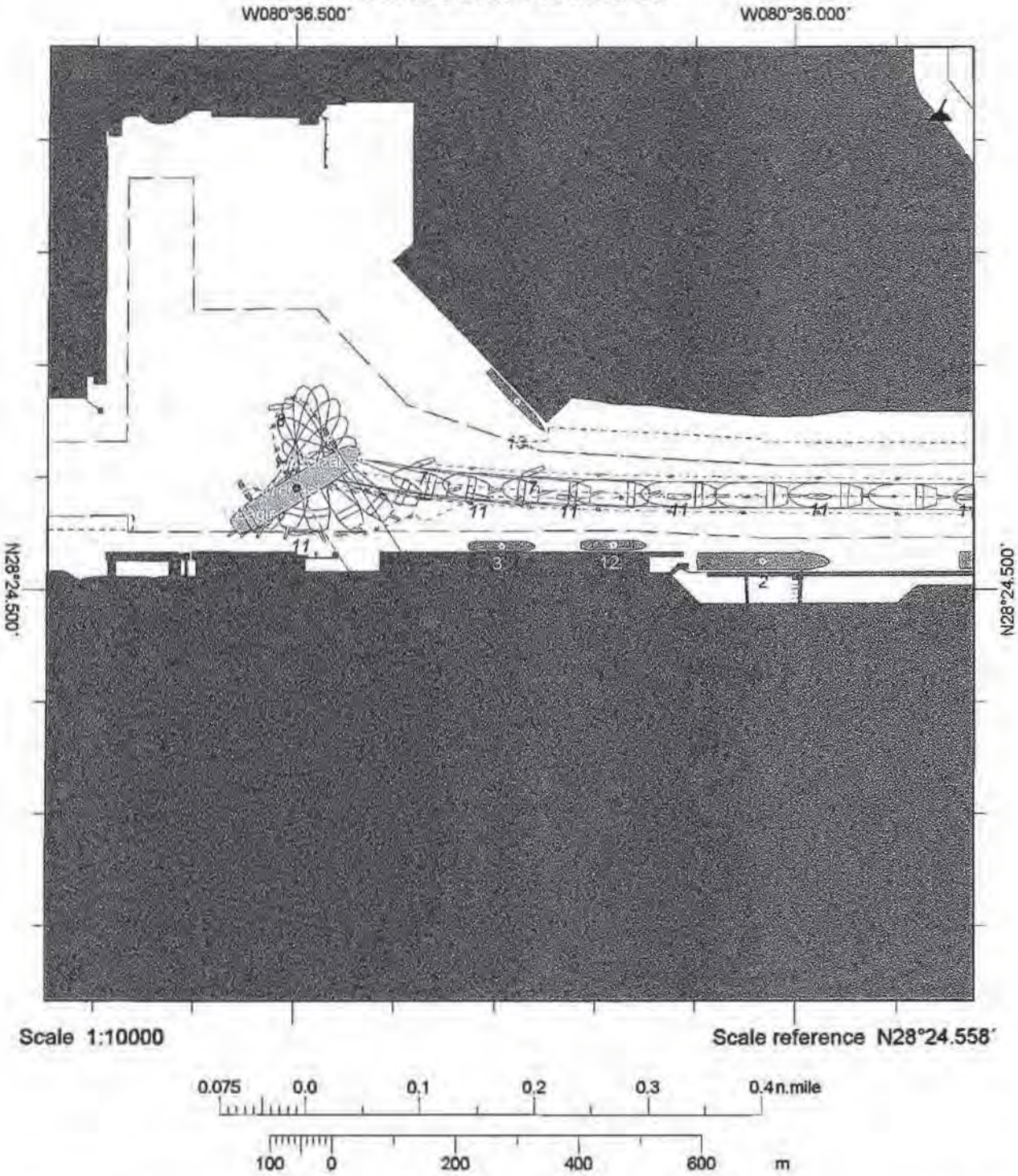
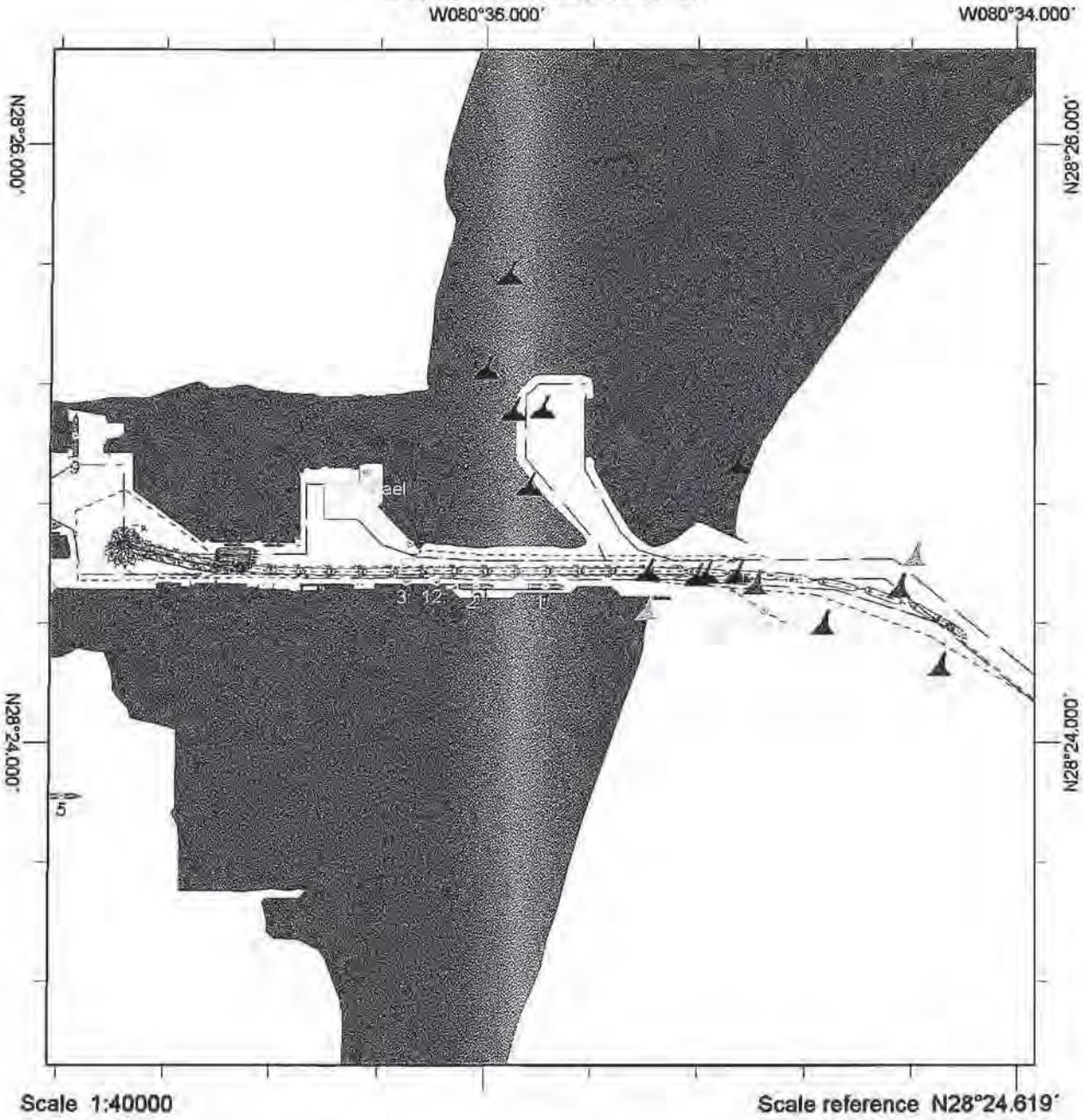
Canaveral Research



Comments: Wind: NW 15K
Current: N 0.3 K

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	60
Shape outline every	01:00

Canaveral Research



Scale 1:40000

Scale reference N28°24.619'

0.25 0.0 0.5 1.0 1.5 n.mile

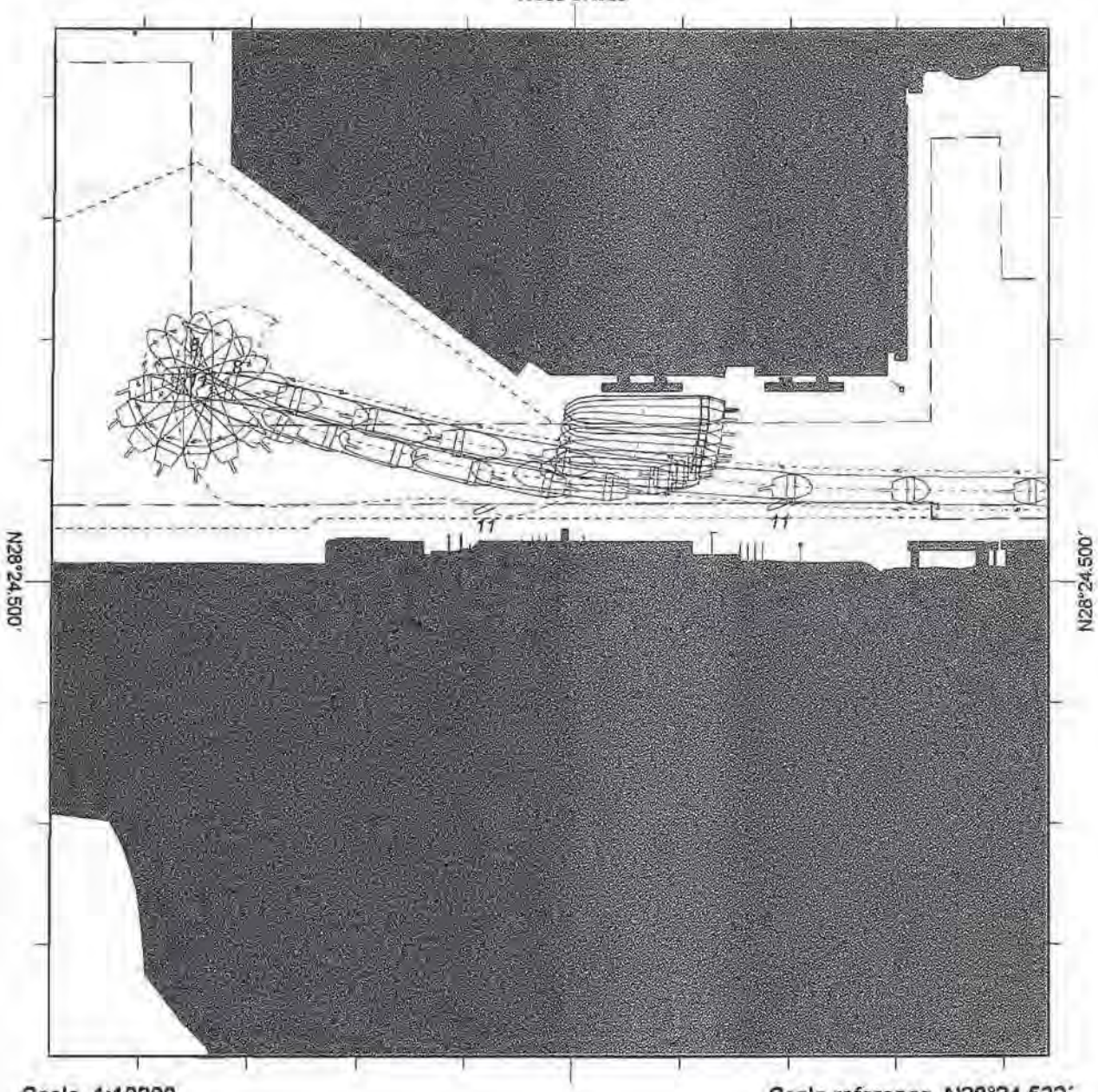
500 0 750 1500 2250 3000 m

Comments: Wind: SE 20-25K
Current: N 0.3 K

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	60
Shape outline every	01:00

Canaveral Research

W080°37.000'



Scale 1:10000

Scale reference N28°24.532'

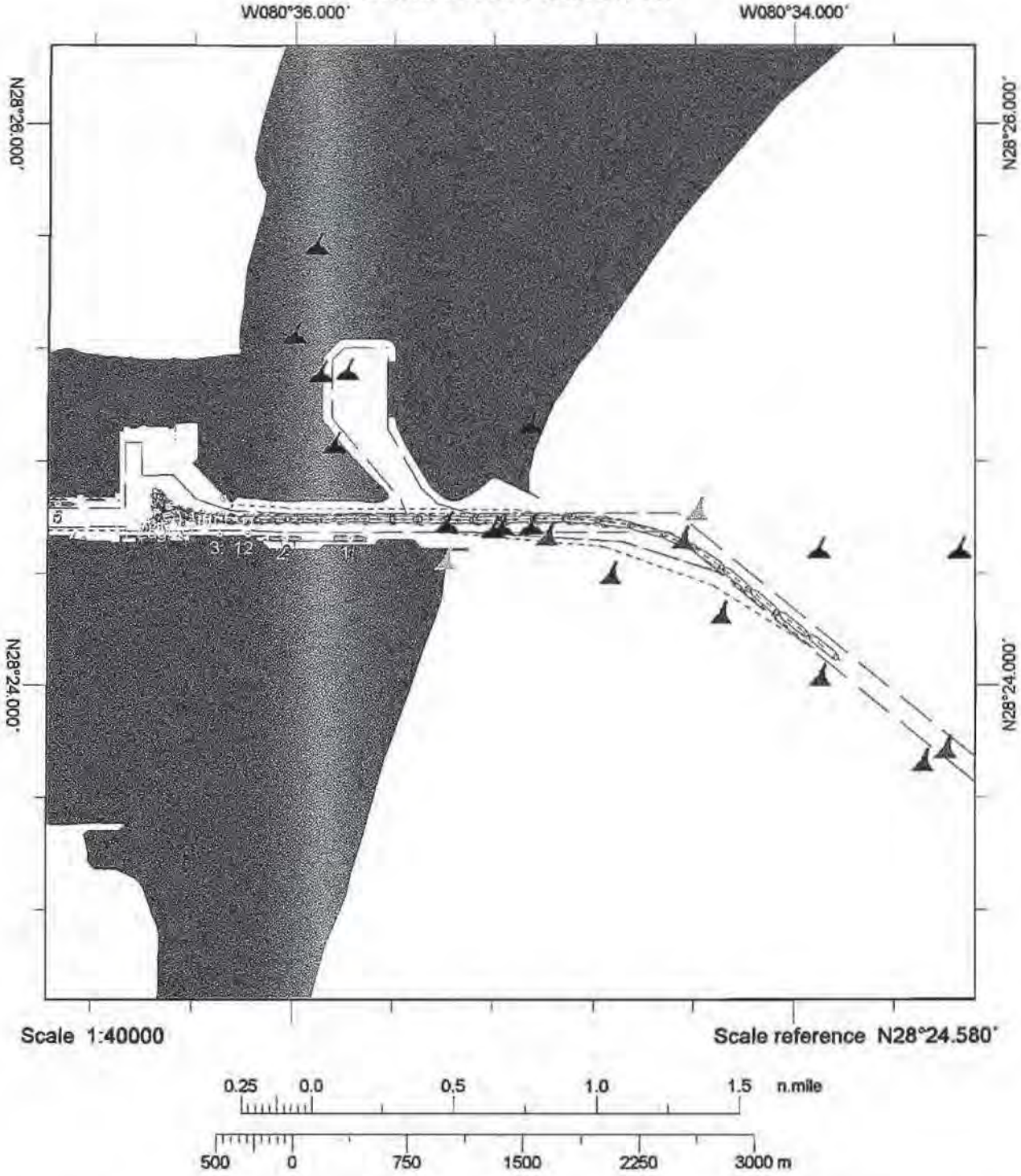
0.075 0.0 0.1 0.2 0.3 0.4 n.mile

100 0 200 400 600 m

Comments: Wind: SE 20-25K
Current: N 0.3 K

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	60
Shape outline every	01:00

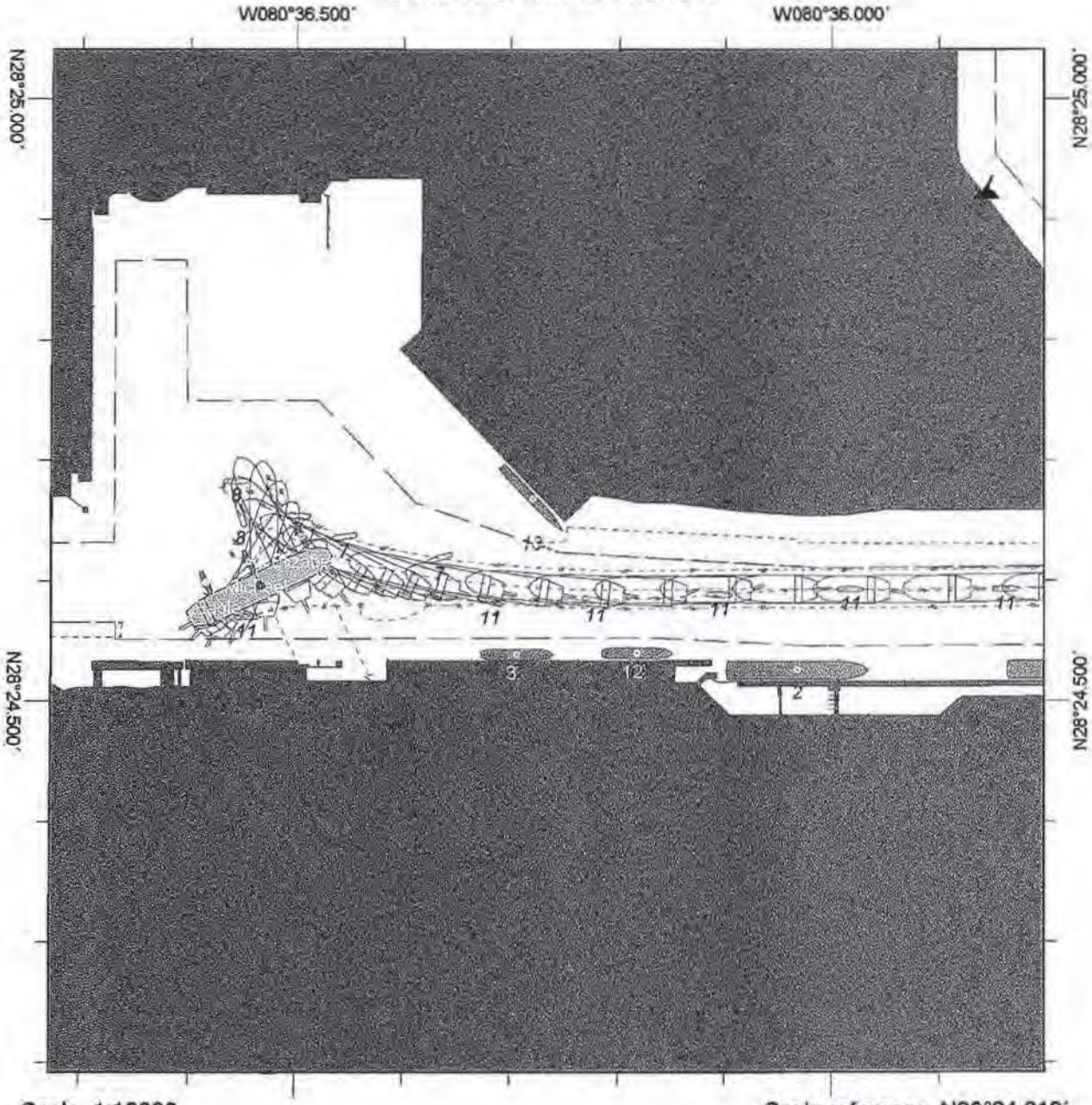
Canaveral Research



Comments: Wind: NW 20-25K
Current: S 0.3 K

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	60
Shape outline every	01:00

Canaveral Research



Scale 1:10000

Scale reference N28°24.616'

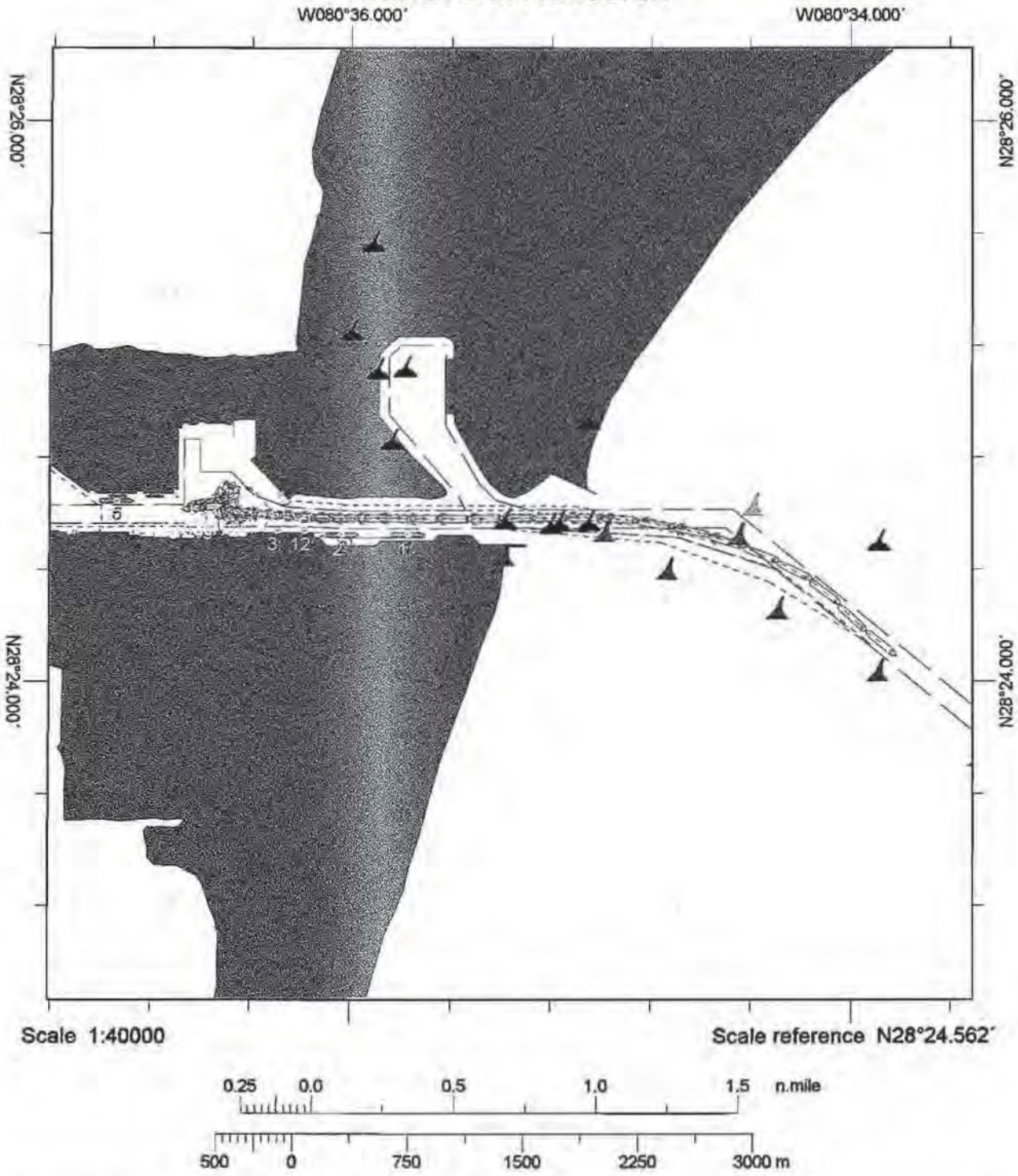
0.075 0.0 0.1 0.2 0.3 0.4 n.mile

100 0 200 400 600 m

Comments: Wind: NW 20-25K
Current: S 0.3 K

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	60
Shape outline every	01:00

Canaveral Research

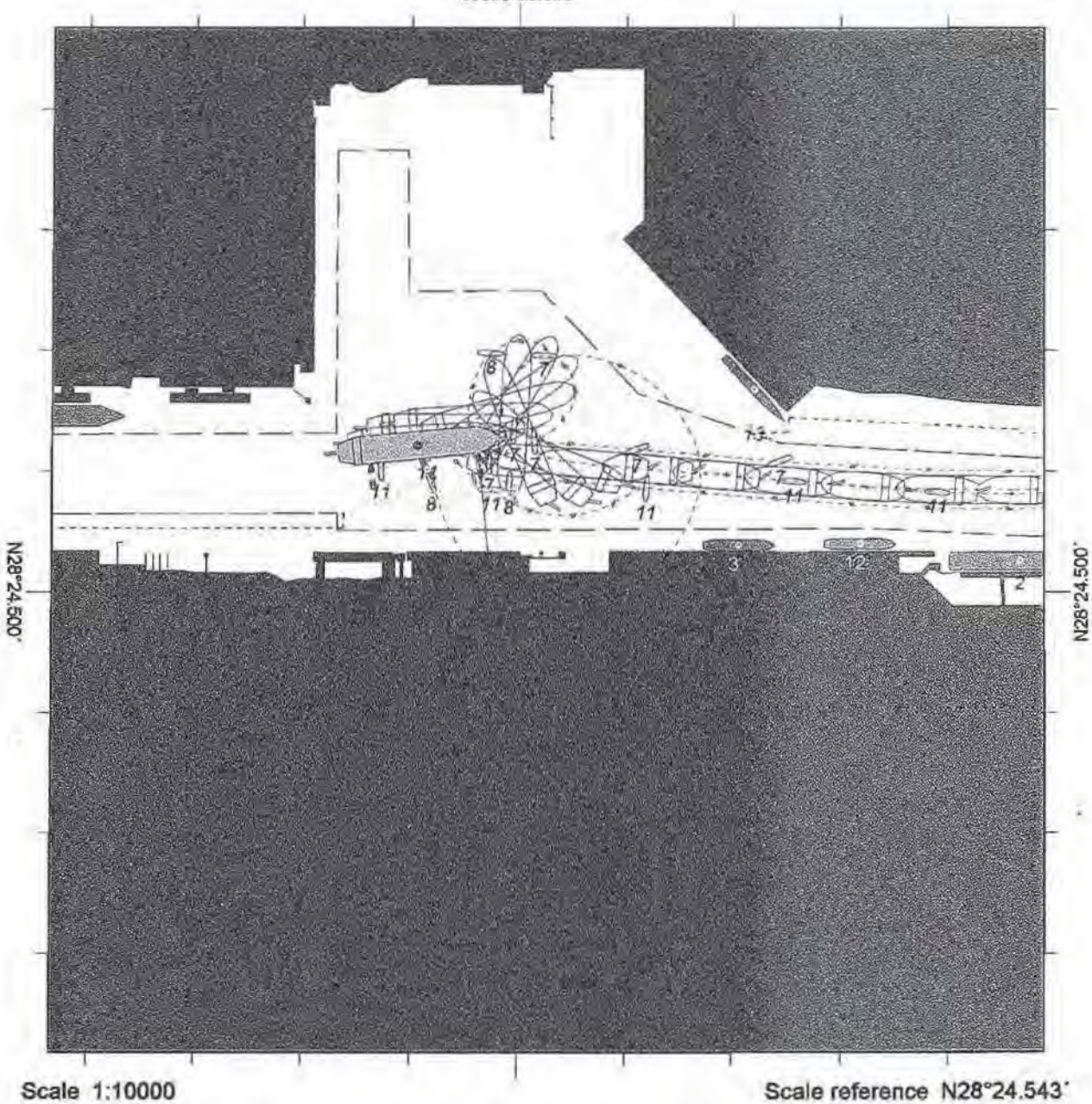


Comments: Wind: SE 20-25K
Current: N 0.3 K

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	60
Shape outline every	01:00

Canaveral Research

W080°36.500'



Scale 1:10000

Scale reference N28°24.543'

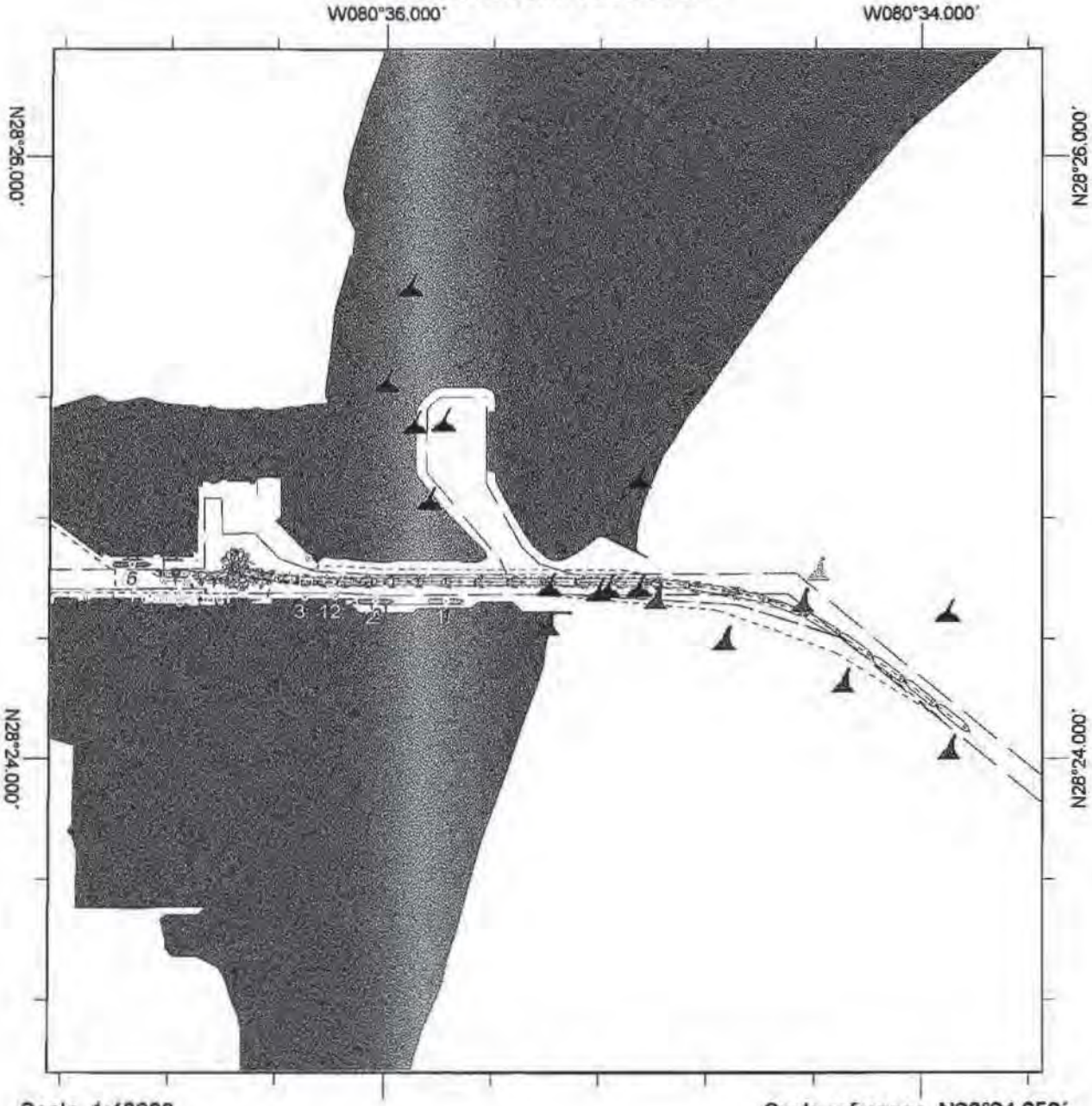
0.075 0.0 0.1 0.2 0.3 0.4 n.mile

100 0 200 400 600 m

Comments: Wind: SE 20-25K
Current: N 0.3 K

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	60
Shape outline every	01:00

Canaveral Research



Scale 1:40000

Scale reference N28°24.656'

0.25 0.0 0.5 1.0 1.5 n.mile

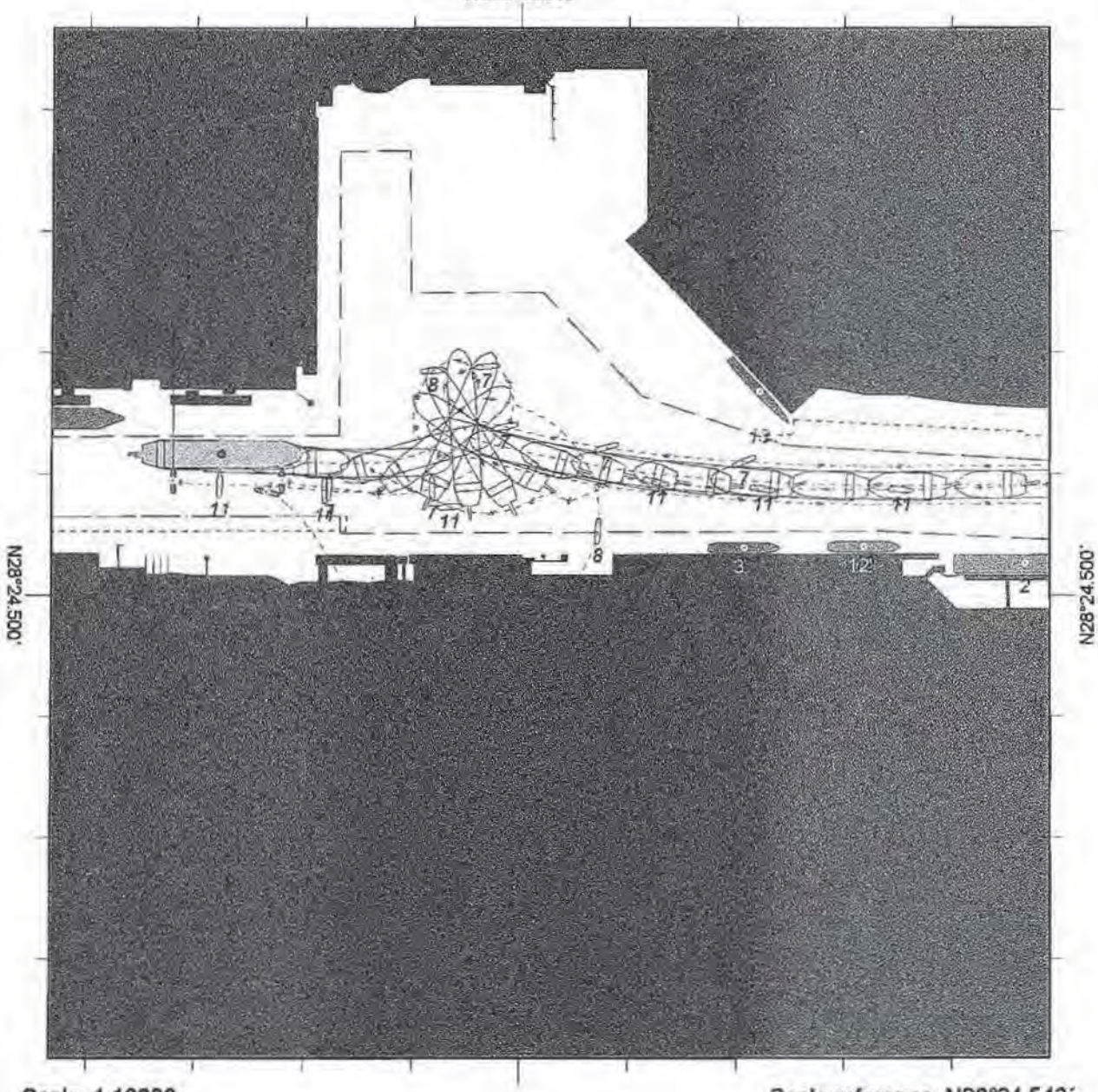
500 0 750 1500 2250 3000 m

Comments: Wind: NW 20-25K
Current: S 0.3 K

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	60
Shape outline every	01:00

Canaveral Research

W080°36.500'



Scale 1:10000

Scale reference N28°24.543'

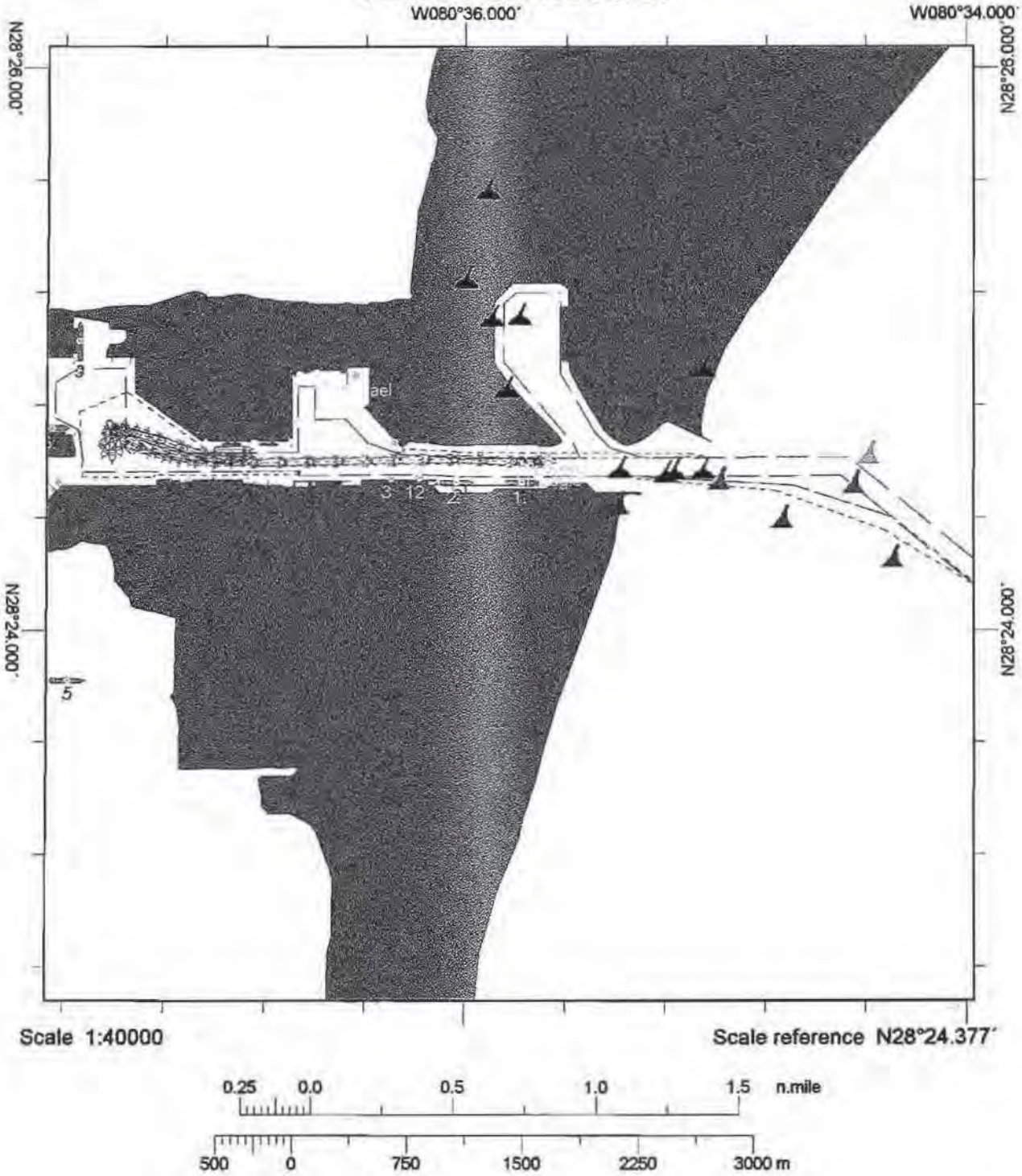
0.075 0.0 0.1 0.2 0.3 0.4 n.mile

100 0 200 400 600 m

Comments: Wind: NW 20-25K
Current: S 0.3 K

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	60
Shape outline every	01:00

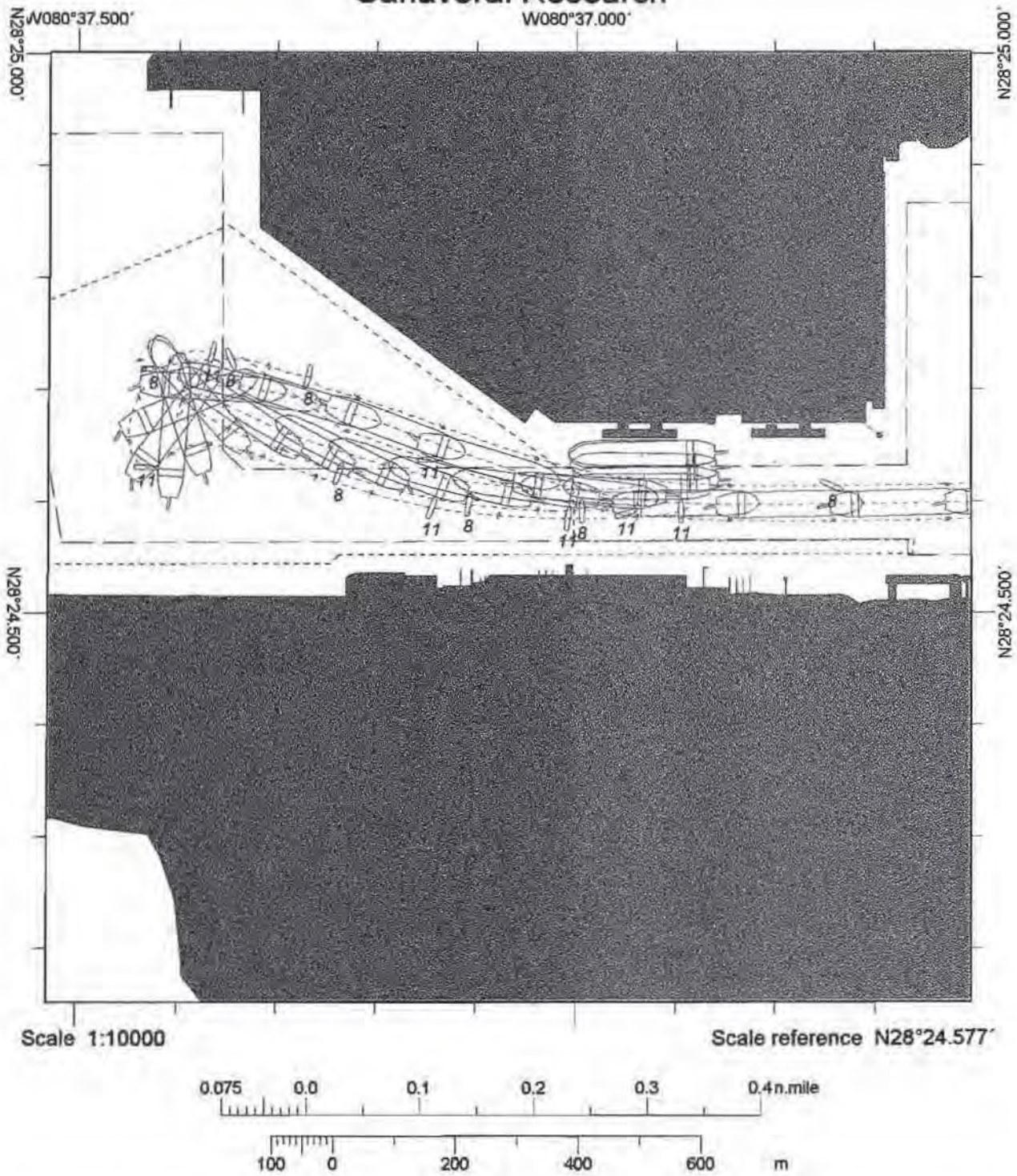
Canaveral Research



Comments: Wind: NW 20-25K
Current: S 0.3 K

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	60
Shape outline every	01:00

Canaveral Research



Comments: Wind: NW 20-25K
Current: S 0.3 K

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	60
Shape outline every	01:00

Port Canaveral 2007
Run Evaluation Form

Pilot # 2

Date March 10-11, 2007

Run #: 16

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: NO WIND, FIRST RUN, NEEDED ADDITIONAL WINDLASS OUTSIDE TO KEEP RATE OF TURN TO ACCEPTABLE LIMITS

(over)

Not at all Difficult ← → Extremely difficult

Task Difficulty 5 4 (3) 2 1

Comments:
FIRST RUN REQUIRED SOME TIME TO GET FAMILIAR WITH EQUIPMENT.

Little Stress ← → Extremely High

Stress Level 5 4 (3) 2 1

Comments:
FIRST RUN JITTERS TO GET COMFORTABLE WITH EQUIPMENT.

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 2

Date March 10-11, 2007

Run #: 17

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: EVEN W/ 15 KNOTS WIND, EXTRA CHANNEL WIDTH IN INNER REACH WAS NEEDED FOR SAFETY.

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	4	(3)	2	1

Comments:

MORE FAMILIAR WITH EQUIPMENT NOW, JOB WENT SMOOTHER, EVEN 15 KNOTS OF WIND MAKES A VESSEL THIS BIG MORE DIFFICULT TO HANDLE.

	Little Stress				Extremely High
Stress Level	5	4	(3)	2	1

Comments:

USING THE IMPROVED CHANNEL GAVE THE NEEDED EXTRA MARGIN OF SAFETY, LOWERING STRESS LEVEL ON NOTCH.

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 2

Date March 10-11, 2007

Run #: 18

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: ABSOLUTELY NEEDED EXTRA WIDNER, AND EXTRA CHANNEL WIDTH TO SAFELY MANEUVER THIS VESSEL UNDER THESE CONDITIONS

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	4	3	2	1

Comments:
NEEDED 4 THRUSTERS TO MAINTAIN SAFE CHANNEL POSITION, AN INTENSE JOB.

	Little Stress				Extremely High
Stress Level	5	4	3	2	1

Comments:
HIGH STRESS. USING TO USE FULL THRUSTER POWER, AND HEAVY MW USAGE.

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 2

Date March 10-11, 2007

Run #: 19

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: EXTRA CHANNEL WIDTH SOUTH OF WEST BASIN ENTRANCE (BUOY 19) WAS ABSOLUTELY NECESSARY WITH SHIPS AT NORTH CARGO PIER 3 AND 4 ALSO, NORTH OF SOUTH 2, THAT AREA WAS USED, AS WELL.

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	4	3	(2)	1

Comments:
HOLDING STERN OFF SOUTH SIDE USING MINIMAL POWER TO AVOID WASH DAMAGE WAS DIFFICULT.

	Little Stress				Extremely High
Stress Level	5	4	3	(2)	1

Comments:
WITHOUT USING "BLUE AREAS" IT WOULD HAVE BEEN UNSAFE IN THESE CONDITIONS.

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 2

Date March 10-11, 2007

Run #: 20

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: EXTRA WIDENER IN OUTSIDE TURN ALLOWED FOR A SAFER, SLOWER RATE OF TURN INBOUND. EXTRA "IMPROVED" CHANNEL BY WEST BASIN ENTRANCE ALLOWED THE STERN TO STAY TO WINDWARD A SAFE DISTANCE FROM NORTH 4.

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	4	(3)	2	1

Comments:
MODERATE WIND ALLOWED FOR LIMITED THRUSTER USE.

	Little Stress				Extremely High
Stress Level	5	4	(3)	2	1

Comments:
STRESS INCREASED BY HAVING TO KEEP SHIP CLOSE TO SHIPS ON SOUTH SIDE.

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 2

Date March 10-11, 2007

Run #: 21

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4*	3	2	1

Comments: * THIS IS ONLY SAFE IF THE IMPROVED CHANNEL IS USED. WITHOUT THE EXTRA MANEUVERING ROOM, THE VESSEL WOULD BE DANGEROUSLY CLOSE TO CHANNEL EDGES AND OTHER MOORED VESSELS.

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	4	3	(2)	1

Comments:
EXTRA BEAM AND LENGTH OF THIS SHIP MADE IT MORE DIFFICULT IN WINDS OF 25KTS

	Little Stress				Extremely High
Stress Level	5	4	3	(2)	1

Comments:
AGAIN, EXTRA ROOM PROVIDES EXTRA MARGIN OF SAFETY WHICH LOWERS STRESS LEVEL.

Additional Comments:
IN THIS EXERCISE THERE IS NOT A VESSEL @ SOUTH CARGO PIER 1. IF THERE HAD BEEN, I WOULD HAVE HAD TO PUT THE VESSEL FURTHER NORTH BY BUOY 14A.

Port Canaveral 2007
Run Evaluation Form

Pilot # 2

Date March 10-11, 2007

Run #: 22

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: WITH SE WIND AREA SOUTH OF WEST BASIN ENTRANCE USED, AREA BY 14A, AND ESPECIALLY EXTRA WIDENER

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	(4)	3	2	1

Comments:

SIZE OF VESSEL MAKES FOR MORE DIFFICULTY BUT POWER AVAILABILITY AND EXTRA ROOM MAKES IT "DOABLE"

	Little Stress				Extremely High
Stress Level	5	4	(3)	2	1

Comments:

SE WIND MEANS YOU HAVE TO "DRIVE" SOUTH, GETTING CLOSER TO MOORED VESSELS AND MARINAS.

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 2

Date March 10-11, 2007

Run #: 23 SCEN 24

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: EXTRA CHANNEL WIDTH ALLOWED ME TO PASS AT A SLOWER SPEED FURTHER AWAY FROM SHIPS ON SOUTH SIDE

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	(4)	3	2	1

Comments:
SHIP MANUELED WELL, GOOD WX

	Little Stress				Extremely High
Stress Level	5	(4)	3	2	1

Comments:
GOOD SHIP, GOOD TUGS, GOOD WX, WIDE CHANNEL MADE FOR A SAFER AND LESS STRESSFUL TRANSIT.

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 2

Date March 10-11, 2007

Run #: 24 SCEN 25

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: EXTRA WIDENER ALLOWED SLOWER RATE OF TURN INBOUND, WHICH WOULD BE VERY HELPFUL IN ENSURING SAFETY WITH A "CRANKY" SHIP.

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	4	3	2	1

Comments:

EXTRA WIDTH, GOOD WX, GOOD SHIP CONTROL

	Little Stress				Extremely High
Stress Level	5	4	3	2	1

Comments:

AS ABOVE.

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 2

Date March 10-11, 2007

Run #: 25 SCEN 26

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: EVEN WITH WINDY CONDITIONS, THE ADDITIONAL DEPTH AND CHANNEL WIDTH PROVIDED FOR AN INCREASED MARGIN OF SAFETY.

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	(4)	3	2	1

Comments:
GOOD SHIP, AND WIDE CHANNEL PROVIDED FOR LESS DIFFICULTY

	Little Stress				Extremely High
Stress Level	5	4	(3)	2	1

Comments:
EVEN IN WINDY CONDITIONS, THE COMBINATION OF GOOD SHIP CONTROL AND THE "IMPROVED CHANNEL" REDUCED STRESS LEVEL.

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 2

Date March 10-11, 2007

Run #: 26 SCEN 30

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: THE IMPROVED CHANNEL SOUTH OF WEST BASIN WAS HELPFUL WITH STRONG SOUTH WIND; AND THE IMPROVED CHANNEL TO THE NORTH IN INNER/MIDDLE REACH ALLOWED ME TO REMAIN FURTHER FROM SHIPS ON SOUTH SIDE.

(over)

Not at all Difficult ← → Extremely difficult

Task Difficulty 5 4 3 (2) 1

Comments:
EXTRA CHANNEL WIDTH WAS VERY HELPFUL HERE WITH BALLAST TANKER IN HIGH WIND

Little Stress ← → Extremely High

Stress Level 5 4 (3) 2 1

Comments:
MORE WIND = MORE STRESS

Additional Comments:
THIS MANEUVER IS SIMPLY NOT POSSIBLE WITHOUT PROPOSED IMPROVED CHANNEL. (TURNING 800' SHIP OFF WEST BASIN ENTRANCE.)

Port Canaveral 2007
Run Evaluation Form

Pilot # 2

Date March 10-11, 2007

Run #: 27 SCEN 27

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: ADDITIONAL DREDGING MADE FOR PLENTY OF DEEP WATER TO SAFELY MANEUVER.

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	(4)	3	2	1

Comments:

GOOD SHIP CONTROL, WIND NOT MUCH OF A FACTOR WITH THIS DRAFT

	Little Stress				Extremely High
Stress Level	5	4	(3)	2	1

Comments:

HEAVY SHIP DUE TO DRAFT AND DOING AN "UNUSUAL" MANEUVER.

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 2

Date March 10-11, 2007

Run #: 28 SCEN 29

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: EXTRA ROOM @ NW CORNER OF INNER REACH ALLOWED VESSEL TO REMAIN A SAFER DISTANCE FROM MOORED VESSELS AT SOUTH CARGO PIER.

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	(4)	3	2	1

Comments:

GOOD SHIP POWER, EVEN IN HIGH WINDS, LARGE BASINS MADE JOB SAFER.

	Little Stress				Extremely High
Stress Level	5	(4)	3	2	1

Comments:

AFTER MANY SIMULATIONS, I FELT COMFORTABLE WITH SHIP CONTROLS.

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr. 2007

Run #: 30

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	~~5~~	~~4~~	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: GETTING VEED TO PODS & PARAMETERS

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr. 2007

Run #: 31

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr, 2007

Run #: 32

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: EXTRA ROOM TO NORTH WORKED WELL!

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr. 2007

Run #: 33

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: 1st. Time out - Know where Buoys Are now

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr. 2007

Run #: 34

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: SPEED?

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr, 2007

Run #: 35

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: EXCELLENT.

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr, 2007

Run #: 36

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: NO PROBLEM!

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr, 2007

Run #: 37

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr, 2007

Run #: 38

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr, 2007

Run #: 39

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr, 2007

Run #: 40

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr, 2007

Run #: 4

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr. 2007

Run #: 42

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 3

Date March 31-1 Apr. 2007

Run #: 43

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Date 3/3/07 2007

Run #: 1

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control N/A	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs N/A	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: Familiarization run
Instrumentation

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Date 3/3 2007

Run #: 2

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control N/A	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs N/A	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: Having N. Jetty cut 160' N increases channel saftey by allowing vessel to remain +30m North of Range ℄ & reduces bank cushion/suction effect.

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Date 3/3 2007

Run #: 3

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control N/A	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs N/A	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: 25+ Kts NW wind imperative to have N'ly channel widened 100ft Jetty to Middle Basin & from Middle Basin to West Basin cut to South. 100ft enables stern to safely transit harbor speeds 6Kts.

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Run #: 4

Date 3/3 2007

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs N/A	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: SE'ly 15 kts can be done adequately with existing channel, however widener & south channel dredging must be done in order to safely transit w/out surge of vessels moored & entering West Basin to allow stern port gtr. from channel edge.

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Date 3/3 2007

Run #: 5

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve N/A	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs N/A	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: 25 kts SE wind inbound widener utilized dredged area to South made it possible to reduce speed & setup properly on range. Entering West Basin vessel set/drift into North dredged area to facilitate turn into West Basin difficult to negotiate turn into West Basin without the dredged area (North) & turn vessel in basin

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Date 3/3 2007

Run #: 6

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin N/A	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs N/A	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: Now, 25Kts vessels bow skirted along existing channel limits from Middle to East basin. Widener improvements allowed for reduced rate of turn 16°/or less to negotiate outbound turn 090-330°

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Date 3/3 2007

Run #: 7 & 8 (RESTART)

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs N/A	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: SE'ly 25 kts existing channel can be utilized but without any saffey margin. Need for S'ly dredging West → Middle Basin inorder to negiate safe passage tanker berth. Outbound widene reduces rate of turn necessary 90° - 7:13 00 and reduces radius arc of turn. (over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Date 3/4 2007

Run #: 9

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve N/A	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: North dredged area East Basin → Middle Basin - essential to reduce bank cushion/suction effect. Also allows widening channel reduces surge effect on vessels moored along South side of channel. Also, opens constriction area South Cargo Pier 2 and Poseidon berth North. (over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Date 3/4 2007

Run #: 10

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve N/A	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: Added vessels Poseidon East berth - North and South side canopies 1 - added degree of difficulty entering Middle basin, requiring more exactness in vessel positioning in channel & maneuvering in Middle Basin.

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Date 3/4 2007

Run #: 11

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve N/A	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: Dredging project from N. Jetty to Middle Basin allows for vessels hydrodynamic effect to be reduced. greatly reducing surge upon moored vessels.

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Date 3/4 2007

Run #: 12

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve N/A	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: SE'ly winds utilized widener improvement to maintain vessel position in channel.

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Date 3/4 2007

Run #: 13

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve N/A	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: SE'ly winds 25kts necessitated utilizing inside widener improvements to allow for set/drift allowing vessel to remain on range centerline/lineup.

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Date 3/4 2007

Run #: 14

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve N/A	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 1

Date 3/4 2007

Run #: 15

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve N/A	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: Turning and 800' vessel off West Turning Basin entrance cannot be safely accomplished without channel dredging improvements. Currently turning 600 ft vessels in the area safely

(over)

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Date April 21-22, 2007

Run #: 44

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Not at all Difficult — Extremely difficult

Task Difficulty 5 4 3 2 1

Comments:

Little Stress — Extremely High

Stress Level 5 4 3 2 1

Comments:

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Date April 21-22, 2007

Run #: 45

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Not at all Difficult — Extremely difficult

Task Difficulty 5 4 3 3½ 2 1

Comments:

Little Stress — Extremely High

Stress Level 5 4 3 3½ 2 1

Comments:

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Date April 21-22, 2007

Run #: 46

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: On this run I would have liked to have had the ship closer to the North side between EAST BASIN & Middle BASIN. I had the ship to close to the centerline which was not the optimal position. I would have preferred to have been closer to the north using some of the north dredged area. (over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	4	3	2	1

Comments:

	Little Stress				Extremely High
Stress Level	5	4	3	2	1

Comments:

Additional Comments:

I noticed that I had to use alot of rudder angle on the pods at times full rudder giving no reserve on the rudder at 6 Kts with this wind condition.

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Run #: 47

Date April 21-22, 2007

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: On this outbound run I held the ship tight on the north bank between middle & EAST BASIN in contrast to the inbound run with NW 25 Knots of wind, where I was closer to the centerline. Being tight to the north was better to keep the ship away from ships moored on the south side.

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	4	3	2	1

Comments:

	Little Stress				Extremely High
Stress Level	5	4	3	2	1

Comments:

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Run #: 48

Date April 21/22, 2007

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3½	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3½	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4½	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: On this run I had the ship to the south of centerline a little more than necessary between EAST Basin & Middle Basin for the wind conditions. The dredged area on the north side allows ~~fore~~ (over) giving more room to ships on the south docks.

Not at all Difficult ← → Extremely difficult

Task Difficulty 5 4 3 2½ 2 1

Comments:

Little Stress ← → Extremely High

Stress Level 5 4 3 2½ 2 1

Comments:

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Date April 21 22, 2007

Run #: 49

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: on the outside turn at the final part, the vessel set to the red as shaped up on to 130 leg - had I kept the vessel tighter on the green in the new dredged area I could have kept her on the centerline. (over)

Not at all Difficult ← → Extremely difficult

Task Difficulty 5 4 3 2 1

Comments:

Little Stress ← → Extremely High

Stress Level 5 4 3 2 1

Comments:

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Date April 21-22, 2007

Run #: 50

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3½	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3½	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4½	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3½	2	1

Comments: Too tight on channel boundary coming through jetties

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	4	3	2	1½ 1

Comments:

	Little Stress				Extremely High
Stress Level	5	4	3	2	1½ 1

Comments:

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Date April 21-22, 2007

Run #: 51

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

	Not at all Difficult				Extremely difficult
Task Difficulty	5	4	3	2	1

Comments:

	Little Stress				Extremely High
Stress Level	5	4	3	2	1

Comments:

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Date April 21-22, 2007

Run #: 52

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4½ 4	3	2	1

Comments: I had the ship slightly south of centerline inbound ideally would have been on centerline.

(over)

Not at all Difficult — Extremely difficult

Task Difficulty 5 4 3 2 1

Comments:

Little Stress — Extremely High

Stress Level 5 4 3 2 1

Comments:

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Date April 21 22 2007

Run #: 53

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Not at all Difficult — Extremely difficult

Task Difficulty 5 4 3 2 1

Comments:

Little Stress — Extremely High

Stress Level 5 4 3 2 1

Comments:

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Date April 21-22 2007

Run #: 54

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Not at all Difficult — Extremely difficult

Task Difficulty 5 4 3 2 1

Comments:

Little Stress — Extremely High

Stress Level 5 4 3 2 1

Comments:

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Date April 21 22 2007

Run #: 55

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Task Difficulty

Not at all Difficult ← 5 4 3 2 1 → Extremely difficult

Comments:

Stress Level

Little Stress ← 5 4 3 2 1 → Extremely High

Comments:

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Date April 21-22, 2007

Run #: 56

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Not at all Difficult ← → Extremely difficult

Task Difficulty 5 4 3 2 1

Comments:

Little Stress ← → Extremely High

Stress Level 5 4 3 2 1

Comments:

Additional Comments:

Port Canaveral 2007
Run Evaluation Form

Pilot # 4

Date April 21 22, 2007

Run #: 57

Circle the number that best describes the run just completed:

	Extremely Satisfactory				Not at all Satisfactory
Vessel Trackline					
- Vessel position with regard to centerline	5	4	3	2	1
- CPA to channel boundaries and/or buoys at the entrance	5	4	3	2	1
- Vessel position with regard to ships at the berth	5	4	3	2	1
- Maneuvering room at turning basin	5	4	3	2	1
Vessel Controllability					
- Engine reserve	5	4	3	2	1
- Rudder reserve	5	4	3	2	1
- Course Control	5	4	3	2	1
- Speed Control	5	4	3	2	1
- Use of Tugs	5	4	3	2	1
- Thruster reserve	5	4	3	2	1

	Absolutely Safe				Not at all Safe
Overall Safety	5	4	3	2	1

Comments: _____

(over)

Not at all Difficult — Extremely difficult

Task Difficulty 5 4 3 2 1

Comments:

Little Stress — Extremely High

Stress Level 5 4 3 2 1

Comments:

Additional Comments:

Port Canaveral 2007
Final Evaluation Form

Name: BENJAMIN BORGIE Date: MARCH 10-12 2007

A geographic database of Port Canaveral was constructed for use in these simulations. This database, a "model of the future", included a dredge plan to modify/widen part of the entrance channel, the channel through the harbor, and the turning basin area at the Western end of the port.

Two vessels were used in the simulations: "Genesis" (LOA 361.5m, Beam 47m, Draft 9.2m) a cruise vessel, and the tanker "Jupiter" (LOA 244m, Beam 42m, Draft 12m) partially loaded, and ballasted (Draft 8.3m).

1) Does this "improved channel" provide ample width for transit of these vessels in the environmental conditions of wind and current as tested? Comments?

"Genesis" YES, THE "IMPROVED CHANNEL" PROVIDED AN INCREASED MARGIN OF SAFETY DURING THE SIMULATED TRANSITS. A VESSEL THIS HUGE NEEDS THE WIDER CHANNEL, AS THE EXTREME DIMENSIONS RESULT IN A MUCH WIDER "SWEPT" PATH, WHEN SUBJECT TO SET/DRIFT.
"Jupiter" YES, "IMPROVED CHANNEL" PROVIDED AMPLE WIDTH FROM BEGINNING OF WIDENER TO MIDDLE BASIN. THE IMPROVED CUT AT THE NW CORNER OF INNER REACH IS AN IMPORTANT IMPROVEMENT TO ALLOW VESSEL TO BE BETTER CONTROLLED AND ALLOW SLOWER SPEEDS TO REDUCE DANGEROUS HYDRODYNAMIC FORCES

2) Depths in the channel are 44 feet in the entrance channel, and 41 feet in the harbor proper and turning areas. Is this depth adequate for the vessels, especially the "Jupiter" with a draft of 12 meters (approximately 39 feet)? Comments?

THE SIMULATION PROVED TO ME THAT DUE TO THE LENGTH/BEAM/DRAFT, THAT THE 41' DEPTH IS ADEQUATE FOR MOST, BUT NOT ALL CONDITIONS. IN ORDER TO MAINTAIN 2'06" UNDER KEEL DEPTH IS ADEQUATE EXCEPT IN RARE CASE WHERE A 39' DRAFT VESSEL WANTS TO TRANSIT AT EXTREME LOW TIDE.

3) "Jupiter" is expected to utilize the Middle Turning Basin into or out of the berth. Does the Middle turning basin area provide ample maneuver room for this operation in the conditions tested?

YES, ADEQUATE ROOM EXISTS TO SAFELY MANEUVER A VESSEL OF THIS SIZE AND DRAFT.

4) "Genesis" will utilize the West Turning Basin. Does the additional dredging in this area provide ample maneuver room for this operation in conditions tested? Comments?

THE SIMULATION PROVED TO ME THAT DUE TO THE LENGTH OF THE VESSEL AND THE RELATIVELY SHARP TURN, IT IS MANDATORY THE ADDITIONAL DREDGING BE DONE TO ALLOW VESSEL TO MANEUVER SAFELY.

5) Under what conditions will the additional width provided by dredging at the inside of the turn of the entrance channel be most useful?

DURING THE SIMULATION, IT WAS PROVEN TO ME HOW IMPORTANT THE ADDITIONAL WIDTH IS WHEN WIND IS S'LY. THE ADDITIONAL ROOM ALSO ALLOWS FOR A SLOWER AND THEREFORE, SAFER, RATE OF TURN UNDER ALL CONDITIONS.

6) Under what conditions and during what maneuvers will the additional channel width provided by dredging the North side of the channel from the East Turning Basin to the Middle Turning Basin be most useful?

ADDITIONAL CHANNEL WIDTH IN THIS AREA WILL ALLOW TRANSITING VESSELS TO REDUCE DANGEROUS HYDRODYNAMIC FORCES ON MOORED VESSELS, REDUCE CUSHION/SUCTION, AND ALLOW FOR GREATER LEEWAY UNDER HIGH WIND CONDITIONS.

7) Under what conditions and during what maneuvers will the additional channel width provided by dredging the South side of the channel opposite the West Turning Basin be most useful?

THIS AREA IS ESPECIALLY NEEDED UNDER HIGH WIND CONDITIONS. IT WILL ALLOW TRANSITING VESSELS A SAFE DISTANCE OFF MOORED VESSELS AND PERMITS A MORE CONTROLLED (SAFER) TURN INBOUND AND OUTBOUND OF WEST BASIN.

8) In your opinion, will this dredge plan provide for greater maneuverability and safety when accommodating these vessels? Comments?

YES, ABSOLUTELY! SAFETY IS FIRST AND FOREMOST TO THE PILOTS IN PORT CANAVERAL. THIS DREDGING WILL ALLOW "GENESIS" CLASS VESSELS TO SAFELY TRANSIT AND WILL PROVIDE INCREASED PROTECTION FOR ALL VESSELS, TRANSITING AND MOORED, AS WELL AS THE MARINAS, DOCKS AND STATE PROPERTY.

9) Are there any issues or comments, or suggestions not covered by simulations or as part of this project? Comments?

1.) A WIDER CHANNEL IN THE MIDDLE AND INNER REACH COULD PROVIDE FOR TWO-WAY TRAFFIC FOR SMALLER VESSELS, REDUCING CONGESTION AND VESSEL WAIT TIMES.

2.) OF HUGE IMPORTANCE, IS THAT THE DEEPER CHANNELS WILL ALLOW EVEN DEEP VESSELS TO TRANSIT AT ANY TIME AND NOT BE DELAYED (AT GREAT EXPENSE) FOR THE TIDE TO RISE.

3.) ADDITIONAL ROOM AT THE OUTSIDE TURN AND AT THE ENTRANCE TO WEST BASIN WILL PROVIDE FOR A SMOOTHER, SAFER, SLOWER, MORE CONTROLLED TURN.

4.) THE EXTRA AREA NORTH OF INNER/MIDDLE REACH WILL ALLOW FOR LARGER VESSELS ON THE SOUTH SIDE.

Please use additional sheets if necessary to complete your responses.

Thank you for your participation in this important project!

Port Canaveral 2007
Final Evaluation Form- Day One - Genesis

Name: Dave Callan Date: 31 March 2007

A geographic database of Port Canaveral was constructed for use in these simulations. This database, a "model of the future", included a dredge plan to modify/widen part of the entrance channel, the channel through the harbor, and the turning basin area at the Western end of the port.

Two vessels were used in the simulations: "Genesis" (LOA 361.5m, Beam 47m, Draft 9.2m) a cruise vessel, and the tanker "Jupiter" (LOA 244m, Beam 42m, Draft 12m) partially loaded, and ballasted (Draft 8.3m).

1) Does this "improved channel" provide ample width for transit of these vessels in the environmental conditions of wind and current as tested? Comments?

"Genesis" Based upon my experiences on the simulator today, I would say that with certainty if the channel improvements are implemented, there will be adequate width for transit of the Genesis class as well as other vessels with similar length and beam. Specifically, the new and improved widener as simulated will allow these vessels to make inbound and outbound turns with a low rate of turn (less than 15 degrees and more likely approaching 10 degrees per minute) which is a design element desirable by the cruise liners of this length so that angles of list are not introduced that are unsafe for passengers moving about the decks and for various objects subject to motion onboard that may be subject to breakage or damage to passengers in the form of "missiles." Inbound, I noticed I had the ability to slow down on the approach to the jetties sooner that allowed me to pass moored vessels berthed at CT# 3 & 4 at six knots or less even with winds in excess of 20 knots. At the same time, I was able in the portion of the channel between the east and middle basins to have no more than five degrees of leeway that effectively increased the beam to over 250 feet yet still gave me adequate room on both the north and south limits of the channel because I now had five hundred feet in which to place the vessel. In strong south winds, this manifested itself by allowing me to keep the stern from impacting the north bank yet keeping the bow clear of ships on the south side. Also, the ability of the bow thrusters to be effective at six knots and higher would have allowed me to maintain less leeway should I had chosen to utilize them more. It was my desire, however, to navigate in the combi mode as much as possible in the channel without using the thrusters any more than I needed to. The wider channel just outside the jetties and between the basins was just the adjustment needed to be able to effect this scenario. The additional width between the middle and west turning basins on the south side also improved the handling of the vessel with vessels at the two berths (North Cargo Piers # 3 & 4) most importantly with strong south winds. By positioning the vessel on the south side of the channel in these circumstances, issues of surge were reduced for vessels on the lee side (north side) and by enlarging the west basin access widener the vessel could be turned sooner and thus eliminating the requirement to "hold off" turning the vessel when strong north winds were prevalent. In summary, in all the simulations tested, the additional width was not only effective and ample for this class vessel but, in the opinion of this experienced pilot, addressed all of the problem areas for vessels in excess of 1000'

up to and including 1200' LOA. In strong N'ly winds I was able to use the new width on the north side between the east and middle basins to keep myself well to windward with ample room to vessels moored on the south side and at a speed that would not amplify surge effects.

2) Depths in the channel are 44 feet in the entrance channel, and 41 feet in the harbor proper and turning areas. Is this depth adequate for the vessels, especially the "Jupiter" with a draft of 12 meters (approximately 39 feet)? Comments?
Comments regarding the Jupiter will be forthcoming after I have had the opportunity to complete the simulation runs for her on day two but without a doubt there is adequate and ample depth in the entrance and harbor channels as well as the turning basins for the Genesis class vessel even considering all conditions of squat. Preliminary to my handling the Jupiter, I will point out that the maximum draft in Port Canaveral for existing tanker traffic and future projected traffic for the VITOL project is 39'06." Existing parameters established by the pilots for vessels underway in the channels and basins is for a minimum under keel clearance of 2'06." If we are to position ourselves to eliminate tidal restrictions the harbor and turning basins should be dredged to 42 feet vice 41 feet. I am aware there is 2' over dredging but we do often experience "minus" MLLW tidal conditions that might affect a vessel's ability to transit the channels during any stage of the tide. Due to the large amount of passenger ship traffic – currently given priority over any other vessel excepting emergency movements – it is essential that we eliminate the need for "tide jobs" as there are often two-to-four day stretches where the high tides fall around the time of arrival and departure of cruise ships. This can often result in extensive delays for deeply laden vessels causing them to remain at anchorage for days and sometimes diverting from Port Canaveral altogether.

3) "Jupiter" is expected to utilize the Middle Turning Basin into or out of the berth. Does the Middle turning basin area provide ample maneuver room for this operation in the conditions tested?

4) "Genesis" will utilize the West Turning Basin. Does the additional dredging in this area provide ample maneuver room for this operation in conditions tested? Comments?
Most certainly, the additional dredging in the West Turning Basin provides ample room for maneuvering. I was most impressed with this fact when turning the vessel with strong SE'ly winds and expect that with any wind direction clockwise from east through south to west the additional widener area is most productive and allows for the Genesis class to be positioned further to the south and well clear of other vessels in the West Turning Basin. Also, the widener allows a vessel in strong N'ly winds to turn sooner to the wind and thus developing further distance between the vessel's stern and vessels/marinas/ramps that are situated along the southern seawall in this vicinity. While not tested today, I can envision a scenario that a Genesis class in a strong S'ly wind in excess of 30 knots would turn completely in this new 1750'+ widener and drift north when turned 180 degrees and then backed into her berth.

5) Under what conditions will the additional width provided by dredging at the inside of the turn of the entrance channel be most useful?
Speaking about the Genesis class, the additional width will be an absolutely essential improvement and necessity for this class when inbound in strong SE – SW'ly winds in order to keep the vessel completely in the channel without swinging the stern outside the north channel limit along the 310 heading of the Approach Channel and from keeping the stern from swinging outside the channel to the extremely shallow area north of the channel between buoy #10 and the north jetty. Given more room to the south as described by the widener improvement will allow inbound vessels to come out of the turn much further to windward and also allow vessels to slow sooner on the approach to berthed vessels reducing the possibility of dynamic surge to the berthed vessels. Outbound, historically we have needed a higher rate of turn than desired because with the vessels accelerating, twenty-degree rate of turns in S'ly winds are often required to maintain the ships in the channel accentuating list and the deleterious effects previously described. The new width and extended widener will allow for a more gradual and less rate of turn transit through this section. As noted below, the possibility of two-way traffic for medium sized cargo vessels with resultant improvement in efficiency and reduced delays may be possible with further study by the pilots.

6) Under what conditions and during what maneuvers will the additional channel width provided by dredging the North side of the channel from the East Turning Basin to the Middle Turning Basin be most useful?
Certainly, when vessels are moored on the south side of the channel, a wider channel will allow greater distance to passing ships and slower speeds for these transiting vessels with the reduced possibility of surge effects to the docked vessels. Another hopeful outcome would be the introduction of two-way traffic for smaller cargo vessels thus making the port more efficient and eliminating many delays that the current scheme requires.

7) Under what conditions and during what maneuvers will the additional channel width provided by dredging the South side of the channel opposite the West Turning Basin be most useful?
In strong SE'ly through SW'ly winds that usually are prevalent before the arrival of a cold front, as described previously, the additional room to the south of the west turning basin will actually increase the room available for turning when inbound and for outbound transits, a vessel will be able to come out of the basin on the extreme south side before turning east to sea and keeping her stern well clear of vessels berthed at North Cargo Pier # 3 & 4 as well as new construction along the NW-SE face of the widener seawall where vessels will be berthed. With vessels berthed along this new section of seawall, added room to the south of the west turning basin will be essential to maintain a safe distance from moored vessels.

8) In your opinion, will this dredge plan provide for greater maneuverability and safety when accommodating these vessels? Comments?
It is my professional opinion based upon twenty-two years as a pilot in Port Canaveral, six years of experience as a ship master prior to that, and as a federal pilot in New York Harbor and the Delaware River before then that this new dredge plan will without a doubt provide for maximum safety for vessels that are turning in the basins and transiting the channels. To date, we have often been on the edge for vessels in the 1000' range due to crab angle in a four hundred foot channel; the new five hundred foot channel and

increased room at the widener will eliminate this dilemma. The existing 1440' turning circle in the West Turning Basin will be enhanced with a new and improved 1750+ foot turning circle that will accommodate a vessel nearly twelve-hundred feet in length. According to documents published by the ACOE, a turning circle should have a diameter that approaches 1.5 times the length of the largest vessel and this parameter would be met by the new dredge plan. I completely support the plan as proposed and would not recommend that it be diminished in any fashion.

9) Are there any issues or comments, or suggestions not covered by simulations or as part of this project? Comments?
To begin with, I would like to thank all those individuals involved in the project. Mr. Howard Straub of the STAR Center, Dave Nieri from New York, Victor the pilot from PR, and Melynne Chiariello from CH2M Hill provided no small amount of support. (Thanks to Jennifer for her assistance in the control room responding to my requests in a timely manner). I might liked to have had an opportunity to make one simulator run not "on the books" at the beginning to get a feel for the controls and to adjust to the simulated environment but the learning curve was ascended rather rapidly and I have to say that having attended several simulators the STAR Center has the best that I have seen. I especially liked the fact that one could go from the center position to port or starboard wing position rapidly. Certainly, the graphics and real time simulation were superb. This enabled me to see that the action I was taking was having the desired effect. As far as the Genesis goes, I believe Port Canaveral will be well positioned to entertain such a vessel calling there should the improvements simulated be implemented. Again, my thanks to all involved.

Please use additional sheets if necessary to complete your responses.

Thank you for your participation in this important project!

Port Canaveral 2007
Final Evaluation Form

Name: Stephen Gasecki Date: March , 2007

A geographic database of Port Canaveral was constructed for use in these simulations. This database, a "model of the future", included a dredge plan to modify/widen part of the entrance channel, the channel through the harbor, and the turning basin area at the Western end of the port.

Two vessels were used in the simulations: "Genesis" (LOA 361.5m, Beam 47m, Draft 9.2m) a cruise vessel, and the tanker "Jupiter" (LOA 244m, Beam 42m, Draft 12m) partially loaded, and ballasted (Draft 8.3m).

1) Does this "improved channel" provide ample width for transit of these vessels in the environmental conditions of wind and current as tested? Comments?

"Genesis" Yes, "improved channel" provided improved safety margin for vessel transit. Allowed proper rate of turn at Widener and allowed for set/drift Middle/Inner reach in channel position due to extreme LOA/Beam.

"Jupiter" Yes, "improved channel" provided ample width from Widener to Middle Basin. Vessel can be maneuvered at slower speeds which reduce hydrodynamic effects - surge moored vessels & bank cushion suction.

2) Depths in the channel are 44 feet in the entrance channel, and 41 feet in the harbor proper and turning areas. Is this depth adequate for the vessels, especially the "Jupiter" with a draft of 12 meters (approximately 39 feet)? Comments?

Yes, depths are adequate to maintain a minimum under keel clearance of 2ft. This will allow 24hr unrestricted transits rather than high water tide restrictions.

3) "Jupiter" is expected to utilize the Middle Turning Basin into or out of the berth. Does the Middle turning basin area provide ample maneuver room for this operation in the conditions tested?

Yes, there is adequate area to maneuver in the Middle Basin for a vessel of Jupiter dimensions LOA/Beam/Draft

4) "Genesis" will utilize the West Turning Basin. Does the additional dredging in this area provide ample maneuver room for this operation in conditions tested? Comments?

It is imperative the additional dredging be done in order to safely maneuver "Genisis" class vessels inbound/out bound West Basin, due to the size of the vessel. under adverse wind conditions.

5) Under what conditions will the additional width provided by dredging at the inside of the turn of the entrance channel be most useful?

The widener improvements will greatly improve safe handling of high windage vessels inbound/outbound in N'lly winds, greater 35kts, allowing vessels to compensate for set & drift and also allows for a reduced rate of turn radius arc.

6) Under what conditions and during what maneuvers will the additional channel width provided by dredging the North side of the channel from the East Turning Basin to the Middle Turning Basin be most useful?

Additional channel width along Northside East → Middle Basin serves to reduce hydrodynamic effects surge moored vessels, bank suction/cushion, and aids high windage vessels crab angle set/drift transiting inbound & outbound.

7) Under what conditions and during what maneuvers will the additional channel width provided by dredging the South side of the channel opposite the West Turning Basin be most useful?

Channel improvements along the South side West → Middle Basin greatly improve large cruise ships transiting in/out West Basin in N'lly & S'lly cross beam winds enabling vessels bow & stern proper positioning entering/exiting West Basin due to the increased LOA & Beam of the large ships

8) In your opinion, will this dredge plan provide for greater maneuverability and safety when accommodating these vessels? Comments?

Absolutely! Safety is primary concern. Without these dredge plan improvements vessels maneuver without any margin of safety endangering vessels, public, & property all susceptible to damage.

9) Are there any issues or comments, or suggestions not covered by simulations or as part of this project? Comments?

Yes additionally improvements to the channel will also provide for tanker/bulk carriers deeply laden greater than 36ft draft to transit 21hrs without tide restrictions allowing more efficient & timely operations. It will also lend on a limited basis for two way vessel passage/meetings Middle & Jones Reach. The widener improvements greatly reduce the rate of turn needed to negotiate inbound & outbound transits and effect alternative arc radius of turn

Please use additional sheets if necessary to complete your responses.

Thank you for your participation in this important project!

Port Canaveral 2007
Final Evaluation Form

Name: Rich Grimson Date: April 21-22, 2007

A geographic database of Port Canaveral was constructed for use in these simulations. This database, a "model of the future", included a dredge plan to modify/widen part of the entrance channel, the channel through the harbor, and the turning basin area at the Western end of the port.

Two vessels were used in the simulations: "Genesis" (LOA 361.5m, Beam 47m, Draft 9.2m) a cruise vessel, and the tanker "Jupiter" (LOA 244m, Beam 42m, Draft 12m) partially loaded, and ballasted (Draft 8.3m).

1) Does this "improved channel" provide ample width for transit of these vessels in the environmental conditions of wind and current as tested? Comments?

"Genesis" Yes the improved channel provides ample width for the Genesis class in the conditions tested. The increased channel width is necessary to provide for additional room required for a vessel of this size to use adequate leeway (continued on back)

"Jupiter" Yes, the improved channel provides ample width for the Jupiter in all conditions tested. The increased channel width is necessary for deep draft vessels to reduce hydrodynamic affects and provide safe distance for passing moored vessels.

2) Depths in the channel are 44 feet in the entrance channel, and 41 feet in the harbor proper and turning areas. Is this depth adequate for the vessels, especially the "Jupiter" with a draft of 12 meters (approximately 39 feet)? Comments?

This depth is adequate for all vessels however there will have to be tide restrictions for vessels approximately 38' in draft and above to insure adequate underkeel clearance. Under current channel configurations with a project depth of 39' in the middle basin, any vessel over 36' in draft is required (cont. on back)

3) "Jupiter" is expected to utilize the Middle Turning Basin into or out of the berth. Does the Middle turning basin area provide ample maneuver room for this operation in the conditions tested?

Yes, the Middle Turning Basin provides ample maneuver room.

4) "Genesis" will utilize the West Turning Basin. Does the additional dredging in this area provide ample maneuver room for this operation in conditions tested? Comments?

YES, the additional dredging in this area provides ample maneuvering room in the conditions tested. The dredged area at the entrance to the West Basin is a critical area due to several factors including the proximity of

1) Genesis (cont) during moderate to high wind conditions and to provide room for the vessel to maintain a safe distance and passing speed for moored vessels on both sides of the channel.

4) (cont.) south side of the channel as the ships are turned in to the West Basin; and the requirement for additional room for margin of safety as ships begin to slow the vessel for docking, especially in high wind conditions. IT should be noted that the cut on the Northeast side of this area will be a berth for large vessels so that the apparent room to the northeast on the simulated exercise will not be available when vessels are moored there. However, I believe there will be ample room even when vessels are moored at the berths. I would also note that some cruise ship captains may prefer to turn their vessels in the newly widened area and then backing in to the existing basin to the berth rather than turning the vessel further to the north as I did in the simulator exercises, especially in southerly wind conditions.

2) (cont.) to take 3 assist tugs and time the inbound transit for high water. With an increase in project depth this requirement could be appropriately adjusted but will not be deep enough to allow all deep draft vessels to transit at any tidal condition.

5) Under what conditions will the additional width provided by dredging at the inside of the turn of the entrance channel be most useful?

The additional width provided at the entrance channel widener is needed for vessels the size of the Genesis class for all conditions and especially in high wind conditions when the vessel will have higher set and drift maneuvering through the turn.

6) Under what conditions and during what maneuvers will the additional channel width provided by dredging the North side of the channel from the East Turning Basin to the Middle Turning Basin be most useful?

The additional channel width on the North side will be most useful in moderate to high wind conditions, for the Genisis class allowing for necessary leeway of this size vessel as well as safe distance off and appropriate passing speed for moored vessels. Also the additional channel width provides a greater (cont. on back)

7) Under what conditions and during what maneuvers will the additional channel width provided by dredging the South side of the channel opposite the West Turning Basin be most useful?

The additional channel width on the south side will be most useful in moderate to high wind conditions for the cruise ships for the reasons given in no. 6 above and especially due to the cruise ship sterns swinging to the South when entering the basin and to provide for holding the cruise (cont. on back)

8) In your opinion, will this dredge plan provide for greater maneuverability and safety when accommodating these vessels? Comments?

YES, I believe that this dredge plan provides for greater maneuverability and safety, for all the reasons addressed in previous questions.

9) Are there any issues or comments, or suggestions not covered by simulations or as part of this project? Comments?

I'd like to make a few comments regarding the simulation runs I made on the Genesis class vessel. During portions of several of the runs I made I conned the vessel well to windward, in some cases in relatively close proximity to moored vessels. This is something I am accustomed to doing with the current channel configurations in high winds. However I believe with the channel improvements I could have given the moored vessels substanti additional passing distance ghll maintaining a safe position in the channel. I also noticed during my inbound simulator runs with the Genesis that I often passed the first moored vessel on the South side at a speed slightly higher than what I consider to be the desirable speed of approximately six knots. (cont. on back)

Please use additional sheets if necessary to complete your responses.

Thank you for your participation in this important project!

7. (cont.) ships down to the south when departing the basin outbound, in strong southerly winds.

6. margin of safety for hydrodynamic affects on deep draft vessels.

---

9. (cont.) I believe this tendency was due to the fact that under existing conditions we rarely have a vessel moored at that berth and I am accustomed to slowing the cruise ships to six knots further to the west. I do not anticipate that there will be any problem in slowing the Genesis class to six knots by the time the vessel passes the first berth to the South in the future.

This simulation provided an outbound range to navigate outbound vessels, something which does not currently exist but which the pilots have been recommending for many years. This simulation convinced me even further that an outbound range should be installed at Port Canaveral.

Additional benefits to the Port will be provided by these channel improvements such as allowing two-way traffic for some vessels, decreasing the amount of deep draft tankers that need to enter the port timed for high water, and providing a potential turn-around area for vessels in the improved widener.

The improved channel newly dredged areas may not necessarily by entered by maneuvering vessels during routine transits, however they are necessary to provide the additional margin of safety required for very large vessels.

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1 STUDY OVERVIEW

This report describes the methodology and the results obtained from the simulation based evaluation of navigation channel improvement designs at Port Canaveral, Florida. The Port Canaveral Authorities plan to increase channel depth, and in places, expand channel width to provide increased safety and facilitate accessibility by larger and future visiting vessels. The objective of this study was to examine the two expansion dredge plans to determine which of the plans would provide safe passage for these vessels in normal to more extreme environmental conditions of wind and tidal current. The simulations were performed at the STAR Center in Dania Beach, Florida during three days of testing during the period 3-5 June 2009 using STAR Center's 360º field-of-view, shiphandling simulator.

The expansion designs are designated as Plan A and Plan B. Both plans effect the same general locations but the channel expansions in Plan A provide a larger/wider navigable area than the dimensions of Plan B. Both of the plans provide for identical increases in channel depths. In cooperation with the US Army Corps of Engineers, the Port has selected two "design vessels" to be used in simulations. The design vessels selected were a large Azipod propelled Cruise vessel and a product Tanker considered to be representative of larger vessels utilizing the facilities at the port now or in the future. Since the focus of the evaluation was vessel safety in all conditions, maximum credible worse-case environmental conditions of wind and current were simulated during each simulation run. Experienced Port Canaveral Pilots actively participated in the evaluation by controlling the simulated ships from the simulator wheelhouse and providing their professional opinion based on their experience and observations on the simulator.

2 SIMULATOR AND SIMULATION MODELS

The simulation runs for the study were conducted on STAR Center's full-mission bridge simulator. STAR Center's simulator bridge is a full-size replica of a commercial vessel's wheelhouse. The simulator presents a 360° panoramic out–the-window view from the wheelhouse. Wheelhouse instrumentation includes two ARPA/Radar displays and a CRT presentation referred to as the ship's "conning page" which provides information on rudder position, thruster setting, true and relative wind speed, transverse, and lateral speed of the vessel, in a single location. The equipment on the simulator bridge can be configured to replicate the bridge arrangement of any merchant vessel.

Taken together, this provided for a highly realistic work environment for the participating Port Canaveral Pilots. Relevant details regarding the configuration of the simulation models are provided in the following sections.

2.1 Ship Response Models

Two different ships from STAR Center's library of ship response models were used. They included the *FREEDOM OF THE SEAS*, the first build of a class of large cruise ships that may routinely call at the Port in the future. The second ship was the *Jupiter*, a moderate sized tanker that is representative of the deepest draft vessels that the channel improvements will accommodate.

Ship characteristics relevant to this evaluation are discussed below. Appendix A shows the particulars for each ship as modeled.

2.1.1 FREEDOM OF THE SEAS

The *FREEDOM OF THE SEAS* is a large cruise ship with a LOA of 1,111.6 feet, a beam of 126.6 feet and draft of 27.9 feet. Exercises on the *FREEDOM* were completed without use of assist tugs because passenger ships rarely require assist tugs. This is possible because modern passenger ships are equipped with maneuvering aids designed to improve slow speed maneuvering and ship self-sufficiency during port transits, docking and undockings. The *FREEDOM* is equipped with four powerful side thrusters at the bow and azi-pod propulsion at the stern.

With respect to this evaluation, it is the *FREEDOM's* length that will challenge the channel widths in the alternative plans. This is because longer ships require wider channels when they are turning and when they must "crab"[1] to counter the effects of the winds and currents used during channel transits.

2.1.2 Jupiter

The *Jupiter* is a relatively large tanker for the Port due to its draft. The ship's LOA is 800 feet and beam is 137.8 feet. A partially loaded version of the vessel was loaded on an even keel draft of 39.4 feet displacing 97,200 tons was used for inbound transits. A ballasted version drawing 27.2 feet aft and 18.7 feet forward and displacing 54,260 tons was used for outbound transits. Note that a fully loaded tanker of similar length and

[1] Crab angle- or drift angle – difference between course steered and the course made good usually due to the action of current or wind. This effectively increases the footprint of a vessel lessening channel maneuver room

breath would displace around 120,000 tons and draw 48 feet. All transits on the *Jupiter* were conducted with tug assistance.

The ship's key characteristics with respect to evaluating the channel design were her draft and low engine power relative to displacement during inbound transits on the partially loaded ship. During outbound transits, the ballasted version of the ship was more wind sensitive and this provided an opportunity to look at how the channel designs faired with a low powered, wind sensitive ship in the high wind conditions.

2.1.3 Assist Tug Modeling and Deployment

Three harbor assistance tugs were used by the Pilots for simulation runs on the *Jupiter*. The tugs were configured to replicate the power and performance characteristics of three tugs presently serving the port. The bollard pulls (BP) used on the simulator was estimated based on the rated horsepower and mechanical efficiency of the tug type as indicated below.

- Elizabeth - 3000 hp conventional - estimated BP at 100% Power = 40 tons
- Michael - 3000 hp conventional - estimated BP at 100% Power = 40 tons
- Eagle - 4000 hp tractor - estimated BP at 100% Power = 52 tons

The tugs were made fast at the start of every exercise on the *Jupiter*. Per the Pilots direction, the same deployment scheme was used each exercise. The Elizabeth and Michael were made fast on the port and starboard bow respectively and the Eagle at the stern with a line through the centerline chock. The Pilots controlled the tugs by communicating with the tug Captains (simulator operator) using a hand-held radio. The tug was identified by name, the direction of the tug relative to the ships side was ordered and the engine power setting was ordered, e.g, "Bow Tug" push half ahead at 90 degrees".

The simulator operator activated the tug by assigning a direction of action relative to the ship's centerline and tons of force based on the engine power. The only exception to this procedure occurred when the ship was moving too fast for the tug to deliver full power. In those instances, the simulator operator reduced the tug force as appropriate to the ship speed through the water and the type of tug being simulated (i.e., conventional propulsion vs. azimuth propulsion).

2.2 Simulator Geographic Model

The geographic model presents a realistic out-of -window visual display using Computer Generated Image (CGI) technology, and a corresponding radar image on the radar displays located on the simulator's navigation bridge. The visual and radar models incorporate landmass, terrain elevations, aids to navigation, piers, jetties, bridges, buildings, towers, and other characteristics of the modeled geographic area, and displays other vessels and aircraft.

Specific structures, buildings, stacks, key landmarks, and other prominent features that can be used as visual cues by the pilots when handling ships in the port are identified for inclusion in the 3- dimensional visual scene.

2.2.1 Channel Improvement Modeling

STAR Center possessed an accurate computer model of Port Canaveral that had been created for a prior evaluation. This geographic database and bathymetric model was modified to reflect dredge plans A and B provided by the Port's consulting firm. The following table quantifies the main differences between Plan A and B. Details of the alternative plans are shown on the engineering drawings in the attached appendices.

HARBOR FEATURE	PLAN A	PLAN B
Entrance Channel turn widener	surface area 22.2 acres	surface area 11.14 acres
Middle and Inner Reaches widening (along north side)	100 feet over 500 ft. length (i.e. 50,000 ft^2)	50 feet over 450 ft. length i.e. (i.e. 22,500 ft^2)
West Access Channel widening	100 feet on south side 13 feet on north side	no change from width
West Basin Turning Basin	1725 feet diameter	1675 feet diameter

When reviewing the engineering drawings, note that both plans deepen to the same depths and widen the navigation channels in the same general areas. Both add new berths and both remove land areas to increase the size of the West Basin however, Plan A provides for wider navigational channels and maneuvering areas.

2.2.2 Other Ship Traffic

Only one-way traffic was simulated so there was only one ship underway during the simulations however, a ship, appropriate in size and type to each berth, was moored alongside at all of the Port's berths. The specific ship selected for a berth was the one with the widest beam likely to dock at that particular berth. This provided for a worse case analysis of the Plans since the ships at berth reduced the available maneuvering area by their beam widths.

Future passenger and cargo ship berths were also included in the simulator databases of Plans A and B and occupied by a ship as well. These included future berths CT6/7, CT12, NCP5, NCP6 and NCP7. The ships at berth are shown on the attached track plots and a list showing the ship name/type and dimensions at each berth is included in the attached appendices.

2.2.3 Depth Modeling

The depth files used for harbor simulation represent the bathymetric definition of the waterway that included bottom contours and shoals and the navigation channels and channel banks, turning basins, and berth dimensions. The bathymetric model provides an extremely important input and is fundamental to providing a high fidelity simulation. Underkeel clearance and proximity to banks and other underwater features have a fundamental and important effect on the maneuvering characteristics of the ship response models.

Project depths are the same for both Plans A and B (except as dictated by the differences in areas effected) and represent an increase over the Port's existing depths. With respect to impact on the simulation analysis, the channel depths of most interest were those in the areas traversed by the *Jupiter* when partially loaded to a draft of 39.4 feet. This included the Outer, Middle and Inner Reaches. Channel depths in the West Access Channel and West Basin (not normally used by tankers) were of less importance to the evaluation

because of the relatively shallow draft of the *FREEDOM*, which at 27.9 feet, is typical for large modern passenger ships.

The following table shows the existing channel depths, and the depths as modeled in the areas traversed during the simulation tests.

HARBOR FEATURE	EXISTING DEPTH	SIMULATED DEPTH (2009 evaluation)
Entrance Channel (Outer Reach)	44 feet	46 feet
Middle Reach	44 feet	46 feet
Inner Reach	40 feet	44 feet
West Access Channel (east of Sta. 260)	39 feet	43 feet
West Access Channel (west of Sta. 260)	31 & 35 feet	35 feet
West Basin Turn Area	31 & 35 feet	35 feet

The water level was held at datum (i.e., the project depths) during the simulation evaluations to provide for a worse-case analysis. A detailed breakdown of the project proposed depths as prepared by the Port's engineering consulting firm is provided in the attached appendices.

2.2.4 Aids to Navigation

Accurate positioning of fixed and floating aids (buoys) to navigation is an essential part of the visual database. The key aids to navigation used in the evaluation included buoys marking the channel limits and range markers marking the centerline of the middle and inner harbor reaches for each alternative channel plan. The Port Canaveral Pilots worked with STAR Center technicians to position buoys at the most appropriate locations to conform to the Plan boundaries.

The existing inbound channel range markers were shifted slightly north in the alternative Plan A and B geographic models to align them with the new channel centerline created by widening and straightening of this channel. In addition, a new outbound range was created in the simulator model to provide a visual cue for the new channel centerlines when transiting the port outbound.

2.3 **Environmental Conditions**

Since the objective of the evaluation was to compare the navigational safety of the alternative plans, maximum credible adverse environmental conditions of both wind and current were used during all simulations. The Port Canaveral Pilots and Port representatives identified the specific conditions that met these criteria.

According to comments made by the participating Pilots, the wind and current effects that were simulated were deemed to produce a very realistic effect on the handling of both ship response models. The specific conditions modeled were as follows.

2.3.1 Wind Modeling

Winds ranging up to a maximum of 40 knots were used. The general approach was to vary the wind within a five-knot range and set the wind direction at right angles to the inner harbor reaches that is from either the north or the south when the scenario included a transit through these reaches.. A NE wind was simulated for exercises that looked at the most extreme wind conditions in the entrance channel (i.e., 40 knots).

Wind forces are automatically calculated on the simulator based upon wind speed and direction relative to the ship's heading, and the aerodynamic coefficients of the wind profile of each ship response model. The large profile presented by today's large passenger cruise vessels result in a substantial impact on shiphandling due to wind effects. The tanker is less affected by the wind in the partially loaded condition due to its deep draft, broad beam, low freeboard and minimal superstructure in comparison to the passenger ships. In ballast condition however, the tanker would experience slightly more of the wind effect. The relative force of the wind on each of the test ships can be compared by comparing the beam on surface area of each ship as noted in table of ship's principle particulars in the appendices.

2.3.2 Current Modeling

The Pilots provided information on the expected direction and velocity of the current based on the wind direction and speed. They noted that wind driven currents exist offshore in the approaches to Port Canaveral, but are minimal in the harbor itself.

The only current simulated was therefore in the approach channel where these currents runs parallel (north and south) to the shoreline. Since currents in this area are wind driven, the effect of the current on the ship's submerged hull was added to that produced by the wind on the ship's exposed hull and house to provide a worse case condition during the testing. A wind from the north therefore generated a current setting the ship south and visa versa for a southerly wind.

Besides setting a ship in the Entrance Channel, the current produces a strong "shear" effect as a ship enters or leaves the breakwater. The shear is more of a safety concern for an inbound ship because the ship handler has the option of increasing engine speed and accelerating the ship when outbound; increasing speed on the inbound vessel is not a desirable option. The shear effect is caused by the bow entering sheltered water while the stern is still out in the current stream which twists the ship into a sudden yaw.

The current speed was set to maximum velocity for a given wind speed and direction, which assumed a prolonged blow from the direction being tested. Current speed for northerly winds was limited to a southerly set of 0.5 knots due to the limited fetch (intervening land mass) lying to the north of the port. This was adjusted downward from the 1.0 and .75 knots that was originally planned. The maximum northerly set tested was 1.0 knot since open water lies to the south of the Port.

3 SIMULATION PROCEDURES

The simulation procedures used during this evaluation are discussed below.

3.1 Participants

Two of Port Canaveral's Pilots participated in the study by handling the simulated ships and by assisting with fine-tuning of the simulation models and the operational procedures and environmental conditions used during the simulations.

Other persons representing organizations with vested interests in the project were present to observe the simulations. This included representative from Port Canaveral and the engineering consultant firms involved in the development of the designs under evaluation. Also present were representatives from the US Army Corps of Engineers Waterways Experiment Station and the Jacksonville District. These individuals helped shape the direction of the testing program by providing valuable insight into project details such as engineering design criteria and operational priorities.

STAR Center's Senior Researcher and a consultant to STAR Center observed simulated transits, noted results and conducted debriefings after each test run. STAR Center also provided an experienced helmsman to steer the ship under the Pilots' direction and a simulator operator to configure the simulator, monitor proper operation of the simulator, control the assist tugs, capture data, and make track plots for each test run.

3.2 Wheelhouse Procedures

The simulation exercises consisted of a number of partial inbound and outbound transits and maneuvers with a Port Canaveral Pilot controlling the vessel from the simulator wheelhouse just as he would in actual practice. The Pilots took turns conning the ships so that each Pilot could rest between exercises as well as observe the other Pilot's activities. Prior to commencing each exercise, the Pilot at the con was briefed on the test conditions, including the vessel's position, starting speed, load condition if applicable, and the wind and current conditions to be expected. The Pilots started with a familiarization exercise on each ship prior to starting the formal test exercises that were recorded for analysis.

Real-world navigational procedures were used during the exercises so far as practical including real-world commands and the simulated transits occurred in "real-time". The Pilot conned the ship and controlled the bow thruster and engines using the controls on the main consoles. The qualified helmsman was available to steer the ship under the Pilots direction when he chose to control the ship in this manner. The tugs were controlled via hand-held radio communication with the tug Captains (i.e., the simulator operator). The Pilot monitored the ship position relative to the channel boundaries, aids to navigation and ships at berths using the out the window view, by observing the simulator's birds eye plan view and by asking the simulator operator to feedback distances from obstructions or fixed objects.

3.3 Data Collection Procedures

The simulator automatically recorded information during each exercise. This includes the vessel's trajectory and heading and information relating to control settings including a

continuous record of each tug's direction and power output. This information was used to generate the attached track plots and to calculate average ships speed and rates of turn. It was also archived so that the test runs can be played back at a later date or if further analysis is needed.

The Pilots filled out a "Run Evaluation Form" after every exercise. This form solicited specific questions about the just completed test run based on: adherence to intended track line, vessel controllability, and adequacy of assist tugs and overall safety and task difficulty. The Pilots also summarized their opinions regarding the overall test program and operation evaluation by completing a "Final Evaluation Form" after all simulator testing was completed. Comments from this form were used in the formulation of the conclusions appearing in this report. STAR Center's project team kept notes regarding each simulator test and noted simulator specific factors that might influence the interpretation of results. Copies of all Exercise and Final Evaluation Forms are included in the attached appendices.

3.4 Special Procedures

Their will always be differences between the simulated environment and the real world regardless of how sophisticate the simulator. STAR Center has therefore developed a number of special operating procedures to mitigate the effect of these differences on the performance of the shiphandler on the simulator bridge. Some of the principle procedures are discussed below.

3.4.1 Ship Control Procedures on the FREEDOM

The normal real-world practice for maneuvering modern cruise ships in confined Port areas is that the ship's Master maintains the con and manipulates the ship's steering and propulsions controls. The Port Pilot acts as an advisor with regard to local knowledge and Port practices and procedures (e.g., speed limits, passing/meeting, dock line placement, etc.). This is the case because specialized knowledge and familiarity with the ship's systems is necessary. For example, the *FREEDOM* is equipped with a sophisticated dynamic positioning system mode that puts many control functions under computer controlled. However, when maneuvering a modern azipod and bow thruster equipped cruise ship in confined waters, the shiphandler has a number of simpler operational modes that can be used to control the ship.

During simulations, the *FREEDOM* was conned by the Pilots from the centerline console where the azipod controls were located, and from which all indicators, radars and navigation equipment could be seen. The ships dynamic positioning maneuvering mode was not used. The pilots were however given the opportunity to practice handling the *FREEDOM* using the following simpler control modes.

- Combi Mode – ship steers much like a conventional ship, the azi pods turn under helm control and propeller RPM for each pod changes in unison per a single throttle lever
- AziMan – azi-pods are controlled independently, usually one is used as a stern thruster and the other used to control fore and aft speed

The ship's four powerful bow thrusters and engines were under direct Pilot control in both of the above maneuvering modes. When in the Combi mode, the Pilot could steer

the ship himself using a mini-wheel on the console or he could delegate the steering task to the helmsman. Simply stated, the AziMan mode provides the shiphandler with more positive control at low speeds while the Combi mode is better for higher ship speeds. Making a distinction between the ships control modes is important because the ship handler can drastically reduce a ships crab angle in high wind conditions by switching from Combi to AziMan mode.

The usual progression of control is that an inbound ship would be in the Combi mode in the Entrance Channel and be changed over to the AziMan mode in the more confined inner harbor areas.

3.4.2 Bridge Wing View

During simulation, the normal position of the eye point represented by the simulators out-the window view is in the center of the simulator wheelhouse. Close quarters maneuvering such as docking and undocking often requires that the shiphandler work from the bridge wing in order to observe the clearance to moored vessels or shore side structures. In the real world, this is accomplished by merely walking out to the ships wing.

On the simulator the ability to view the operation from the bridge wing is facilitated by moving the eye point of the visual scene laterally to the outer edge of the simulated ship's side, or in the case of some vessels, to the extended bridge wing beyond the ship's beam. This permits the shiphandler to see the entire side of the vessel near the pier, to look around obstructions such as cranes or deck cargo on the foredeck, or to view objects that are astern of the ship.

3.4.3 "Birds Eye View"

For docking maneuvers and turning around in the turning basin, a "bird's-eye view" display was provided on the console. This display provides a plan view of the harbor area and is similar in some respects to an ECDIS (Electronic Chart Data Information System), lacking only the detailed chart information.

4 RESULTS

Testing took place during three consecutive days in June 2009. A test plan consisting of 16 scenarios was used as the basis of the program. Additional runs were added as time and conditions allowed so that a total of 20 simulation exercises were completed. In all, 18 exercises were retained for analysis and 2 were discarded because simulation related factors rendered their results unusable.

The test plan provided a head to head comparison of the Plans by simulating identical conditions for Plan A and Plan B. This included wind, current, ship and direction of transit. Exercises were numbered sequentially with Plan A first then Plan B under the identical conditions; an odd number was assigned to an exercise using Plan A and an even number assigned to an exercise in Plan B.

While the exercises have sequential numbers, the exercises were not run in their sequential order on the simulator. That is, the order that the Pilots actually completed the exercises was randomized except that exercise on the first day of testing used the *Jupiter* exclusively and exercises on days 2 and 3 were with the *FREEDOM* exclusively. Alternating between test conditions helped to prevent a learning effect due to the back to back running of the exact same conditions twice in a row. A table listing all completed exercises and associated test conditions is provided in the attached appendices.

4.1 Criteria for Evaluating Results

The following are the main factors that were considered during evaluating and interpretation of the results of the simulation tests.

4.1.1 Pilots Overall Safety Rating

Since the simulations considered the maximum credible adverse environmental conditions, a key factor in the comparison of the plans is their relative safety. As noted earlier, the Pilots filled out an “Run Evaluation Form” after every test run which included an Overall Safety rating. The rating assigned by the Pilots was based on a 5 point scale where a rating of 5 = “Absolutely Safe” and a Rating of 1 = “Not at All Safe”. The overall safety rating for each exercise is documented in these Debriefing Forms and is therefore reported is this section.

4.1.2 Surge Effects

Hydraulic effects caused by the displacement of a large volume of water during the passage of vessels transiting the channel can cause problems in the Trident Basin, home to Navy submarines and other support vessels or any passenger vessels moored at the outer cruise terminal docks (CT2 to CT4). Speed control in the Middle and Inner Harbor is an important factor in order to minimize surging impacts on any ships that are berthed along the channel. Another factor to minimize surge effects is lateral distance form the moored vessel. Maintaining the north side of the channel as much as practical depending on environmentals, contributes to a lessened effect. The maximum speed that the Pilots stated was acceptable in these reaches was in the 6 to 6.5 knot range.

The extreme wind conditions imposed during a simulation exercise forced the Pilots to go as fast as they dared to help maintain control and to minimize crab angle. Therefore, consistent differences in average speed when transiting the Inner and Middle Reaches would be indicative of a safety advantage of one plan over another. That is, a higher

average speed equates to a lower margin of safety and a higher probability of surge damage to other ships. The ship's average ground speed was therefore calculated for each exercise for that portion of the transit between the east side of the Trident Basin and the east side of the Middle Basin.

Note that maintaining an adequate lateral distance when going past the cruise ships at berths CT3 and CT4 is also important to minimizing surging impacts since hydrodynamic forces are a function of both speed and separation distance. In this regard, Plan A has a built in advantage over Plan B since it provides 50 feet of additional width on the north side of the channel. Conversely, the negative impact of a higher ship speeds is amplified in Plan B.

4.1.3 Proximity to Channel Boundary

The shiphandler strives to maintain adequate clearance between the ship and channel boundaries. First and foremost this is to insure a margin of safety against grounding. In addition, when a ship has significant headway, the closer that a ship is to an underwater bank and the faster it is moving, the larger the hydrodynamic force on the ship's hull due to its interaction with the channel bank walls. The resultant "bank cushion" or "bank suction" can make it more difficult to control a ship's heading, and, under extreme conditions, can overwhelm a ship's rudder and cause a dangerous uncontrolled shear away from the bank.

The track plots, which provide a visual record of the ships clearance to the channel boundary, were therefore examined and are referenced in this section as appropriate. Track plots of all exercises, including expanded scale track showing details in areas of interest, are therefore provided in the attached appendices.

The Pilots also rated their bank clearance in the Entrance Channel and in the West Basin area in the Run Debriefing Forms. The rating assigned by the Pilots was based on a 5 point scale where a rating of 5 = "Extremely Satisfactory" and a Rating of 1 = "Not at All Satisfactory". The ratings, as documented in the Debriefing Forms, are therefore reported is this section when appropriate.

4.2 *Jupiter* Exercises

There were six exercises using the tanker *Jupiter*. All exercises retained for analyses were completed without serious mishaps. The exercise conditions and a summary contrasting the results in each plan is shown in the following table.

Exercise Numbers (A & B)	Wind &Current Conditions	Transit Direction	Pilot's Overall Safety Rating		Turn Widener Clearance Rating		Ave. Speed Middle & Inner Reaches	
			Plan A	Plan B	Plan A	Plan B	Plan A	Plan B
5 & 6	S 25/30 kts, N .75 kts.	inbound	3.5	2	4	2	4.7 kts.	4.5 kts.
7 & 8	N 25/30 kts, S .5 kts.	outbound	4.5	2.5	5	2	8.6	8.5
19 & 20	S 25/30 kts, N 1.0 kts.	outbound	NR	3	4	3	7.1	6.7

Exercises on the *Jupiter* were limited to examining the Entrance Channel turn widener and Middle and Inner Reach wideners since areas west will be too shallow to accommodate vessels drawing as much as the partially loaded *Jupiter*. *T*he area transited therefore ranged from the south of Buoy #9 in the Outer Reach through where the Middle Reach joins the Middle Basin.

The overall safety rating for the six exercises indicates that the Pilots thought that Plan A provided a better margin of safety than did Plan B for both the partially loaded and ballasted version of the ship. Both Pilots also commented that the increased depths in the Entrance Channel and Inner Harbor improved the overall handling of the partially laden *Jupiter*. Observed results in each channel segment are discussed below.

4.2.1 Results in Entrance Channel Turn Widener

Ship clearance to the channel boundaries was consistently rated as satisfactory in Plan A and unsatisfactory in Plan B. A visual inspection of the trackplots shows marginal clearance in exercise #6 only, however, closer inspection of the trackplots suggests a slower and more controlled turn through the bend that provides a smoother transition between the Outer and Middle Reaches facilitated by the larger turning radius allowed by Plan A.

4.2.2 Results in Middle and Inner Harbor Reaches

Average speed through the reaches was essentially the same for both Plans. While Plan A should have allowed the ship to pass further north of the docked ships, this did not consistently happen on the simulator. Differences between the two plans with regard to the potential for damaging the berthed passenger ships and with regard to clearance to the northern channel boundary was therefore not demonstrated on the simulator. The Pilots however, were definitely more comfortable in Plan A as expressed in their Final Debriefing Form comments. This fact is attributed to the fact that the wider channel in Plan A, while not utilized by the ship, did provide increased tug boat maneuver room should it be required.

4.3 FREEDOM OF THE SEAS Exercises

There were twelve exercises aboard the *FREEDOM* and 11 of the 12 exercises retained for analyses were completed without serious mishaps. The only problem occurred in exercise #2 when the Pilot grounded the ship on the north side of the Inner Reach widened per Plan B. The grounding was however, a direct result of the Pilot's unfamiliarity with simulator bridge equipment, and not indicative of vessel handling problems. The vessel would have grounded in either Plan A or B, and was discounted as mechanical problems in our analysis.

The exercises conditions and a summary contrasting the results in each plan are shown in the following table.

Exercise Numbers (A & B)	Wind &Current Conditions	Transit Direction	Pilot's Overall Safety Rating		Turn Widener (West Basin) Clearance Rating		Ave. Speed Middle & Inner Reaches	
			Plan A	Plan B	Plan A	Plan B	Plan A	Plan B
1a & 2	N 30/35 kt, S .5 kt.	inbound	5	2	5 (5)	2 (4)	5.8	8.8
3 & 4	S 30/35 kt, N 1.0 kt.	inbound	4	4	5 (5)	5 (5)	4.0	5.8
9 & 10	N 30/35 kt, S .5 kts.	outbound	5	4	4	3	8.8	10.1
11 & 12	S 30/35 kt, N 1.0 kt.	outbound	4	NR	4	4	5.6	7.0
13 & 14	S 35/40 kt, N 1.0 kt	inbound	3	NR	4	4	NA	NA
15 & 16	NE 30/35 kt, S .5 kt.	outbound	2	3.5	4	5	NA	NA

Exercises on the *FREEDOM* included all of the areas under evaluation. Therefore areas transited ranged from south of Buoy #9 in the Outer Reach through to the West Basin Turning Area.

The Pilots' overall safety rating for the exercises suggest that Plan A offers a slight to moderate safety advantage over Plan B. The ratings do not however reflect the strong preference for Plan A voiced by the Pilots in their Final Debriefing Forms. This may be attributable to the fact that the *FREEDOM* is an exceptionally powerful and sure handling ship and the Pilots were able to keep the ship safe and under firm control in both plans, even under the extreme environmental conditions. The opinions expressed in the Final Debriefing Forms take into account that fact that the Pilots are very aware that not all ships as easily controlled as is the *FREEDOM*.

Observed results in each segment of the waterway are discussed below.

4.3.1 Results in Entrance Channel Turn Widener

Twelve exercises included transits through the Entrance Channel Turn Widener on the *FREEDOM*. The Pilots rating for clearance to the channel boundaries was only marginally better for the Plan A widener however, the Pilots pointed out that the Plan A widener allowed for a smoother, more gradual turn during both inbound and outbound transits that was facilitated by the larger turning radius provided by the increased area in Plan A.

The Pilots observation is confirmed by the ships maximum rate-of-turn as recorded by the simulator and as can be seen by closely examining the trackplots. Analysis of the simulator data showed a consistently lowered maximum rate of turn in the Plan A exercises when transitioning between the Middle and Outer Reaches.

The advantage of the Plan A over the Plan B widener is most observable on the trackplots of the four exercises that used the most extreme environmental conditions (wind 35 to 40 knots) and that only transited the wideners, i.e., exercise #s 13 & 14 and 15 & 16. The trackplots clearly illustrate a slower rate of turn and smother transition between the Outer and Middle reaches in the Plan A exercises.

4.3.2 Results in Middle and Inner Harbor Reaches

Eight exercises included the transit through the Middle and Inner Harbor Reaches. The results show that, given identical environmental conditions, the Pilots were consistently able to transit the reaches at a lower speed in Plan A (see previous summary table). This performance demonstrates a measurable increased margin of safety over Plan B and it is consistent with the Pilot's extensive description of the navigational issues as documented in their Final Debriefing Forms.

4.3.3 Results in West Access Channel

Eight exercises examined the transit through the West Access Channel. The trackplots show that, given identical environmental conditions, the Pilots were able to safely transit the area in both Plans A and B. Plan A did provide for a greater clearance to the channel boundaries, however, the reduced clearance was not significant given the powerful maneuvering capability of the *FREEDOM*.

4.3.4 Results in West Basin Turning Area

The Freedom was turned in the Turning Basin area in four exercises (i.e., 1a&2 and 3&4). The smaller radius West Basin (by 50 feet) provided by Plan B proved adequate and safe for the *FREEDOM* and the Pilots rated the channel boundary clearance as satisfactory for both Plans A and B.

5 CONCLUSIONS AND RECOMMENDATIONS

The simulation evaluations demonstrated that both Plans A and B can accommodate the design vessels, even during maximum credible adverse environmental conditions. However, it was also demonstrated using both the *Jupiter* and *FREEDOM OF THE SEAS* design vessels that Plan A provides a significantly wider margin of safety over Plan B in the Inner and Middle Reaches and, to a lesser extent, in the Entrance Channel turn widener. These findings are supported by the observed results of the simulations and by the strong endorsements of the participating Port Canaveral Pilots

The Pilots were also of the opinion that Plan A would provide significant safety advantages over Plan B in the West Access Channel and in the West Basin Turning area. The advantages noted by the Pilots were however not directly observable during the simulated transits on the design vessel, the *FREEDOM OF THE SEAS.*

A more detailed discussion of the conclusions and associated recommendation follows.

5.1 Middle and Inner Harbor Reach Wideners

The simulation exercises clearly demonstrated a safety advantage of Plan A over Plan B during transits of the *FREEDOM* as reflected in consistent an significantly lower transit speeds in the reaches with the Plan A widening. The effect on transit speed was not observed on the *Jupiter*, however, a greater clearance to the north channel boundary on the deeper draft *Jupiter* was available in Plan A's wider channel. In addition, the Pilots strongly endorsed Plan A and they provided a comprehensive explanation of its advantages from the ship handler's perspective in their Final Evaluation Forms which are reproduced in the appendices.

Therefore, STAR Center recommends that the Middle and Inner Harbor reaches be improved per the Plan A design.

5.1.1 Outbound Ranges

The Pilots made extensive use of the outbound range during all of the outbound simulations during this evaluation. Both Pilots noted that the range is particularly helpful when handling large cruise ship with the house forward and that the range would enhance the safety of nighttime transits. They also strongly recommend that the centerline range be included in the project in their Final Evaluation comments.

STAR Center concurs that an outbound range marking the centerline of the Middle and Inner Harbor reaches be included in the final project design for either Plan A or Plan B. Entrance Channel Turn Widener

The simulations also clearly demonstrated that the entrance channel widener in Plan A allowed for a smoother transition with a lower rate of turn between the Outer and Middle Harbor reaches. This is especially important to passenger ships which must limit their turn rates to insure that the ship does not develop a list (heel angle) that is avoided on any and all passenger vessels.

The smoother turn was especially beneficial for an inbound ship with a strong southerly wind, which caused a shear current effect at the breakwater. In this case, both the wind and current acted in concert to turn the ship to the left towards the passenger ship at CT4

as the ship was passing through the breakwater. The smoother and more controlled turn in Plan A allowed the Pilot to better position and control of the ship as it entered the Middle Reach and likely contributed to the dramatically improved performance seen in the Middle and Inner Reaches. The two Plan A design elements in effect worked together to improve safety margins for an inbound ship during extreme environmental conditions.

STAR Center concurs that the Plan A Entrance Channel widener be implemented in tandem with the Middle and Inner Reach Plan A widener.

5.2 West Access Channel Widening and West Basin Turn Area

Both Plans were observed to be equally safe and usable by the *FREEDOM*. While Plan A did provide a larger clearance to the channel boundaries, the added space was not needed given the exceptional power and maneuverability of this particular design ship.

Given that the simulation evaluation finding are restricted to the observed results using the two design ships (see discussion below), STAR Center must conclude that both Plans A and B are acceptable from a navigational safety perspective for these waterway segments.

5.3 Channel Depths

While only two exercises were completed on the deeply laden, partially loaded tanker, both Pilots reported that the increased project depths, as modeled in the simulations, provided a more acceptable underkeel clearance for the deep draft vessel. They noted that the added depth improved the ship's maneuverability, shortened its stopping distance and reduced the chances of the ship bottoming out due to ship movement in a seaway or due to squat.

5.4 Related Observations

A simulation evaluation is narrowly focused on a few key operations and/or areas out of economic and technical necessity. Ship's Masters, Pilots, Port Officials, tug Captains and other participants in a simulation evaluation on the other hand, have a much more encompassing and integrated understanding of the environment being simulated. Consequently, these individuals often logically deduce and report other benefits or predict problems not directly addressed by the simulations. It is often the case that this is due to what they have observed on the simulator or is a result of discussions with the other participants.

This evaluation was especially productive in this regard and the reader is referred to the attached Final Debriefing Forms where the Pilots commented extensively on what they believe are advantages of Plan A over Plan B. Their main observations not necessarily addressed in simulations are briefly described below.

- the increased channel depth (in both Plans A and B) would reduce or totally eliminate "tide jobs where the movement of deep draft commercial ships is delayed due to the higher priority given to passenger ships

- the wider Plan A could enable two-way-traffic to be permitted in some areas of the channel, with smaller vessels that operate at Port Canaveral
- additional width of Plan A Entrance Channel widener may provide an "escape plan" for small to moderate size vessels in the event of an emergency (steering or engine casualty for example) while transiting the Outer Reach
- the Plan A West Basin would provide additional room and a wider safety margin when maneuvering ships that require tug assistance
- the larger West Basin and widened West Access depicted by Plan A Channel could accommodate cruise ships larger than the design ship (e.g., *GENESIS* Class)
- the Plan A widening along the south side of the West Access Channel provides for advanced maintenance dredging and thus reduces the chances of a grounding should the area silt in prior to maintenance dredging

Figure 1 - Plans A and B

SHIP PARTICULARS AZI / AZIMUTHING POD

SHIP NAME FREEDOM OF THE SEAS *FILE NAME* CR112DE

SHIP TYPE cruise *LOAD COND* Design

TONNAGE 72,330 *DWT* [ ] *DISPL* [X] *GRT* [ ] *Aero:* 13020

EYEBOW: 43.8 | 144 *Ft.* *Height Eye* 34 | 110 *Ft.* *EYESTERN:* 295.1 | 968 *Ft.*

Air Draft 64 | 210 *Ft.* *BEAM Bridge Wing* 47 | 154.2 *Ft.*
(If Wider than Beam)

LOA	338.9	1,111.6 *Ft.*	*Draft*		
LBP	303.3	994.8 *Ft.*	*FWD*	8.5	27.9 *Ft.*
W/L BEAM	38.6	126.6 *Ft.*	*AFT*	8.5	27.9 *Ft.*

PROPULSION Diesel Azipod

AZIPOD NO. 3 *SHAFT HP* 18,774 *EACH*

PROPELLER DIRECTION Inwar *TYPE* *FIXED* X *VARIABLE* [ ]

BOW THRUSTERS 4 *HP* 4,425 *EACH*

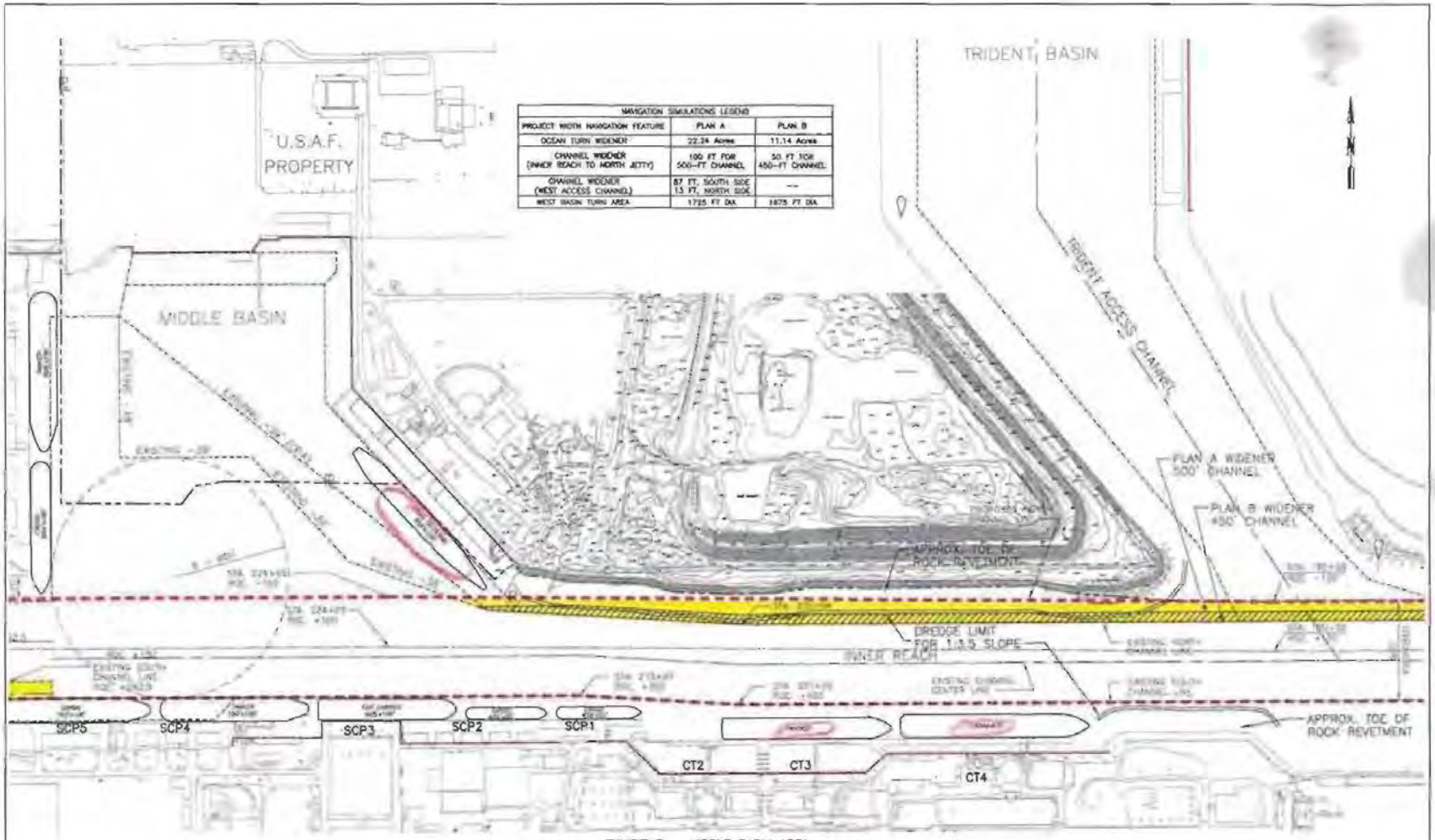
Shaft RPM and Speed

MANEUVERING

MAX_RPM 143 MIN_RPM: [ ] Max Speed: 23.3

Lever Position		RPM	Speed Shallow	Speed Deep
8	FULL AHD:	134	20	22
5	HALF AHD:	67	11	11
3	SLOW AHD:	36	6	6
1	DSLOW AHD	20	3	3
8	FULL ASTN	111	12	13
5	HALF ASTN	68	8	8
3	SLOW ASTN	35	4	4
1	DSLOW ASTN	18	2	2

APPENDIX B – Engineering Drawings for Navigation Simulations



NAVIGATION SIMULATIONS LEGEND		
PROJECT WIDTH NAVIGATION FEATURE	PLAN A	PLAN B
OCEAN TURN WIDENER	22.24 Acres	11.14 Acres
CHANNEL WIDENER (INNER REACH TO NORTH JETTY)	100 FT FOR 500-FT CHANNEL	50 FT FOR 450-FT CHANNEL
CHANNEL WIDENER (WEST ACCESS CHANNEL)	87 FT, SOUTH SIDE 13 FT, NORTH SIDE	--
WEST BASIN TURN AREA	1725 FT DIA	1675 FT DIA

EXHIBIT 7 – MIDDLE BASIN AREA

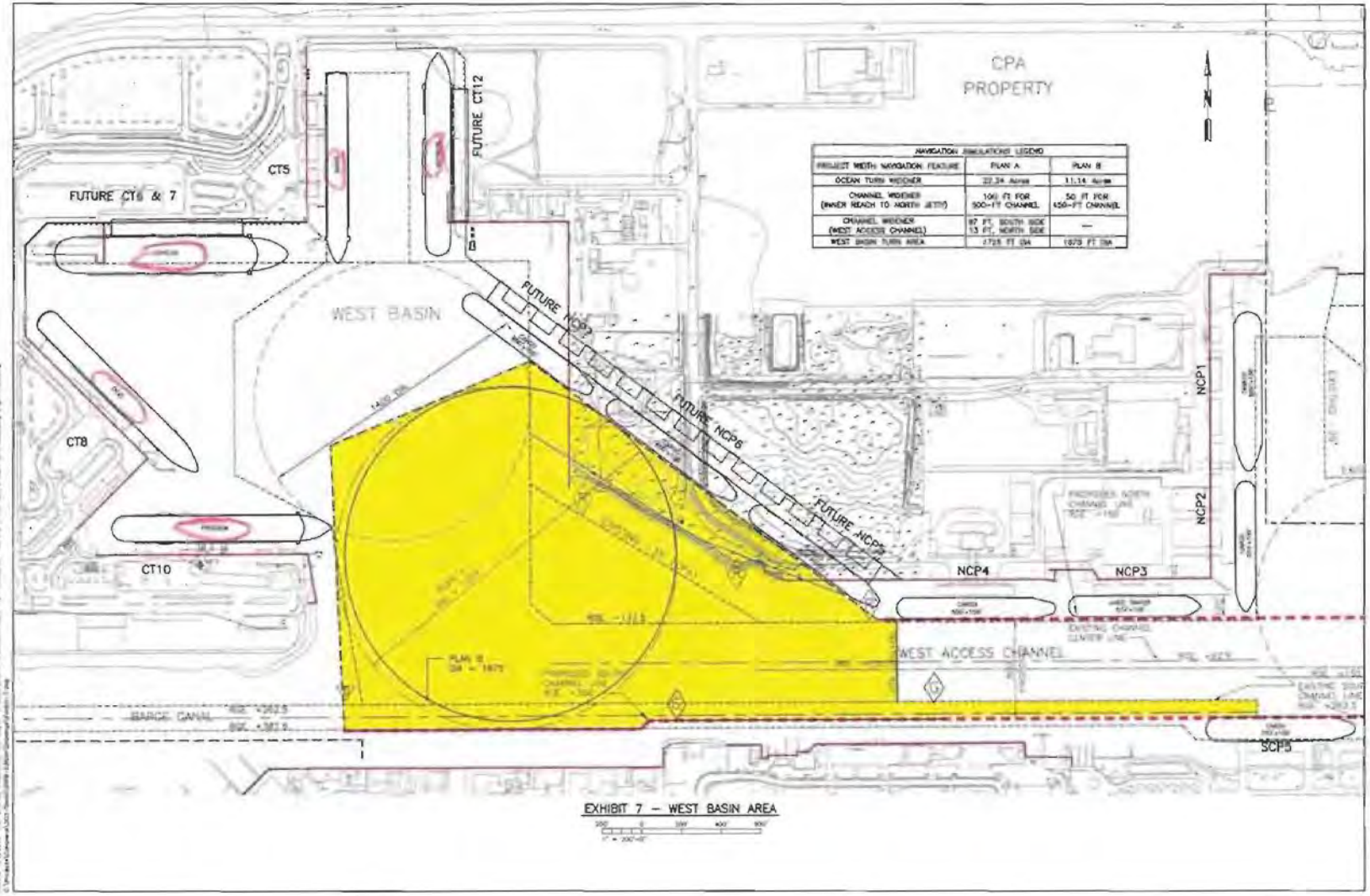


EXHIBIT 7 – WEST BASIN AREA

APPENDIX C

SHIPS AT PIERS FOR SIMULATIONS

Cruise Pier	Ship Type	GRT	Length (ft)	Beam (ft)	Draft (ft)
CT3	Fantasy Class	70,400	855	103.3	26
CT4	Conquest Class	110,000	952	116.5	27
CT4	Destiny Class	101,400	893	116.5	27
CT5	Spirit Class	84,000	960	105.6	26
Future CT6/7	Genesis Class	220,000	1187	154	30
CT8	DCXL Class	122,000	1115	121	27
CT10	Freedom Class	158,000	1112	127	28
Future CT12	Voyager Class	138,000	1021	127	28

Cargo/Fuel Pier	Ship Type	DWT	Length (ft)	Beam (ft)	Draft (ft)	
SCP1	Sunbelt Spirit-Car Carrier	17,950	696	105.7	32	air draft = 125 ft
SCP2	Bulk-BreakBulk	Green Spring	409	60?	24	
SCP3	Bulk-BreakBulk	Prince of Seas	428	62	25.5	
SCP4/TB1	Tanker	65,000	750	105.6	39.5	max draft = 42.7 ft
SCP5	Bulk-Limestone	67,000	753	105.6	39.5	max draft = 43.3 ft
NCP1	Tanker	110,000	800	138	39.4	max draft = 48.9 ft
NCP2	Bulk-BreakBulk	47,027	653.6	100	38.8	Saga Andorinha
NCP3	Bulk-BreakBulk	43,420	672	105.6	37.4	Cutrale Juice
NCP4	Cargo-Sm Cont	45,000	800	105.6	39.4	
Future NCP5	Cargo-Sm Cont	45,000	800	105.6	32.5	max draft = 39.4 ft
Future NCP6	Cargo-Sm Cont	45,000	800	105.6	32.5	max draft = 39.4 ft
Future NCP7	Cargo-Sm Cont	45,000	800	105.6	32.5	max draft = 39.4 ft
Poseidon Pier	MPS-LMSR Ship	USNS Gilliland	954	105.7	31	Bow at SE end of pier

PROJECT DEPTHS FOR SIMULATIONS

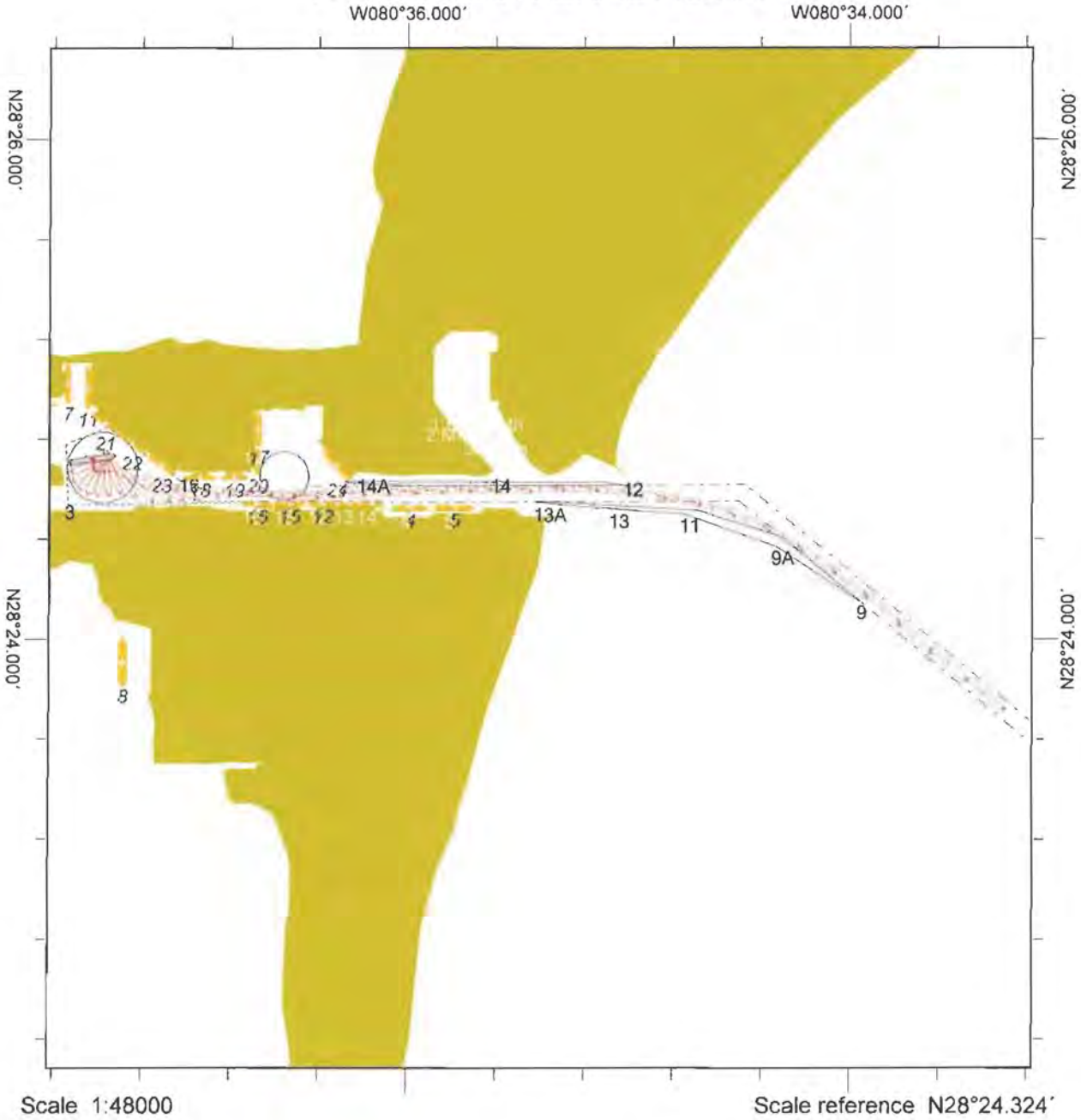
Canaveral Harbor Feature	Existing Project Depth (ft)	Simulation Project Depth (ft)
Outer Reach	44	46
Navy Widener	44	46
Civil Widener	41	46
Plan A Widener	–	46
Plan B Widener	–	46
Middle Reach	44	46
Trident Access Channel	44	44
Trident Basin	41	41
Inner Reach	40	44
Middle Basin	39 & 35 & 39 (CPA)	43 & 35
West Access Channel (East of Sta 260+00)	39	43
West Access Channel, Cut A (West of Sta 260+00)	31 & 35 (CPA)	35
Plan A or B TB at WB Entrance	31 & 35 (CPA)	35
Remainder of West Basin	31 & 35 (CPA)	35

APPENDIX D – Test Plan (as run)

Ex. #	Seq.*	Pilot	Project Element(s) Evaluated	Plan	Ship	Dir.	Wind	Current
1	1	1	not included in evaluation					
1a	13	1	Outer, Middle & Inner Reaches, West Access Channel & West Basin	A	Freedom	Inbound	N 30/35	S 0.5
2	2	2	Outer, Middle & Inner Reaches, West Access Channel & West Basin	B	Freedom	Inbound	N 30/35	S 0.5
3	3	2	Outer, Middle & Inner Reaches, West Access Channel & West Basin	A	Freedom	Inbound	S 30/35	N 1.0
4	4	1	Outer, Middle & Inner Reaches, West Access Channel & West Basin	B	Freedom	Inbound	S 30/35	N 1.0
5	14	2	Outer, Middle & Inner Reaches	A	Jupiter	Inbound	S 25/30	N .75
6	15	2	Outer, Middle & Inner Reaches	B	Jupiter	Inbound	S 25/30	N .75
7	16	1	Outer, Middle & Inner Reaches	A	Jupiter	Outbound	N 25/30	S 0.5
8	17	1	Outer, Middle & Inner Reaches	B	Jupiter	Outbound	N 25/30	S 0.5
9	5	1	Outer, Middle & Inner Reaches, West Access Channel	A	Freedom	Outbound	N 30/35	S 0.5
10	6	2	Outer, Middle & Inner Reaches, West Access Channel	B	Freedom	Outbound	N 30/35	S 0.5
11	7	2	Outer, Middle & Inner Reaches, West Access Channel	A	Freedom	Outbound	S 30/35	N 1.0
12	8	1	Outer, Middle & Inner Reaches, West Access Channel	B	Freedom	Outbound	S 30/35	N 1.0
13	9	2	Outer and Middle Reahces	A	Freedom	Inbound	S 35/40	N 1.0
14	10	1	Outer and Middle Reahces	B	Freedom	Inbound	S 35/40	N 1.0
15	11	1	Outer and Middle Reahces	A	Freedom	Outbound	NE 35/40	S 0.5
16	12	1	Outer and Middle Reahces	B	Freedom	Outbound	NE 35/40	S 0.5
19	20	1	Outer, Middle & Inner Reaches	A	Jupiter	Outbound	S 25/30	N 1.0
20	21	2	not included in evaluation					
20a**	22	2	Outer, Middle & Inner Reaches	B	Jupiter	Outbound	S 25/30	N 1.0

* Sequential order that exercises were completed
** Trackplot for this exercises is designated as Exercise #21, Pilot's Run Evaluation Form is designated as Run #20

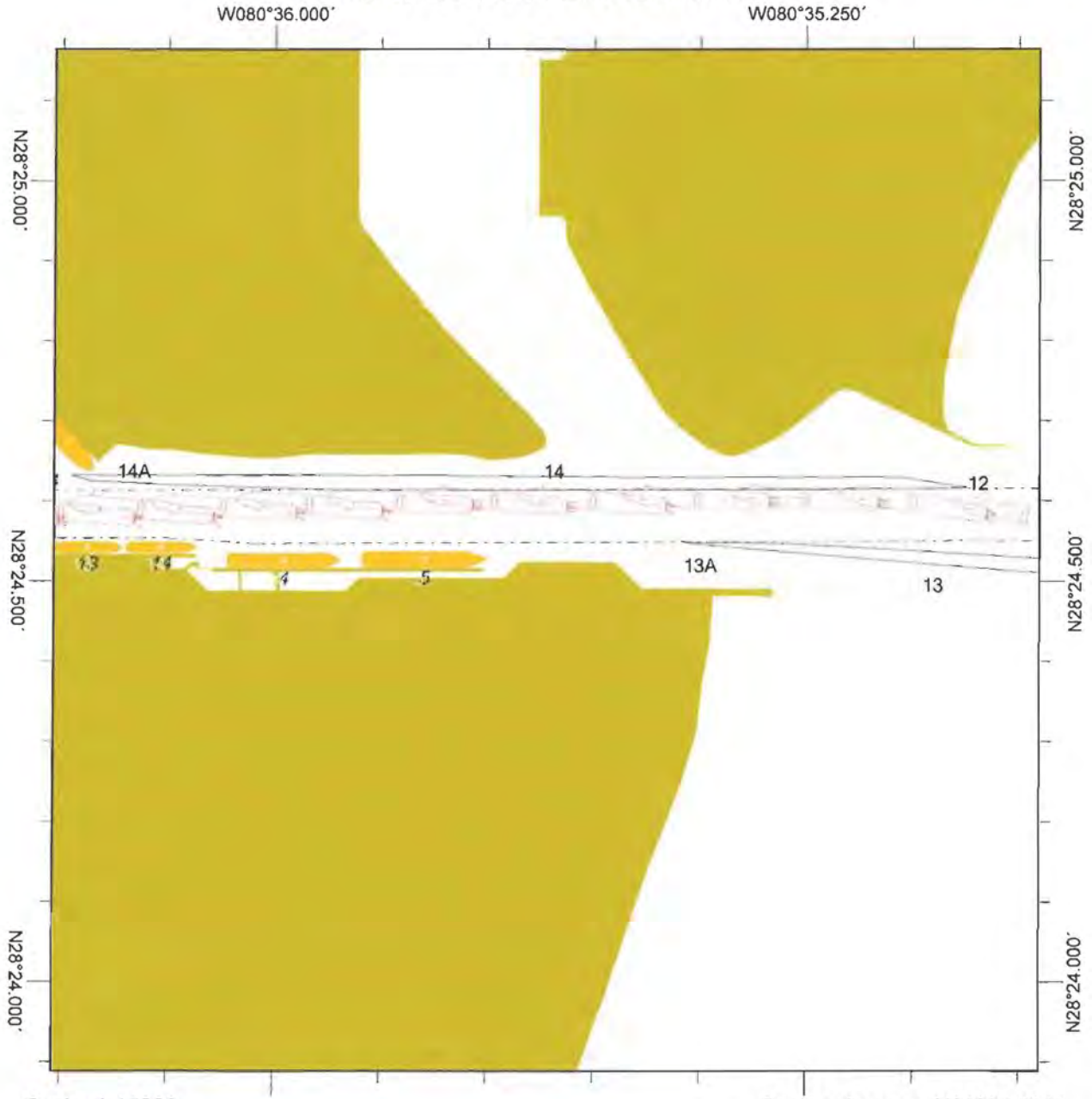
PORT CANAVERAL Run #1



Comments: Wind: N30-35kts / Current: S0.5kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run #1



Scale 1:15000 Scale reference N28°24.526′

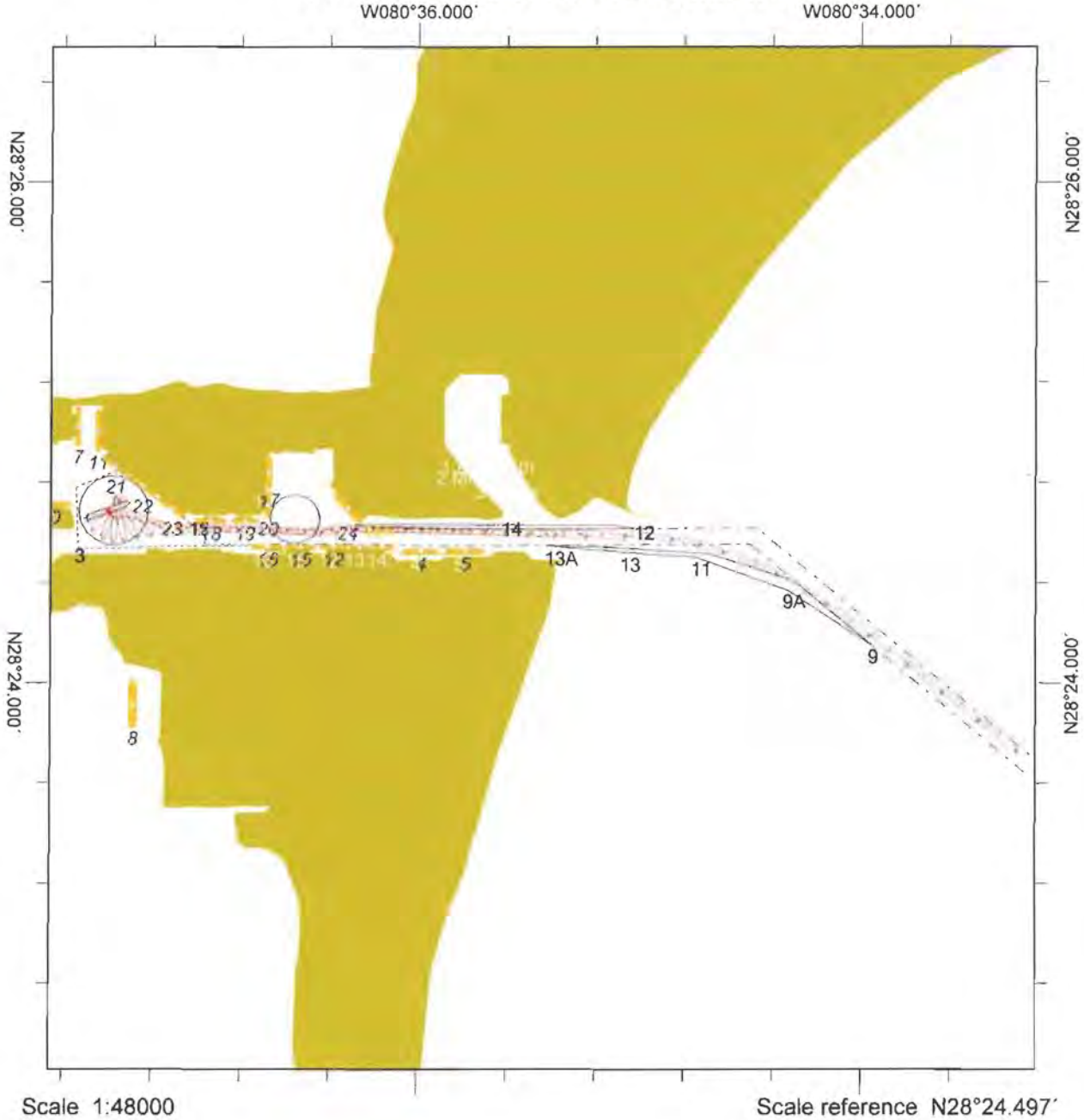
0.1 0.000 0.125 0.250 0.375 0.500 n.mile

200 0 250 500 750 1000 m

Comments: Wind: N30-35kts / Current: S0.5kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run#1A



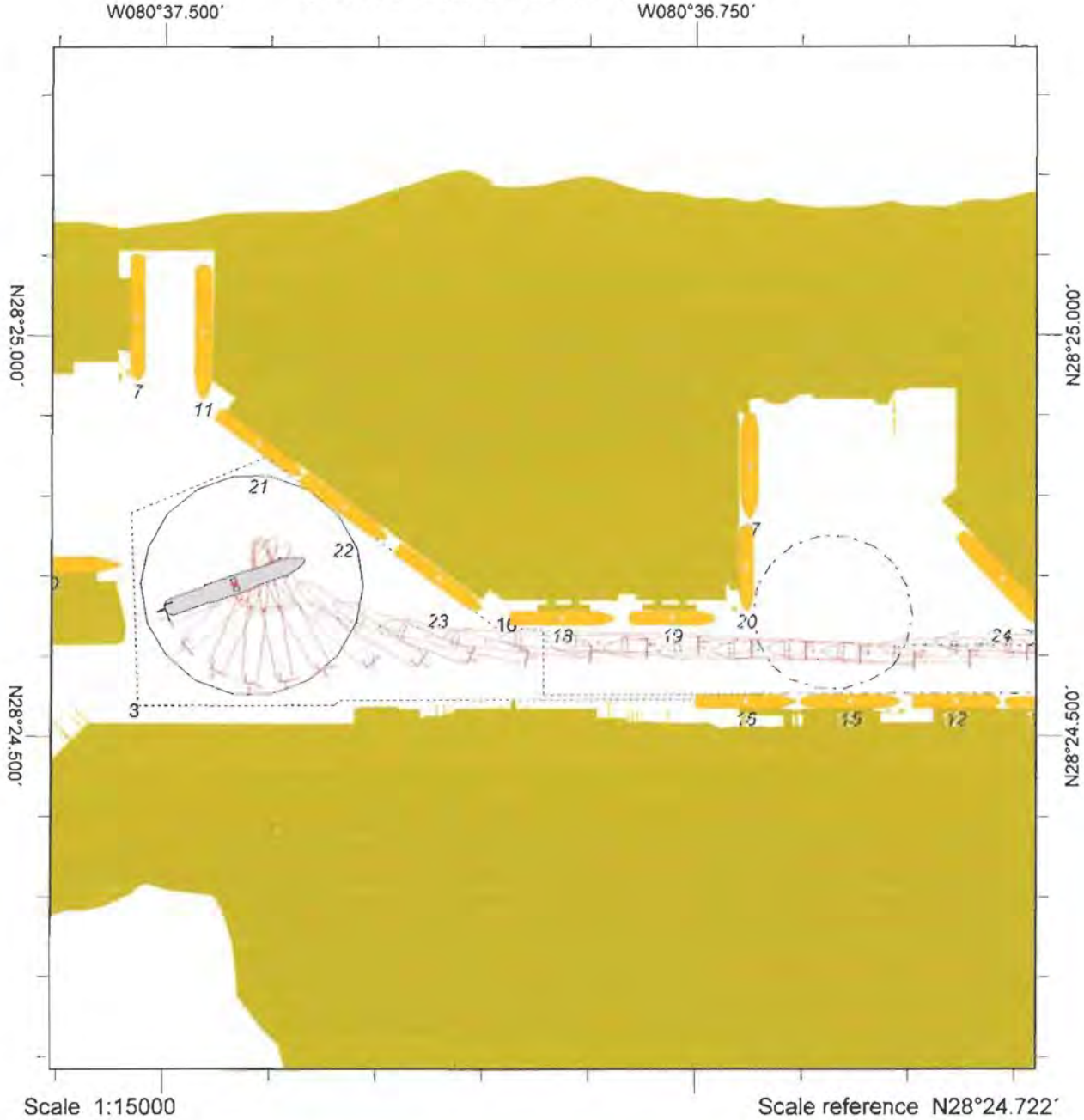
0.5 0.0 0.5 1.0 1.5 n.mile

500 0 750 1500 2250 3000 m

Comments: Wind: N30-35kts / Current: S0.5kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run#1A



Scale 1:15000 Scale reference N28°24.722′

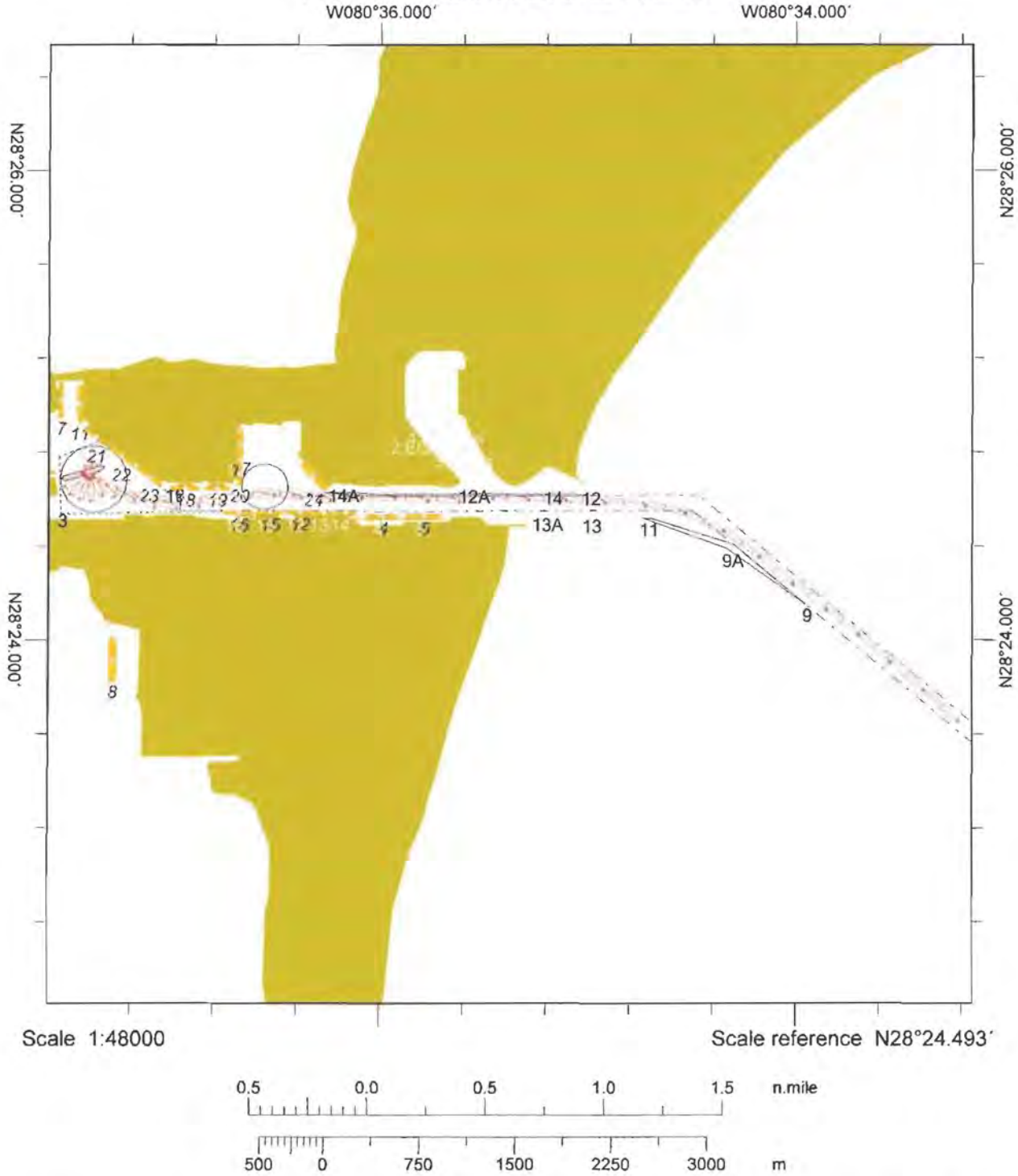
0.1 0.000 0.125 0.250 0.375 0.500 n.mile

200 0 250 500 750 1000 m

Comments: Wind: N30-35kts / Current: S0.5kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

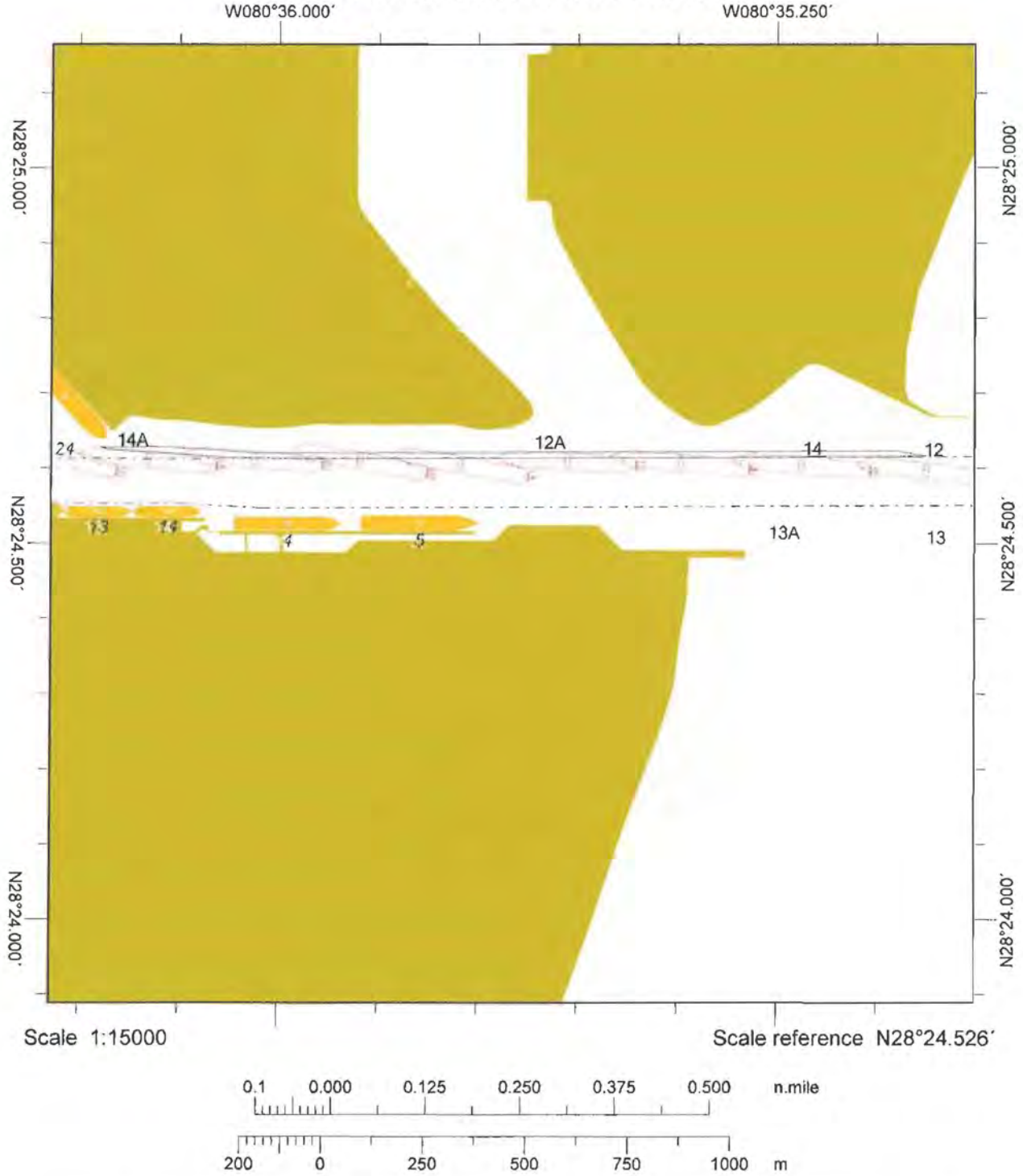
PORT CANAVERAL Run#2



Comments: Wind: N30-35kts / Current: S0.5kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

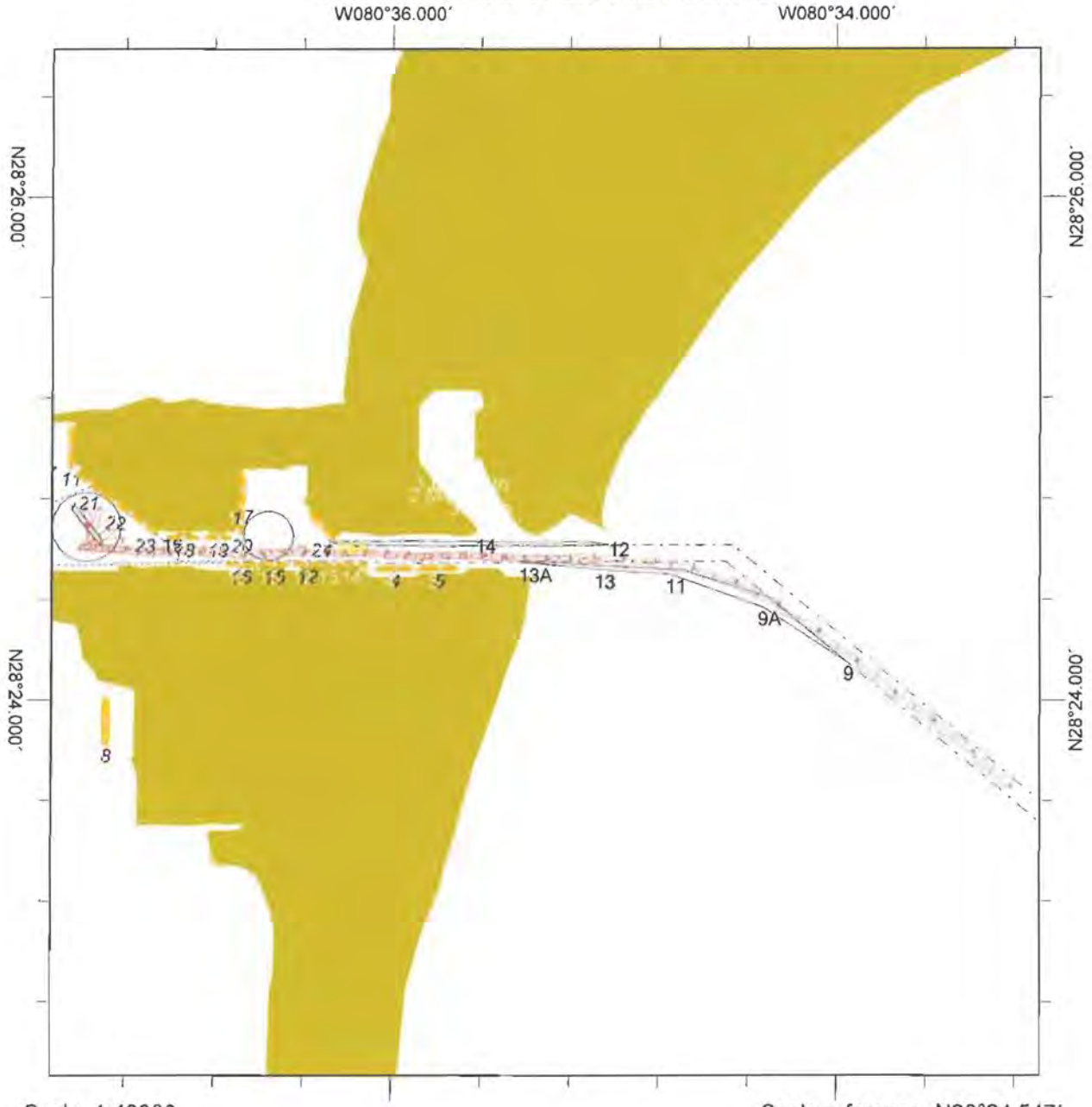
PORT CANAVERAL Run#2



Comments: Wind: N30-35kts / Current: S0.5kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run#3



Scale 1:48000 Scale reference N28°24.547′

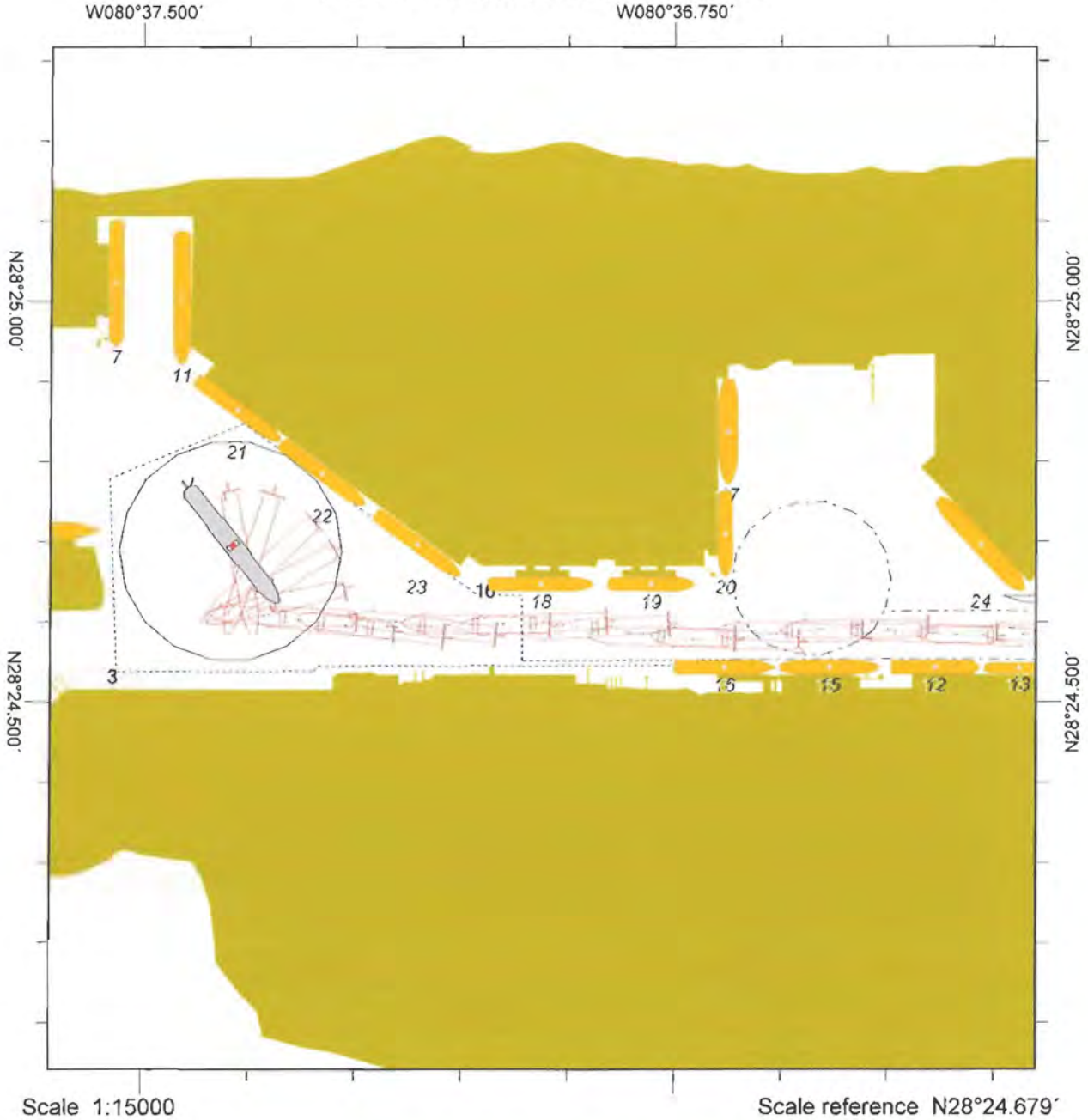
0.5 0.0 0.5 1.0 1.5 n.mile

500 0 750 1500 2250 3000 m

Comments: Wind: S30-35kts / Current: N1.0kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run#3



Scale 1:15000

Scale reference N28°24.679´

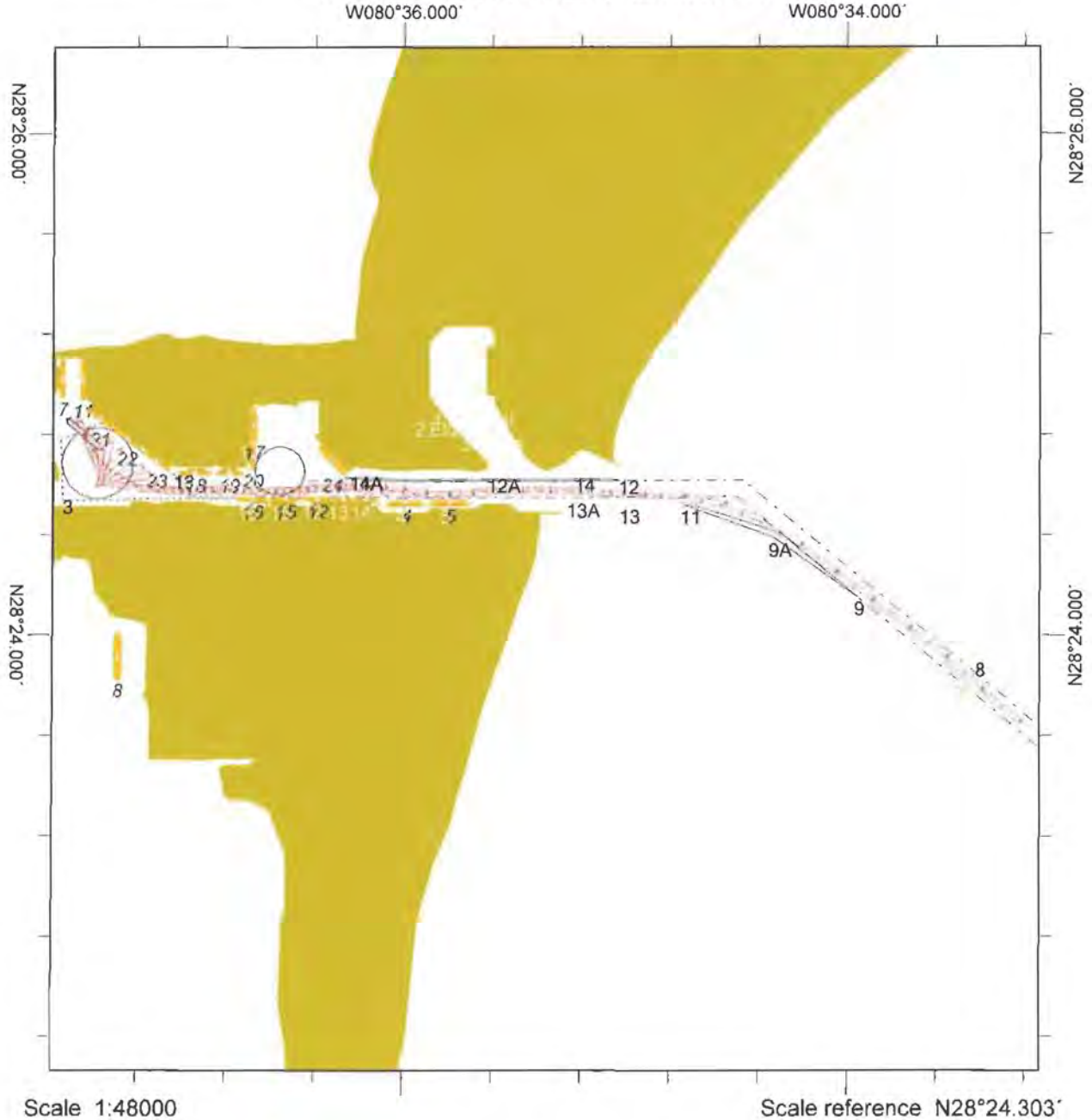
0.1 0.000 0.125 0.250 0.375 0.500 n.mile

200 0 250 500 750 1000 m

Comments: Wind: S30-35kts / Current: N1.0kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run#4



Scale 1:48000 Scale reference N28°24.303'

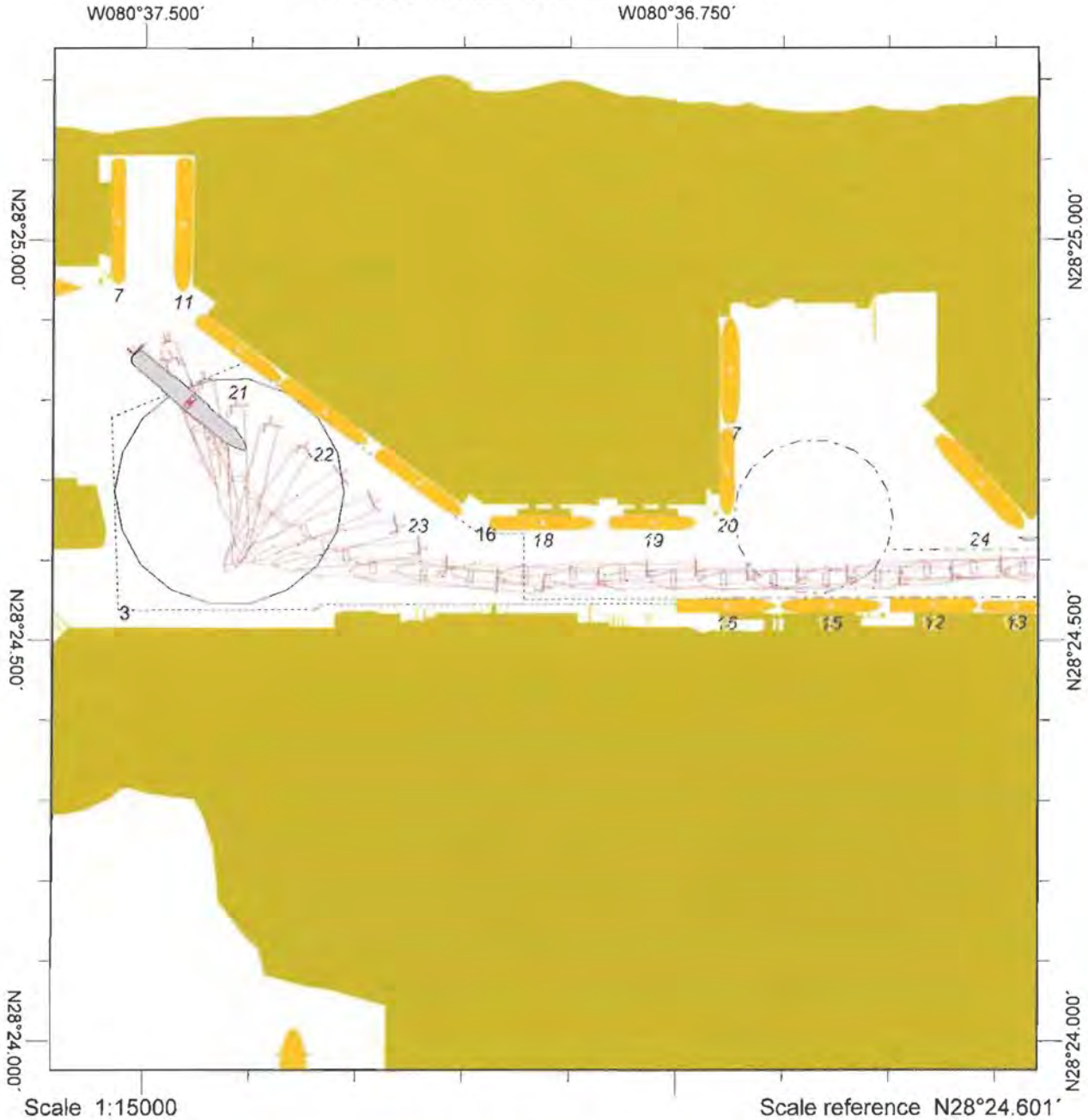
0.5 0.0 0.5 1.0 1.5 n.mile

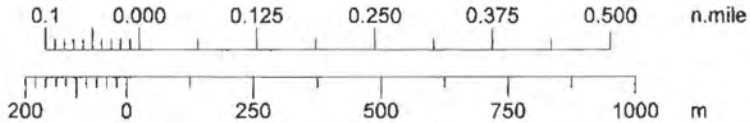
500 0 750 1500 2250 3000 m

Comments: Wind: S30-35kts / Current: 1.0kt N

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run#4

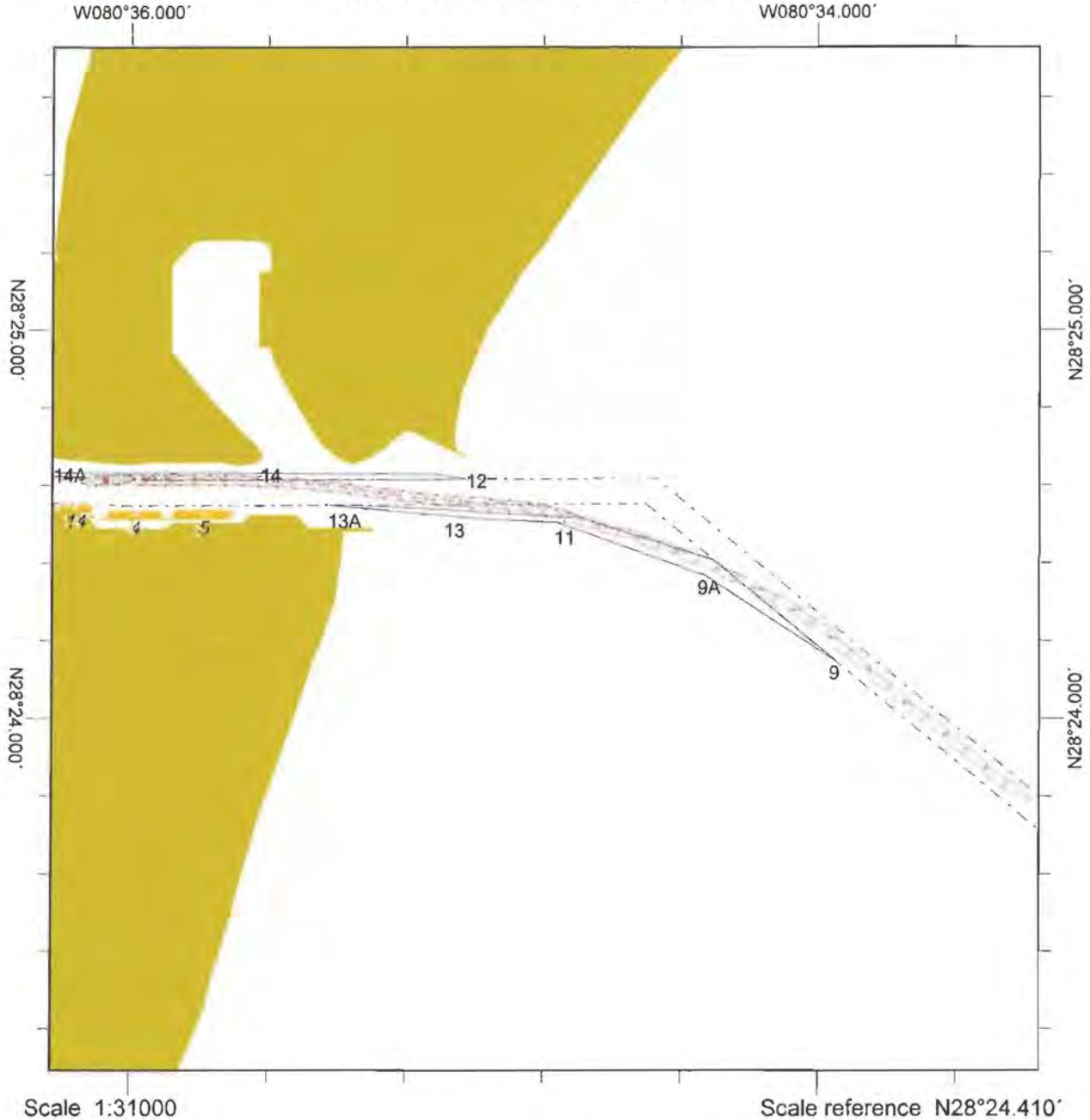




Comments: Wind: S30-35kts / Current: 1.0kt N

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

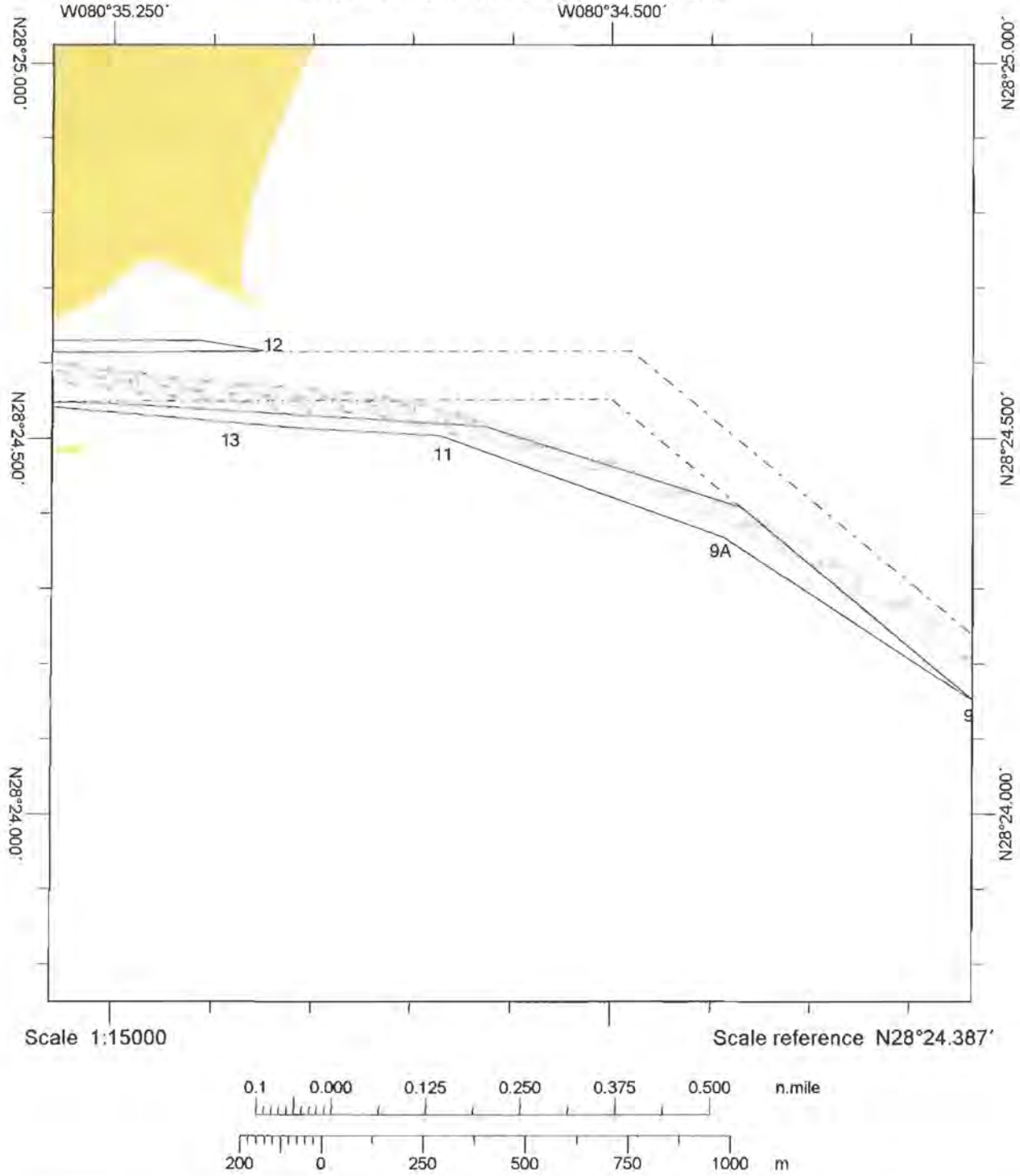
PORT CANAVERAL Run #5



Comments: Wind: 25-30 Current: 0.75kt N

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

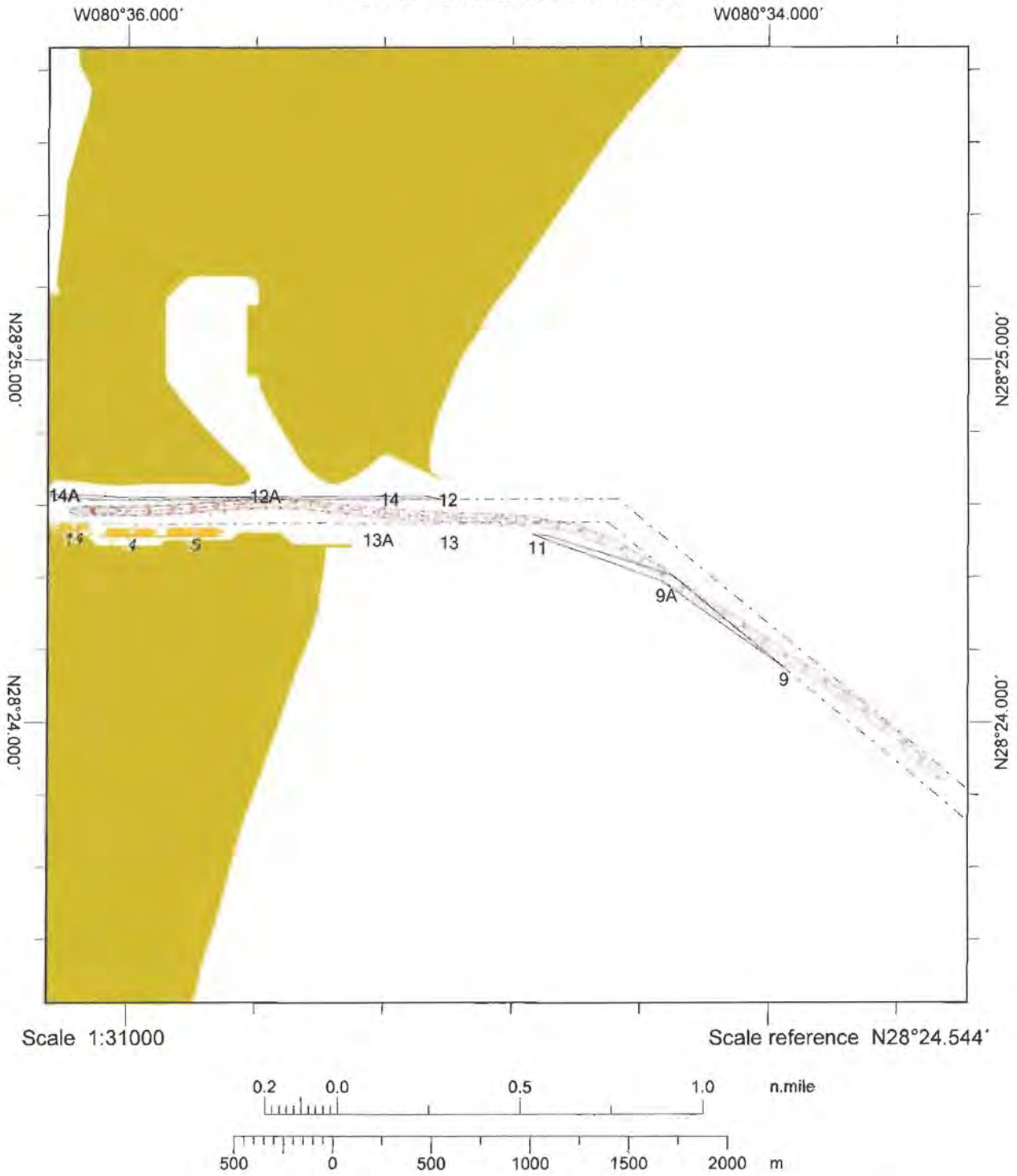
PORT CANAVERAL Run #5



Comments: Wind: 25-30 Current: 0.75kt N

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

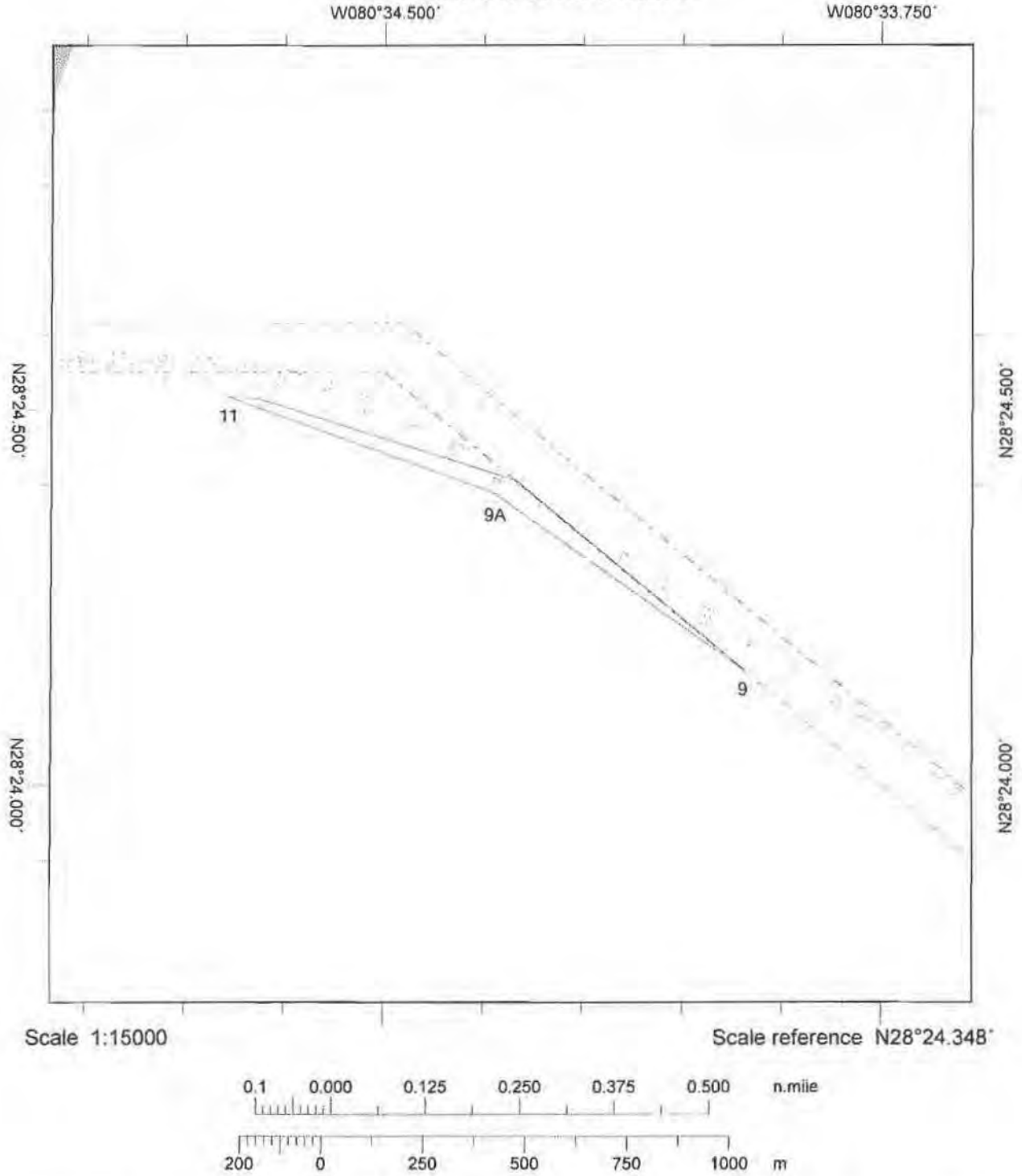
PORT CANAVERAL #6



Comments: Wind: S25-30kts / Current: N0.75kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

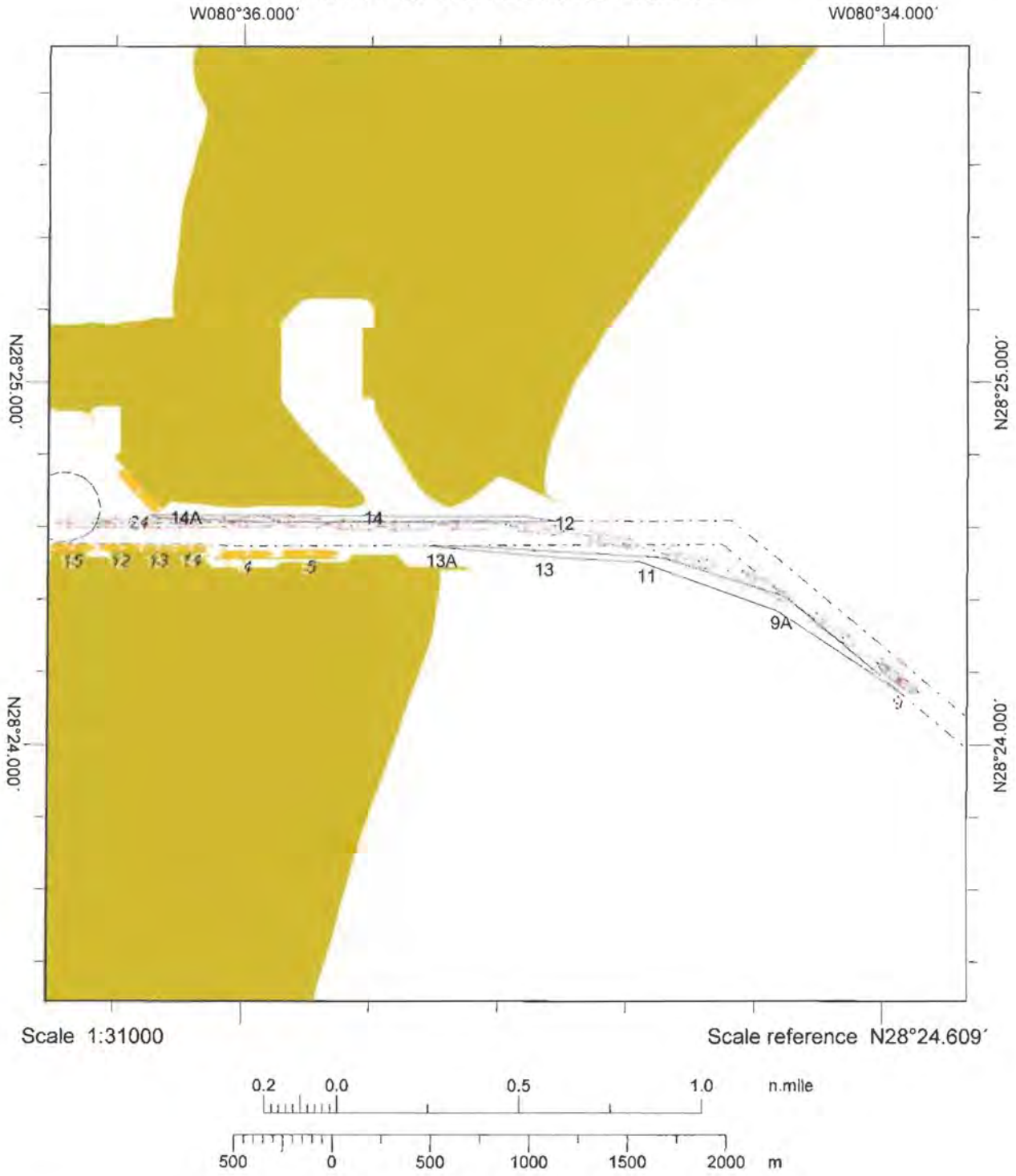
PORT CANAVERAL #6



Comments: Wind: S25-30kts / Current: N0.75kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

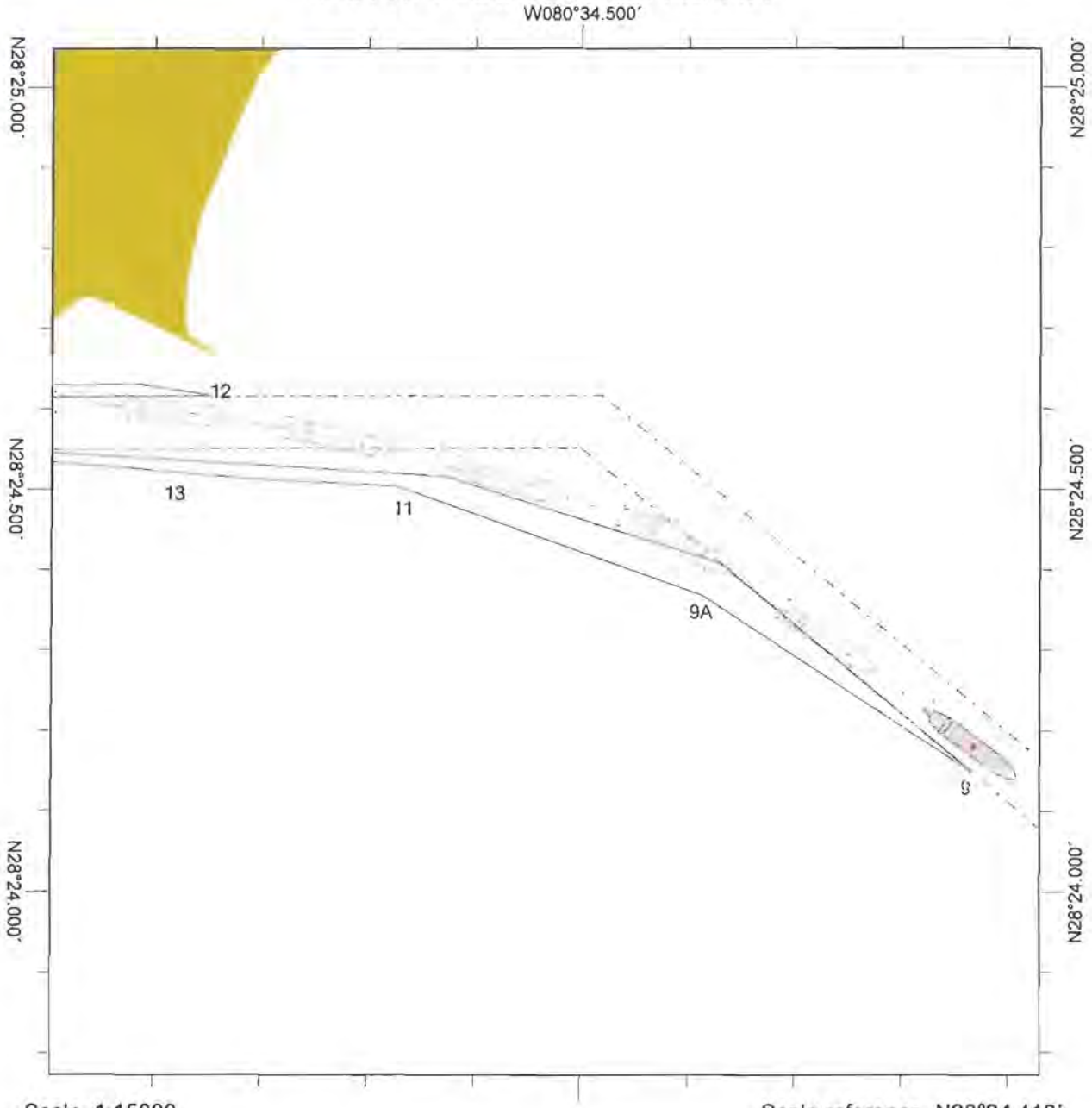
PORT CANAVERAL Run #7



Comments: Wind: N25-30kts / Current: 0.5kt S

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run #7



Scale 1:15000 Scale reference N28°24.410'

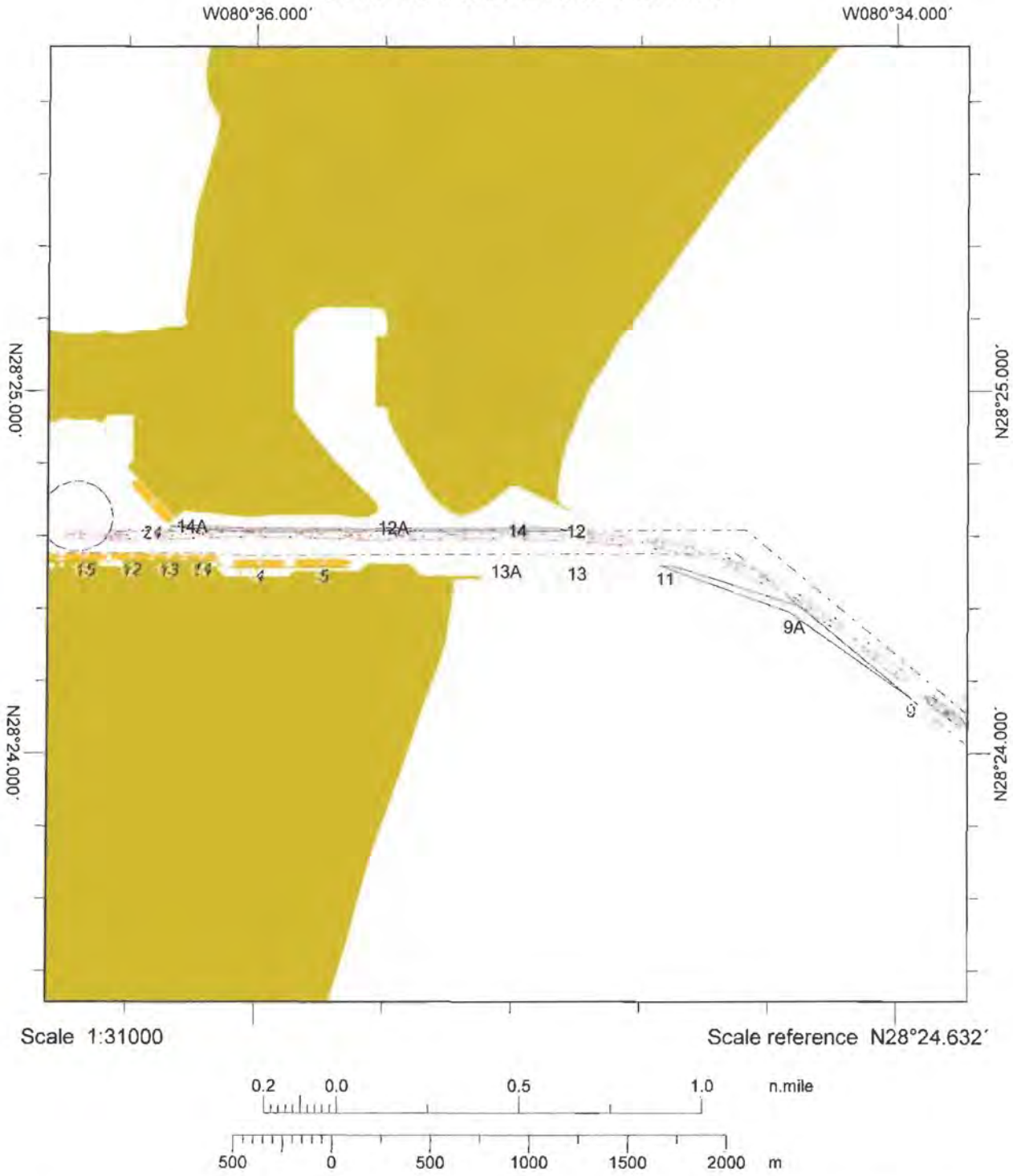
0.1 0.000 0.125 0.250 0.375 0.500 n.mile

200 0 250 500 750 1000 m

Comments: Wind: N25-30kts / Current: 0.5kt S

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

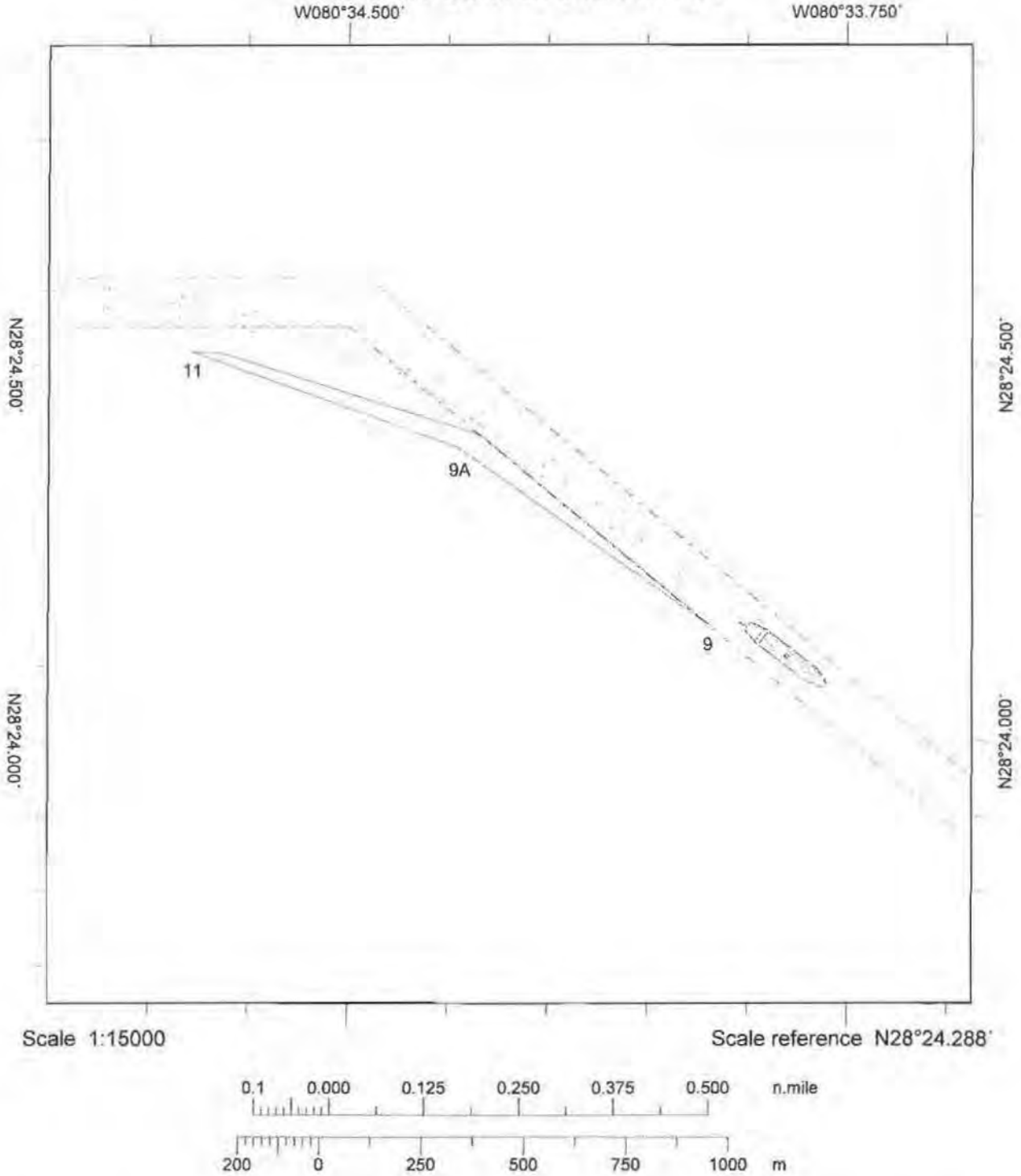
PORT CANAVERAL Run #8



Comments: Wind: 25-30kts N / Current: 0.5kt S

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

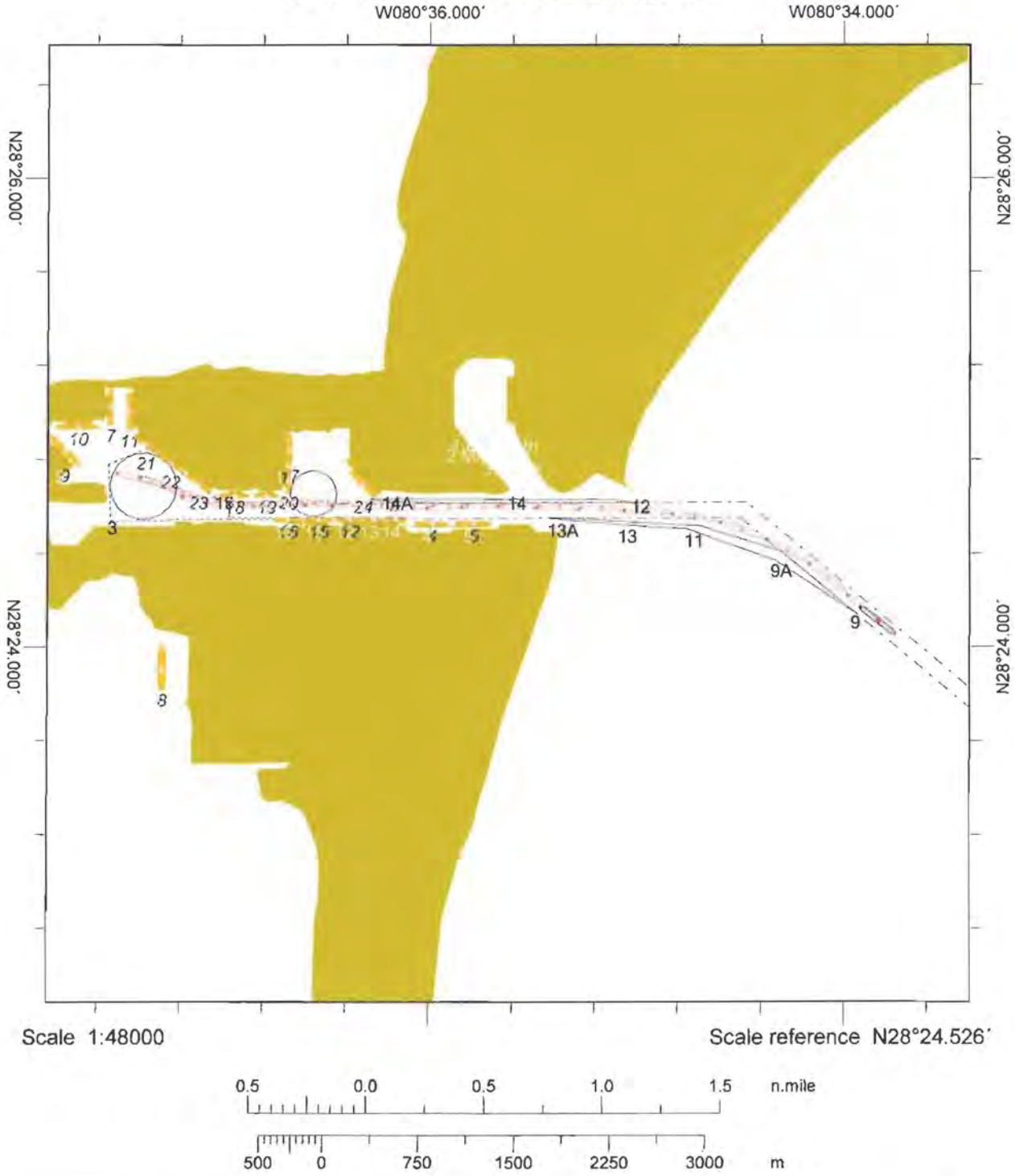
PORT CANAVERAL Run #8



Comments: Wind: 25-30kts N / Current: 0.5kt S

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

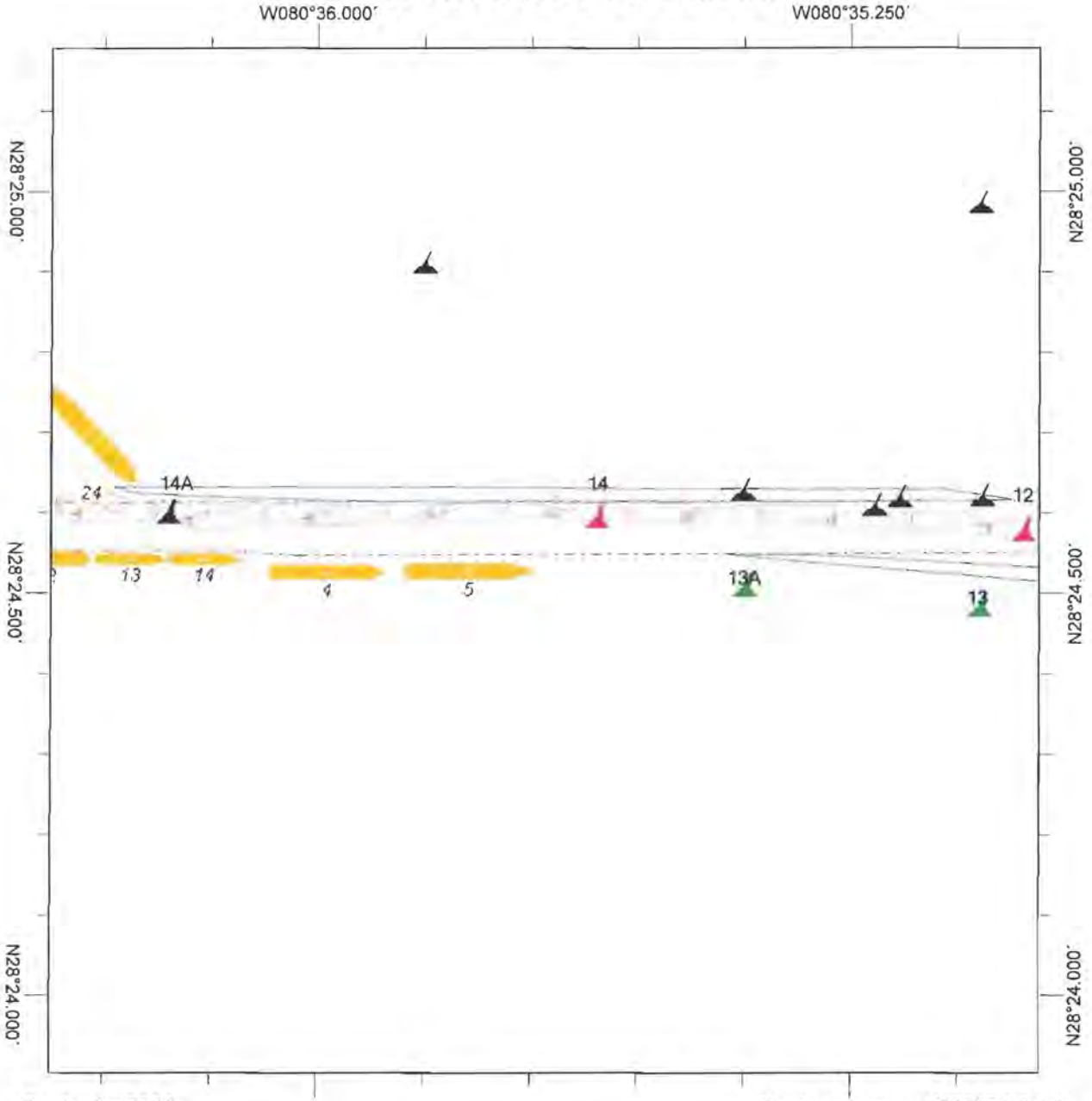
PORT CANAVERAL Run #9



Comments: Wind: N30-35kts / Current: S0.5kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run #9



Scale 1:15000 Scale reference N28°24.541′

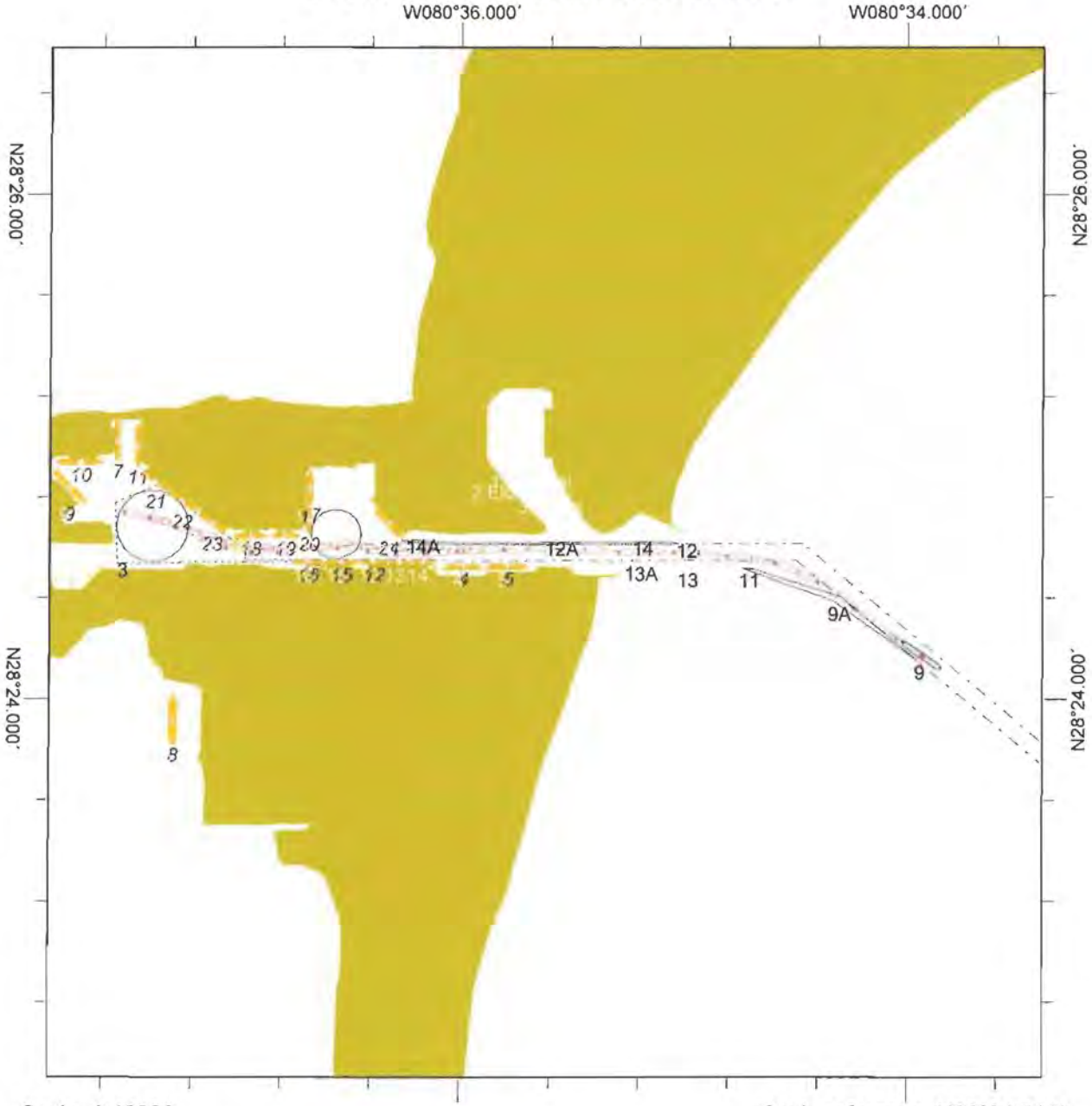
0.1 0.000 0.125 0.250 0.375 0.500 n.mile

200 0 250 500 750 1000 m

Comments: Wind: N30-35kts / Current: S0.5kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run#10



Scale 1:48000 Scale reference N28°24.541′

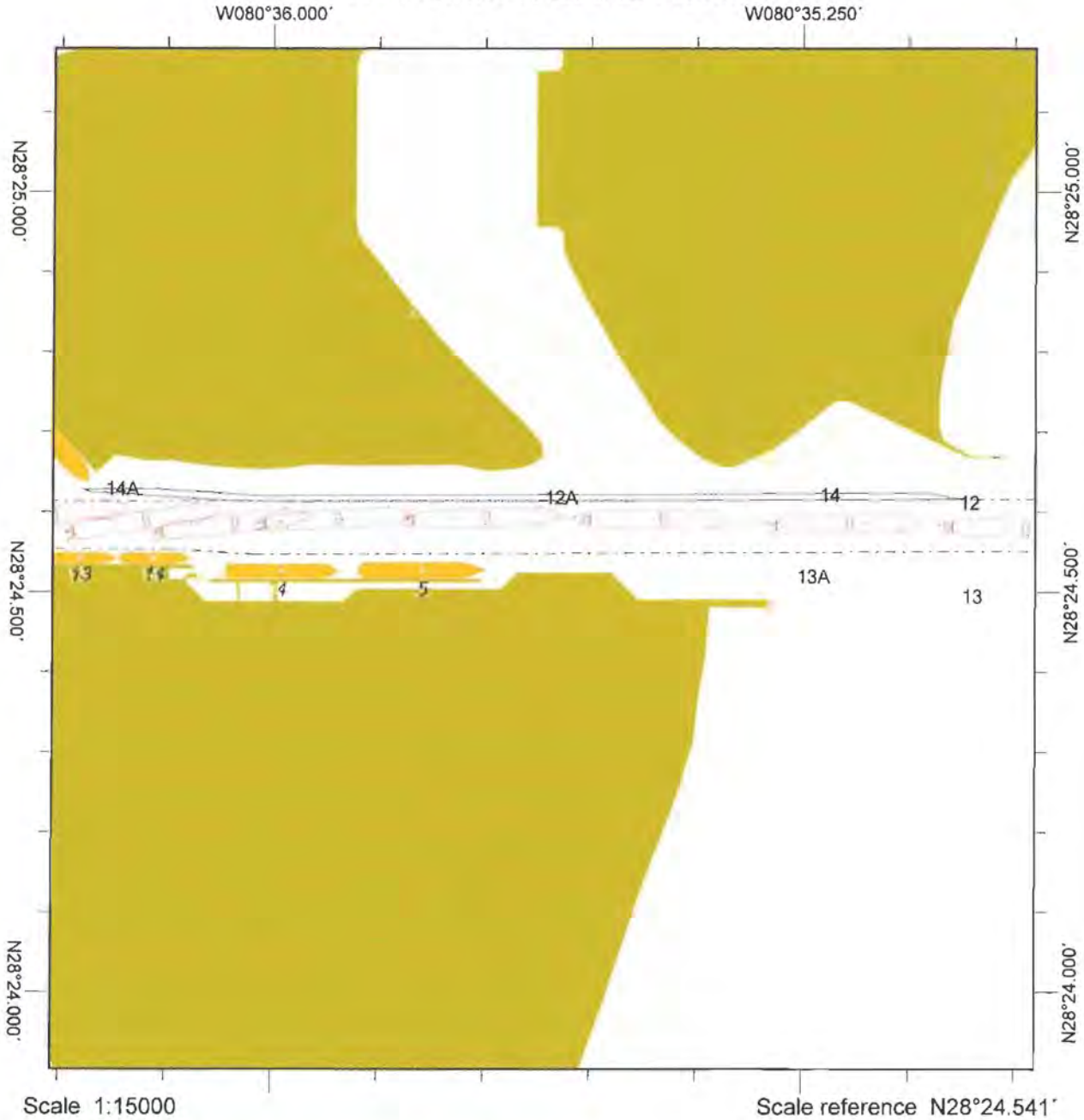
0.5 0.0 0.5 1.0 1.5 n.mile

500 0 750 1500 2250 3000 m

Comments: Wind: N30-35kts / Current: 0.5kts S

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

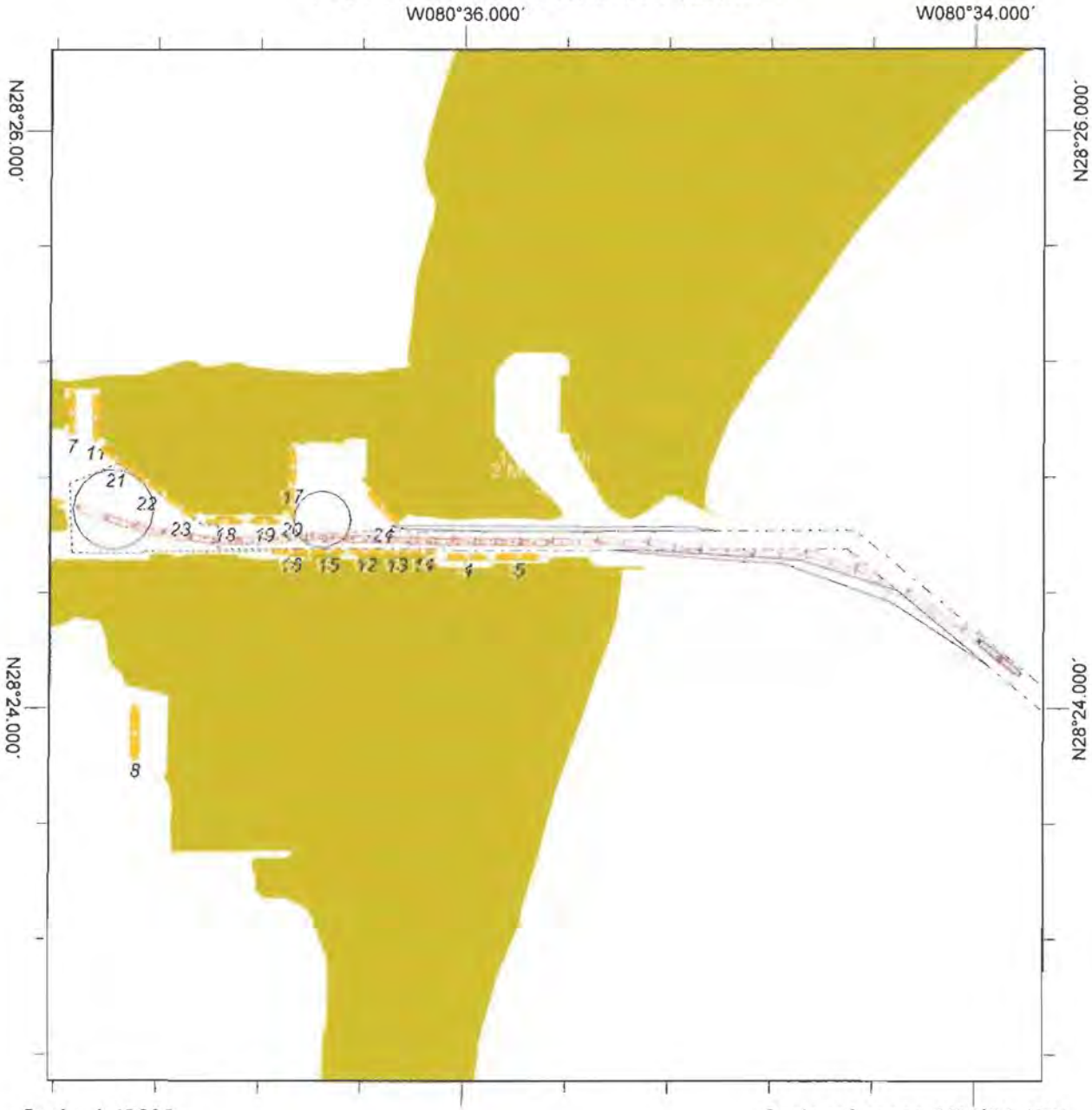
PORT CANAVERAL Run#10



Comments: Wind: N30-35kts / Current: 0.5kts S

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run#11



Scale 1:42000 Scale reference N28°24.495´

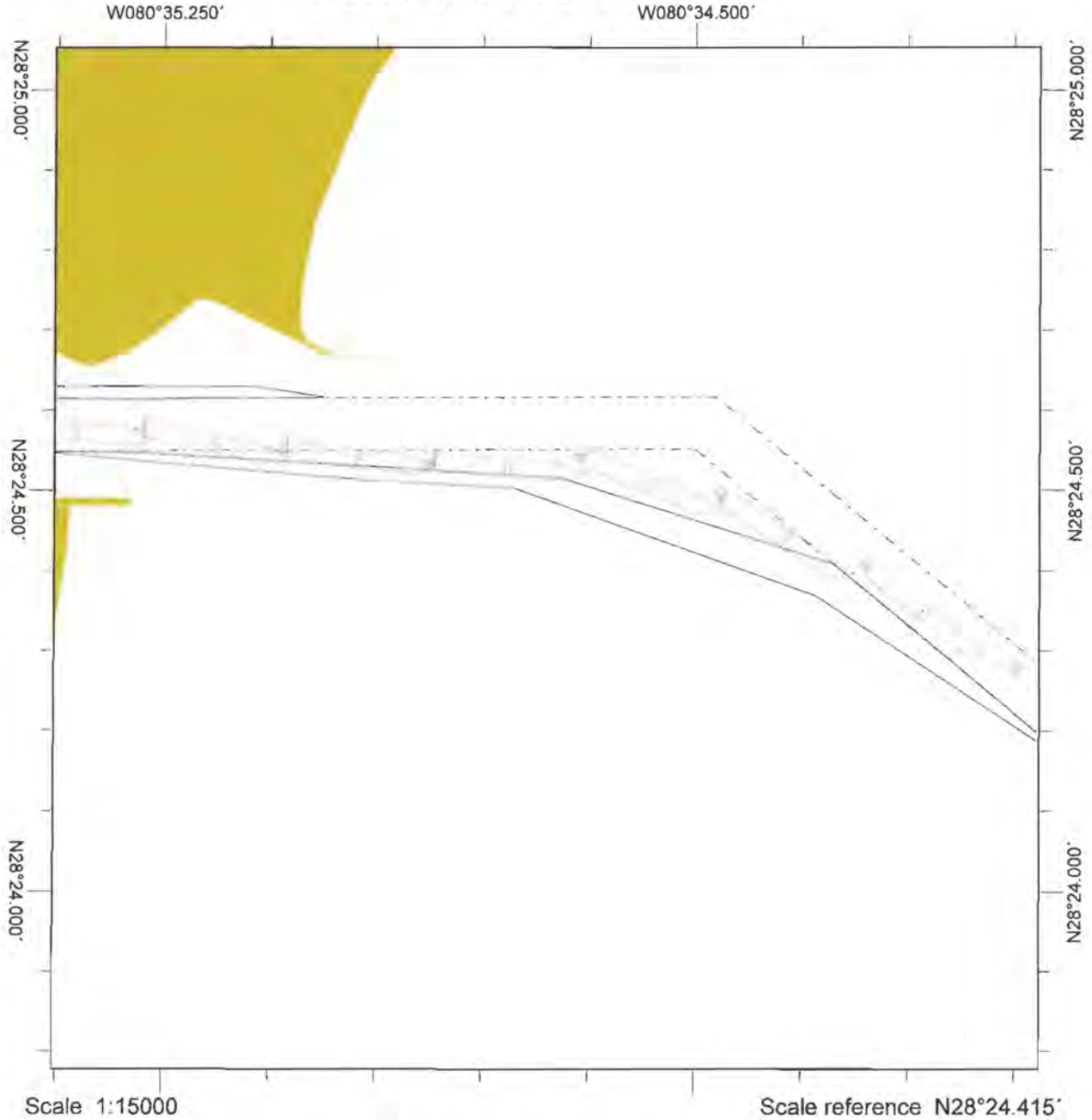
0.25 0.0 0.5 1.0 1.5 n.mile

500 0 750 1500 2250 3000 m

Comments: Wind: S30-35kts / Current: N1.0kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

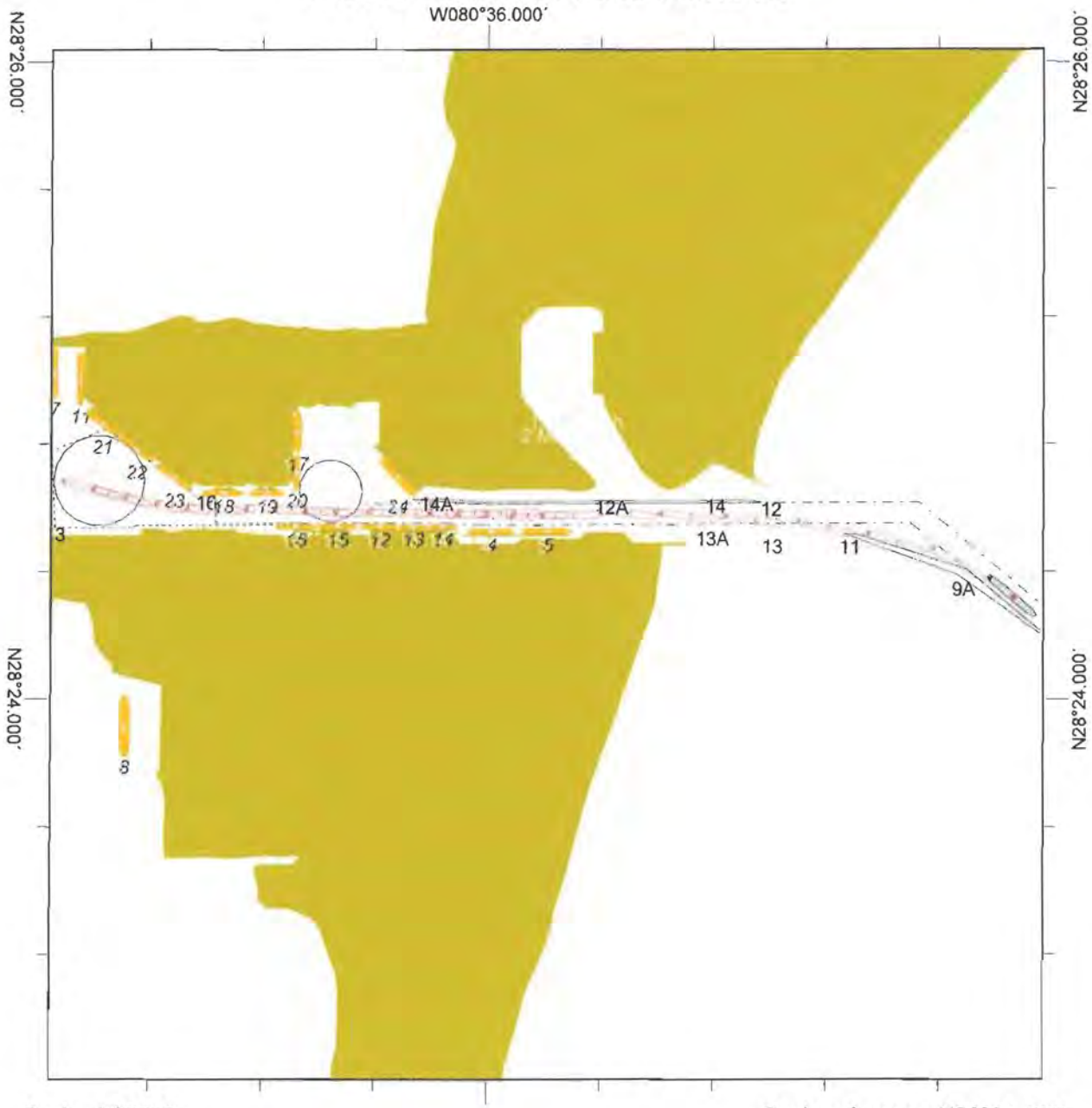
PORT CANAVERAL Run#11



Comments: Wind: S30-35kts / Current: N1.0kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run#12



Scale 1:38000 Scale reference N28°24.422´

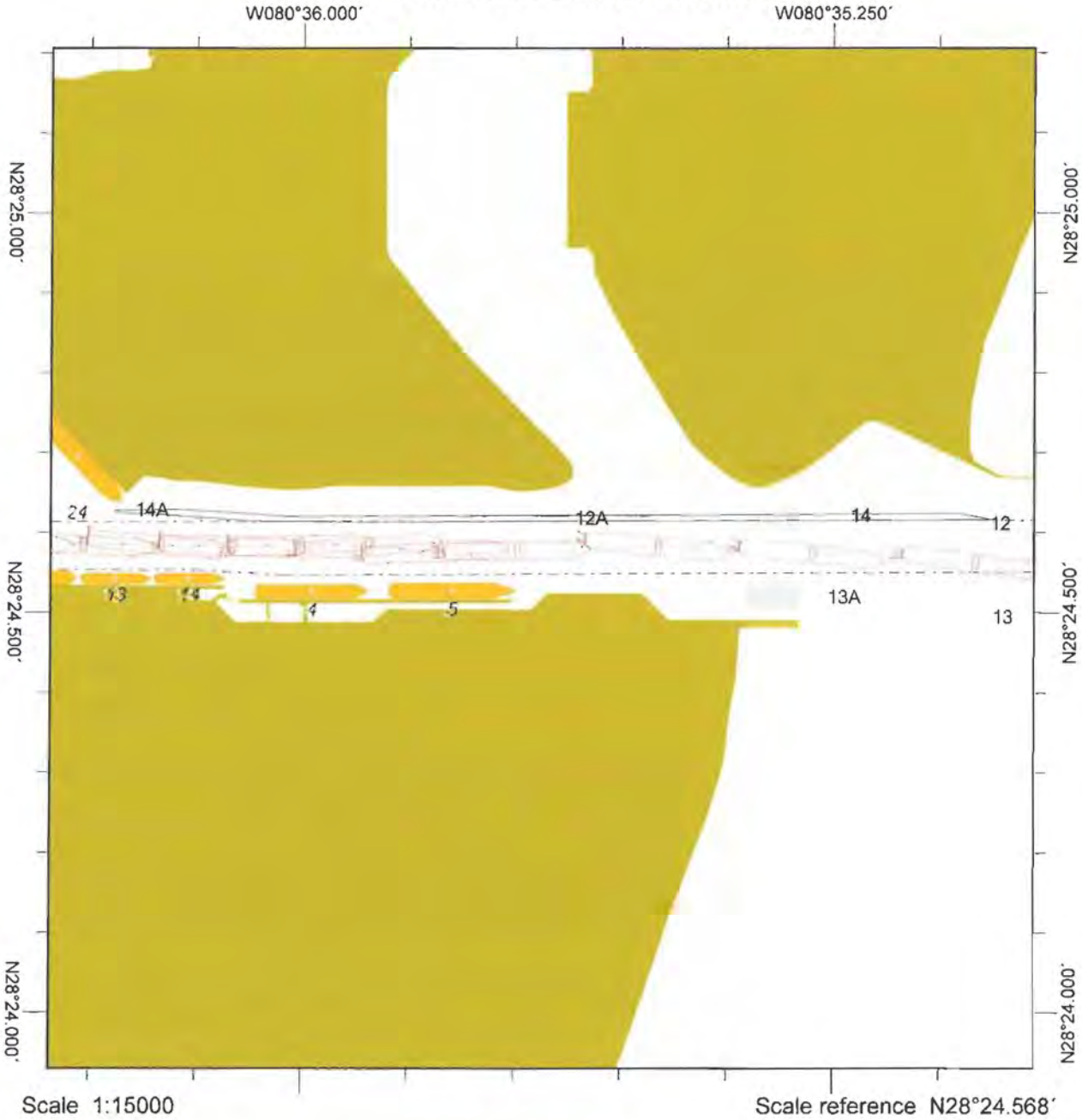
0.25 0.0 0.5 1.0 1.5 n.mile

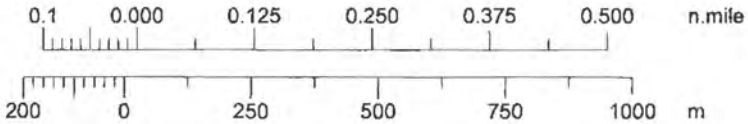
500 0 750 1500 2250 m

Comments: Wind: S30-35kts / Current: N1.0kt

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run#12

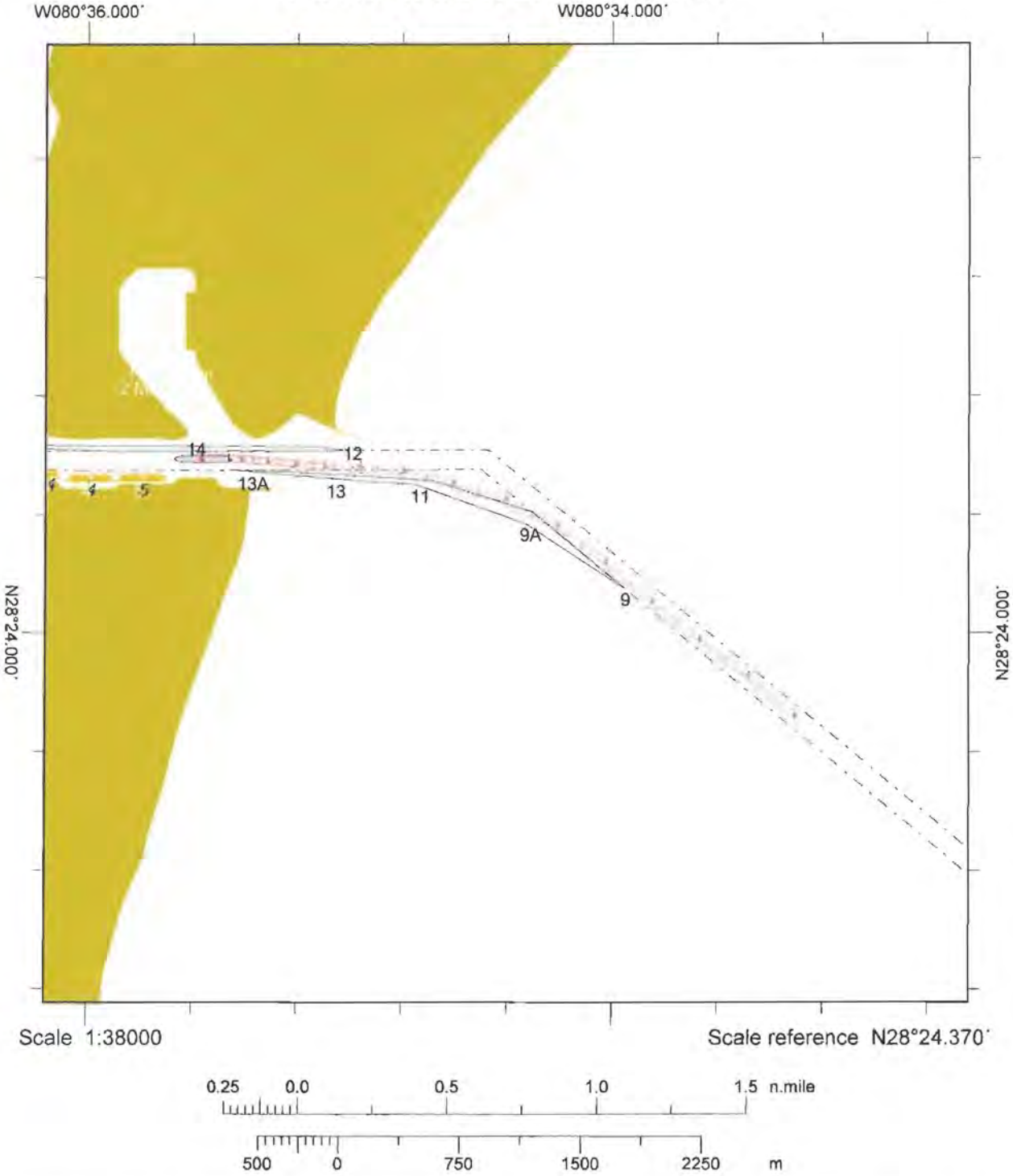




Comments: Wind: S30-35kts / Current: N1.0kt

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

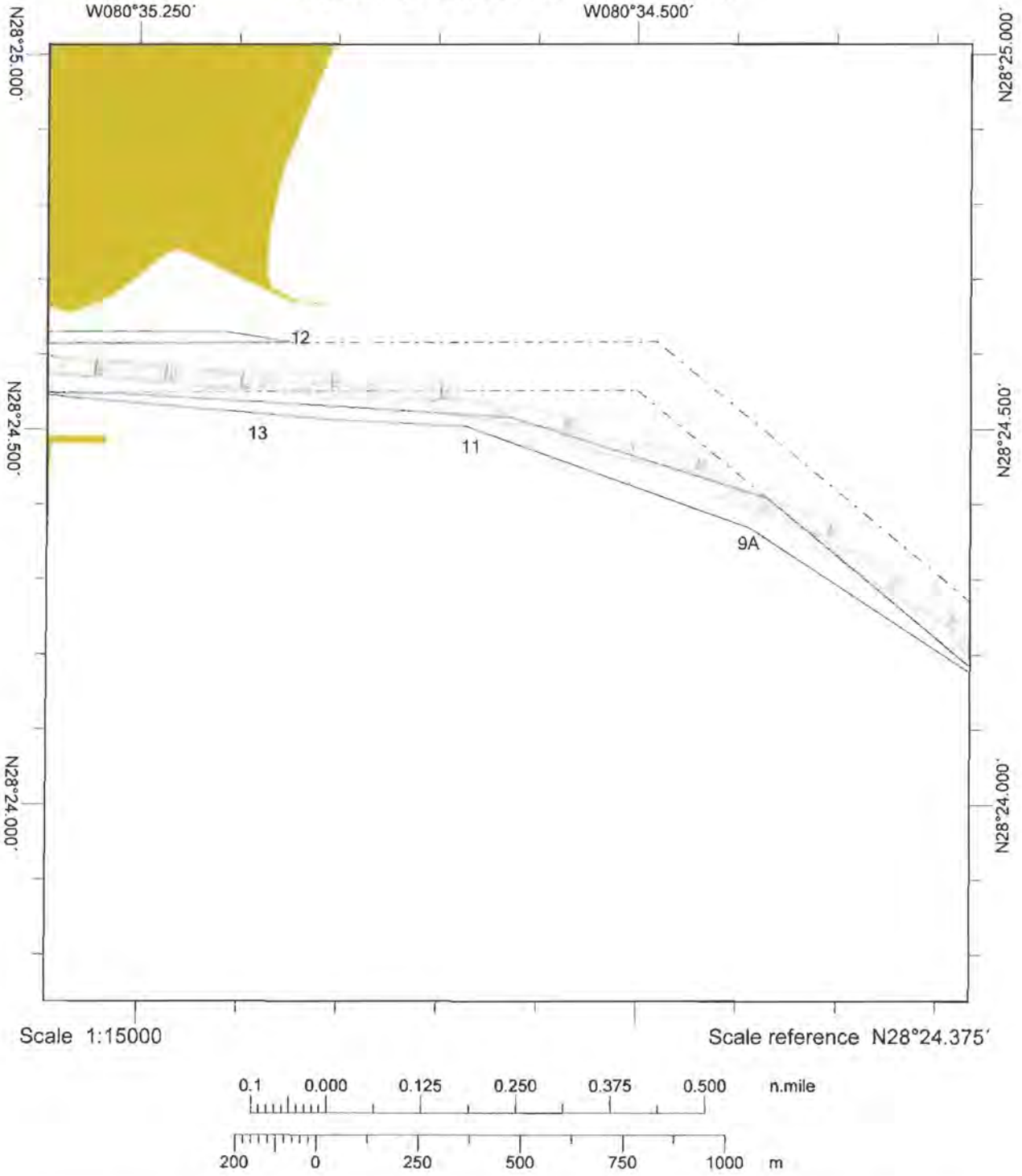
PORT CANAVERAL Run#13



Comments: Wind: S35-40kts / Current: N1.0kt

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

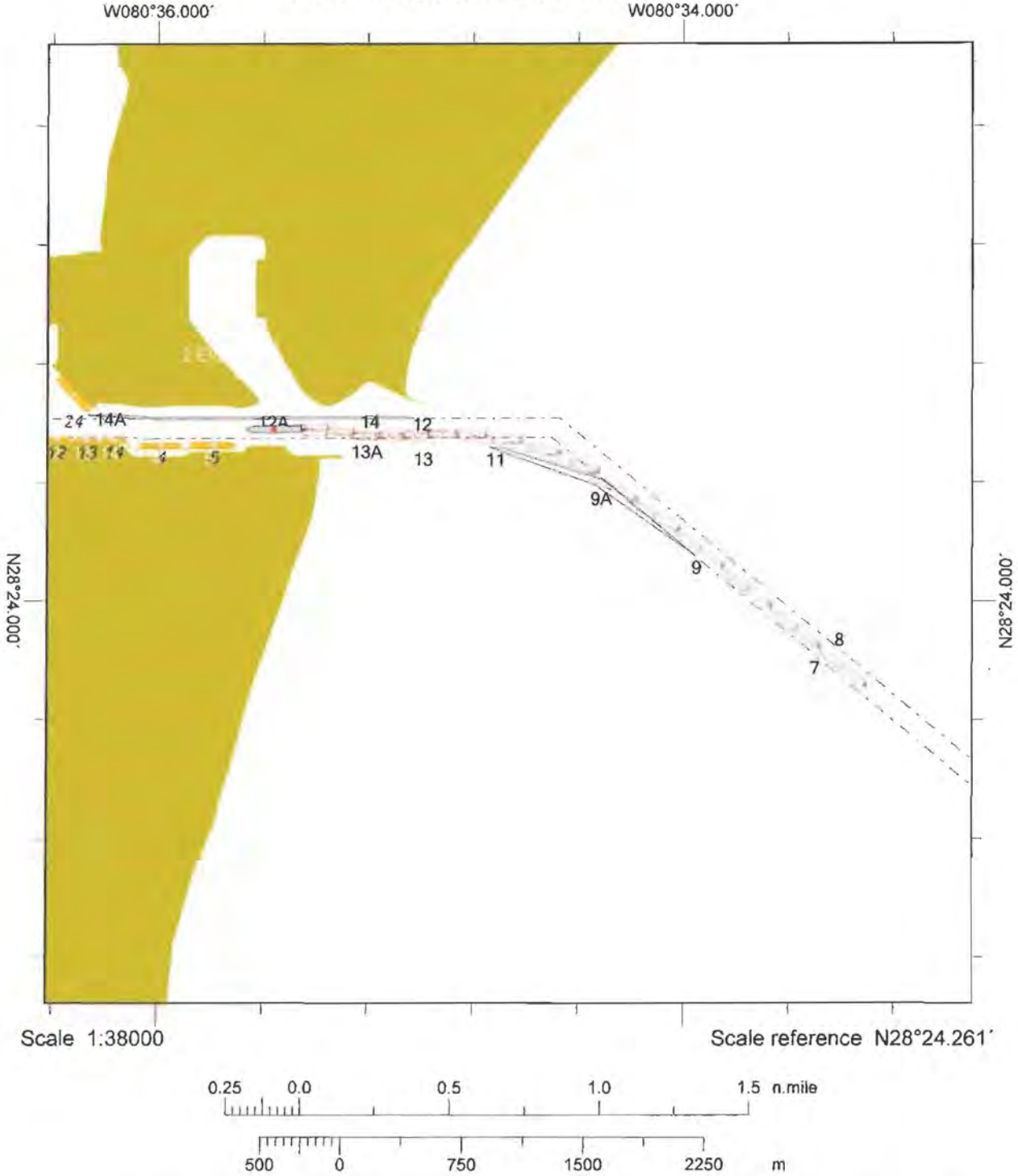
PORT CANAVERAL Run#13



Comments: Wind: S35-40kts / Current: N1.0kt

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

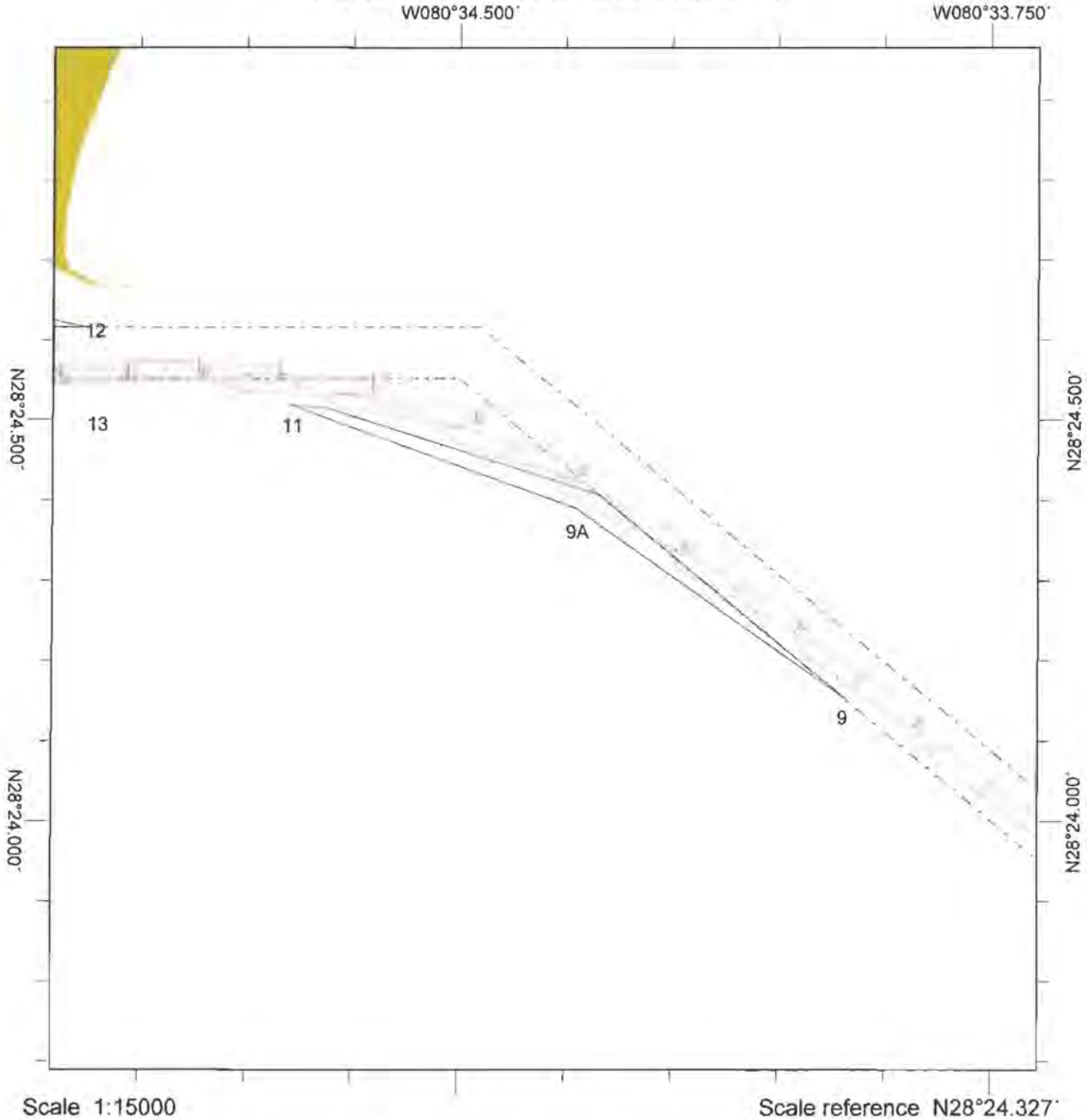
PORT CANAVERAL Run#14



Comments: Wind: S35-40kts / Current: N1.0kt

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run#14



Comments: Wind: S35-40kts / Current: N1.0kt

Line sample period (s)	30
Course marker every	N/A
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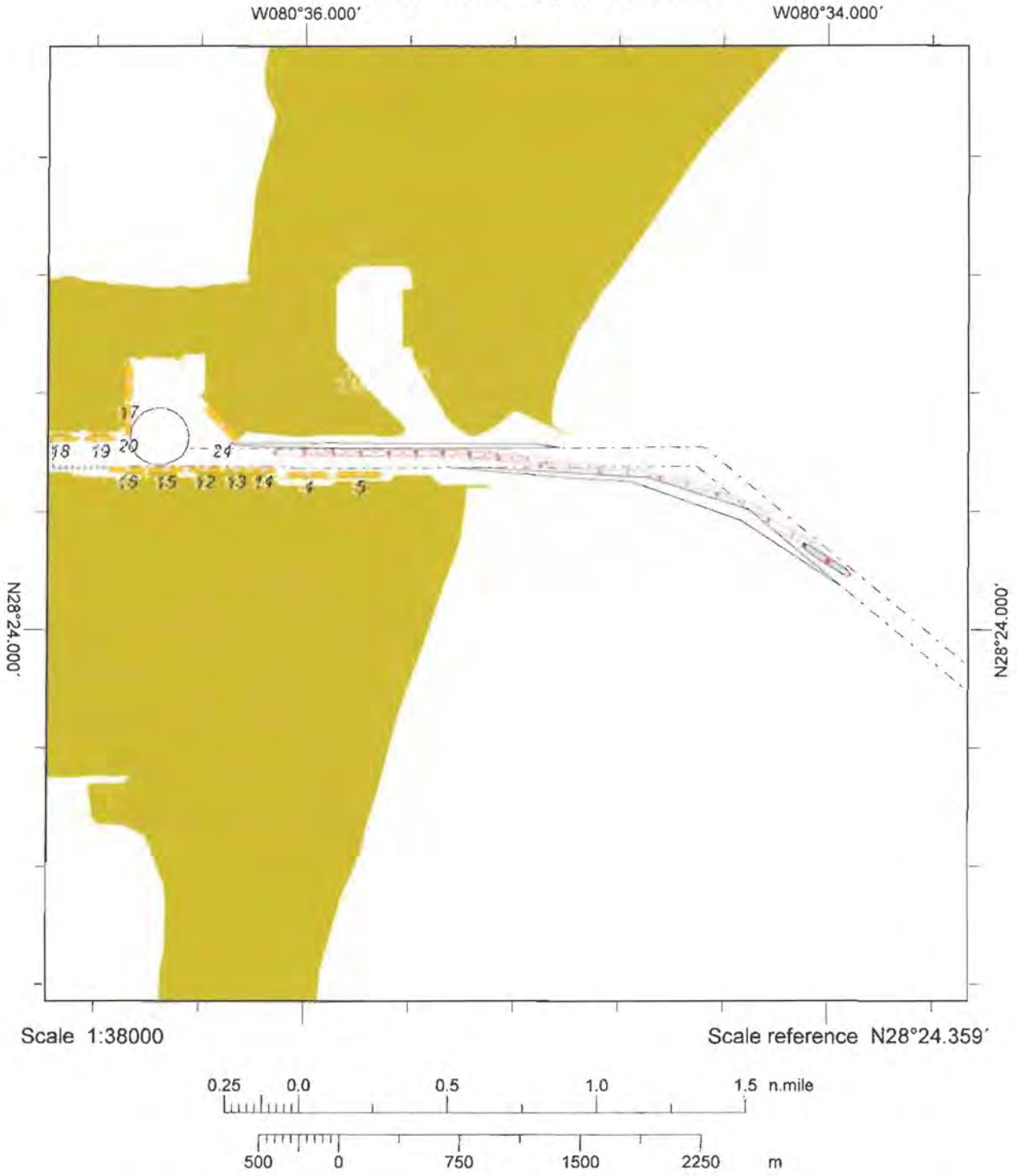
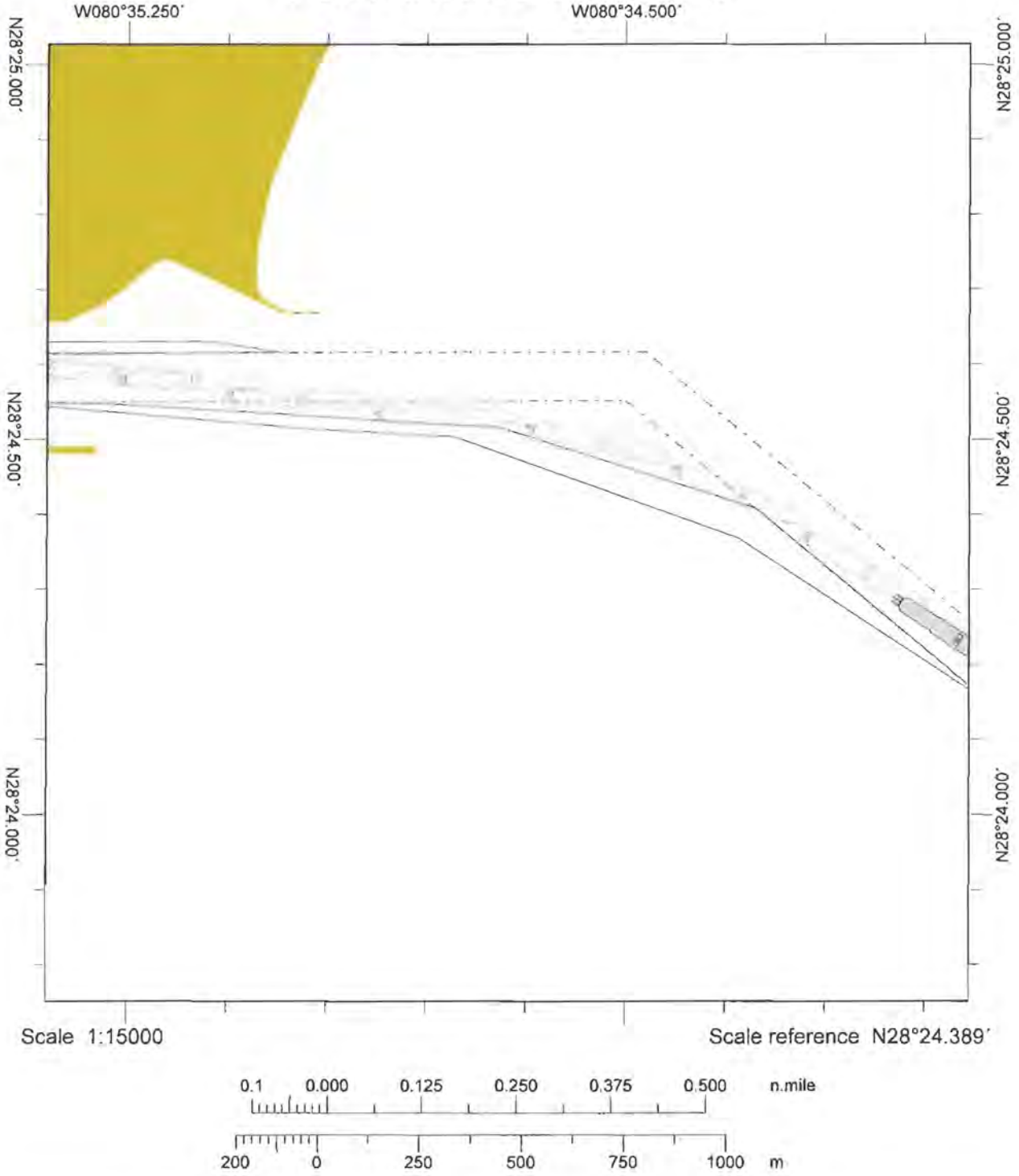


Comments: Wind: NE35-40kts / Current: S0.5kt

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

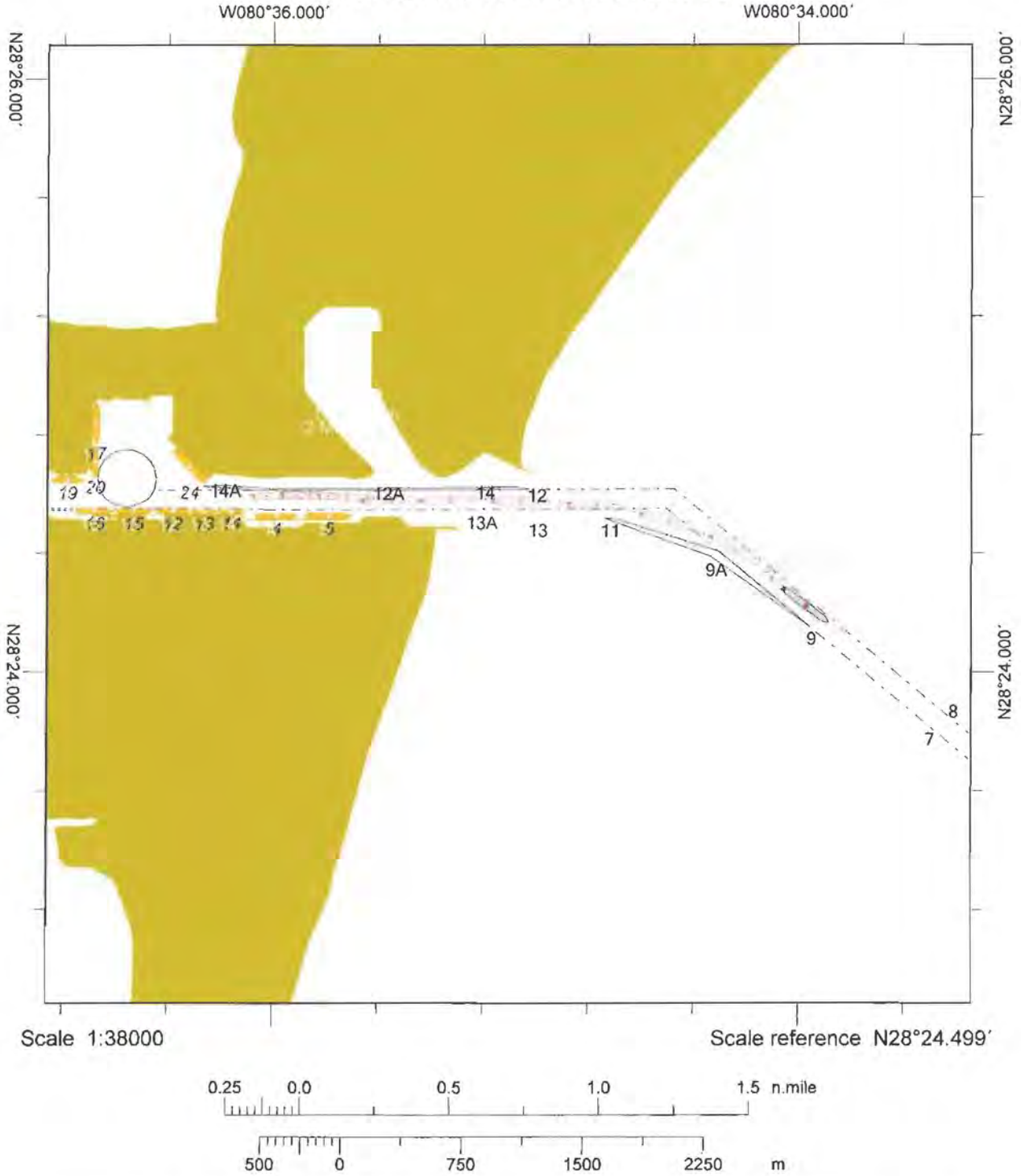
PORT CANAVERAL Run#15



Comments: Wind: NE35-40kts / Current: S0.5kt

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run#16



Scale 1:38000 Scale reference N28°24.499′

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500 0 750 1500 2250 m

Comments: Wind: NE35-40kts / Current: S0.5kts

Line sample period (s)	30
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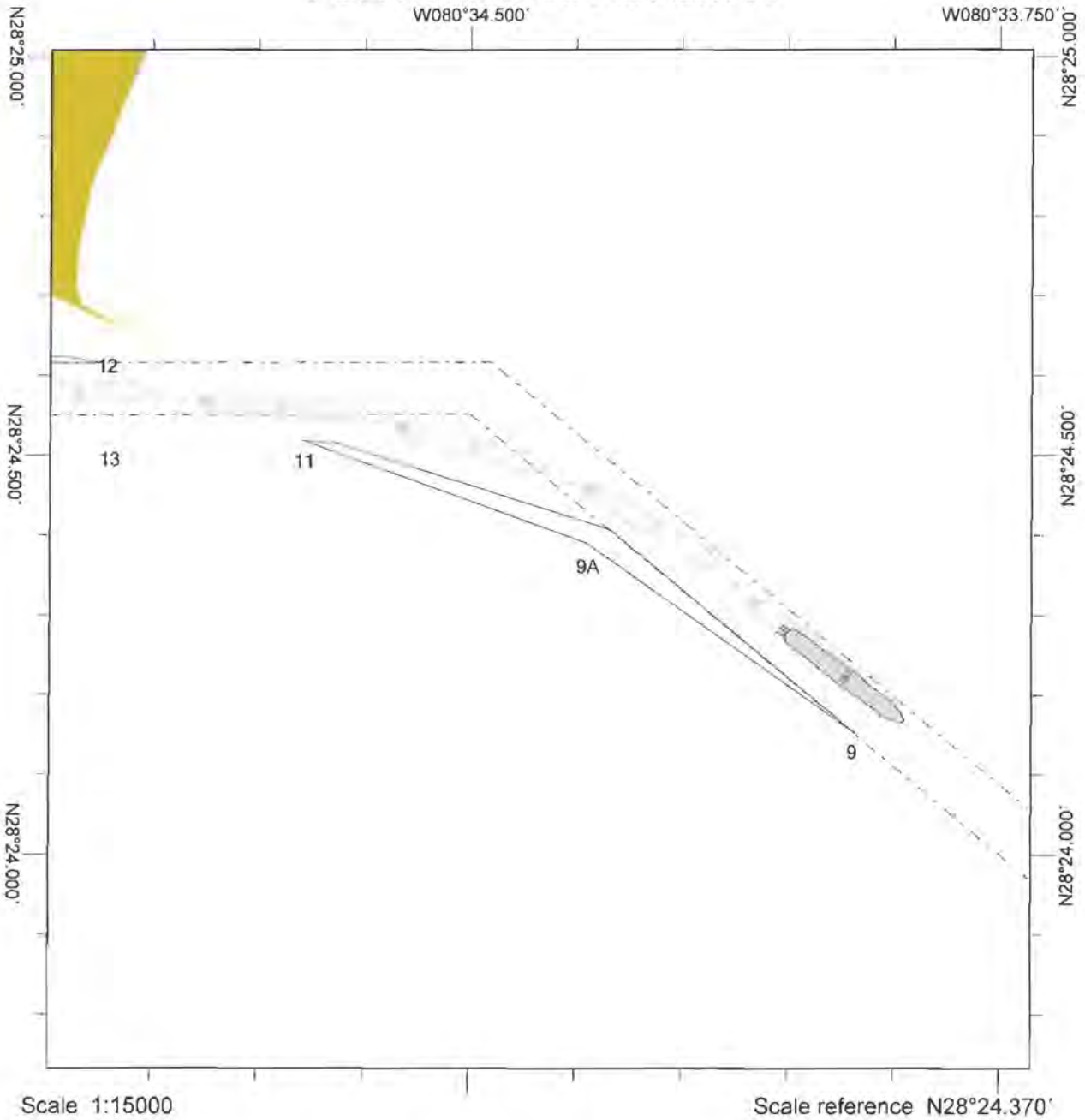
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run#16



Scale 1:15000 Scale reference N28°24.370'

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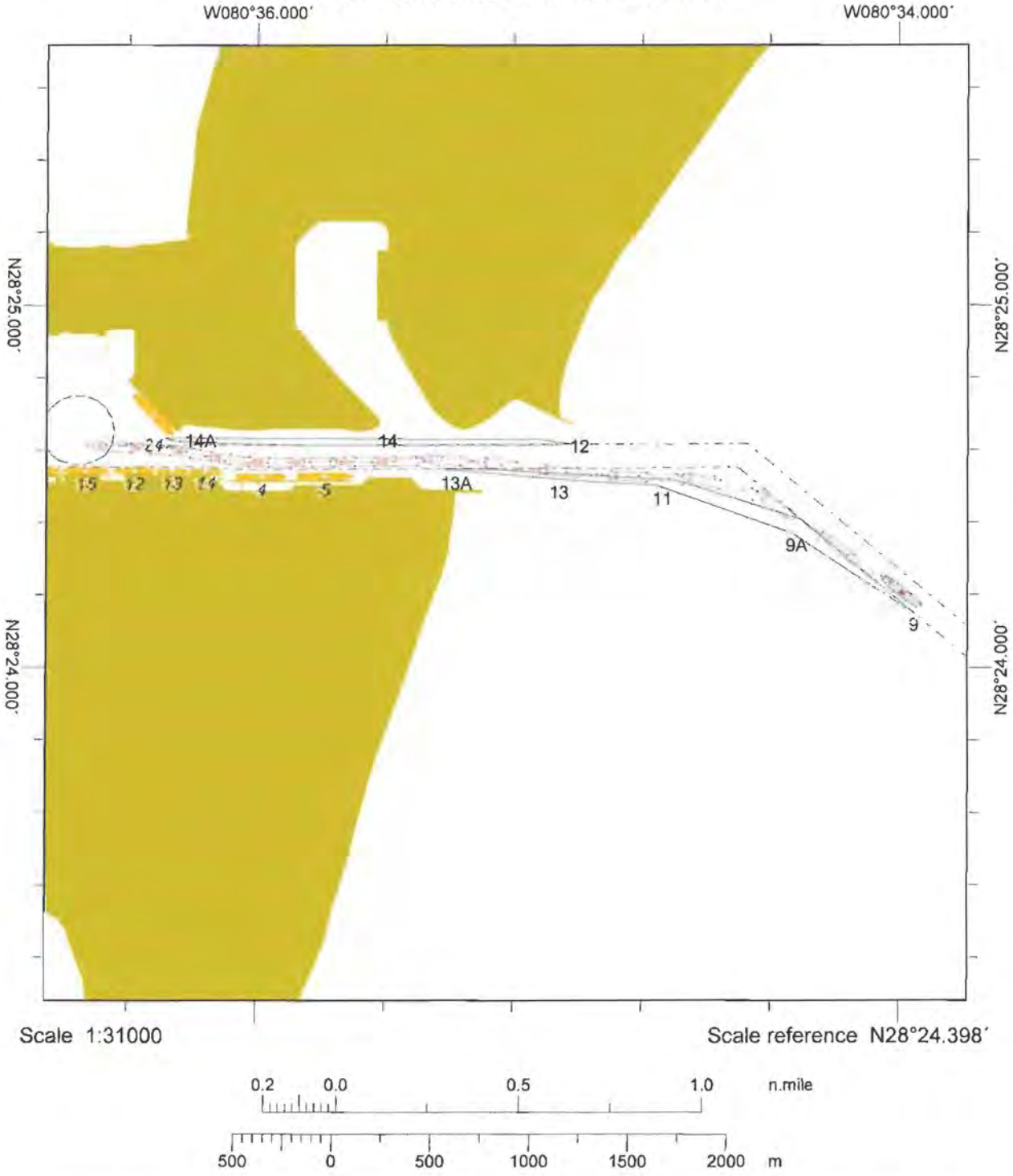
Comments: Wind: NE35-40kts / Current: S0.5kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

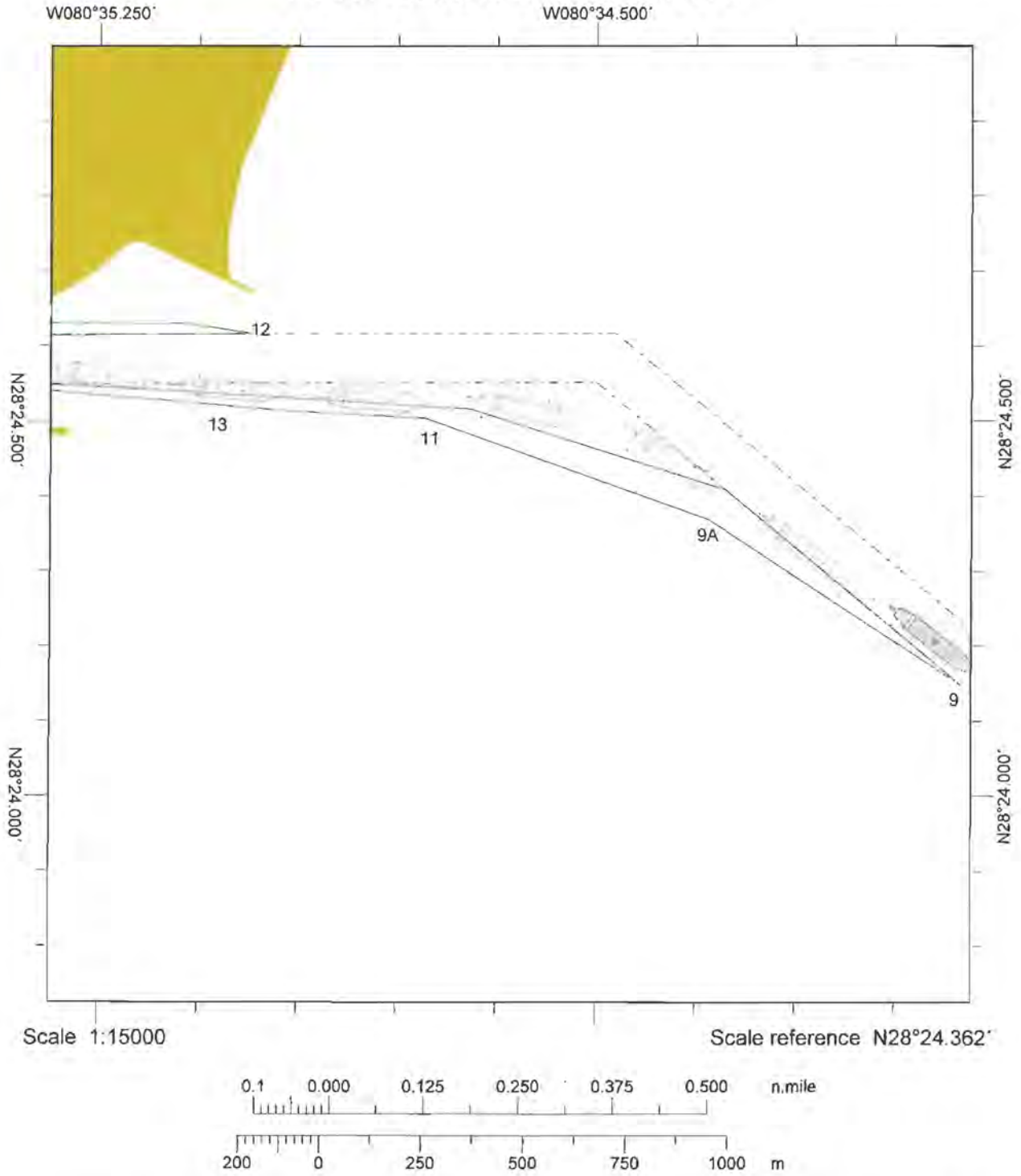
PORT CANAVERAL Run #19



Comments: Wind: S25-30kts / Current: 1.0kt N

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

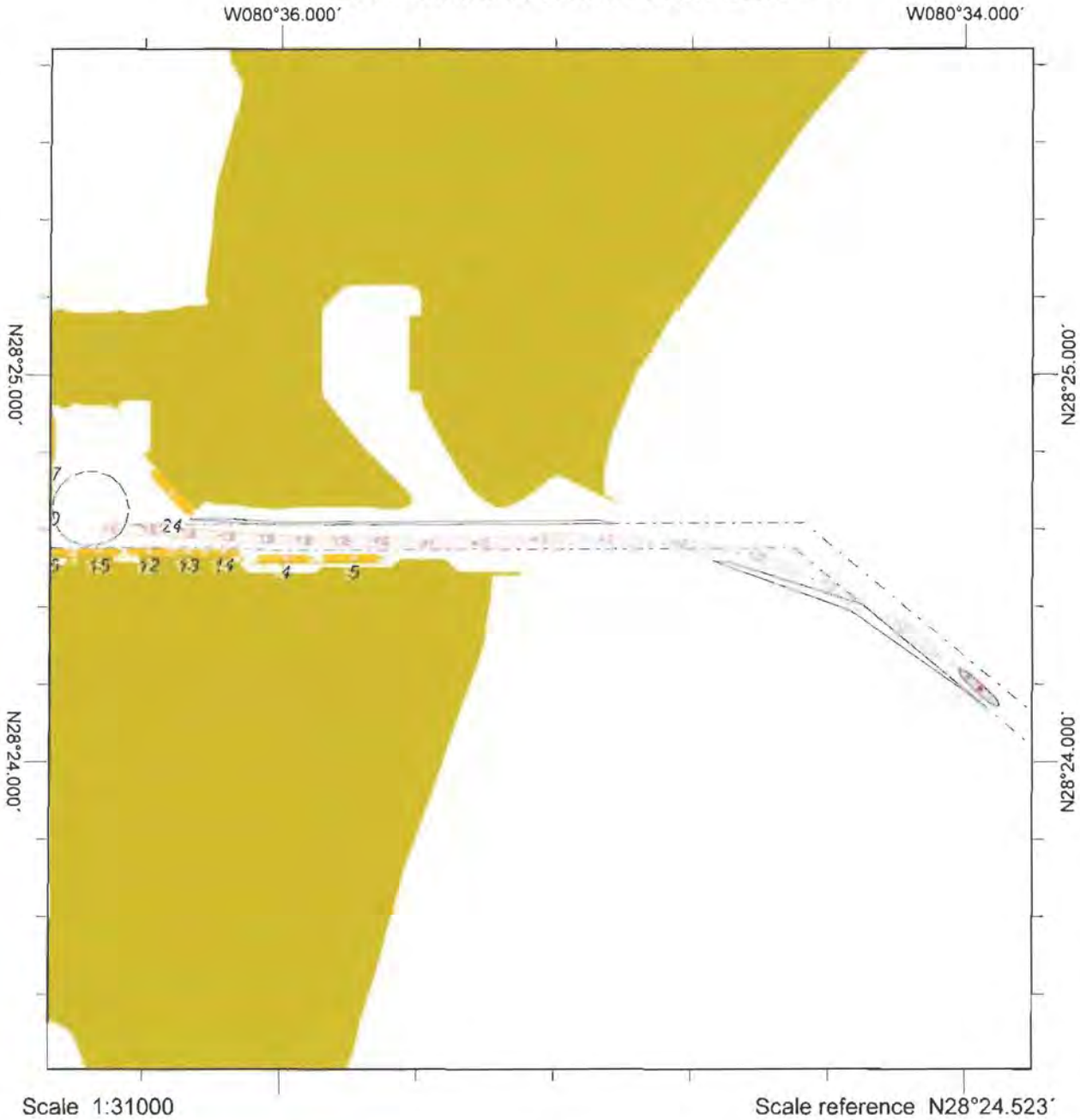
PORT CANAVERAL Run #19



Comments: Wind: S25-30kts / Current: 1.0kt N

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run #~~20~~ 21



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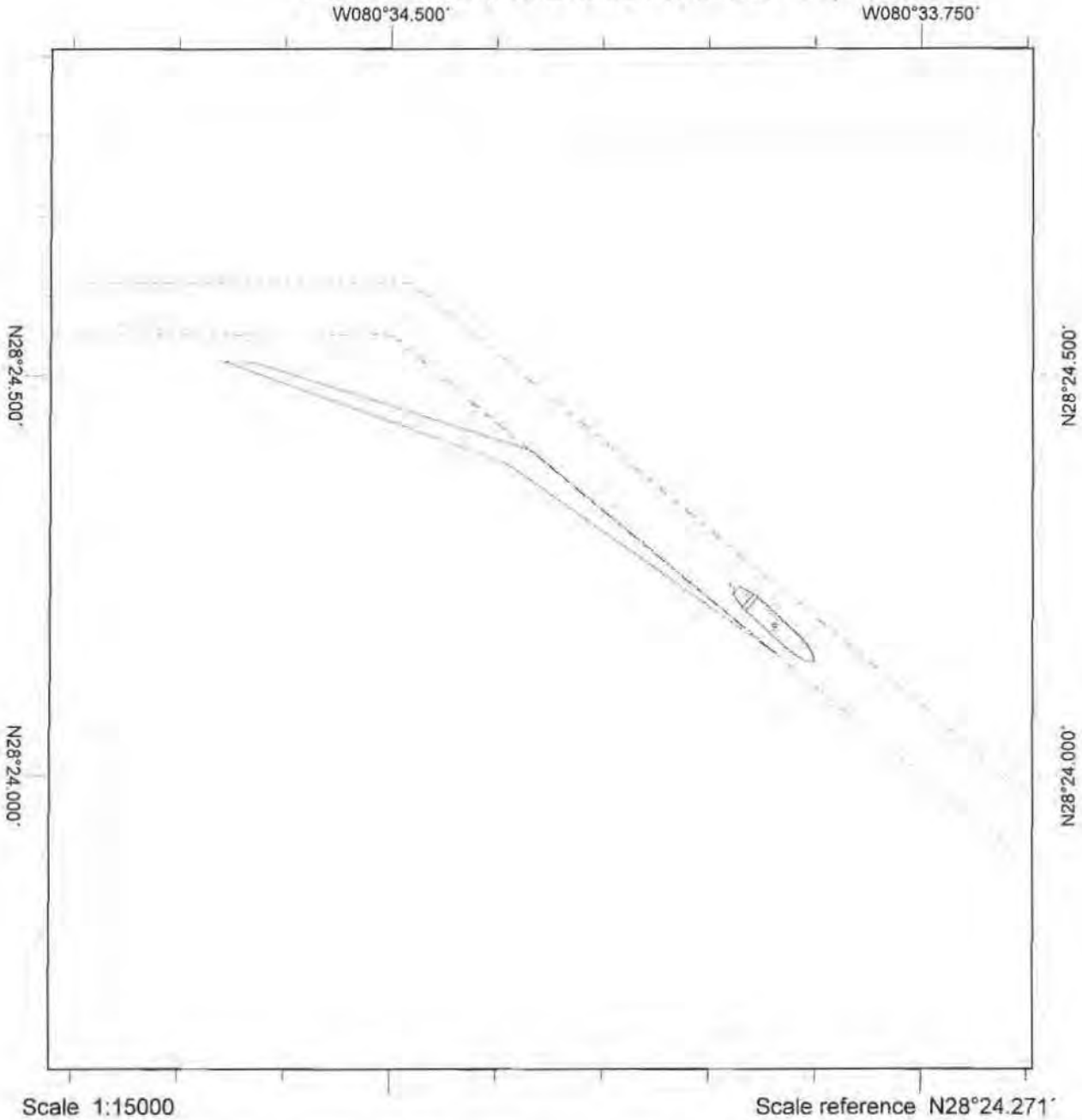
Comments: Wind: S25-30kts / Current: N1.0kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

PORT CANAVERAL Run #~~20~~ 21



Comments: Wind: S25-30kts / Current: N1.0kts

Line sample period (s)	30
Course marker every	N/A
Heading marker period (s)	30
Shape outline every	01:00

Port Canaveral Evaluation 2009
Final Evaluation Form

Name: Captain Ben Borgie Date: 3-5 June 2009

The existing geographic database for Port Canaveral was modified to reflect two different dredge expansion plans. Both plans "A" and "B" widen the channel at the "dog leg" or junction of the outer reach and middle reach channels, and an area on the north side of middle reach channel. Plan "B" provides the narrower of the two options. Both plans provide for an expanded west turning basin as well except that the plan B basin has a slightly reduced diameter (50 feet). Channel depths were increased slightly and to the same controlling depth in both plans.

Two vessels were used in the simulations as the design vessel for the project: "Freedom of the Seas" (LOA 338.8m, Beam 38.6m, Draft 8.5m), and "Jupiter" (LOA 244m, Beam 42m, Draft 12m and 8.3m).

Northerly and Southerly winds of between 25 to 40 knots were used in simulation, in addition to currents both Northerly and Southerly of up 1 knot in velocity.

1) Does the channel widening provided by Plan A provide ample width for safe transit in the environmental conditions of wind and current as tested for all improved areas? Please comment for both the Jupiter and Freedom of the Seas if differences were noted?

Bend Widener "dog leg" After spending three days in the simulator and comparing and evaluating both Plan A and Plan B, it is my opinion that Plan A provides ample width for the safe transit of both deep-draft vessels and high-windage cruise ships. In consideration of the special handling characteristics of heavy laden, deep-draft ships, (simulated as the *Jupiter*) the extra room provided by Plan A allows for a greater safety margin. The wider area allows the vessel to transit further from the channel edges, reducing the very dangerous effects of bank cushion and stern suction. Additionally, some of these large tankers arrive with an improper trim (the bow deeper than the stern). This condition makes these vessels very difficult to steer and the extra room provided by the Plan A widener will certainly allow for a greater safety margin when the vessel exhibits this "sloppy" steering. The extra room also gives the escort tugs more time and more room to accomplish their maneuvers in an emergency, thereby avoiding a bad situation!

As of the date of this evaluation, the *Freedom* is currently one of the largest operating cruise ships in the world. This massive vessel, while possessing adequate power,

clearly needs a lot of room to safely transit her thousands of passengers into and out of Port Canaveral under all expected weather conditions. There are multiple reasons why the additional width provided by Plan A will permit a safer transit of this area. One reason is that it allows the pilot to slow down earlier. The vessel has to be going slow upon entering the port as to not surge and damage moored vessels. By slowing down, the crab angle of the vessel will increase and when dealing with ships the size of the *Freedom* (or larger) the extra room needed to accommodate the new "virtual beam" (actual beam + crab angle) is substantial and sufficient room is provided for this in Plan A. Secondly, Plan A allows the pilot to better position the vessel for the turn by buoy 9. This allows the pilot to plan ahead in anticipation of the increased drift angle. The extra room provided by buoy 11 and 13 would be very useful in a S'ly wind to stay a safe distance off the north jetty. Additionally, the larger area provides for a smaller, more preferable, rate of turn.

Middle/Inner Harbor Reach Vessels the size of the *Freedom* are approaching their safe limits when navigating 400' wide channels. The need for the extra 100' of width provided by Plan A cannot be overstated. The ever-critical crab angle is even more of an issue in the Middle and Inner reach, because outside these channel edges is hard rock to the north and moored vessels to the south. Speeds in the inner reach also need to be kept low to avoid surge, making the crab angle even worse. When operating vessels of this size, the extra room is needed so that in the case of an equipment failure or helmsman error, there is adequate time and maneuvering room to perform emergency maneuvers.

At first, it may seem that the extra room in the middle and inner reach is not applicable when dealing with the heavy, deep draft ships, because theses ships usually do not use the edges of the channels like the cruise ships do. But again, we have the issue of dangerous hydraulic effects on the vessel (amplified in the inner reach), which can be reduced or eliminated when the vessel is able to transit further from the edges of the channel. The extra maneuvering room provided by Plan A also allows the escort tugs to do their job in an emergency if called upon to break a sheer or slow the vessel.

Turning Basin The Plan A turning basin as simulated, is sufficient in size to allow vessels the size of the *Freedom* to turn around safely under all expected weather conditions. Plan A allows the vessel to stay a safe distance off any moored vessels and simultaneously maintain a safe distance off the shore. The placement and size of the turning basin provide adequate room to slow and stop the vessel, while still maintaining control. The extra room to the east of the basin in the west cut, will also make the transit safer in both strong N'ly and strong S'ly wind conditions.

2) Does the channel widening provided by Plan B provide ample width for safe transit in the environmental conditions of wind and current as tested for all improved areas? Please comment for both the Jupiter and Freedom of the Seas if differences were noted?

Bend Widener "dog leg" The simulator provided a very good way to compare the two plans. In the drawings, the difference between Plan A and B may seem small, but from the bridge of a huge cruise ship in strong winds, the difference is VERY noticeable. The simulator runs using plan B forced the pilot much closer to channel edges and much closer to dangerous situations. Both of the vessels simulated need the extra room of Plan A. Plan B simply forces the tanker too close to the shallow edges of the channel. The cruise ship is not as concerned about shallow water effects, but still needs the extra channel width to swing that big stern and keep it in good water. Shoaling in the bend widener also needs to be considered. Shoaling will reduce the usable channel, so Plan B would become even smaller, thereby reducing the safety margin even more! Plan B would simply not provide as large of a safety margin as is needed here.

Middle/Inner Harbor Reach Fifty feet may not seem like much, but as a pilot who handles these ships within very tight operating parameters, the narrower channel provided by Plan B makes a BIG difference. As pilots, we routinely pass buoys only 15' off. This is done on purpose to get the ship in the safest position in the channel. By subtracting another fifty feet from the equation as provided by in Plan B, the safety margin shrinks substantially.

Turning Basin The difference on paper here seems small between A and B, but B still falls a bit short here in providing the necessary room for future growth. While highly

maneuverable ships like the *Freedom* can have sufficient room with Plan B, future ships expected over the next decade may be less maneuverable and may have insufficient area within the turning basin to safely turn around under Plan B.

3) Both Plans A and B provide slightly increased depth in channels. Are these depths adequate for the vessels, especially the "Jupiter" with a draft of 12 meters (approximately 39 feet)? Comments?
Ships do not like shallow water. In other words, the maneuverability of a ship degrades as the depth under the keel decreases. The extra depth provided in the simulation increased safety for many reasons. One being a vessel is less likely to touch bottom. Another reason is the more water under the keel, the more control I have as a pilot to safely maneuver the vessel. The extra depth would also allow vessels 39 feet deep to transit at any time, because the vessels would not have to wait for high tide. With the new oil terminal coming online next year, the extra depth will have a direct, positive impact on port operations.

4) Only maximum credible adverse environmental conditions were simulated. Would Plan A provide any advantages to the shiphandler over Plan B under less extreme environmental conditions?

Bend Widener "dog leg" Even under "normal" conditions, Plan A provides some advantages over Plan B. Plan A's extra room would allow for a slower rate of turn on cruise ships. These large cruise ships can be 16 decks high and when the ship rolls due to excessive rate of turn, the roll is felt more on the upper decks. Too much roll could result in passenger falls or equipment damage. Secondly, Plan A would allow for two-way traffic, something that would not likely be possible under Plan B.

Middle/Inner Harbor Reach The ability to handle two-way traffic is the differentiator here. Plan A could accommodate it, but Plan B would likely not provide enough room. It also bears repeating that the extra 50' missing under Plan B would be very missed in the case of an emergency!

Turning Basin The *Freedom* could safely use either turning circle, but the size and maneuverability of all vessels projected to use the basin must be considered. It is very conceivable that vessels in the future may well need the extra room to the south that Plan A provides.

5) Please comment on the effectiveness of the new outbound range. Do you recommend any other fixed (non-buoy) navigational aids to improve the overall project navigability?
I was very pleased to see the outbound range simulated. I found it very effective in helping me place the vessel properly in the channel. Being so far forward on a cruise ship, one must remember that almost 90% of the ship is behind you. This requires a lot of expertise to put the stern of the ship (that you cannot see) in the proper place in the channel. The range allows me to do that. Inbound, the range is probably the most important navigational tool, so I dream of the day when we can finally get one for the outbound leg. Also, even though we did not simulate it, ranges are especially effective at night. Many of our large "port of call" ships leave at night and that outbound range would sure increase safety as an additional tool.

6) Please comment on the accuracy of the simulation models.
It seems like simulator technology is improving exponentially. I have used many simulators around the country and the one at STAR center is the best. The handling characteristics of both vessels were very realistic and allowed me to really get into the moment and "feel" the ship. The degree of realism had a positive impact on my ability to evaluate the proposed channel improvements.

7) Is there a thought or impression that you would like to express, that is not characterized or encouraged by any of the above impressions.

Safety is always paramount in this business and is more important than all else. However, in order to have a sustainable port providing positive financial impact, both locally and nationally, we need to move ships. The cost benefit of these proposed changes, while of secondary importance to safety, needs to be given strong consideration.

The extra depth will raise current restrictions on draft, which means deep draft ships could come and go at any tide, thereby saving tens of thousands of dollars that otherwise would have been wasted sitting at anchor. Secondly, deeper ships with more cargo could call at the port and more cargo means more revenue. It also allows for increased capacity to bring in emergency supplies after a hurricane. Currently under construction in Port Canaveral is the

largest tank farm on the east coast of Florida. The deeper depth of the channel will allow us to bring in more amount of product to meet the needs of central Florida.

Under Plan A two-way traffic is a possibility. This will reduce congestion delays and allow ships to transit at any time, without incurring expensive delays while dockside or at anchor.

The cruise ships being built now were unimaginable just a decade ago. How big will these ships get? I do not believe we know that answer yet. We need to be looking and planning for 20 to 30 years ahead and not just for the minimum required now. We are simulating ships that are already here! With 4 million Americans riding these cruise ships in and out of Port Canaveral annually, I have a duty as a pilot to not only keep the passengers safe, but to protect the port and Florida's pristine beaches and maritime environment. It is my belief, as an experienced pilot, that the improvements outlined in Plan A will provide a safer and financially beneficial improvement to the current channel and will encourage growth and commerce for decades to come.

Port Canaveral Evaluation 2009
Final Evaluation Form

Name: Captain David P Callan Date: 3-5 June 2009

The existing geographic database for Port Canaveral was modified to reflect two different dredge expansion plans. Both plans "A" and "B" widen the channel at the "dog leg" or junction of the outer reach and middle reach channels, and an area on the north side of middle reach channel. Plan "B" provides the narrower of the two options. Both plans provide for an expanded west turning basin as well except that the plan B basin has a slightly reduced diameter (50 feet). Channel depths were increased slightly and to the same controlling depth in both plans.

Two vessels were used in the simulations as the design vessel for the project: "Freedom of the Seas" (LOA 361.5m, Beam 47m, Draft 8.5m), and "Jupiter" (LOA 244m, Beam 42m, Draft 12m and 8.3m).

Northerly and Southerly winds of between 25 to 40 knots were used in simulation, in addition to currents both Northerly and Southerly of up 1 knot in velocity.

1) Does the channel widening provided by Plan A provide ample width for safe transit in the environmental conditions of wind and current as tested for all improved areas? Please comment for both the Jupiter and Freedom of the Seas if differences were noted?

Bend Widener "dog leg" **It is my professional opinion, after three full days evaluating the two plans for the "Bend Widener," that Plan A will undoubtedly provide ample width for the safe transit of both deep draft tankers and high freeboard / high windage cruise vessels for the most severe of wind conditions whether they be from the N'ly or S'ly directions. Certainly, there is a difference between the two types of vessels in that tankers have less freeboard affecting the set of the vessel but as has been pointed out by Mr. Jon Brazee of the Canaveral Port Authority: the soon-to-be new partner in the port, Vitol S.A., with its looming, large tank farm to be completed by year end, will be expanding the refined product market within six months to include both longer and deeper drafted vessels that will command the larger bend widener.**

Simultaneously, at 1111' LOA according to the pilot card, the passenger vessel *Freedom* (1186' as referred to above) is third among the largest three cruise class vessels in the world. Coming from the 400' wide approach channel into the widener of Plan A will allow the pilot onboard to adequately position the vessel for the approach to buoy 13A near the entrance of the expanded 500' channel that will be provided throughout the middle and inner reaches. At the same time, Plan A will provide the pilot with the ability to slow the vessel much sooner, even with increasing side drift, in order to reduce the surge effect upon vessels inside the port, and still maintain proper channel placement leaving the widener, and ensuring safe speed at all times in accordance with both International and Inland Rules of the Road.

Middle/Inner Harbor Reach **Of equal importance to the new Plan A widener, and certainly just as crucial to the overall enhancement of safe navigation in the port, is the 25% increase in channel width along these reaches to a 500' channel vice the current 400' channel. Not only is it critical to give the vessels a wide berth that rest along the piers at Cruise Terminals 2, 3 & 4 and at South Cargo Piers 1, 2 & 3, to preclude any possible surge to these vessels, it is an area where the pilots must continue to slow the vessels for a safe speed in the middle basin that often result in large crab angles of leeway not necessarily seen by the *Freedom* runs but are very evident for other vessels that are not fixed with azipods but must rely on speed and rudder power to effect a safe crab angle transiting this area.**

With respect to the "Jupiter," the additional width will allow the deeply laden tankers to not only maintain a larger, and thus safer distance to the ships on the south side at the various berths, but will minimize the effects of bow cushion and stern suction that we pilots must currently "fight" by strenuously utilizing the various assist tugs while slowing down for entry into the middle basin and docking therein. There can be no doubt that safety will be enhanced in the delivery of petroleum products to the port with the benefit of much safer transits and a reduction in the possibility of marine incidents that may result in oil pollution or allision with other moored vessels. Even in extreme S'ly winds, vessels transiting the area will be able to use the additional 100' channel width on the north side to maintain a greater distance to these vessels berthed on the south side as described above.

Turning Basin **Again, there can be no doubt that the Plan A turning Basin near the west basin will be adequate for the safe turning of the *Freedom* class vessel under all extreme weather directions and conditions as tested during the simulation. There is ample room to maintain a safe speed coming out of the middle basin and passing vessels in the West Cut A / West Cut B channel portion on the approach to the turning circle, especially considering the additional and essential widening along the south side in this West Cut section. Sufficient stopping distance will be available upon approach to the turning circle to slow the large passenger vessels and deep draft cargo vessels to a stop and proceed with the turning maneuver.**

What is most significant with the new widener when discussing other classes of vessels is to note that while not simulated, all of the vessels that will be berthed at North Cargo Piers 3, 4, 5, 6, & 7 will have adequate room to proceed inbound from sea, turn around under any condition of draft and weather, and dock port side to, headed for sea in the event of an emergency that requires vessels to leave port in haste due to approaching tropical storms or for an emergency in the port as per the port tariff. These vessels will more than likely have to be turned with the assist of tugs and they do not possess the same maneuverability that cruise vessels have so it is essential that the largest possible turning diameter be provided to these sometimes older but always less handy vessels in terms of engine usage and power reserve as well as thruster capacity, if provided at all. It is not as easy to check up headway and sternway as efficiently as cruise vessels due to the type of propulsion available.

2) Does the channel widening provided by Plan B provide ample width for safe transit in the environmental conditions of wind and current as tested for all improved areas? Please comment for both the Jupiter and Freedom of the Seas if differences were noted?

Bend Widener "dog leg" **I do not feel that Plan B would provide the same standard of safety that Plan A would for the simple fact that it is imperative in strong S'ly winds to "hug" the south channel limit so as to allow a gradual decrease in speed on the approach to the middle / inner reaches for the reasons of safety provided previously. While it may not seem to the layman that 50' is a significant and necessary improvement, one must recognize that in our current training program a pilot must develop the skills necessary to oftentimes pass within 10-15' of a windward buoy so as to allow the vessel to both slow and maintain channel integrity. Regardless of the Plan A improvements that may come to fruition, this skill will still need to be developed due to the fact that most vessels do not have the same tools that the *Freedom* does.**

Further, especially in the case of Plan B, it will be necessary at times to place the ship close to the channel limit well into the left outside quarter inbound in strong S'ly winds. This will not be ideal for either high freeboard vessels such as large cruise liners and certainly deep draft tankers such as the simulated "Jupiter" that would feel the cushion and suction effects to a greater extent.

It should also be remembered that channel degradation occurs first along the outer limits of the channel and historically Port Canaveral has seen most shoaling occur on that Southerly side of the channel. The recently constructed sand trap on the south widener limit has been documented to be almost completely full and there have been channel condition reports that there is further shoaling into the channel along the south limit of the section from buoys 11 through 13A. This is due to the large fetch to the south of the channel that is impacted by strong southerly winds of an extended duration. This is fact and not myth, as ACOE records will show.

Middle/Inner Harbor Reach **Quite simply, Plan B does not offer the same degree of safety as does Plan A. I cannot overstate the significance of 50' when maneuvering vessels at slow speed. One must continue slowing down, maintain adequate clearance to berthed vessels so as to eliminate surge, and still provide for channel integrity, i.e.: keeping the ship in the channel within the channel limits and eliminating bank cushion and stern suction effects. For both the widener and middle / inner reaches, understand that we are talking about almost one entire ship's beam in plan A but less than half a ship's beam in Plan B. Again, let me remind you that a 10% increase in channel width is considerable.**

Again, it is imperative that along this channel section the pilots are able to utilize the right inside quarter more so than infringing upon the right outside quarter where cushion/suction effects are exacerbated. Plan A offers greater advantages in this respect.

Turning Basin **Once more, it must be pointed out that for those vessels at North Cargo Piers 3 - 7, the largest diameter turning basin that is possible should be constructed due to the limitations in maneuverability, the time lag especially in**

going from ahead to astern and vice versa, and the need for assist tugs to turn the vessels. The situation, from a pilot's point of view, mandates the largest possible turning circle under Plan A vice Plan B. When using tugs, they will often need to be repositioned during the turning maneuver and will need area adjacent to the vessel turning to relocate themselves but will have to remain inside the turning circle clear of small boat marinas on the south side especially when doing so.

3) Both Plans A and B provide slightly increased depth in channels. Are these depths adequate for the vessels, especially the "Jupiter" with a draft of 12 meters (approximately 39 feet)? Comments?

As witnessed during the simulation, the additional depth will allow for a more acceptable under keel clearance when transiting the channel with deep draft laden tankers. A larger under keel clearance will ensure that the vessels do not come close to "bottoming out" in the channel due to the effects of squat at higher speeds in the approach channel and when maneuvering with strong backing bells in the turning basins. A deeper channel will allow the vessels to have a larger, denser medium of water in which to go astern and result in both shorter stopping distances and decrease in time of overall transit. One cannot overstate the shallow water effect on deep draft tankers/ bulkers / container vessels in our modest turning basins. Current tide restrictions as a result of the existing project depth, as well as delays incurred by the high priority cruise ships calling the port, oftentimes cause delays and/or cancellations of vessels that do not wish to sit and wait for the tides to cycle out of the cruise ship scheduling time frames. The new Project Depth simulated will allow tide restrictions to be lifted and allow twenty-four hour transit availability for commercial traffic.

4) Only maximum credible adverse environmental conditions were simulated. Would Plan A provide any advantages to the shiphandler over Plan B under less extreme environmental conditions?

Bend Widener "dog leg" **Plan A would most certainly be effective in providing sufficient width in the widener to allow for two-way traffic for medium size vessels under less extreme environmental conditions thus eliminating the need for strictly one-way traffic in the channel ways. Pilots will be able to time their vessel passings to be conducted either in the widener or, as in the next question, along the improved 500' middle/inner reach. This will most definitely have a favorable economic effect on vessels arriving and departing that would normally have been delayed in the past. Unwarranted charges for berthing and delays at their next port of call would be minimized if not eliminated. Plan B would more than likely not provide this advantage to the degree of Plan A, if at all.**

Middle/Inner Harbor Reach **For the same reason noted in the previous question, the 500' channel would allow for two way traffic for medium sized vessels and would improve the cost effectiveness of Port Canaveral that now only allows for one-way traffic due to the narrow nature of the reaches and widener. Plan B would remain sufficiently constricted so as to preclude such two-way traffic. The additional fifty feet would enhance safety and provide economic benefits.**

Turning Basin **The answer to this question is the same as that responded to earlier: with the exception of highly-maneuverable cruise ships, Plan A would afford the**

best possible turning circle diameter for vessels that are less maneuverable and that require tug assistance, or for other cruise vessels that will need to back up an extended distance from the turning circle to their berths on the north side of the West Basin. Plan B will not provide this additional safety enhancement.

5) Please comment on the effectiveness of the new outbound range. Do you recommend any other fixed (non-buoy) navigational aids to improve the overall project navigability?

The outbound range is an essential part of the equation. When working close to the bow of an 1100' cruise liner, with no view of the stern "dragging" behind you, the range is necessary to determine the position of the vessel in the channel in coordination with the perspective offered by the buoys. I would recommend, as we did during the simulation, that a buoy be placed along the upper channel limit of the middle / inner reach south of the west bank of the entrance to the east basin. This will provide an intermediary buoy between 14A and 12 to give the pilot an additional aid to navigation that will allow him to work as close to the North Channel limit as he needs to in this section. As well, an additional buoy will need to be positioned at the southwest corner of the West Basin turning circle to show the extent of the maneuvering area. (Near the barge canal approach channel)

6) Please comment on the accuracy of the simulation models.

Having been to several simulations at the STAR Center, I can attest to the constant improvements that I have seen each time I have been there in terms of real time movement, accurate depiction of the surrounding environs, and most importantly the actual handling characteristics of the vessels being simulated. I found this latter fact most striking for the *Freedom* and *Jupiter* and I must commend the designers and staff at the center for their positive reaction to real time feedback from the ships' crews and pilots alike. Having been to many simulation facilities, I find the STAR Center to be the most realistic. I personally feel that the STAR center gives an accurate portrayal of both the port layout and the handling characteristics of the ships simulated.

7) Is there a thought or impression that you would like to express, that is not characterized or encouraged by any of the above impressions.

While I neither infer nor imply that I am a professional channel designer, my personal reference source is the ASCE Publication "Ship Channel Design and Operation" Publication No. 107. In Section 2.4, it states that, "The designer will use the information on traffic type to select the design ship – usually the largest commodity mover expected to most frequently use the channel improvements." Certainly we have done that during this simulation and as noted in this section's response below we address the anticipated future scope of vessels calling Canaveral that are even larger than that simulated.

Quite appropriately, Section 8.7.3, Turn Design, addresses specific turn types. In my opinion, the Circle Turn (Figure 8-6) shown and simulated this past week properly addresses the anticipated deflection angle of these large cruise vessels throughout the turn, provides for the optimal radius of the navigation channel curve from the

channel center line to the center of curvature, and accurately increases the channel width in the turn.

I think it is very important, and hopefully not seemingly disingenuous, to take into consideration the fact that the responses that I have provided do indeed come from an individual who has a deep pool of experience in piloting vessels in Port Canaveral, New York Harbor, and the Delaware River. None of my comments are frivolous or exaggerated in nature. I have mentioned that a width of 50', while to an untrained eye may seem insignificant, is indeed a factor both my fellow pilots and I use on an almost daily basis while performing our duties. One should consider that 50' represents an increase of 10% in channel width, significant in itself, but more importantly it is almost 40-50% of a ship's beam that we normally handle in the port. This is noteworthy.

Also, while we did not simulate other vessels, it should be clearly understood that Disney Cruise Lines is currently building two 1110+ foot long ships to be home ported out of Canaveral that will not have the benefit of azipods but will have conventional Becker rudders and less horsepower from the bow and stern thrusters that will necessitate larger crab angles than simulated. This factor alone will make it essential to have all four improvements: the larger bend widener, the 500' channel, the additional channel width in West Cut, and the larger turning circle. For these vessels and for cruise vessels berthing at the to-be-built cruise terminals in the northern part of the west basin, it will be essential to have the largest possible turning basin to the south so as to allow for a safe and proper approach to these berths.

The consideration of Plan B does not factor in the very simple detail that while we are planning for the maneuvering of 1100+ feet vessels currently built, there are other vessels such as the *Queen Mary* at 1150' and the *Genesis* class at 1175' that are also scheduled to use Canaveral as a port of call. Should the pilots be presented with a channel and turning basin that is anything less than that established by Plan A, there can be no question that safety would not be enhanced and, quite possibly, may prohibit such vessels from calling. If we are to consider a safety factor of 1.5 times the length of a vessel for the design dimension of a turning circle, the Plan A configuration best suits our needs.

Therefore, if we are to consider that such a large capital outlay should ensure viability for the port well into the next thirty years, it would be imprudent, if not shortsighted, to consider any improvements that do not take into account the future demand for even larger vessels. In the past ten years, yours truly has seen the largest cruise ship in Canaveral go from 880' in length to the now simulated *Freedom* and *Disney* class vessels. The former is already calling Canaveral while the *Disney* vessels will be constructed in late 2010 and early 2011. With the *Queen Mary* and *Genesis* class vessels a reality, one can only anticipate the scope of vessels to appear on the horizon and Port Canaveral needs to be ready to be a proper port of call or homeport for them as the need arises.

As one aside before I end, it is my experience that the people of the state of Florida demand that the most experienced individuals – their harbor pilots – make strong arguments for providing the safest parameters for operating conditions and it is in this spirit that I have made my observations. It is in this spirit that I include one last quote from the ASCE Publication referred to above regarding factors influencing channel design, Chapter 4, "Navigation project planners / designers should develop strong coordination with the local pilot groups throughout the project development." I hope that the participation of both Captain Ben Borgie and myself during the simulation study this past week has served this interest.

Finally, while I am mere pilot at this point in time, I have over forty years of experience in the maritime industry after having been graduated from the United States Merchant Marine Academy and I have seen a consistent trend towards both the enrichment of safety oversight that Plan A will provide, and for larger and deeper vessels that again will be adequately addressed by the establishment of the Plan A channel and basin improvements. We must be pro-active in providing for the future of Port Canaveral rather than finding ourselves having to act in hindsight and being reactive to the ships that are built with further requests for channel relief. Plan A will provide Port Canaveral with the necessary improvements to enable it to be a first class port in our ever changing and challenging maritime world well into the future without the need to revisit the existing channel and turning basin scenarios.

Thank you for the opportunity to participate,

Captain David P. Callan

Please use additional sheets if necessary to complete your responses.

Thank you for your participation in this important project!