U.S. Virgin Islands Project Summary

Type of Survey: Benthic Habitat and Hydrographic

Project No. NF-05-05-USVI

Time Frame: February 01-12, 2005

Locality

U.S. Virgin Islands

General Locality: South of St. John and St. Thomas and Buck Island, St. Croix

2005

Chief Scientist

Timothy A. Battista

Lead Hydrograher

John V. Lazar, Jr.

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NOAA Ship Nancy Foster

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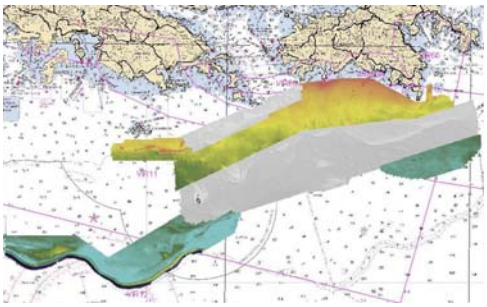
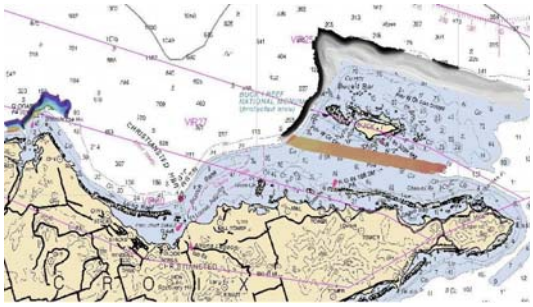
St. Croix, St. John, and St. Thomas, U.S. Virgin Islands

2004-2005

I. Area

The National Oceanic and Atmospheric Administration's (NOAA) Center for Coastal Monitoring and Assessment (CCMA) Biogeography Team conducted two research cruises aboard the NOAA Ship Nancy Foster in the U.S Virgin Islands during the month of February, 2004 and 2005. The purpose of these joint ventures with the National Park Service (NPS), the National Marine Fisheries Service (NMFS), and the US Virgin Islands government was the exploration and characterization of moderate depth habitats (<300) within the U.S. Virgin Islands for natural resource management. Priority areas included NPS Buck Island Reef and Virgin Islands National Coral Reef Monuments, Salt River Bay National Historical Park and Ecological Reserve, and the NMFS Grammanik Bank system south of St. Thomas. The area designated NPS Inshore immediately south of St. John as chosen as a benthic habitat mapping/charting survey demonstration site during the 2005 cruise. The two figures below depict shaded relief models of the areas surveyed. The grey coverage represents work carried out in 2004 and the color-by-depth coverage represents the 2005 field season. A comprehensive summary of the line mileage from the two field seasons is listed as Appendix A. A comprehensive summary of the lines collected during the two field seasons is listed as Appendix B.





II. Equipment

Vessel

The NOAA Ship Nancy Foster provided an adequate platform for the acquisition of high-resolution shallow water multibeam and backscatter data. The Nancy Foster is 56.8 meters in length with a beam of 12 meters and she draws approximately 3.2 meters of water. Her steel pole sonar mount was re-engineered for the 2005 field season to deliver a more rigid support system for multibeam operations. Additionally, new antenna mounts were designed and installed to accommodate the integrated gps and inertial motion reference unit.

Sonar System

A Reson SeaBat 8101 Extended Range (ER) Multibeam Echosounder System provided the depth measurements during both trips. With the side scan sonar Option 033, where both the transducer and processor are upgraded to measure, process, and output multibeam backscatter imagery in "standard" and "Snippets" formats, the sonar will be able to identify structure not available to direct sounding measurements. The 8101 is also upgraded with Option 037, the titanium housing and Option 040, the extended range projector. The SeaBat 8101 ER is a 240 kHz multibeam system that measures relative water depths across a 150^{o} swath, consisting of 101 individual 1.5^{o} x 1.5^{o} beams. This system is used to obtain full-bottom coverage in depths less than 300 meters, with range scale values dependent upon the depth of water and across-track slope. The concept of "full bottom coverage" will be discussed in more detail in section III.

Motion Reference Unit

A POS/MV was brought along to complement the 2005 survey. The POS/MV Model 320 is a GPS aided inertial measurement unit that generates attitude data in three axes. Measurements of roll, pitch and heading are all accurate to $\pm$ 0.02° or better, regardless of the vessel latitude. Heave measurements supplied by POS/MV maintain an accuracy of 5% of the measured vertical displacement or $\pm$ 5cm (whichever is the larger) for movements that have a period of up to 20 seconds. The accuracy and stability of measurements delivered by the System remain unaffected by vessel turns, changes of speed, wave-induced motion, or other dynamic maneuvers. Position and motion data were supplied to the acquisition system via Ethernet allowing for the highest update rate. No less than 25 hZ was supplied to the ISS system. Com Port 2 was configured to supply motion data to the Reson sonar for real-time motion corrected depth gating if the hydrographer determined it was needed. The heave bandwidth was set to 20.0 seconds with a dampening ration of .707. Roll, pitch, and heave positive sense were port up, bow up, and heave up respectively. Multipath was set to medium due to the placement of the two GPS antennae. Software and hardware versions follow.

The 2004 field party invited the Ixsea Octans gyrocompass & integrated motion sensor to provide true heading in addition to heave, pitch and roll correctors in NEMA and TSS HDT formats. The Octans generates attitude data in three axes (roll, pitch and heading). The manufactures specifications state that the dynamic heading accuracy was ∀0.2E and the dynamic accuracy for roll and pitch was ∀0.01E. Heave measurements supplied by the OCTANS maintained an accuracy of 5 cm or 5% of the measured vertical displacement. The heave period was automatically compensated for by the firm ware for periods between 0.03 and 40 seconds

Positioning System

The POS/MV Model 320 provides two identical GPS antennas that support its own GPS receiver card designated primary and secondary. The primary receiver can receive and process differential corrections. This receiver provides the position and velocity information to POS/MV. It also provides the 'Pulse per second' (PPS) strobe that POS/MV uses to synchronize data output to UTC or GPS time. The secondary receiver allows POS/MV to compute GPS heading aided by performing carrier phase differential measurements between the two GPS receivers achieving an accuracy to $\pm$

0.02° or better in low latency environments. Position data was getting transmitted via an Ethernet connection but was digitally logged to the ISS system per depth measurement. Therefore, position data points are only as frequent as the sounding data.

The Nancy Foster is positioned with two Northstar 941X GPS Navigator antennae on top of the pilot house. Both the port and starboard systems receive differential corrections internally with published accuracies of 1-3 meters. Each system will be involved with the survey independently. The port receiver will provide the differential corrections to the POS/MV and the starboard receiver will have its position recorded with the acquisition software. Each receiver was configured to manually lock to frequency 295.0 kHz, the Port Isabel, San Juan Continually Operating Reference Station (CORS) beacon.

The 2004 survey vessel positions were obtained using a Trimble DSM212L GPS receiver. The differential correctors were provided by the Port Isabel CORS beacon. The receiver was initially set to Auto Search for differential beacon signals mode but was later changed to manual frequency lock to avoid the unintended signal loss.

Sound Velocity

The primary instrument for determining sound velocity during both surveys was a Seabird Electronics SBE-19P Conductivity, Temperature, and Depth (CTD) gage. A second SBE-19 tagged along during 2005 for calibration and back-up deployment in the event of the primary system failure.

Acquisition System

The SAIC ISS 2000 acquisition platform was selected for data collection during the 2005 cruise. This platform integrated the sensor data streams, applied sound velocity corrections real-time, applied predicted tides and was configured to eliminate those beams beyond 70° for all survey areas except NPS Inshore which eliminated beams beyond 60°. Line spacing was determined by depth and was kept to approximately three times the water depth for the NPS Inshore area and up to 4 times the water depth in the other survey areas. A 2m coverage grid was built real-time with the ISS system to monitor the survey for gaps in coverage. The coverage grid had the potential to identify problems with the patch test values since the data was motion, tide and sound velocity corrected. Line planning occurred with the Survey Planning module of the ISS software.

III. Quality Control

The 2005 cruise witnessed the SAIC ISS2000 acquisition system generate generic sensor format (GSF) raw multibeam data. Raw data arrives corrected for sound velocity, with predicted tides, and the preliminary patch test values applied. The Caris Hips Conversion Wizard used the GSF converter to create the Hips format processed data files in the North American Datum of 1983, Universal Transmercator Zone 20, Northern Hemisphere (NAD83 UTM20N). The ISS2000 system acquires the GSF format with either an online or an offline flag attached to the data. All survey lines with the exception of the NPS Inshore lines flagged those soundings beyond 70 (ALT+0176) as reconnaissance data. The NPS Inshore area used the 60 (ALT+0176) cutoff for data

acquisition. All data but the final day of acquisition was converted and preliminary processing occurred in the field.

The 2004 field crew collected raw multibeam with Triton-Elics International (TEI) Isis acquisition software. Isis provided uncorrected data with Bathy Pro, a TEI processing software offering preliminary corrections for determining real-time coverage plots. Similar techniques and processing routines were used to convert the raw data into the HIPS format processed data files. Caris processing software and the Reson 8101 were the two pieces of the process not to be altered between the two survey seasons.

Preliminary data processing or the initial phase consists of three steps: navigation editing, attitude editing, and swath data editing. Navigation edits included reviewing for time jumps and removing data in turns. Attitude data was reviewed for time jumps, none were identified. Swath data was converted without filtering. Filtering of swath data occurred prior to editing and was used to eliminate large outliers in the water column. The minimum and maximum depths filtered varied by survey area. Swath edit mode efficiently removed fliers as well as down slope beams where the survey lines crossed over the shelf escarpment providing unreliable soundings. Swath editing is conducted one line at a time.

As stated, efficient handling of data processing in the field afforded the opportunity to review over half of the areas surveyed in Hips Subset Editor, one step in the second phase of editing. Subset editing enabled the hydrographer to evaluate each line against its neighbors while identifying potential tide and motion artifacts. The verification of features from adjacent lines as well as feature alignment occurs in subset edit mode. The second step is the review of base surfaces for coverage and systematic errors or artifacts. The BASE surface routine produced sun-illuminated imagery that was created for final surface evaluation prior to the final archival and production of deliverables. Final processing of the datasets was completed by the Contract Hydrographer after the completion of field operations. The BASE surface images were reviewed from multiple resolutions, sun angles, sun azimuths and vertical exaggerations. The BASE surface routine produced images identifying depth, shoal-biased depth, deep-biased depths, mean depths, standard deviation, sounding density, and depth uncertainty.

Fine image resolutions were built to measure our success of achieving “full bottom coverage” in a survey area. Section 5.2.2 of the National Ocean Service’s Specifications and Deliverables document determines full bottom coverage to be shown as the location of “3.2 beam footprints , center-to-center, fall within 3 meters, or a distance equal to 10 percent of the depth, whichever is greater in the along track direction”. Therefore a 1 meter grid resolution adequately demonstrates this requirement in depths less than 30 meters. With our deepest survey depths on the shelf reaching 58 meters approximately, a 2 meter grid will demonstrate full bottom coverage. Geo-referenced images and x,y.z exports were produced with the Hips Export Wizard and were derived from the Depth base surface. Final analysis was performed on reference surfaces with the Hips Quality Control Report. A minimum of one cross line was statistically analyzed by each available beam against a 3m grid of the reference surface. Results of the analysis of four survey areas are presented in *Separate C*. The 2004 survey did not acquire cross-line data, however, it is assumed that proper care was taken to plan for the best survey practices.

IV. Corrections to Echo Soundings

Instrument corrections

An initial barcheck and leadline confidence check was measured against the Reson Seabat 8101 multibeam echosounder prior to the start of field operations. The purpose of these two checks was to calibrate the system to the in situ conditions and to verify that the digital depths being recorded reflected the actual depths observed. The barcheck resulted in a 3cm difference. Several factors may have contributed to this difference. Survey tape placement onto the bar, the short distance to the bar beneath the sonar, and the measurement of the distance to the sonar on the pole could each account for 1cm. The leadline followed and returned a difference of 1cm between the observed distance to the seafloor and the resulting digital depth recorded. These initial confidence checks were the only opportunity to make the comparisons in calm water. No instrument error correction was applied because of insufficient evidence of a systematic error. The 2004 cruise saw no leadline or barcheck comparisons made.

Sensor Offsets

On the 15th of January, 2005 the NOAA Ship Nancy Foster had her sensor offsets surveyed by Kendall Fancher of National Geodetic Survey (NGS). The values obtained from the survey are documented in *Appendix B.* Reference marks created during the sensor offset survey were then used to obtain final offsets once the actual sensors were secured to the vessel. These offsets were entered into the ISS 2000 acquisition software and the POS/MV software and are recorded into the GSF data files. These offsets will not be entered as sensor offsets in the Caris Hydrographic Vessel File (HVF) file but will be recorded in the Total Propagated Error (TPE) parameter information.

The 2004 installation crew measured sensor offsets with a rag tape. These offsets were applied to the data through the Caris Vessel Configuration File (VCF). The name of this file extension changed by 2005, the function of the file remained the same.

Static and Dynamic Draft Corrections

The static draft correction recorded on February 1 was of magnitude 3.34m. The final static draft recorded on February 12, 2005 was of magnitude 3.15m. Attempts to read the static draft occurred daily, however the sea state was not conducive to accurately record the changes in vessel loading. Therefore, the Hydrographer determined corrections based on fuel consumption and water discharge that accounted for the changes during the survey. These draft corrections will be applied during post-processing. Dynamic draft values at this time have not been determined for the NOAA Ship Nancy Foster. No dynamic draft values will be entered into the HVF unless determined prior to post-processing.

The static draft observed prior to survey operations of the fully loaded vessel in 2004 was 3.44m. A value of 1.87 was recorded from the waterline to the vertical reference point. Since a discrepancy of approximately 2.0m was observed between the

two surveys, this hydrographer believes that this value of 1.87m was incorrectly applied in the HSD supplied VCF during 2004. This discrepancy will be discussed later.

System Alignment and Calibrations

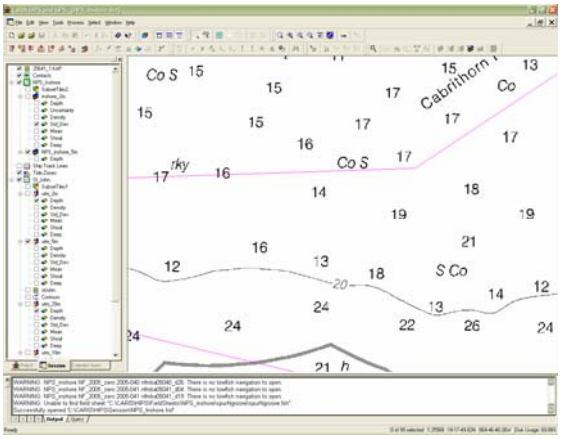
System Alignment and calibration procedures are documented in *Appendix D*, the NF-05-05-USVI Patch Test Report. The initial patch test was conducted in shallow water and did not provide the survey depths to assess sensor bias as precisely as wished. Therefore, an opportunity to conduct a deep water patch test occurred on the third day of acquisition and those values determined from the second patch test were applied by way of an adjustment to the HVF. The document titled "Foster Patch test report_finaldreaft.doc" provides the system alignment information that corresponds to the 2004 calibration.

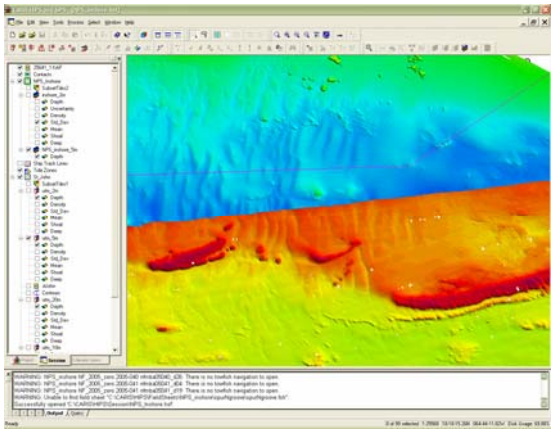
Tide Corrections

The report submitted by CO-OPS prior to the commencement of survey operations will be submitted as *Appendix C.* Existing water level stations were used in conjunction with height and time correctors in a tide zone definition file or ZDF. The Vertical Datum for this survey was Mean Lower-Low Water (MLLW). The National Water Level Observation Network (NWLON) primary tide stations at, Charlotte Amalie, VI (9751639) and Lime Tree Bay, VI (9751401) served as the primary sources for water level reducers for this survey. Six-minute predicted tides were obtained from the CO-OPS home page www.co-ops.nos.noaa.gov and were applied during acquisition during 2005. The same tide stations sourced the water level corrections and a similar ZDF was used to apply time and height corrections across the survey area in 2004.

2004 Offset Correction

As earlier stated, a discrepancy was observed between the two sets of multibeam data. The offset appears to be a systematic error and was traced to an incorrect draft value in the vcf for 2004. An independent verification of survey accuracy needed to be conducted due to a discrepancy between the 2004 and 2005 datasets. An area south of St. John in the National Park was chosen randomly for chart comparison. Thirty-two soundings were used to compare survey results. Sixteen soundings for each survey were compared to the chart. The following images show the area by Chart 25641 and with a 5 meter hill-shaded image. The top survey was conducted in 2005, the bottom area was collected in 2004. The overall image depicts the prevailing rotolith migratory route due to the predominant westerly current.





The color scheme separation was used to identify the two areas. An overall discrepancy of 2.2 meters between the two surveys was observed. The 2004 dataset was observed to be more shoal than the 2005 dataset. The following spreadsheet averaged the delta between the chart depth and observed soundings. The largest outlier was removed from each survey and the remaining fifteen deltas were averaged. The outlier is highlighted. Additional survey areas where overlap between the two surveys occurred were compared and similar result of a 2.2m difference was the average.

Chart (m)	2004	Delta
21.9	19.6	2.3
21.9	20.9	1.0
23.8	21.4	2.4
23.8	22	1.8
25.6	22.7	2.9
29.3	27.7	1.6
32.9	32.2	0.7
34.7	31	3.7
34.7	32.4	2.3
38.4	35.5	2.9
38.4	37.1	1.3
43.9	41.2	2.7
43.9	42.6	1.3
43.9	39.9	4.0
47.5	44.2	3.3
40.2	35.9	4.3
	Average Delta	**2.3**

Chart (m)	2005	Delta
23.8	22.4	1.4
25.6	24.9	0.7
27.4	27	0.4
27.4	27.8	-0.4
27.4	30.2	-2.8
27.4	28.2	-0.8
27.4	25.9	1.5
29.3	30.4	-1.1
29.3	29.7	-0.4
31.1	31.2	-0.1
31.1	29.8	1.3
31.1	31.1	0.0
31.1	30.3	0.8
31.1	30.2	0.9
32.9	33.3	-0.4
31.1	28.2	2.9
	Average Delta	**0.1**

The results appear to depict which survey more accurately represents that actual depths in the area surveyed. Further statistical comparisons can be conducted if necessary, however, the Hydrographer feels that the survey conducted in Feb. of 2005 is accurate and he is comfortable applying the 2.2 meter offset to the 2004 dataset to correct the error.

Appendix A. Comprehensive Line Mileage Summary (Nmi)

Type	STJ	STT	STC	Total 04	SRC	BIC	GRB	GRM	NPSI	NPSO	MSR	Total 05	Overall
MS	889.0	226.4	126.5	1242.0	13.9	78.0	78.0	186.2	454.7	77.2	237.3	1125.3	2367.2
XL	37.8	0.0	0.0	37.8	0.0	0.0	2.3	9.7	23.9	8.5	4.2	48.6	86.4
% XL	4.3	0.0	0.0	3.0	0.0	0.0	3.0	5.2	5.2	11.0	1.8	4.3	3.6

Appendix B. Comprehensive List of Lines

The following table is comprised of four columns described from left to right as the Caris project name, vessel name, year-julian day, and line name.

Mainscheme

NPS_inshore	NF_2005_zero	2005-036	nfmba05036_d16
NPS_inshore	NF_2005_zero	2005-036	nfmba05036_d17
NPS_inshore	NF_2005_zero	2005-036	nfmba05036_d18
NPS_inshore	NF_2005_zero	2005-036	nfmba05036_d19
NPS_inshore	NF_2005_zero	2005-036	nfmba05036_d20
NPS_inshore	NF_2005_zero	2005-036	nfmba05036_d24
NPS_inshore	NF_2005_zero	2005-036	nfmba05036_d25
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d01
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d02
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d03
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d04
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d05
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d07
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d09
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d10
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d11
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d12
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d14
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d16
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d17
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d18
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d20
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d21
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d22
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d23
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d24
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d25
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d27
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d28
NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d01
NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d02
NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d03

NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d05
NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d06
NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d07
NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d08
NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d09
NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d10
NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d11
NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d12
NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d13
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NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d28
NPS_inshore	NF_2005_zero	2005-038	nfmba05038_d30
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NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d11
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d12
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d13
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d18
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d19
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d20
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d21
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d22
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d23
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d24
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d25
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d28
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NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d30
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d31
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d32

NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d33
NPS_inshore	NF_2005_zero	2005-039	nfmba05039_d34
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NPS_inshore	NF_2005_zero	2005-040	nfmba05040_d02
NPS_inshore	NF_2005_zero	2005-040	nfmba05040_d03
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NPS_inshore	NF_2005_zero	2005-040	nfmba05040_d23
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Buck_Island	NF_2005_zero	2005-033	nfmba05033_d11
Buck_Island	NF_2005_zero	2005-033	nfmba05033_d12
Buck_Island	NF_2005_zero	2005-033	nfmba05033_d13
Buck_Island	NF_2005_zero	2005-033	nfmba05033_d14
Buck_Island	NF_2005_zero	2005-033	nfmba05033_d15
Buck_Island	NF_2005_zero	2005-033	nfmba05033_d16
Buck_Island	NF_2005_zero	2005-033	nfmba05033_d17
Buck_Island	NF_2005_zero	2005-033	nfmba05033_d18
Buck_Island	NF_2005_zero	2005-033	nfmba05033_d19
Buck_Island	NF_2005_zero	2005-033	nfmba05033_d20
Buck_Island	NF_2005_zero	2005-033	nfmba05033_d21
Buck_Island	NF_2005_zero	2005-033	nfmba05033_d22
Buck_Island	NF_2005_zero	2005-033	nfmba05033_d23
Grammanik	NF_2005_zero	2005-034	nfmba05034_d02
Grammanik	NF_2005_zero	2005-034	nfmba05034_d03
Grammanik	NF_2005_zero	2005-034	nfmba05034_d04
Grammanik	NF_2005_zero	2005-034	nfmba05034_d05
Grammanik	NF_2005_zero	2005-034	nfmba05034_d06
Grammanik	NF_2005_zero	2005-034	nfmba05034_d07
Grammanik	NF_2005_zero	2005-034	nfmba05034_d08

Grammanik	NF_2005_zero	2005-034	nfmba05034_d09
Grammanik	NF_2005_zero	2005-034	nfmba05034_d10
Grammanik	NF_2005_zero	2005-034	nfmba05034_d11
Grammanik	NF_2005_zero	2005-034	nfmba05034_d12
Grammanik	NF_2005_zero	2005-034	nfmba05034_d13
Grammanik	NF_2005_zero	2005-034	nfmba05034_d14
Grammanik	NF_2005_zero	2005-034	nfmba05034_d17
Grammanik	NF_2005_zero	2005-034	nfmba05034_d18
Grammanik	NF_2005_zero	2005-034	nfmba05034_d19
Grammanik_East	NF_2005_zero	2005-035	nfmba05035_d02
Grammanik_East	NF_2005_zero	2005-035	nfmba05035_d03
Grammanik_East	NF_2005_zero	2005-035	nfmba05035_d04
Grammanik_East	NF_2005_zero	2005-035	nfmba05035_d05
Grammanik_East	NF_2005_zero	2005-035	nfmba05035_d06
Grammanik_East	NF_2005_zero	2005-035	nfmba05035_d07
Grammanik_East	NF_2005_zero	2005-035	nfmba05035_d08
GrammanikEast_Mid	NF_2005_zero	2005-042	nfmba05042_d22
GrammanikEast_Mid	NF_2005_zero	2005-042	nfmba05042_d23
GrammanikEast_Mid	NF_2005_zero	2005-042	nfmba05042_d24
GrammanikEast_Mid	NF_2005_zero	2005-042	nfmba05042_d25
GrammanikEast_Mid	NF_2005_zero	2005-042	nfmba05042_d26
GrammanikEast_Mid	NF_2005_zero	2005-042	nfmba05042_d27
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d01
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d02
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d03
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d04
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d05
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d06
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d07
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d08
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d09
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d10
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d11
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d12
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d13
MSR	NF_2005_zero	2005-039	nfmba05039_d15
MSR	NF_2005_zero	2005-039	nfmba05039_d16
MSR	NF_2005_zero	2005-039	nfmba05039_d17
MSR	NF_2005_zero	2005-040	nfmba05040_d10
MSR	NF_2005_zero	2005-040	nfmba05040_d11
MSR	NF_2005_zero	2005-040	nfmba05040_d12
MSR	NF_2005_zero	2005-040	nfmba05040_d13
MSR	NF_2005_zero	2005-040	nfmba05040_d14
MSR	NF_2005_zero	2005-040	nfmba05040_d15
MSR	NF_2005_zero	2005-040	nfmba05040_d16
MSR	NF_2005_zero	2005-041	nfmba05041_d11
MSR	NF_2005_zero	2005-041	nfmba05041_d12

MSR	NF_2005_zero	2005-041	nfmba05041_d13
MSR	NF_2005_zero	2005-041	nfmba05041_d14
MSR	NF_2005_zero	2005-041	nfmba05041_d15
MSR	NF_2005_zero	2005-041	nfmba05041_d16
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MSR	NF_2005_zero	2005-041	nfmba05041_d18
MSR	NF_2005_zero	2005-042	nfmba05042_d07
MSR	NF_2005_zero	2005-042	nfmba05042_d08
MSR	NF_2005_zero	2005-042	nfmba05042_d09
MSR	NF_2005_zero	2005-042	nfmba05042_d10
MSR	NF_2005_zero	2005-042	nfmba05042_d11
MSR	NF_2005_zero	2005-042	nfmba05042_d12
MSR	NF_2005_zero	2005-042	nfmba05042_d13
MSR	NF_2005_zero	2005-042	nfmba05042_d14
MSR	NF_2005_zero	2005-042	nfmba05042_d15
MSR	NF_2005_zero	2005-042	nfmba05042_d16
MSR	NF_2005_zero	2005-042	nfmba05042_d17
MSR	NF_2005_zero	2005-042	nfmba05042_d18
MSR	NF_2005_zero	2005-042	nfmba05042_d19
NPS_offshore	NF_2005_zero	2005-035	nfmba05035_d14
NPS_offshore	NF_2005_zero	2005-035	nfmba05035_d15
NPS_offshore	NF_2005_zero	2005-036	nfmba05036_d02
NPS_offshore	NF_2005_zero	2005-036	nfmba05036_d03
NPS_offshore	NF_2005_zero	2005-036	nfmba05036_d04
NPS_offshore	NF_2005_zero	2005-036	nfmba05036_d05
NPS_offshore	NF_2005_zero	2005-036	nfmba05036_d06
NPS_offshore	NF_2005_zero	2005-036	nfmba05036_d08
NPS_offshore	NF_2005_zero	2005-036	nfmba05036_d09
NPS_offshore	NF_2005_zero	2005-036	nfmba05036_d10
NPS_offshore	NF_2005_zero	2005-036	nfmba05036_d11
NPS_offshore	NF_2005_zero	2005-036	nfmba05036_d12
SaltRiver	NF_2005_zero	2005-033	nfmba05033_d25
SaltRiver	NF_2005_zero	2005-033	nfmba05033_d26
SaltRiver	NF_2005_zero	2005-033	nfmba05033_d27
SaltRiver	NF_2005_zero	2005-033	nfmba05033_d28
SaltRiver	NF_2005_zero	2005-033	nfmba05033_d29
SaltRiver	NF_2005_zero	2005-033	nfmba05033_d30
StThomas	Nancy_Foster	2004-061	061-2023
StThomas	Nancy_Foster	2004-061	061-2129
StThomas	Nancy_Foster	2004-061	061-2212
StThomas	Nancy_Foster	2004-061	061-2257
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StThomas	Nancy_Foster	2004-062	062-0112
StThomas	Nancy_Foster	2004-062	062-0133
StThomas	Nancy_Foster	2004-062	062-0203

StThomas	Nancy_Foster	2004-062	062-0229
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StThomas	Nancy_Foster	2004-062	062-0506
StThomas	Nancy_Foster	2004-062	062-0544
StThomas	Nancy_Foster	2004-062	062-0559
StThomas	Nancy_Foster	2004-062	062-0638
StThomas	Nancy_Foster	2004-062	062-0652
StThomas	Nancy_Foster	2004-062	062-0731
StThomas	Nancy_Foster	2004-062	062-0800
StThomas	Nancy_Foster	2004-062	062-0822
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StThomas	Nancy_Foster	2004-062	062-0908
StThomas	Nancy_Foster	2004-062	062-0921
StThomas	Nancy_Foster	2004-062	062-0955
StThomas	Nancy_Foster	2004-062	062-1028
StThomas	Nancy_Foster	2004-062	062-1101
StThomas	Nancy_Foster	2004-062	062-1137
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StThomas	Nancy_Foster	2004-062	062-1516
StThomas	Nancy_Foster	2004-062	062-1536
StThomas	Nancy_Foster	2004-062	062-1600
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StThomas	Nancy_Foster	2004-062	062-1717
StThomas	Nancy_Foster	2004-062	062-1758
StThomas	Nancy_Foster	2004-062	062-1820
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StThomas	Nancy_Foster	2004-062	062-1904
StThomas	Nancy_Foster	2004-062	062-1931
StThomas	Nancy_Foster	2004-062	062-2017
StThomas	Nancy_Foster	2004-062	062-2037
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StThomas	Nancy_Foster	2004-062	062-2140
StThomas	Nancy_Foster	2004-062	062-2249
StThomas	Nancy_Foster	2004-062	062-2307
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StThomas	Nancy_Foster	2004-062	062-2346
StThomas	Nancy_Foster	2004-063	063-0005
StThomas	Nancy_Foster	2004-063	063-0022
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StThomas	Nancy_Foster	2004-063	063-0057
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StThomas	Nancy_Foster	2004-063	063-0131
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StThomas	Nancy_Foster	2004-063	063-0234
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StThomas	Nancy_Foster	2004-063	063-0317

StThomas	Nancy_Foster	2004-063	063-0343
StThomas	Nancy_Foster	2004-063	063-0408
StThomas	Nancy_Foster	2004-063	063-0430
StJohn	Nancy_Foster	2004-055	055-0053
StJohn	Nancy_Foster	2004-055	055-0141
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StJohn	Nancy_Foster	2004-055	055-0501
StJohn	Nancy_Foster	2004-055	055-0550
StJohn	Nancy_Foster	2004-055	055-0720
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StJohn	Nancy_Foster	2004-055	055-0856
StJohn	Nancy_Foster	2004-055	055-0920
StJohn	Nancy_Foster	2004-055	055-1008
StJohn	Nancy_Foster	2004-055	055-1046
StJohn	Nancy_Foster	2004-055	055-1349
StJohn	Nancy_Foster	2004-055	055-1504
StJohn	Nancy_Foster	2004-055	055-1553
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StJohn	Nancy_Foster	2004-055	055-1720
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StJohn	Nancy_Foster	2004-054	054-0826
StJohn	Nancy_Foster	2004-054	054-0907
StJohn	Nancy_Foster	2004-054	054-0951
StJohn	Nancy_Foster	2004-054	054-1041
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StJohn	Nancy_Foster	2004-054	054-1149
StJohn	Nancy_Foster	2004-054	054-1231
StJohn	Nancy_Foster	2004-054	054-1312
StJohn	Nancy_Foster	2004-056	056-0000
StJohn	Nancy_Foster	2004-056	056-0024
StJohn	Nancy_Foster	2004-056	056-0118
StJohn	Nancy_Foster	2004-056	056-0208
StJohn	Nancy_Foster	2004-056	056-0320
StJohn	Nancy_Foster	2004-056	056-0406
StJohn	Nancy_Foster	2004-056	056-0453
StJohn	Nancy_Foster	2004-056	056-0545
StJohn	Nancy_Foster	2004-056	056-0622
StJohn	Nancy_Foster	2004-056	056-0725
StJohn	Nancy_Foster	2004-056	056-0809
StJohn	Nancy_Foster	2004-056	056-0824
StJohn	Nancy_Foster	2004-056	056-0908
StJohn	Nancy_Foster	2004-056	056-0955
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StJohn	Nancy_Foster	2004-056	056-1056
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StJohn	Nancy_Foster	2004-055	054-0001
StJohn	Nancy_Foster	2004-055	055-2213

StJohn	Nancy_Foster	2004-055	055-2300
StJohn	Nancy_Foster	2004-055	055-2347
StJohn	Nancy_Foster	2004-056	056-2130
StJohn	Nancy_Foster	2004-056	056-2215
StJohn	Nancy_Foster	2004-056	056-2306
StJohn	Nancy_Foster	2004-054	054-2320
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StJohn	Nancy_Foster	2004-057	057-0320
StJohn	Nancy_Foster	2004-057	057-0407
StJohn	Nancy_Foster	2004-057	057-0432
StJohn	Nancy_Foster	2004-057	057-0511
StJohn	Nancy_Foster	2004-057	057-0552
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StJohn	Nancy_Foster	2004-057	057-0816
StJohn	Nancy_Foster	2004-057	057-0831
StJohn	Nancy_Foster	2004-057	057-0843
StJohn	Nancy_Foster	2004-057	057-0854
StJohn	Nancy_Foster	2004-057	057-0938
StJohn	Nancy_Foster	2004-057	057-1022
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StJohn	Nancy_Foster	2004-057	057-1239
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StJohn	Nancy_Foster	2004-057	057-2225
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StJohn	Nancy_Foster	2004-058	058-0557
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StJohn	Nancy_Foster	2004-059	059-0219
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StJohn	Nancy_Foster	2004-059	059-0358
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StJohn	Nancy_Foster	2004-059	059-0529
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StJohn	Nancy_Foster	2004-059	059-0636
StJohn	Nancy_Foster	2004-059	059-0721
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StJohn	Nancy_Foster	2004-059	059-0941
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StJohn	Nancy_Foster	2004-059	059-2215
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StJohn	Nancy_Foster	2004-060	060-0120
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StJohn	Nancy_Foster	2004-060	060-0218
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StJohn	Nancy_Foster	2004-060	060-0936
StJohn	Nancy_Foster	2004-060	060-0953
StJohn	Nancy_Foster	2004-060	060-1005
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StJohn	Nancy_Foster	2004-060	060-1033
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StJohn	Nancy_Foster	2004-061	061-0820
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StJohn	Nancy_Foster	2004-060	060-2319
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StJohn	Nancy_Foster	2004-058	058-2237
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BuckIsland_StCroix	Nancy_Foster	2004-052	052-2059
BuckIsland_StCroix	Nancy_Foster	2004-052	052-2128
BuckIsland_StCroix	Nancy_Foster	2004-052	052-2130
BuckIsland_StCroix	Nancy_Foster	2004-052	052-2145
BuckIsland_StCroix	Nancy_Foster	2004-052	052-2154
BuckIsland_StCroix	Nancy_Foster	2004-052	052-2240
BuckIsland_StCroix	Nancy_Foster	2004-052	052-2245
BuckIsland_StCroix	Nancy_Foster	2004-052	052-2253
BuckIsland_StCroix	Nancy_Foster	2004-052	052-2321
BuckIsland_StCroix	Nancy_Foster	2004-052	052-2323
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BuckIsland_StCroix	Nancy_Foster	2004-053	053-0033
BuckIsland_StCroix	Nancy_Foster	2004-053	053-0059
BuckIsland_StCroix	Nancy_Foster	2004-053	053-0123
BuckIsland_StCroix	Nancy_Foster	2004-053	053-0140
BuckIsland_StCroix	Nancy_Foster	2004-053	053-0154
BuckIsland_StCroix	Nancy_Foster	2004-053	053-0206
BuckIsland_StCroix	Nancy_Foster	2004-053	053-0223
BuckIsland_StCroix	Nancy_Foster	2004-053	053-0235
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BuckIsland_StCroix	Nancy_Foster	2004-053	053-0316
BuckIsland_StCroix	Nancy_Foster	2004-053	053-0552
BuckIsland_StCroix	Nancy_Foster	2004-053	053-0557
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BuckIsland_StCroix	Nancy_Foster	2004-053	053-0755
BuckIsland_StCroix	Nancy_Foster	2004-053	053-0758
BuckIsland_StCroix	Nancy_Foster	2004-053	053-0842
BuckIsland_StCroix	Nancy_Foster	2004-053	053-1041
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BuckIsland_StCroix	Nancy_Foster	2004-053	053-1117
BuckIsland_StCroix	Nancy_Foster	2004-053	053-1243
BuckIsland_StCroix	Nancy_Foster	2004-053	053-1254
BuckIsland_StCroix	Nancy_Foster	2004-053	053-1302
BuckIsland_StCroix	Nancy_Foster	2004-053	053-1317
BuckIsland_StCroix	Nancy_Foster	2004-053	053-1328
BuckIsland_StCroix	Nancy_Foster	2004-053	053-1336
BuckIsland_StCroix	Nancy_Foster	2004-053	053-1403
BuckIsland_StCroix	Nancy_Foster	2004-053	053-1431
BuckIsland_StCroix	Nancy_Foster	2004-053	053-1454
BuckIsland_StCroix	Nancy_Foster	2004-053	053-1510
BuckIsland_StCroix	Nancy_Foster	2004-053	053-1523

BuckIsland_StCroix	Nancy_Foster	2004-053	053-1625
BuckIsland_StCroix	Nancy_Foster	2004-053	053-2201
BuckIsland_StCroix	Nancy_Foster	2004-053	053-2207
BuckIsland_StCroix	Nancy_Foster	2004-053	053-2237
BuckIsland_StCroix	Nancy_Foster	2004-053	053-2253
BuckIsland_StCroix	Nancy_Foster	2004-054	054-0035
BuckIsland_StCroix	Nancy_Foster	2004-054	054-0125
BuckIsland_StCroix	Nancy_Foster	2004-054	054-0207
BuckIsland_StCroix	Nancy_Foster	2004-054	054-0000
BuckIsland_StCroix	Nancy_Foster	2004-053	053-0401
BuckIsland_StCroix	Nancy_Foster	2004-053	053-0738

Crosslines

Grammanik	NF_2005_zero	2005-034	nfmba05034_d20
GrammanikEast_Mid	NF_2005_zero	2005-043	nfmba05043_d15
MSR	NF_2005_zero	2005-042	nfmba05042_d06
NPS_inshore	NF_2005_zero	2005-037	nfmba05037_d06
NPS_inshore	NF_2005_zero	2005-040	nfmba05040_d27
NPS_inshore	NF_2005_zero	2005-041	nfmba05041_d01
NPS_inshore	NF_2005_zero	2005-041	nfmba05041_d02
NPS_inshore	NF_2005_zero	2005-041	nfmba05041_d03
NPS_inshore	NF_2005_zero	2005-041	nfmba05041_d05
NPS_inshore	NF_2005_zero	2005-041	nfmba05041_d06
NPS_inshore	NF_2005_zero	2005-041	nfmba05041_d07
NPS_inshore	NF_2005_zero	2005-041	nfmba05041_d09
NPS_offshore	NF_2005_zero	2005-036	nfmba05036_d13
NPS_offshore	NF_2005_zero	2005-036	nfmba05036_d14
NPS_offshore	NF_2005_zero	2005-036	nfmba05036_d15
StJohn	Nancy_Foster	2004-054	054-2200
StJohn	Nancy_Foster	2004-060	060-0443
StJohn	Nancy_Foster	2004-060	060-0900
StJohn	Nancy_Foster	2004-061	061-0634
StJohn	Nancy_Foster	2004-061	061-0712
StJohn	Nancy_Foster	2004-061	061-1044

Shallow Patch Test lines

PatchTest	NF_2005_patch	2005-031	nfmba05032_d22
PatchTest	NF_2005_patch	2005-032	nfmba05032_d13
PatchTest	NF_2005_patch	2005-032	nfmba05032_d17
PatchTest	NF_2005_patch	2005-032	nfmba05032_d19
PatchTest	NF_2005_patch	2005-032	nfmba05032_d21

Deep Patch Test lines

PatchTest	NF_2005_zero	2005-035	nfmba05035_d11
PatchTest	NF_2005_zero	2005-035	nfmba05035_d12
PatchTest	NF_2005_zero	2005-035	nfmba05035_d13