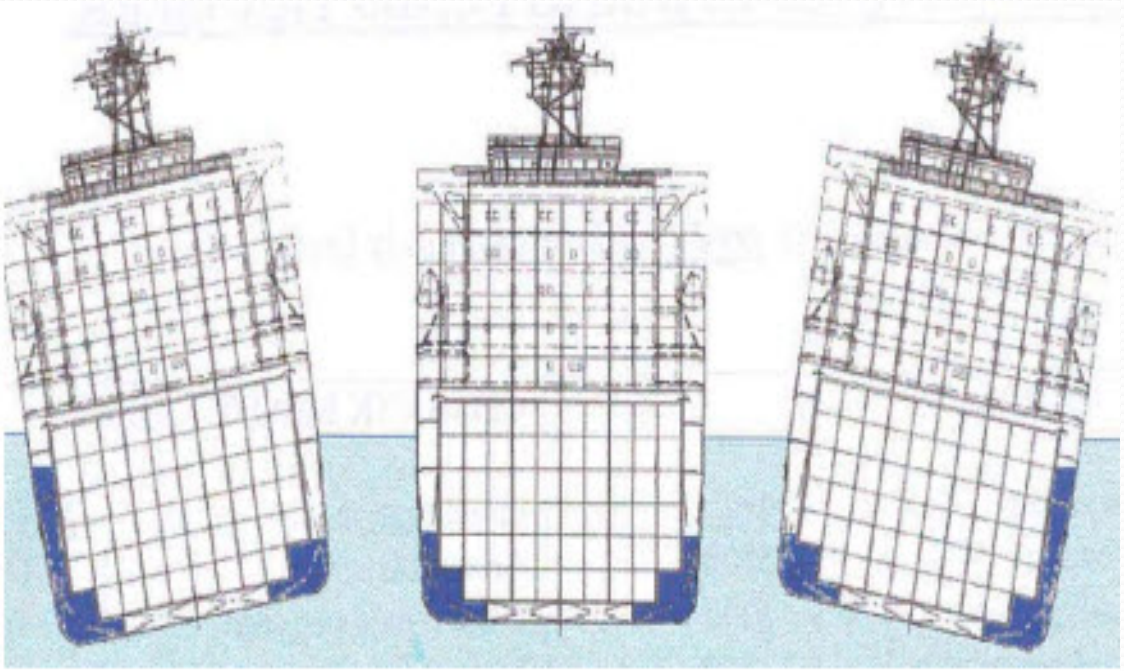


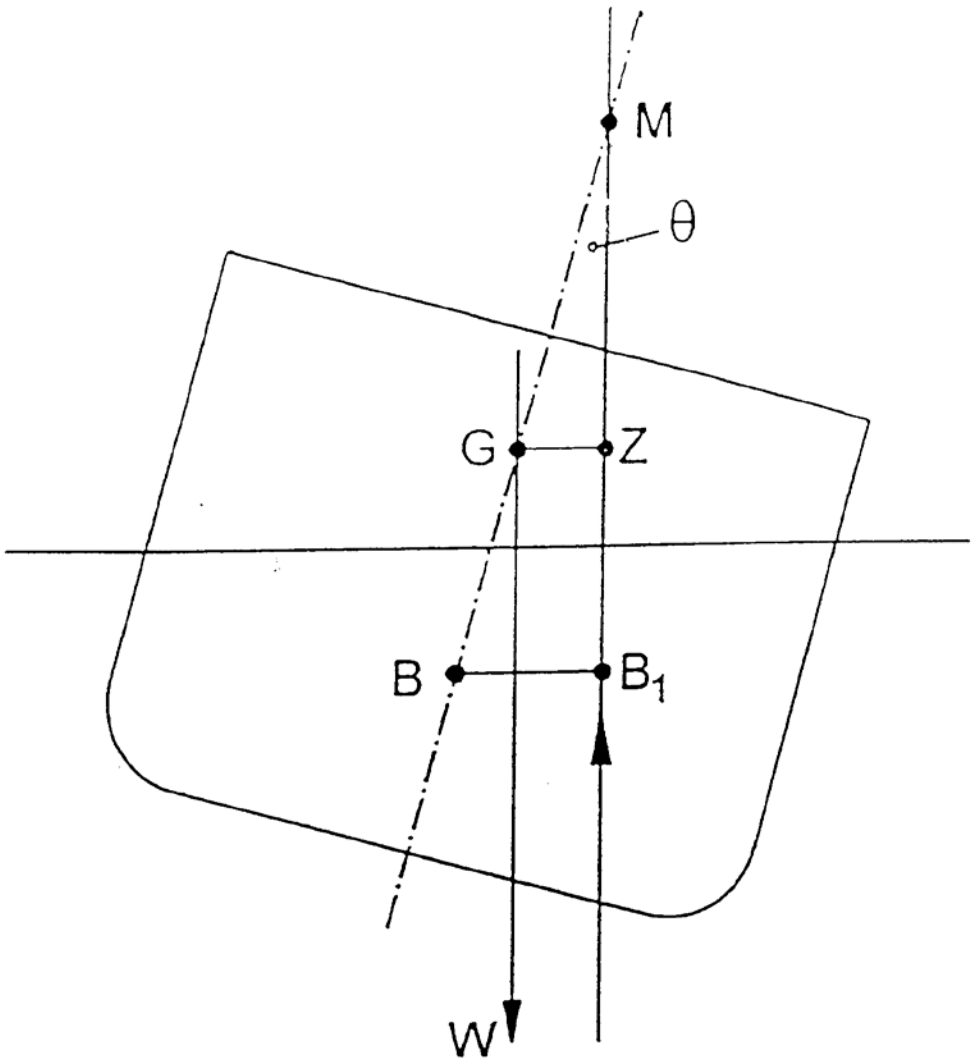
Squat and sinkage

The **SQUAT TABLE** below is from the ***MSC TOMOKO***

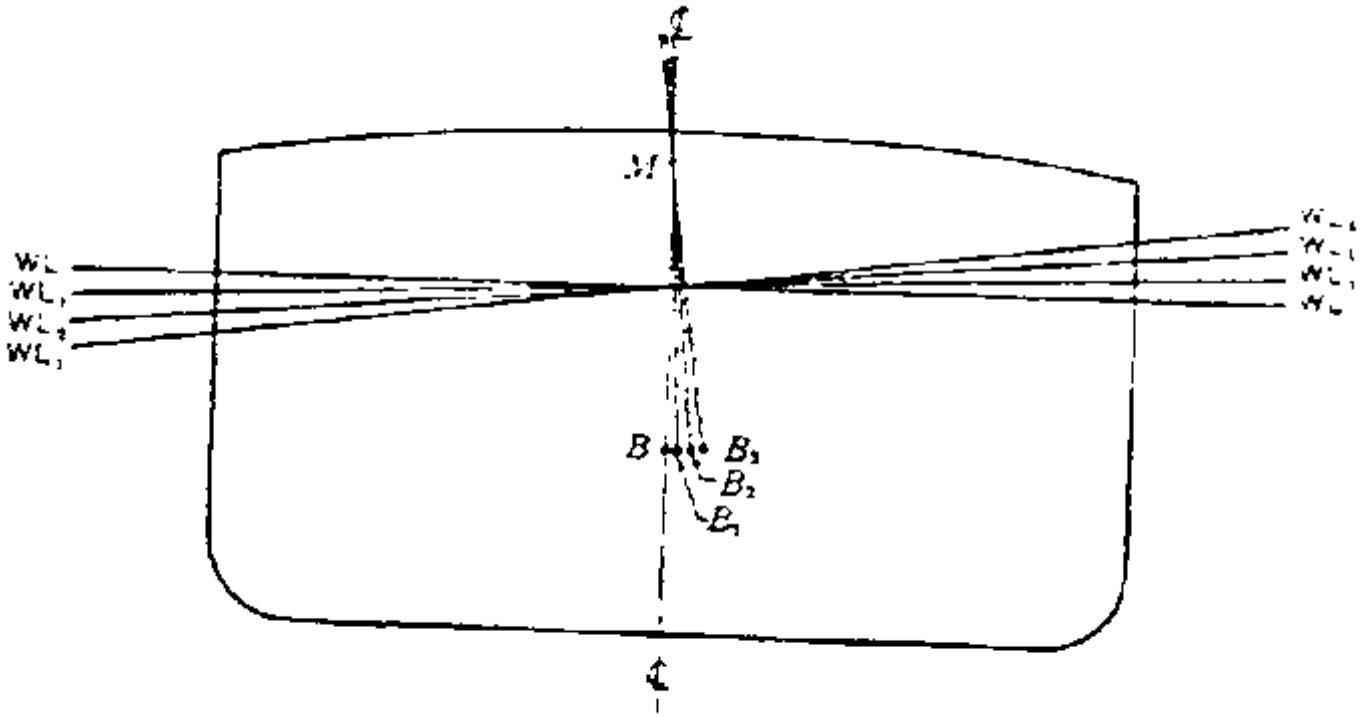
SPEED (knots)	6.4	9.2	12.5	15.3	17.5
DRAFT	**SQUAT (Increase in Draft)**				
32’10”	10”	1’9”	3’3”	4’10”	6’4”
36’1”	10”	1’10”	3’4”	4’11”	6’6”
39’4”	11”	1’10”	3’5”	5’1”	6’7”
42’8”	11”	1’10”	3’5”	5’2”	6’2”
45’11”	11”	1’11”	3’6”	5’3”	6’10”
49’4”	11”	1’11”	3’7”	5’4”	7’0”

Stability




M
θ
G
Z
B
B1
W

COAL PIER 6
ABEROUS


M
WL
WL₁
WL₂
WL₃
B
B₃
B₂
B₁

Bulk ship: low center of gravity

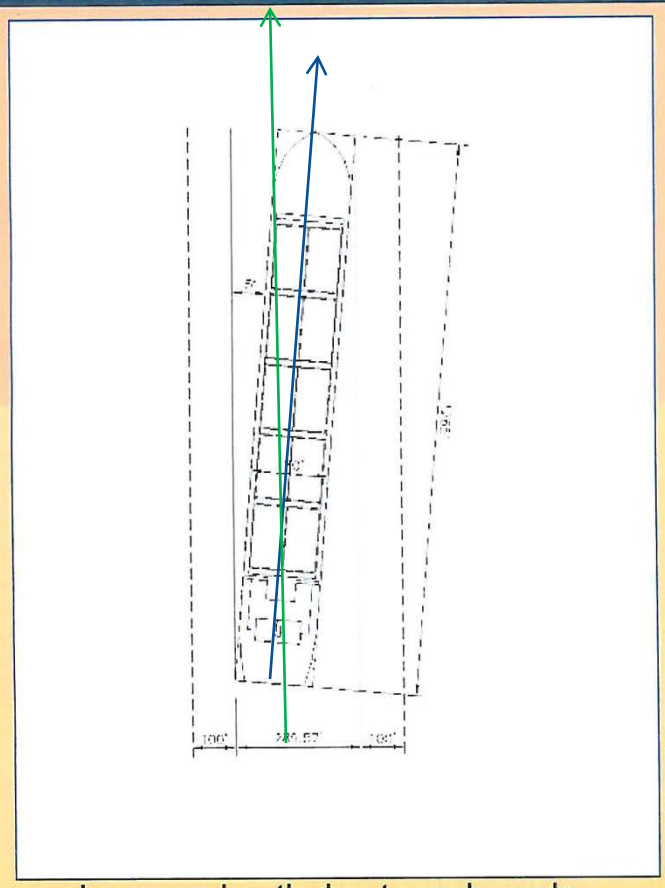
High center of gravity

Heel/roll/list

BEAM	LIST 1.0°	LIST 2.0°	LIST 3.0°
106	.93	1.85	2.77
120	1.05	2.09	3.14
140	1.22	2.44	3.66
150	1.31	2.62	3.93

Impacts of wind upon navigation

Actual vs. "Effective" width



Increased path due to crab angle

5 degree crab angle: results in a 180' wide ship having a 290' effective width

Wind impact upon base-line course

As a general rule, container ships require a minimum of three feet of under-keel clearance to safely transit confined waterways.

1999 VPA slide depicting a 50’ channel and its corresponding containership maximum draft of 46’, illustrating under-keel clearance requirements.

Increase in DRAFT due to PITCH

IN FEET

LENGTH	PITCH 0.5°	PITCH 1.0°	PITCH 2.0°
900	3.92	7.85	15.70
965	4.21	8.42	16.84
1000	4.36	8.73	17.45
1050	4.58	9.17	18.32
1100	4.79	9.6	19.19

Off-shore coastal fairways and sea lanes require in excess of six feet underkeel clearance

- Formula: (Length or Beam ÷ 2) x Sine of Angle
- Assume tipping center is at mid-point

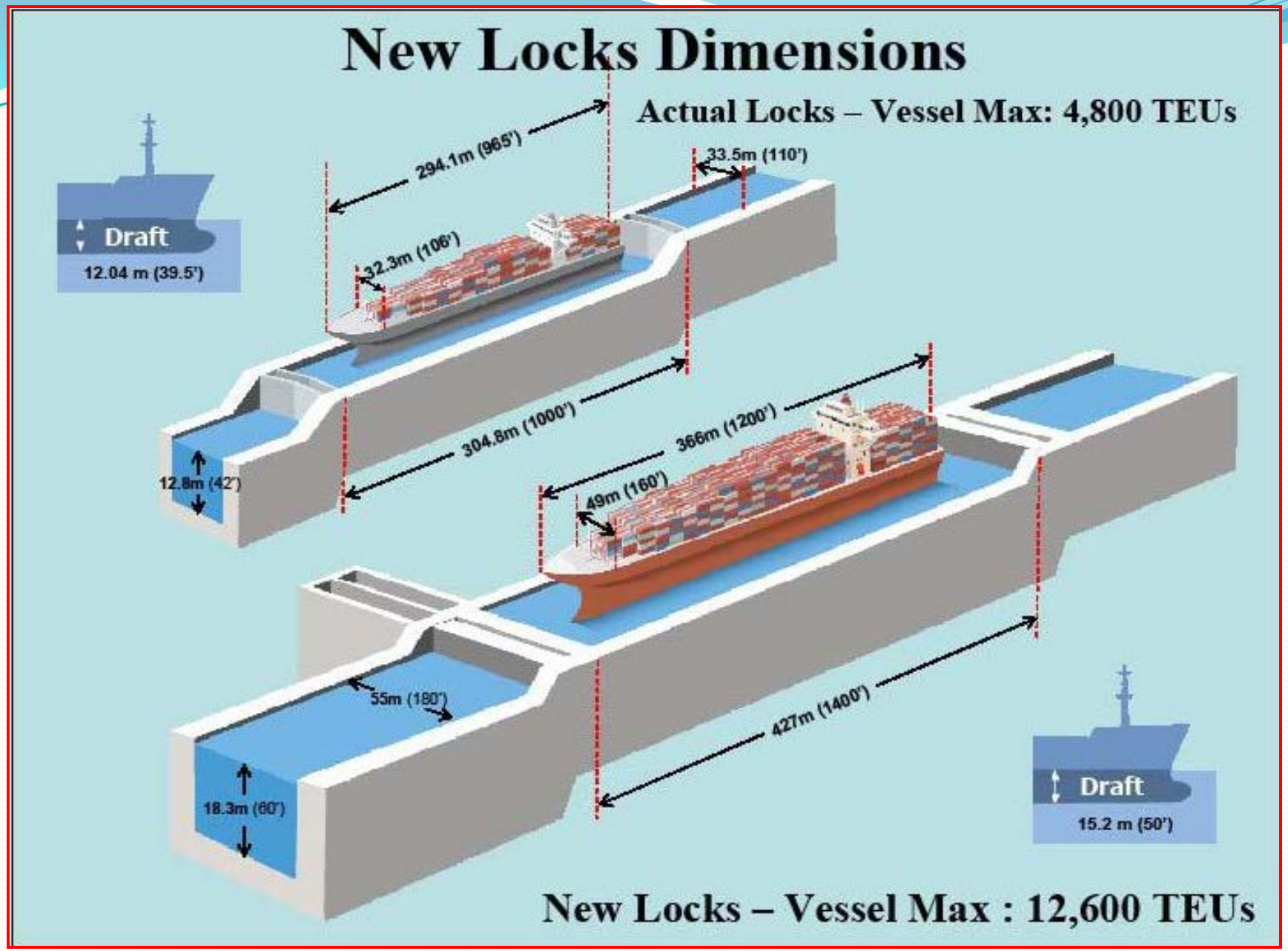
Virginia Containership Drafts

(50 foot channel depth)

47’ anytime movements
49’03” (15 meter) on tide

Deepest on the east coast of the United States

New Panamax…New Paradigm

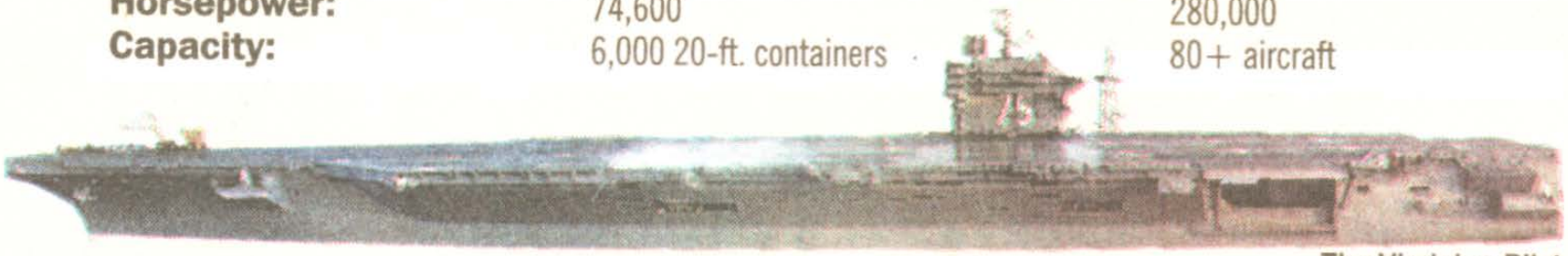


UNRESTRICTED NAVIGATION FOR THE PORT OF HAMPTON ROADS

"WIDER DEEPER SAFER"

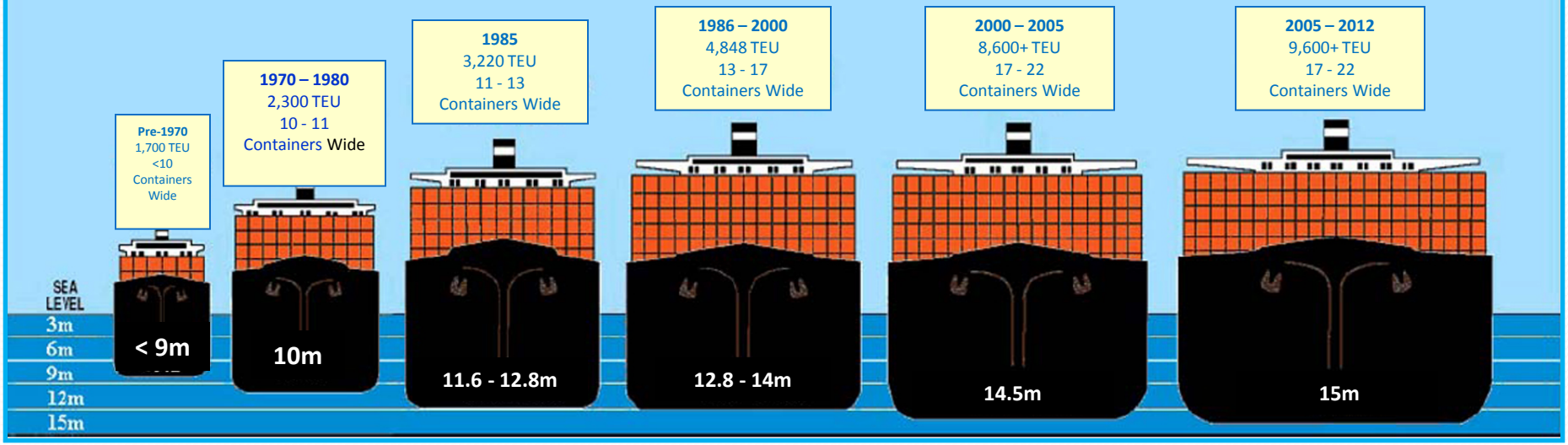
TWO GIANTS COMPARED

	▲ REGINA MAERSK	HARRY S. TRUMAN ▼
Length:	1,043 ft.	1,096 ft.
Beam:	137 ft.	134 ft.
Speed:	25 knots	30+ knots
Crew:	15	5,680
Power plant:	Diesel	Nuclear
Horsepower:	74,600	280,000
Capacity:	6,000 20-ft. containers	80+ aircraft

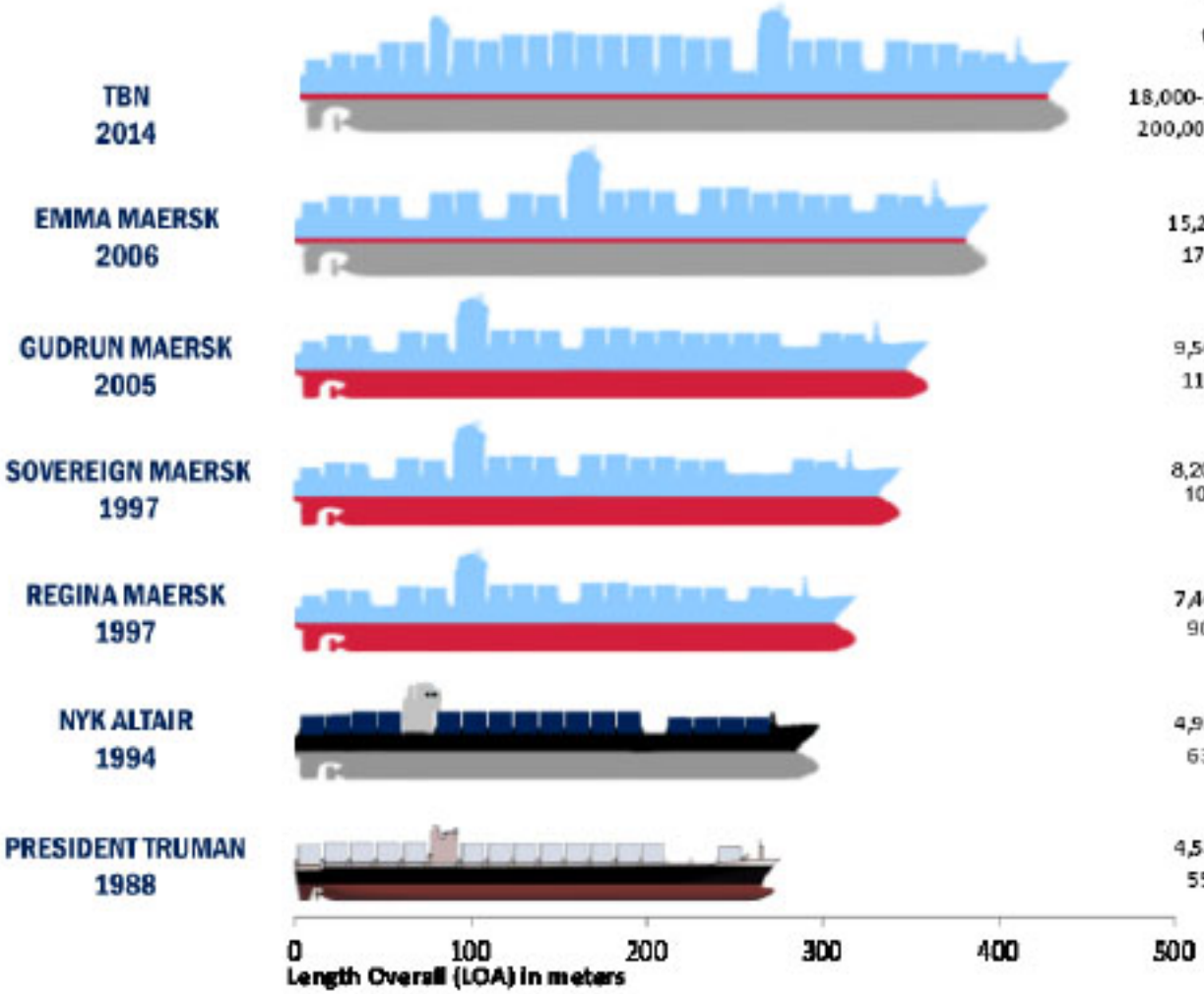


The Virginian-Pilot

Evolution of Container Ships



Evolution of the world's largest containerships 1985-2011

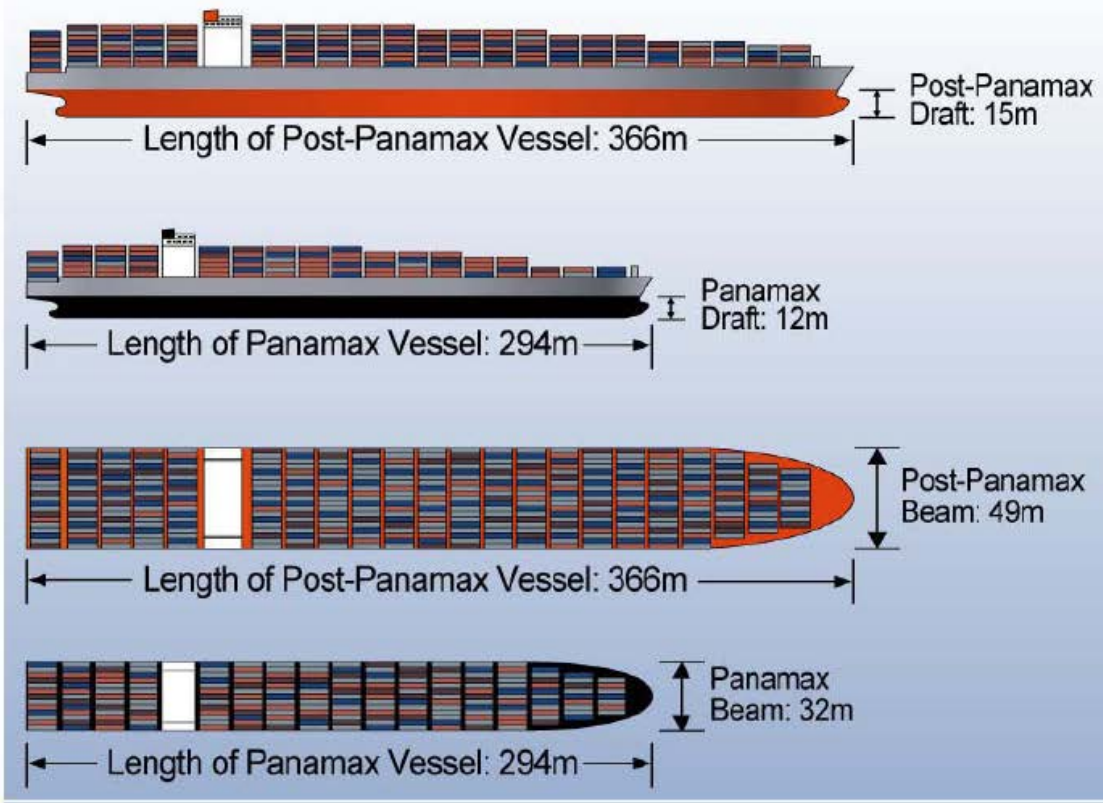


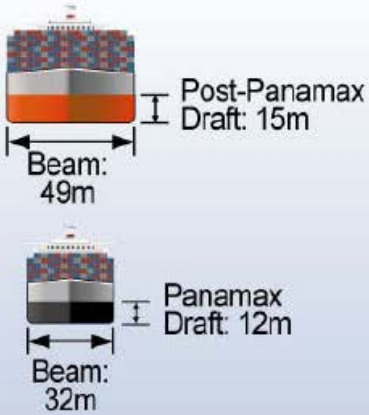
	TEU tdw	LOA m	Breath m	Draft m
TBN 2014	18,000-20,200 TEU 200,000-220,000	440	59.0	16.5
EMMA MAERSK 2006	15,200 TEU 175,000	397	56.4	16.0
GUDRUN MAERSK 2005	9,500 TEU 115,700	367	42.8	15.0
SOVEREIGN MAERSK 1997	8,200 TEU 106,000	347	42.8	15.0
REGINA MAERSK 1997	7,403 TEU 90,500	318	42.8	14.5
NYK ALTAIR 1994	4,953 TEU 63,000	300	37.1	13.0
PRESIDENT TRUMAN 1988	4,538 TEU 55,500	275	39.4	12.5

Source: Alphaliner

“New Panamax…..New Paradigm”

Comparison between Panamax and Post-Panamax Container Vessels





	Panamax	Post-Panamax
Capacity:		
Containers(TEUs)	4,500	12,000
Dimensions:		
Beam	32m (106’)	49m (160’)
Length	294m (965’)	366m (1,200’)
Draft	12m (39.5’)	15m (50’)

MSC Daniela class ULCV

13,500 teu

- LOA: 366 M - 1205 FT
- BEAM: 51 m - 167 FT
- GRT: 151,559 MT
- DISPLACEMENT: 201,518 MT
- DESIGN DRAFT: 48 FT - DEADWEIGHT 137,606 MT
- VESSEL WINDAGE AT DESIGN DRAFT: 12,000 SQ. M

Maersk EEE

- **Maersk Line Triple-E: The largest, most efficient ship in the world**

18,000 TEU

World class ports utilize world class tug fleets

50 feet isn't enough!

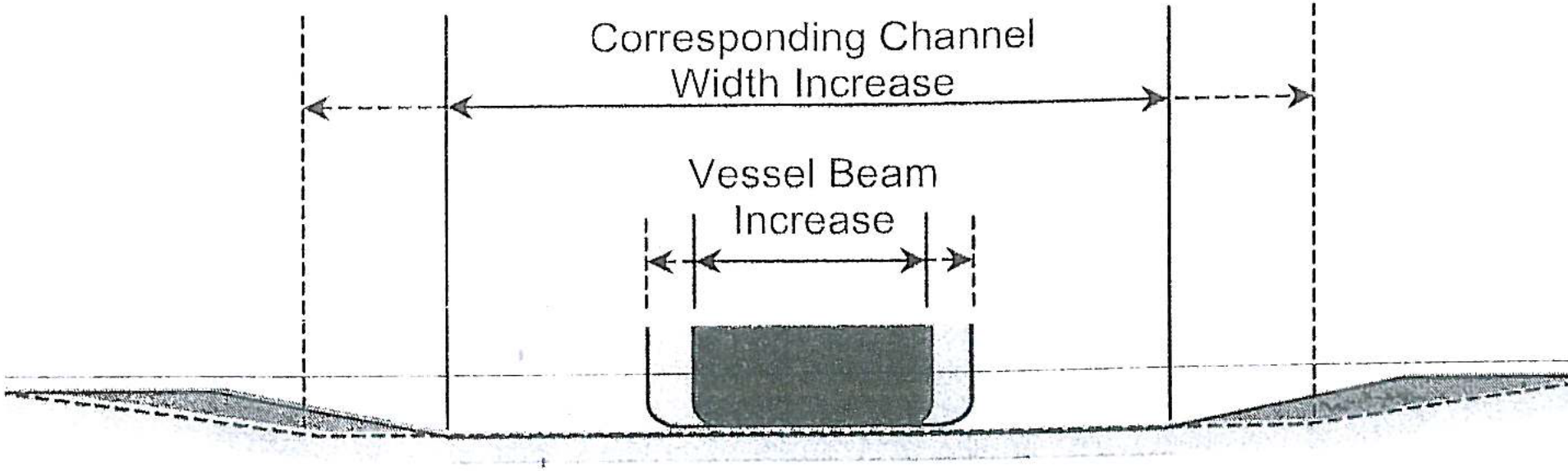
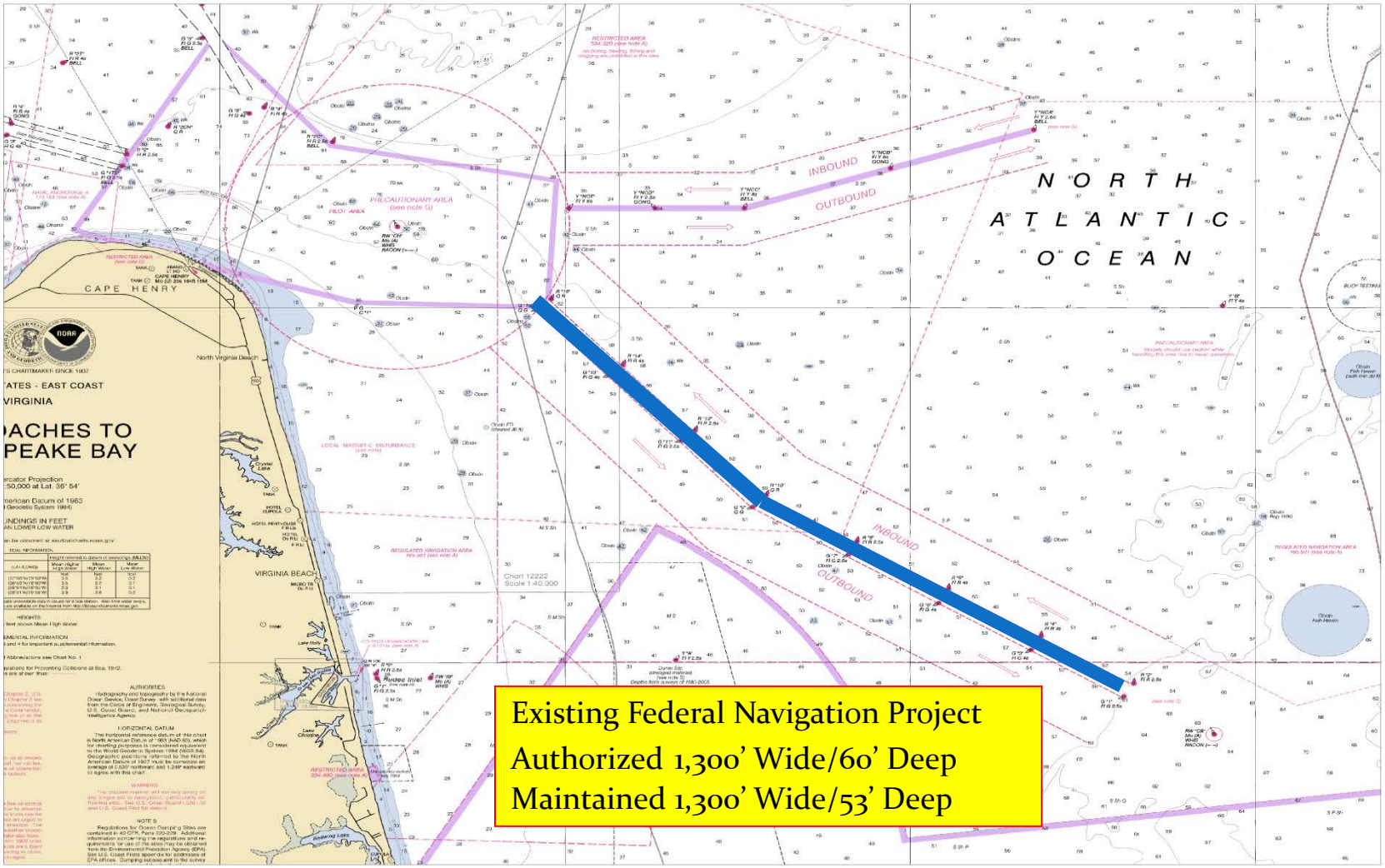
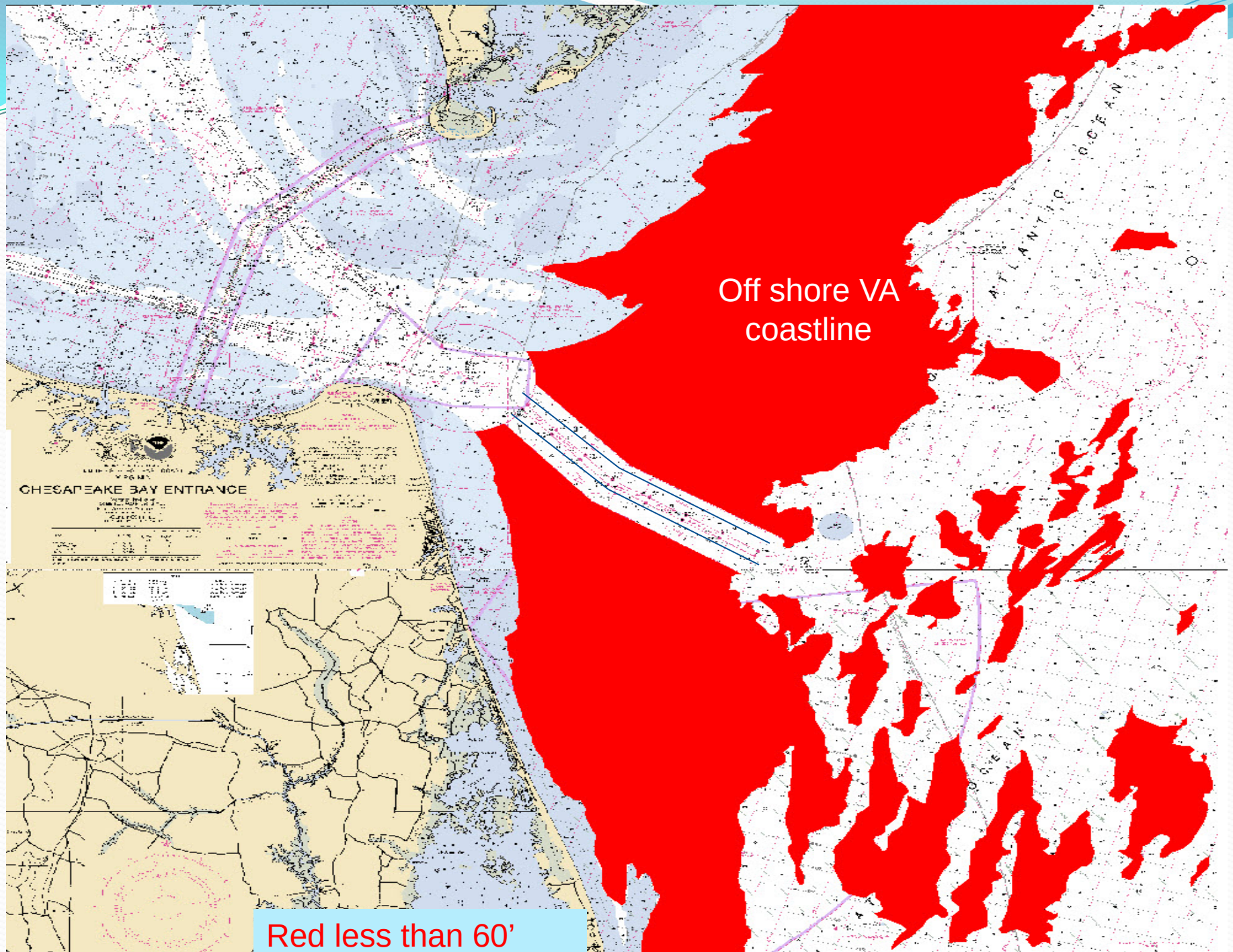


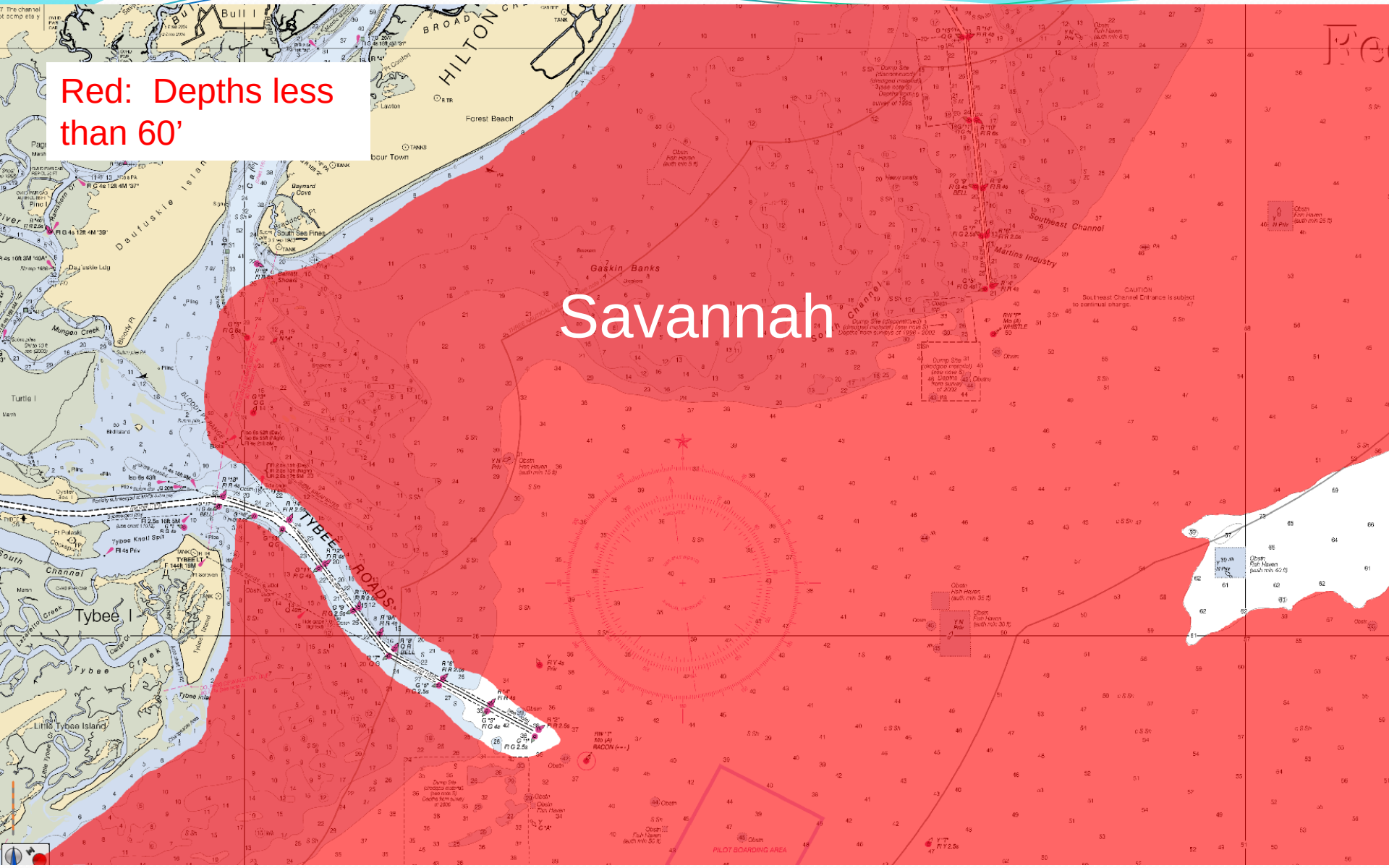
Figure 4: Schematic of vessel in one-way channel illustrating implication of larger vessel beam on corresponding channel design width

The *Port of Virginia* is the only east
coast port authorized to dredge
55 ft channels including
60 ft sea lane approaches

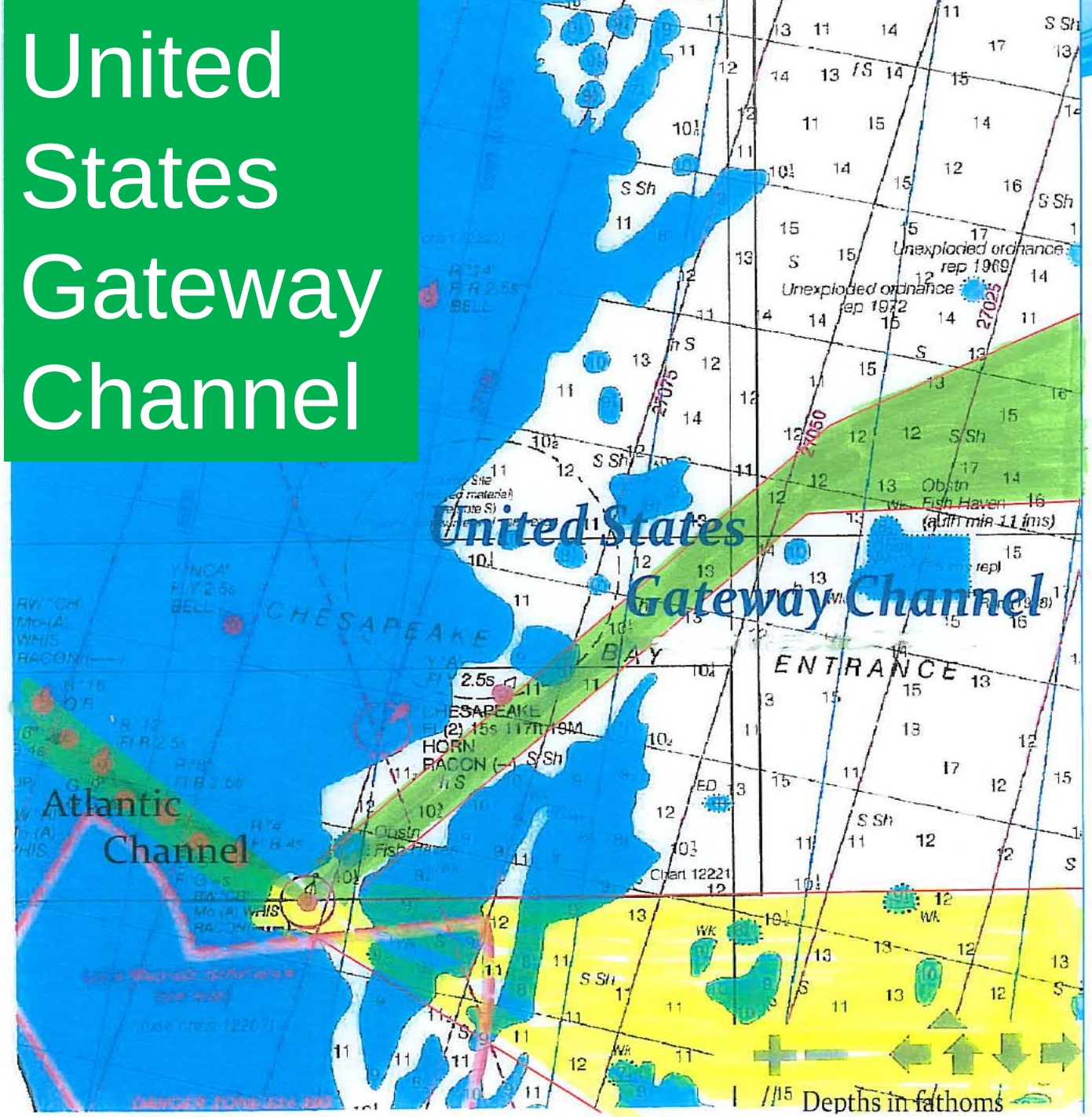
Atlantic Ocean Sea Lane




Off shore VA
coastline
CHESAPEAKE BAY ENTRANCE
ATLANTIC OCEAN
Red less than 60’

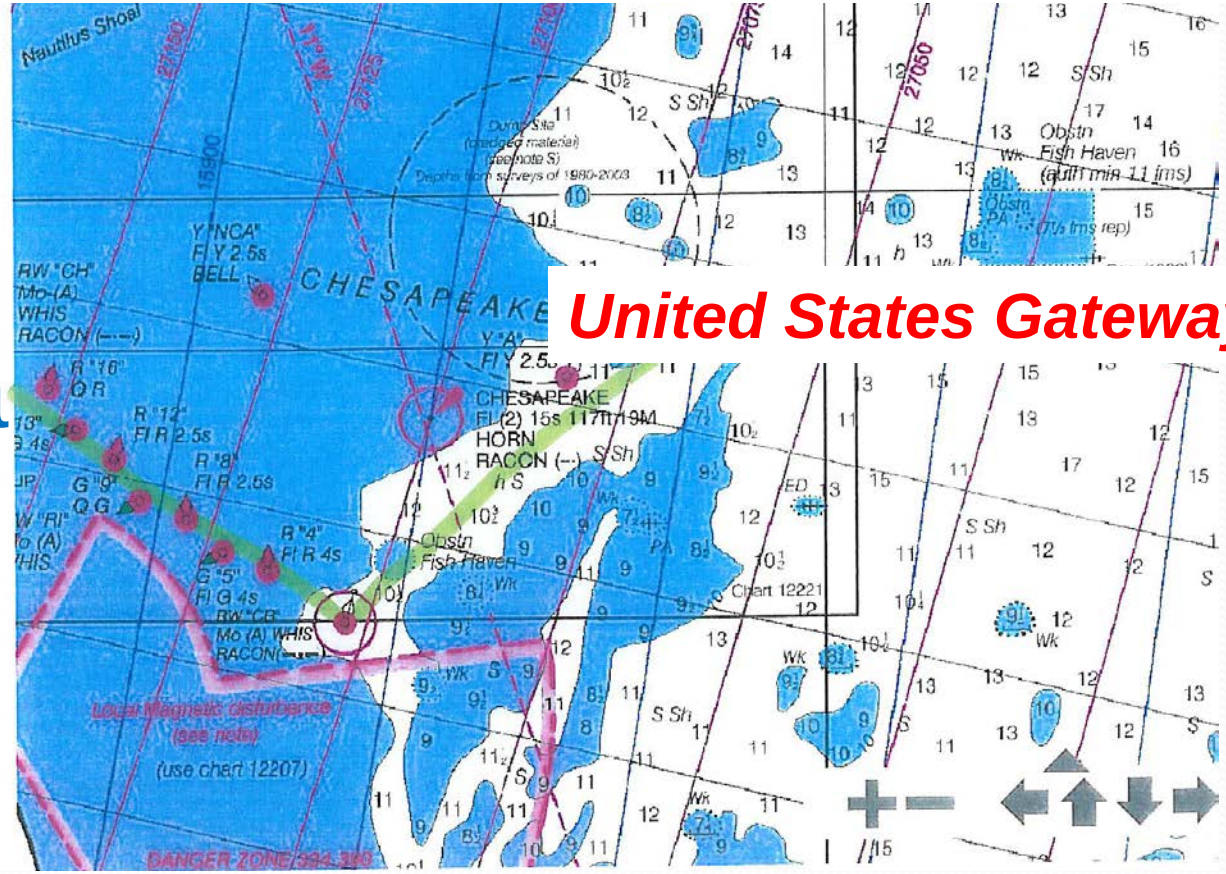

Red: Depths less than 60'
Savannah
Bull I
HILTON
Forest Beach
Daufuskie Island
Gaskin Banks
Southeast Channel
Martins Industry
Turtle I
Tybee I
TYBEE ROADS
Little Tybee Island
PILOT BOARDING AREA

United States Gateway Channel



*Virginia's offshore, deepwater ocean fairways will become known as the "**United States Gateway**"… the only waterway on the east coast of the United States that can accept every size ship in all weather conditions!*

Virginia



United States Gateway Channel

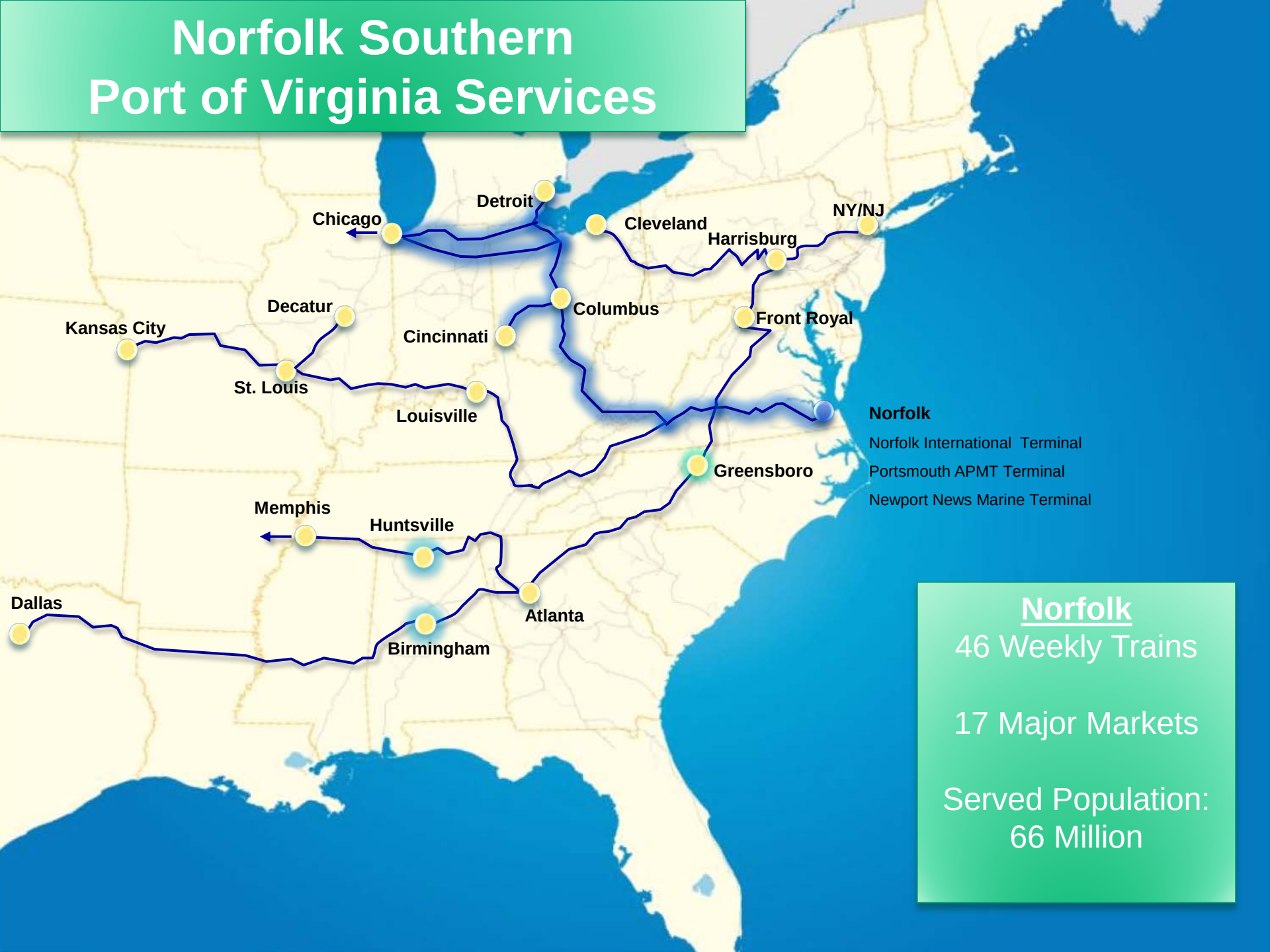
Virginia will be the only east coast port deep enough to service the global shipping fleet of the future.

The Implications of Panama Canal Expansion to U.S. Ports and Coastal Navigation Economic Analysis

Figure 16: Ports Potentially Impacted by Canal's Expansion (based on controlling depths)

Port[1]	Main Channel Depth	Entrance Channel (Approach) Depth
Long Beach	55'	76'
LA Harbor	53'	81'
Norfolk	~~50'~~ 55'	~~55'~~ 60'
Oakland	50'	55'
NY/NJ	50'	53'
Seattle	50'	N/A
Port Everglades, FL	49'	54'
San Juan, PR	46'	66'
Port Freeport, TX	45'	47'
Houston	45'	45'
Mobile Bay	45'	47'
Charleston	45'	47'
Honolulu	45'	50'
Tampa	43'	45'
Portland, OR	43'	48'
Miami[2]	42'	44'

Norfolk Southern
Port of Virginia Services



Norfolk

46 Weekly Trains

17 Major Markets

Served Population:
66 Million

US Army Corps of Engineers Presentation on Impacts of Panama Canal Expansion

October 2012

- **Observation 4: Outlines demand for future capacity**
- As a region, Atlantic ports in the southeast are seeing the most growth
- By 2030, 62% of container ship capacity will be Post-Panamax
- Movement of TEU's through East Coast ports are expected to triple from current 15 million to about 45 million in 2035
- Population and trade growth, coupled with port capacity, have shown the nations most critical *capacity* needs are along the southeast and gulf coasts.
- **Post-Panamax vessels will dominate the East Coast fleet by 2020**

"East coast entry into the United States will run through Virginia"

One port…The Port…..Virginia!

The World is Coming to

Virginia

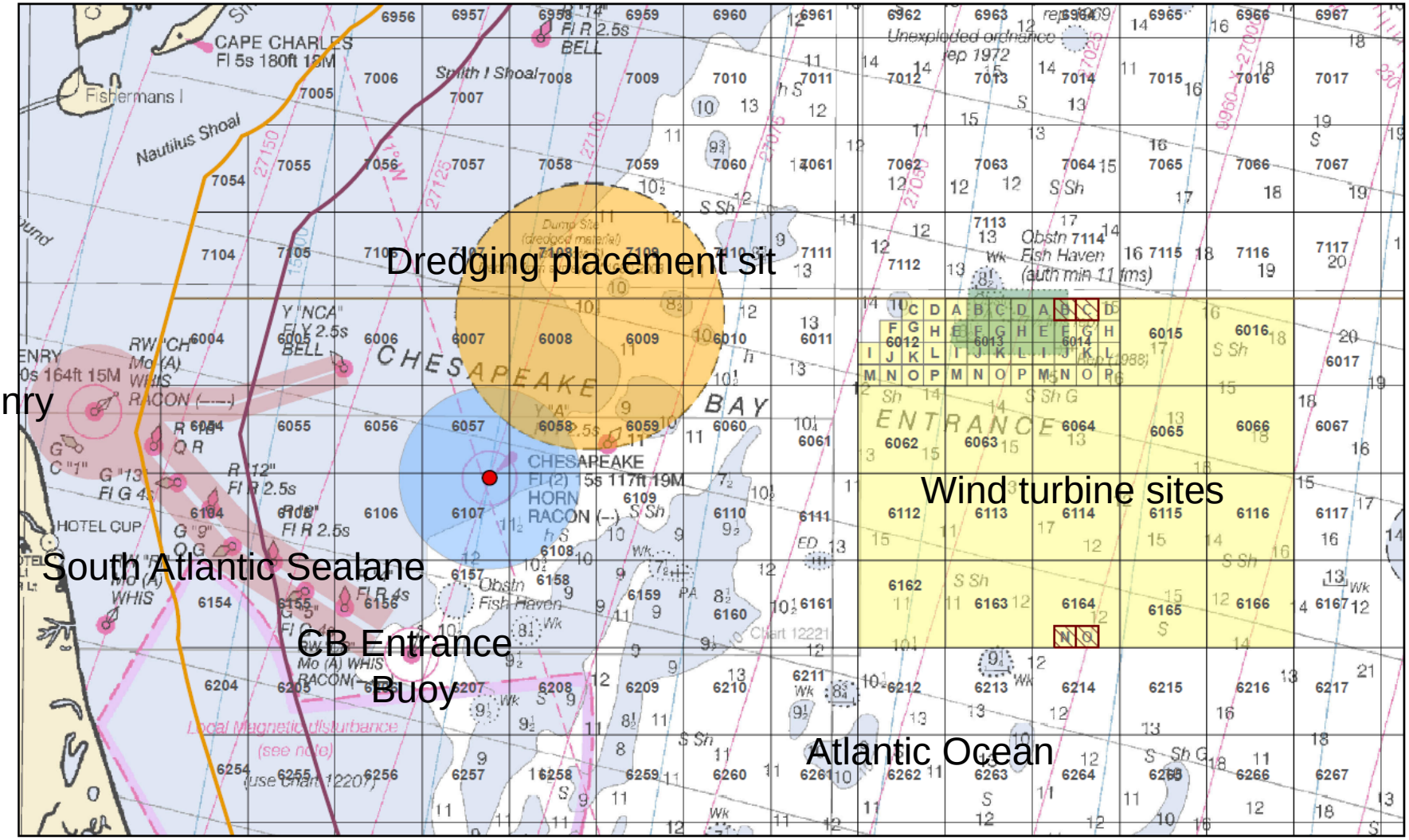
The end

Containership Drafts

Port	Channel depth depth	UKC	Max Depth Containership	
New York	50' when completed	3'outer 2'inner	47-48'	$ 1,634,000,000
Baltimore	50'	3' outer ches 2'inner	47'	
Virginia	50'	3'outer ches 2' inner	47' anytime **49'03 tide**	
Charleston (seeking authorization to 47')	43'	4' outer 2' inner	43' anytime 48' tide	
Savannah	47' when completed (currently 42'tide, 38' anytime)	4' outer 2' inner		$ 652,000,000
Jacksonville	40'-44' differing channel legs	4' outer 2' inner		
Brunswick	36'	4' outer 2' inner		
Miami	41'	2'6"	38'6"	
New authorized depth 50' when completed				$ 180,000,000

PILOT
VIRGINIA

BOEM Virginia Call for Information and Nominations Area



Fed/State Boundary
8g Line
Chesapeake Light House
Chesapeake Lt/Bcn 5km Zone
Fish Haven
Dredge Disposal Area
Traffic Separation Scheme
Proposed Research Sub-blocks
Virginia Call Area
OCS Lease Blocks
Official Protraction Diagram

0 2 4 6 8 10 12 Nautical Miles

0 5 10 15 20 Kilometers

Map ID: PACB-2011-1098

2020 need for channel depths to 55’ and sealanes to 60’

Corps Report on the E class ships being built in shipyards today needing 50’-51’ drafts, resulting in the need of ship channels to 54’-55’ deep and offshore ocean fairways of 60’-70’depths…..

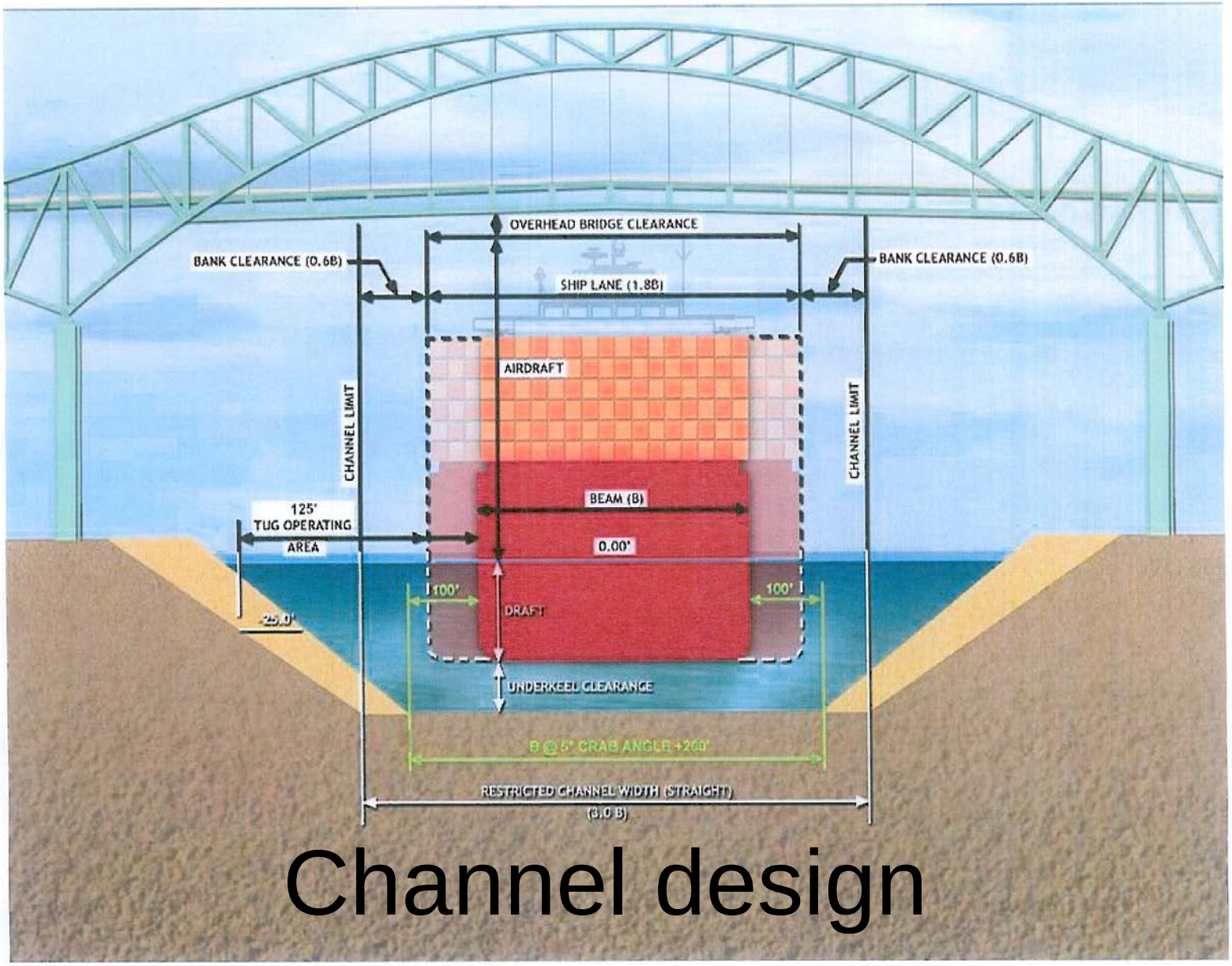
*Only one port on the east coast of the United States can accomplish this requirement……one port….**Virginia**….**The Port!!!!!!***

US Army Corps Report: Ship classes

The shipbuilding industry now categorizes separate classes of Post-Panamax vessels which include K, S, G and E classes. The Emma Mærsk, an E-Class vessel, is presently the world’s largest containership based on twenty-foot equivalent unit (TEU) capacity[4], but she does not stop in the US. In fact, most of the world’s largest containerships are exclusively used in the Far East to Europe pendulum. The third set of locks would accommodate E Class vessels, which contain design drafts of **50-51 feet** (requiring 54-55’ channels).

Classes of Post-Panamax Vessels

Class	TEU	Approx Max Draft
1st generation “K”	~6,000 TEU	47.5’
2nd generation “S”	~6,600 TEU	47.6’
2nd generation “G”	~7,500 TEU	48.0’
3rd generation “E”	~11,000 TEU	51.0’



Channel design

Unrestricted navigation for the Port of Hampton Roads

The Vision *- To meet the present and future needs of the Port of Hampton Roads through the provision of a safe, secure, efficient, and environmentally compatible commercial and military navigation system and related land-based support facilities.*