

ATTACHMENT 3

APPENDIX I

COAST GUARD RACONS

Racons to be provided:

Seabeacon 2, System 5 racons which transmit on the X and S marine band and are manufactured by Tideland Signal Corporation of Houston, Texas.

The Coast Guard intends to install 8 racons at the below locations.

STATION	CODE	Power Equipment	SHIPTO
Fowey Rocks LT	O	1 Solar panel & Battery	Miami
Carrysfort Reef LT	C	1 Solar panel & Battery	Miami
Alligator Reef LT	G	1 Solar panel & Battery	Key West
Dry Tortugas LT	K	1 Solar panel & Battery	Key West
Sombrero Key LT	M	1 Solar panel & Battery	Key West
American Shoal LT	Y	1 Solar panel & Battery	Key West
Sand Key LT	N	1 Solar panel & Battery	Key West
Twenty Eight Foot Shoal LT	T	1 Solar panel & Battery	Key West

The racons should be coded as above, set for a 75-80% duty cycle with a code-length set for best presentation on a radar with the scale set for 12-miles.

Power Equipment Description and Sources of Supply:

Batteries. DELCO S2000 Photovoltaic Batteries, 12 Volt, 100 Ampere-hour

Batteries Inc.
4788 Lake Mirror Place
Forest Park, GA 30297
Ph. (404) 361 6260

Solar Panels: Solar Panel, # SM10 10 Watt

SALT Inc.
204 107th Street
Marathon, FL 33050
(305) 289 1150

COAST GUARD RACONS

Racons, solar panels and batteries for these stations should be shipped to:

KEY WEST SHIPMENT:

Officer in Charge
U. S. Coast Guard Aids to Navigation Team Key West
C/O USCG Group
Key West, FL 33040-6695
Point of Contact: Chief Pantelakos, Phone 305-292-8748

MIAMI SHIPMENT:

Officer in Charge
USCG Aids to Navigation Team
C/O USCG Group Miami
100 MacArthur Causeway
Miami, FL 33139
Point of Contact: Chief Dever (305-535-4371)

An additional six racons, coded "T", set for a 50% duty cycle and best presentation on a 12-mile scale should be shipped to:

Commanding Officer
U.S.C.G. Engineering Logistics Center (O2L)
2401 Hawkins Point Rd Building 86
Baltimore, Md. 21226
Attn: Mr. Bill Walstrum MS#16

**HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
(Major Scar - Stern Area)**

2052	0.0%	0.0%	0.0	0.0
2053	0.0%	0.0%	0.0	0.0
2054	0.0%	0.0%	0.0	0.0
2055	0.0%	0.0%	0.0	0.0
2056	0.0%	0.0%	0.0	0.0
2057	0.0%	0.0%	0.0	0.0
2058	0.0%	0.0%	0.0	0.0
2059	0.0%	0.0%	0.0	0.0
2060	0.0%	0.0%	0.0	0.0
2061	0.0%	0.0%	0.0	0.0
2062	0.0%	0.0%	0.0	0.0
2063	0.0%	0.0%	0.0	0.0
2064	0.0%	0.0%	0.0	0.0
2065	0.0%	0.0%	0.0	0.0
2066	0.0%	0.0%	0.0	0.0
2067	0.0%	0.0%	0.0	0.0
2068	0.0%	0.0%	0.0	0.0
2069	0.0%	0.0%	0.0	0.0
2070	0.0%	0.0%	0.0	0.0
2071	0.0%	0.0%	0.0	0.0
2072	0.0%	0.0%	0.0	0.0
Total Discounted Sq.-M Years of Services Lost (Major Scar - Stern Area)				48,823.8

**HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
(Estimated Service Losses Avoided per Grounding Prevented)**

<i>HEA Parameters Characterizing Services Gained through Prevention of Avg. Grounding:</i>	
Sq. M of Total (100%) Coral Reef Injury Prevented for Avg. Size Grounding	2,474.6
% of Resource Services that Would have Been Lost in Initial Period:	100.0%
Percentage of Prevented Grounding Area Expected to Consist of Live Coral	100.0%
Year Grounding Would Have Occurred But for Racon System	2007
Current Year:	1997
Year in Which Recovery would have been Assumed to Begin:	2008
Recovery Function For Primary Restoration Area	
Functional Form of Recovery Function	Linear
Duration of Recovery Horizon (years)	30
Real Discount Rate	3.0%

<i>Calculation of Sq. M of Resource Services Losses Prevented:</i>				
Year	Percent of Resource Services Anticipated Lost (Beginning of Period)	Percent of Resource Service Lost (End of Period)	Raw Adj. Square Meter-Years of Resource Services Anticipated Lost	Discounted Square Meter-Years of Resource Services Anticipated Lost
1997	0.0%	0.0%	0.0	0.0
1998	0.0%	0.0%	0.0	0.0
1999	0.0%	0.0%	0.0	0.0
2000	0.0%	0.0%	0.0	0.0
2001	0.0%	0.0%	0.0	0.0
2002	0.0%	0.0%	0.0	0.0
2003	0.0%	0.0%	0.0	0.0
2004	0.0%	0.0%	0.0	0.0
2005	0.0%	0.0%	0.0	0.0
2006	0.0%	0.0%	0.0	0.0
2007	0.0%	100.0%	2,474.6	1,841.4

HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
(Estimated Service Losses Avoided per Grounding Prevented)

2008	100.0%	96.7%	2,392.2	1,728.1
2009	96.7%	93.3%	2,309.7	1,620.0
2010	93.3%	90.0%	2,227.2	1,516.6
2011	90.0%	86.7%	2,144.7	1,417.9
2012	86.7%	83.3%	2,062.2	1,323.6
2013	83.3%	80.0%	1,979.7	1,233.7
2014	80.0%	76.7%	1,897.2	1,147.9
2015	76.7%	73.3%	1,814.7	1,066.0
2016	73.3%	70.0%	1,732.2	987.9
2017	70.0%	66.7%	1,649.8	913.4
2018	66.7%	63.3%	1,567.3	842.5
2019	63.3%	60.0%	1,484.8	774.9
2020	60.0%	56.7%	1,402.3	710.5
2021	56.7%	53.3%	1,319.8	649.3
2022	53.3%	50.0%	1,237.3	591.0
2023	50.0%	46.7%	1,154.8	535.5
2024	46.7%	43.3%	1,072.3	482.8
2025	43.3%	40.0%	989.9	432.6
2026	40.0%	36.7%	907.4	385.0
2027	36.7%	33.3%	824.9	339.8
2028	33.3%	30.0%	742.4	296.9
2029	30.0%	26.7%	659.9	256.3
2030	26.7%	23.3%	577.4	217.7
2031	23.3%	20.0%	494.9	181.2
2032	20.0%	16.7%	412.4	146.6
2033	16.7%	13.3%	330.0	113.8
2034	13.3%	10.0%	247.5	82.9
2035	10.0%	6.7%	165.0	53.7
2036	6.7%	3.3%	82.5	26.0
2037	3.3%	0.0%	0.0	0.0
2038	0.0%	0.0%	0.0	0.0
2039	0.0%	0.0%	0.0	0.0
2040	0.0%	0.0%	0.0	0.0
2041	0.0%	0.0%	0.0	0.0
2042	0.0%	0.0%	0.0	0.0
2043	0.0%	0.0%	0.0	0.0
2044	0.0%	0.0%	0.0	0.0
2045	0.0%	0.0%	0.0	0.0
2046	0.0%	0.0%	0.0	0.0
2047	0.0%	0.0%	0.0	0.0
2048	0.0%	0.0%	0.0	0.0
2049	0.0%	0.0%	0.0	0.0
2050	0.0%	0.0%	0.0	0.0
2051	0.0%	0.0%	0.0	0.0
2052	0.0%	0.0%	0.0	0.0

**HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
(Estimated Service Losses Avoided per Grounding Prevented)**

2053	0.0%	0.0%	0.0	0.0
2054	0.0%	0.0%	0.0	0.0
2055	0.0%	0.0%	0.0	0.0
2056	0.0%	0.0%	0.0	0.0
2057	0.0%	0.0%	0.0	0.0
2058	0.0%	0.0%	0.0	0.0
2059	0.0%	0.0%	0.0	0.0
2060	0.0%	0.0%	0.0	0.0
2061	0.0%	0.0%	0.0	0.0
2062	0.0%	0.0%	0.0	0.0
2063	0.0%	0.0%	0.0	0.0
2064	0.0%	0.0%	0.0	0.0
2065	0.0%	0.0%	0.0	0.0
2066	0.0%	0.0%	0.0	0.0
2067	0.0%	0.0%	0.0	0.0
2068	0.0%	0.0%	0.0	0.0
2069	0.0%	0.0%	0.0	0.0
2070	0.0%	0.0%	0.0	0.0
2071	0.0%	0.0%	0.0	0.0
2072	0.0%	0.0%	0.0	0.0
2073	0.0%	0.0%	0.0	0.0
2074	0.0%	0.0%	0.0	0.0
2075	0.0%	0.0%	0.0	0.0
2076	0.0%	0.0%	0.0	0.0
2077	0.0%	0.0%	0.0	0.0
2078	0.0%	0.0%	0.0	0.0
2079	0.0%	0.0%	0.0	0.0
2080	0.0%	0.0%	0.0	0.0
2081	0.0%	0.0%	0.0	0.0
2082	0.0%	0.0%	0.0	0.0
2083	0.0%	0.0%	0.0	0.0
2084	0.0%	0.0%	0.0	0.0
2085	0.0%	0.0%	0.0	0.0
2086	0.0%	0.0%	0.0	0.0
2087	0.0%	0.0%	0.0	0.0
2088	0.0%	0.0%	0.0	0.0
2089	0.0%	0.0%	0.0	0.0
2090	0.0%	0.0%	0.0	0.0
2091	0.0%	0.0%	0.0	0.0
2092	0.0%	0.0%	0.0	0.0
2093	0.0%	0.0%	0.0	0.0
2094	0.0%	0.0%	0.0	0.0
2095	0.0%	0.0%	0.0	0.0
2096	0.0%	0.0%	0.0	0.0
2097	0.0%	0.0%	0.0	0.0

HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
(Estimated Service Losses Avoided per Grounding Prevented)

2098	0.0%	0.0%	0.0	0.0
2099	0.0%	0.0%	0.0	0.0
2100	0.0%	0.0%	0.0	0.0
2101	0.0%	0.0%	0.0	0.0
2102	0.0%	0.0%	0.0	0.0
2103	0.0%	0.0%	0.0	0.0
2104	0.0%	0.0%	0.0	0.0
2105	0.0%	0.0%	0.0	0.0
2106	0.0%	0.0%	0.0	0.0
2107	0.0%	0.0%	0.0	0.0
2108	0.0%	0.0%	0.0	0.0
2109	0.0%	0.0%	0.0	0.0
2110	0.0%	0.0%	0.0	0.0
2111	0.0%	0.0%	0.0	0.0
2112	0.0%	0.0%	0.0	0.0
2113	0.0%	0.0%	0.0	0.0
2114	0.0%	0.0%	0.0	0.0
2115	0.0%	0.0%	0.0	0.0
2116	0.0%	0.0%	0.0	0.0
2117	0.0%	0.0%	0.0	0.0
2118	0.0%	0.0%	0.0	0.0
2119	0.0%	0.0%	0.0	0.0
2120	0.0%	0.0%	0.0	0.0
2121	0.0%	0.0%	0.0	0.0
2122	0.0%	0.0%	0.0	0.0
2123	0.0%	0.0%	0.0	0.0
2124	0.0%	0.0%	0.0	0.0
2125	0.0%	0.0%	0.0	0.0
2126	0.0%	0.0%	0.0	0.0
2127	0.0%	0.0%	0.0	0.0
2128	0.0%	0.0%	0.0	0.0
2129	0.0%	0.0%	0.0	0.0
2130	0.0%	0.0%	0.0	0.0
2131	0.0%	0.0%	0.0	0.0
2132	0.0%	0.0%	0.0	0.0
2133	0.0%	0.0%	0.0	0.0
2134	0.0%	0.0%	0.0	0.0
2135	0.0%	0.0%	0.0	0.0
2136	0.0%	0.0%	0.0	0.0
2137	0.0%	0.0%	0.0	0.0
2138	0.0%	0.0%	0.0	0.0
2139	0.0%	0.0%	0.0	0.0
2140	0.0%	0.0%	0.0	0.0
2141	0.0%	0.0%	0.0	0.0
2142	0.0%	0.0%	0.0	0.0

HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
(Estimated Service Losses Avoided per Grounding Prevented)

2143	0.0%	0.0%	0.0	0.0
2144	0.0%	0.0%	0.0	0.0
2145	0.0%	0.0%	0.0	0.0
2146	0.0%	0.0%	0.0	0.0
2147	0.0%	0.0%	0.0	0.0
2148	0.0%	0.0%	0.0	0.0
2149	0.0%	0.0%	0.0	0.0
2150	0.0%	0.0%	0.0	0.0
Total Discounted Sq.-M Years of Service Loss Prevention for Average Grounding				21,915.4

HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
 (Summary of Preventative Benefits of Racon System)

Summary of Total Resource Services Lost Due to CONTSHIP HOUSTON Grounding:

Injured Area/Polygon	Total Discounted Sq. M-Years of Resource Services Lost
Minor Scar Areas	1,160.8
Major Scar Areas PL1, RP1, RP2	11,163.8
Major Scar Area - Stem Area	48,823.8
Total	61,148.5

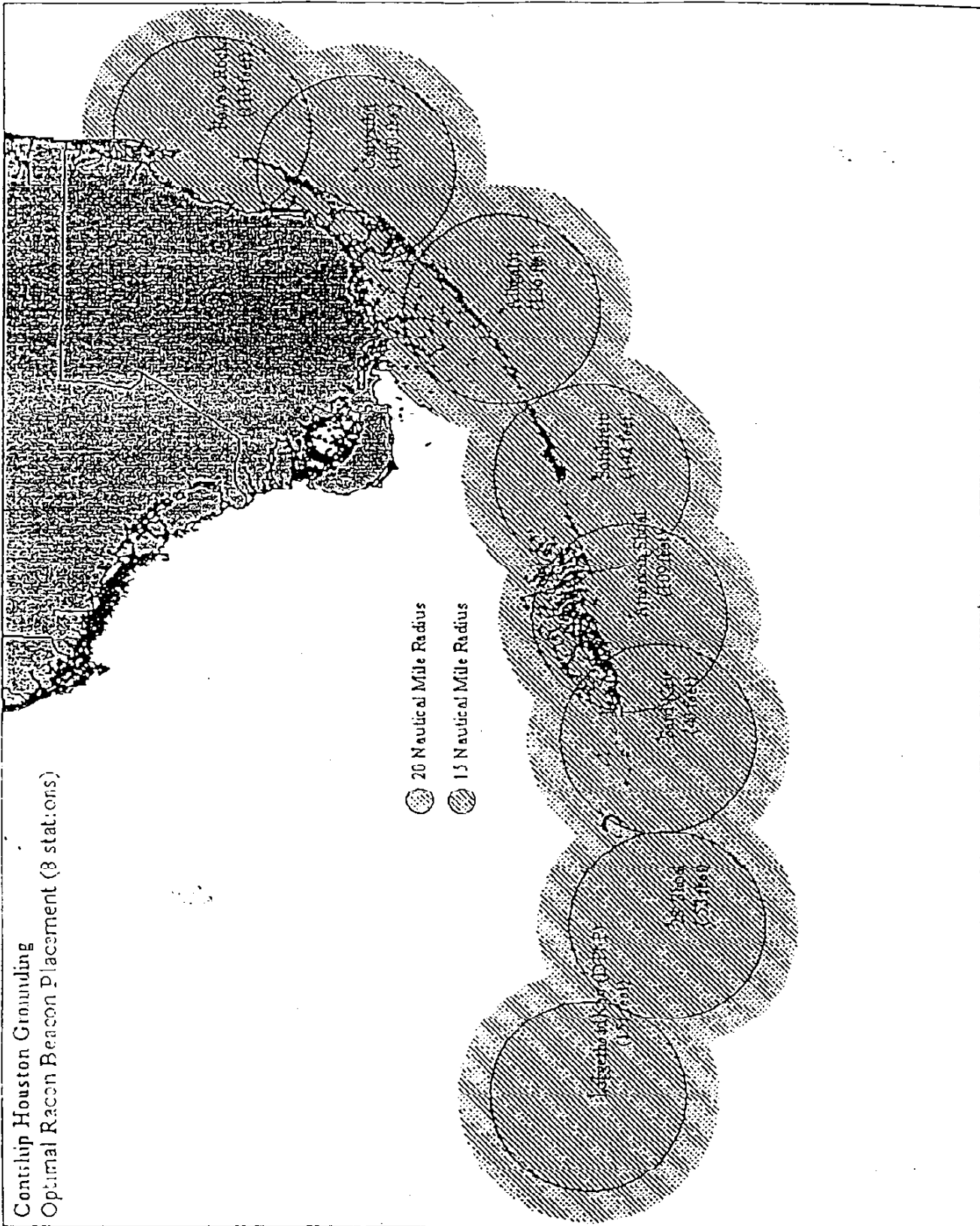
Summary of Total Resource Services Gained Due to Installation and Maintenance of FKNMS-Wide Racon System:

Total Sq. M-Years of Resource Service Losses Anticipated to be Prevented for an Average Size Grounding	21,915.4
Sq. M-Years of Resource Service Losses Caused by CONTSHIP HOUSTON Grounding Divided by Sq. M-Years of Resource Service Gains from Preventing Average Sized Grounding	2.8
Number of Groundings of Average Size Racon System would have to Prevent in Order to Compensate for Resource Injuries Due to CONTSHIP HOUSTON Grounding	3
Number of Groundings Resulting in 312/NRDA Action Predicted to Occur in 10 Year Period Based on Historical Data	7
Number of Major Groundings in Past 10 Years that Potentially Would Have Been Prevented by a FKNMS-Wide Racon System	4
Percentage of Predicted Major Groundings that Racon Would Have to Prevent to Provide Sufficient Compensatory Services to Compensate for Losses Due to CONTSHIP HOUSTON Grounding	43%
Percentage of Major Groundings to Date that Potentially Would Have Been Prevented by Racon System	56%
Percentage of Major Groundings in the Past 10 Years that Potentially Would Have Been Prevented by Racon System	50%

CONCLUSION:
 Based on Analysis of Historical Grounding Data and Causes of Major Groundings, FKNMS-Wide Racon System Would be Expected to Prevent Sufficient Future Groundings to Compensate for Resource and Service Losses Due to the CONTSHIP HOUSTON Grounding.

ATTACHMENT 4

APPENDIX II



CONTSHIP HOUSTON GROUNDING
Final Racon Beacon Placement

No.	Latitude	Longitude	Station
1	25° 35.4	80° 05.8	Fowey Rocks
2	25° 13.3	80° 12.7	Carysfort
3	24° 51.1	80° 37.1	Alligator
4	24° 37.2	81° 06.6	Sombrero
5	24° 31.5	81° 31.2	American Shoal
6	24° 27.2	81° 52.7	Sand Key
7	24° 25.9	82° 25.4	28' Shoal (aka Tail End Buoy)
8	24° 38.0	82° 55.2	Loggerhead Key (DTNP)

ATTACHMENT 5

SUMMARY OF CONTSHIP HOUSTON HEA APPROACH AND RESULTS

Based on a careful review of compensatory restoration projects, the trustees have determined that implementation of a Florida Keys-wide (from Fowey Rocks to the Dry Tortugas) Racon warning system is the preferred action for compensating the public for lost services resulting from the CONTSHIP HOUSTON grounding. The primary benefit of this project is the avoidance of future vessel groundings and the associated resource service losses. A modified version of the standard Habitat Equivalency Analysis (HEA) was used to determine whether the Racon system would provide sufficient benefits to fully compensate the public for the interim lost resource services pending full recovery of the reef.

Based on historical data of past major vessel groundings (where a major vessel grounding is defined as one that results in a National Marine Sanctuaries Act Section 312 action) on coral reefs, the trustees estimated the average extent and severity of a typical major grounding. Comparing the lost services from the CONTSHIP HOUSTON grounding with the lost services from a typical vessel grounding, the trustees estimated the number of future groundings that would need to be prevented in order for the project to provide sufficient compensation for the incident. Based on information from Sanctuary managers and Coast Guard personnel on the cause of specific grounding incidents, the trustees estimated the number of past major groundings that likely would have been prevented by a Keys-wide Racon system. From this analysis, it was determined that the Racon system would be expected to prevent more than the threshold number of major groundings necessary to fully compensate the public for the interim lost services resulting from the CONTSHIP HOUSTON grounding.

Specifically, the analysis determined that the Racon system would need to prevent 43 percent of major groundings over a ten-year period in order to provide an appropriate level of compensation. Based on the analysis of all past major grounding events, the Racon system likely would have prevented 50 percent of major groundings over the past ten years, and 56 percent of all past major grounding incidents. Assuming that the same patterns hold over the next ten years, the Racon system would be expected to prevent the destruction of at least 9,900 square meters of total destruction of coral reefs within the FKNMS.

CONTSHIP HOUSTON ANALYSIS OF LOST REEF SERVICES PREVENTED THROUGH RAICON SYSTEM

Historical Analysis of FKNMS Grounding Events Resulting in 312 NRDA Actions:

Grounding Site	Year of Grounding	Sq Meters of Coral		Notes
		Totally Destroyed (or Equiv.)	Potentially Prevented by Raicon?	
Wellwood	1984	4,379	Yes	Based on 4,865 sq. m x 90% mortality. Does not include 70,371.3 sq. m x 75% mortality for cable injury, since unlikely to occur again
Mavro Vetricnic	1989	5,475	Yes	Does not include 10,325 sq. m of siltation impact
Contship Houston	1997	5,206	Yes	Based on % coral and % service loss adjustments in Sept. 8 letter from ECM/Hucson
Epiis	1989	2,605	Yes	Does not include 468 sq. m of partial injury
Iglou Moon	1996	2,360	Yes	Based on 295 m x 20 m injury x 40% mortality. Note: Right over FKNMS Border
Miss Beholden	1993	1,026	No	Includes area for spur tops, spur structure and grove areas
Maitlanc	1989	681	No	Does not include \$30 sq. m of partial injury
Columbus Iselin	1994	345	No	Entire grounding area was total destruction
Jacquelyn L	1991	196	No	Includes 73 sq. m of injured framework
		<u>2,475</u>		Average Sq. M Totally Destroyed

Historical Analysis of Frequency of FKNMS Grounding Events Resulting in 312 Actions:

No. of Grounding Resulting in NRDA Actions	9
No. of Years Over Which Groundings Occurred	14
Est. No. of Major Groundings Per Year	0.64
Est. Years Between Major Groundings	1.56
Est. Major Groundings Over 10 Year Period	6.43

Notes:

- These estimates do not include calculations of partial injury where a % mortality was not estimated.
- 3-dimensional relief from boulders installed in primary restoration likely may raise services above baseline for injured area.
- This analysis does not take into account enhancement to aids to navigation potentially undertaken as part of Columbus Iselin and other settlements.
- Only looks at coral reef groundings, not seagrass incidents.
- Does not include incidents that result in injury to reefs, but were not large enough to warrant 312/NRCA action
- Prevention HEA component conservatively assumes that groundings would occur at the end of the estimated operational period for the Raicon system.

Summary of Extent and Severity of Injuries Caused by CONTSHIP HOUSTON Grounding

Injured Area/Polygon	Area (Sq. Meters)	Percent Services Lost	Percent of Area = Coral	Equivalent Area of Total Coral Loss (Initial Period)	Est. Recovery Horizon (yrs.)
Minor Scar Areas					
Caused by Initial Grounding	569.0	25.0%	100.0%	142.3	15
Caused by Vessel Salvage	93.5	25.0%	100.0%	23.4	15
Subtotal for Minor Areas	662.5			165.6	
Major Scar Areas					
PL-1	468.0	100.0%	100.0%	468.0	30
RP-1	81.0	100.0%	100.0%	81.0	30
RP-2	389.0	100.0%	100.0%	389.0	30
Stern Area	6,725.0	100.0%	61.0%	4,102.3	30
Subtotal for Major Areas	7,663.0			5,040.3	

HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING (Minor Scar Area)

<i>HEA Parameters Characterizing Initial Injury:</i>	
Injured Area/Polygons	Number Scar Areas
Raw Sq. Meters Injured by the Grounding:	662.5
Percent of Resource Services Lost in Initial Post-Grounding Period:	25.0%
Percent of Area Injured Consisting of Live Coral (Pre-grounding):	100.0%
Year of Initial Injury:	1997
Current Year:	1997
Year in Which Recovery is Assumed to Begin:	1998
Recovery Function For Primary Restoration Area:	
Functional Form of Recovery Function	Linear
Duration of Recovery Horizon (years)	15
Real Discount Rate	3.0%

<i>Calculation of Square Meter-Years of Resource Services Lost:</i>				
Year	Percent of Resource Services Lost (Beginning of Period)	Percent of Resource Services Lost (End of Period)	Raw Adj. Square Meter-Years of Resource Services Lost	Discounted Square Meter-Years of Resource Services Lost
1997	0.0%	25.0%	165.6	165.6
1998	25.0%	23.3%	154.6	150.1
1999	23.3%	21.7%	143.5	135.3
2000	21.7%	20.0%	132.5	121.3
2001	20.0%	18.3%	121.5	107.9
2002	18.3%	16.7%	110.4	95.2
2003	16.7%	15.0%	99.4	83.2
2004	15.0%	13.3%	88.3	71.8
2005	13.3%	11.7%	77.3	61.0
2006	11.7%	10.0%	66.3	50.8

**HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
(Minor Scar Area)**

2007	10.0%	8.3%	55.2	41.1
2008	8.3%	6.7%	44.2	31.9
2009	6.7%	5.0%	33.1	23.2
2010	5.0%	3.3%	22.1	15.0
2011	3.3%	1.7%	11.0	7.3
2012	1.7%	0.0%	0.0	0.0
2013	0.0%	0.0%	0.0	0.0
2014	0.0%	0.0%	0.0	0.0
2015	0.0%	0.0%	0.0	0.0
2016	0.0%	0.0%	0.0	0.0
2017	0.0%	0.0%	0.0	0.0
2018	0.0%	0.0%	0.0	0.0
2019	0.0%	0.0%	0.0	0.0
2020	0.0%	0.0%	0.0	0.0
2021	0.0%	0.0%	0.0	0.0
2022	0.0%	0.0%	0.0	0.0
2023	0.0%	0.0%	0.0	0.0
2024	0.0%	0.0%	0.0	0.0
2025	0.0%	0.0%	0.0	0.0
2026	0.0%	0.0%	0.0	0.0
2027	0.0%	0.0%	0.0	0.0
2028	0.0%	0.0%	0.0	0.0
2029	0.0%	0.0%	0.0	0.0
2030	0.0%	0.0%	0.0	0.0
2031	0.0%	0.0%	0.0	0.0
2032	0.0%	0.0%	0.0	0.0
2033	0.0%	0.0%	0.0	0.0
2034	0.0%	0.0%	0.0	0.0
2035	0.0%	0.0%	0.0	0.0
2036	0.0%	0.0%	0.0	0.0
2037	0.0%	0.0%	0.0	0.0
2038	0.0%	0.0%	0.0	0.0
2039	0.0%	0.0%	0.0	0.0
2040	0.0%	0.0%	0.0	0.0
2041	0.0%	0.0%	0.0	0.0
2042	0.0%	0.0%	0.0	0.0
2043	0.0%	0.0%	0.0	0.0
2044	0.0%	0.0%	0.0	0.0
2045	0.0%	0.0%	0.0	0.0
2046	0.0%	0.0%	0.0	0.0
2047	0.0%	0.0%	0.0	0.0
2048	0.0%	0.0%	0.0	0.0
2049	0.0%	0.0%	0.0	0.0
2050	0.0%	0.0%	0.0	0.0
2051	0.0%	0.0%	0.0	0.0

**HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
(Minor Scar Area)**

2052	0.0%	0.0%	0.0	0.0
2053	0.0%	0.0%	0.0	0.0
2054	0.0%	0.0%	0.0	0.0
2055	0.0%	0.0%	0.0	0.0
2056	0.0%	0.0%	0.0	0.0
2057	0.0%	0.0%	0.0	0.0
2058	0.0%	0.0%	0.0	0.0
2059	0.0%	0.0%	0.0	0.0
2060	0.0%	0.0%	0.0	0.0
2061	0.0%	0.0%	0.0	0.0
2062	0.0%	0.0%	0.0	0.0
2063	0.0%	0.0%	0.0	0.0
2064	0.0%	0.0%	0.0	0.0
2065	0.0%	0.0%	0.0	0.0
2066	0.0%	0.0%	0.0	0.0
2067	0.0%	0.0%	0.0	0.0
2068	0.0%	0.0%	0.0	0.0
2069	0.0%	0.0%	0.0	0.0
2070	0.0%	0.0%	0.0	0.0
2071	0.0%	0.0%	0.0	0.0
2072	0.0%	0.0%	0.0	0.0
Total Discounted Sq.-M Years of Services Lost (Minor Scar Areas)				1.160.8

**HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
(Major Scar Areas PL1, RP1 and RP2)**

<i>HEA Parameters Characterizing Initial Injury:</i>	
Injured Area/Polygons	Major Scar Areas PL1, RP1, RP2
Raw Sq. Meters Injured by the Grounding:	938.0
Percent of Resource Services Lost in Initial Post-Grounding Period:	100.0%
Percent of Area Injured Consisting of Live Coral (Pre-grounding):	100.0%
Year of Initial Injury:	1997
Current Year:	1997
Year in Which Recovery is Assumed to Begin:	1998
Recovery Function For Primary Restoration Area:	
Functional Form of Recovery Function	Linear
Duration of Recovery Horizon (years)	30
Real Discount Rate	3.0%

<i>Calculation of Square Meter-Years of Resource Services Lost:</i>				
Year	Percent of Resource Services Lost (Beginning of Period)	Percent of Resource Services Lost (End of Period)	Raw Adj. Square Meter-Years of Resource Services Lost	Discounted Square Meter-Years of Resource Services Lost
1997	0.0%	100.0%	938.0	938.0
1998	100.0%	96.7%	906.7	880.3
1999	96.7%	93.3%	875.5	825.2
2000	93.3%	90.0%	844.2	772.6
2001	90.0%	86.7%	812.9	722.3
2002	86.7%	83.3%	781.7	674.3
2003	83.3%	80.0%	750.4	628.4
2004	80.0%	76.7%	719.1	584.7
2005	76.7%	73.3%	687.9	543.0
2006	73.3%	70.0%	656.6	503.2

**HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
(Major Scar Areas PL1, RP1 and RP2)**

2007	70.0%	66.7%	625.3	465.3
2008	66.7%	63.3%	594.1	429.2
2009	63.3%	60.0%	562.8	394.7
2010	60.0%	56.7%	531.5	361.9
2011	56.7%	53.3%	500.3	330.7
2012	53.3%	50.0%	469.0	301.0
2013	50.0%	46.7%	437.7	272.8
2014	46.7%	43.3%	406.5	245.9
2015	43.3%	40.0%	375.2	220.4
2016	40.0%	36.7%	343.9	196.1
2017	36.7%	33.3%	312.7	173.1
2018	33.3%	30.0%	281.4	151.3
2019	30.0%	26.7%	250.1	130.5
2020	26.7%	23.3%	218.9	110.9
2021	23.3%	20.0%	187.6	92.3
2022	20.0%	16.7%	156.3	74.7
2023	16.7%	13.3%	125.1	58.0
2024	13.3%	10.0%	93.8	42.2
2025	10.0%	6.7%	62.5	27.3
2026	6.7%	3.3%	31.3	13.3
2027	3.3%	0.0%	0.0	0.0
2028	0.0%	0.0%	0.0	0.0
2029	0.0%	0.0%	0.0	0.0
2030	0.0%	0.0%	0.0	0.0
2031	0.0%	0.0%	0.0	0.0
2032	0.0%	0.0%	0.0	0.0
2033	0.0%	0.0%	0.0	0.0
2034	0.0%	0.0%	0.0	0.0
2035	0.0%	0.0%	0.0	0.0
2036	0.0%	0.0%	0.0	0.0
2037	0.0%	0.0%	0.0	0.0
2038	0.0%	0.0%	0.0	0.0
2039	0.0%	0.0%	0.0	0.0
2040	0.0%	0.0%	0.0	0.0
2041	0.0%	0.0%	0.0	0.0
2042	0.0%	0.0%	0.0	0.0
2043	0.0%	0.0%	0.0	0.0
2044	0.0%	0.0%	0.0	0.0
2045	0.0%	0.0%	0.0	0.0
2046	0.0%	0.0%	0.0	0.0
2047	0.0%	0.0%	0.0	0.0
2048	0.0%	0.0%	0.0	0.0
2049	0.0%	0.0%	0.0	0.0
2050	0.0%	0.0%	0.0	0.0
2051	0.0%	0.0%	0.0	0.0

**HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
(Major Scar Areas PL1, RP1 and RP2)**

2052	0.0%	0.0%	0.0	0.0
2053	0.0%	0.0%	0.0	0.0
2054	0.0%	0.0%	0.0	0.0
2055	0.0%	0.0%	0.0	0.0
2056	0.0%	0.0%	0.0	0.0
2057	0.0%	0.0%	0.0	0.0
2058	0.0%	0.0%	0.0	0.0
2059	0.0%	0.0%	0.0	0.0
2060	0.0%	0.0%	0.0	0.0
2061	0.0%	0.0%	0.0	0.0
2062	0.0%	0.0%	0.0	0.0
2063	0.0%	0.0%	0.0	0.0
2064	0.0%	0.0%	0.0	0.0
2065	0.0%	0.0%	0.0	0.0
2066	0.0%	0.0%	0.0	0.0
2067	0.0%	0.0%	0.0	0.0
2068	0.0%	0.0%	0.0	0.0
2069	0.0%	0.0%	0.0	0.0
2070	0.0%	0.0%	0.0	0.0
2071	0.0%	0.0%	0.0	0.0
2072	0.0%	0.0%	0.0	0.0
Total Discounted Sq.-M Years of Services Lost (Major Scar Areas PL1, RP1, RP2)				11,163.8

**HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
(Major Scar - Stern Area)**

<i>HEA Parameters Characterizing Initial Injury:</i>	
Injured Area/Polygons	Major Scar Area Stern Area
Raw Sq. Meters Injured by the Grounding:	6,725.0
Percent of Resource Services Lost in Initial Post-Grounding Period:	100.0%
Percent of Area Injured Consisting of Live Coral (Pre-grounding):	61.0%
Year of Initial Injury:	1997
Current Year:	1997
Year in Which Recovery is Assumed to Begin:	1990
Recovery Function For Primary Restoration Area:	
Functional Form of Recovery Function	Linear
Duration of Recovery Horizon (years)	30
Real Discount Rate	3.0%

<i>Calculation of Square Meter-Years of Resource Services Lost:</i>				
Year	Percent of Resource Services Lost (Beginning of Period)	Percent of Resource Services Lost (End of Period)	Raw Adj. Square Meter-Years of Resource Services Lost	Discounted Square Meter-Years of Resource Services Lost
1997	0.0%	100.0%	4,102.3	4,102.3
1998	100.0%	96.7%	3,965.5	3,850.0
1999	96.7%	93.3%	3,828.8	3,609.0
2000	93.3%	90.0%	3,692.0	3,378.7
2001	90.0%	86.7%	3,555.3	3,158.8
2002	86.7%	83.3%	3,418.5	2,948.9
2003	83.3%	80.0%	3,281.8	2,748.5
2004	80.0%	76.7%	3,145.1	2,557.2
2005	76.7%	73.3%	3,008.3	2,374.8
2006	73.3%	70.0%	2,871.6	2,200.8

**HABITAT EQUIVALENCY ANALYSIS FOR CONTSHIP HOUSTON GROUNDING
(Major Scar - Stern Area)**

2007	70.0%	66.7%	2,734.8	2,035.0
2008	66.7%	63.3%	2,598.1	1,876.9
2009	63.3%	60.0%	2,461.4	1,726.3
2010	60.0%	56.7%	2,324.6	1,582.9
2011	56.7%	53.3%	2,187.9	1,446.4
2012	53.3%	50.0%	2,051.1	1,316.5
2013	50.0%	46.7%	1,914.4	1,193.0
2014	46.7%	43.3%	1,777.6	1,075.5
2015	43.3%	40.0%	1,640.9	963.9
2016	40.0%	36.7%	1,504.2	857.8
2017	36.7%	33.3%	1,367.4	757.1
2018	33.3%	30.0%	1,230.7	661.5
2019	30.0%	26.7%	1,093.9	570.9
2020	26.7%	23.3%	957.2	485.0
2021	23.3%	20.0%	820.5	403.6
2022	20.0%	16.7%	683.7	326.5
2023	16.7%	13.3%	547.0	253.6
2024	13.3%	10.0%	410.2	184.7
2025	10.0%	6.7%	273.5	119.5
2026	6.7%	3.3%	136.7	58.0
2027	3.3%	0.0%	0.0	0.0
2028	0.0%	0.0%	0.0	0.0
2029	0.0%	0.0%	0.0	0.0
2030	0.0%	0.0%	0.0	0.0
2031	0.0%	0.0%	0.0	0.0
2032	0.0%	0.0%	0.0	0.0
2033	0.0%	0.0%	0.0	0.0
2034	0.0%	0.0%	0.0	0.0
2035	0.0%	0.0%	0.0	0.0
2036	0.0%	0.0%	0.0	0.0
2037	0.0%	0.0%	0.0	0.0
2038	0.0%	0.0%	0.0	0.0
2039	0.0%	0.0%	0.0	0.0
2040	0.0%	0.0%	0.0	0.0
2041	0.0%	0.0%	0.0	0.0
2042	0.0%	0.0%	0.0	0.0
2043	0.0%	0.0%	0.0	0.0
2044	0.0%	0.0%	0.0	0.0
2045	0.0%	0.0%	0.0	0.0
2046	0.0%	0.0%	0.0	0.0
2047	0.0%	0.0%	0.0	0.0
2048	0.0%	0.0%	0.0	0.0
2049	0.0%	0.0%	0.0	0.0
2050	0.0%	0.0%	0.0	0.0
2051	0.0%	0.0%	0.0	0.0

ATTACHMENT 6

Contship Houston Data Products

Hi 8mm Tapes

Primarily from the injury assessment-IVMS data
Tapes have video, audio and time codes for IVMS
55 tapes

Database

Injury category/type
Geographic Location
Injury types logged with description
Microsoft Access format
Linked to IVMS data

Geographical Information System Maps

10 different final map products
approximately 70 different layer types
associated database
can sort and map by any injury category/type

Still Photographs and Slides

Approximately 30 rolls
taken throughout the project

Aerial Photographs

February aerials
July aerials

Rubble Photo Log

Documentation of rubble areas with descriptions

Miscellaneous Videos

VHS format
Digital Video format