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Technical Memorandum

TEST REPORT FOR 27' NIGHT CAT INTERCEPT BOATS, INC.

by

Combatant Craft Department (23)

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Comparison testing was conducted between the 27' Night Cat, from Intercept Boats, Inc and a 27' center console, open deck craft built by Fountain Boats, Inc. This craft is presently the inventory craft of this length catagory as maintained by US Customs. Results indicate the 27' Night Cat exhibits superior seakeeping and ride characteristics compared to a craft of the same length.

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ABSTRACT

Comparison testing was conducted between the 27' Night Cat from Intercept Boats, Inc. and a 27' center console, open deck craft built by Fountain Boats, Inc.This testing was performed with funding provided by the Office of National Drug Control Policy. The Fountain craft presently is the inventory craft of this length category used by the various drug enforcement agencies, which include the DEA, Customs, and the Border Patrol. The results of this comparison indicate the 27' Night Cat has superior seakeeping and ride control abilities in comparison to similar size craft. Some minor design changes have been identified and solutions suggested as a result of the rough water tests should the 27' Night Cat be purchased by the government.

ADMINISTRATIVE INFORMATION

The Office of National Drug Control Policy (ONDCP), Washington, DC, through the Electronic Proving Ground, Fort Huschuca, Arizona contracted the Combatant Craft Department (CCD), Carderock Division, Naval Surface Warfare Center, Suffolk, Virginia to develop a test plan, conduct side by side testing, and prepare a final test report for comparison testing of the 27' Fountain craft and the 27' Night Cat.

The 27' Night Cat was built by Intercept Boats, Inc. as a private endeavor to provide a craft capable of operating offshore in relatively high sea states to interdict inbound drug/alien smuggling marine vehicles. The main thrust of this design was to provide personnel the most comfortable ride possible in order that they would encounter fewer injuries and arrive at the mission site much less fatigued.

TEST OBJECTIVE AND RESULTS

Background

The various drug enforcement agencies, which include U.S. Customs, U.S. Border Patrol and the Drug Enforcement Agency, all have various requirements for inshore and offshore interdiction craft. Their present inventory consist of off the shelf or confiscated boats, none of which have been specifically designed for the intended mission. Mr. Robert Perette of Intercept Boats embarked on a crusade to persuade the Office of National Drug Control Policy to evaluate his craft for the intended missions under the ONDCP umbrella of influence.

Mr. Perette was successful in accomplishing this goal and he requested the Combatant Craft Engineering Department to perform this testing in order to lend as much government credibility as possible. These tests would provide parallel information for comparison against similar tests the Massachusetts Institute of Technology performed previously. The claims for the Night Cat have been centered around improved ride and handling qualities at higher speeds when compared to conventional deep-vee hulls of like size and displacement. Mr. Perette presented an unsolicited proposal to the ONDCP, which was accepted and funded. This proposal consisted of a plan to compare a present inventory craft of similar size and displacement to the Night Cat. Rough water performance, calm water performance, scale weighing and turning tests were to be performed.

Craft Description

27' Night Cat

The 27' Night Cat is an open cockpit, catamaran hull, constructed of GRP and is outboard powered with twin OMC 300 hp gasoline engines. The craft has marine radios, Furuno Radar, and a Furuno 1600 GPS. The cockpit is equipped with two forward seat/bolsters and a single bench seat aft. Storage is provided just aft of the cockpit running to the transom with hatches provided as access. Photographs are provided in Appendix A. General characteristics are as follows:

Length, overall	27 feet, 0 inches
Beam, overall	10 feet, 3 inches
Draft, full load	2 feet, 4 inches
Displacement, mission load	8225 pounds
Fuel Capacity	250 gallons
Speed, mission load	54.2 knots
Crew	2
Passengers	2
Propulsion engines	Two OMC OB-300 hp (J300PXERC)
Weapons	None mounted
Electrical System	12 Vdc
Hull Construction	Glass Reinforced Plastic (GRP)
Hull type	Catamaran

27' Fountain

The 27' Fountain is a center console, open deck, deep-vee hull, constructed of GRP and is outboard powered with twin MERC 225 hp gasoline engines. The craft has marine radios, and Loran. The cockpit is equipped with a single seat/bolster with storage under the seat and console. Photographs are provided in Appendix A. General characteristics are as follows:

Length, overall	27 feet, 0 inches
Beam, overall	8 feet, 2 inches
Draft, full load	2 feet, 0 inches
Displacement, mission load	7590 pounds
Fuel Capacity	215 gallons
Speed, mission load	46.6 knots
Crew	2
Passengers	None
Propulsion engines	Two MERC OB-225hp ea
Weapons	None mounted
Electrical System	12 Vdc
Hull Construction	Glass Reinforced Plastic (GRP)
Hull type	Deep-vee

Test Objective

The objective of these tests is to provide the various drug enforcement and other interested agencies an objective evaluation conducted by the government of the seakeeping superiority claims made by Intercept Boats. In addition these tests will provide a good baseline for scaling various parameters of this craft for the possible design of a larger version of the Night Cat.

These tests were conducted to ascertain the following:

a) determine the exact weight and longitudinal center of gravity (LCG)

b) determine the calm water performance including speed, fuel consumption, range, and running trim for both mission load and full load

c) measure accelerations at two (or more) locations in at least a sea state 2 with secondary measurements of pitch and roll

d) turning and maneuvering tests

Note: These tests were slightly modified from the original test plan in that most measurements were also conducted on the comparison craft in lieu of just during the rough water comparison. This gives a better overall view of both craft tested.

Scale Weighing and LCG Determination

It was originally planned to conduct a two point lift using two load cells to determine the total weight and by leveling the craft in this configuration, determine the LCG. Since the proper equipment was not available in St. Augustine a travel lift was used at the Customs Facility with a load cell inserted at each end of the basket, first measuring the aft end and then the forward end. LCG was determined by leveling the craft and taking appropriate measurements and then calculating the LCG using simple statics. Two or three lifts were performed to obtain a good average and each lift was begun in a slacked condition to zero tare weight. This method was repeated for the comparison craft.

For these tests light load condition is defined as the boat ready for operation including full fuel and safety gear, but with no personnel or other gear onboard. Mission load is light load plus four personnel with side arms and minimal gear. Full load condition is mission load plus 1200 pounds to allow for heavy gear, prisoners or confiscated cargo.

The Night Cat as weighed was 6712 pounds. The craft was 115 gallons short of fuel which when added to the as weighed condition brings the craft to a light load condition of 7425 pounds with an LCG 7.92 feet forward of the transom/keel intersection (chosen as the reference line). Mission light load would become 8225 pounds with an LCG of 7.83 feet forward and full load would become 9425 with an LCG of 7.81 forward.

The Fountain craft as weighed was 6776 pounds with an LCG of 7.83 feet forward of the transom/keel intersection and required no adjustment since the fuel tanks were full. The mission load was calculated to be 7576 pounds with an LCG of 7.79 forward and full load added an additional 1200 pounds for a total of 8776 pounds with an LCG of 7.53 feet forward. Tabulated forms of the scale weights and corresponding LCG's are presented as figures 1 through 6. It should be noted here that in the absence of actual known mission loads assumptions were made to define the various loads. It was felt the loads chosen provided a wide enough spread in displacement to determine weight effects on other parameters.

27' NIGHT CAT LCG CALCULATIONS

Light Load Condition

WEIGHTS TO ADD OR DEDUCT

Load Description	Add Weight (Lbs.)	Subtract Weight (Lbs.)	Weight Differance (Lbs.)	Distance From Transom (In.)	Distance From Transom (Ft.)	Moment (Ft.-Lbs.)
Boat Crew Weight	0	0	0		0.00	0.0
Crew Gear	0	0	0		0.00	0.0
Weapon and Ammo	0	0	0		0.00	0.0
Fuel In Stbd Tank	360	0	360	210	17.50	6300.0
Fuel In Port Tank	353	0	353	210	17.50	6177.5
Total	**713**	**0**	**713**			**12478**

WEIGHT DATA

Weight - (As Weighed)	6712

distance from transom to 1st. band (Ft.) = 1.3
distance from transom to 2nd. band (Ft.) = 15.3

weight at stern (Lbs.) = 4028
weight at bow (Lbs.) = 2684

LCG CALCULATION

LCG (Ft.) - As Weighed/feet forward of tr	6.90

WEIGHT/LCG CORRECTION

Corrected Weight - Lbs.	7425
Corrected Moment (Ft.-Lbs.)	58779
Corrected LCG	7.92

Weight Light Load Condition **7425 Lbs.**
LCG **7.92 Ft. fwd of trans**

Figure 1

27' NIGHT CAT LCG CALCULATIONS

Mission Load Condition

WEIGHTS TO ADD OR DEDUCT

Load Description	Add Weight (Lbs.)	Subtract Weight (Lbs.)	Weight Differance (Lbs.)	Distance From Transom (In.)	Distance From Transom (Ft.)	Moment (Ft.-Lbs.)
Boat Crew Weight	800	0	800	84	7.00	5600.0
Crew Gear	0	0	0	0	0.00	0.0
Weapon and Ammo	0	0	0	0	0.00	0.0
Fuel In Stbd Tank	0	0	0	0	0.00	0.0
Fuel In Port Tank	0	0	0	0	0.00	0.0
Total	**800**	**0**	**800**	**0**	**0**	**5600**

WEIGHT DATA

Weight - Light Load Condition	7425

LCG CALCULATION

LCG -Light Load / Ft. forward of transom	7.92

WEIGHT/LCG CORRECTION

Corrected Weight - Lbs.	8225
Corrected Moment (Ft.-Lbs.)	64406
Corrected LCG	7.83

Weight Mission Load Condition **8225 Lbs.**
LCG **7.83 Ft. fwd of trans**

Figure 2

27 'NIGHT CAT LCG CALCULATIONS

Full Load Condition

WEIGHTS TO ADD OR DEDUCT

Load Description	Add Weight (Lbs.)	Subtract Weight (Lbs.)	Weight Differance (Lbs.)	Distance From Transom (In.)	Distance From Transom (Ft.)	Moment (Ft.-Lbs.)
Boat Crew Weight	800	0	800	89	7.42	5933.3
Crew Gear	400	0	400	89	7.42	2966.7
Weapon and Ammo	800	0	800	89	7.42	5933.3
Fuel In Stbd Tank	0	0	0	0	0.00	0.0
Fuel In Port Tank	0	0	0	0	0.00	0.0
Total	**2000**	**0**	**2000**	**0**	**0**	**14833**

WEIGHT DATA

Weight - Light Load Condition	7425

LCG CALCULATION

LCG -Light Load / Ft. forward of transom	7.92

WEIGHT/LCG CORRECTION

Corrected Weight - Lbs.	9425
Corrected Moment (Ft.-Lbs.)	73639
Corrected LCG	7.81

Weight Full Load Condition **9425 Lbs.**
LCG **7.81 Ft. fwd of trans**

Figure 3

27' FOUNTAIN LCG CALCULATIONS

Light Load Condition

WeightsTo Add or Deduct:

Load Description	Add Weight (Lbs.)	Subtract Weight (Lbs.)	Weight Differance (Lbs.)	Distance From Transom (In.)	Distance From Transom (Ft.)	Moment (Ft.-Lbs.)
Boat Crew Weight	0	0	0	0	0.00	0.0
Crew Gear	0	0	0	0	0.00	0.0
Weapon and Ammo	0	0	0	0	0.00	0.0
Fuel In Stbd Tank	0	0	0	0	0.00	0.0
Fuel In Port Tank	0	0	0	0	0.00	0.0
Total	**0**	**0**	**0**	**0**	**0**	**0**

WEIGHT DATA

Weight - As Weighed	6776

distance from transom to 1st. band (Ft.) = 0.67
distance from transom to 2nd. band (Ft.) 14.67

weight at stern (Lbs.) = 3312
weight at bow (Lbs.) = 3464

LCG CALCULATION

LCG - As Weighed Ft. forward of transom	7.83

WEIGHT/LCG CORRECTION

Corrected Weight - Lbs.	6776
Corrected Moment (Ft.-Lbs.)	53036
Corrected LCG	7.83

Weight Light Load Condition **6776 Lbs.**
LCG **7.83 Ft. fwd of trans.**

Figure 4

27' Fountain LCG Calculations

Mission Load Condition

WeightsTo Add or Deduct:

Load Description	Add Weight (Lbs.)	Subtract Weight (Lbs.)	Weight Differance (Lbs.)	Distance From Transom (In.)	Distance From Transom (Ft.)	Moment (Ft.-Lbs.)
Boat Crew Weight	800	0	800	89	7.42	5933.3
Crew Gear	0	0	0	0	0.00	0.0
Weapon and Ammo	0	0	0	0	0.00	0.0
Fuel In Stbd Tank	0	0	0	0	0.00	0.0
Fuel In Port Tank	0	0	0	0	0.00	0.0
Total	**800**	**0**	**800**	**0**	**0**	**5933**

WEIGHT DATA

Weight - Light Load Condition	6776

LCG CALCULATION

LCG -Light Condition / Ft. forward of trans	7.83

WEIGHT/LCG CORRECTION

Corrected Weight - Lbs.	7576
Corrected Moment (Ft.-Lbs.)	58989
Corrected LCG	7.79

Weight Mission Load Condition **7576 Lbs.**

LCG **7.79 Ft. fwd of trans**

Figure 5

27' FOUNTAIN LCG CALCULATIONS

Full Load Condition

WeightsTo Add or Deduct:

Load Description	Add Weight (Lbs.)	Subtract Weight (Lbs.)	Weight Differance (Lbs.)	Distance From Transom (In.)	Distance From Transom (Ft.)	Moment (Ft.-Lbs.)
Boat Crew Weight	800	0	800	105	8.75	7000.0
Crew Gear	400	0	400	50	4.17	1666.7
Weapon and Ammo	800	0	800	65	5.42	4333.3
Fuel In Stbd Tank	0	0	0		0.00	0.0
Fuel In Port Tank	0	0	0		0.00	0.0
Total	**2000**	**0**	**2000**			**13000**

WEIGHT DATA

Weight - Light Load Condition	6776

LCG CALCULATION

LCG -Light Condition / Ft. forward of trans	7.83

WEIGHT/LCG CORRECTION

Corrected Weight - Lbs.	8776
Corrected Moment (Ft.-Lbs.)	66056
Corrected LCG	7.53

Weight Full Load Condition **8776 Lbs.**

LCG **7.53 Ft. fwd of trans**

Figure 6

Calm Water Performance

Initial calm water tests were performed in St. Augustine on the Matanzas and Tolomato Rivers. Fuel consumption and range data were not collected due to instrumentation problems, but were collected later during testing at Ft. Monroe, VA. Speed, engine RPM, and dynamic trim at the mission and full loads were recorded. Each craft was run on a straight line course about 1/2 mile long in both directions (180 ° to each other). LCG's were not varied in accordance with the test plan, but rather were taken based on how the load could be placed in these particular craft. Therefore, only the two LCG's were tested. RPM's were measured using optical sensors on each engine taking readings from reflective tape fixed to the flywheel. The RPM signals were recorded from digital readout counters. Static trim was measured using an electronic digital readout. Atmospheric conditions were obtained from local weather reports and NOAA weather and sea buoy stations. Dynamic trim was observed via an inclinometer placed parallel to the baseline and manually read. Speed was obtained with a calibrated radar gun (reading in Knots) and verified with differential GPS. Shaft horsepower was previously obtained on a dynamometer by Outboard Marine Corporation. At present Combatant Craft has no means for measuring torque on an outboard gasoline engine, therefore, curves plotted include only RPM.

The weather was mild in St. Augustine with temperatures in the mid 80's and winds light and variable not exceeding 10 knots. Water depth was 20-22 feet and surface conditions were very light wind blown chop. Calm water results can be found in tables 1 and 2.

The Night Cat is starting to plane at approximately 2700 RPM's in the lighter load and 2900 with the heavier load. This is the transition mode from semi-planing to full planing and there is no pronounced hump speed indicated. Top speed in light mission load was 54.8 knots (averaged in both directions using the radar gun and GPS). The top speed in the full load mission profile was 51.0 knots using the same averaging method. The Fountain exhibits a higher hump speed of around 3300 RPM for the lighter load and 3500 RPM for the heavier load. Top speed for the Fountain was 46.6 knots and 44.4 respectfully.

No comparison of speed should be made here, since the Night Cat has almost 600 horsepower versus 450 horsepower for the Fountain. This test was carried out simply to determine what speeds could be expected from each craft when deciding the comparison test run to be made in rough water. Speed power curves are presented as figures 7 and 8.

Fuel flow measurements and a range measurement were accomplished once the craft were returned to Fort Monroe. Fuel flow was accomplished using a turbine flow meter, while range was determined by running the craft from a fuel dock at Willoughby Spit (Norfolk, VA), just topped off with fuel to a point east of the Bay Bridge Tunnel and returning to the fuel dock and topping off again. This gives a better indication of range since the operator actually operates the craft from idling power up to a predetermined cruise RPM, in this case 4000, and attempts to hold that RPM until the craft returns to refuel. Sea State, boat traffic, etc., however, will actually cause the operator to vary the RPM's and give a more true picture of range. The fuel flow curve for the Night Cat plotted as part of figure 7, will give the operator a good idea of range for planing purposes. The range was determined to be 205 NM with a burn rate of 1.22 gallons per nautical mile at the cruise RPM of 4000. No fuel flow measurement or range data was taken on the Fountain since a comparison should not be made here due to the difference in horsepower. Further tests could be accomplished to provide a comparison of horsepower for the different hull forms. Catamarans usually have slightly more drag associated with the hull form when compared to a deep-vee.

TABLE 1

27' NIGHT CAT CALM WATER PERFORMANCE

27' NIGHT CAT FULL LOAD - 9/10/97

RPM	SPD-GPS	SPD-RDR	SPD-AVG	DIR	SPD-GPS	SPD-RDR	SPD-AVG	DIR	SPD-Kn	TRIM-deg
6000	51.80	51.20	51.50	N	51.40	51.80	51.60	S	51.00	3.5
5200	48.80	48.90	48.85	N	49.60	49.70	49.65	S	49.25	3.5
4800	44.10	44.30	44.20	N	45.70	45.80	45.75	S	44.98	3.6
4400	39.60	39.30	39.45	N	40.10	40.00	40.05	S	39.75	3.7
3600	27.10	27.20	27.15	N	28.30	28.90	28.60	S	27.88	3.9
3000	17.70	18.00	17.85	N	19.90	19.80	19.85	S	18.85	8.4
2600	13.90	13.70	13.80	N	15.00	15.10	15.05	S	14.43	8.4
2000	7.20	7.30	7.25	N	9.50	9.30	9.40	S	8.33	4.5

27' NIGHT CAT MISSION LOAD - 9/10/97

RPM	SPD-GPS	SPD-RDR	SPD-AVG	DIR	SPD-GPS	SPD-RDR	SPD-AVG	DIR	SPD-Kn	TRIM-deg
6000	53.70	54.80	54.25	N	54.90	55.80	55.35	S	54.80	3.5
5200	50.80	50.50	50.65	N	53.00	52.30	52.65	S	51.65	3.6
4800	44.80	44.70	44.75	N	48.00	48.10	48.05	S	46.40	3.6
4400	39.90	38.50	39.2	N	42.50	42.20	42.35	S	40.78	3.7
3600	27.70	28.20	27.95	N	30.40	30.20	30.30	S	29.13	4.2
2800	16.40	16.30	16.35	N	18.20	18.30	18.25	S	17.30	5.7
2000	9.00	8.80	8.9	N	11.10	10.90	11.00	S	9.95	7.7

TABLE 2

27' FOUNTAIN CALM WATER PERFORMANCE

27' FOUNTAIN FULL LOAD - 9/10/97

RPM	SPD-GPS	SPD-RDR	SPD-AVG	DIR	SPD-GPS	SPD-RDR	SPD-AVG	DIR	SPD-Kn	TRIM-deg
5800	NA	43.70	43.70	N	NA	45.00	45.00	S	44.35	2.9
5200	NA	38.80	38.80	N	NA	39.20	39.20	S	39.00	3.2
4800	NA	31.60	31.60	N	NA	33.70	33.70	S	32.65	3.4
4400	NA	28.90	28.90	N	NA	30.80	30.80	S	29.85	3.6
3600	NA	24.20	24.20	N	NA	24.80	24.80	S	24.50	4.1
3400	NA	14.60	14.60	N	NA	13.90	13.90	S	14.25	4.7
3000	NA	7.20	7.20	N	NA	8.50	8.50	S	7.85	5.1

27' FOUNTAIN MISSION LOAD - 9/10/97

RPM	SPD-GPS	SPD-RDR	SPD-AVG	DIR	SPD-GPS	SPD-RDR	SPD-AVG	DIR	SPD-Kn	TRIM-deg
5800	NA	45.40	45.40	N	NA	47.70	47.70	S	46.55	3.3
5200	NA	40.60	40.60	N	NA	41.90	41.90	S	41.25	3.7
4800	NA	37.30	37.30	N	NA	38.50	38.50	S	37.90	3.9
4400	NA	33.70	33.70	N	NA	35.60	35.60	S	34.65	4.2
3600	NA	27.40	27.40	N	NA	29.50	29.50	S	28.45	5.4
3400	NA	24.70	24.70	N	NA	25.20	25.20	S	24.95	6.1
3200	NA	13.70	13.70	N	NA	15.10	15.10	S	14.40	8.4
2800	NA	10.80	10.80	N	NA	12.50	12.50	S	11.65	8.4
2000	NA	6.30	6.30	N	NA	8.20	8.20	S	7.25	4.3

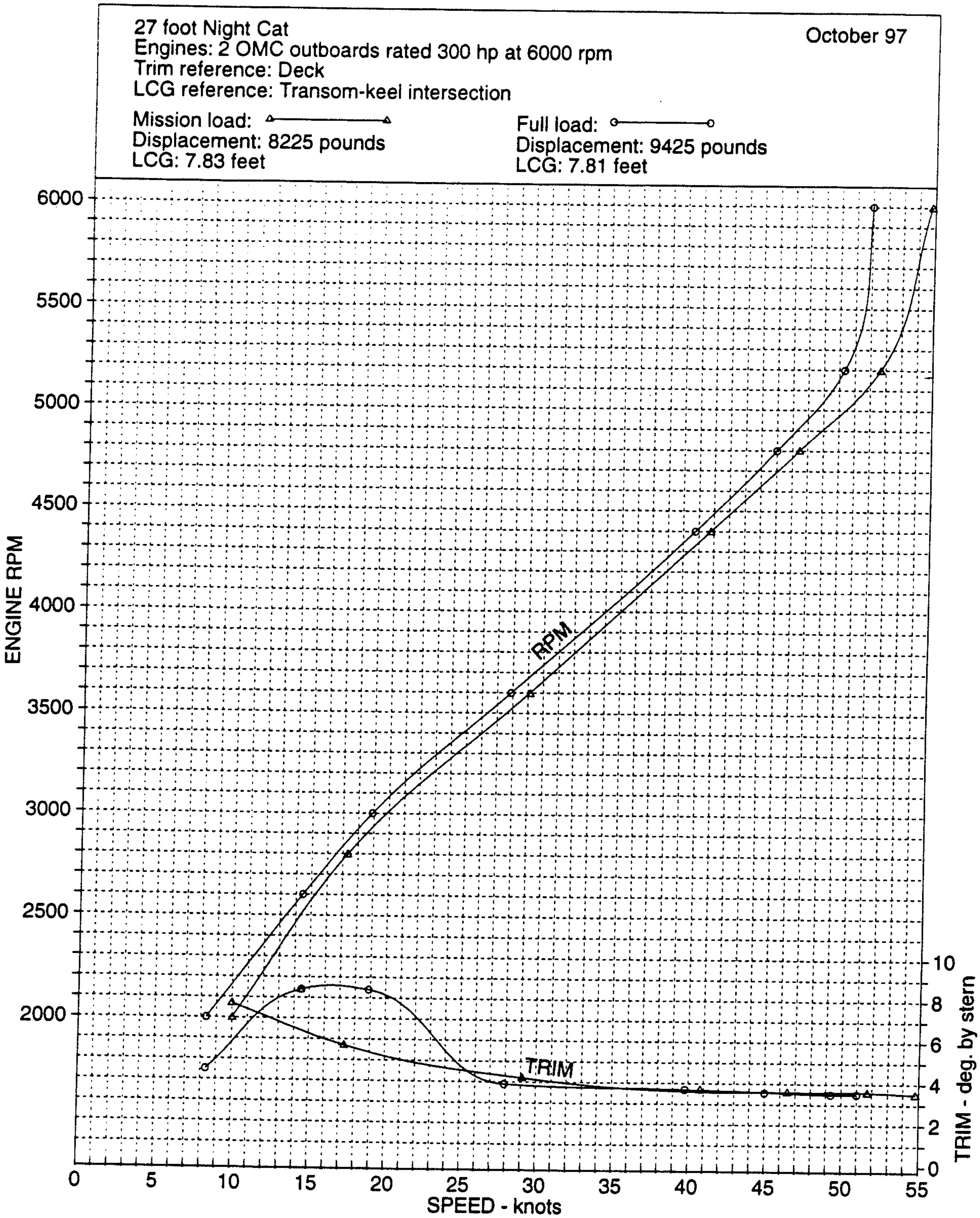


Fig. 7. Calm water performance

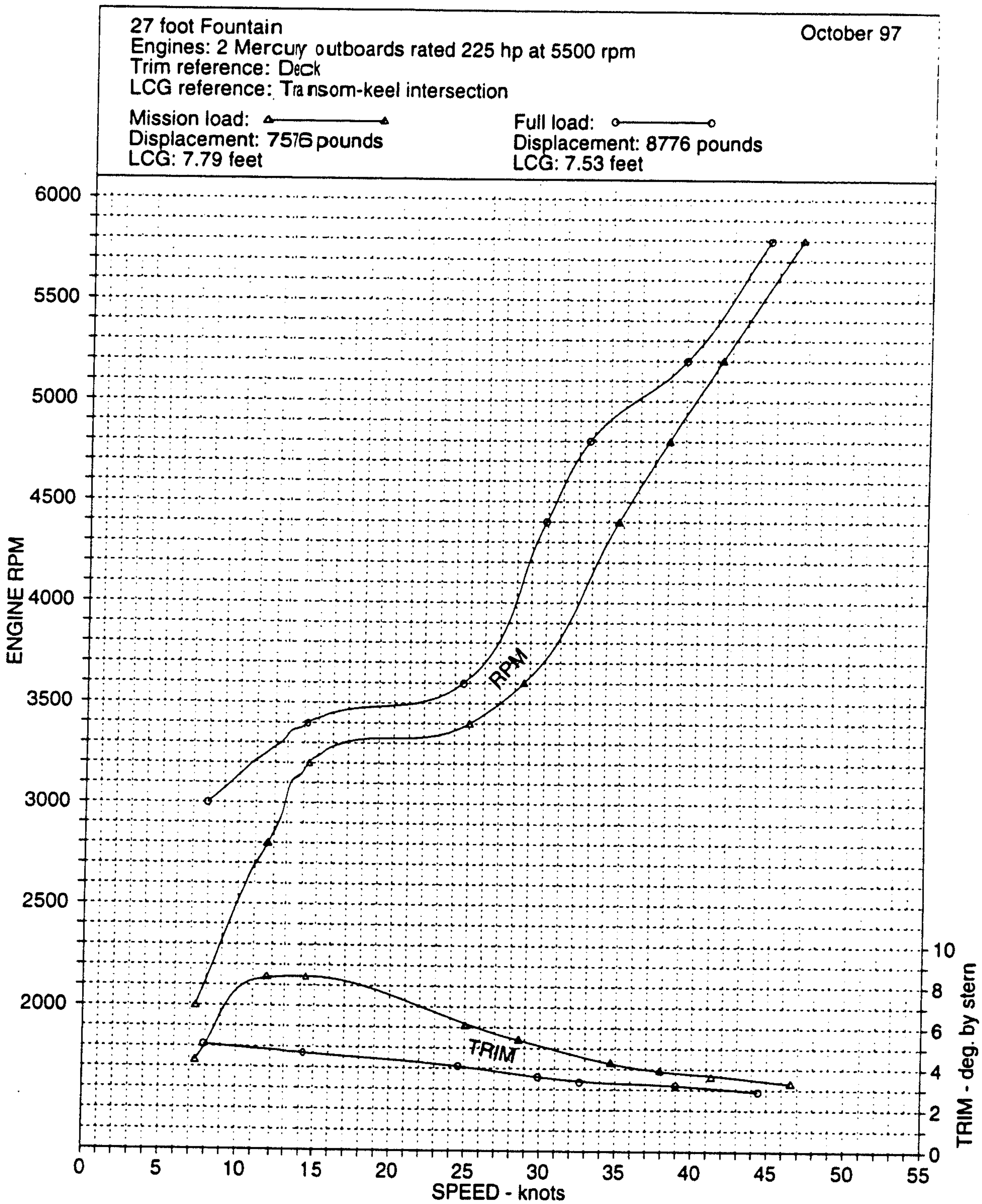


Fig. 8. Calm water performance

Rough Water Performance (Seakeeping)

There was insufficient rough water in St. Augustine to provide a good side by side comparison of the Night Cat and the Fountain. A 3' swell was running, but at a long period and fairly gentle slope. Four craft actually ventured offshore from St. Augustine into the Atlantic including the two test craft, a 40' Fountain equipped with Stidd Seats, and a 40' Cigarette boat. It is interesting to note that the Night Cat was able to run at full throttle under these conditions while the other craft had to run at something below full throttle position. This is also significant considering the Night Cat can attain faster speeds at full throttle than three of the other craft. The Cigarette had been out running the Night Cat in calm water, but was forced to slow down in the swells. Under these conditions the Night Cat even outperformed the more powerful Cigarette.

Since rough water could not be obtained in St. Augustine within the allotted time frame both test craft were shipped to Ft. Monroe, VA to the Combatant Craft Test Facility. This was done to complete testing with hopes in obtaining rough water conditions. These conditions occurred on September 30, 1997 when high SW winds were present due to a stationary low front off the Virginia Capes. 3 to 4 foot significant height waves were produced with occasional 6 footers at Chesapeake Light. The location chosen for the comparison testing was just east of the Chesapeake ....Bay Bridge Tunnel were 2-3 foot significant wave heights were encountered. The waves were very steep with a very short period and mostly of a confused nature. There was very little underlying swell (about 1 foot) and it was difficult to determine at which heading (in degrees), because of the confused seas to run in order to obtain the desired data. Runs were made for 10 minutes in head, bow, beam, stern and following seas. At first it was hoped that three series of runs could be made; low RPM, maximum RPM (Fountain) and maximum RPM (Night Cat). The Night Cat was to run during all three series, while the Fountain had to run only two series. After running the Fountain maximum, however, it was decided to reduce the testing to two series, Fountain maximum and Night Cat maximum in order to reduce the pounding and possibility of injury on the Fountain coxswain and test engineer. The Night Cat maximum run was also reduced to running only a head sea and following sea direction to reduce fatigue on the Night Cat personnel.

Mr. Waldemar Kropacek, the Director of the National Marine Support Center for U.S. Customs agreed to operate the Fountain during the rough water trials at Ft. Monroe. Mr. Kropacek is a very experienced operator and could push the Fountain as hard as possible and obtain the maximum speed under adverse conditions. The test were begun by having the Fountain run as fast as possible while the Night Cat adjusted its speed to coincide with the Fountain during runs in each direction. The Night Cat operator, Ms. Amy Baker, was experienced with the Night Cat, but not in heavy seas of this type. The Fountain was able to sustain speeds from 18-34 knots depending on the heading, but required constant throttle attention. The Night Cat easily maintained speed with minimal throttle attention and in fact Ms. Baker had to be reminded to back off the throttles as the Night Cat was constantly over taking the Fountain. This is significant since it indicates a very experienced operator operating in rough seas is pushing his craft to the limit, while a less experienced operator in the Night Cat can actually exceed the Fountain speeds with little or no problem.

Acceleration data from both craft was analyzed and plotted for each heading on curves, figures 9 through 34, derived from *International Standard, ISO 2631/1, part 1*. Part 1 pertains to the evaluation of crew exposure to whole body vibration (1 to 80 hz). This standard states that their are four physical factors of primary importance in determining an individuals response to vibrations. The intensity, the frequency, the direction and the exposure time.

The ISO curves presented represent a fatigue -decreased proficiency boundary as a function of frequency and exposure time in the vertical direction. It should be kept in mind that these curves show the general onset of interference. Actual interference will of course vary depending on several factors such as individual characteristics, type of task, and difficulty of the task. As an individual becomes fatigued it is more likely that individual can be hurt and make mistakes. Vertical accelerations experienced by a sitting or standing person is most sensitive in the 4 to 8Hz frequency bands (horizontal portion of the curves). To obtain the maximum exposure limit for health and safety the corresponding limits shown on these curves are raised by 6db. For transverse and longitudinal accelerations the most sensitive is at and below 2Hz.

Figures 9 through 13 represent a comparison of the five headings, bow accelerometer, with the Fountain at maximum safe speed and the Night Cat at the same speed. These curves indicate a 45% reduction in vertical accelerations in bow quartering seas to about a 15% reduction in following seas for the Night Cat over the Fountain. The bow accelerometers for both craft were approximately the same distance forward from the transom.

Figures 14 through 18 are the same comparison except with the accelerometers placed at the respective coxswain's station. The difference is a little less here, but was expected. This is because the coxswain station on the Fountain is at the LCG, while the Night Cat LCG is aft of the coxswain station. None the less, the accelerations on the Night Cat are less for all headings and are still about 50% less for the bow sea. Good design practice will place the coxswain station forward of any passenger seats and a position slightly ahead of the LCG will help keep the operators from exceeding the design limit set for the passenger seats or compartment, as well as the boat structure.

Figures 19 through 23 are again the same comparison, but with accelerometers placed at the stern. Again the same story, the Night Cat exhibits significantly less acceleration in all headings.

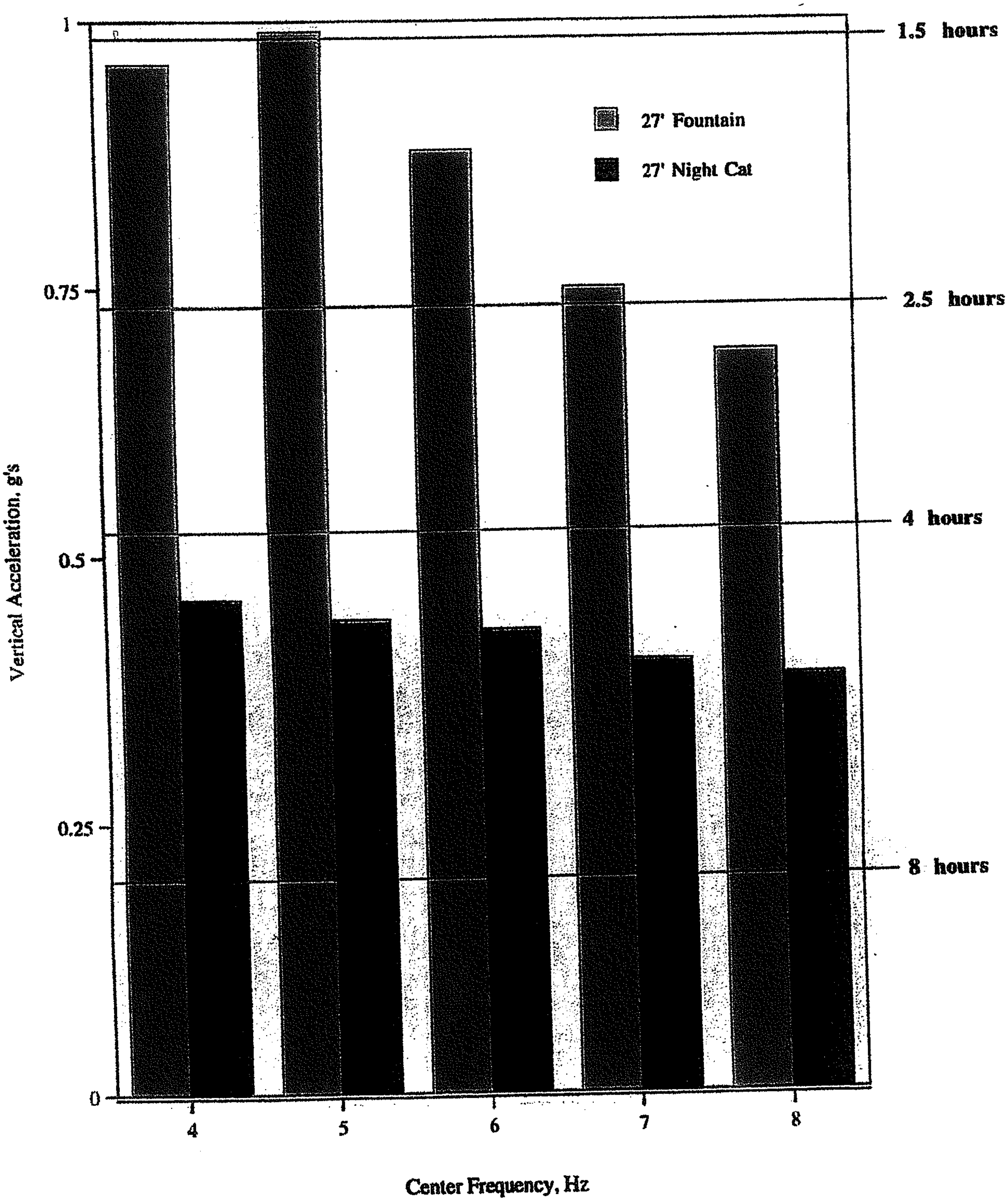
The ISO curves for the coxswain station and stern accelerometers indicate a spike at about 5 Hz for the Night Cat and the curves for both craft sometimes cross above 18Hz. These occur probably due to some wave slap on the horizontal hull of the Night Cat and some engine or propulsor noise. A full analysis of this is beyond the scope of this report and not considered significant. However, if a larger scale craft is considered these spikes and cross curves need to be kept in mind.

Figures 24 through 29 are acceleration comparisons at all three stations of the Night Cat while running at its perceived maximum safe speed with the previous Night Cat accelerations (figures 19 through 23) superimposed. This gives a comparison of the increased speed the Night Cat can achieve, while not increasing accelerations significantly. Unfortunately due to weather conditions and the decision to cut this test short only data at head seas and following seas was taken. Based on the previous analysis it is suspected the Night Cat would turn in its maximum performance at the bow sea heading.

The last figures shown are longitudinal accelerations taken at the coxswain station and plotted as figures 30 through 34. The Night Cat again exhibits significantly less longitudinal acceleration, about 40% less for all headings, than the Fountain craft. Transverse acceleration data was taken during these runs and analyzed, but not reported. The data is almost identical to the longitudinal data except that the reduced proficiency is lower and therefore insignificant.

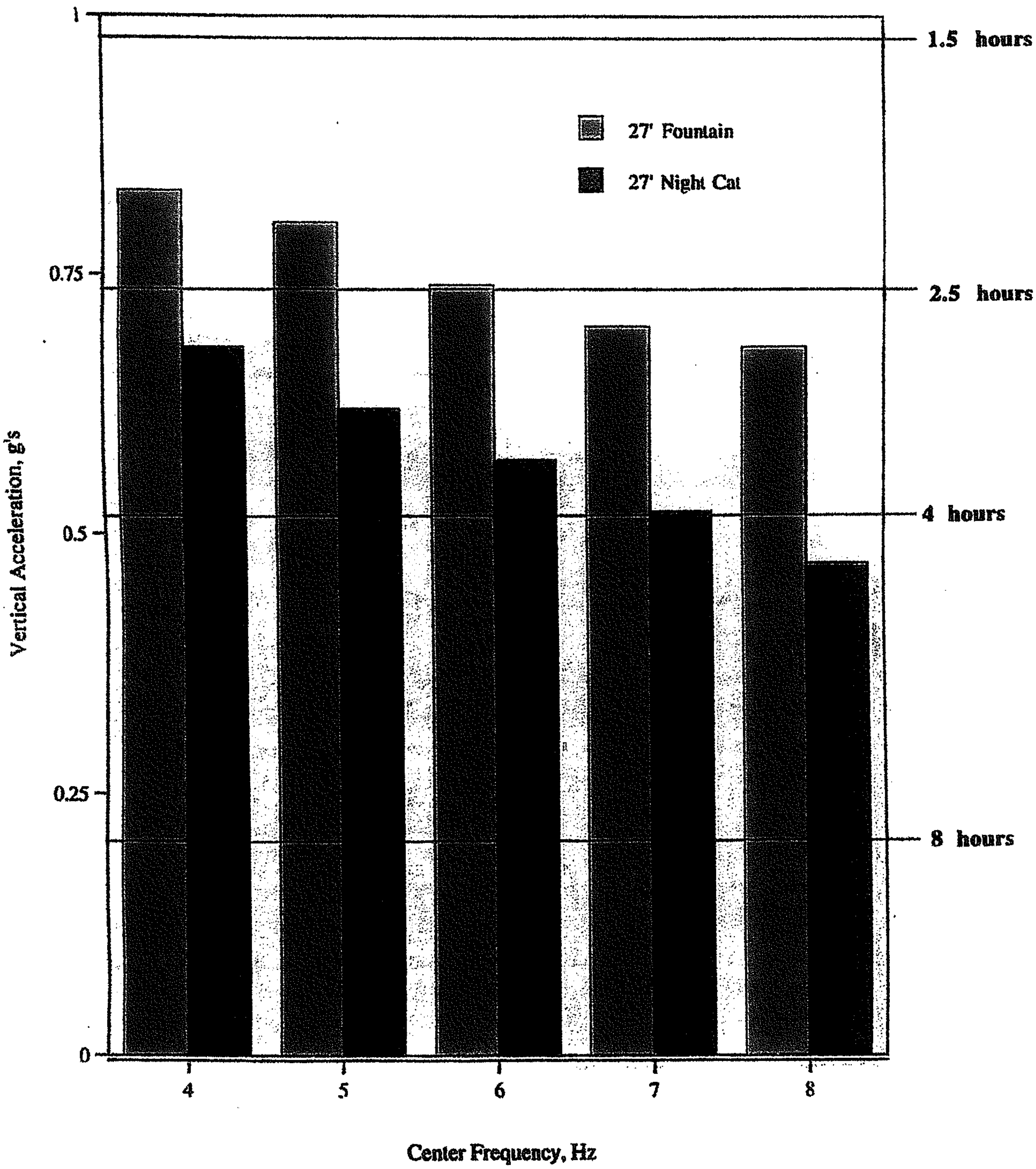
Acceleration Comparison
Port Bow Sea, 18 Knots
Coxswain Location

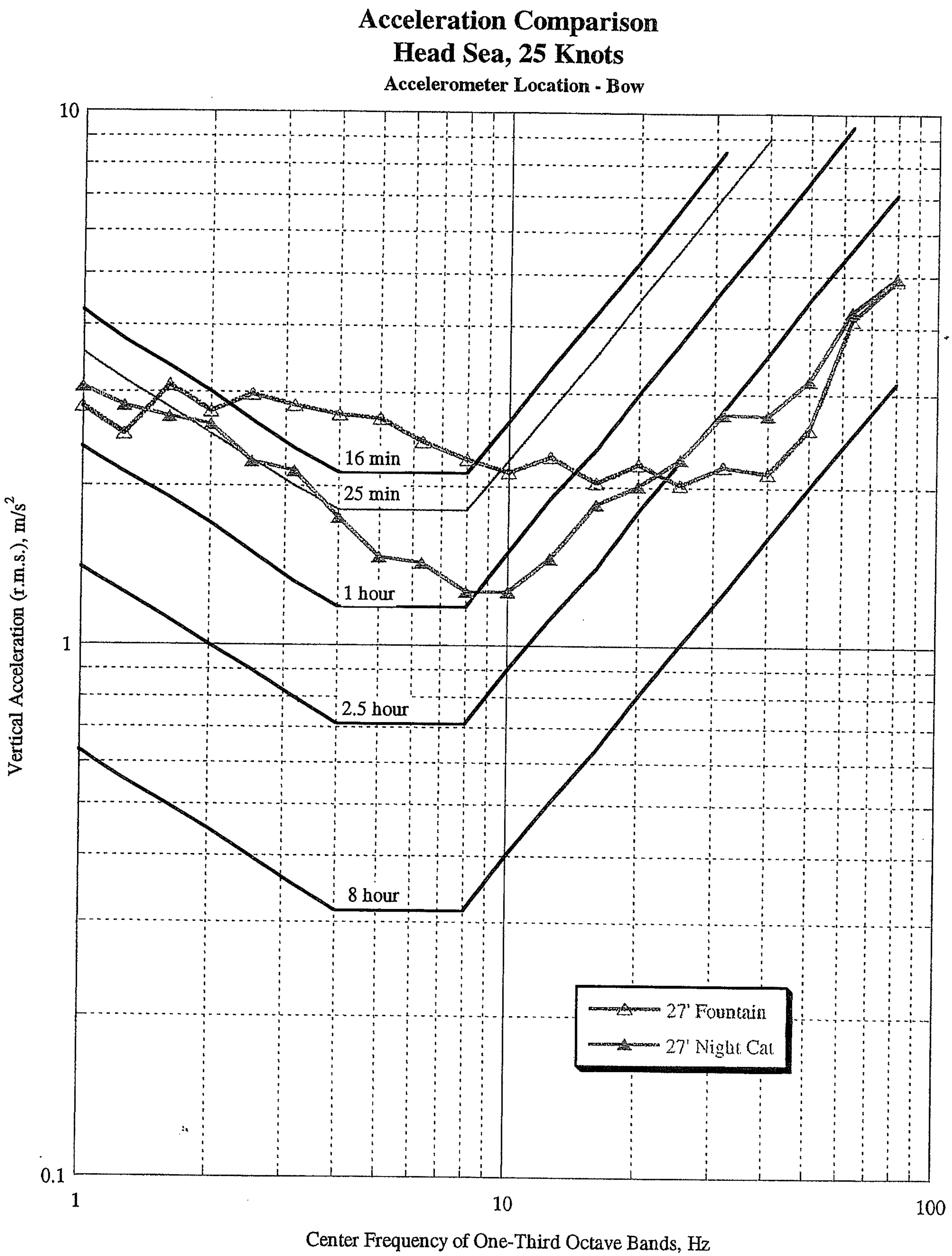
***Note:** Hour lines indicate onset of decreased proficiency. Night Cat exhibits 50% decrease in accelerations, while increasing reduced fatigue time by 300%.*



Acceleration Comparison
Following Sea, 25 Knots
Coxwain Location

***Note:** Hour lines indicate onset of decreased proficiency. Night Cat exhibits 30% decrease in accelerations, while increasing reduced fatigue time by 150%.*





Acceleration Comparison
Head Sea, 25 Knots
Accelerometer Location - Bow
10
1
0.1
1
10
100
Vertical Acceleration (r.m.s.), m/s²
Center Frequency of One-Third Octave Bands, Hz
16 min
25 min
1 hour
2.5 hour
8 hour
27' Fountain
27' Night Cat

Figure 9

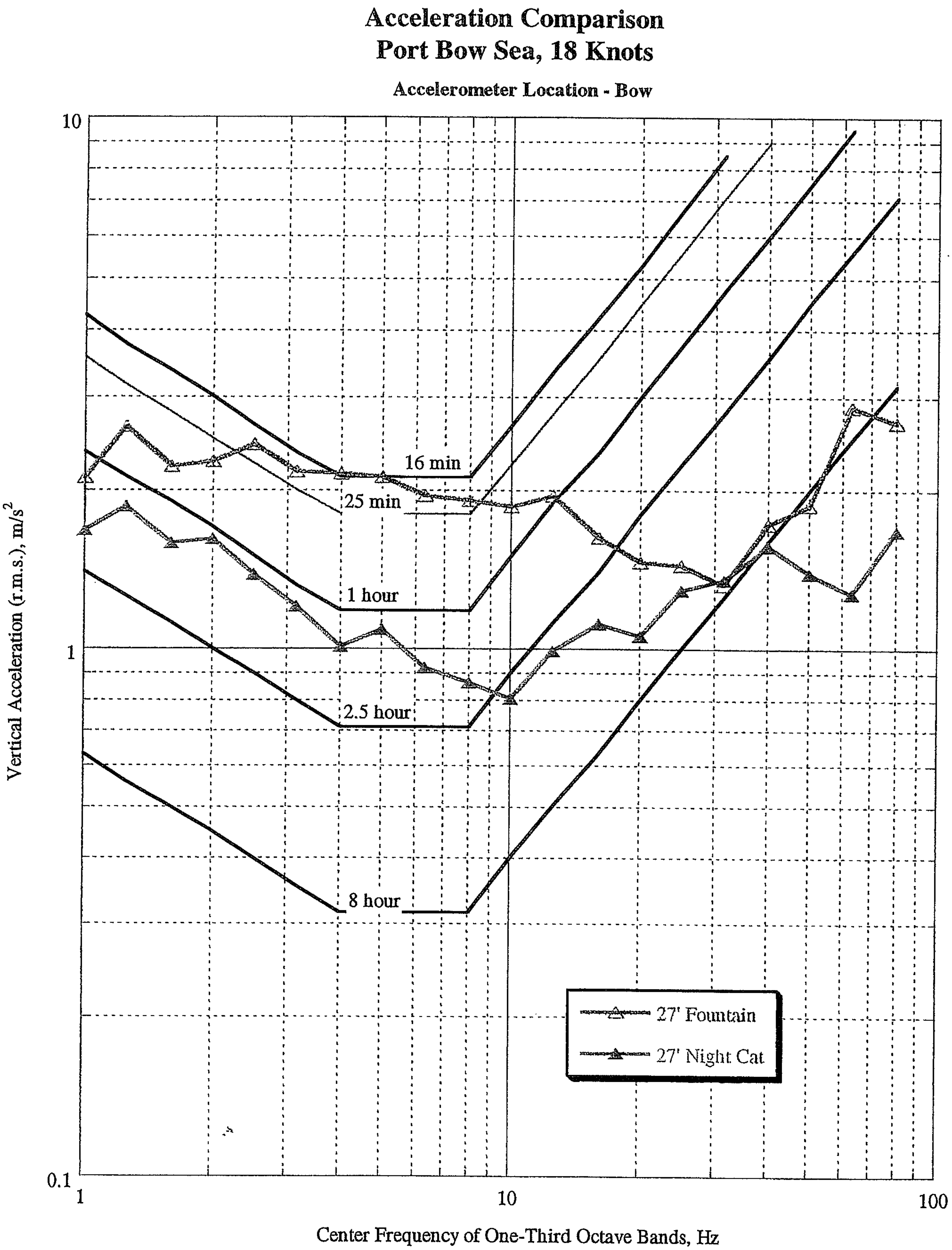
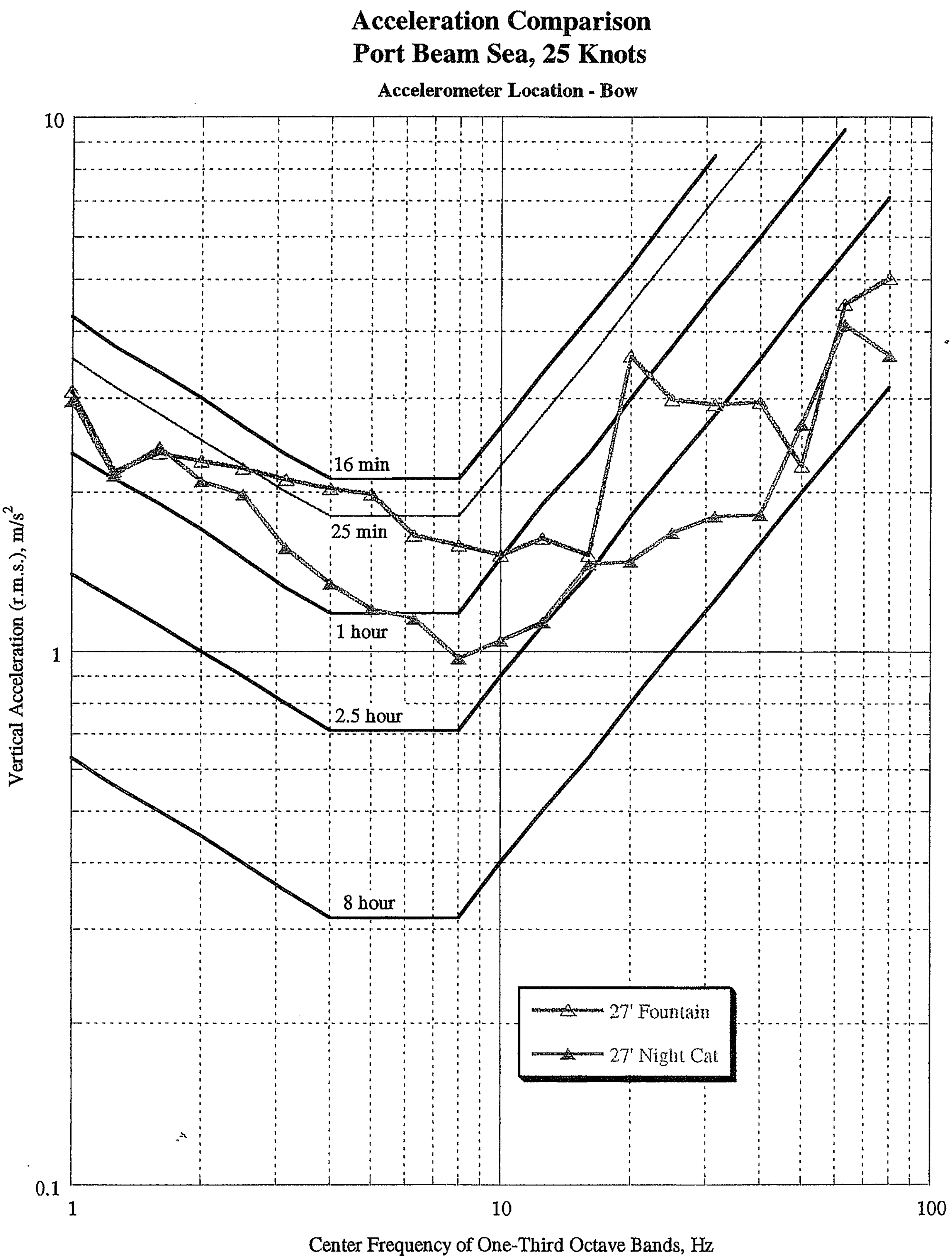

Acceleration Comparison
Port Bow Sea, 18 Knots
Accelerometer Location - Bow
Vertical Acceleration (r.m.s.), m/s2
Center Frequency of One-Third Octave Bands, Hz
10
1
0.1
1
10
100
16 min
25 min
1 hour
2.5 hour
8 hour
27' Fountain
27' Night Cat

Figure 10



Acceleration Comparison
Port Beam Sea, 25 Knots
Accelerometer Location - Bow
10
1
0.1
1
10
100
Vertical Acceleration (r.m.s.), m/s2
Center Frequency of One-Third Octave Bands, Hz
16 min
25 min
1 hour
2.5 hour
8 hour
27' Fountain
27' Night Cat

Figure 11

Acceleration Comparison
Starboard Quartering Sea, 31 Knots

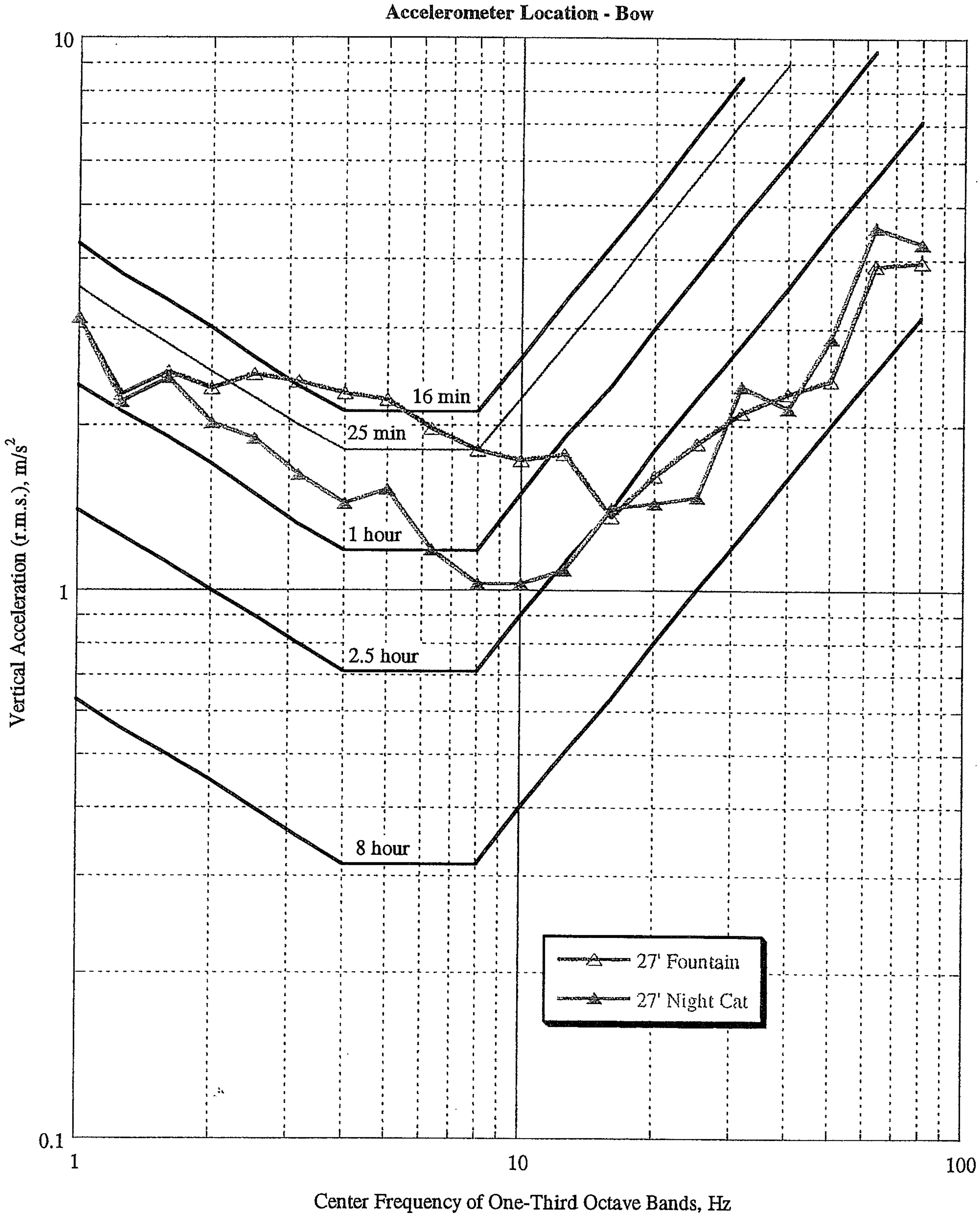
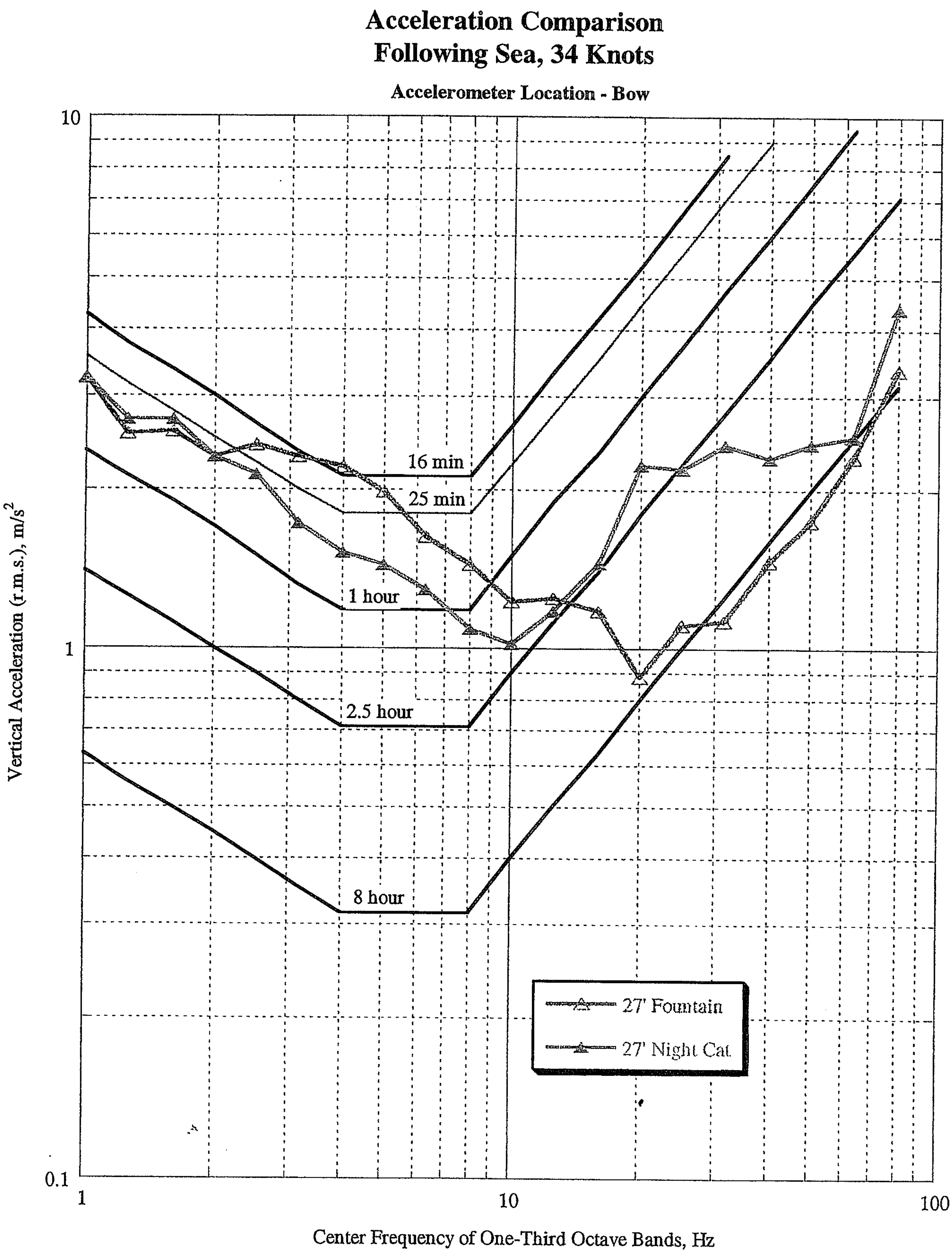
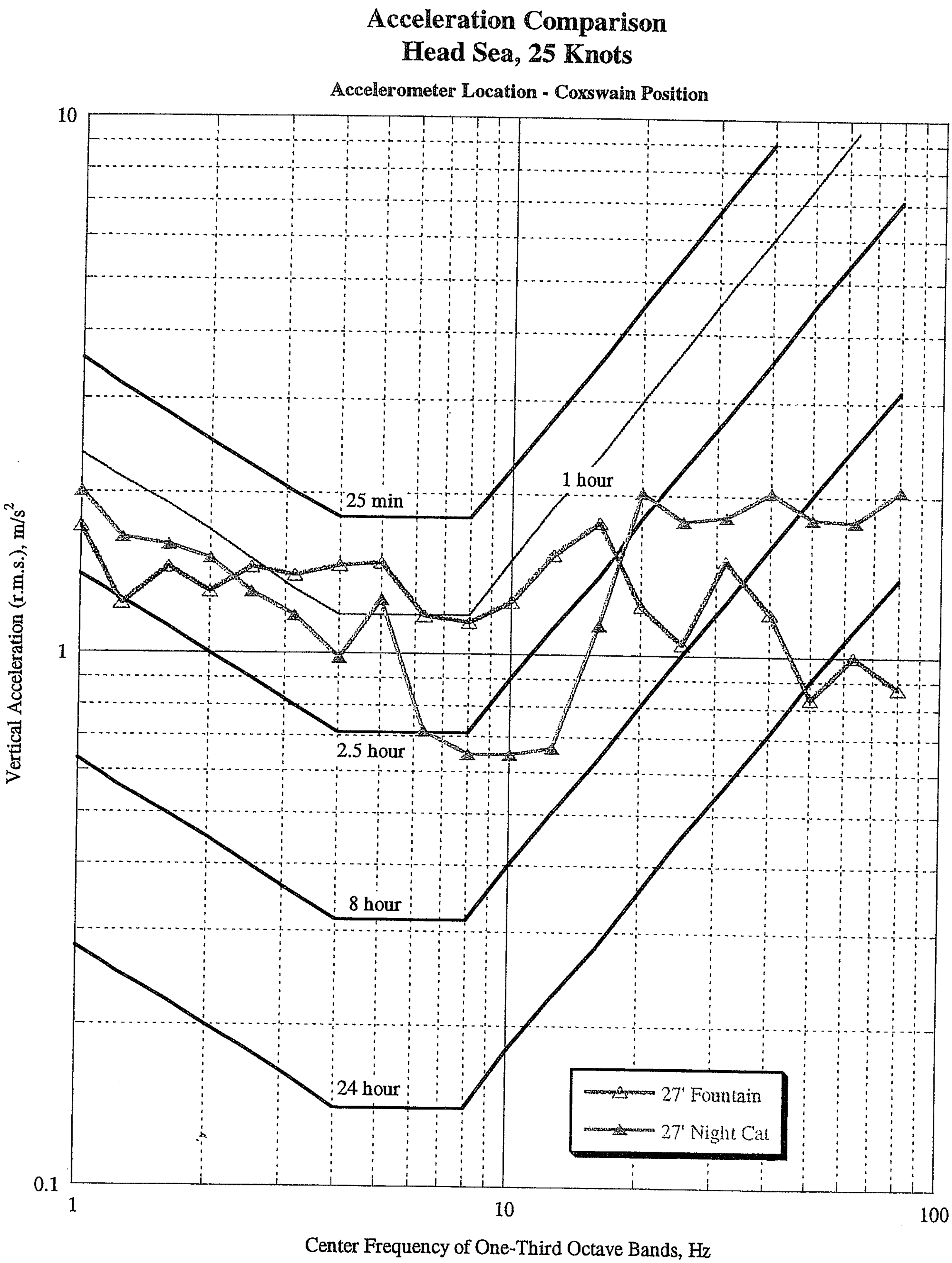


Figure 12



Acceleration Comparison
Following Sea, 34 Knots
Accelerometer Location - Bow
Vertical Acceleration (r.m.s.), m/s²
Center Frequency of One-Third Octave Bands, Hz
10
1
0.1
1
10
100
16 min
25 min
1 hour
2.5 hour
8 hour
27' Fountain
27' Night Cat

Figure 13



Acceleration Comparison
Head Sea, 25 Knots
Accelerometer Location - Coxswain Position
Vertical Acceleration (r.m.s.), m/s2
10
1
0.1
1
10
100
Center Frequency of One-Third Octave Bands, Hz
25 min
1 hour
2.5 hour
8 hour
24 hour
27' Fountain
27' Night Cat

Figure 14

Acceleration Comparison
Port Bow Sea, 18 Knots

Accelerometer Location - Coxswain Position

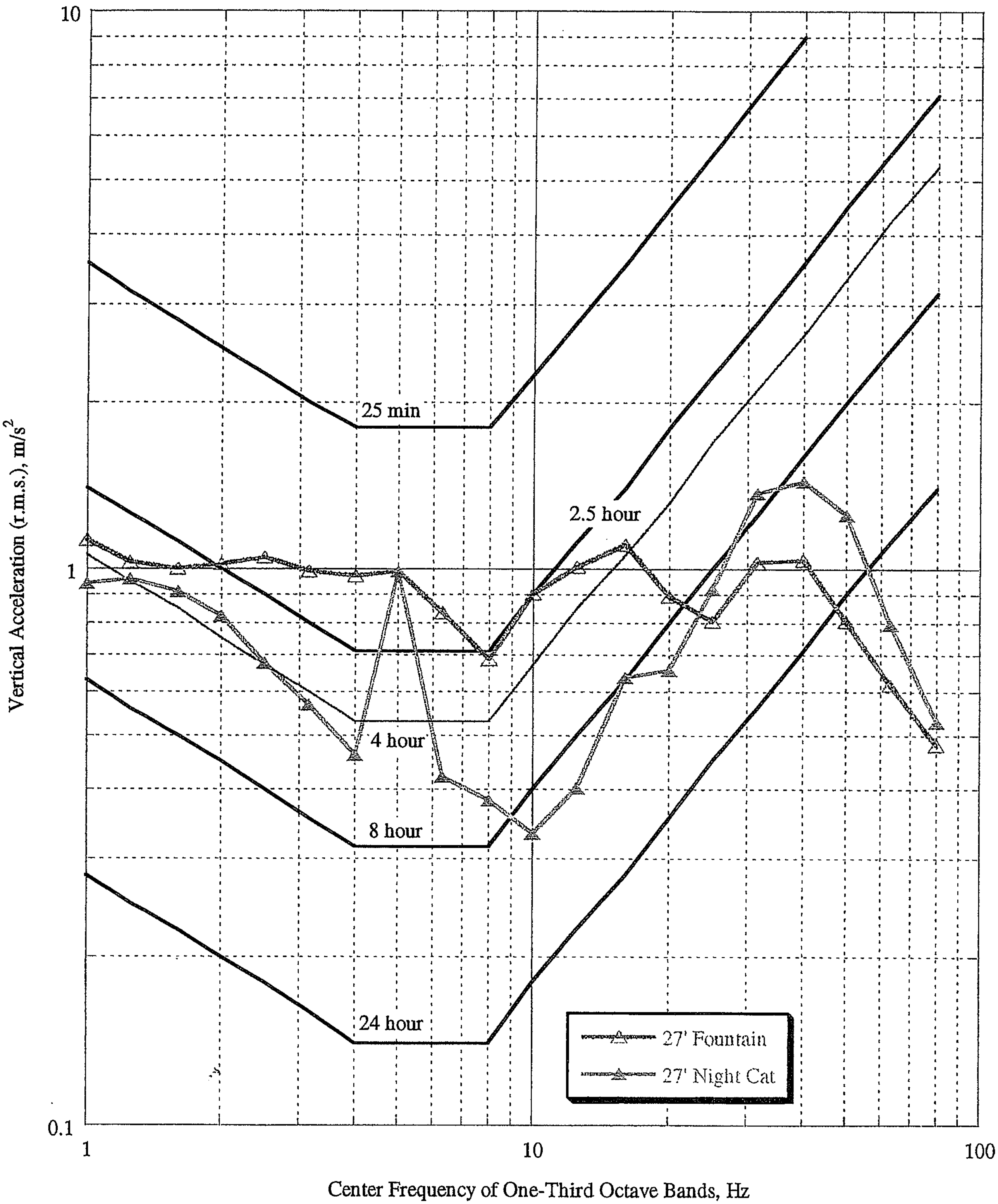


Figure 15

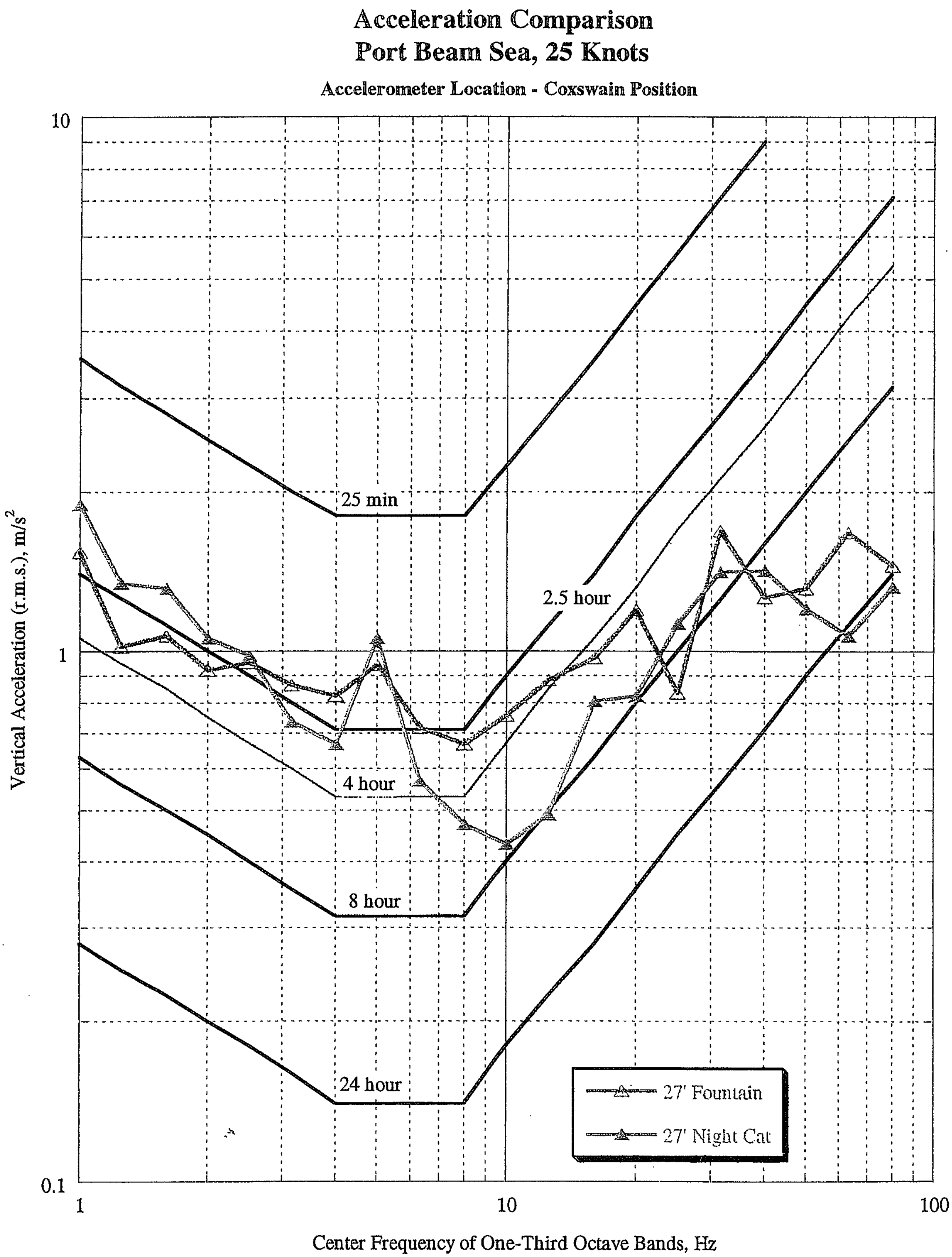
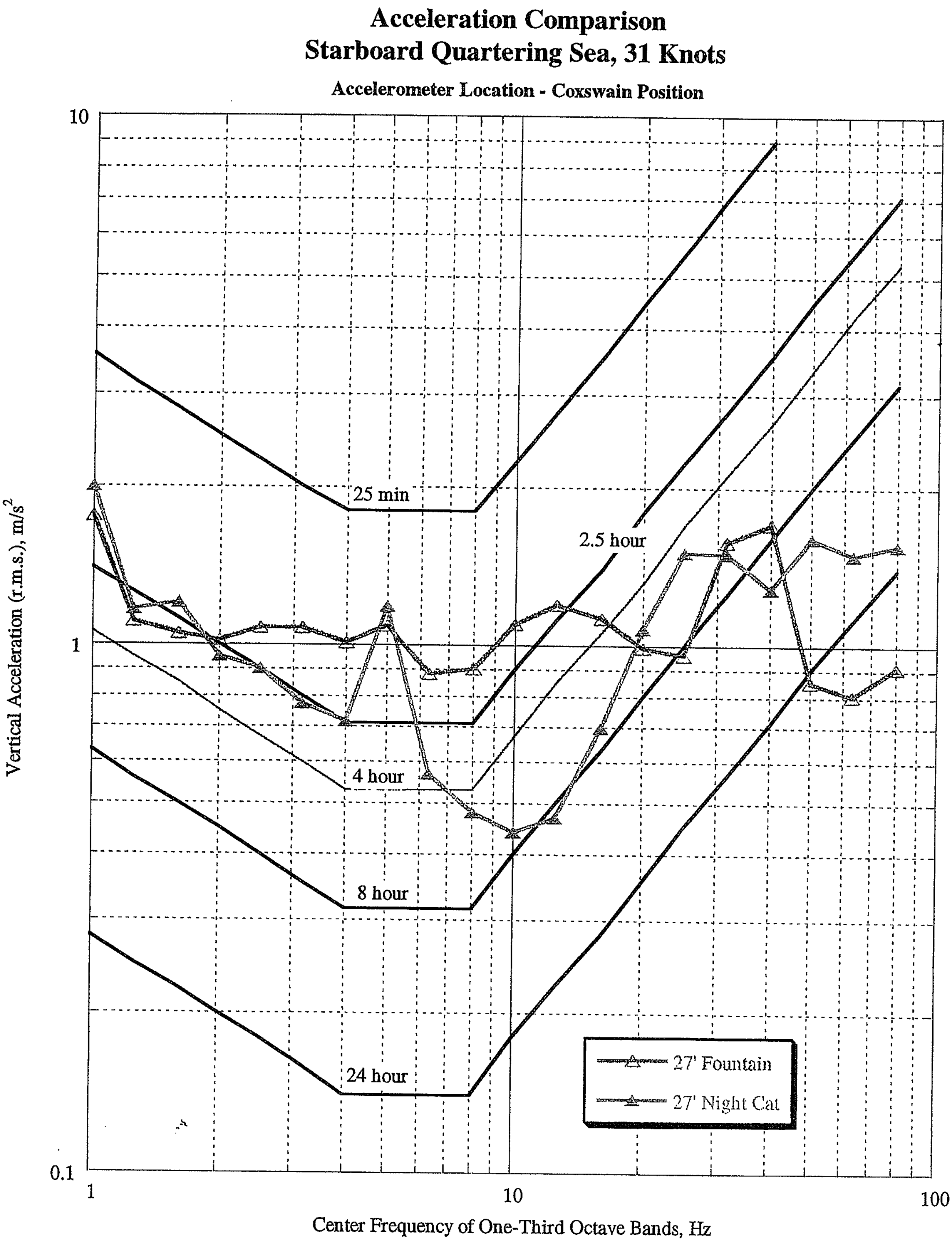

Acceleration Comparison
Port Beam Sea, 25 Knots
Accelerometer Location - Coxswain Position
Vertical Acceleration (r.m.s.), m/s^2
10
1
0.1
25 min
2.5 hour
4 hour
8 hour
24 hour
27' Fountain
27' Night Cat
1
10
100
Center Frequency of One-Third Octave Bands, Hz

Figure 16



Acceleration Comparison
Starboard Quartering Sea, 31 Knots
Accelerometer Location - Coxswain Position
10
1
0.1
1
10
100
Vertical Acceleration (r.m.s.), m/s2
Center Frequency of One-Third Octave Bands, Hz
25 min
2.5 hour
4 hour
8 hour
24 hour
27' Fountain
27' Night Cat

Figure 17

Acceleration Comparison
Following Sea, 34 Knots

Accelerometer Location - Coxswain Position

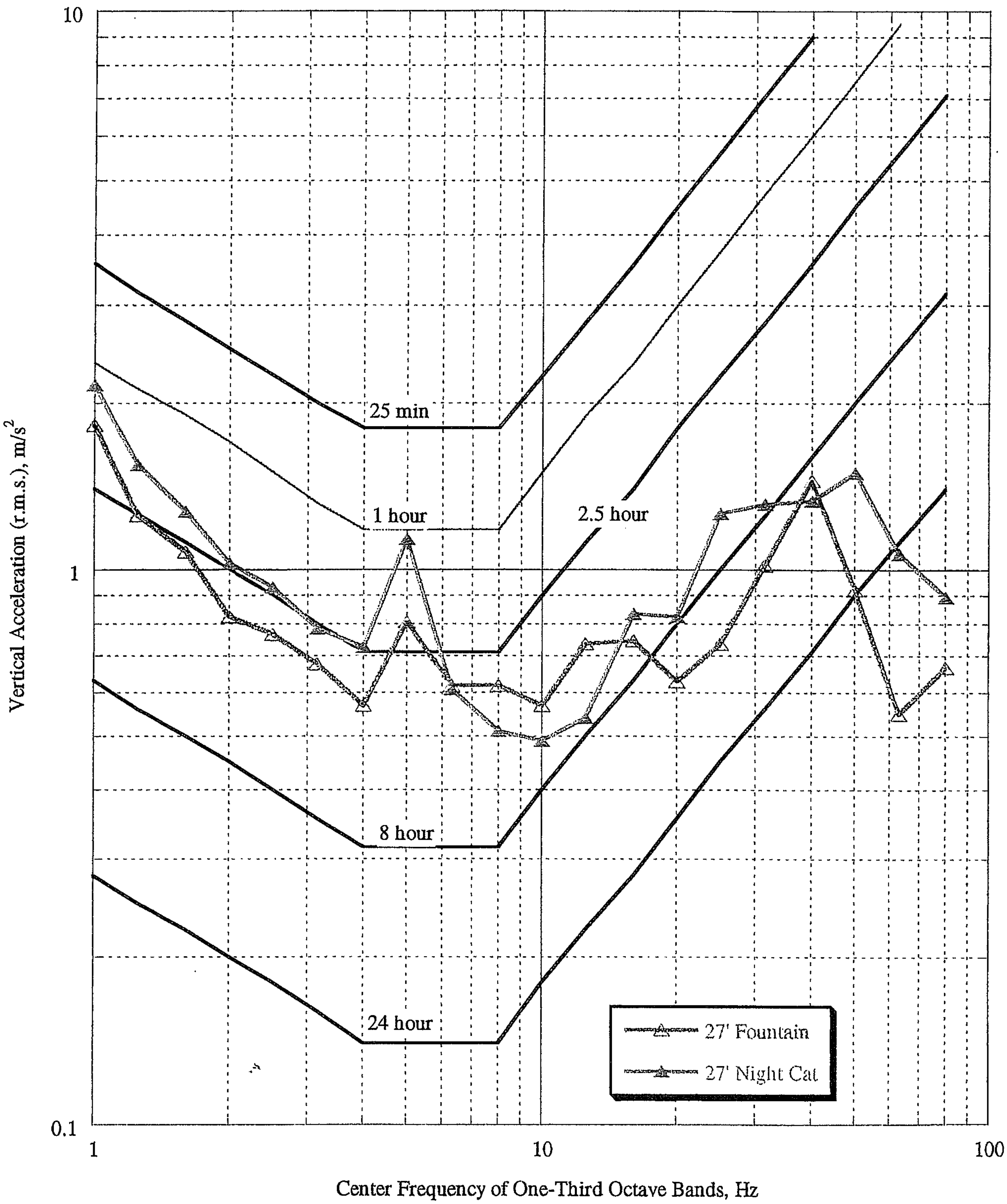


Figure 18

Acceleration Comparison
Head Sea, 25 Knots

Accelerometer Location - Stern

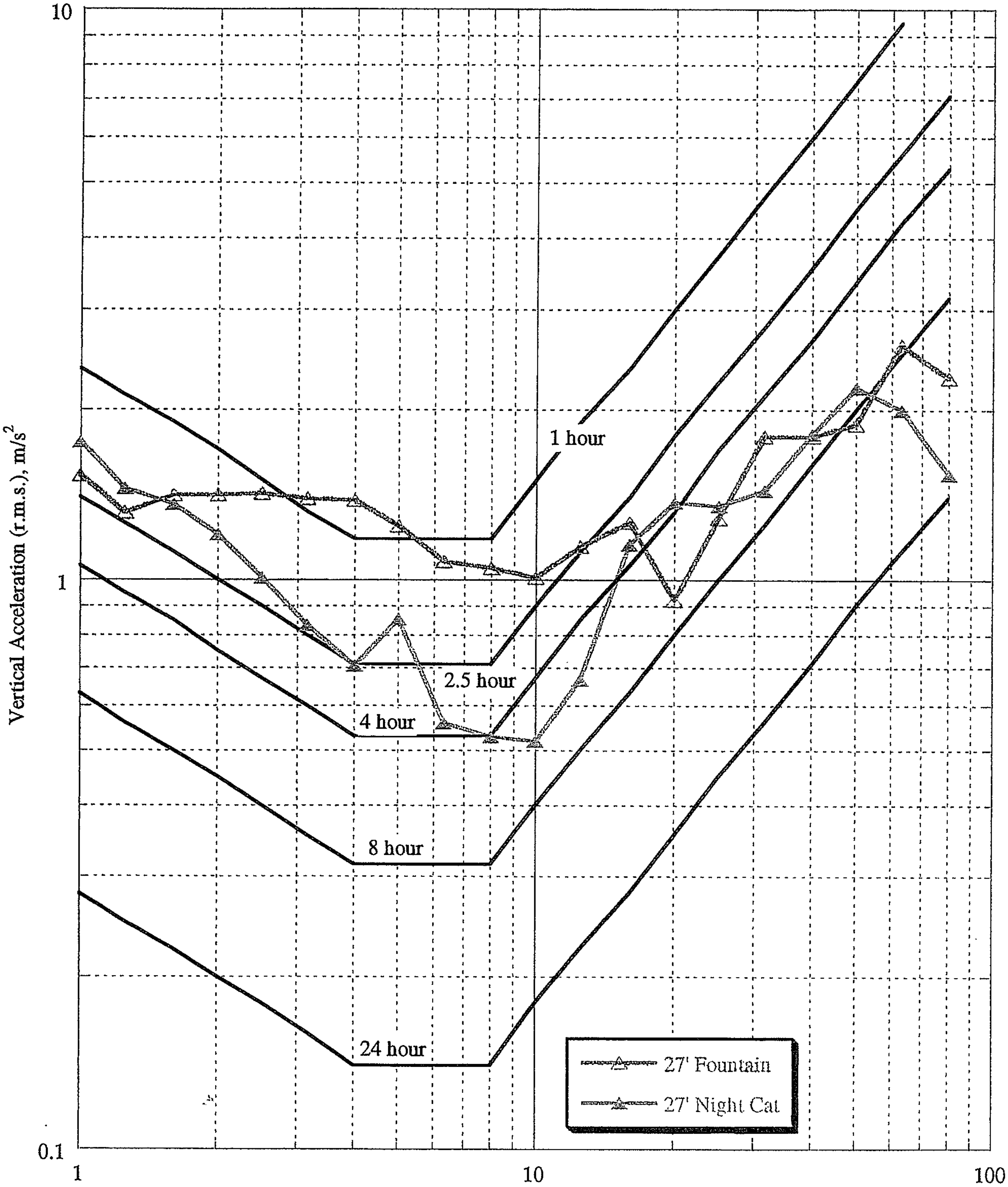
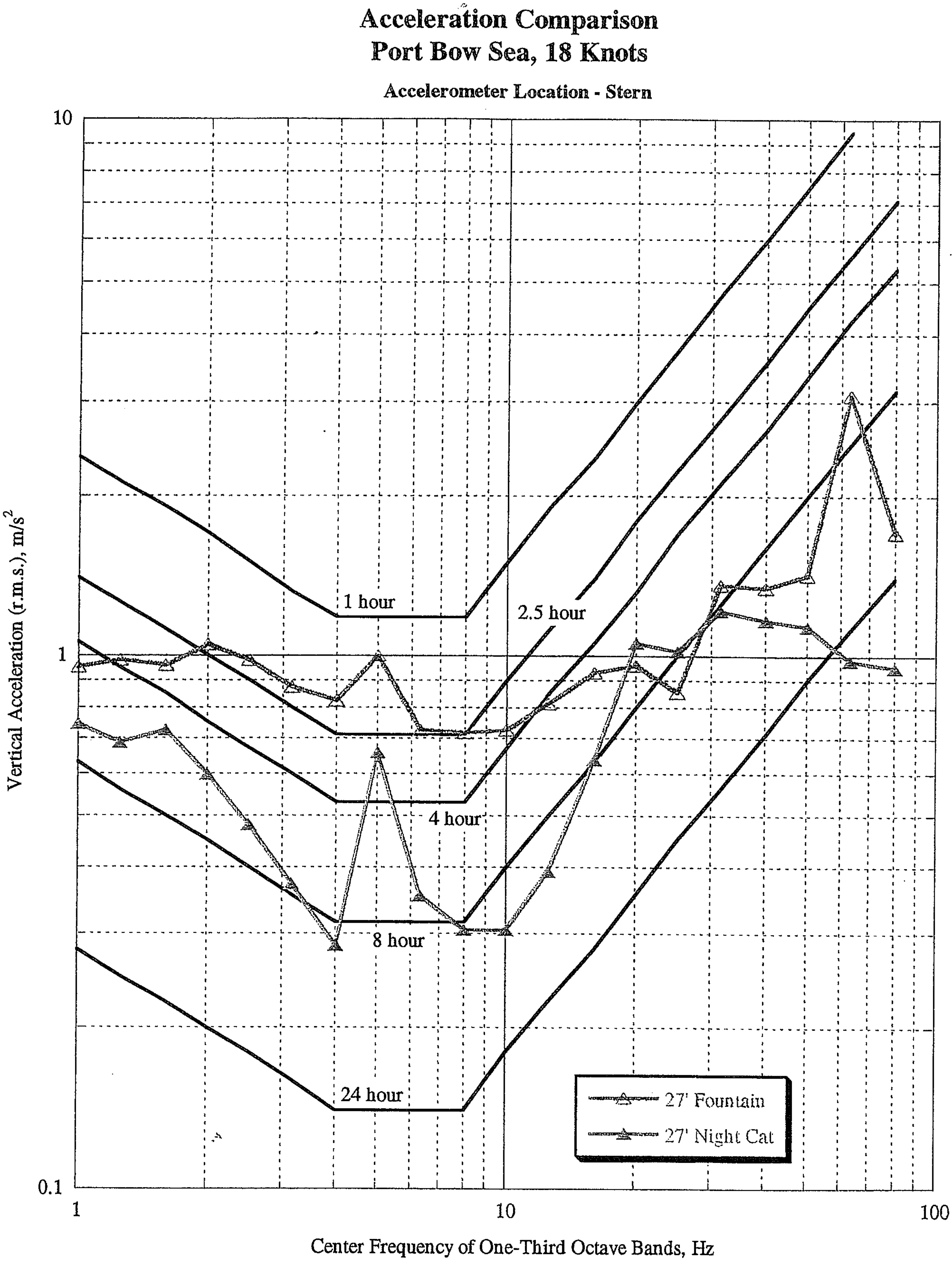
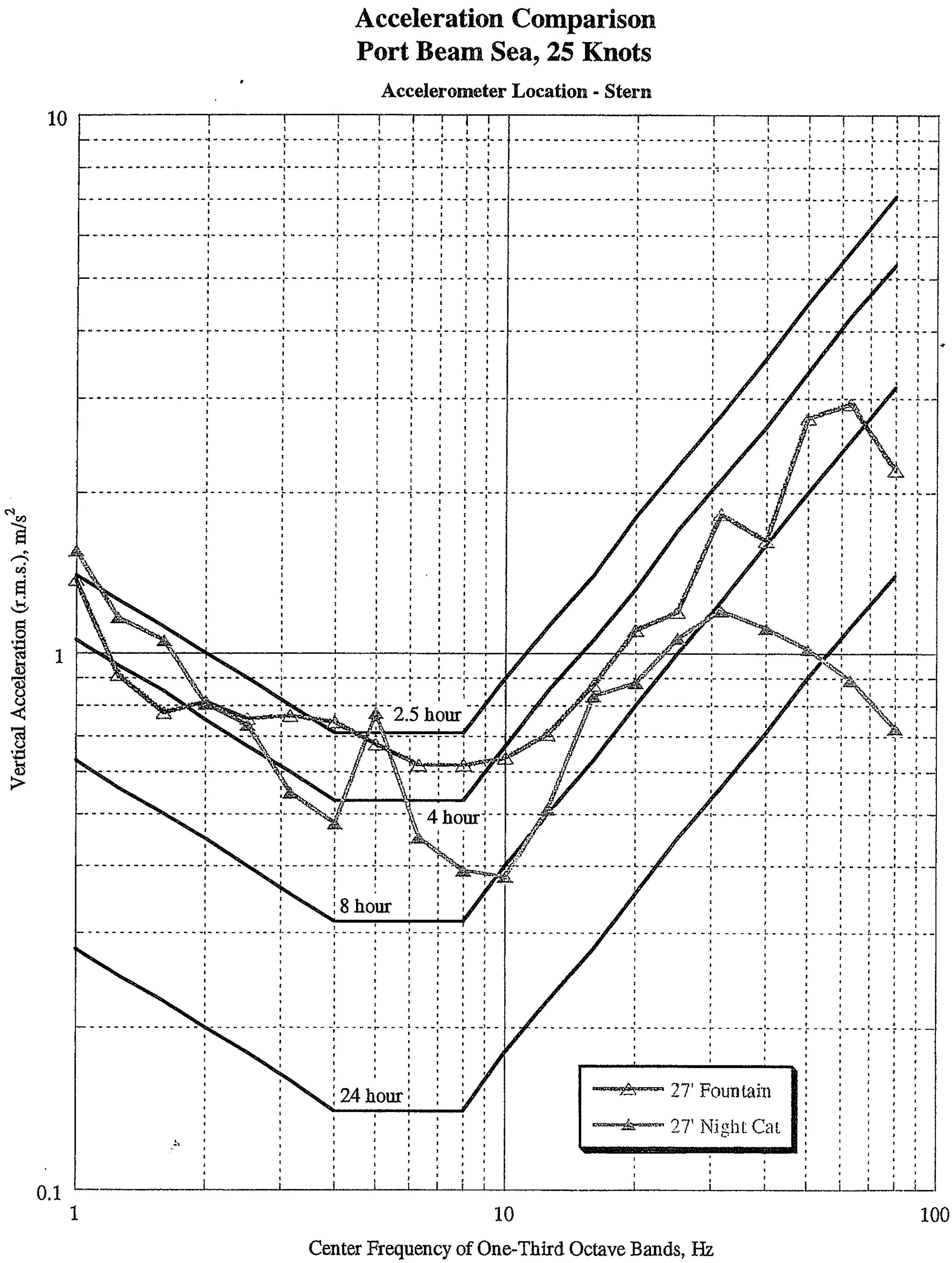


Figure 19



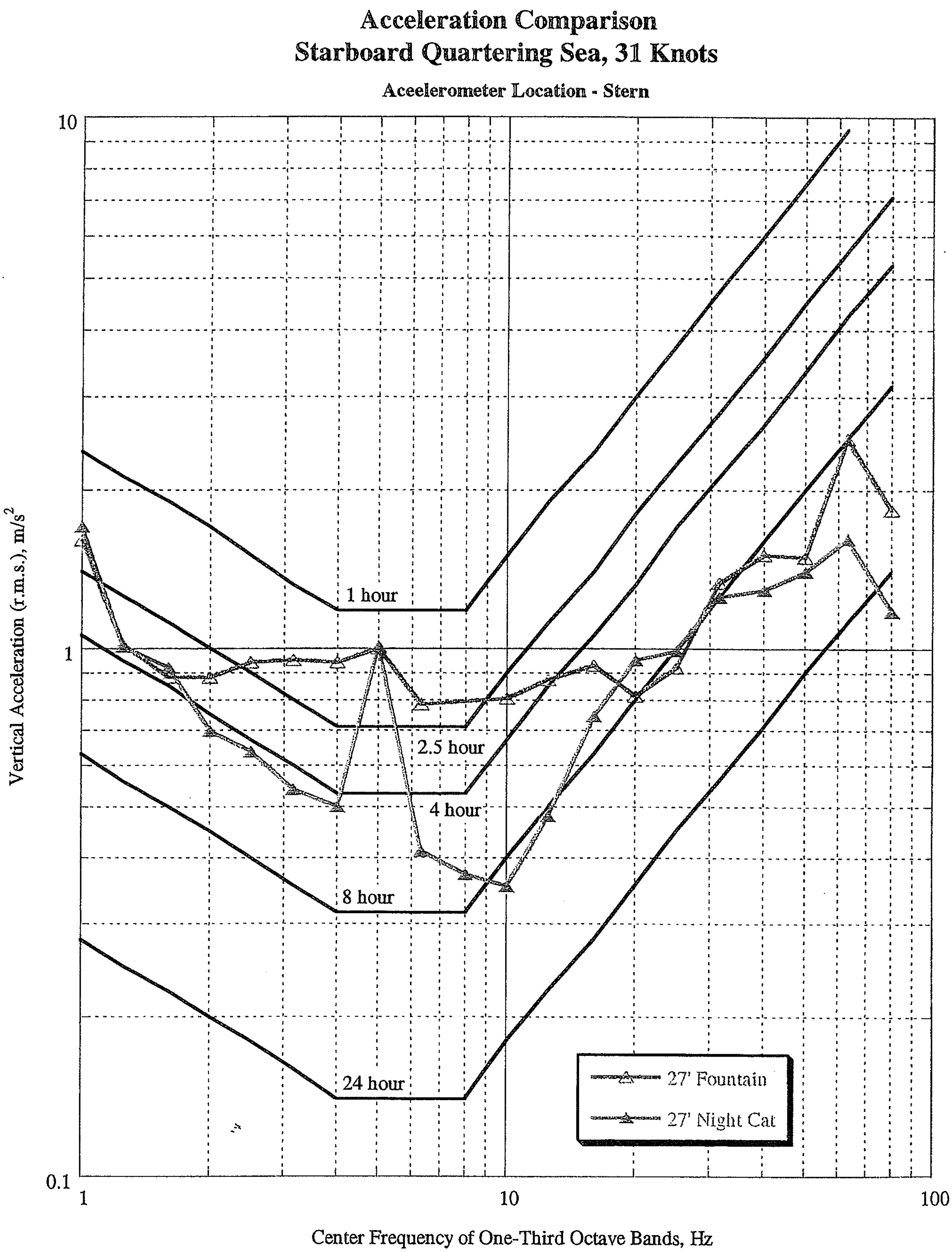
Acceleration Comparison
Port Bow Sea, 18 Knots
Accelerometer Location - Stern
Vertical Acceleration (r.m.s.), m/s2
Center Frequency of One-Third Octave Bands, Hz
10
1
0.1
1
10
100
1 hour
2.5 hour
4 hour
8 hour
24 hour
27' Fountain
27' Night Cat

Figure 20



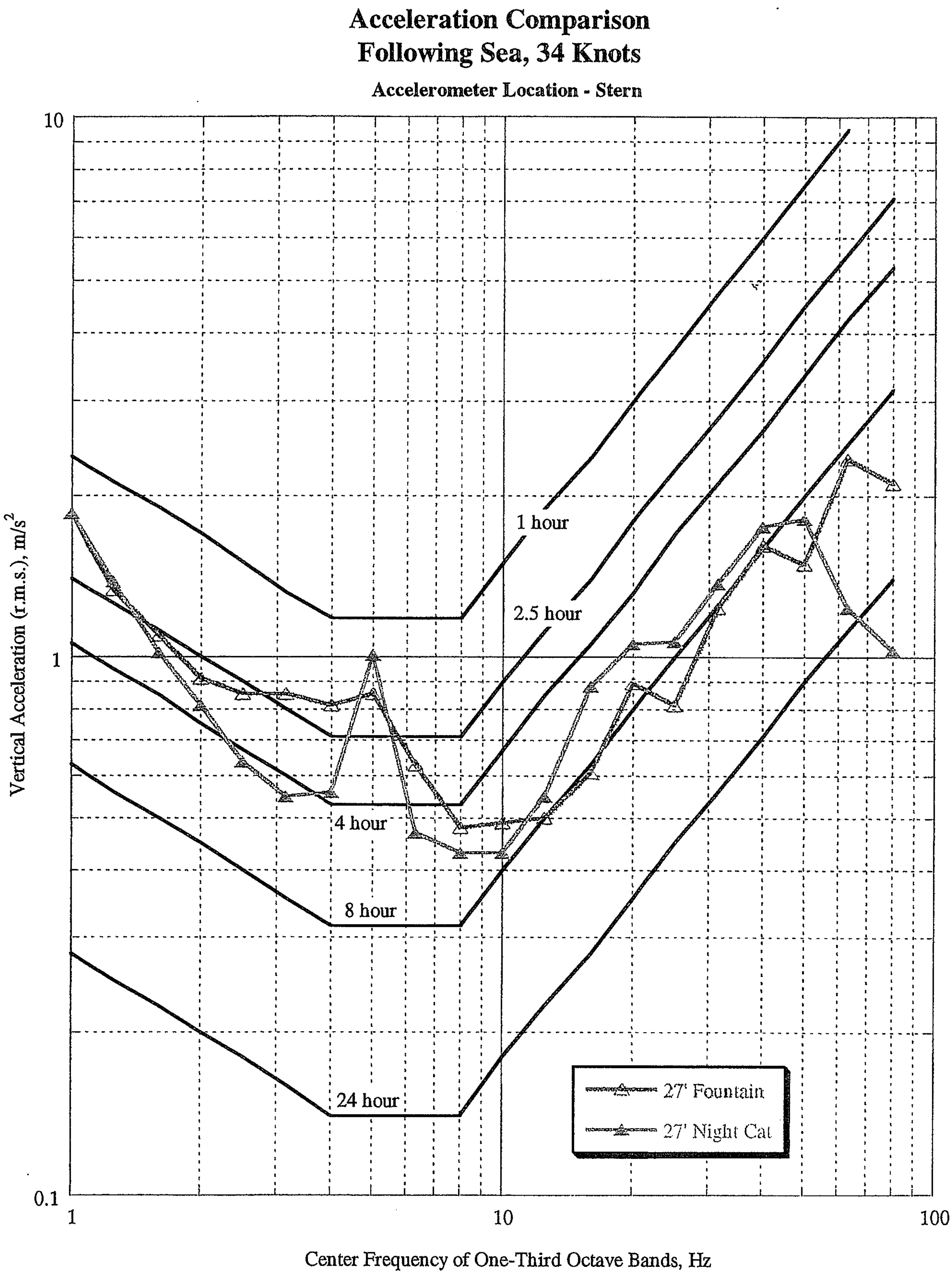
Acceleration Comparison
Port Beam Sea, 25 Knots
Accelerometer Location - Stern
10
1
0.1
1
10
100
Vertical Acceleration (r.m.s.), m/s^2
Center Frequency of One-Third Octave Bands, Hz
2.5 hour
4 hour
8 hour
24 hour
27' Fountain
27' Night Cat

Figure 21



Acceleration Comparison
Starboard Quartering Sea, 31 Knots
Aceelerometer Location - Stern
Vertical Acceleration (r.m.s.), m/s2
10
1
0.1
1 hour
2.5 hour
4 hour
8 hour
24 hour
27' Fountain
27' Night Cat
1
10
100
Center Frequency of One-Third Octave Bands, Hz

Figure 22



Acceleration Comparison
Following Sea, 34 Knots
Accelerometer Location - Stern
Vertical Acceleration (r.m.s.), m/s²
10
1
0.1
1 hour
2.5 hour
4 hour
8 hour
24 hour
27' Fountain
27' Night Cat
1
10
100
Center Frequency of One-Third Octave Bands, Hz

Figure 23

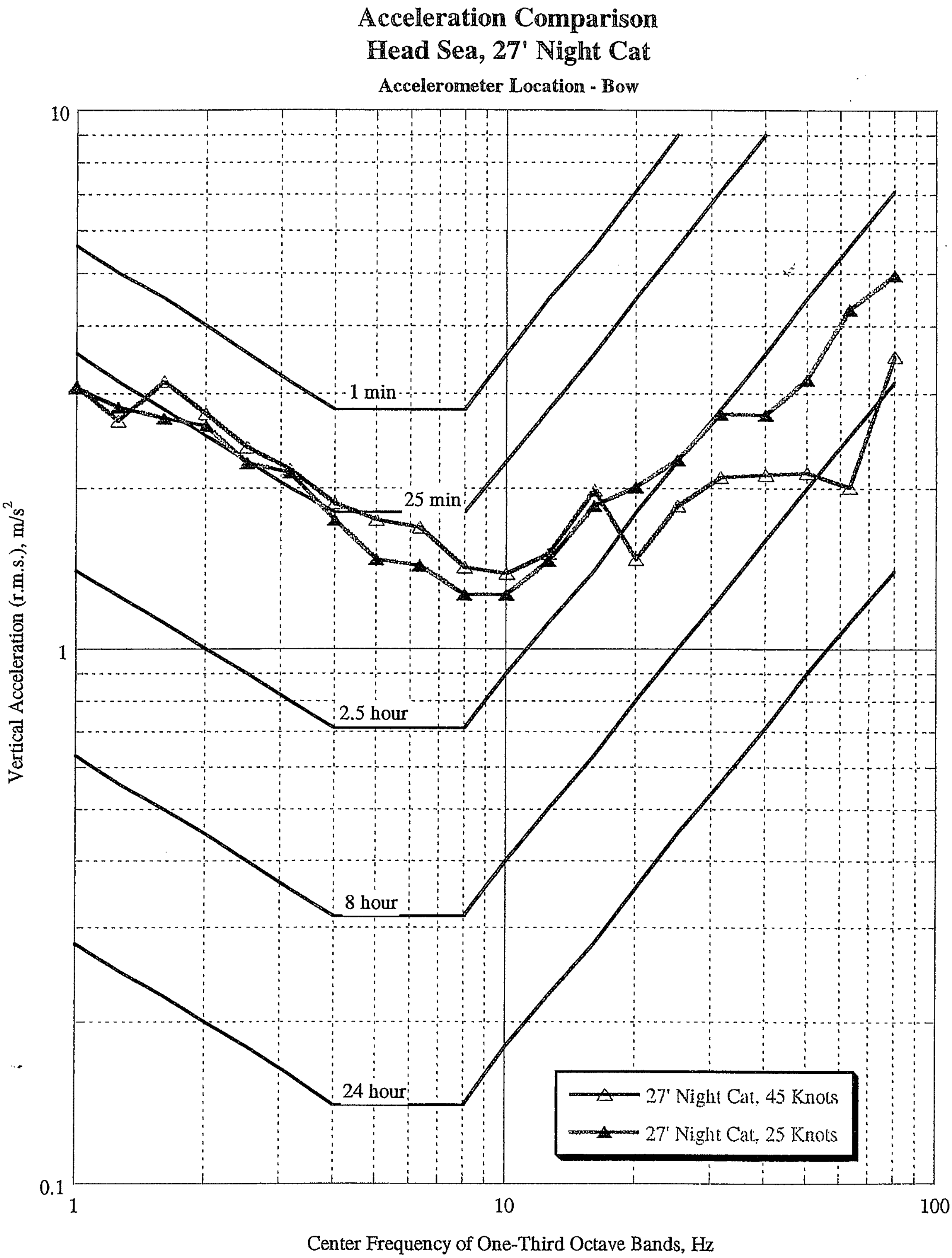
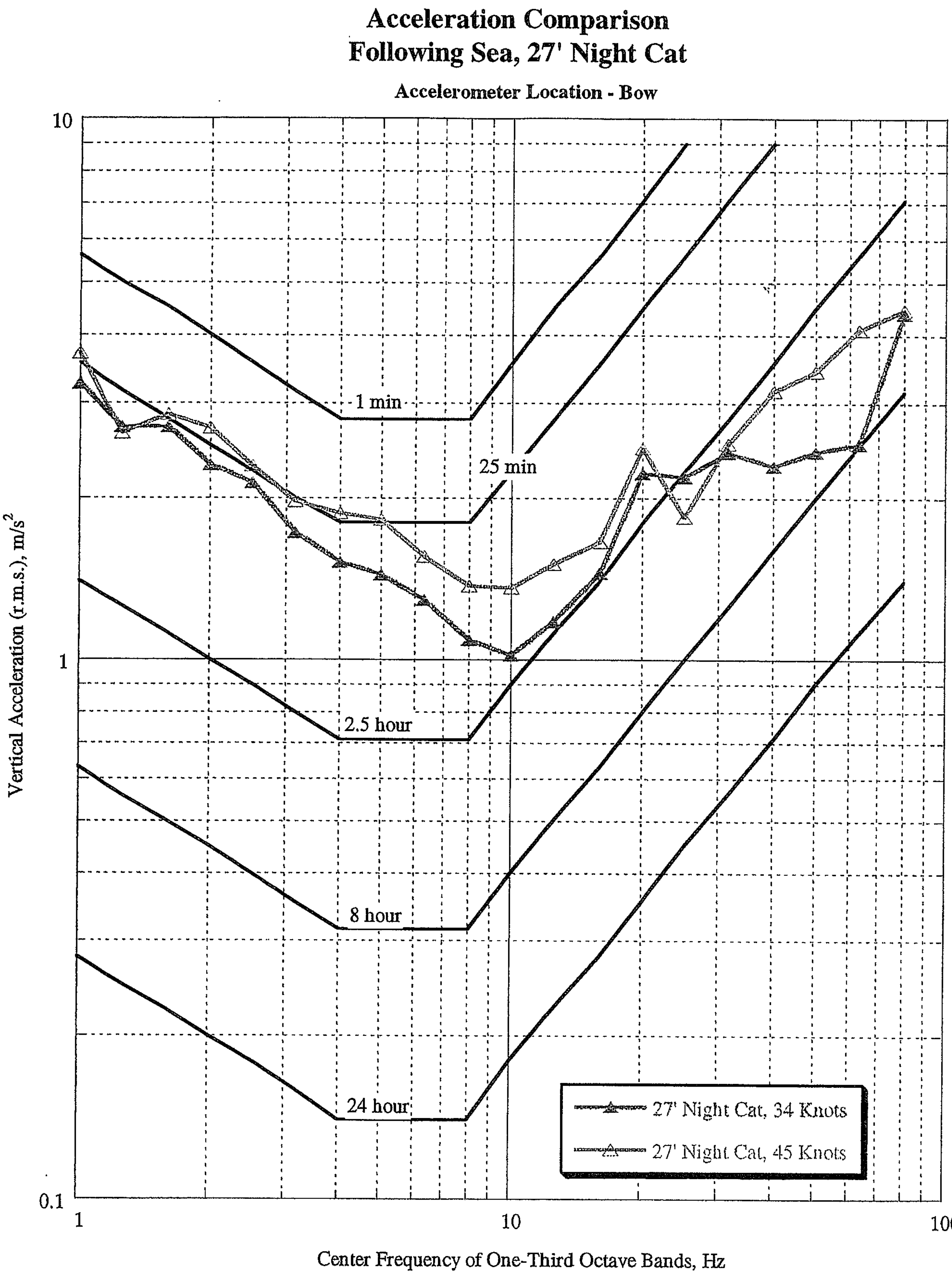

Acceleration Comparison
Head Sea, 27' Night Cat
Accelerometer Location - Bow
Vertical Acceleration (r.m.s.), m/s2
Center Frequency of One-Third Octave Bands, Hz
10
1
0.1
1
10
100
1 min
25 min
2.5 hour
8 hour
24 hour
27' Night Cat, 45 Knots
27' Night Cat, 25 Knots

Figure 24



Acceleration Comparison
Following Sea, 27' Night Cat
Accelerometer Location - Bow
10
1
0.1
1
10
100
Vertical Acceleration (r.m.s.), m/s²
Center Frequency of One-Third Octave Bands, Hz
1 min
25 min
2.5 hour
8 hour
24 hour
27' Night Cat, 34 Knots
27' Night Cat, 45 Knots

Figure 25

Acceleration Comparison
Head Sea, 27' Night Cat

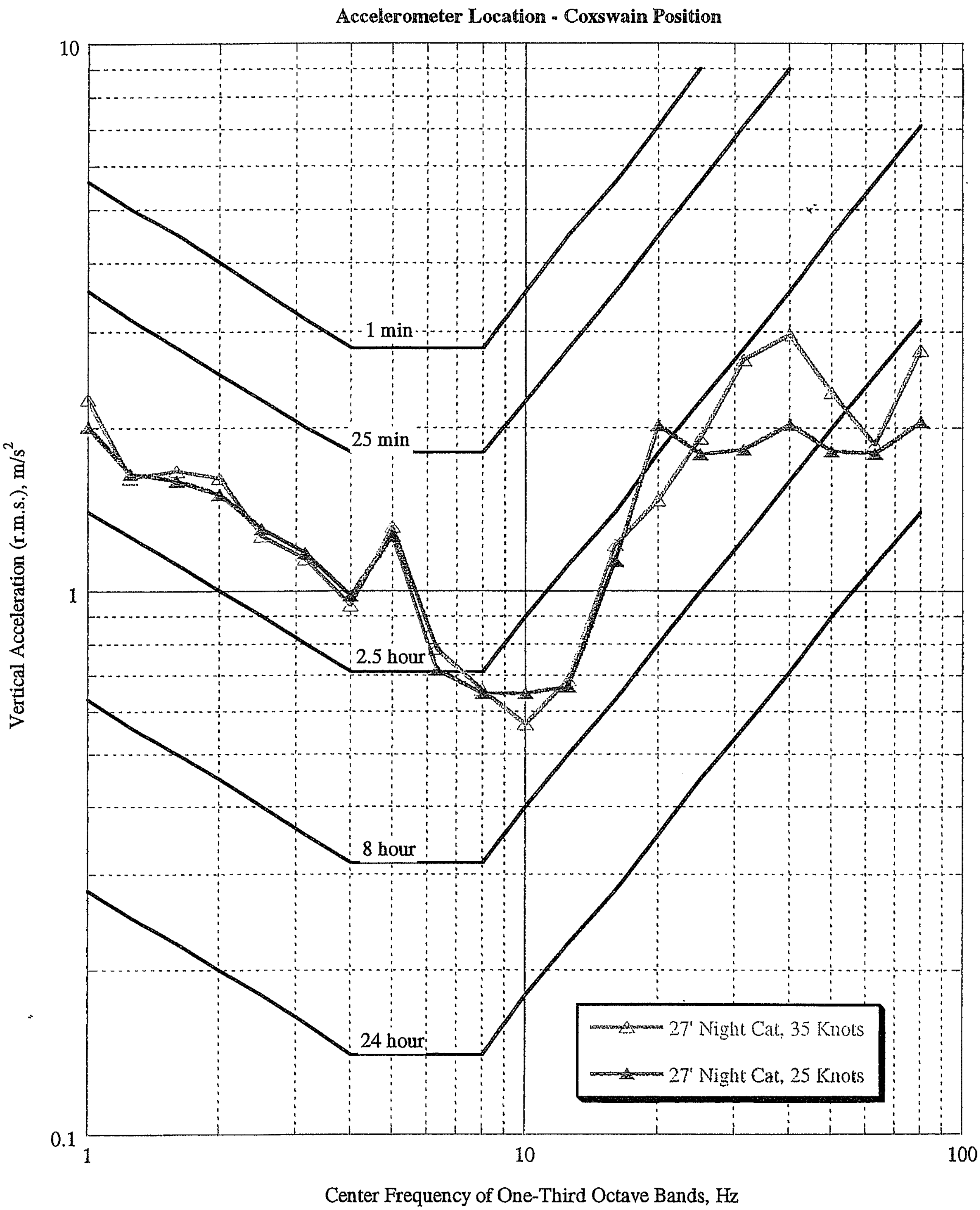


Figure 26

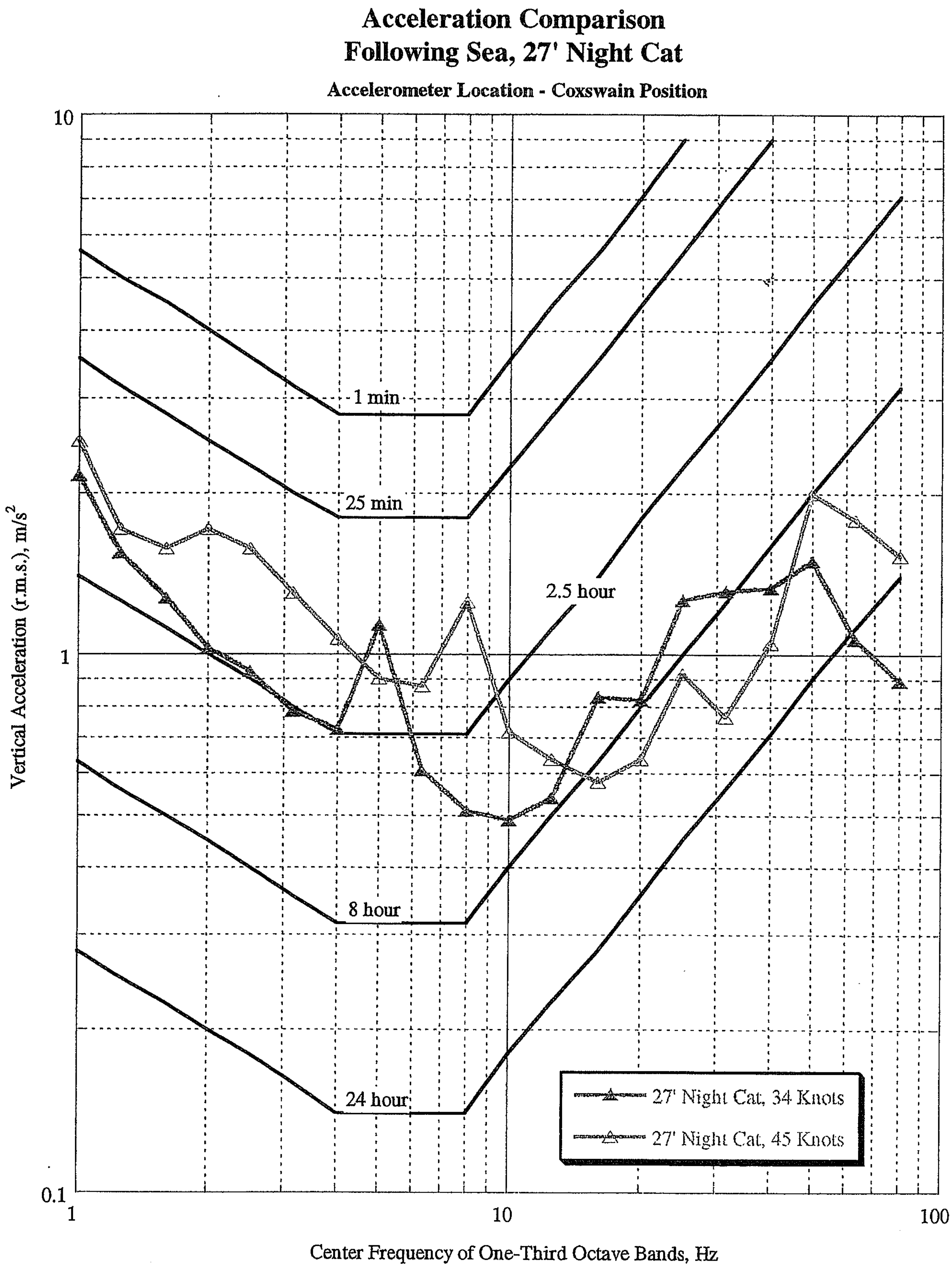

Acceleration Comparison
Following Sea, 27' Night Cat
Accelerometer Location - Coxswain Position
Vertical Acceleration (r.m.s.), m/s²
10
1
0.1
1
10
100
1 min
25 min
2.5 hour
8 hour
24 hour
27' Night Cat, 34 Knots
27' Night Cat, 45 Knots
Center Frequency of One-Third Octave Bands, Hz

Figure 27

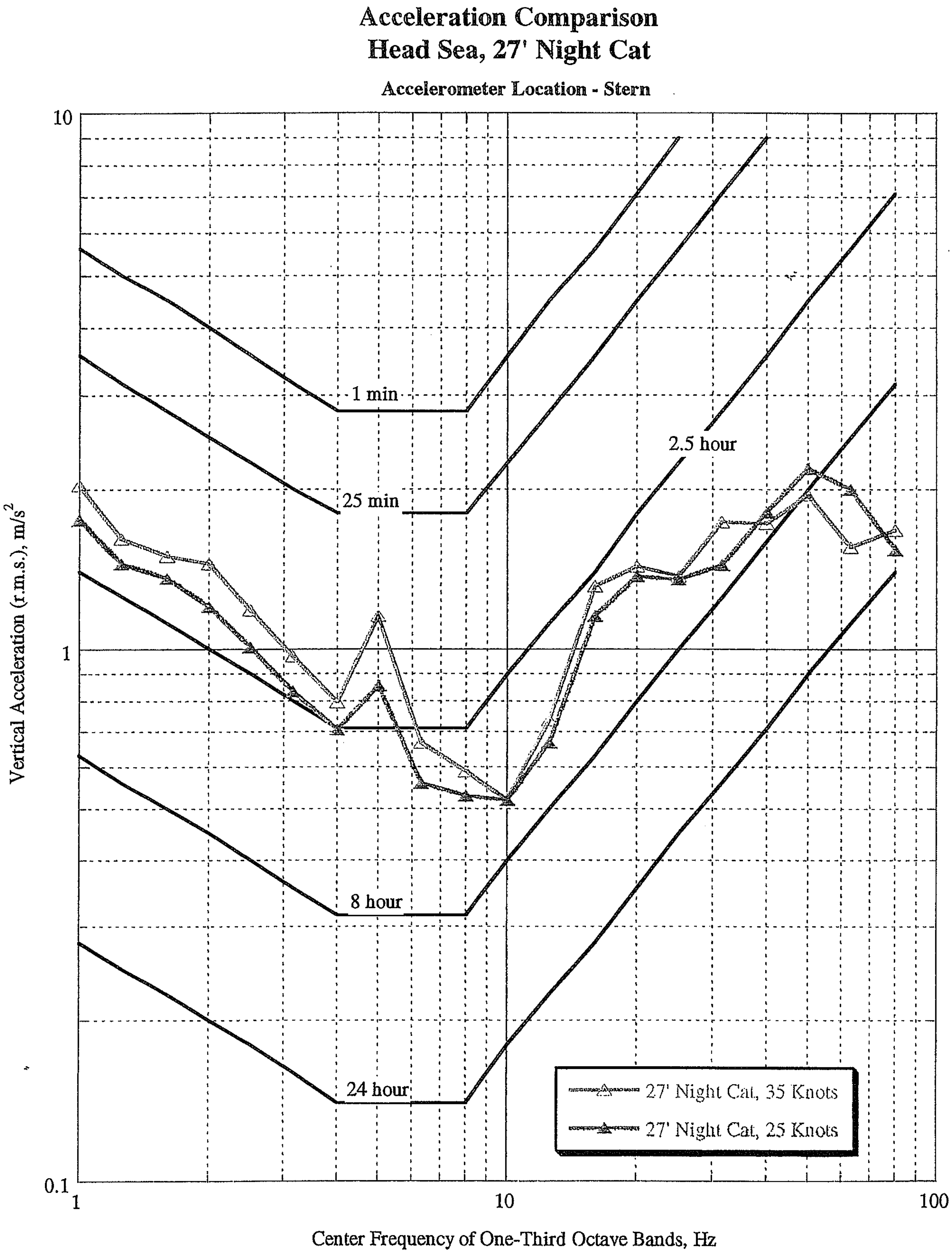

Acceleration Comparison
Head Sea, 27' Night Cat
Accelerometer Location - Stern
10
1
0.1
1
10
100
Vertical Acceleration (r.m.s.), m/s2
Center Frequency of One-Third Octave Bands, Hz
1 min
25 min
2.5 hour
8 hour
24 hour
27' Night Cat, 35 Knots
27' Night Cat, 25 Knots

Figure 28

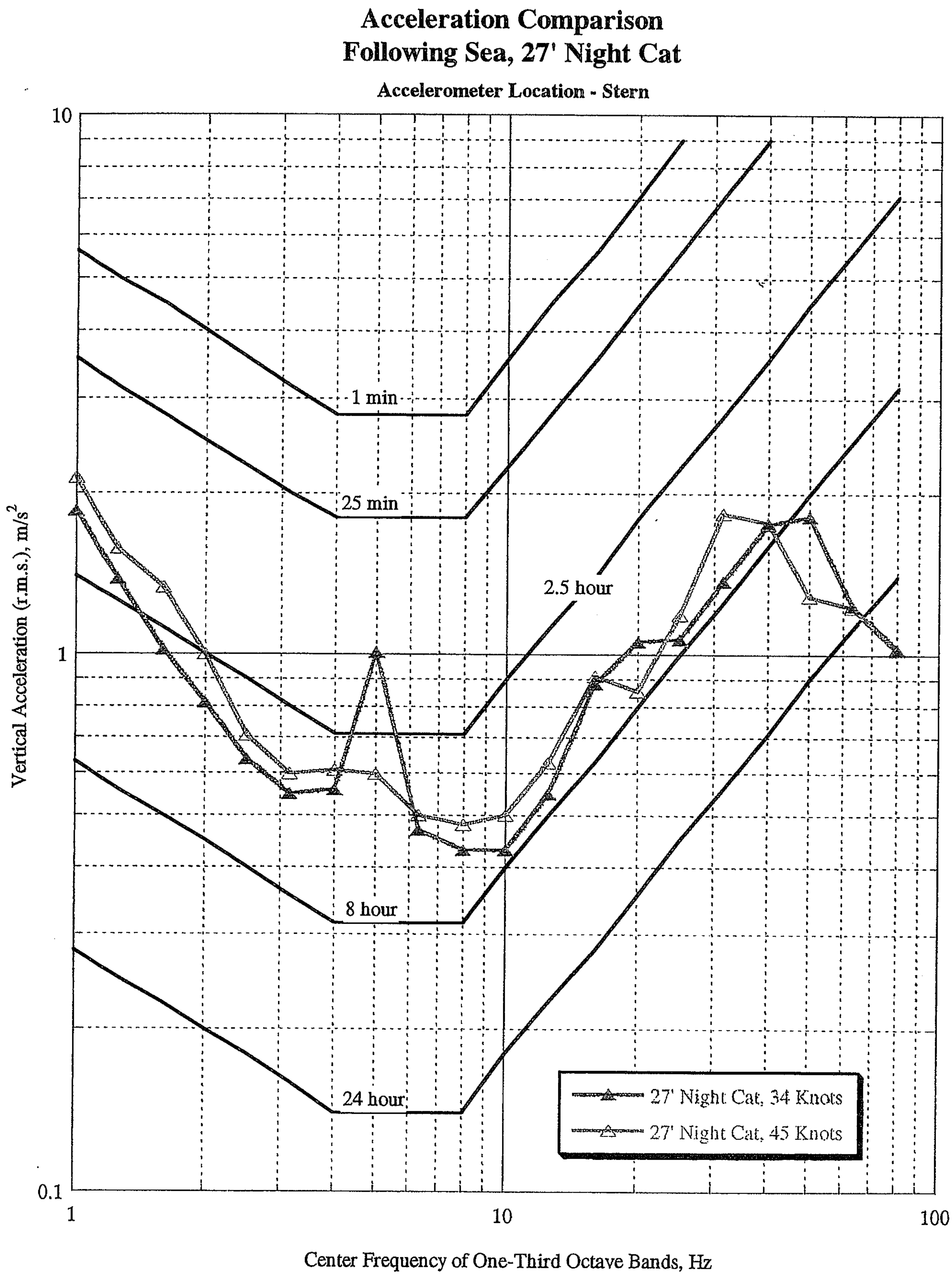

Acceleration Comparison
Following Sea, 27' Night Cat
Accelerometer Location - Stern
10
1
0.1
1
10
100
Vertical Acceleration (r.m.s.), m/s²
Center Frequency of One-Third Octave Bands, Hz
1 min
25 min
2.5 hour
8 hour
24 hour
27' Night Cat, 34 Knots
27' Night Cat, 45 Knots

Figure 29

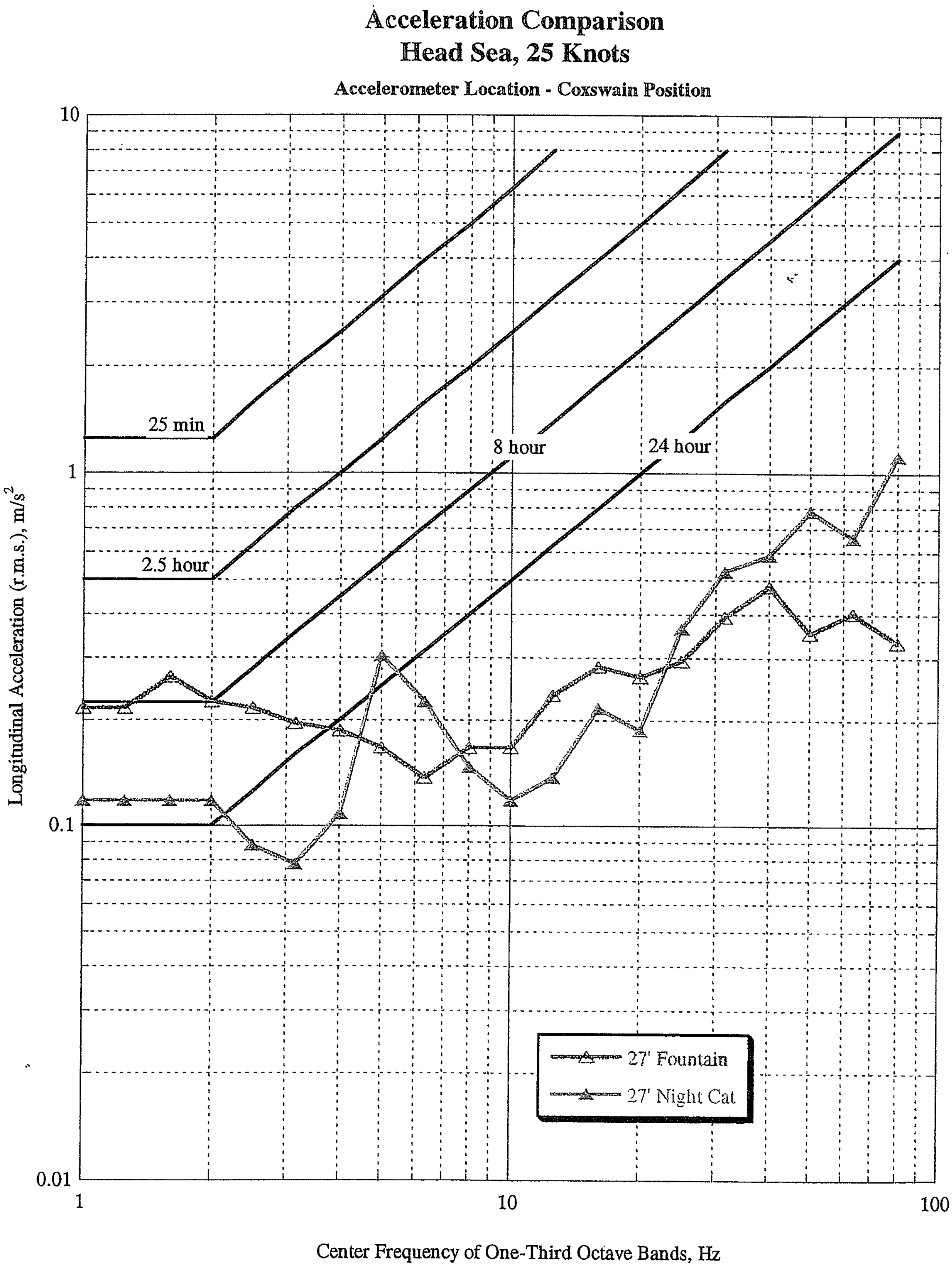
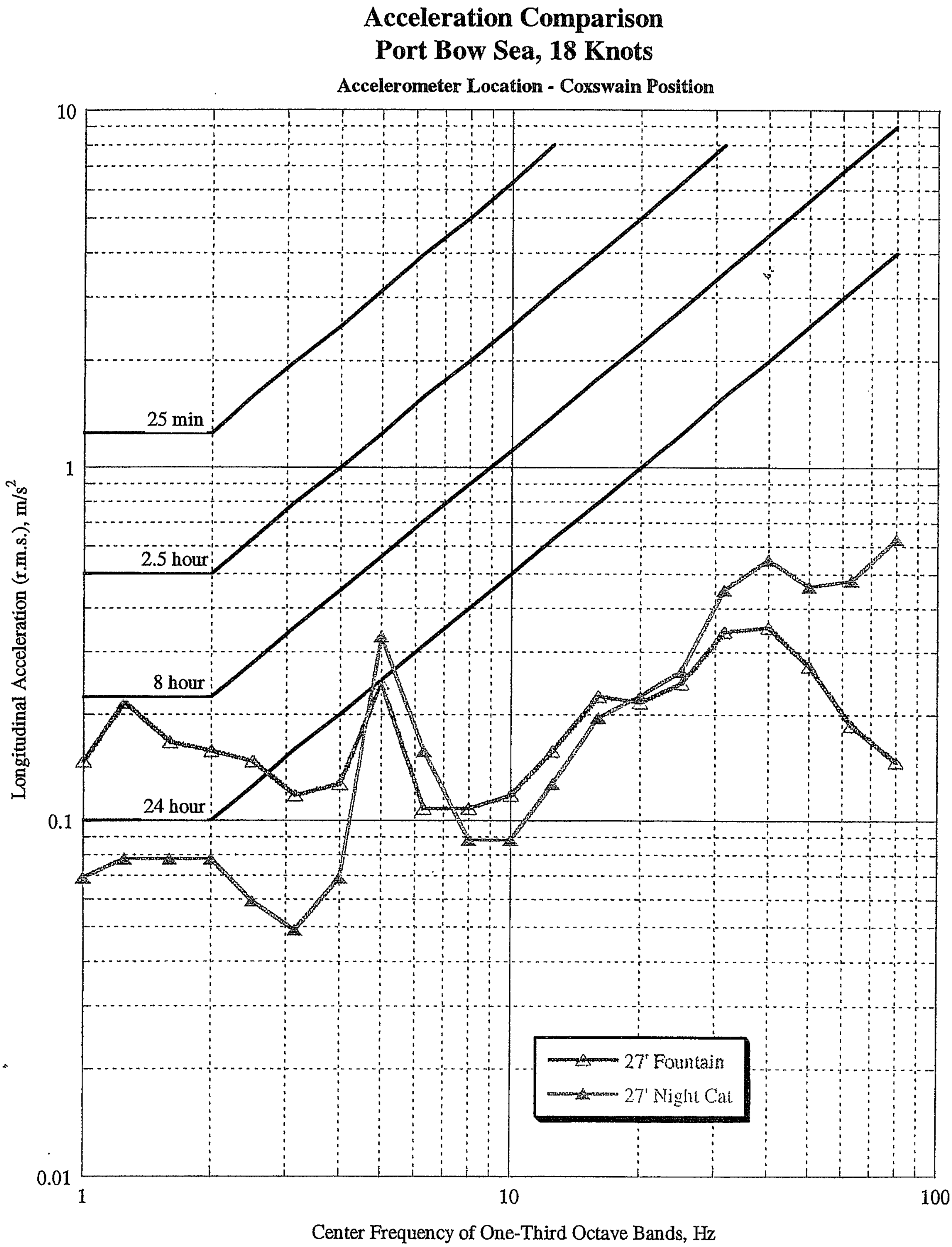
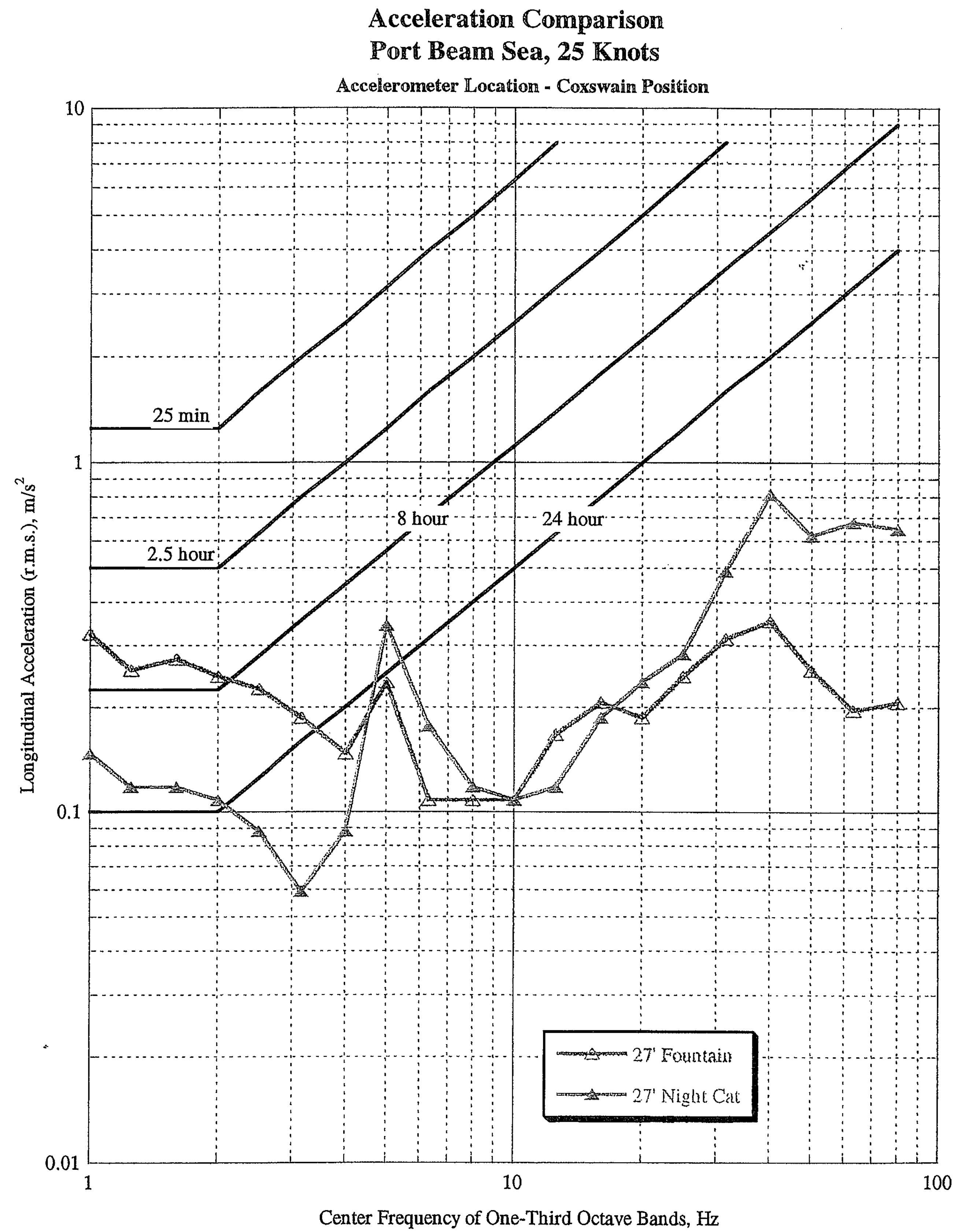

Acceleration Comparison
Head Sea, 25 Knots
Accelerometer Location - Coxswain Position
Longitudinal Acceleration (r.m.s.), m/s2
Center Frequency of One-Third Octave Bands, Hz
10
1
0.1
0.01
1
10
100
25 min
2.5 hour
8 hour
24 hour
27' Fountain
27' Night Cat

Figure 30



Acceleration Comparison
Port Bow Sea, 18 Knots
Accelerometer Location - Coxswain Position
10
1
0.1
0.01
25 min
2.5 hour
8 hour
24 hour
Longitudinal Acceleration (r.m.s.), m/s2
1
10
100
Center Frequency of One-Third Octave Bands, Hz
27' Fountain
27' Night Cat

Figure 31



Acceleration Comparison
Port Beam Sea, 25 Knots
Accelerometer Location - Coxswain Position
Longitudinal Acceleration (r.m.s.), m/s^2
Center Frequency of One-Third Octave Bands, Hz
10
1
0.1
0.01
1
10
100
25 min
2.5 hour
8 hour
24 hour
27' Fountain
27' Night Cat

Figure 32

Acceleration Comparison
Starboard Quartering Sea, 31 Knots

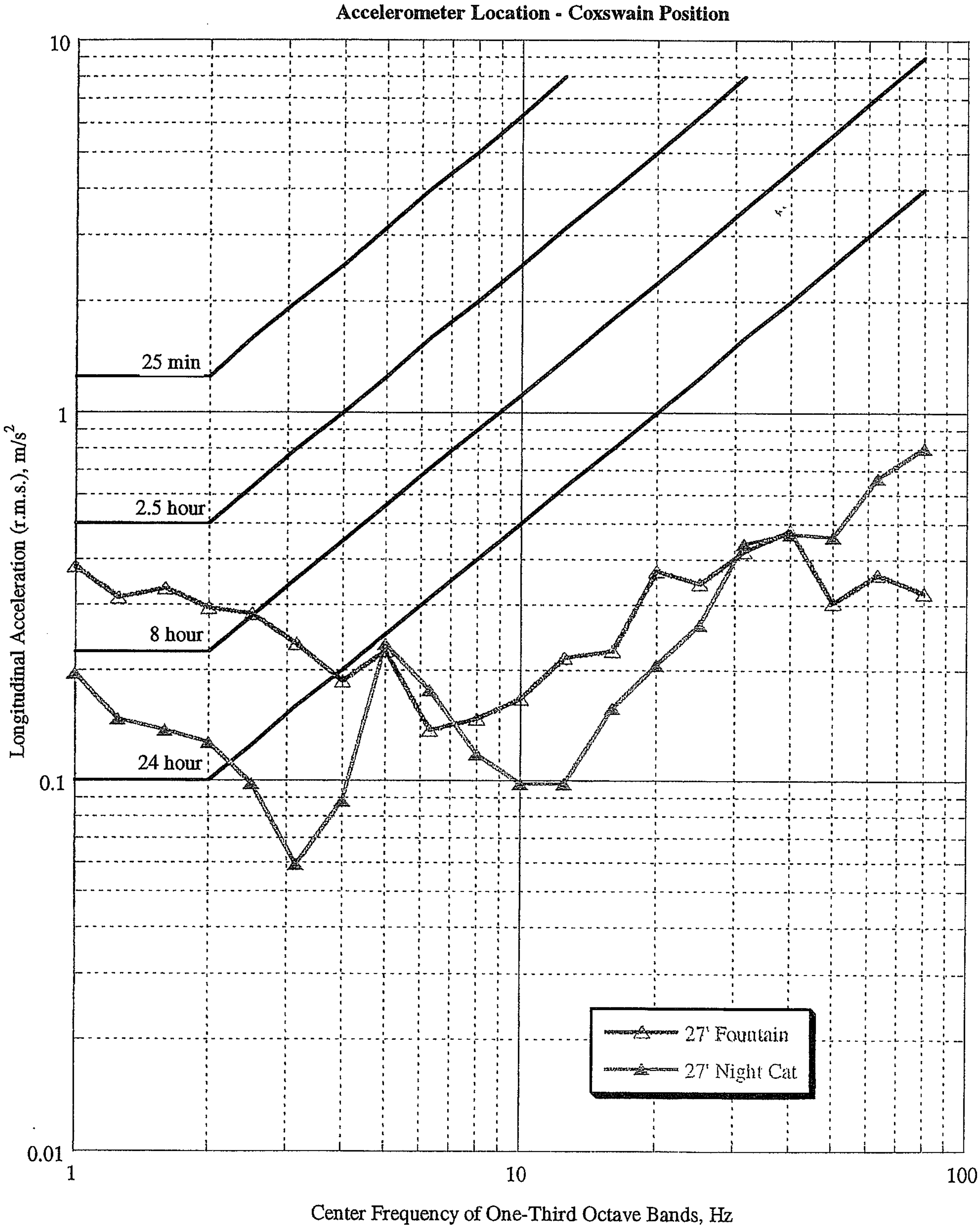
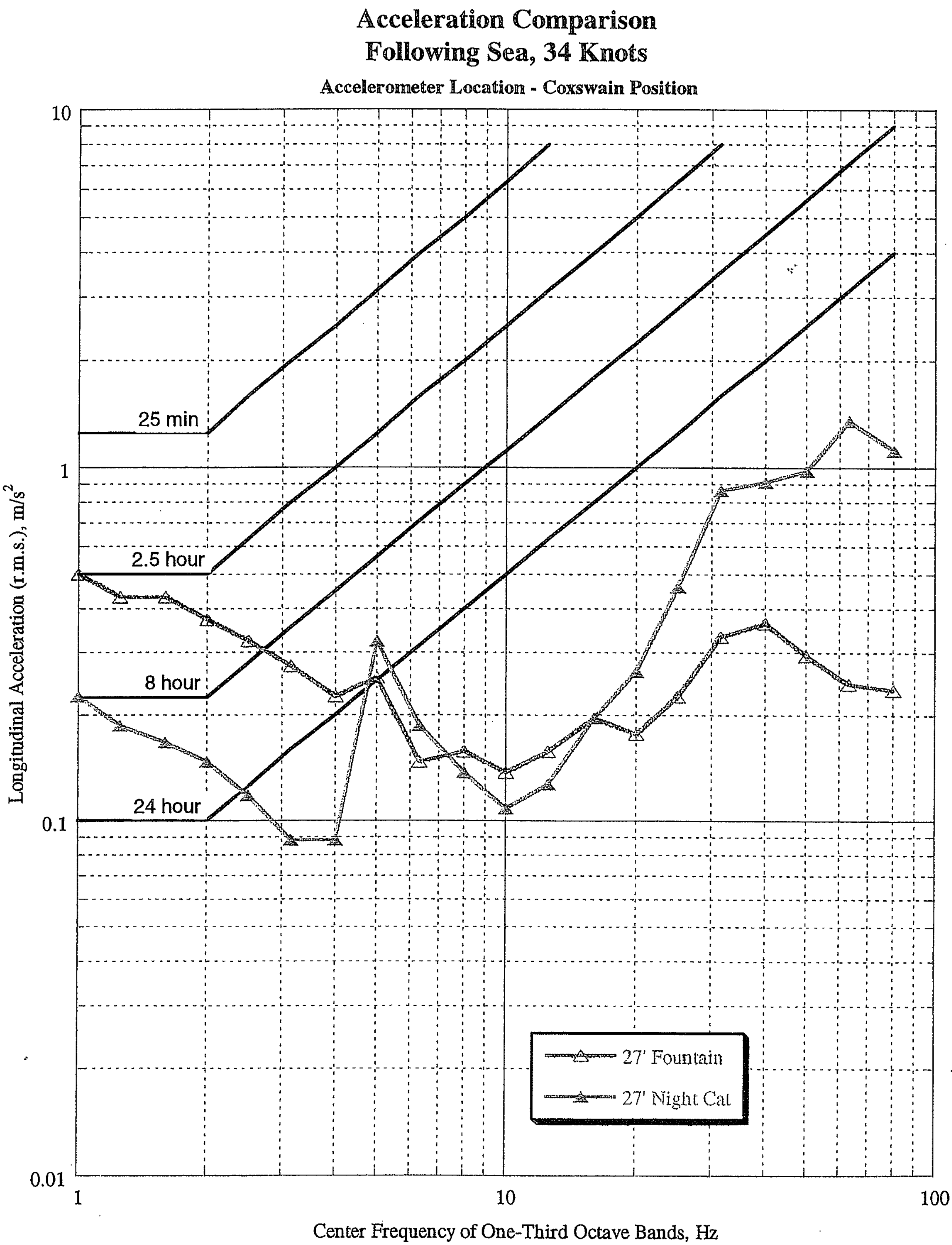


Figure 33



Acceleration Comparison
Following Sea, 34 Knots
Accelerometer Location - Coxswain Position
10
1
0.1
0.01
Longitudinal Acceleration (r.m.s.), m/s²
25 min
2.5 hour
8 hour
24 hour
27' Fountain
27' Night Cat
1
10
100
Center Frequency of One-Third Octave Bands, Hz

Figure 34

Turning and Maneuvering

Standard turning tests were conducted on both craft while at Ft. Monroe. The operator was asked to proceed on a straight course at a certain RPM then initiate a port (or starboard) turn at half rudder at which time a full 360 degree turn was recorded using GPS. This data would later be used to plot the turning diameter of each craft . This was repeated at two additional RPM's and full rudder. The maximum RPM and full rudder were not to be very hard over g-producing turns, but rather turns most operators would initiate under normal conditions. The Night Cat is capable of extremely fast tight turns if required under tactical or emergency conditions, but these were not necessary nor performed here. High g-turns cause high stress to the lower units of the OMC outboards and precipitate premature lower gear failure.

In nearly all of the turning maneuvers the Night Cat turns with less diameter than the Fountain, and does not lose as much speed in the turn. The following tables are a summary of the turning plots that are provided as figures 35 through 41. Some turns were erratic, but are due to inexperience of the operator in most cases. None the less, enough turns were made to draw the basic conclusion presented.

Table 3 - Turning Data/Night Cat

Port				Starboard			
Rudder Position	Rpm	Speed In Turn	Diameter, ft.	Rudder Position	Rpm	Speed In Turn	Diameter, ft.
Half	Max	44kn	382	Half	Max	46kn	420
Full	Max	46kn	382	Full	Max	46kn	382
Half	4500	32kn	295	Half	4500	34kn	410
Full	4500	29kn	260	Full	4500	31kn	365
Half	3000	15kn	210	Half	3000	18kn	270
Full	3000	13kn	38	Full	3000	14kn	100

Table 4 - Turning Data/Fountain

Port				Starboard			
Rudder Position	Rpm	Speed In Turn	Diameter, ft.	Rudder Position	Rpm	Speed In Turn	Diameter, ft.
Half	Max	39k	730	Half	Max	39k	735
Full	Max	33k	410	Full	Max	31k	375
Half	4500	27k	630	Half	4500	27k	605
Full	4500	15k	210	Full	4500	19k	240
Half	4000	22k	450	Half	4000	23k	685
Full	4000	10k	130	Full	4000	10k	130

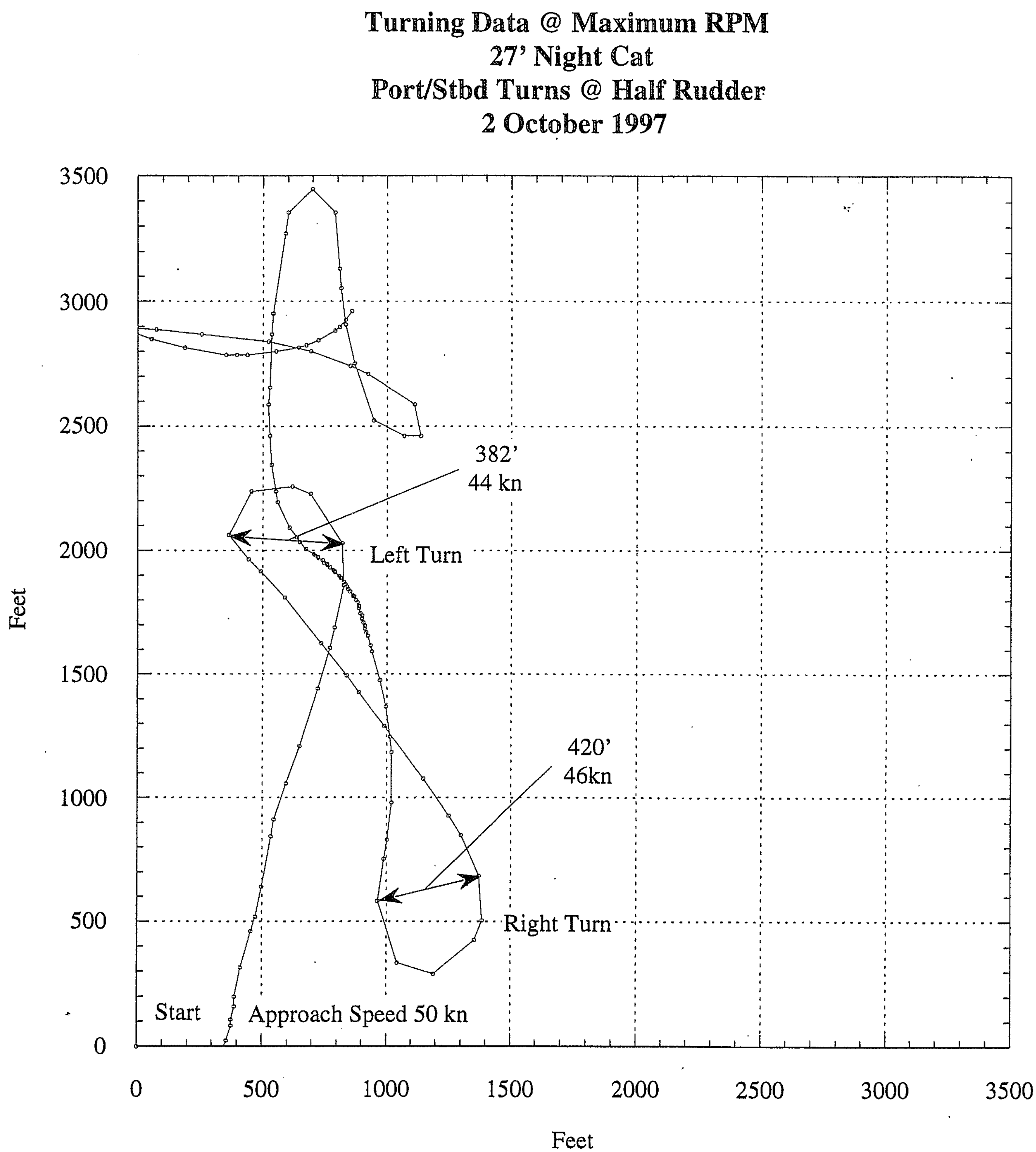

Turning Data @ Maximum RPM
27' Night Cat
Port/Stbd Turns @ Half Rudder
2 October 1997
382'
44 kn
Left Turn
420'
46kn
Right Turn
Start
Approach Speed 50 kn
Feet
Feet
0
500
1000
1500
2000
2500
3000
3500

Figure 35

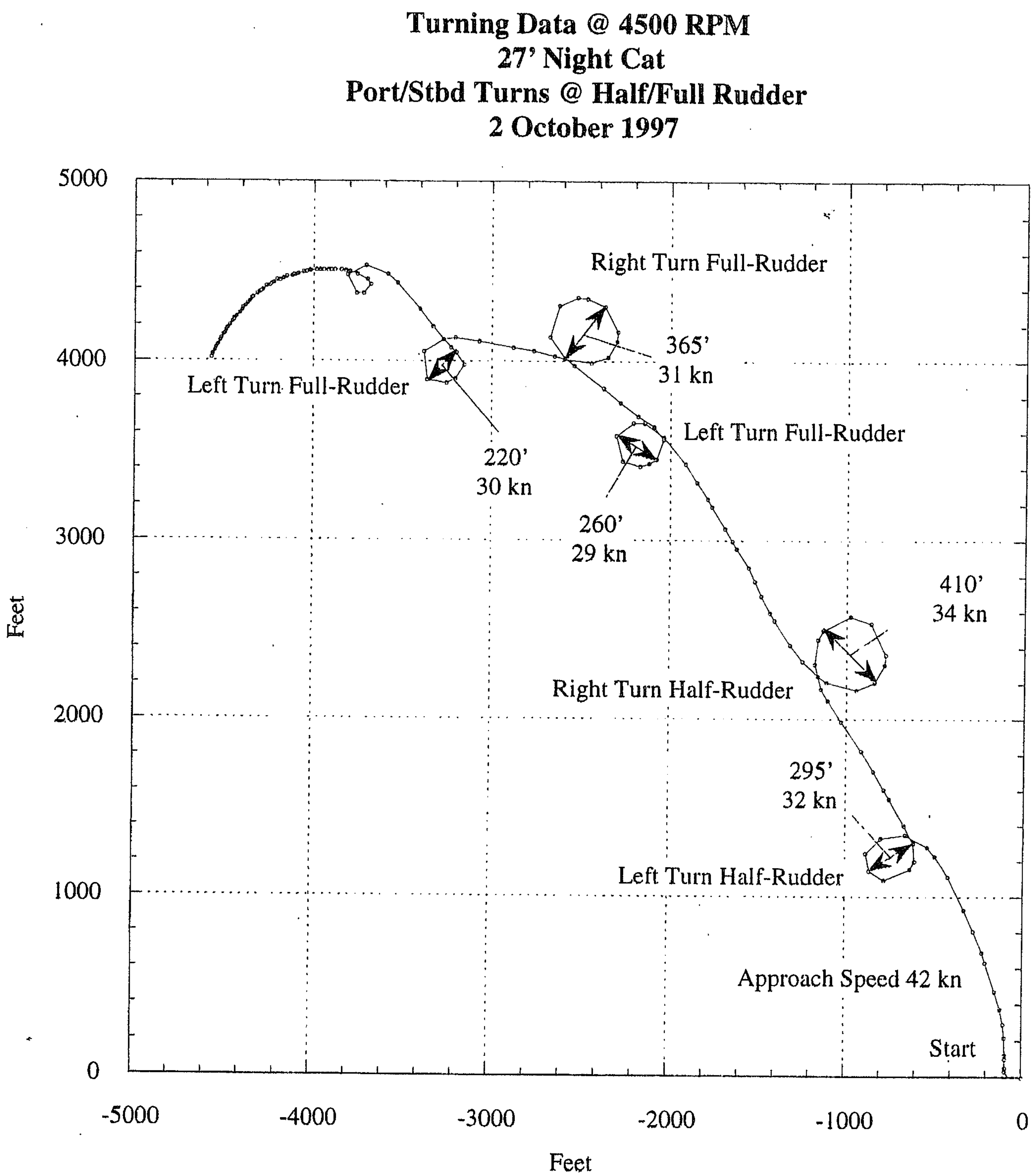
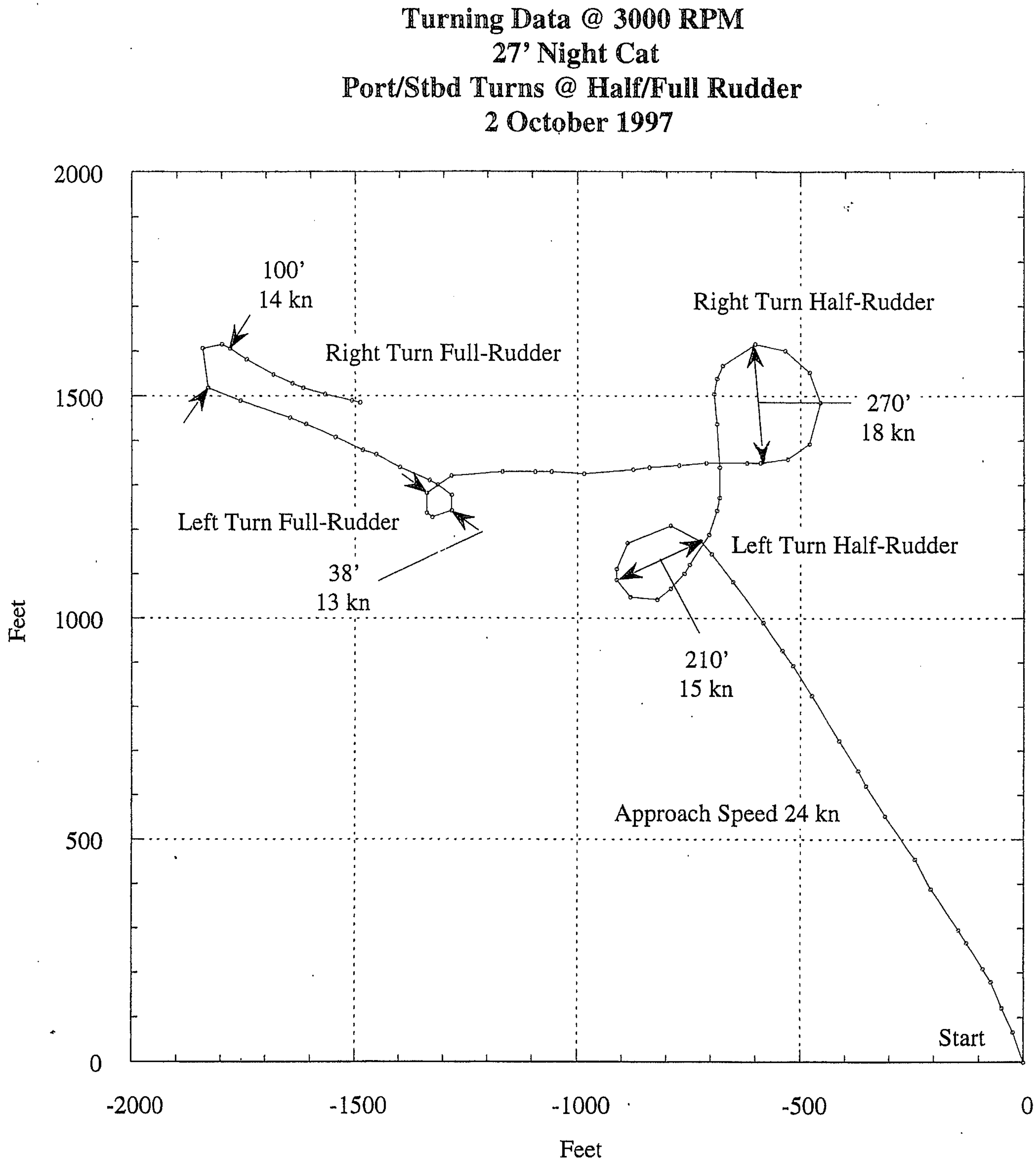

Turning Data @ 4500 RPM
27' Night Cat
Port/Stbd Turns @ Half/Full Rudder
2 October 1997
5000
4000
3000
2000
1000
0
Feet
-5000
-4000
-3000
-2000
-1000
0
Feet
Right Turn Full-Rudder
365'
31 kn
Left Turn Full-Rudder
220'
30 kn
Left Turn Full-Rudder
260'
29 kn
410'
34 kn
Right Turn Half-Rudder
295'
32 kn
Left Turn Half-Rudder
Approach Speed 42 kn
Start

Figure 36



Turning Data @ 3000 RPM
27' Night Cat
Port/Stbd Turns @ Half/Full Rudder
2 October 1997
2000
1500
1000
500
0
-2000
-1500
-1000
-500
0
Feet
Feet
100'
14 kn
Right Turn Full-Rudder
Right Turn Half-Rudder
270'
18 kn
Left Turn Full-Rudder
38'
13 kn
Left Turn Half-Rudder
210'
15 kn
Approach Speed 24 kn
Start

Figure 37

Turning Data @ 3000 and 4500 RPM
27' Night Cat
Port/Stbd Turns @ Half Rudder
2 October 1997

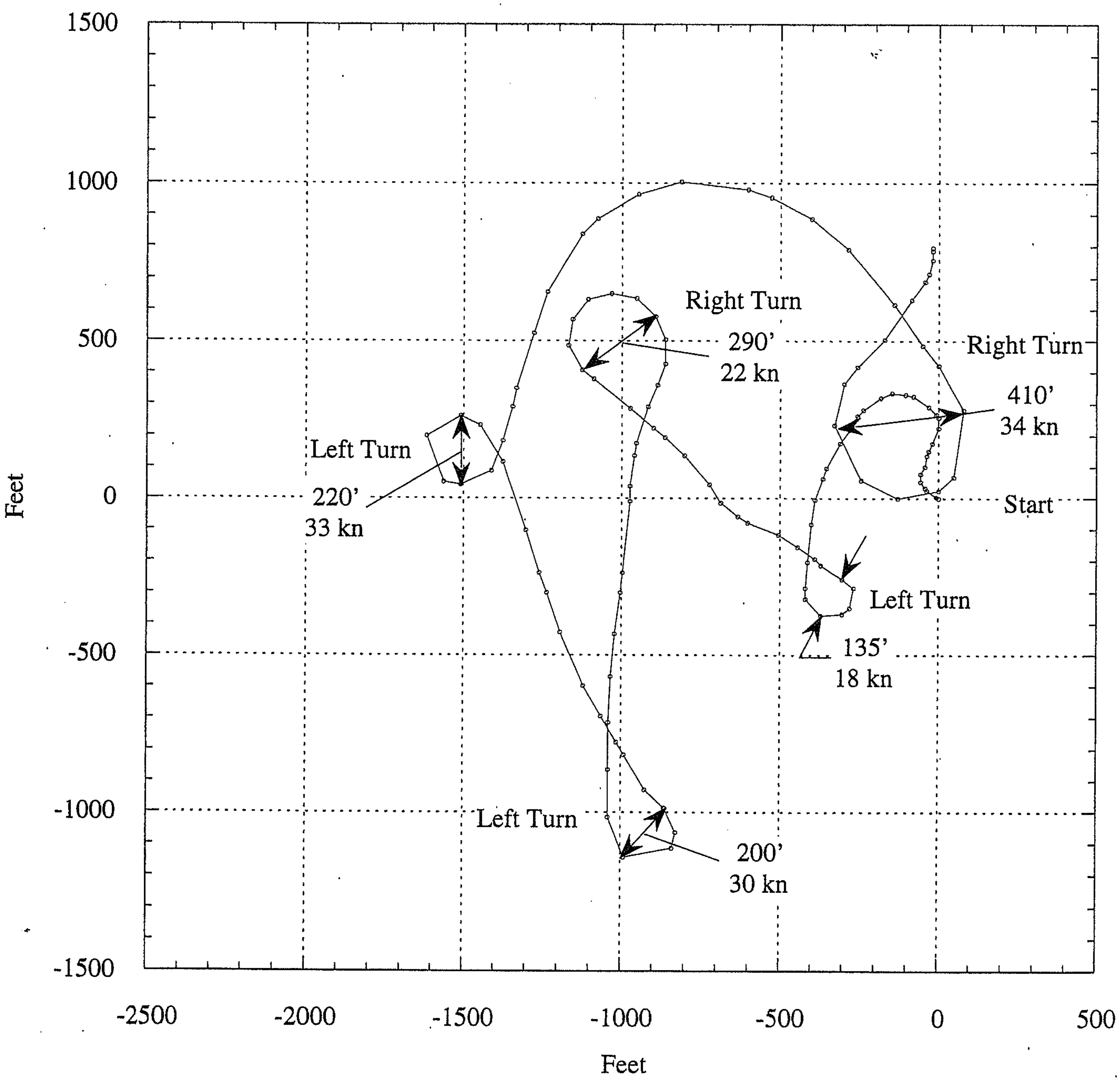


Figure 38

Turning Data @ Maximum RPM
27' Fountain
Port/Stbd Turns @ Half/Full Rudder
2 October 1997

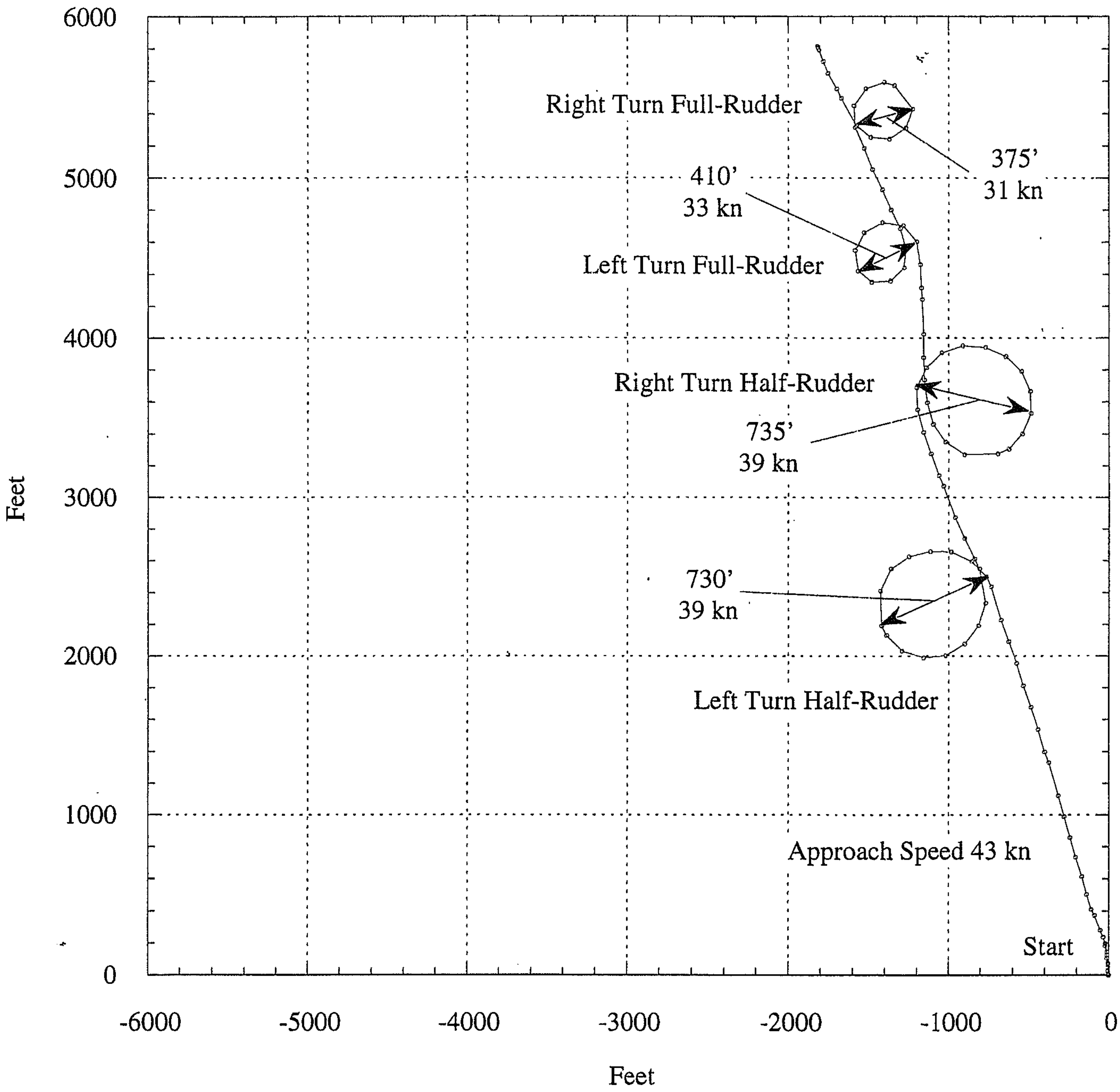


Figure 39

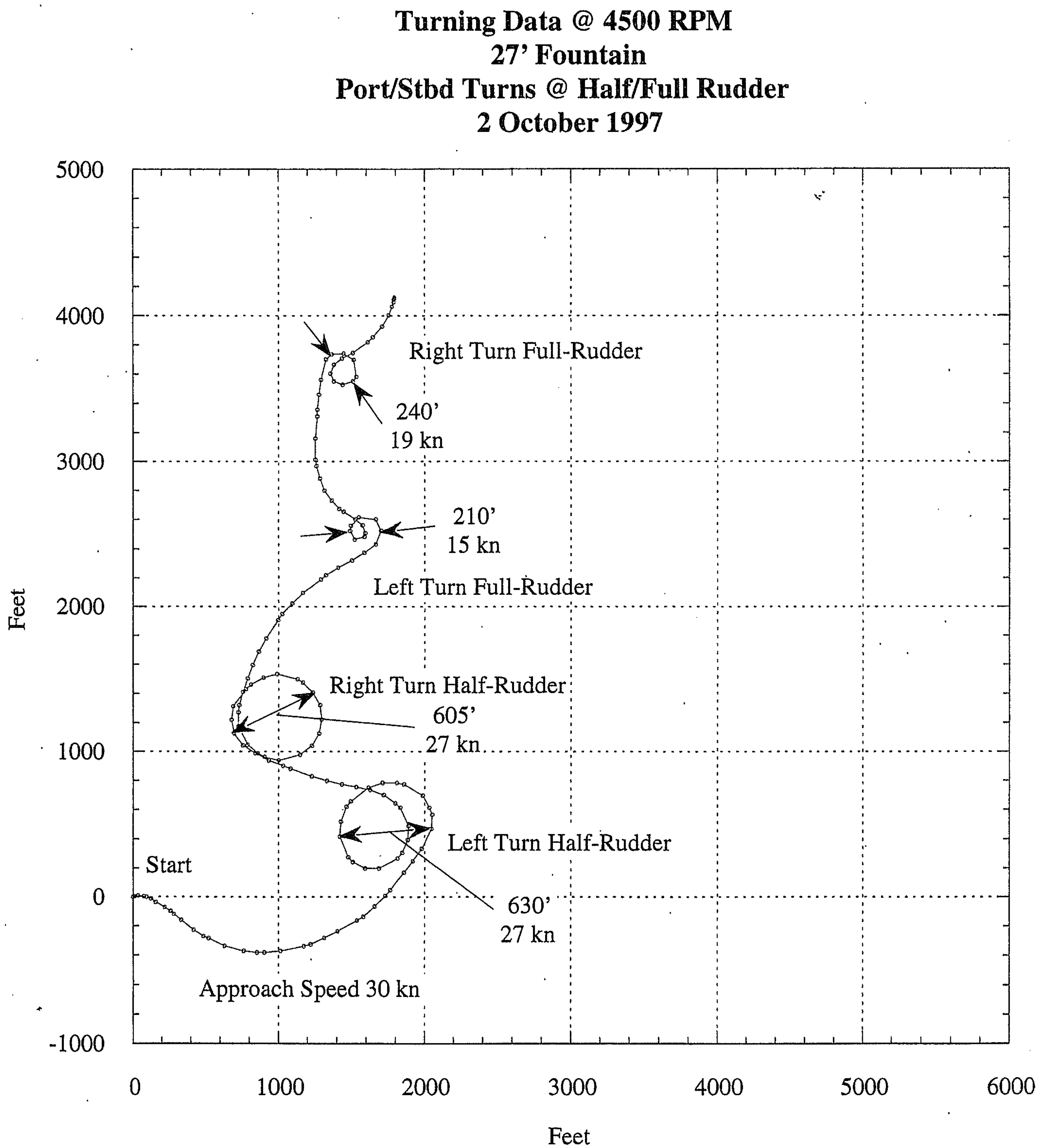

Turning Data @ 4500 RPM
27' Fountain
Port/Stbd Turns @ Half/Full Rudder
2 October 1997
Right Turn Full-Rudder
240'
19 kn
210'
15 kn
Left Turn Full-Rudder
Right Turn Half-Rudder
605'
27 kn
Left Turn Half-Rudder
Start
630'
27 kn
Approach Speed 30 kn
5000
4000
3000
2000
1000
0
-1000
0
1000
2000
3000
4000
5000
6000
Feet
Feet

Figure 40

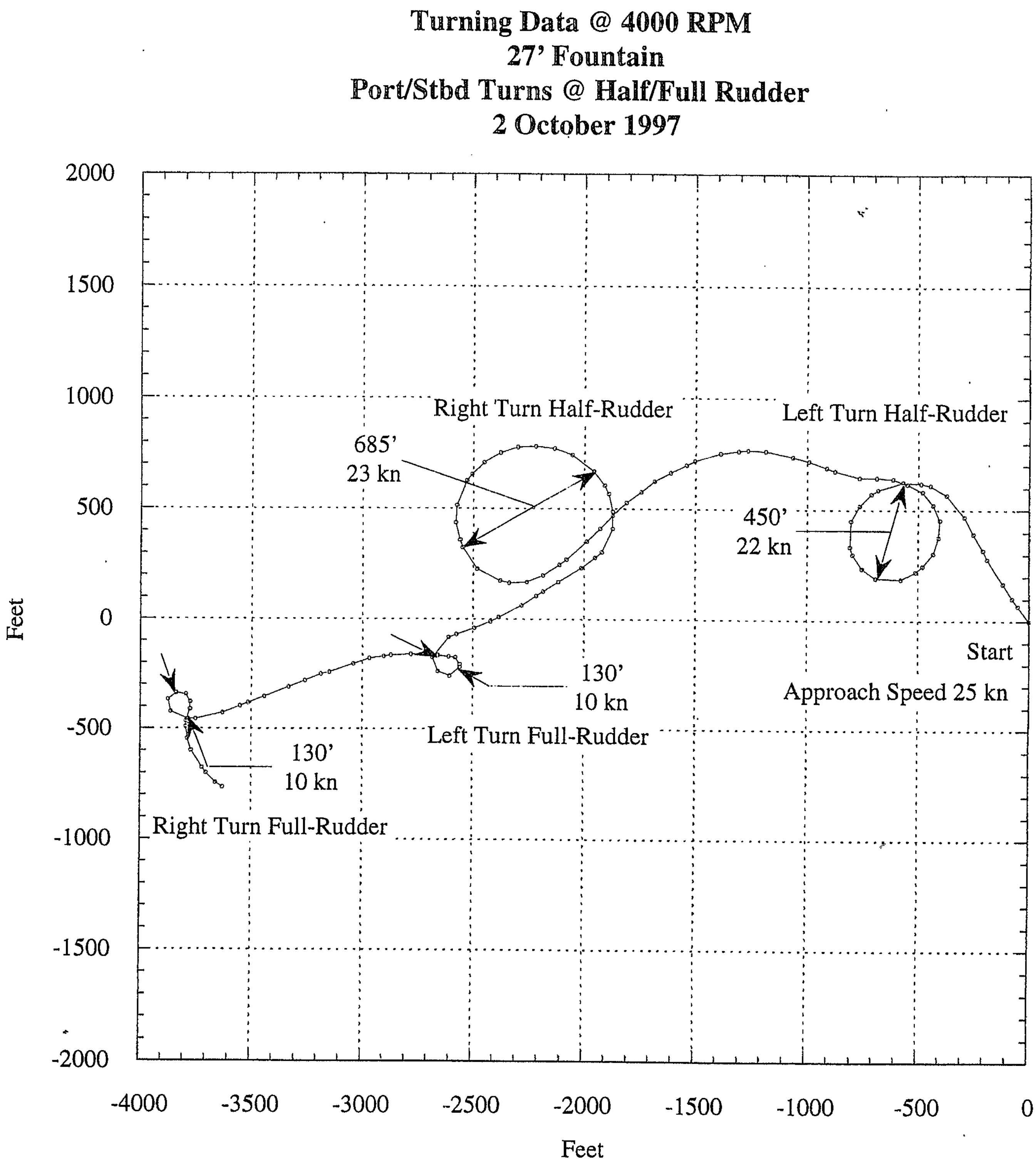

Turning Data @ 4000 RPM
27' Fountain
Port/Stbd Turns @ Half/Full Rudder
2 October 1997
Right Turn Half-Rudder
685'
23 kn
Left Turn Half-Rudder
450'
22 kn
Start
Approach Speed 25 kn
130'
10 kn
Left Turn Full-Rudder
130'
10 kn
Right Turn Full-Rudder
2000
1500
1000
500
0
-500
-1000
-1500
-2000
Feet
-4000
-3500
-3000
-2500
-2000
-1500
-1000
-500
0
Feet

Figure 41

Classic maneuvering trials were not conducted, but rather observations were made during each boats day to day operation as to its ability to maneuver in the close harbors and launching docks. Neither craft had problems manoeuvering around the docks at close quarters, launching or retrieving from their respective trailers or docking in small wet slips.

Personnel Observations

Several personnel from various agencies were invited or asked to be invited to ride and in some cases operate the craft as time permitted between testing events. All of these personnel with no exceptions, indicated and some so stated in memos to their management (Appendix C) that the Night Cat was a superior riding and handling craft when compared to any craft in the present inventory up to and including the 40' Fountains with Stidd seats. This is also the consensus of the Navy test personnel who conducted the tests in St. Augustine and the Norfolk area.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

a) The 27' Night Cat exhibits significantly superior seakeeping characteristics (up to 50% less accelerations in some cases) when compared to present inventory craft as used by U. S. Customs, the DEA and the Border Patrol for interdiction of marine drug smuggling operations.

b) The 27' Night Cat can sustain higher speeds in a given sea state with lower accelerations then present inventory craft.

c) The 27' has a smaller turning diameter than a craft of similar size and is capable of very tight turns while maintaining stability and speed in emergency or tactical situations. Since this craft loses less speed in a turn the Night Cat can maintain the chase and turn tighter than its adversary (assumes craft of similar size).

d) The 27' Night Cat outperforms other craft up to 150% the Night Cat's size.

Recommendations

a) Strong consideration should be given to scaling this craft to at least 40' to provide a viable craft for personnel to operate, feel safe on and to substantially reduce injuries during drug operation interdiction in coastal and deep waters.

b) If the craft tested is of a desirable size and configuration for more inshore operations the following minor design changes should be considered:

1. Provide bolster seats similar to the two forward bolster seats in place of the after transverse bench seat with a storage console placed between the aft seats.

2. Provide additional hand holds in several places and make the present flat type a round bar type.

3. Provide cargo nets/hold downs in the aft storage compartment

Appendix A

Test Plan For Side By Side Comparison Of The 27' Night Cat VS. 27' Custom's Craft (Open 27' Fountain Craft)

TEST PLAN
FOR

27' Night Cat (Intercept Boats)

1. This test plan describes the testing to be conducted on the 27' Night Cat. The purpose of this testing is to determine the performance characteristics of the craft and conduct a side by side rough water comparison with a similar size craft presently in service (preferably a 27' Fountain). A series of tests will be conducted in which quantitative evaluations of various aspects of craft performance and characteristics will be made. The data will establish a performance baseline for the craft; this will be useful in predicting the effects on performance of any future modifications to the craft, for comparison to other craft, and in future design work.

2. This test plan contains a series of test outlines which describe the procedures for accomplishing the required tests. Each outline includes the objective of the test, equipment required, and a brief description of the test procedure.

3. In conducting these tests safety is paramount. Recognizing the inherent dangers involved during testing, and that a certain level of risk is unavoidable, every effort shall be made by all participating personnel to minimize that risk. In preparing for and conducting these tests due regard shall be had for all dangers of weather and sea conditions, and of navigation and collision, and to any special circumstances, including the limitations of the test craft and safety boat, which may require a departure from this test plan.

4. Test outlines.

Test No.	Title
1	Scale Weighing
2	Calm Water Performance
3	Rough Water Performance
4	Turning and Maneuvering

Title: Scale Weighing

Objective: Accurately determine the weight and longitudinal center of gravity (LCG) of both test craft in a known and well documented configuration.

Data requirements:

A. Actual weight of the test craft.

B. Actual location of the LCG of the test craft.

C. Accurate accounting of the configuration of the test craft as weighed, including:

   1. Weight and LCG of required items not on board.
   2. Weight and LCG of items on board which are not part of the craft.

Equipment requirements:

A. Load cells with required ancillary equipment.

B. Measuring tools including tape, levels, plumb bobs, etc., as required.

C. Cranes or travel lift with suitable rigging.

Procedure:

A. Determine and record the condition of the test craft. This includes items missing from the craft, the condition of all tanks, and liquid levels in the bilge.

B. Weigh the craft using a two-point lift. Record the weight readings and hoisting geometry.

C. Calculate the craft weight and LCG corrected to the light load condition.

Title: Calm Water Performance

Objective: Establish speed, power, fuel consumption, range, and running trim for various conditions of loading.

Data requirements:

A. Data will be taken at the following conditions of loading:

1. Mission Load, Measured LCG
2. Full Load, Measured LCG

B. The following data will be taken for each condition of loading:

1. Craft displacement
2. LCG
3. Static trim
4. Engine RPM
5. Fuel consumption
6. Running trim
7. Craft speed
8. Video tape of selected portions of testing

Equipment requirements:

A. RPM pickups

B. Fuel flowmeters

C. Inclinometer

D. Global Positioning System

E. Ballast weights

F. Video camera

Procedure:

A. Install instrumentation

B. From the scale weighing data and the configuration of the test craft, determine the amount and location of ballast required to achieve the desired condition of loading. Record the condition of the test craft, amount and location of ballast, test equipment, fuel, personnel, etc., and the static trim.

C. For each load condition data shall be taken for at least six engine RPMs from idle to full power. Two runs, one in each direction, shall be made at each RPM to eliminate the effects of wind and current. The engine throttle will remain fixed for each run. Trim tabs will be fully retracted. Record the following data for each run:

1. Shaft RPM
2. Fuel flow, supply and return
3. Running trim
4. Time to run course, radar gun, and/or GPS

D. From the raw data obtained for each load condition, compute the following:

1. Speed for each run and average speed for each pair of runs
2. Fuel consumption
3. Range

E. Plot graphs of the horsepower, running trim, total fuel consumption, range, and propulsion engine RPM versus speed for each trial condition.

Note: Hp will can only be determined by dyno curves which will not take into account the propeller.

Title: Rough Water Performance

Objective: Determine the motions of both craft when operated at various speeds and headings in a sea state 2 or higher (significant wave height of 2.9 feet).

Data Requirements:

A. Data will be taken at mission load conditions, at maximum safe speed and at a reduced speed at the following headings to the sea:

1. Head
2. Bow
3. Beam
4. Quartering
5. Following

B. The following data will be taken for each condition of loading:

1. Craft weight
2. LCG
3. Static trim

C. The following data will be taken for each run:

1. Vertical acceleration at coxswain's station
2. Vertical acceleration(s) at other determined location
3. Pitch
4. Roll
5. Speed
6. RPM
7. Heading
8. Video tape

Equipment requirements:

A. Wave buoy with receiver and recorder or wave data from Ches Light

B. Accelerometers

C. Pitch and roll gyro

D. Radar gun and/or GPS

E. Ballast weights

Procedure:

A. Install instrumentation

B. From scale weighing data and the configuration of the test craft, determine the amount and location of ballast required to achieve the desired condition of loading. Record the condition of the craft including the weight and location of ballast, test equipment, personnel, fuel, etc., and the static trim.

C. Launch the wave buoy if used, and ascertain that the sea conditions are suitable for the test.

D. Make the required test runs recording the data on the recorder. Trim tabs will be fully retracted for all runs.

E. Analyze the recorded data to determine the average of the 1/3 highest and extreme values for craft accelerations, roll, and pitch for each run. Analyze the wave data to determine the average of the 1/3 highest, and extreme wave heights and the wave spectrum.

Title: Turning and Maneuvering

Objective: Asses the turning and maneuvering performance of each craft.

Data requirements:

A. Turning

1. Turning test data will be taken at the maximum safe speed and at a reduced speed at the following rudder angles:
   a. ½ full right rudder
   b. hard right rudder
   c. ½ full left rudder
   d. hard left rudder

2. For each turning maneuver the following data will be taken:
   a. speed
   b. heading
   c. craft's track
   d. rudder angle
   e. engine RPM

C. A qualitative assessment of the ability of the craft to maneuver in and around launch and dock areas.

Equipment requirements:

A. GPS

B. Rudder angle indicator

C. RPM pickups

Procedure:

A. Install instrumentation

B. Turning tests will be conducted in a large unobstructed area of calm water. Each run is started with the test craft on a straight approach course with fixed throttle settings. The throttles will remain fixed throughout each maneuver. At the initiation of the turning maneuver the rudder is rapidly moved to the desired angle and held at that angle until the craft has turned through at least 540 degrees. Rudder angle, engine speed during the approach, engine speed in the turn, craft's track, will be monitored by the GPS and recorded.

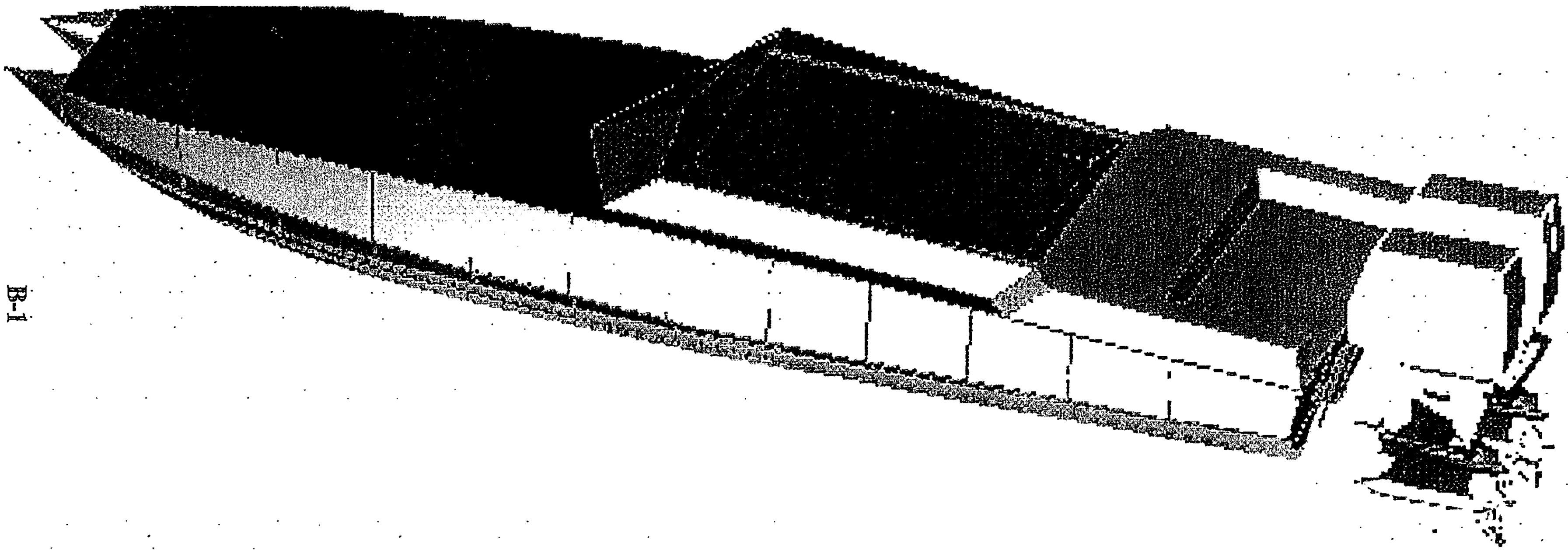
D. Analyze the GPS system data to correct for set and drift and determine the following:

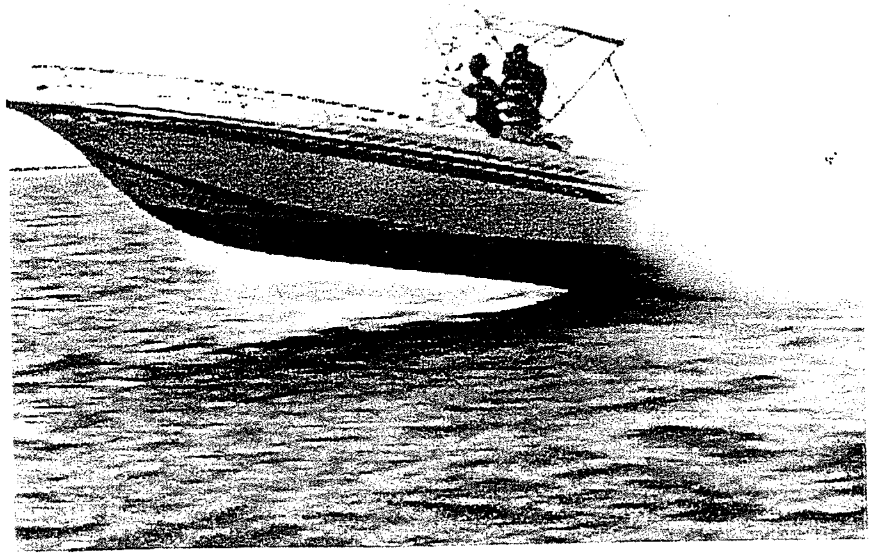
1. Turning diameter
2. Rate of turn
3. Speed of approach
4. Speed in turn

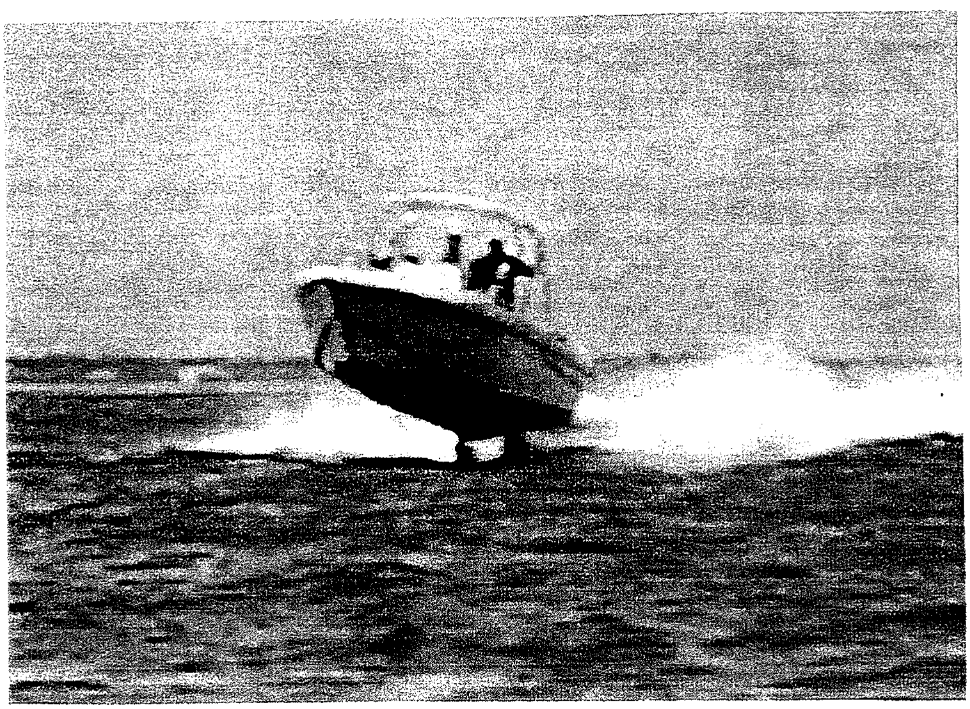
Appendix B

Photographs of 27' Night Cat / 27' Fountain underway while testing

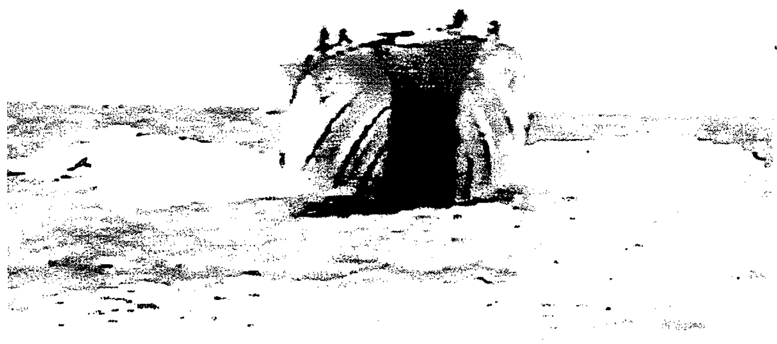
INTERCEPT BOATS INC.
27 FOOT NIGHT CAT

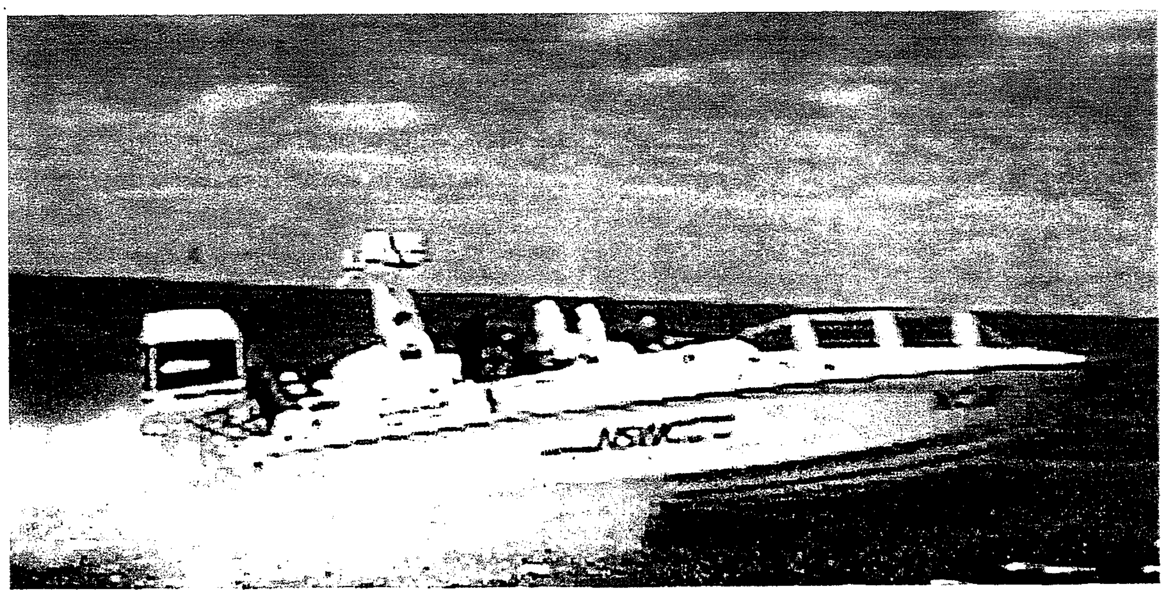




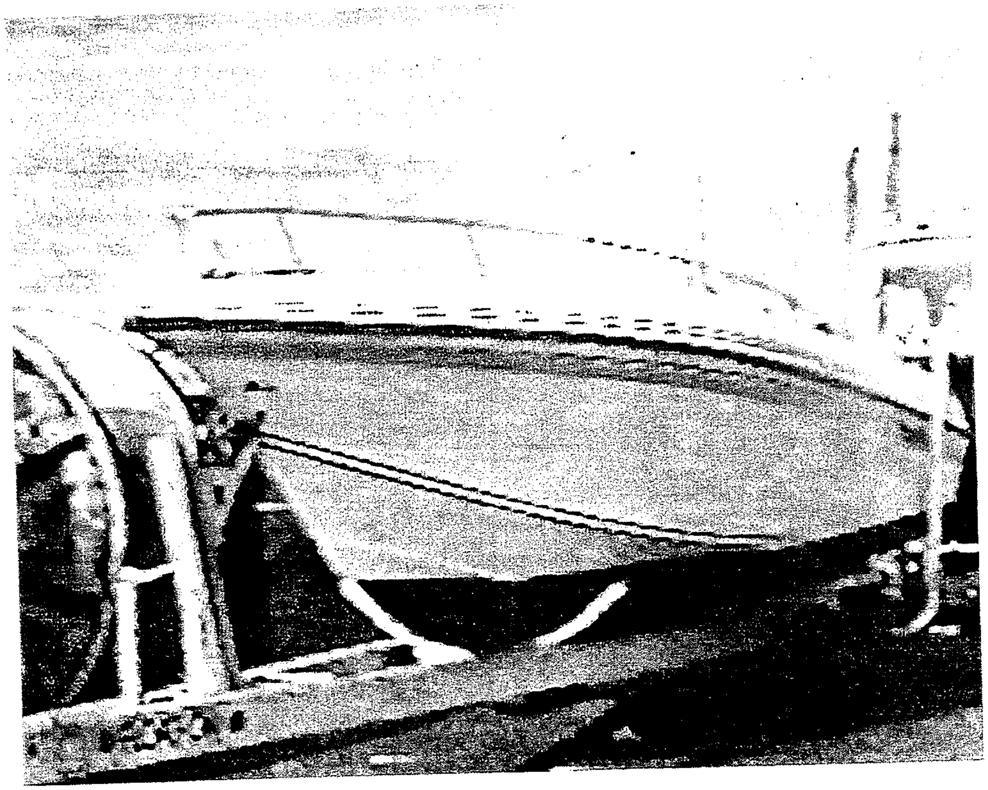


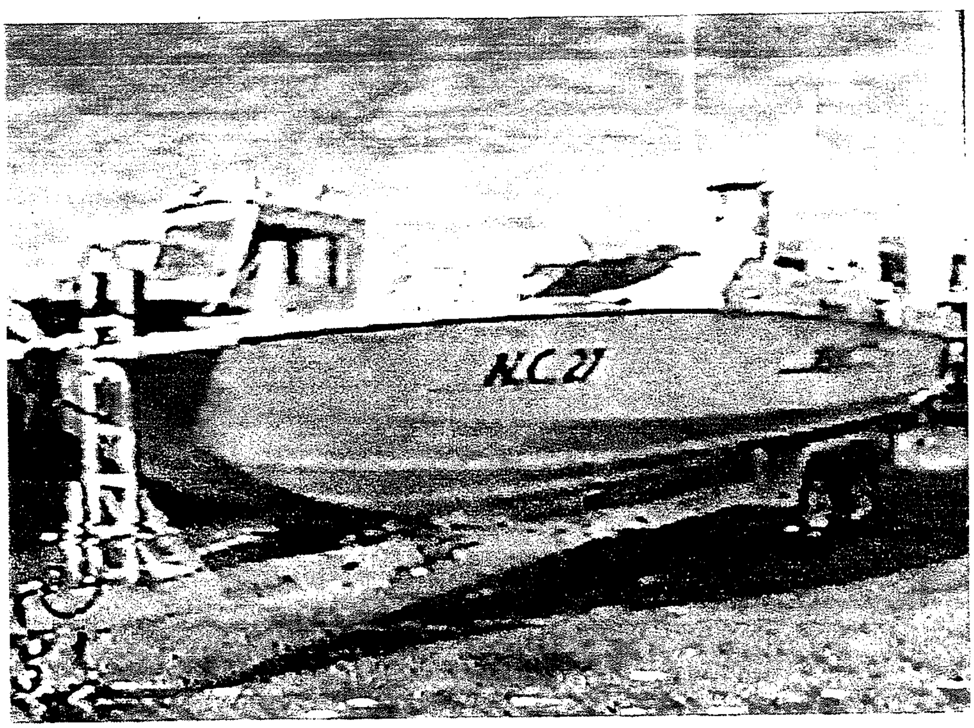
27' Fountain Underway - Full Speed in St. Augustine
Long Wave Length Swell at About 2-3 Feet



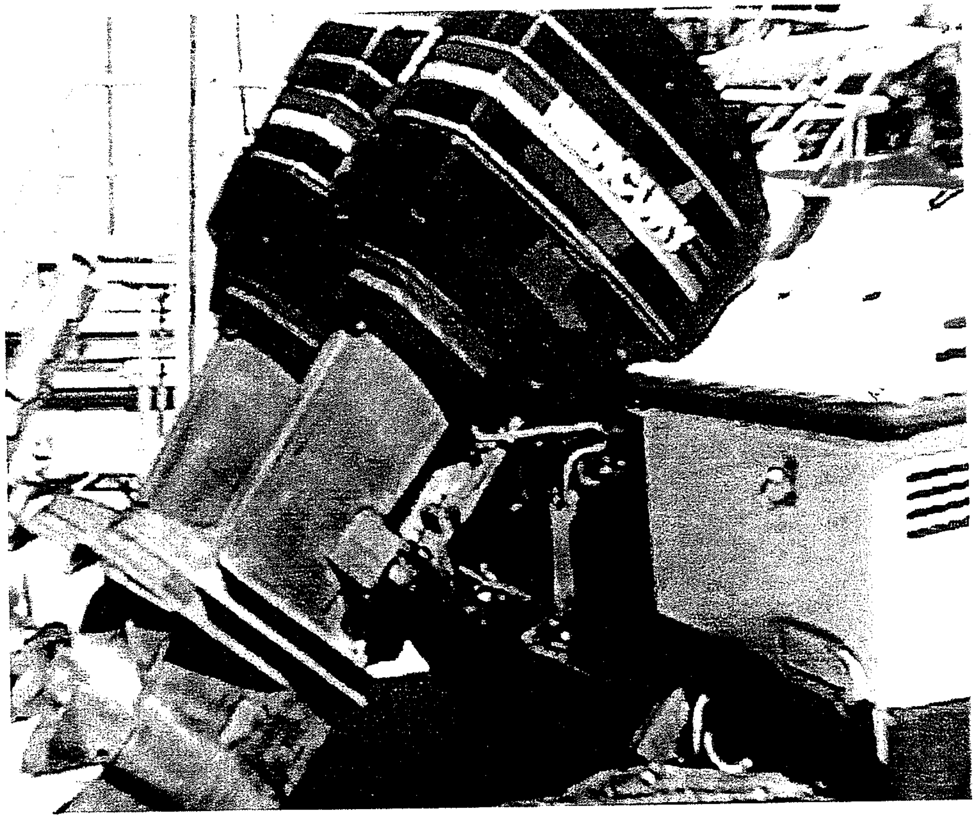


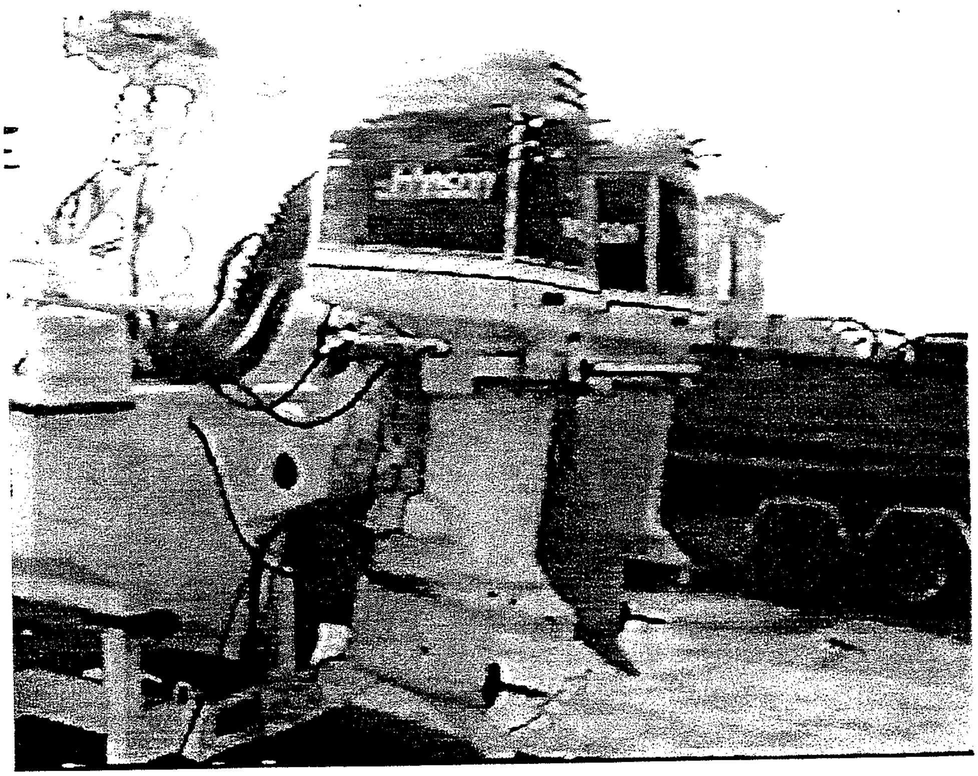
27' Night Cat Underway - Full Speed in Hampton Roads
Short, Steep Waves at About 2-3 Feet



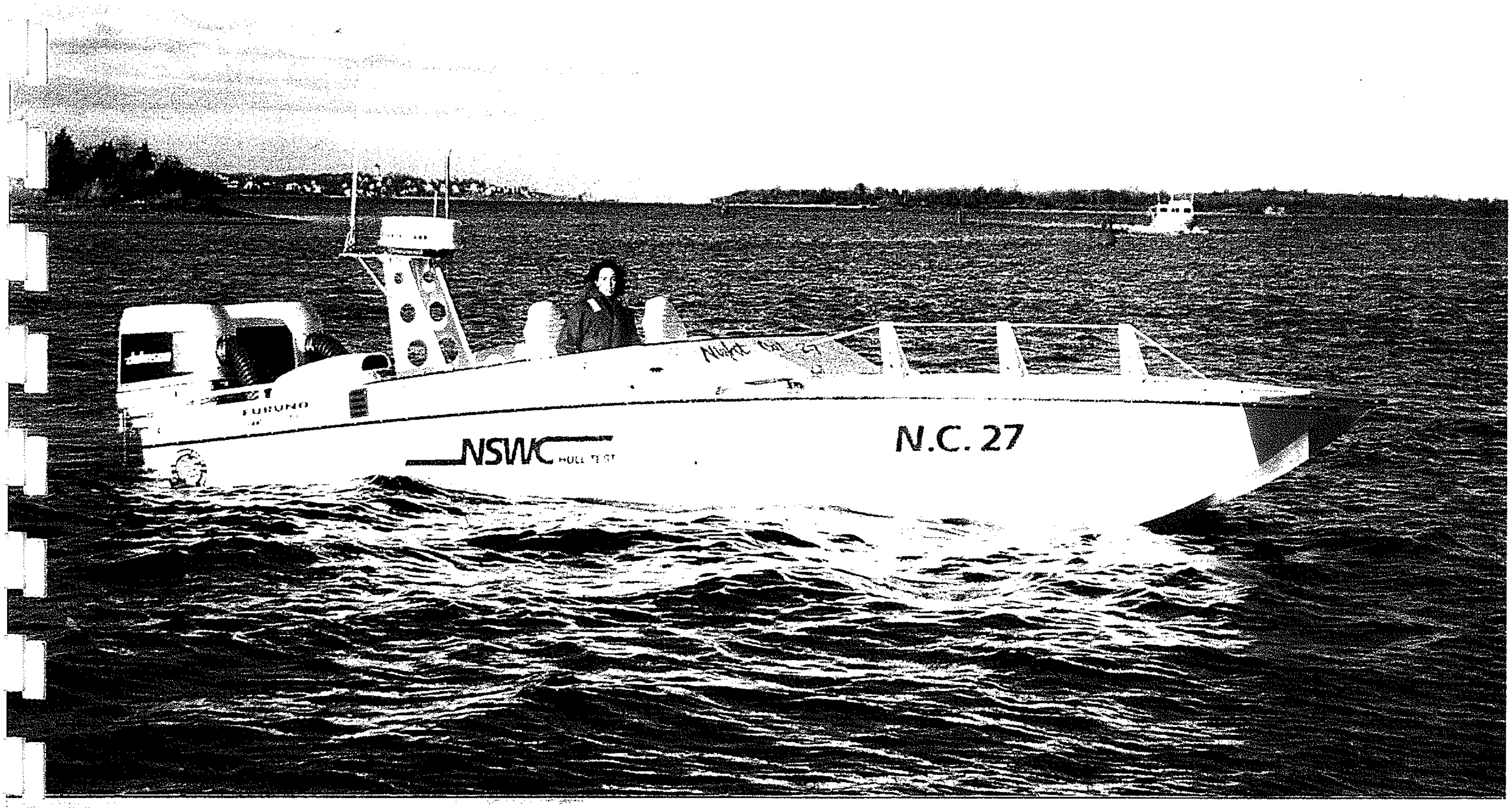


27' Night Cat / 27' Fountain - On Trailers
Ft. Monroe, VA





27’ Night Cat OMC OB / 27’ Fountain Mercury OB
Ft. Monroe, VA


NSWC
N.C. 27


NSWC
N.C. 27

Appendix C

Memo/Letters written to higher management by agents participating in the evaluation and testing

UNITED STATES GOVERNMENT
Memorandum

DEPARTMENT OF THE TREASURY
UNITED STATES CUSTOMS SERVICE

DATE: September 12, 1997

FILE: FAC-8-01 OI:IO:SM WJK

TO : Deputy Assistant Director, Investigative Operations

FROM : Director, National Marine Support Center

SUBJECT: Evaluation of Intercept Boats 27' Night Cat

During the week of September 8, 1997 tests were conducted on the Intercept Boats Night Cat 27 to evaluate the technology used in the vessel to serve as a model for the development of a 40 foot high speed interceptor. Representatives from the Border Patrol, DEA, Naval Surface Warfare Center, U.S. Army Electronic Proving Ground (serving as contracting officers for ONDCP), Intercept Boats, MIT and U.S. Customs Service met at the Customs National Marine Support Center to participate in the tests.

The tests were conducted under the direction of the Naval Surface Warfare Center, Carderock Division, Combatant Craft Department, utilizing the Intracoastal Waterway, the Matanzas and Tolomato Rivers and the Atlantic Ocean in and around St. Augustine, Florida. The test results will be published by the Naval Surface Warfare Center once all the data has been collected, collated and analyzed. Based upon my personal observations and conversations with the other representatives it appears that the test results will support the development of a 40 foot vessel.

While the tests were not intended to serve as an evaluation of the 27' vessel, it would be impossible not to make some judgements while participating in the tests. The Night Cat 27 is a 27' catamaran, utilizing twin asymmetrical deep V hulls, powered by twin 300hp outboard engines. This vessel in appearance resembles the current twin outboard utility class catamarans in the Customs fleet, while it performs more like an interceptor class vessel. Every vessel operator that drove the 27' Night Cat agreed that this vessel was the best small boat that they had ever ridden in. The Night Cat out performed the 27' deep V utility vessel used for comparison and was equal to and in rough ocean conditions out performed a 38' cigarette type vessel.

Based upon observations by the test participants the Night Cat incorporates fuel efficiency, high cruise and top speeds, excellent handling and maneuvering capabilities, a different approach to wave piercing (providing a smoother ride) and addresses the problems of physical stress and injuries to the crew caused by vertical acceleration.

The potential contributions the addition of a Night Cat 27 to the Customs fleet would make include: the aspect of addressing small boat injuries caused by vertical acceleration to the crew; replacing high maintenance interceptor vessels; reducing operating costs of the Customs Fleet. The Customs Service has worked for years on implementing measures which would reduce the physical stress placed upon its crews. Lacking the technical capabilities of vessel design and configuration to produce safer vessels the Customs Marine Program has had to focus on external measures to reduce crew stress. Utilizing absorbent rubber matting, shock absorbent seats and supportive boat shoes. Currently, several areas utilize utility vessels as the only customs vessel assigned to the area. This is extremely restrictive, in that these vessels can only be used under favorable weather conditions. The Night Cat can be used in the same sea states as our interceptors. Unlike our interceptors the Night Cat requires the maintenance of a utility vessel.

The Night Cat 27 is a vessel the U.S. Customs Service should add to the fleet. The concept of incorporating the speed and rough water handling of an interceptor into a smaller utility class vessel with lower operating costs and less physical stress to the crew is immediately appealing. I recommend that the Customs Service fully support the ONDCP in the development of the 40' interceptor vessel. The addition of the 27' Night Cat and the 40' Night Cat interceptor would greatly enhance the Customs Marine program.

For additional information, questions or comments please contact me at 904-823-8751.

Waldemar J. Kropacek

TEST OF NIGHT CAT 27 IN ST AUGUSTINE, FLORIDA, SEPTEMBER 8-11, 1997

SEPTEMBER 11, 1997

SUPERVISORY S/A JESSE T. MEEKINS
DEA HQS, DOL SECTION
WASHINGTON, D C.

S/A JOHN M BURNS
BOAT HANDLER
JACKSONVILLE RESIDENT OFFICE
JACKSONVILLE, FLAORIDA

On September 8, 1997, the DOL Section in DEA HQS requested S/A Burns, the Senior Boat Handler in DEA, attend the testing of a new 27 foot catamaran proposed for service by US Customs, DEA, the Coast Guard, the US Border Patrol, and the US Forces S/A Burns attended the testing of the NIGHT CAT 27, manufactured by Intercept Boats, Higham, Ma., in the vicinity of St Augustine, Florida, September 8-11, 1997.

The tests, conducted under the direction of the Naval Surface Warfare Center, Carderock Division Combatant Craft Department, were conducted at the US Customs East Coast Maintenance Center in St Augustine, Florida, and in the waters of the Intra coastal Waterway, the Atlantic Ocean and the Manassas River. The tests were funded by the Office of National Drug Control Policy and a representative of the Electronic Proving Ground was present for the tests and briefing.

Attached to this memorandum is the schedule and description of the testing done in St Augustine, Florida S/A Burns was present at the tests and attended the evening briefing about the Night Cat 27 conducted by Intercept Boats on September 9, 1997.

In summary, the 27 foot catamaran, called the NIGHT CAT 27, manufactured and developed with private funding by Intercept Boats, is the best small boat this S/A has ever or ridden in or driven. The boat out performed her chief competitor, the Fountain 27, by far and her performance was more equal to a much larger Cigarette boat. This boat was developed as a multi-mission boat and in various configurations could easily be used as an undercover load boat, an interceptor for interdiction, a stealth boat for special forces, or a surveillance boat . It is an extremely stable platform at speeds approaching 80 mph and cruises effortlessly at 50 mph (4100 rpm) and has the capacity to carry seven (7) fully armed /equipped personnel. In my opinion, this boat will out maneuver any boat currently in production and she is one of the most comfortable boats of this type I have ridden in or driven.

The boat is air transportable due to her light weight and can be transported by trailer easily anywhere in CONUS using a standard pick up truck. This boat appeared simple to maintain as well as easy to drive. She keeps a low profile in the water and the crew can remain seated during the operation of the boat. Even short in stature agents would have outstanding visibility ahead in this boat as apposed to some boats that the crew has to remain standing during the operation to see over the hull forward of the cockpit. The entire layout of the boat is well thought out and is crew friendly even in heavy seas or high speed operations.

The boat is sound, exceeds the capability of any other boat in her class and has the ability to assume a number of roles for the different agencies. The final question that should be addressed is, does DEA need this type of boat? The answer, from a street agent point of view is absolutely yes! This boat, or the larger 42 foot catamaran that is planned, would be excellent for undercover operations in the Bahamas, the Gulf of Texas, or Florida. This vessel could have been utilized in the recent joint operation in the Gulf of Mexico near Brownsville, Texas, as a pursuit and surveillance platform. The boat could be used on a operation currently underway by the San Francisco FD in the Mediterranean Sea for the rendezvous and pickup of 100 kilograms of heroin off the Island of Cyprus. During a dangerous off shore rendezvous with a mother ship this boat could provide backup to undercover agents on a undercover vessel without being discovered visibility or electronically.

Finally, this agent strongly recommends to DOL to a positive recommendation by DEA to allow the ONDCP to fund the building of a 42 prototype for multi agency inspection and testing. Although, the boat is expensive to a single agency, the purchase of this multi role boat by several agencies and the funding of the electronic package on the boat by the Electronic Proving Ground under the ONDCP would make the boat affordable in both the 27 foot and 42 foot configuration.

Any questions concerning this matter may be directed to S/A Burns at the Jacksonville RO, telephone number 904-232-3566 ext.. 205.

Memorandum

Subject: Operation Night Breaker Test of "Night Cat 27" Vessel	Date: 10/01/97

To:
Edward J. Wisniefski
Chief Investigative Technology
Technical Operations
DEA

From:
D.S. Mud Rice
SSA Boat Handler/ Captain
Marine Coordinator
Houston Field Division

On September 25, 1997, DEA Headquarters Marine Program Coordinator Dennis Prewitt of the Technical Operation Unit, Lorton, Va. requested SSA Boat Handler/ Captain D.S. Mud Rice, DEA's most experienced Marine Coordinator/ Boat Captain, attend the testing of a technically superior prototype marine vessel capable of unequaled stability at high speed. The prototype vessel, code named "Night Cat 27", is described as a 27 foot catamaran with a re-invented/ engineered/designed hull form proposed for utilization by Multi Forces, including but not limited to DEA, Border Patrol, Coast Guard, Customs, and specialized units of the Armed Forces. This superior vessel hull was designed and built by Robert Perette, of Intercept Boats, Higham, Ma.

The Office of National Drug Control Policy (ONDCP) has funded a full scale naval evaluation of the "Night Cat 27". The evaluation, conducted under the direction of the Naval Surface Warfare Center (NSWC), Carderock Division, Combatant Craft Department, has documented the advanced technology of its hull form compared to that of vessels currently utilized by the U.S. Government. Initial tests were conducted September 8th thru 11th, 1997 at St. Augustine, Fl.. On October 1, 1997, I was briefed on Operation Night Breaker and believe in my humble opinion that it is the most exciting concept to be developed during this Administration. On this date, I attended and participated in the tests conducted at the NSWC facility, Ft. Monroe, Va.. The tests, including fuel consumption, high speed maneuvers and heavy seas capabilities were conducted in the Atlantic Ocean and lower Chesapeake Bay at the confluence of the York, James and Potomac Rivers.

Based on many years of experience on the water, my opinion of this vessel and its capabilities were described as OUTSTANDING. Mr. Perette has designed and developed what can only be described as a technological breakthrough. The "Night Cat 27", a prototype 27 foot catamaran powered by twin 300 horsepower outboards, outperformed, outmaneuvered, and flat outran all competition. And it did this with complete comfort, ease, and safety for the operator and crew. While operating the vessel, I was amazed at its stability and felt comfortable cruising at speeds approaching 60 mph (5000 rpm). I maneuvered the "Night Cat 27" through all sea headings and found it to be incredibly stable and secure.

Mr. Perette designed this vessel with the front line agent/soldier in mind. The vessel is user friendly and minimizes the fatigue of extended marine missions due to its innovative hull design. The "Night Cat 27" and its planned larger 40 foot version were designed as multi force and multi mission vessels. Their application in law enforcement and military theaters is infinite, utilizing it for undercover, surveillance, interdiction, and stealth for special forces to name a few.

In March 1997, as Marine Coordinator for the Houston Field Division, I coordinated and directed DEA's role in Operation Gulf Shield in the Gulf of Mexico, an operation similar to Operation BAT in the Bahamas. The primary role of DEA's U/C vessel was to conduct surveillance along the U.S./Mexico maritime boundary. The "Night Cat 27" would have increased this mission's success and the planned 40' version not only would have increased its success, but minimized the fatigue caused by the incredibly heavy seas and allowed missions of greater duration.

I emphatically encourage DEA Technical Operations, Marine Programs to provide a positive recommendation to ONDCP for the funding of the construction of the 40' prototype for multi force inspection and testing. Let us not let this project sit on the shelf. Thank you for your consideration in this important matter.

cc: Edward J. Wisniefski
cc: Jesse T. Meekins
cc: Dennis Prewitt