3.2 Gulf of Mexico

3.2 GULF OF MEXICO

NEPA and its implementing regulations require that, for major Federal actions significantly affecting the human environment, the proponent of the action prepare an EIS describing the proposal and its effects on the environment. This requirement applies to Federal actions occurring in or affecting U.S. territory. EO 12114 requires that for similar actions and effects occurring outside of the territorial limits of the United States, within the global commons, the proponent prepare an EIS describing its effects on the environment of the global commons. While the EO does not require exactly the same procedure and formality as NEPA, the substantive analysis required is comparable. In the interest of brevity and efficiency, this document will not identify each instance in which the analysis is conducted pursuant to NEPA or in which it is conducted pursuant to the EO. Rather, it will simply identify the action and its impacts and the location of each. This SEIS is being prepared using the procedures applicable to NEPA, including the required public notices and involvement within the United States.

Eglin AFB has been involved in testing and training activities over the Gulf of Mexico since the 1950's. The trend of increasing the use of the Gulf of Mexico for large scale weapons testing is likely to continue in the future.

3.2.1 AIR QUALITY

he majority of TMD emissions would occur above the altitudes to which th ublic has access. Air emissions will disperse before people are affected.

3.2.1.1 Resource Description and Evaluative Methods

The existing air quality of the affected environment is defined by examining air quality monitoring records from monitoring stations maintained by the FDEP Department of Air Resource Management (DARM). No monitoring sites exist within the Gulf of Mexico; therefore, the entire region is considered unclassifiable.

The primary area of concern in the Gulf of Mexico as regards air quality is the potential impact missile exhaust products may have on stratospheric ozone. While there may be several support activities (such as safety patrols) that could have exhaust emissions in the lower atmosphere, the resulting emissions would quickly disperse over the open Gulf area.

Missile exhaust from solid-fuel rocket motors emits hydrogen chloride as a major component. This has the potential to cause a temporary lowering of ozone levels in the immediate vicinity of the emissions when released in the stratosphere. Therefore, the majority of the air quality analysis of potential impacts in the Gulf of Mexico concentrates on the potential impacts to the protective ozone layer due to exhaust emissions as the missile passes through this region.

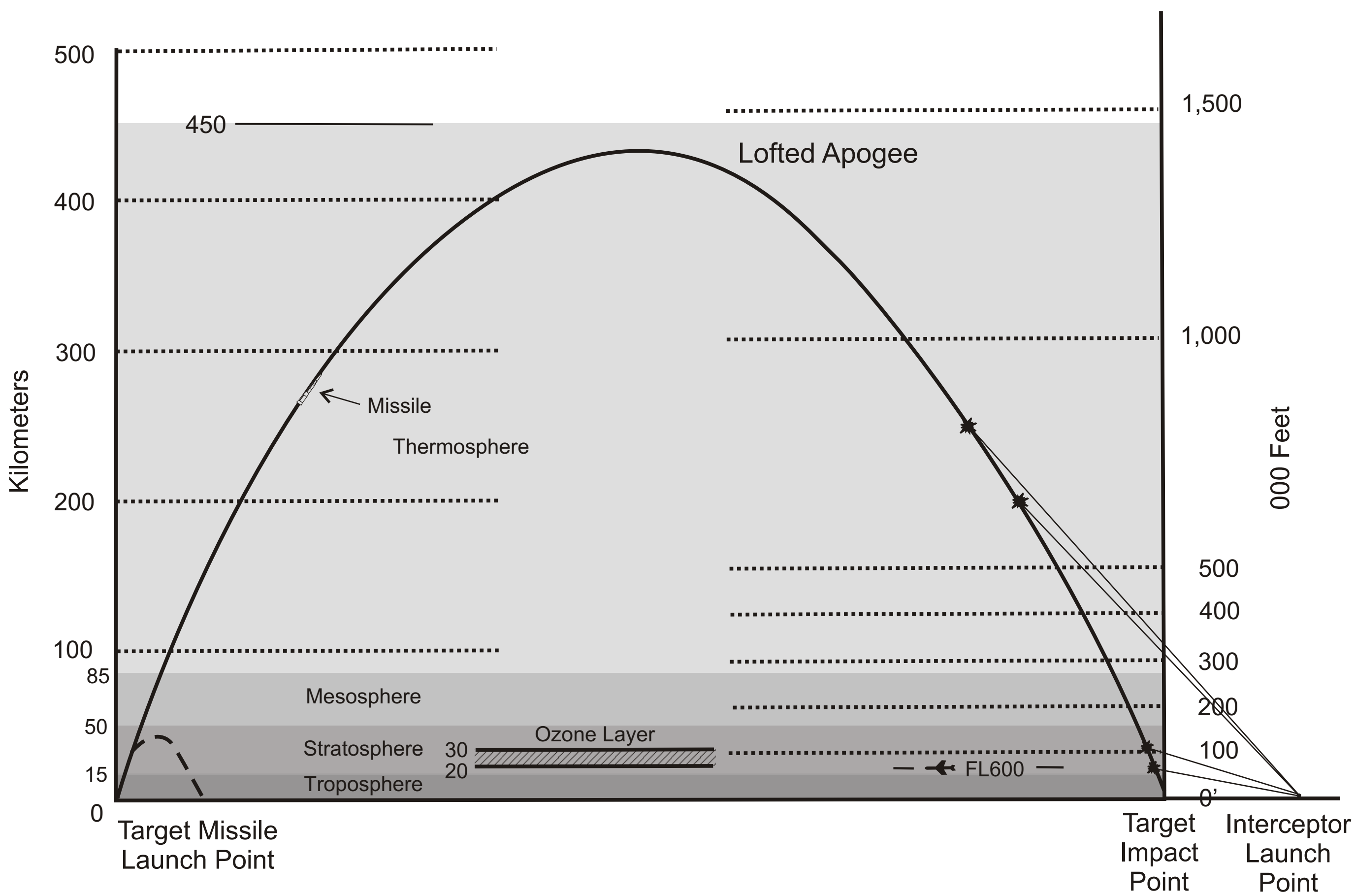
3.2.1.2 Region of Influence

The ROI would be the entire flight corridor at variable altitudes throughout the missile trajectory. The ROI would also include the air corridor occupied by attendant safety patrols.

3.2.1.3 Affected Environment

Regional Climate

The troposphere, from the earth's surface up to approximately 15 kilometers (9 miles), contains approximately 80 percent of the atmosphere's mass, including nearly all the water vapor and dust. The stratosphere, from approximately 15 to 50 kilometers (9 to 31 miles), is the atmospheric layer that contains most of the upper ozone. This ozone is concentrated mainly in the lower half of the stratosphere. The mesosphere (50 to 85 kilometers [31 to 53 miles]) is the next atmospheric layer with the remaining traces of water vapor. Temperatures in the mesosphere fall to approximately -113°C (-173°F). The thermosphere follows (85 to 450 kilometers [53 to 280 miles]), with temperatures rising due to ionization of the increasingly rarified gasses by solar radiation. Figure 3.2.1-1 shows the relative thickness of these atmospheric layers.



EXPLANATION

Ballistic Missile Trajectory

Booster Drop Trajectory

Atmospheric Layers

Figure 3.2.1-1

002egl

Regional Air Quality

The airshed in the eastern Gulf of Mexico has very low concentrations of air pollutants. There are very few emissions sources (air traffic, drilling platforms, surface vessel exhaust, transport phenomena), and while these sources may have limited localized effects on air quality, their impact on overall Gulf of Mexico air quality is generally not measurable.

Air Pollution Emissions Sources

Normal sources of air pollution emissions in the Gulf of Mexico include aircraft exhaust, surface vessel exhaust, and drilling platform emissions. These sources emit varying levels of air pollutants. Aircraft and surface vessel exhausts are both mobile sources. Jurisdiction over OCS-related emissions is shared: the U.S. Environmental Protection Agency regulates OCS emissions offshore of Florida, and the U.S. Department of the Interior regulates OCS emissions offshore of the remaining Gulf Coast states. None of these sources emit enough pollutants to cause more than a temporary localized elevation in the ambient air quality. There is virtually no measurable effect from normal air pollution sources. This is due, at least in part, to the area the sources have in which to dissipate the emissions and the limited numbers of potential sensitive receptors.

The other major source of air pollution in the Gulf of Mexico is transport of air pollution from onshore areas into the Gulf of Mexico air shed. This transport phenomenon is most pronounced for VOCs. Due to the delayed nature of photoreactive ozone generation, the precursor air pollutants must be airborne for an hour or two before there is any marked rise in ozone levels. The coastal winds would tend to carry these emissions into the Gulf of Mexico and disperse them there. Therefore, most of the ozone generated in the Gulf of Mexico can be assumed to come from transported pollutants.

3.2.1.4 Environmental Impact and Mitigations

No-action Alternative

Under the no-action alternative, the proposed TMD test activities would not be implemented. Current military operations and maritime and fishing activities in the EGTR would continue. Continuing Eglin AFB activities over the Gulf of Mexico could result in a negligible change in regional air quality.

Site Preparation Activities

Construction of the proposed launch platforms could result in some localized, short-term impacts to air quality in the vicinity of the construction.

Flight Test Activities

In addition to missile launches, several additional activities have the potential for air quality impacts due to proposed action activities. These may include limited aircraft patrols or surface patrols to ensure evacuation of safety areas and sea-launch platform or airborne launch platform activities.

The majority of emissions occurring in the Gulf of Mexico would occur above the altitudes considered by the AAQS. Due to the large volume of air and limited emissions, there are no anticipated long-term effects on Gulf of Mexico air quality due to proposed action or alternatives.

Both the target missile and the interceptor have the potential to emit Ozone Depleting Chemicals (ODCs) directly into the stratosphere. This has the potential to cause temporary local depletion of the earth's protective ozone layer. The Space Shuttle's impact on the ozone layer has been the subject of extensive studies. Comparison of the potential project-related emissions with those generated by the Space Shuttle shows that the proposed action would generate emissions at much lower levels. The level of ODCs released by the Space Shuttle has been shown to have minimal effect on the ozone layer either locally or globally. Therefore, it is anticipated that there would be even less impact on the ozone layer due to the proposed action.

The Air Drop Target System would result in emissions of criteria pollutants and HAPs. Sources of pollutants associated with the Air Drop Target System would include emissions from the C-130 and NP-3D aircraft operations, the target launch exhaust, non-road mobile sources associated with support equipment, on-road mobile sources associated with component transport and employee commutes, and potential VOCs associated with preprocessing activities. No construction activities or associated emissions would occur under the proposed action. Operational emissions would generally be episodic and brief in duration. The majority of the operational air emissions would occur from the exhaust of the launch vehicle. If the air-launch alternative were selected, the impacts would be nearly the same, since similar planes and target missiles would be used.

Emissions of the Hera target missile would exceed emissions of any other proposed TMD missile system. The Hera missile burns approximately 93.3 kilograms (206 pounds) of fuel per second during the approximately 67 seconds of the first-stage burn (U.S. Army Space and Strategic Defense Command, 1994c). The Hera would transit the ozone layer (20 to 30 kilometers [12 to 18 miles]) in less than 20 seconds. Comparisons of the potential Hera emissions with those of the Space Shuttle are shown in table 3.2.1-1. The primary pollutant of concern regarding ozone depletion is hydrogen chloride. There is currently some speculation that aluminum oxide may act as a catalyst; therefore, the amount of aluminum oxide emitted may also be of concern. Review of the data in table 3.2.1-1 shows the Hera emits less than 1 percent of the hydrogen chloride and aluminum oxide the Space Shuttle emits in the ozone layer. Since previous studies have indicated the Space Shuttle has minimal impact on the ozone layer, it is reasonable to assume the proposed action would have even less impact.

Successful intercept of the target missile by the interceptor has the potential to create small particulate matter whose size and mass would classify it as particulate air pollution (dust). All intercepts are projected to occur well above the mixing height. As such, they will be widely dispersed by the time they are introduced to ambient air levels. The same would hold true for any other non-debris emissions resulting from successful intercept.

Table 3.2.1-1: Comparison of Stratospheric Exhaust Emissions

Pollutant	Hera First Stage (SR19-AJ-1) in kilograms (pounds)	Space Shuttle in kilograms (pounds)
Aluminum Oxide	526 (1,160)	128,885 (2,83,547)
Carbon Monoxide	395 (869)	78,775 (173,305)
Carbon Dioxide	85.67 (188)	8,944 (1,857)
Chlorine	~ 0 (0)	898 (1,976)
Hydrogen Chloride	417.6 (919)	75,937 (167,061)
Hydrogen	34.92 (77)	7,939 (17,466)
Water	2,313 (509)	27,623 (60,771)
Nitrogen	162.4 (357)	29,958 (65,908)
Nitrogen Oxide	~ 0 (0)	<36 (<79)

Source: U.S. Army Space and Strategic Defense Command, 1994c; National Aeronautics and Space Administration, Office of Space Science, 1995.

Due to the small volume of emissions of the proposed action (as compared to normal exhaust due to commercial air traffic), there is no anticipated measurable impact on cloud formation, air clarity, or visibility.

Cumulative Impacts

Eglin AFB has been involved in testing and training activities over the Gulf of Mexico since the 1950s, and the trend toward increasing the use of the Gulf of Mexico for large-scale weapons testing will likely continue for the foreseeable future. In addition, natural gas and oil exploration, which has occurred in the Gulf of Mexico for nearly 40 years, is expected to continue at the current pace of development for the foreseeable future.

Due to the non-continuous nature of the projected air emissions, the large physical volume of space (air) considered, the low density of receptors (numbers of people in the area), and relatively low level of additional air emissions sources (aircraft, surface vessels, platforms, and coastal air pollutants), no cumulative air impacts are anticipated due to the proposed action.

Mitigations Considered

No mitigations are considered.

3.2.2 AIRSPACE USE

MD test activities would require clearing of portions of airspace for periods o o longer than 4 hours per test. This practice is a routine function of airspac nanagement and air traffic control for the water test areas.

3.2.2.1 Resource Description and Evaluative Methods

Airspace is the area that lies above a nation and comes under its jurisdiction. Airspace is defined vertically and horizontally and by time when describing its use for aviation purposes. Additional information on airspace use is given in section 3.1.2.1.

3.2.2.2 Region of Influence

The Gulf of Mexico ROI is defined as the overwater area that would be potentially affected by the proposed action using portions of the international airspace over the Gulf of Mexico. This includes the entire northern Gulf of Mexico within the Houston, Jacksonville, and Miami Air Route Traffic Control Centers (ARTCCs), and the Houston and Miami Oceanic Control Area/Flight Information Regions (CTA/FIR) (figure 3.2.2-1).

3.2.2.3 Affected Environment

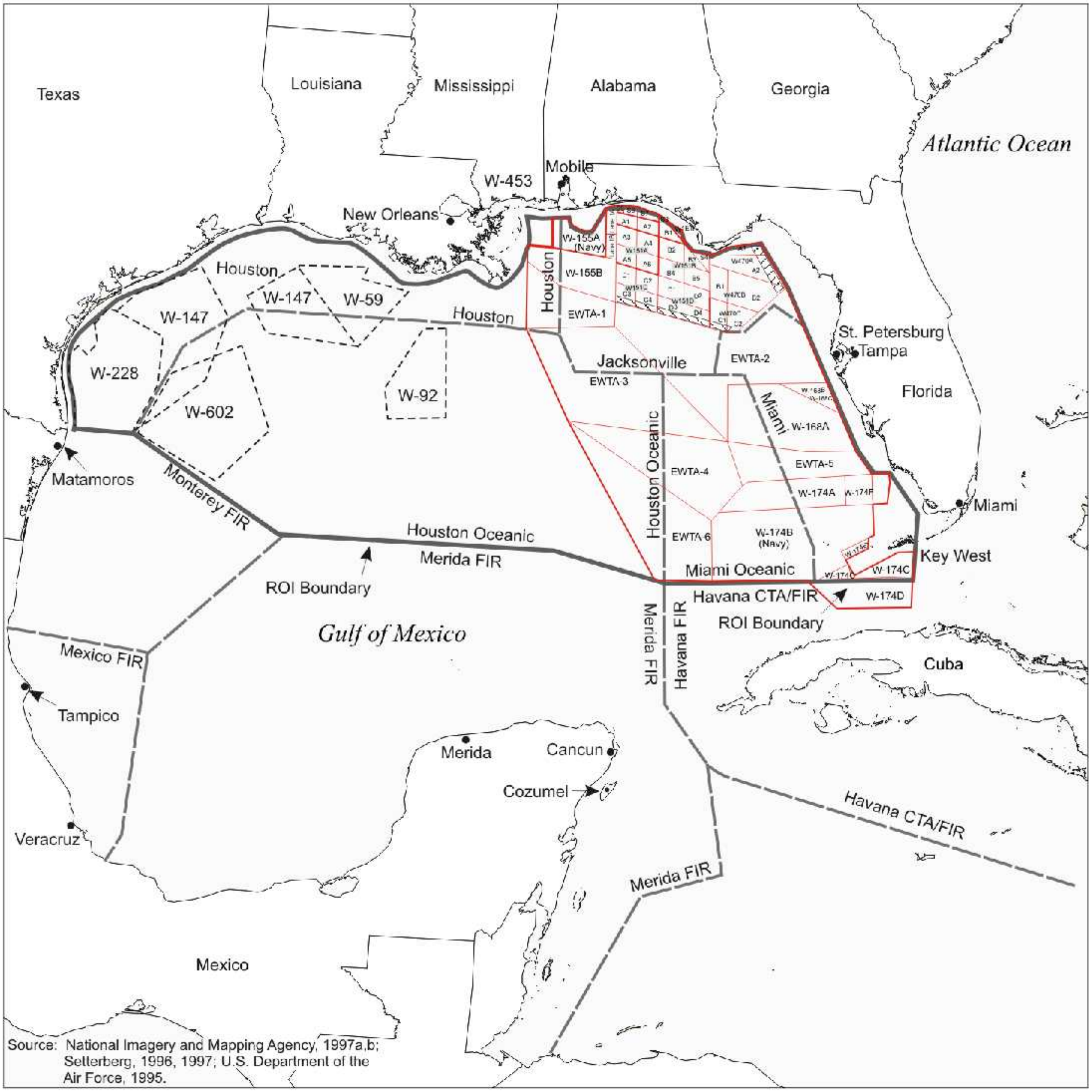
The affected airspace use environment is described below in terms of its principal attributes, namely, controlled and uncontrolled airspace, special use airspace, military training routes, en route airways and jet routes, airports and airfields, and air traffic control. Although special use airspace is considered either controlled or uncontrolled, depending on its location, it is discussed separately.

Controlled and Uncontrolled Airspace

The airspace in the ROI beyond 22.2 kilometers (12 nautical miles) from shore lies in international airspace and, consequently, is not part of the NAS. The airspace in the northern half of the ROI within the Houston, Jacksonville, and Miami ARTCCs and within the Houston and Miami Oceanic CTA/FIR is controlled airspace (figure 3.2.2-1).

Special Use Airspace

Special use airspace occupies a significant portion of the Gulf of Mexico ROI. Much of the eastern part of the Gulf of Mexico ROI is occupied by the EWTA (figure 3.2.2-2). The Letter of Agreement between Jacksonville ARTCC, Miami ARTCC, Houston ARTCC, Navy Training Wing 6, and the AFDTC defines the EWTA as " . . . all airspace in Warning Areas W-151, W-155B, W-168, W-174, W-470, and the airspace divided into five (5) areas . . ." These are described in annexes to the agreement (Jacksonville Air Route Traffic Control Center, 1991). EWTA 6 was added in 1996. The six EWTAs serve a similar function as Warning Areas, via the NOTAM system, providing airspace for hazardous aircraft flying operations including air-to-surface, air-to-air, and surface-to-air



Source: National Imagery and Mapping Agency, 1997a,b; Setterberg, 1996, 1997; U.S. Department of the Air Force, 1995.

EXPLANATION

- Eglin Overwater Region of Influence
- ROI
- Air Route Traffic Control Center Boundary
- Special Use Airspace

ADIZ = Air Defense Identification Zone
CTA = Control Area
FIR = Flight Information Region
W = Warning Area
EWTA = Eglin Water Test Area

Thunder Area

Lightning Area

NORTH

Scale 1:11,000,000

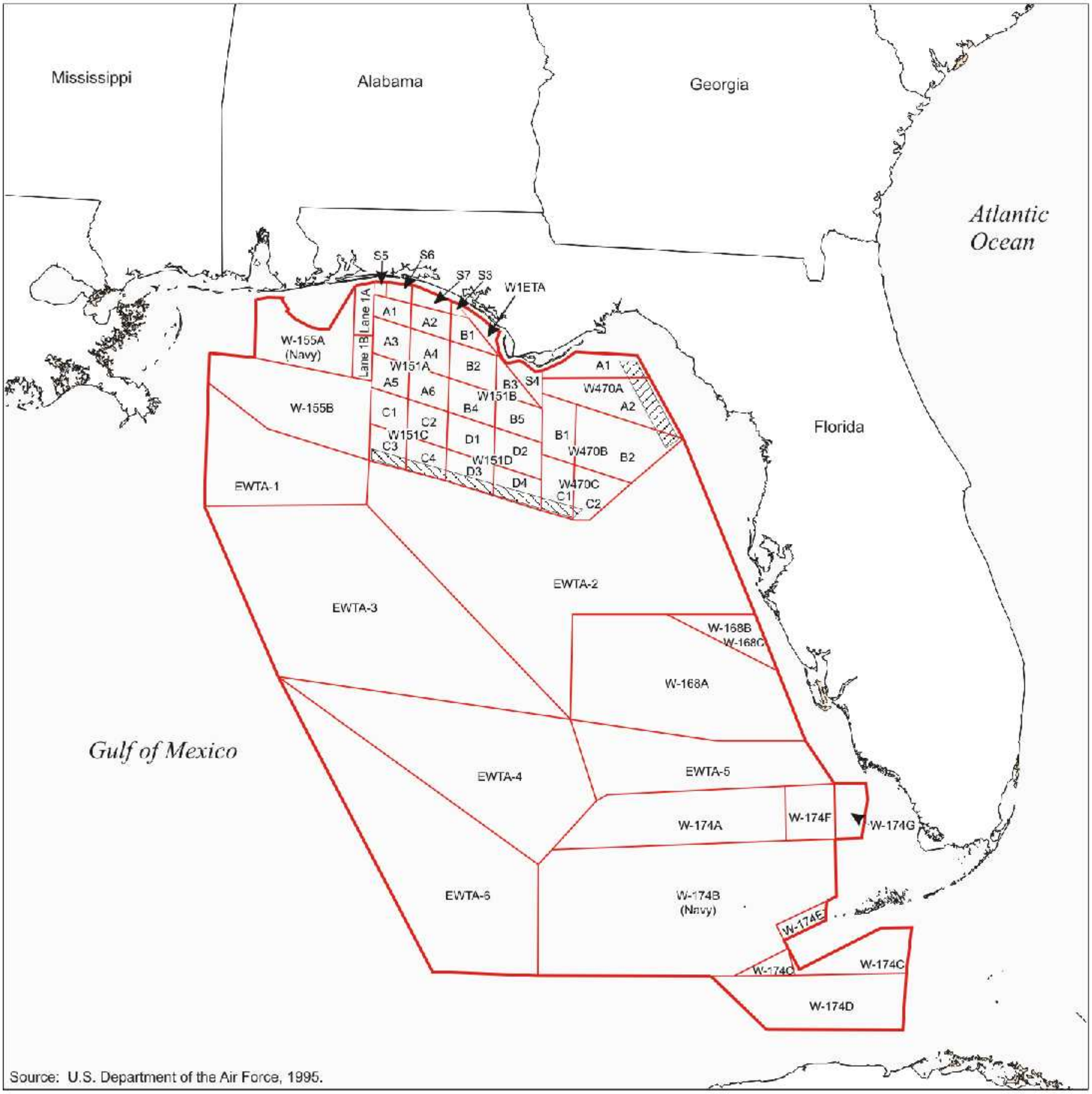
0 100 200 Miles

0 150 300 Kilometers

Eglin Gulf Test Range Region of Influence

Figure 3.2.2-1

gom-11m-3as008



EXPLANATION

Eglin Overwater Region of Influence

EWTA Eglin Water Test Area

W Warning Area

Thunder Area

Lightning Area

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

NORTH

Notes: Lightning and Thunder Areas in W151 and W470 are deviation areas for Gulf Route 26 and J41-43, respectively, during severe weather.

Airspace is controlled by the FAA and scheduled and used by the Air Force and the Navy.

Special Use Airspace in the Eastern Part of the Eglin Gulf Test Range Region of Influence

Figure 3.2.2-2

gom-6m-3as002

activities. Almost all of the EWTAs lie outside the 22.2-kilometer (12-nautical-mile) limit of the NAS and include EWTAs 1, 2, 3, 4, 5, and 6. Other special use airspace in the eastern part of the ROI includes the Tortugas MOA, due west of Key West.

Special use airspace areas in the western part of the Gulf of Mexico ROI include Warning Area W-453 south of Mobile, Alabama; Warning Areas W-92, W-59, and W-147A/B south and southwest of New Orleans, Louisiana; and Warning Areas W-147C/D/E, W-228, and W-602 off the Texas coast (figure 3.2.2-1 and table 3.2.2-1).

Table 3.2.2-1: Special Use Airspace in the Gulf Flight Test Range Airspace Use ROI

		Time of Use		
Number	**Altitude (Feet)**	**Days**	**Hours**	**Controlling Agency**
W-453	To FL 500	Cont[1]	Inter[2]	Houston (ZHU) CNTR
W-155A,B	To FL 600	Cont[1]	Sunrise-0700	Jacksonville (ZIX) CNTR
W-151A-D	Unlimited	Inter[2]	Inter[2]	Jacksonville (ZIX) CNTR
W-470A-C	Unlimited	Inter[2]	Inter[2]	Jacksonville (ZIX) CNTR
W-168A	Unlimited	Inter[2]	Inter[2]	Miami (ZMA) CNTR
W-168B	To FL 290	Inter[2]	Inter[2]	Miami (ZMA) CNTR
W-168C	FL 290 to Unlimited	Inter[2]	Inter[2]	Miami (ZMA) CNTR
W-174A, F&G	To FL 700	Inter[2]	1200-0400	Miami (ZMA) CNTR
W-174B	To FL 700	Inter[2]	1200-0400	Miami (ZMA) CNTR
W-92	To FL 400	Cont[1]	1300-0600[3]	Houston (ZHU) CNTR
W-59A	To FL 500	Cont[1*]	1500-0300[3]	Houston (ZHU) CNTR
W-59B	To but not including FL 280	Cont[1*]	1500-0300[3]	Houston (ZHU) CNTR
W-59C	FL 280 to FL 500	By NOT[4]	By NOTAM	Houston (ZHU) CNTR
W-147A	To but not including FL 230	Cont[1*]	1400-0400[3]	Houston (ZHU) CNTR
W-147B	FL 230 to FL 500	By NOT[4]	By NOTAM	Houston (ZHU) CNTR
W-147C&D	To FL 500	Cont[1*]	1400-0400[3]	Houston (ZHU) CNTR
W-147E	FL 260 to FL 500	Cont[1*]	1400-0400[3]	Houston (ZHU) CNTR
W-228A-D	To FL 450	Cont[1]	Cont[1]	Houston (ZHU) CNTR
W-602	To FL 250	By NOT[4]	By NOTAM	Miami (ZMA) CNTR

P-Prohibited, R-Restricted, A-Alert, W-Warning, MOA-Military Operations Area
[1] Cont = Continuous
[1*] Cont = Continuous, other times by NOTAM
[2] Inter = Intermittent
[3] During periods of Daylight Saving Time effective hours are one hour earlier than shown
[4] NOT = NOTAM = Notice to Airmen
[5] FIR = Flight Information Region
CNTR = Center
Sources: National Imagery and Mapping Agency, 1997; National Oceanic and Atmospheric Administration, National Ocean Service, 1995.

Military Training Routes

There are no MTRs in the Gulf of Mexico ROI.

En Route Airways and Jet Routes

The Gulf of Mexico ROI airspace is crossed by numerous airways and jet routes, especially the important Gulf Route 26 and J-58-86 jet route (figure 3.2.2-3). An airway is a control area, or portion thereof, established in the form of a corridor up to but not including 5,486.4 meters (18,000 feet) MSL, the centerline of which is defined by radio navigational aids. The routes are referred to as Colored Federal Airways, or very high frequency omni-directional range (VOR) airways over land, and A routes, or low frequency/medium frequency (LF/MF) airways over water, with numbering to identify the designated route. A jet route is a route designed to serve aircraft operations from 5,486.4 meters (18,000 feet) MSL up to and including FL 450. The jet routes are referred to as J routes with numbering to identify the designated route. The low-altitude airways and jet routes crossing the ROI, the cities they connect, and the controlling agencies are provided in table 3.2.2-2.

Figure 3.2.2-4 presents an Aircraft Situation Display of the Gulf of Mexico ROI on Tuesday, 7 October 1997, at 9:30 a.m. (Martin, 1997). It represents a snapshot of all aircraft in the air at that time, taken from the radar at Jacksonville ARTCC. Clearly, the number of aircraft actually en route would vary by time of day, and also by week, month, or season, but the snapshot does give a representative account of the number of aircraft in the air over the Gulf of Mexico at a moment in time. Some 32 aircraft are in the overwater ROI. The snapshot also illustrates the relative low density of en route air traffic over the Gulf of Mexico, compared to the much higher density of air traffic over the mainland, and even along the Atlantic coast. Even so, most of the ROI air traffic in this snapshot is between the central and south Florida and New Orleans, Louisiana, area (figure 3.2.2-4). Approximately 500 aircraft each day use J58-86 or GR26 to transit the Gulf of Mexico between St. Petersburg/Sarasota, Florida, and New Orleans/Leesville, Louisiana. Of these, approximately 325, or 65 percent, operate during daylight hours (7:00 a.m. to 9:00 p.m. Eastern Daylight Time) (Armstrong, 1997). This translates into a nominal average of 23 aircraft per hour, assuming an even hourly distribution.

A new jet route across the northeastern Gulf of Mexico has been proposed by the FAA and agreed to by the U.S. Air Force. Although it has not yet been formalized, the route would accommodate the increased traffic across the Gulf of Mexico that is expected with the full implementation of the North American Free Trade Agreement (NAFTA). It would be an extension of the existing A-758 jet route northeast directly into Tampa Bay (figure 3.2.2-3). This new route would cut across the northwest corner of W-168A. West of the new route, W-168A would still be used at 8,534.4 meters (28,000 feet) AGL and below. Commercial aircraft would be assigned 8,839.2 meters (29,000 feet) AGL and above (Hicks, 1995).

Airports and Airfields

There are no airports or airfields in the Gulf of Mexico ROI.

EXPLANATION

- - - - Enroute High Altitude Jet Routes

—— Enroute Low Altitude Airways and High Altitude Jet Routes

Enroute Airways and Jet Routes in the Gulf Flight Test Range Region of Influence

NORTH

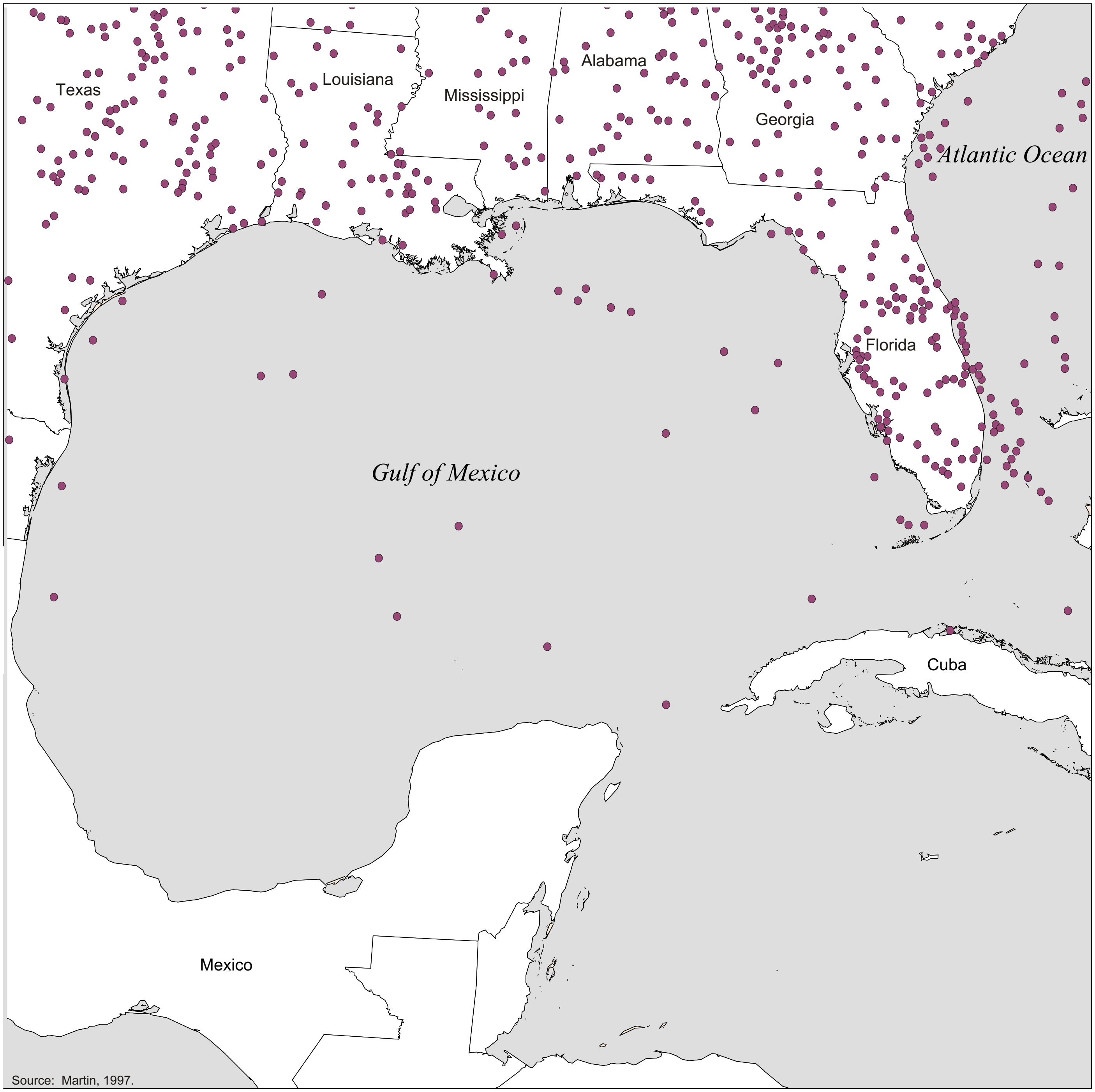
Scale 1:11,000,000

0 100 200 Miles

0 150 300 Kilometers

Figure 3.2.2-3

gom-11m-3as010



EXPLANATION

● Aircraft

Representative Aircraft Density - Single Point in Time

NORTH

Scale 1:11,000,000

0 100 200 Miles

0 150 300 Kilometers

Gulf of Mexico

Figure 3.2.2-4

gom-11m-3as001

Table 3.2.2-2: Overwater Airway and Jet Route Segments in the Gulf of Mexico Airspace Use ROI

Airway/Jet Route	Between	Controlling Agencies
J177[1]	Houston - Tampico	Houston ARTCC, Monterrey FIR
A552[2]	New Orleans - Tampico	Houston ARTCC, Houston Oceanic, Monterrey FIR, Mexico FIR
A649[2]	Houston - Veracruz	Houston ARTCC, Houston Oceanic, Monterrey FIR, Mexico FIR
B753[2]	Houston - Merida	Houston ARTCC, Houston Oceanic, Merida FIR
A766[2]	Houston - Cozumel	Houston ARTCC, Houston Oceanic, Merida FIR
A770[2]	New Orleans - Merida	Houston ARTCC, Houston Oceanic, Merida FIR
A626[c]	New Orleans - Cozumel	Houston ARTCC, Houston Oceanic, Merida FIR
A321[2]	New Orleans - Panama	Houston ARTCC, Houston Oceanic, Merida FIR
G26	Leesville - Tampa	Houston ARTCC, Jacksonville ARTCC, Miami ARTCC
J86	Leesville - Tampa	Houston ARTCC, Jacksonville ARTCC, Miami ARTCC
J58	New Orleans - Tampa	Houston ARTCC, Jacksonville ARTCC, Miami ARTCC
R875[3]	Tampa - Merdia	Houston ARTCC, Jacksonville ARTCC, Merida FIR
A509[3]	Miami - Veracruz	Miami ARTCC, Miami Oceanic, Houston Oceanic, Merida FIR, Mexico FIR
A758[4]	Miami - Merida	Miami Oceanic, Houston Oceanic, Merida FIR
B646[5]	Key West - Merida	Miami ARTCC, Havana CTA/FIR, Merida FIR

[1]Only those segments within Houston ARTCC lie within the ROI.
[2]Only those segments within Houston ARTCC and Houston Oceanic CTA/FIRs lie within the ROI.
[3]Only those segments within Miami ARTCC, Miami and Houston Oceanic CTA/FIRs lie within the ROI.
[4]Only those segments within Miami Oceanic CTA/FIR and Houston Oceanic CTA/FIR lie within the ROI.
[5]Only those segments within the Miami ARTCC lie within the ROI.

CTA/FIR = Control Area/Flight Information Region

Sources: National Imagery and Mapping Agency, 1997; National Oceanic and Atmospheric Administration, National Ocean Service, 1997c.

Air Traffic Control

Air traffic in the ROI is managed by the Houston, Jacksonville, and Miami ARTCCs, and the Houston and Miami Oceanic CTA/FIRs.

The special use airspace areas in the Gulf of Mexico ROI are managed or scheduled by the organizations identified in table 3.2.2-1. The EWTA, the largest special use airspace complex in the ROI, is managed by Eglin AFB under a letter of agreement among Jacksonville ARTCC, Miami ARTCC, Houston ARTCC, Navy Training Wing 6, and the AFDTC (Jacksonville Air Traffic Control Center, 1991). There are some overlaps in airspace assignment, notably that Warning Area W-155B occupies some of Eglin AFB EWTA-1, and is used on a coordinated basis. Additionally, several portions of airspace adjacent to or overlapping these areas are used by Eglin AFB assigned units, but are managed by other organizations. FACSFAC, Naval Air Station Pensacola, functions as the controller for the airspace assigned to their units.

When a requirement exists for use of airspace beyond the Warning Areas and above FL 240 (7,315.2 meters [24,000 feet]) that would impact Gulf Route 26, the airspace may not be scheduled for longer than a 4-hour block of time when the requirement is for a hazardous use of the airspace (such as missiles or drones). At FL 240 and below, it may not be scheduled for longer than 12 hours. There must be a 3-hour period between blocks of scheduled airspace (Jacksonville Air Route Traffic Control Center, 1991).

3.2.2.4 Environmental Impacts and Mitigations

No-action Alternative

Under the no-action alternative, the proposed ground-based TMD test activities would not be implemented. Current operations at Eglin AFB would continue.

Ongoing Eglin AFB and other military mission activities, including air-to-air, air-to-surface, surface-to-air test and evaluation and training activities would continue to utilize the existing overwater special use airspace. No new special use airspace proposal, or any modification to the existing special use airspace, is contemplated to accommodate continuing mission activities. Consequently, no impacts to the controlled or uncontrolled airspace in the ROI would result from the no-action alternative.

Although the nature and intensity of use vary over time and by individual special use airspace area, the continuing mission activities represent precisely the kinds of activities for which the overwater special use airspace was created. The Warning Areas were set aside in the 1950s by the FAA to accommodate activities that present a hazard to other aircraft. Warning Areas consist of airspace over international waters in which hazardous activity may be conducted. This designation corresponds to the Danger Area designation of the International Civil Aviation Organization (ICAO). As such, the continuing mission activities do not represent an adverse impact to special use airspace, and do not conflict with any airspace use plans, policies, and controls.

There are no low altitude airways or high altitude jet routes that would be affected by continuing mission activities in the Gulf of Mexico overwater Warning Areas. However, unlike the Warning Areas, the EWTAs in the eastern Gulf of Mexico ROI are crossed by a number of jet or oceanic routes, especially Gulf Route 26 and the J58-86 high altitude jet route, which cross EWTAs 1 and 2. When these Gulf routes are unavailable due to flight test operations, the traffic must be rerouted over Tallahassee, Florida, and J2 westbound over Mobile, Alabama. These re-routes begin in sufficient time, usually 1 hour prior to the closure, to ensure that all aircraft are clear of the impact area. This results in significant congestion in the vicinity of Tallahassee and Cross City, Florida. Typically, aircraft re-routed over Tallahassee or Cross City, departing from Tampa, Orlando, Regional Southwest, Palm Beach, Ft. Lauderdale, and Miami incur departure delays from 30 to 45 minutes. If traffic is especially heavy or weather is impacting en route operations, delays can exceed an hour. (Armstrong, 1997)

The portion of the EWTAs outside the 22.2-kilometer (12-nautical-mile) limit are located in international airspace. Because the area is in international airspace, the procedures of the ICAO, outlined in ICAO Document 444, *Rules of the Air and Air Traffic*

Services, are followed (International Civil Aviation Organization, 1985, 1994). ICAO Document 444 is the equivalent air traffic control manual to FAA Handbook 7110.65, *Air Traffic Control*. The FAA acts as the U.S. agent for aeronautical information to the ICAO, and air traffic in the overwater ROI is managed by the Miami, Jacksonville, and Houston ARTCCs and the Miami and Houston Oceanic CTA/FIRs.

In terms of potential airspace use impacts to en route airways and jet routes, the continuing mission activities would be in compliance with DOD Directive 4540.1, *Use of Airspace by U.S. Military Aircraft and Firings Over the High Seas*, which specifies procedures for conducting aircraft operations and for missile or projectile firing, namely the missile or projectile "firing areas shall be selected so that trajectories are clear of established oceanic air routes or areas of known surface or air activity" (DOD Directive 4540.1, E5, 1981). In addition, before conducting an operation that is hazardous to non-participating aircraft, NOTAMs and NOTMARs would be sent in accordance with the conditions of the directive specified in AFMAN 11-208.

As noted above, ongoing mission activities would continue to use the existing overwater special use airspace, and would not require any of the following: a change to an existing or planned IFR minimum flight altitude, a published or special instrument procedure, or an IFR departure procedure; or, require a VFR operation to change from a regular flight course or altitude. Consequently, no impacts to the surrounding low altitude airways or high altitude jet routes would occur from the no-action alternative.

There are no airports or airfields in the Gulf of Mexico ROI. Consequently, the no-action alternative would have no impacts on airfields or airports.

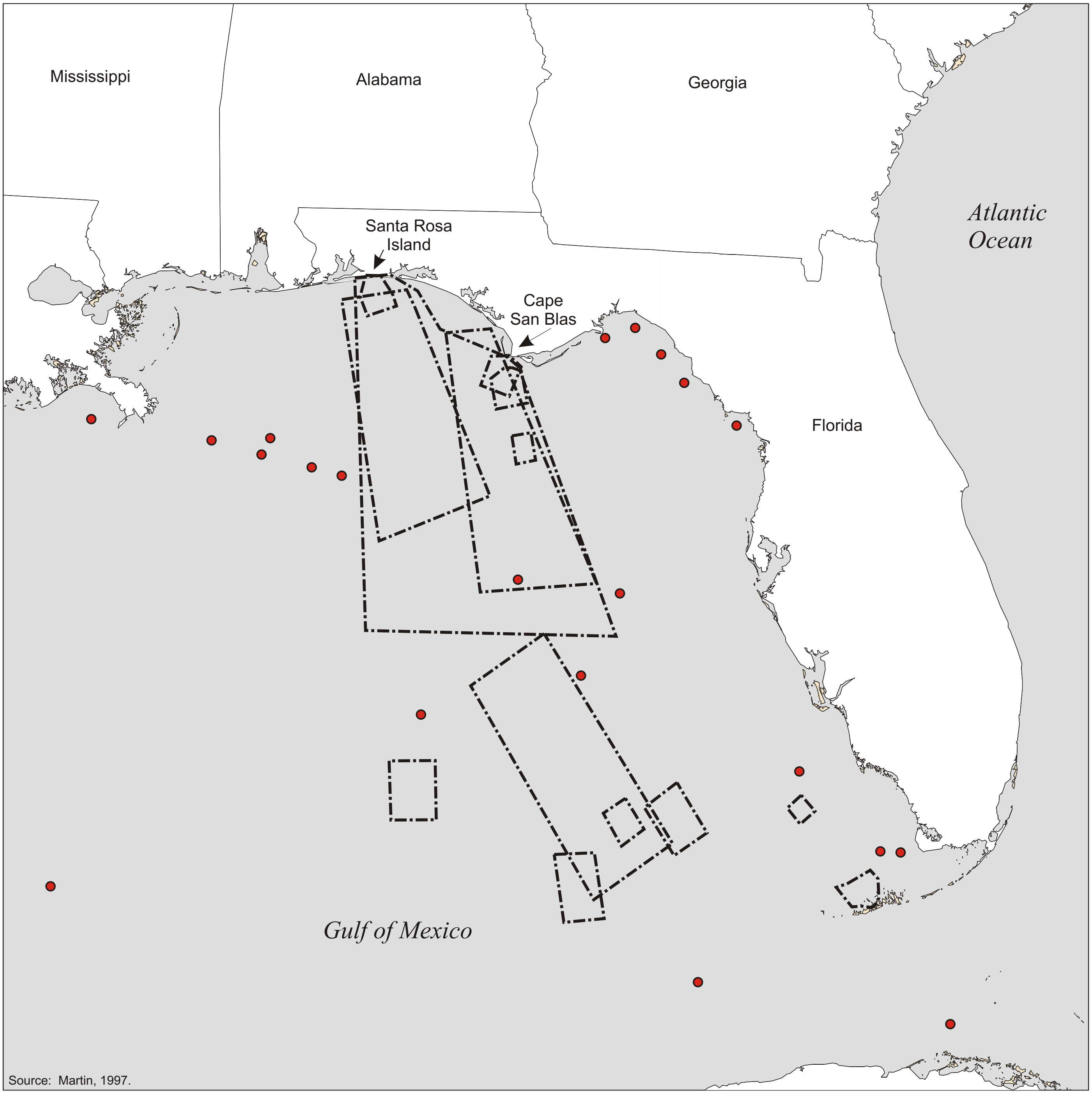
Site Preparation Activities

There would be no site preparation activities in the Gulf of Mexico that could have an impact on controlled and uncontrolled airspace, special use airspace, en route airways and jet routes, or airfields and airports in the ROI.

Flight Test Activities

Target missile and defensive missile trajectories would be at altitudes of 200 to 450 kilometers (124.3 to 279.6 miles), well above FL 600, and thus well above the Positive Controlled Airspace and the NAS airway system for the portion of the launch corridor that is within U.S. airspace. Target and defensive missile trajectories for the portion of the launch corridor outside U.S. airspace would also be well above the airspace subject to Article 12 and Annex 11 of the ICAO Convention. However, the designation and activation of booster drop areas in the launch corridor and intercept debris impact areas could have airspace use impacts that would essentially be the same for each of the four flight tests and missile intercept examples (figure 3.2.2-5). The LHA for Air Drop targets would be designed to contain all debris in the event of flight test termination within 40 seconds of flight.

The airspace in the ROI outside the 22.2-kilometer (12-nautical-mile) limit lies in international airspace and, consequently, is not part of the NAS. Because the area is in international airspace, the procedures of ICAO, outlined in ICAO Document 444, *Rules of*



EXPLANATION

Aircraft

Clearance Areas

Displacement of Aircraft - Single Point in Time - Examples 1 Through 4

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

NORTH

Figure 3.2.2-5

gom-6m-4as002

the Air and Air Traffic Services, are followed (International Civil Aviation Organization, 1985, 1994). ICAO Document 444 is the equivalent air traffic control manual to FAA Handbook 7110.65, *Air Traffic Control*. The FAA acts as the U.S. agent for aeronautical information to the ICAO, and air traffic in the overwater ROI is managed by the Houston, Jacksonville, and Miami ARTCCs and the Houston and Miami Oceanic CTA and FIRs.

There would be no impact to controlled or uncontrolled airspace in the launch corridor, as the TMD Extended Test Range program would not change or alter the status of this airspace and would not, even temporarily, reduce the amount of navigable airspace in the ROI.

Missile intercepts would be conducted primarily in the existing special use airspace in the eastern part of the Gulf of Mexico ROI. The eastern part of the ROI consists of Warning Areas W-151, W-155B, W-168, W-174, and W470 and EWTAs 1 through 6 (figure 3.2.2-1). Although the nature and intensity of use varies over time and by individual special use airspace area, the TMD program would not represent a direct special use airspace impact. Warning Areas consist of airspace over international waters in which hazardous activity may be conducted. This designation corresponds to the Danger Area designation of ICAO.

At this time it is anticipated that the existing Warning Areas in the western Gulf of Mexico (figure 3.2.2-1) would suffice for the anticipated TMD flight tests including Air Drop or air-launch targets. However, should additional Warning Areas be required to accommodate the flight testing, a Warning Area proposal would be submitted to the FAA regional air traffic division through the appropriate military representative well in advance of the desired effective date, in accordance with the processing procedures identified in FAA Order 7400.2D CHG 4, Chapter 30, Section 2. In accordance with EO 10854, Warning Area actions would also require coordination with the Departments of State and Defense.

The numerous airways and jet routes that crisscross the ROI would be affected by the TMD Extended Test Range program. All four of the flight test examples contained within the EWTAs would temporarily close the J58-86, G26R875, A509, and A758 routes (and its proposed new extension) in the eastern part of the airspace use ROI. The proposed long—range air—launched target flight test originating off the Texas coast in the western Gulf of Mexico, with intercepts in Warning Area W-151, would also close the J177, A552, A649, B753, A766, A770, A626, and A321 routes, in addition to J58-86 and G26.

By far the busiest route is the J58-86 and G26, with approximately 500 aircraft each day using them to transit the Gulf of Mexico between St. Petersburg/Sarasota, Florida, and New Orleans/Leesville, Louisiana. All four flight test examples would close this route, and the other much less busy routes identified above, for up to 4 hours, not only for the actual flight test, but also to ensure that all intercept debris has settled to the Earth's surface (see section 2.1.4.5). Normally, as many as 92 flights on the J58-86 and G28 route alone could be affected. It is important to note that these re-routes begin in sufficient time, usually 1 hour prior to closure, to ensure that all aircraft are clear of the impacted area. Indeed, departing aircraft would be notified in time for them to take on any extra fuel required to accommodate the re-routing. While this would undoubtedly increase congestion over the mainland, and perhaps lead to some departure delays as the additional re-routed traffic is integrated into the air traffic control system, it would not be substantially different from the re-routing and delays occasioned by severe weather. Because the proposed flight tests would require a change from a regular flight course or altitude, it would represent a negligible impact to the ROI's en route airways and jet routes.

Before conducting a missile launch or intercept test, NOTAMs would be sent in accordance with AFMAN 11-208. In addition, to satisfy airspace safety requirements, the responsible commander would obtain approval from the Administrator, FAA, through the appropriate Air Force airspace representative. Provision is made for surveillance of the affected airspace either by radar or patrol aircraft. In addition, safety regulations dictate that hazardous operations would be suspended when it is known that any unauthorized aircraft have entered any part of the danger zone until the unauthorized entrant has been removed or a thorough check of the suspected area has been performed.

There are no airports or airfields in the EGTR airspace ROI.

Cumulative Impacts

TMD flight test implementation of a stationary altitude reservation (ALTRV) procedure for airspace utilization between the proposed CFAs above Cudjoe Key or Saddlebunch Keys in the south and Warning Area W-174 to the northwest would remove navigable airspace from the international airspace system for periods of as much as 4 hours, 24 times a year, for the duration of the program (figure 3.2.2-6).

For the Gulf of Mexico there would be incremental, additive cumulative impacts to the en route airways and jet routes, especially for the J58-86 and G28 route across the northern Gulf Mexico. When these Gulf routes are unavailable due to ongoing flight test operations, the traffic must be re-routed over land. This already results in congestion and departure delays from 30 to 45 minutes. If traffic is especially heavy or weather is impacting en route operations, delays can exceed an hour. The proposed action could marginally contribute to this congestion and delay during the proposed 24 test events per year. With each test event taking up to 4 hours, the Gulf of Mexico's affected en route airways and jet routes could experience cumulative impacts during 96 of a year's 5,110 daylight hours (0700 to 2100 EDT), or less than 2 percent of the total.

With air traffic generally expected to increase by less than 3 percent per year, and with a new jet route proposed by the FAA to accommodate the increased traffic across the Gulf of Mexico, the potential for cumulative impacts to en route airways and jet routes in the Gulf of Mexico is increased. The eventual implementation of the "free flight" concept allowing aircraft to fly more directly to their destination may make it more difficult to anticipate where individual aircraft are likely to be in the future, but the issuance of NOTAMs, radar and patrol aircraft surveillance, and positive air traffic control in the ROI would minimize the potential for cumulative impacts.

EXPLANATION

- - - - Enroute High Altitude Jet Routes

—— Enroute Low Altitude Airways and High Altitude Jet Routes

Clearance Areas

Scale 1:11,000,000

0 100 200 Miles

0 150 300 Kilometers

NORTH

Cumulative Effect of Clearance Areas on Jet Routes - Examples 1 Through 4

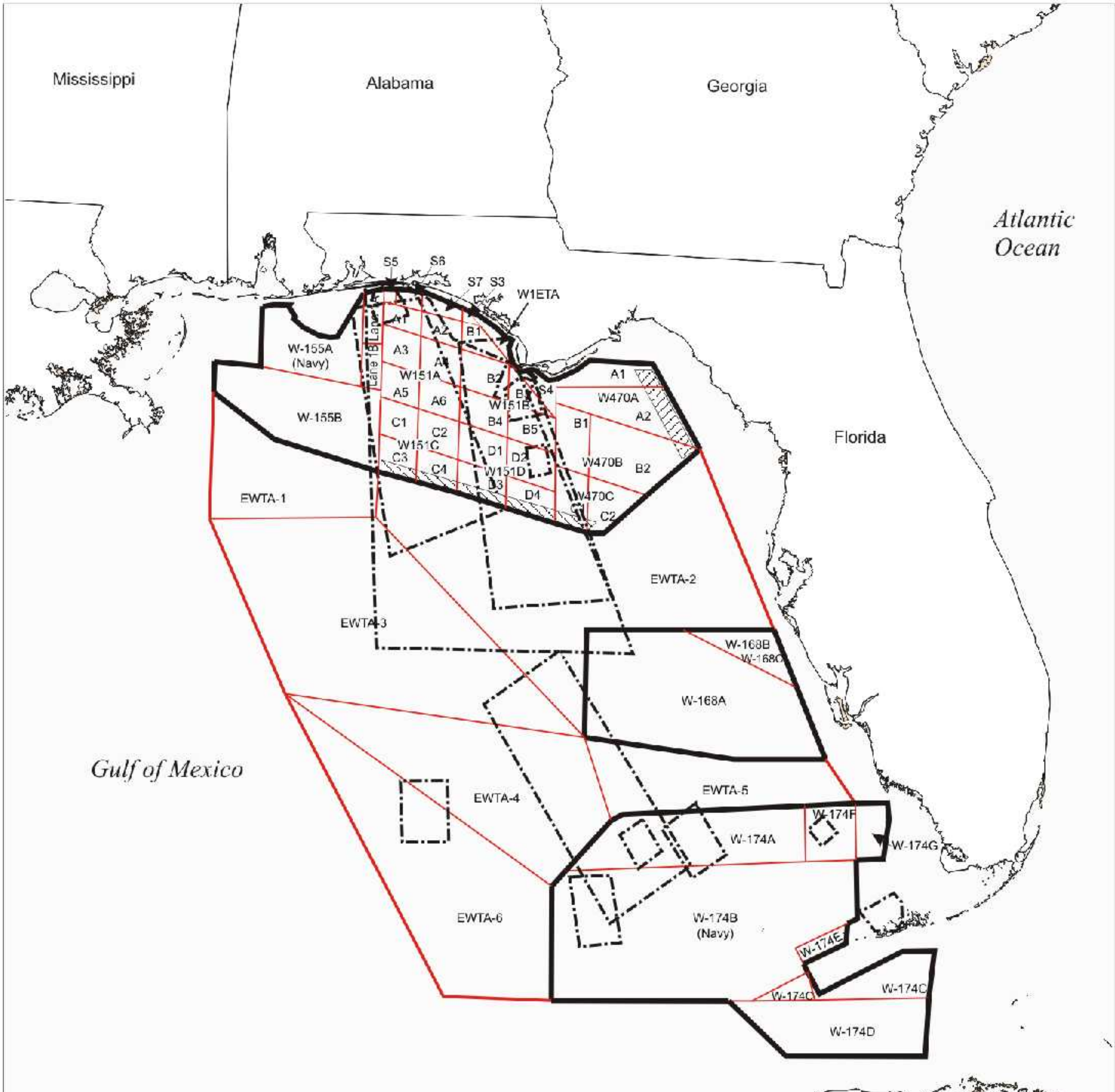
Figure 3.2.2-6

gom-11m-4as010

Eglin AFB is moving some of its live fire weapons testing to the Gulf of Mexico to accommodate the larger scale of safety footprint required for newer stand-off weapon systems. This trend toward increasing use of the Gulf of Mexico for large scale weapons testing will likely continue for the foreseeable future. TMD activities will be incorporated into the scheduling of special use airspace and warning areas along with the increased use of these areas by Eglin and Tyndall AFBs (figure 3.2.2-7).

Mitigations Considered

TMD flight test activities are within the current airspace use, and no mitigations are proposed.



Source: U.S. Department of the Air Force, 1995.

EXPLANATION

- Eglin Overwater Region of Influence
- Warning Area
- EWTA Eglin Water Test Area
- Thunder Area
- Lightning Area
- Clearance Areas

Notes: Lightning and Thunder Areas in W151 and W470 are deviation areas for Gulf Route 26 and J41-43, respectively, during severe weather.

Airspace is controlled by the FAA and scheduled and used by the Air Force and the Navy.

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

NORTH

Cumulative Effect of Clearance Areas on Special Use Airspace - Examples 1 Through 4

Figure 3.2.2-7

gom-8m-4as001

3.2.3 BIOLOGICAL RESOURCES

ite preparation activities for an offshore launch platform could cause hort-term impact on the sea floor, but this would be balanced by the habita onstructed for fish. Flight test activities could harm or harass marine mammal ith sonic booms from missile reentry.

3.2.3.1 Resource Description and Evaluative Methods

Native or naturalized vegetation, wildlife, and the habitats in which they occur are collectively referred to as biological resources. Refer to section 3.1.3.1 for a more in-depth description of biological resources. Appendix L describes the sensitive species found in the Gulf of Mexico affected by the proposed action.

3.2.3.2 Region of Influence

The ROI for the Gulf Flight Test Range is the area of the Gulf of Mexico that has the potential to be impacted by proposed activities, such as the LHA, the booster drop impact areas and debris impact areas.

3.2.3.3 Affected Environment

Vegetation

Marine vegetation such as seagrasses and benthic (bottom-dwelling) algae are attached to the bottom and are dependent on light. Therefore, they generally are found in shallow, sunlit depths of less than 18.3 meters (60 feet). Within the eastern Gulf of Mexico, the most common seagrasses are turtle grass (*Thalassia testudinum*), shoal grass (*Halodule wrightii*), and manatee grass (*Syringodium filiforme*). Less common species include stargrass (*Halophila engelmanni*) and paddle grass (*Halophila decipiens*) (U.S. Department of the Interior, 1997). Seagrass communities are further discussed below under sensitive habitats.

Wildlife

The Florida manatee (*Trichechus manatus*) is a Federal and state endangered species. Most of the manatees are located along the Atlantic shore of Florida, with smaller numbers occurring in the Florida Keys and along the Gulf of Mexico. The maximum number occurring in the vicinity of the Lower Keys is approximately six, and most of the time only one or two are present (Ackerman, 1997). The bottlenose dolphin (*Tursiops truncatus*) is the most common marine mammal in south Florida waters and feeds on fish in seagrass beds (U.S. Department of the Interior, 1982).

The Gulf sturgeon (*Acipenser oxyrhinchus desotoi*) is a Federally threatened fish that migrates from saltwater into large coastal rivers to spawn and spend the warm months. It is found predominately in the northeastern Gulf of Mexico from the Mississippi Delta east to Tampa Bay. This species is almost depleted throughout most of its range.

Analysis of stomach contents of the sturgeon suggests that this species could feed as far as 32.2 kilometers (20 miles) offshore (U.S. Department of the Air Force, 1996).

Other fish present in the Gulf of Mexico are shown in tables 3.2.3-1 and 3.2.3-2. Table 3.2.3-1 provides a list of fish species that are representative of species common to the Gulf of Mexico along the north Florida shore. Table 3.2.3-2 provides a list of fish species that are representative of species common to the Gulf of Mexico along the south Florida shore. Figure 3.2.3-1 depicts sensitive species and habitats in the overwater areas proposed for testing.

Table 3.2.3-1: Fish Species Common to the Gulf of Mexico Along the North Florida Shore

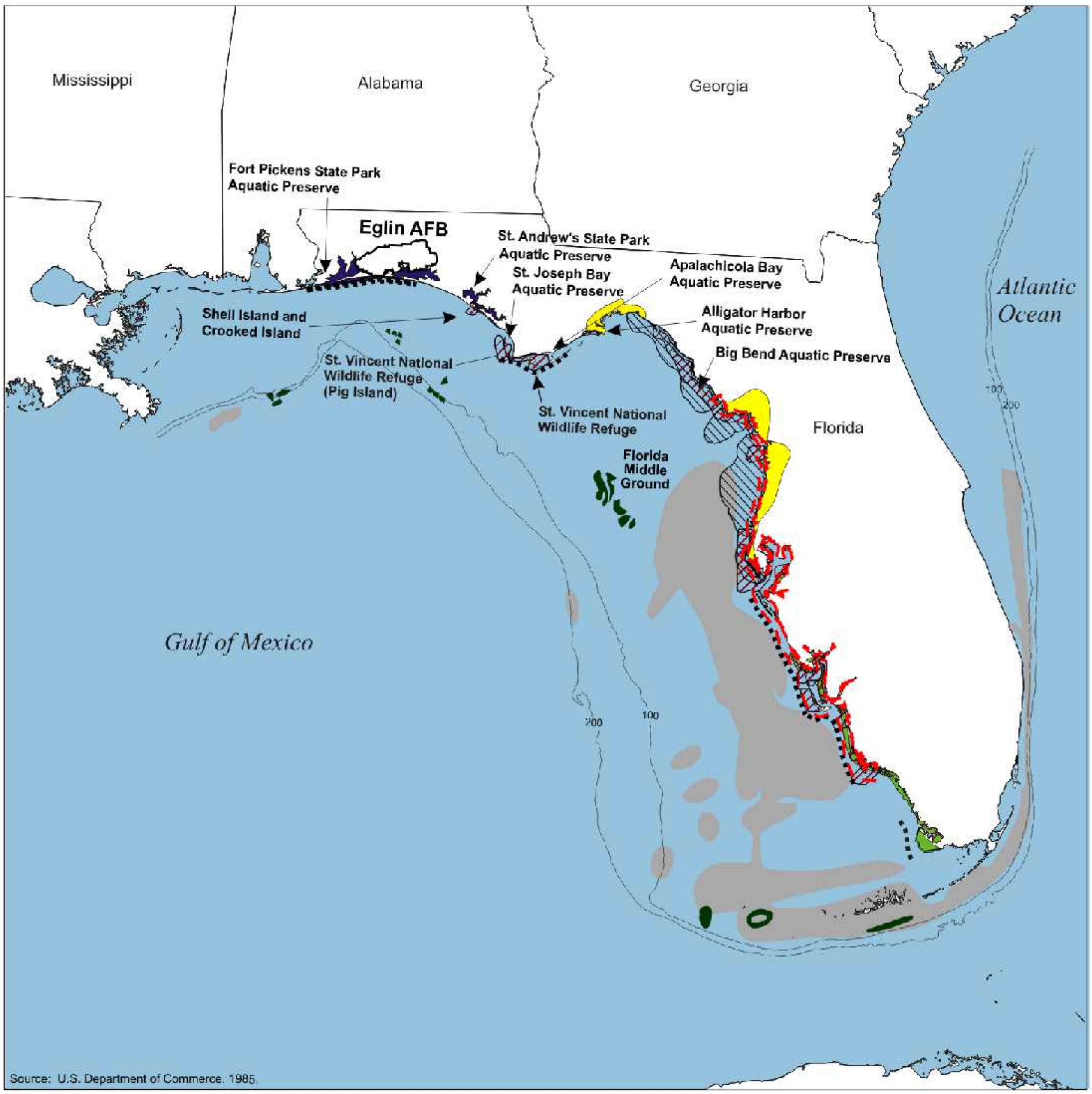
Scientific Name	Common Name
Alosa chrysochloris	Skipjack herring
Arius felis	Sea catfish
Eucinostomus argenteus	Spotfin mojarra
Micropogon undulatus	Atlantic croaker
Paralichthys albigutta	Gulf flounder
Pomatomus saltatrix	Bluefish
Scomberomorus cavalla	King mackerel
Scomberomorus maculatus	Spanish mackerel
Synodus foetens	Inshore lizardfish
Trachinotus carolinus	Florida pompano

Source: U.S. Department of the Air Force, 1992b.

Table 3.2.3-2: Fish Species Common to the Gulf of Mexico Along the South Florida Shore

Scientific Name	Common Name
Coryphaena hippurus	Dolphin
Epinelus morio	Red grouper
Lachnolaimus maximus	Hogfish
Lutjanus campechanus	Red snapper
Mycteroperca bonaci	Black grouper
Rachycentron canadum	Cobia
Scomberomorus cavalla	King mackerel
Scomberomorus maculatus	Spanish mackerel
Seriola dumerili	Greater amberjack

Source: U.S. Department of Commerce and National Oceanic and Atmospheric Administration, 1996.



EXPLANATION:

- Sea Turtle, Snowy Plover, Least Tern Nesting Areas
- West Indian Manatee Critical Habitat
- Bald Eagle Nesting Areas
- Saltwater Marsh and Possible Gulf Sturgeon and Salt Marsh Topminnow Habitat
- Known Coral Reef
- Mangrove
- Suspected Areas of Scattered Coral Heads, Banks, or Hard Bottoms
- Aquatic Preserve
- Seagrass Bed

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

NORTH

Depth in Meters

Sensitive Species and Sensitive Habitats in the EGTR

Gulf of Mexico

Figure 3.2.3-1

015a

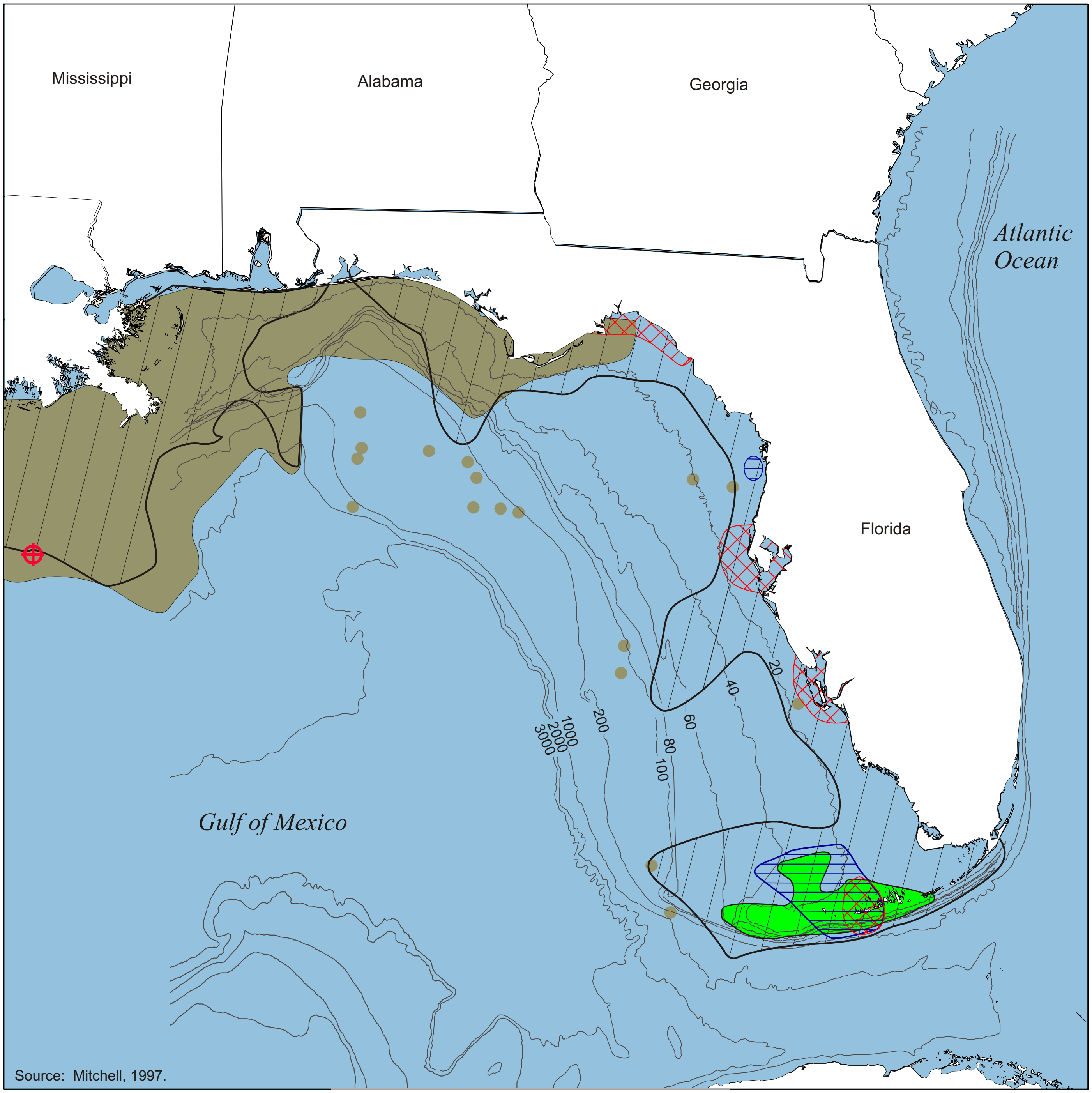
Five species of sea turtles (described in appendix L) are located in the Gulf of Mexico (table 3.2.3-3 and figure 3.2.3-2). The hawksbill (*Eretmochelys imbricata*) is seen regularly in the waters near the Florida Keys. The loggerhead is the most commonly seen sea turtle in the southeastern United States and may be found near underwater structures and reefs. Adult Kemp's Ridley turtles (*Lepidochelys kempii*) are usually confined to the Gulf of Mexico and have the most restricted distribution of any sea turtle. Green sea turtles occur throughout the Gulf of Mexico, but appear to be particularly common in the southern Gulf of Mexico region. Green sea turtles (*Chelonia mydas*) are frequently found in the Gulf of Mexico in areas where there is an abundance of seagrass. The leatherback sea turtle (*Dermochelys coriacea*), a migratory species that nests in the tropics, has a world-wide distribution (U.S. Department of the Air Force, 1996). Loggerhead and leatherback turtles are the most frequently sighted species.

Table 3.2.3-3: Species with Federal or State Status Known to Occur in the Gulf of Mexico Near the Proposed Project

		Status	
Scientific Name	**Common Name**	**State**	**Federal**
Marine Mammals			
Balaenoptera physalus	Fin whale	E	E
Balaenoptera borealis	Sei whale	E	E
Eubalaena glacialis	Right whale	E	E
Megaptera novaeangliae	Humpback whale	E	E
Physeter catodon	Sperm whale	E	E
Balaenoptera musculus	Blue whale	E	E
Trichechus manatus	Florida manatee	E	E
Turtles			
Caretta caretta	Atlantic loggerhead turtle	T	T
Chelonia mydas	Atlantic green turtle	E	E
Dermochelys coriacea	Leatherback turtle	E	E
Eretmochelys imbricata	Atlantic hawksbill turtle	E	E
Lepidochelys kempii	Kemp's Ridley turtle	E	E
Fish			
Acipenser oxyrinchus desotoi	Gulf sturgeon	SC	T
Fundulus jenkinsi	Saltmarsh topminnow	S	None
Menidia conchorum	Key silverside	T	None
Rivulus marmoratus	Mangrove rivulus	SC	None

E – Endangered
T – Threatened
SC – Species of Concern
Source: U.S. Department of Commerce, 1997; Atencio, 1993.

Most sea turtles in the Gulf of Mexico typically occur in relatively shallow nearshore waters close to coastal feeding and nesting areas. Exceptions are the leatherback turtle that is known to prefer deeper water and hatchlings that are likely to be found near Sargassum rafts (U.S. Department of the Air Force, 1996).



EXPLANATION

- Hawksbill
- Loggerhead
- and Kemp's Ridley
- and Leatherback
- Green

Depth in Meters

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

NORTH

Distribution of Sea Turtles

Northern Gulf of Mexico

Figure 3.2.3-2

gom-6m-3gen001c

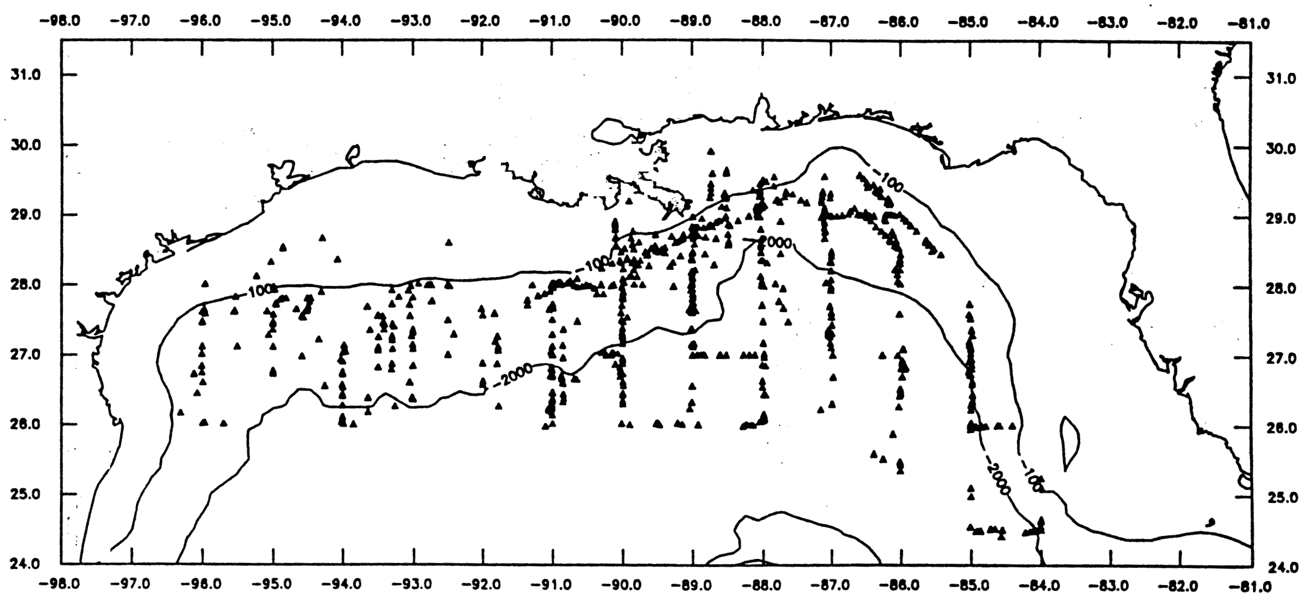
Six endangered species of whales (described in appendix L) have the potential to occur in the Gulf of Mexico: the fin whale (*Balaenoptera physalus*), Sei whale (*Balaenoptera borealis*), right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaeangliae*), blue whale (*Balaenoptera musculus*), and sperm whale (*Physeter catodon*). Figures 3.2.3-3 and 3.2.3-4 depict the location of cetaceans in the Gulf of Mexico and the locations of sperm whales in the Gulf of Mexico, respectively, during a 1992 and a 1993 survey. Table 3.2.3-4 depicts the estimated density of toothed and baleen whales in the EGTR.

Table 3.2.3-4: Distribution of Toothed and Baleen Whales in the EGTR (Northern Gulf of Mexico)

Name	Estimated Density (Individuals/Square Nautical Mile)
Toothed Whales	
Atlantic bottlenose dolphin	0.30511
Atlantic spotted dolphin	0.02766
Blainville's beaked whale	0.00009
Clymene dolphin	0.04796
Cuvier's beaked whale	0.00026
Dwarf sperm whale	0.00294
False killer whale	0.00328
Fraser's dolphin	0.00109
Gervais' beaked whale	0.00009
Killer whale	0.00195
Melon-headed whale	0.03413 (primarily outside EGTR)
Pantropical spotted dolphin	0.26961
Pygmy killer whale	0.00446
Pygmy sperm whale	0.00048
Risso's dolphin	0.02366
Rough-toothed dolphin	0.00733
Short-finned pilot whale	0.00304
Sperm whale	0.00456
Spinner dolphin	0.05437
Striped dolphin	0.04182
Baleen Whales	
Blue whale	0.00009
Bryde's whale	0.00027
Fin whale	0.00027
Humpback whale	0.00009
Northern Right whale	0.00009
Sei whale	0.00027

Source: U.S. Department of the Air Force, 1997.

Pelagic seabirds can be found throughout the Gulf of Mexico throughout the year. Numerous migratory or nonresident birds cross the Gulf of Mexico during summer and fall migrations.



Source: U.S. Department of the Interior, 1994.

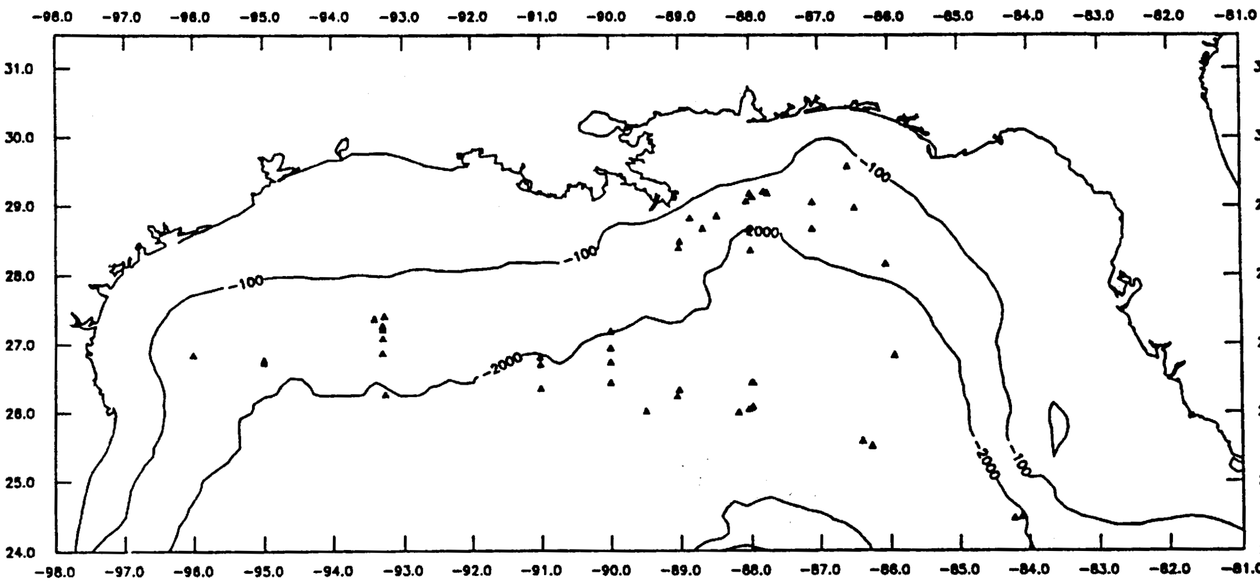
EXPLANATION

Locations (▲) of all Cetacean groups sighted during SEFSC marine mammal cruises in the northern Gulf of Mexico along the edge and off of the Outer Continental Shelf during 1992-1993.

Locations of Cetaceans (Whales and Dolphins)

Figure 3.2.3-3

cet001



Source: U.S. Department of the Interior, Mineral Management Service, 1994.

EXPLANATION

Locations (▲) of *Physeter macrocephalus*(Sperm Whale) groups sighted during SEFSC marine mammal cruises in the northern Gulf of Mexico along the edge and off of the Outer Continental Shelf during 1992-1993.

Locations of Sperm Whales

Figure 3.2.3-4

wha001

Approximately-two thirds of the breeding birds of the eastern United States migrate to Central and South America, Mexico, and the Caribbean. The migratory route for many of these species includes the Gulf of Mexico. All migratory birds are protected under the Migratory Bird Treaty Act. Fall migration occurs between September and October; spring migration peaks in late April. Some of the commonly observed migratory birds within the eastern Gulf of Mexico are listed in table 3.2.3-5. (U.S. Department of the Air Force, 1996)

Table 3.2.3-5: Examples of Eastern Gulf Migratory Birds

Scientific Name	Common Name
Anas discors	Blue-winged teal
Archilochus calubris	Ruby-throated hummingbird
Bartramia longicauda	Upland sandpiper
Bubulcus ibis	Cattle egret
Calidris fuscicollis	White-rumped sandpiper
Chaetura pelagica	Chimney swift
Chlidonias niger	Black tern
Dendroica striata	Blackpoll warbler
Falco peregrinus	Peregrine falcon
Oceanodroma spp.	Storm petrels
Puffinus spp.	Shearwaters
Tyrannus tyrannus	Eastern kingbird
Zenaida macroura	Mourning dove

Source: U.S. Department of the Air Force, 1996.

Sensitive Habitats

Seagrass habitats have been declining, according to recent studies, mainly in highly developed, industrialized, or populated areas. Most causes of decline are related to habitat alteration, such as dredging, wetland filling, and removal of submergent vegetation. Boating has also contributed to the direct destruction of seagrass habitat. Much of the seafood consumed in this country is dependent on seagrass community food chains. Seagrass beds serve as nurseries for juveniles of a variety of fin and shellfish. Seagrasses also stabilize sediments by reducing water velocity and forming a complex matrix that binds sediments and retards erosion (U.S. Department of the Interior, Minerals Management Service, 1990). Figure 3.2.3-1 shows locations of seagrass beds and other sensitive habitats along the coast of Florida.

Live-bottom communities are among the most widely distributed marine communities in Florida waters. Species vary throughout a range of depth and substrata, but algae, sponges, octocorals, and bryozoans are often dominant. The Florida Middle Ground is the best developed live-bottom habitat on the west Florida shelf. (Myers and Ewel, 1992)

In the lower Florida Keys, algal-dominated live-bottom communities are evident on the southern sides of islands. Octocorals such as *Pterogorgia anceps*, and stony corals such as *Siderastrea radians* are characteristic organisms. Dominant algae include species of *Jania*, *Amphiroa*, *Eucheuma*, *Gracilaria*, and *Laurencia*. (U.S. Department of Commerce and National Oceanic and Atmospheric Administration, 1996)

Extensive coral reefs occur offshore of the Florida Keys archipelago. Coral reefs also extend into the Gulf of Mexico from Key West to the Content Keys. Coral reefs thrive in relatively warm, clear waters with normal marine salinities. Corals derive nutrition from algae that require light. Most reef corals are colonial organisms. Two species of fire corals, or branching corals, occur on Florida reefs: the bladed fire coral (*Millepora complarata*) and the crenulated fire coral (*Millepora alcicornis*).

Octocorals, which include sea whips, sea plumes, sea fans, gorgonians, and soft corals, are found on most Florida Keys reefs. Sixty-three species of stony corals have been identified in the Florida Keys. Stony corals with octocorals form the reef canopy. Branching corals along with the reef framework provide shelter for fish. The coral canopy provides shelter from larger predators that occur along the reef margin. (U.S. Department of the Interior, Minerals Management Service, 1990)

The Florida Keys reefs occur on the Atlantic Ocean side of the Florida Keys and are not within the ROI. Bank reefs occur seaward of the Florida Keys off Key Largo and from Big Pine Key to Key West. The deepest portions of bank reefs are 37 to 40 meters (121.4 to 131.2 feet) deep. Coral reefs are vital to the economy of Florida. Commercial and recreational fishing depend on the many species that inhabit reefs during all or part of their life cycles. Healthy coral reefs act as self-tending breakwaters. Natural stresses, urban growth, and increased tourism have contributed to the reduced vitality of coral reefs. (U.S. Department of the Interior, Minerals Management Service, 1990)

Several areas or habitats in the Gulf of Mexico are afforded special protection or recognition. Aquatic preserves (figure 3.2.3-1) are state-owned submerged lands with outstanding biological or scientific features. These lands are managed to ensure that development activities are compatible with goals of resource protection. The Gulf Islands National Seashore was established in 1971 to preserve and maintain historic and natural features. It is composed of three mainland tracts in Pensacola and Gulf Breeze, Florida, and Ocean Springs, Mississippi, and 241.4 kilometers (150 miles) of islands from Ship Island, Mississippi, to Santa Rosa Island. (U.S. Department of the Air Force, 1996)

The Florida Keys National Marine Sanctuary consists of 7,251.4 square kilometers (2,800 square miles) of nearshore waters extending from just south of Miami to the Dry Tortugas. The Dry Tortugas were declared a National Park in 1992 and have the least disturbed coral reef system in the continental United States. The Dry Tortugas are not in the ROI. The Florida Middle Grounds contains the principal hard-bottom in the United States and is the northernmost extent of coral reefs in the Gulf of Mexico. This live bottom area supports a variety of species similar to typical Caribbean reef communities. The Florida Middle Grounds are sensitive to environmental change. (U.S. Department of the Air Force, 1996)

3.2.3.4 Environmental Impacts and Mitigations

No-action Alternative

Under the no-action alternative, the Gulf of Mexico in the region of the proposed project would continue to be used for military training exercises in the EGTR. Continuing Eglin AFB testing and training activities could result in changes to marine biological resources.

Site Preparation Activities

The construction activities for the launch platform alternative may include barge/ship activity, pile-driving, and/or installation of concrete piers. This may result in a temporary increase in marine water turbidity associated with disturbances of the ocean floor during the construction period. In addition, an underwater cable may be installed to transmit information to shore. However, this increase in turbidity would be short-term in nature, and would occur within only a few meters of the construction zone due to dispersion from ocean currents.

Vessel and construction noise could potentially cause marine mammals to avoid the area during the 8-month construction period. Increased human activities in the construction area could result in marine mammals and sea turtles avoiding the area and thus lessen impacts from noise propagation into the water column surrounding the launch platform.

The sites selected for platforms would be in areas that do not support seagrass beds or coral reefs and are not likely, therefore, to have high densities of marine mammals or sea turtles. Interceptor launch platforms would be installed approximately 8 kilometers (5 miles) offshore in approximately 30 meters (100 feet) of water. Installation of the platforms would result in the loss of minimal (less than 100 square meters [1,076.4 square feet]) marine benthic habitat. No coral or seagrass beds would be affected. The platforms would over time provide substrate for a wide variety of marine sessile organisms and increased habitat for fish and marine mammals. The installation of the offshore platforms would likely cause some mortality of small marine organisms. However, no larger mobile species are expected to be directly affected.

Installation of ESQD buoys would cause minimal habitat alterations and only short-term disturbances of marine organisms. Installation of the buoys and launch platforms would slightly increase the risk of fuel spills while the construction vessels are onsite.

Flight Test Activities

In addition to missile launches, several additional activities have the potential for impacts to biological resources due to proposed action activities. These may include limited aircraft patrols or surface patrols to ensure evacuation of safety areas and sea launch platform or airborne launch platform activities.

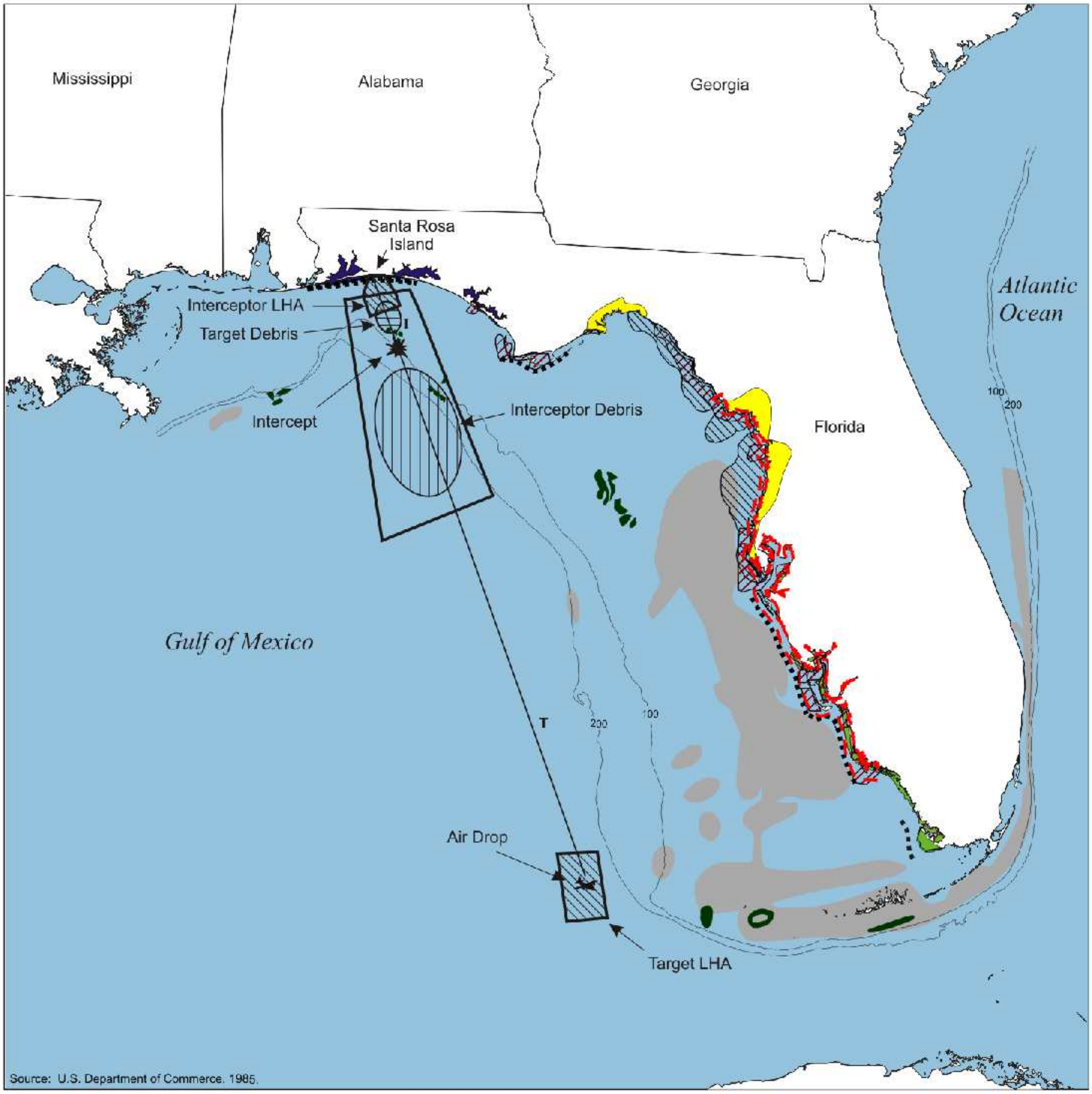
The potential impact to marine ecosystems within the Gulf Flight Test Corridor from expended booster motors, impact debris, or failed launches would be primarily associated with the corrosion of hardware and decomposition of solid propellants on the ocean floor.

Boats or helicopters would carry personnel and equipment to the platform for installation, checkout, and calibration prior to an event. The platform would not likely be manned during an event as interceptors could be launched remotely. The boat or helicopter traffic may cause a slight disturbance to marine mammals and sea turtles. Given the low density of whales and dolphins in the region, the activities are not likely to cause injury or harm to individuals.

During periods of high humidity, hydrogen chloride gas in the exhaust plume of the TMD missiles would dissolve into cloud water droplets, causing a temporary increase in rainwater acidity. If it were to rain shortly after a missile launch, the hydrogen chloride present in the exhaust plume would be dissolved in the rain droplets, which would result in a temporary reduction in rainfall pH. Depending on the buffering capacity of the receiving water, rainfall may result in an increase in surface water acidity. Increases in surface water acidity ranging from approximately pH 4.0 to 6.0 are generally believed to result in stress to marine life and possibly death (National Aeronautics and Space Administration, 1990). The degree and duration of any increased acidity in surface waters would depend on several variables, including surface water volume and alkalinity, as well as the amount and pH level of rainfall. It is expected that even for the most conservative case condition where all of the hydrogen chloride emission falls over the Gulf of Mexico, the pH level would not be depressed by more than 0.2 standard units for more than a few minutes. This effect would quickly dissipate with additional rainfall and mixing of the surface waters, thus ameliorating the slight potential for impact.

The real danger to any particular marine mammal, sea turtle, or migratory bird would be to be hit by a piece of debris with high kinetic energy while at the surface or flying through the area (figures 3.2.3-5 through 3.2.3-8). Figures 3.2.3-9 through 3.2.3-12 show potential locations of sea turtles in relation to examples of test scenarios. It is unlikely that a piece of sinking debris would have sufficient velocity to harm individual marine mammals or fish. Debris that hits the surface of the water would subsequently sink. Its behavior in the water will be similar to that in air, except slower. Pieces with a low coefficient of drag will sink quickly, and those with a high coefficient of drag will sink slowly. Eventually they will all settle on the bottom.

The GulfCET survey provides a density prediction for various species of cetacean for the entire northern Gulf of Mexico. Density distributions for specific areas within the Gulf of Mexico are not yet available. The density predictions are found in table 3.2.3-4. The probability of individual injury or mortality of a marine mammal or sea turtle also depends upon their density distribution within the Gulf of Mexico. Together, the distribution of debris for a single test event and the distribution of mammals means that there is an extremely remote probability of mortality for any single test event. All activities would be carried out in a manner that avoids to the maximum extent possible any adverse impacts on resources and qualities.



EXPLANATION:

- Sea Turtle, Snowy Plover, Least Tern Nesting Areas
- West Indian Manatee Critical Habitat
- Bald Eagle Nesting Areas
- Saltwater Marsh and Possible Gulf Sturgeon and Salt Marsh Topminnow Habitat
- Known Coral Reef
- Mangrove
- Suspected Areas of Scattered Coral Heads, Banks, or Hard Bottoms
- Aquatic Preserve
- Seagrass Bed

Depth in Meters

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

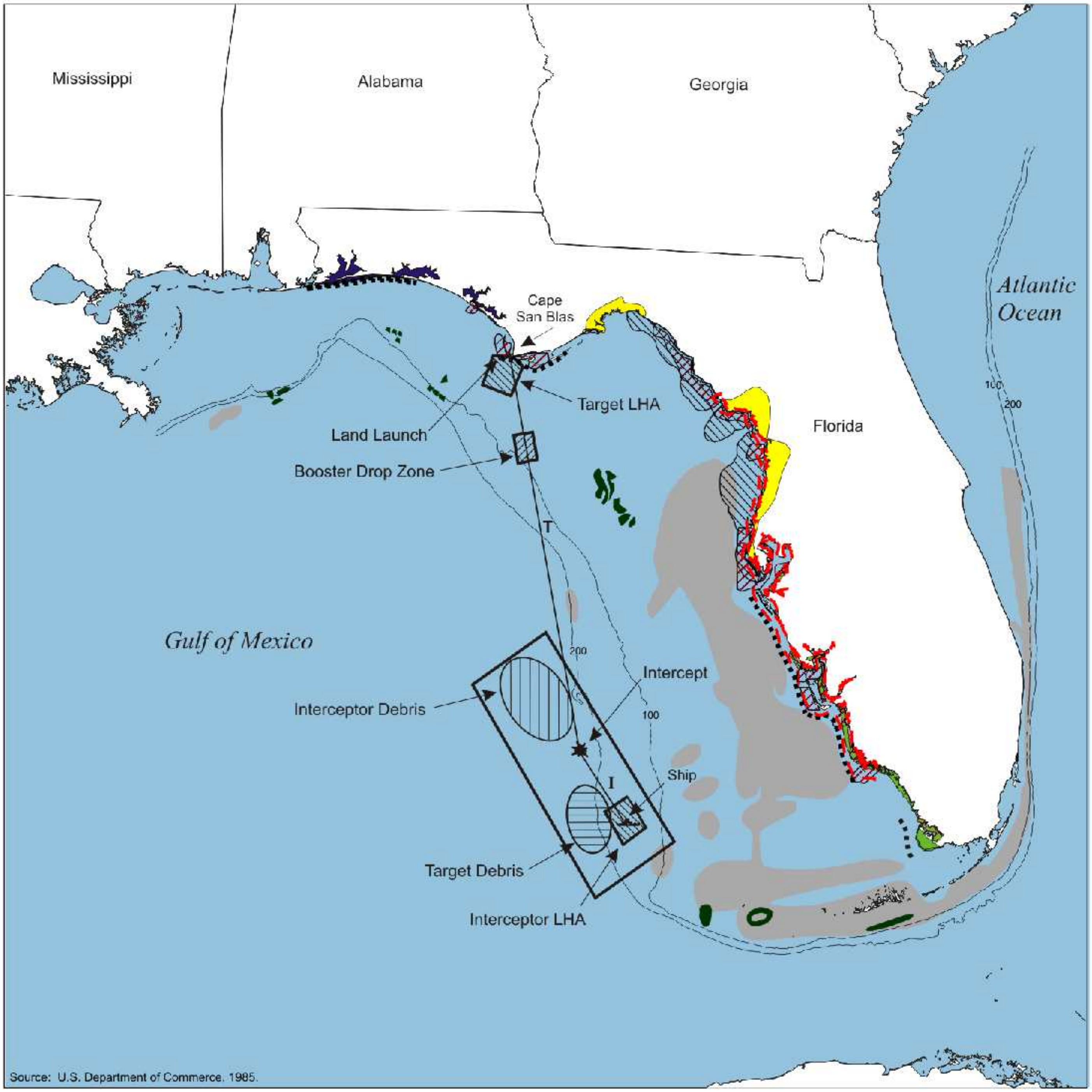
NORTH

Sensitive Species and Sensitive Habitats in the EGTR - Example 1

Gulf of Mexico

Figure 3.2.3-5

015a-ex1



EXPLANATION:

- Sea Turtle, Snowy Plover, Least Tern Nesting Areas
- West Indian Manatee Critical Habitat
- Bald Eagle Nesting Areas
- Saltwater Marsh and Possible Gulf Sturgeon and Salt Marsh Topminnow Habitat
- Known Coral Reef
- Mangrove
- Suspected Areas of Scattered Coral Heads, Banks, or Hard Bottoms
- Aquatic Preserve
- Seagrass Bed

Depth in Meters

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

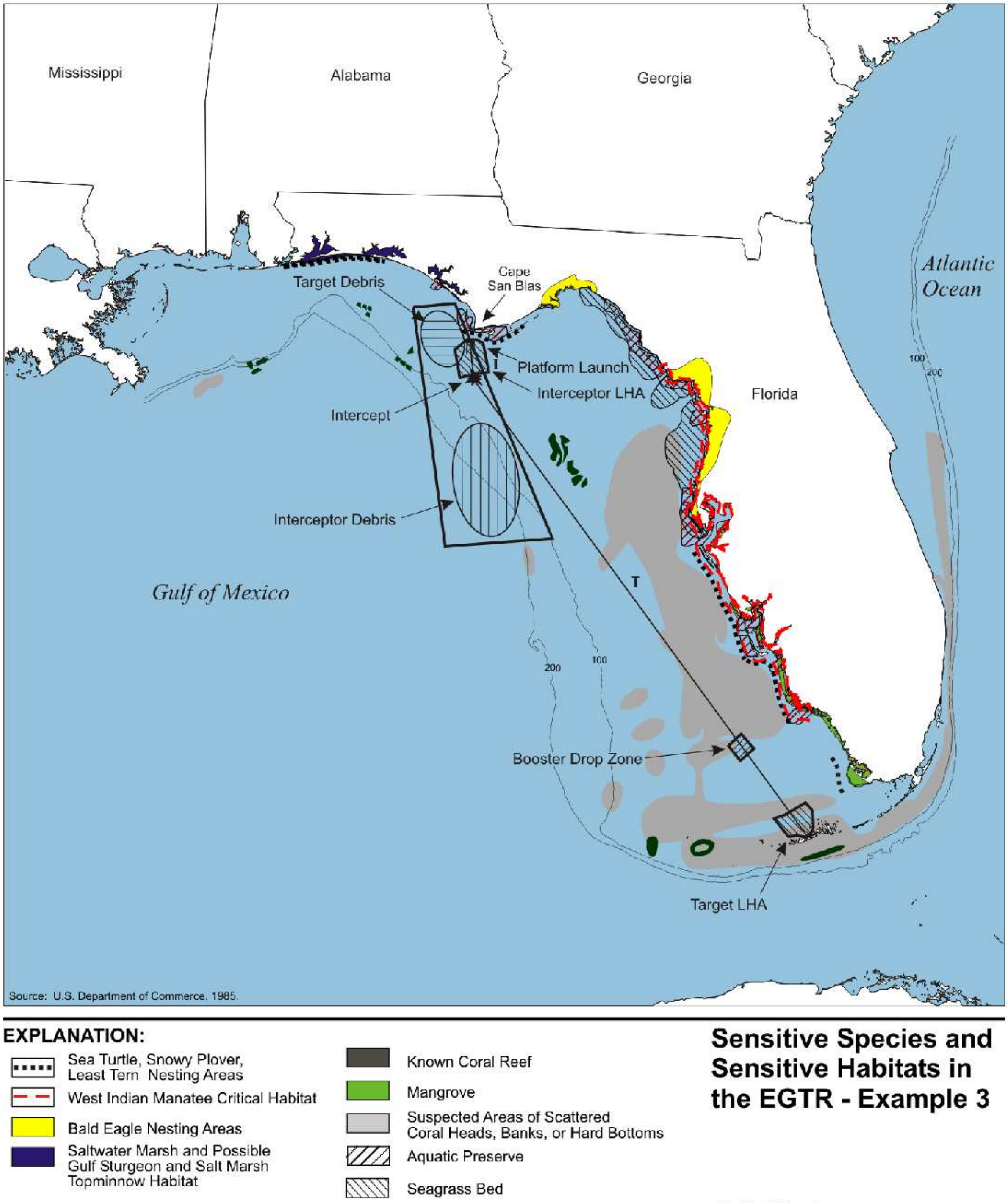
NORTH

Sensitive Species and Sensitive Habitats in the EGTR - Example 2

Gulf of Mexico

Figure 3.2.3-6

015a-ex2

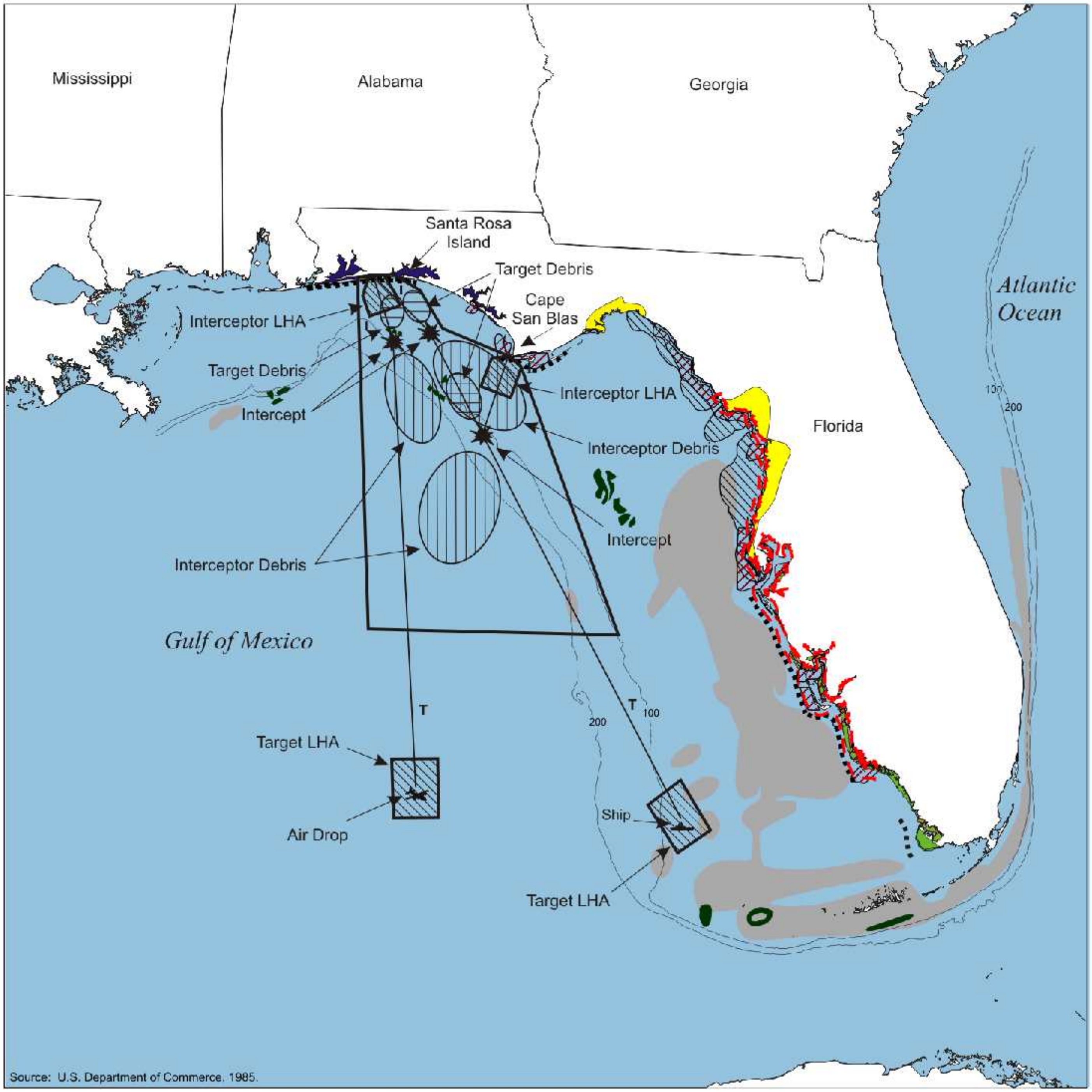


Sensitive Species and Sensitive Habitats in the EGTR - Example 3

Gulf of Mexico

Figure 3.2.3-7

015a-ex3



EXPLANATION:

- Sea Turtle, Snowy Plover, Least Tern Nesting Areas
- West Indian Manatee Critical Habitat
- Bald Eagle Nesting Areas
- Saltwater Marsh and Possible Gulf Sturgeon and Salt Marsh Topminnow Habitat
- Known Coral Reef
- Mangrove
- Suspected Areas of Scattered Coral Heads, Banks, or Hard Bottoms
- Aquatic Preserve
- Seagrass Bed

Depth in Meters

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

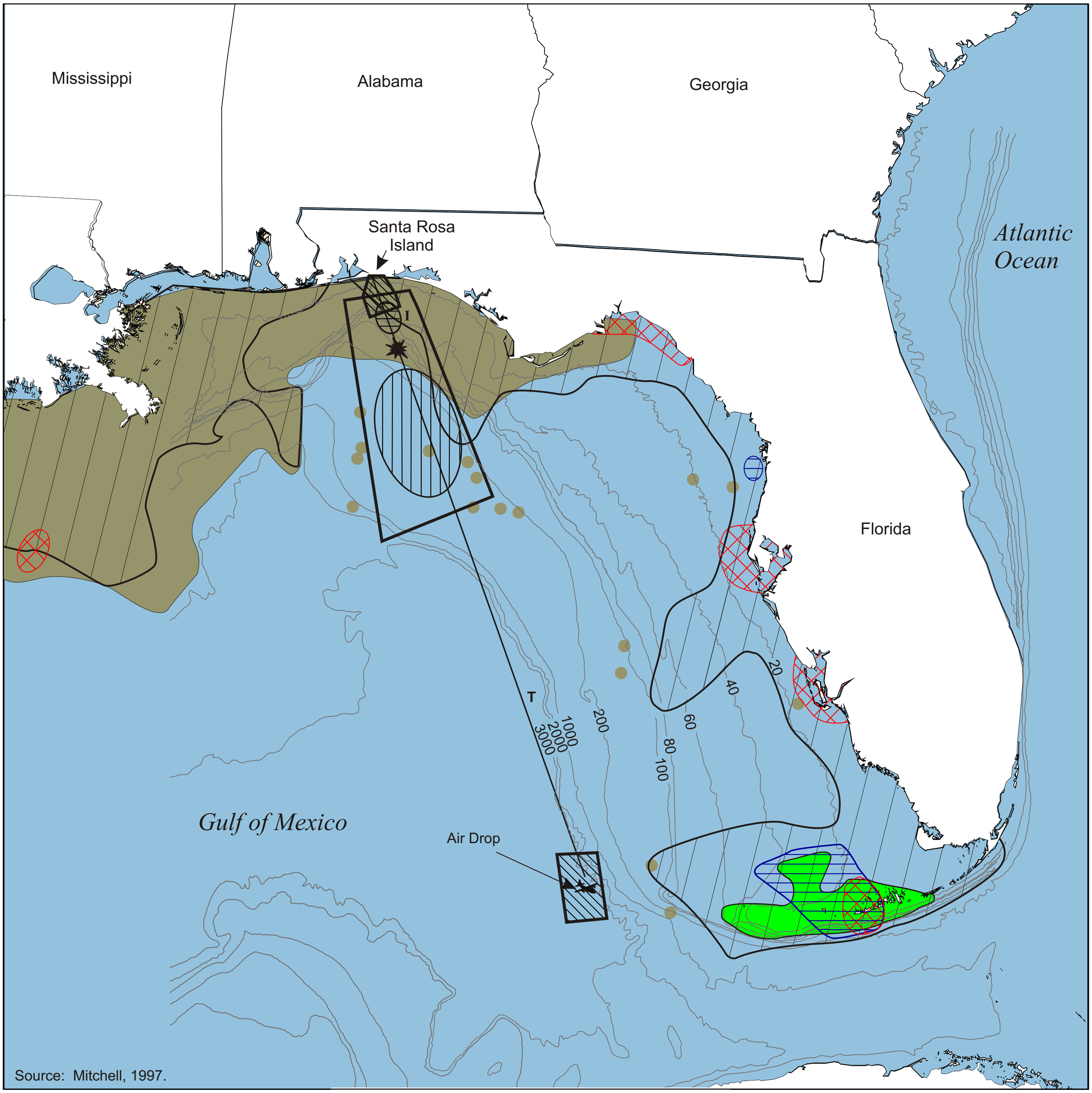
NORTH

Sensitive Species and Sensitive Habitats in the EGTR - Example 4

Gulf of Mexico

Figure 3.2.3-8

015a-ax4



Source: Mitchell, 1997.

EXPLANATION

- Hawksbill
- Loggerhead
- Kemp's Ridley
- Leatherback
- Green

Depth in Meters

- Interceptor Debris
- Target Debris
- Representative Evacuation Areas
- Launch Hazard Area
- Booster Drop Zone

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

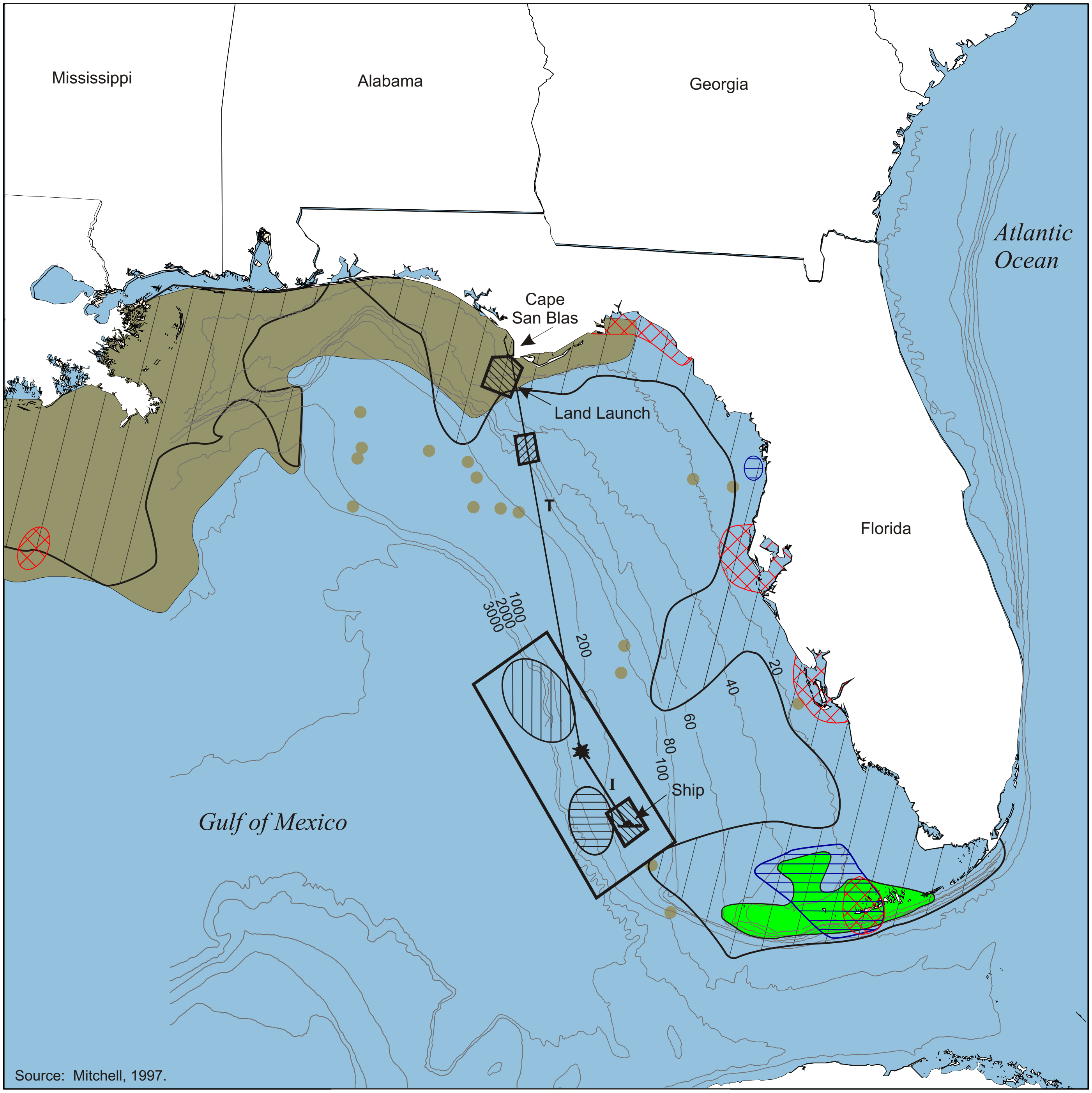
NORTH

Representative Effect on Sea Turtles - Example 1

Northern Gulf of Mexico

Figure 3.2.3-9

gom-6m-4gen008



Source: Mitchell, 1997.

EXPLANATION

- Hawksbill
- Loggerhead
- Kemp's Ridley
- Leatherback
- Green

Depth in Meters

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

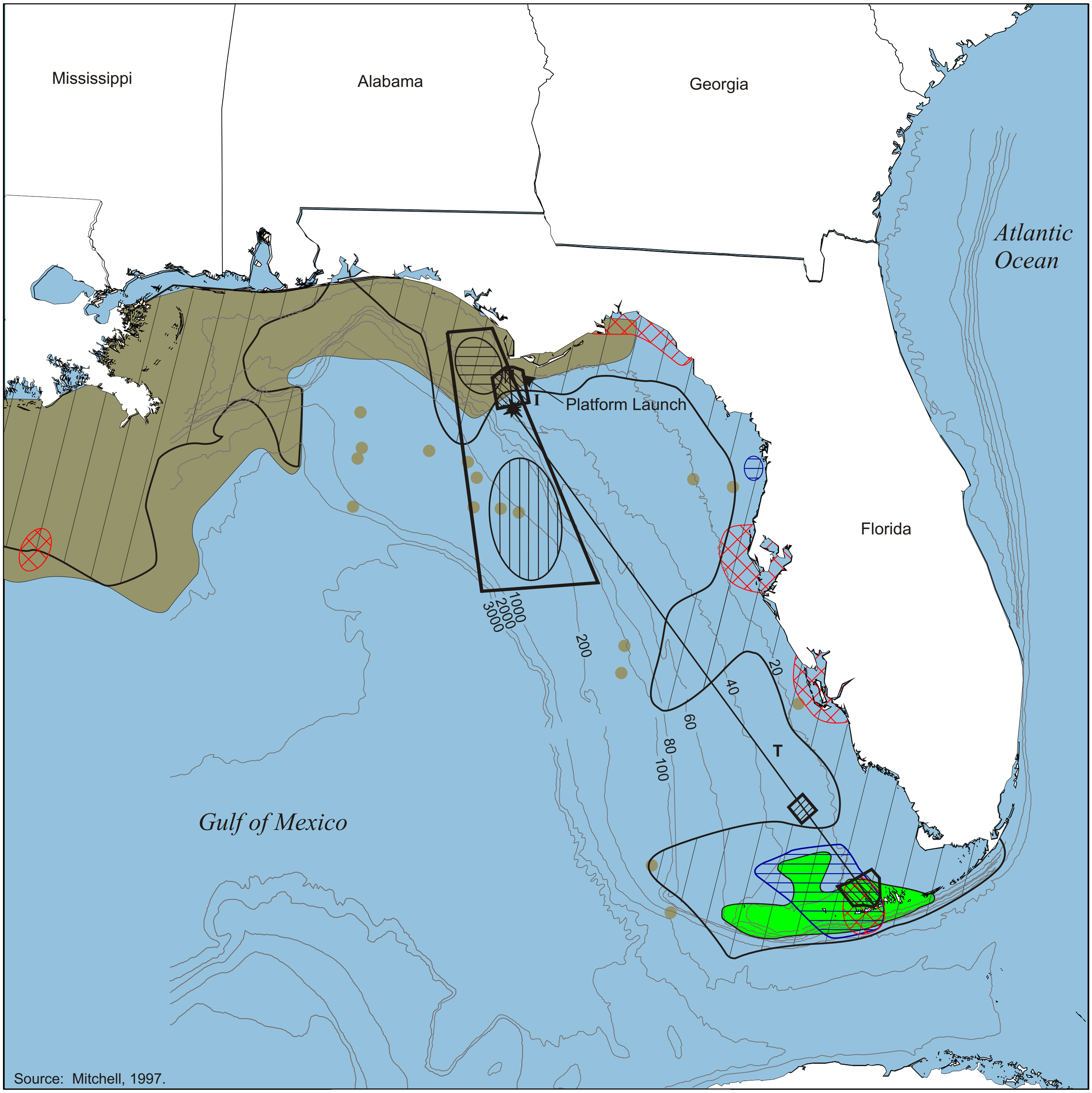
NORTH

- Interceptor Debris
- Target Debris
- Representative Evacuation Areas
- Launch Hazard Area
- Booster Drop Zone

Representative Effect on Sea Turtles - Example 2

Northern Gulf of Mexico

Figure 3.2.3-10



EXPLANATION

- Hawksbill
- Loggerhead
- Kemp's Ridley
- Leatherback
- Green

Depth in Meters

- Interceptor Debris
- Target Debris
- Representative Evacuation Areas
- Launch Hazard Area
- Booster Drop Zone

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

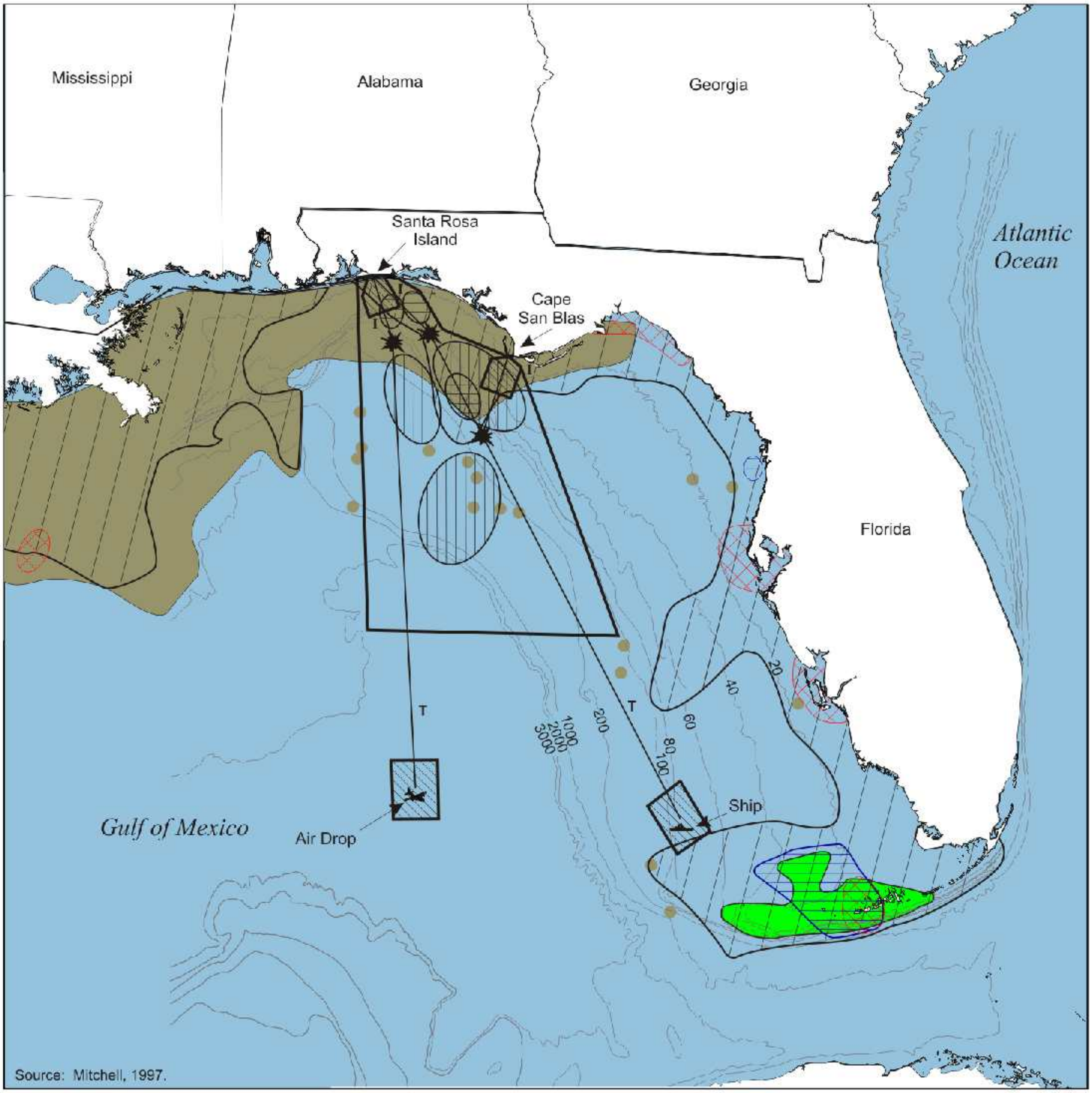
NORTH

Representative Effect on Sea Turtles - Example 3

Northern Gulf of Mexico

Figure 3.2.3-11

gom-6m-4gen010



EXPLANATION

Hawksbill
Loggerhead
Kemp's Ridley
Leatherback
Green
Depth in Meters

Interceptor Debris
Target Debris
Representative Evacuation Areas
Launch Hazard Area
Booster Drop Zone

Scale 1:6,000,000
0 50 100 Miles
0 100 200 Kilometers
NORTH

Representative Effect on Sea Turtles - Example 4

Northern Gulf of Mexico

Figure 3.2.3-12

gom-6m-4gen011

Because sensitive species tend to be widely scattered and occupy small surface areas, the chance of an individual animal being struck by the sled, expanded rocket stage, or debris would be remote and not likely to jeopardize the continued existence of any individual species.

In a successful intercept, both missiles would be destroyed by the impact. Momentum would carry debris along the respective paths of the two missiles until the debris falls to earth. The debris would consist of a few large pieces, 50 kilograms (100 pounds), of each missile, many medium pieces, 5 kilograms (10 pounds), and mostly tiny particles. This debris is subject to winds on its descent to the surface. The debris would generally fall into two elliptically-shaped areas. Most debris would fall to earth within 3 to 40 minutes after intercept, but some of the lighter particles may drift, airborne, for as long as 2 to 4 hours before landing.

Within several kilometers (miles) of the missile launch sites short duration, high level launch noise could be propagated into the nearshore waters. This noise may cause a reaction by marine mammals and sea turtles. However, no long-term reactions or effects are anticipated. Impacts from launch noise would be similar to those described in section 3.1.3.4.1, Launch Activities.

Interceptor missile launch peak noise levels would be approximately 115 dBA at 100 meters (328 feet) from the launch site (see figure 3.1.8-6). This noise is composed of a number of frequencies, known as incoherent sound. The physics of incoherent sound transmission through the air-water interface are not well understood; it is not, however, believed to be an efficient translation; therefore, a small proportion of the energy would translate into the water column.

In the event of a missed intercept, the target missile would continue, intact, on its trajectory. The target missile could generate a sonic boom. The target missile would reenter the atmosphere at velocities several times the speed of sound. It would decelerate due to atmospheric friction. If the interceptor fails to hit the target, the target may potentially still be traveling at supersonic speeds when it reaches the water of the Gulf of Mexico.

It is not anticipated that an interceptor missile would generate a sonic boom that would strike the ground or the surface of the Gulf of Mexico.

As a missile moves through the air, the air in front is displaced to make room for the missile and then returns once the missile passes. In subsonic flight, a pressure wave (which travels at the speed of sound) precedes the missile and initiates the displacement of air around the missile. When a missile exceeds the speed of sound, referred to as Mach 1, the pressure wave, which cannot travel faster than the speed of sound, cannot precede the aircraft, and the parting process is abrupt. As a result, a shock wave is formed initially at the front of the missile when the air is displaced around it, and lastly at the rear when a trailing shock wave occurs as the air recompresses to fill the void after passage of the missile.

The shock wave that results from supersonic flight is commonly called a sonic boom. A sonic boom differs from most other sounds because it is impulsive (similar to a double gunshot), there is no warning of its impending occurrence, and the magnitude of the peak levels is usually higher. Sonic booms are measured in C-weighted decibels or by changes in air pressure. For a vehicle flying straight, the maximum sonic boom amplitudes will occur along the flight path and decrease gradually to either side. Because of the effects of the atmosphere, there is a distance to the side of the flight path beyond which the sonic booms are not expected to reach the ground. This distance is normally referred to as the lateral cut-off distance.

Sonic booms will result during normal target flight; that is, they are planned occurrences. Depending upon the specific missile trajectory, if the interceptor misses the target, sonic booms of 0.10 kilopascal (2 pounds per square foot [psf]) would on average enclose an area of up to 11,257 hectares (27,816 acres) in the Gulf of Mexico. Sonic booms would occur over the Gulf and, other than possibly startling any sea birds within the immediate area, should not impact terrestrial wildlife.

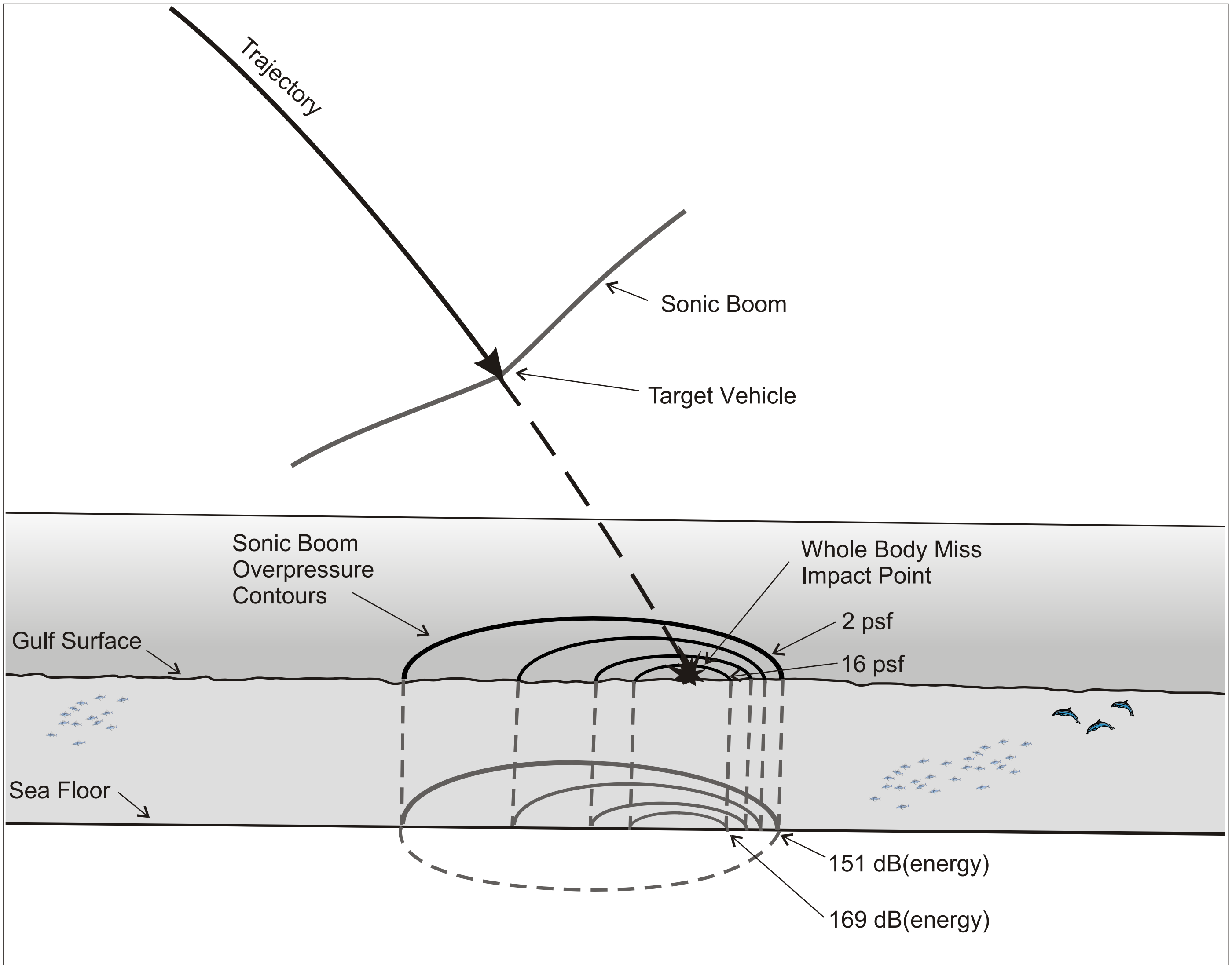
Analysis of potential impacts from sonic booms was based on the following methods/assumptions:

- A conservative intercept failure rate of 80 percent was used for analysis.
- Three representative Hera missile trajectories were provided and used to model sonic booms.
- U.S. Air Force PCBOOM3 modeling was used to compute sonic booms from these three representative trajectories.
- The differing areas that resulted from the PCBOOM3 modeling were averaged to provide a representative sonic boom footprint.
- Underwater noise levels were computed using assumed sonic boom duration of 250 milliseconds.

These methods/assumptions are based on representative data and result in a very conservative analysis. Sonic boom footprints would actually be unique for each test, depending on reentry angle, reentry speed, missile shape, and actual trajectory. The Hera missile is also intended to be intercepted during tests.

Estimated trajectories of the Hera missile from possible target-flight scenarios were used to compute resultant sonic booms. The sonic booms were computed using the U.S. Air Force's PCBoom3 software (Plotkin, 1996), which is a full ray tracing model. The resultant sonic boom calculations are depicted as contours of constant overpressure (see section 3.2.8.4, Noise).

In the event of a missed intercept, the sonic boom overpressures would translate into the water column with corresponding underwater noise levels (figure 3.2.3-13). These underwater noise levels were computed using an assumed sonic boom duration of 250 milliseconds.



EXPLANATION

2 psf (surface) = 151 dB re 1μPa^2- sec (underwater)
16 psf (surface) = 169 dB re 1μPa^2- sec (underwater)
psf = pounds per square foot

Effect of Sonic Boom Overpressures on the Water Column

Figure 3.2.3-13

034egl

The two different sonic boom contours illustrated in section 3.2.8.4 demonstrate the variability of sonic boom propagation. Each missile would propagate a unique sonic boom contour depending upon its mass, shape, velocity, and reentry angle, among other variables. The location of the possible impact point would vary depending upon the particular flight test profile. It is, therefore, difficult to predict the specific location, extent, duration, or intensity of sonic boom impacts upon marine life.

Table 3.2.3-6 presents the scientific data available on the densities of marine mammals within areas of the Gulf that could potentially be exposed to underwater sound pressure levels greater than 157 dB re 1 microPascal (μPa) caused by sonic boom overpressures. (With the assumption of a 20 millisecond duration, a sound pressure level of 157 dB re 1 μPa causes an energy referenced noise level of 151 dB re 1 microPascal^2-second [μPa^2-sec].) The population estimates and densities of toothed whales in table 3.2.3-6 were derived from NMFS Gulf of Mexico stock assessments. Information used in calculating minimum population estimates was provided by aerial and vessel surveys conducted by NMFS for cetaceans in the northern Gulf of Mexico. The area surveyed was approximately 116,169/nm^2, a larger area than that represented by the representative sonic boom footprints used for this analysis. Therefore, the densities listed may not accurately represent the actual numbers of cetaceans likely to be in the EGTR. Impacts could be under- or over-estimated, depending on the actual species densities within the test area. For the purposes of this analysis, marine mammals are assumed to be distributed evenly across the Gulf of Mexico. (U.S. Department of the Air Force, 1997)

The only population estimates available for baleen whales are those for the Bryde's whale. This population estimate was used to develop a density estimate for the other baleen whales, a value that was subsequently refined during coordination with NMFS. Density estimates for fin and sei whales are approximately the same as those for Bryde's whales. The other species of baleen whales have been sighted only rarely and are collectively estimated at 0.00015/nm^2, or 0.00005/nm^2 for each species. These density estimates are considered very conservative and represent an over-estimation. (U.S. Department of the Air Force, 1997)

Approximate regional locations of marine mammals are also given in table 3.2.3-6. Species were designated as usually occurring in the shelf area (S) of the Gulf at depths of 100 meters (328 feet) or less, on the edge of the Continental Shelf (E) at depths of 100 to 2,000 meters (328 to 6,562 feet), or on the plain (P) at depths greater than 2,000 meters (6,562 feet). Sufficient data does not exist to enable estimation of separate population densities for each geophysical region provided in table 3.2.3-6. Therefore, regional impacts are not determined, but a single estimated population density for the entire Gulf of Mexico for each species is provided. Species that are commonly located on the shelf or edge, such as the Atlantic bottlenose and Atlantic spotted dolphins, may not actually be affected by sonic booms if they occur farther than 2,000 meters (6,562 feet) off shore. In table 3.2.3-6, these species are listed as being within the 2 to 16 psf range of impacts.

Table 3.2.3-6: Distribution of Toothed and Baleen Whales in the EGTR (Northern Gulf of Mexico)

Name	Dominant Habitat	Estimated Density per nm^2	Number of Individuals Exposed* 2 psf 151 dB/ 157 dB	4 psf 157 dB/ 163 dB	8 psf 160 dB/ 166 dB	12 psf 163 dB/ 169 dB	14 psf 166 dB/ 172 dB	16 psf 169 dB/ 175 dB
Toothed Whales								
Atlantic bottlenose dolphin	E,S[1]	0.30511	10.0141	1.9568	0.6440	0.2711	0.0639	0.0164
Atlantic spotted dolphin	S	0.02766	0.9078	0.1774	0.0584	0.0246	0.0058	0.0015
Blainville's beaked whale	E	0.00009	0.0030	0.0006	0.0002	0.0001	0.0000	0.0000
Clymene dolphin	E,P	0.04796	1.5741	0.3076	0.1012	0.0426	0.0101	0.0026
Cuvier's beaked whale	E,P	0.00026	0.0085	0.0017	0.0005	0.0002	0.0001	0.0000
Dwarf sperm whale	E,P	0.00294	0.0965	0.0189	0.0062	0.0026	0.0006	0.0002
False killer whale	E,P	0.00328	0.1077	0.0210	0.0069	0.0029	0.0007	0.0002
Fraser's dolphin	E,P	0.00109	0.0358	0.0070	0.0023	0.0010	0.0002	0.0001
Gervais' beaked whale	E,P	0.00009	0.0030	0.0006	0.0002	0.0001	0.0000	0.0000
Killer whale	E,P	0.00195	0.0640	0.0125	0.0041	0.0017	0.0004	0.0001
Melon-headed whale	E,P	0.03413	1.1202	0.2189	0.0720	0.0303	0.0072	0.0018
Pantropical spotted dolphin	S,E,P	0.26961	8.8489	107292	0.5691	0.2395	0.0565	0.0145
Pygmy killer whale	E,P	0.00446	0.1464	0.0286	0.0094	0.0040	0.0009	0.0002
Pygmy sperm whale	E,P	0.00048	0.0158	0.0031	0.0010	0.0004	0.0001	0.0000
Risso's dolphin	E,P	0.02366	0.7765	0.1517	0.0499	0.0210	0.0050	0.0013
Rough-toothed dolphin	E,P	0.00733	0.2406	0.0470	0.0155	0.0065	0.0015	0.0004
Short-finned pilot whale	E,P	0.00304	0.0998	0.0195	0.0064	0.0027	0.0006	0.0002
Sperm whale	E,P	0.00456	0.1497	0.0292	0.0096	0.0041	0.0010	0.0002
Spinner dolphin	E,P	0.05437	1.7845	0.3487	0.1148	0.0483	0.0114	0.0029
Striped dolphin	E,P	0.04182	1.3726	0.2682	0.0883	0.0372	0.0088	0.0022
Baleen Whales								
Blue whale	E,P	0.00009	0.0030	0.0006	0.0002	0.0001	0.0000	0.0000
Bryde's whale	E,P	0.00027	0.0089	0.0017	0.0006	0.0002	0.0001	0.0000
Fin whale	E,P	0.00027	0.0089	0.0017	0.0006	0.0002	0.0001	0.0000
Humpback whale	E,P	0.00009	0.0030	0.0006	0.0002	0.0001	0.0000	0.0000
Northern Right whale	E,P	0.00009	0.0030	0.0006	0.0002	0.0001	0.0000	0.0000
Sei whale	E,P	0.00027	0.0089	0.0017	0.0006	0.0002	0.0001	0.0000
TOTALS (for one sonic boom)			**27.4046**	**5.3551**	**1.7625**	**0.7418**	**0.1750**	**0.0448**
TOTALS (for 19 sonic booms in one year)[2]			**521**	**102**	**33**	**14**	**3**	**1**
TOTALS (for 95 sonic booms in 5 years)[2]			**2,631**	**514**	**169**	**71**	**17**	**4**

*Number of individuals exposed to noise levels greater than or equal to an energy density of 151 dB re 1 μPa^2-sec/greater than or equal to an overpressure of 157 dB re 1 μPa for one sonic boom averaged over the three physiographic areas.
[1]E = Edge, S = Shelf, P = Plain
[2]Based on 24 test events per year, likely to be fewer.
Source: U.S. Department of the Air Force, 1997.

Table 3.2.3-6 depicts a conservative estimate of the number of individual marine mammals that could potentially be exposed to energy density value noise levels greater than or equal to 151 dB re 1 μPa^2-sec for one sonic boom averaged over the three physiographic regions. The number of sonic booms per year was determined by using an 80 percent missed intercept rate.

Available information is generally insufficient to determine independently of experience whether, and at what distances, underwater sounds from various man-made sources will result in harassment that will adversely affect the behavior of different species of marine mammals. Also, there are currently no consistent standard protocols for measuring and reporting the levels and other characteristics of underwater noise that may adversely affect marine mammals. Little information is available on marine mammal hearing thresholds and how they respond to sound. Little marine mammal acoustical data exists because of the difficulty of the type of research necessary to understand the hearing sensitivities of marine mammals in their natural habitat.

The noise level thresholds of impact to marine life in general, and marine mammals in particular, are currently the subject of scientific debate. There is the possibility that underwater noise levels resulting from missile reentry sonic booms could affect some marine mammals or sea turtles in the Gulf of Mexico. A study referenced by NMFS in 60 FR 143 states that sonic booms having peak overpressures in the range of 138 to 169 dB (it is assumed that these values are referenced to 1 μPa) (0.23 to 12 psf) may cause a temporary hearing threshold shift (TTS) in marine mammals lasting at most a few minutes (U.S. Department of Commerce, 1995). Based on these levels, 10 Atlantic bottlenose dolphins, for example, could be subjected to TTS per sonic boom.

For Air Drop target launch, collisions with migrating birds could potentially occur because various species migrate at 1,524 meters (5,000 feet) AGL. Waterfowl migration takes place predominantly at night, although they may move at any time of day, at 1,525 meters (5,000 feet) AGL. Coastal and wetland areas support congregations of the species at dusk and dawn, and thus the greatest potential for impacts to migratory species would occur during launches conducted at these times, or at night.

Noise generated by the aircraft used in Air Drop target launches would be typical of and consistent with other numerous operations conducted currently over the Gulf of Mexico. The missile would be ignited at an altitude of 1,524 meters (5,000 feet) and would then rapidly ascend on a ballistic trajectory. Concentration of emissions would be transitory and rapidly dispersed and the probability of a sensitive marine species encountering or ingesting a toxic chemical/seawater solution is remote. Other potential impacts from an Air Drop launch would be similar to those occurring in the Gulf from land-launched missiles.

Under the Marine Mammal Protection Act, a "take" is defined as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." Small incidental takes may be authorized by the NMFS for periods up to 5 years, but only if the NMFS determines that the takes will have only a negligible impact upon the species in question. The likelihood of sonic boom impacts to marine mammals will be assessed before test activities commence. Based on this review, the agency may decide to seek Letters of Authorization to permit small takes as well as incidental harassment from NMFS.

Cumulative Impacts

The trend toward increasing the use of the Gulf of Mexico for large-scale weapons testing is likely to continue for the foreseeable future. In addition, natural gas and oil exploration, which has occurred in the Gulf of Mexico for nearly 40 years, is expected to continue at the current pace of development for the foreseeable future.

The Gulf of Mexico is rich in biological resources; of special interest are marine mammals, corals, and live bottoms. Construction of launch platforms offshore could cause short-term disturbance to the sea floor and adjacent marine life. The platform would cause no long-term emissions to the air or discharges to the water during its operational life. The probability of booster drops or intercept debris striking a surfaced marine mammal is extremely remote.

Booster drops and debris would take place in the Gulf of Mexico. Marine mammals are known to occur in the Gulf of Mexico, but the densities are on the order of 0.9224 individual pantropical dolphins per square kilometer (0.269 individuals per square nautical mile) to 0.0031 individual fin whales per square kilometer (0.00009 individuals per square nautical mile). The likelihood of a piece of debris or booster actually striking and killing one is considered remote. Debris from a normal flight would not result in impacts to seagrass beds or the reef.

Mitigations Considered

In compliance with Section 7 of the Endangered Species Act, AFDTC would consult with the USFWS and NMFS to ensure that program actions are not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of areas determined by the USFWS to be critical habitat. AFDTC would also, in coordination with the USFWS, NMFS, FDEP, FGFWFC, FDCA, and other appropriate agencies, establish and implement measures to mitigate impacts to any listed or otherwise protected species.

Prior to the selection of a location for the installation of an offshore interceptor launch platform, a live-bottom survey with a radius of approximately 1,500 meters (4,900 feet) would be conducted to ensure avoidance of significant sea bottom habitats.

3.2.4 CULTURAL RESOURCES

ite preparation activities have the potential to affect submerged prehistoric site r shipwrecks.

3.2.4.1 Resource Description and Evaluative Methods

Cultural resources for the Gulf of Mexico are defined to include submerged prehistoric sites and historic shipwrecks.

The potential for submerged prehistoric sites results from the gradual rise in sea levels, from a maximum low sea stand at approximately 16,000 B.C., to its current high stand at approximately 3000 to 1000 B.C. Cultural research for the Gulf indicates that humans have been present in the region from approximately 10,000 B.C., and would have exploited the shoreline environment. At 10,000 B.C. the coastline would have been approximately 45 meters (147.6 feet) below the present sea level (U.S. Department of the Air Force, 1995).

The area shoreward from the 45-meter bathymetric contour (figure 3.2.4-1) would, therefore, have a higher potential to contain buried and submerged sites.

Two criteria are used to evaluate the potential for submerged prehistoric sites within the high probability zone: the presence of submerged geologic features with a high probability of associated prehistoric sites, and the factors governing site preservation, such as storm erosion, currents, tidal movement, and sedimentation.

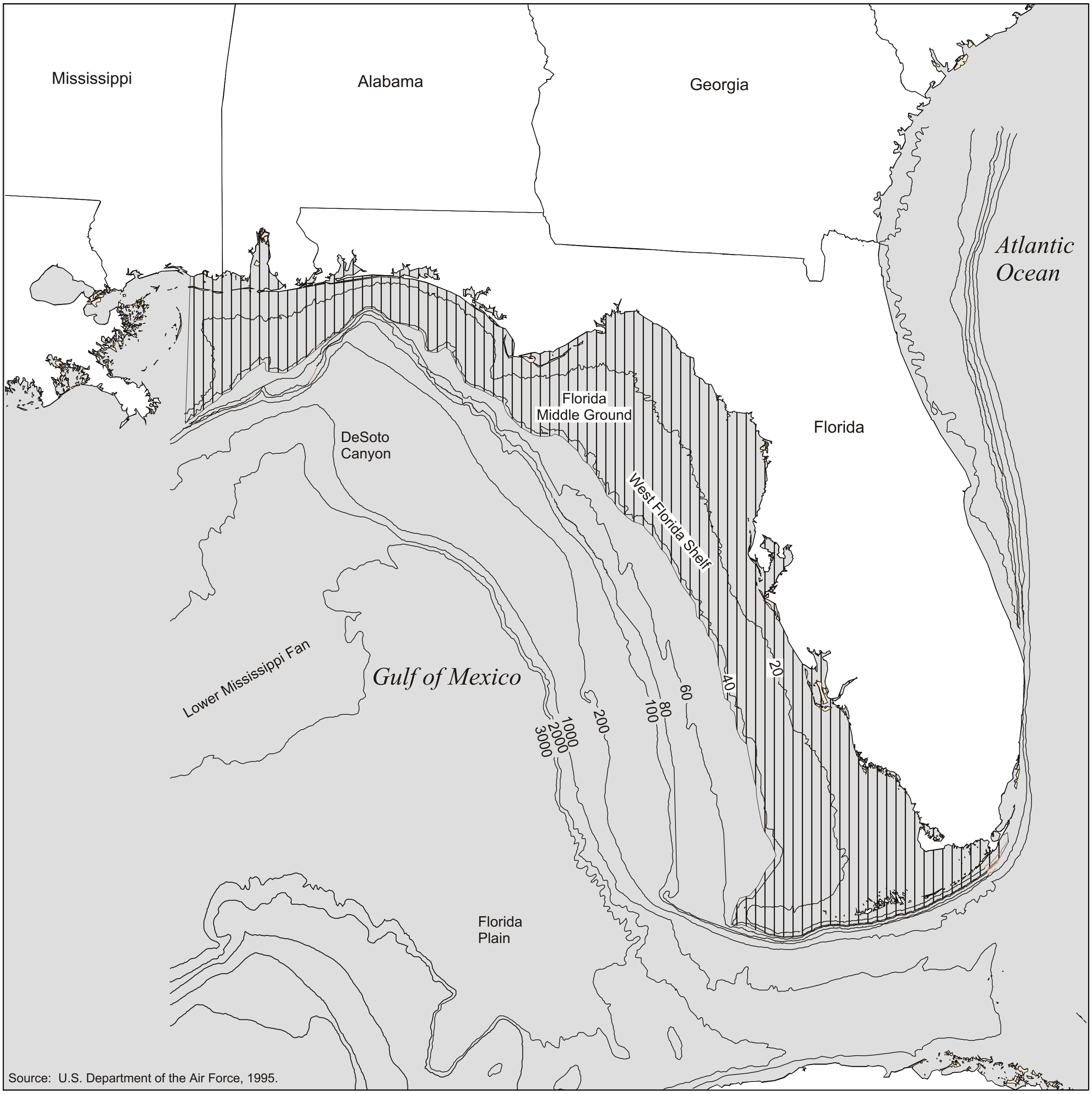
Two elements determine the potential for the presence of submerged shipwrecks: the geographic, economic, and atmospheric factors that govern the actual incidence of ship loss, and the factors that determine the preservation/integrity of the shipwreck once it lies on the ocean bottom. The integrity of the shipwreck is governed by the sea state, water depth, type of bottom, nature of adjacent coast, strength and direction of storm currents and waves, and the size and type of construction of the vessel (U.S. Department of the Interior, 1990).

The Minerals Management Service (MMS) has identified high probability zones for shipwrecks that include areas offshore from Pensacola and the Apalachicola-Cape San Blas areas (figure 3.2.4-2) (U.S. Department of the Interior, Minerals Management Service, 1990). (U.S. Department of the Air Force, 1995)

3.2.4.2 Region of Influence

The ROI for cultural resources in the Gulf of Mexico includes the area of the sea floor encompassed by the construction footprint of the proposed offshore platforms.

Candidate locations for the launch platforms are from 8 to 20.9 kilometers (5 to 13 miles) offshore from Site A-15 on Santa Rosa Island and 8 to 20.9 kilometers (5 to 13 miles) offshore from Site D3-A on Cape San Blas.



EXPLANATION

High Probability Zone

Depth in meters.

High Probability Zone for Prehistoric Archaeological Sites

Scale 1:6,000,000

0 50 100 Miles

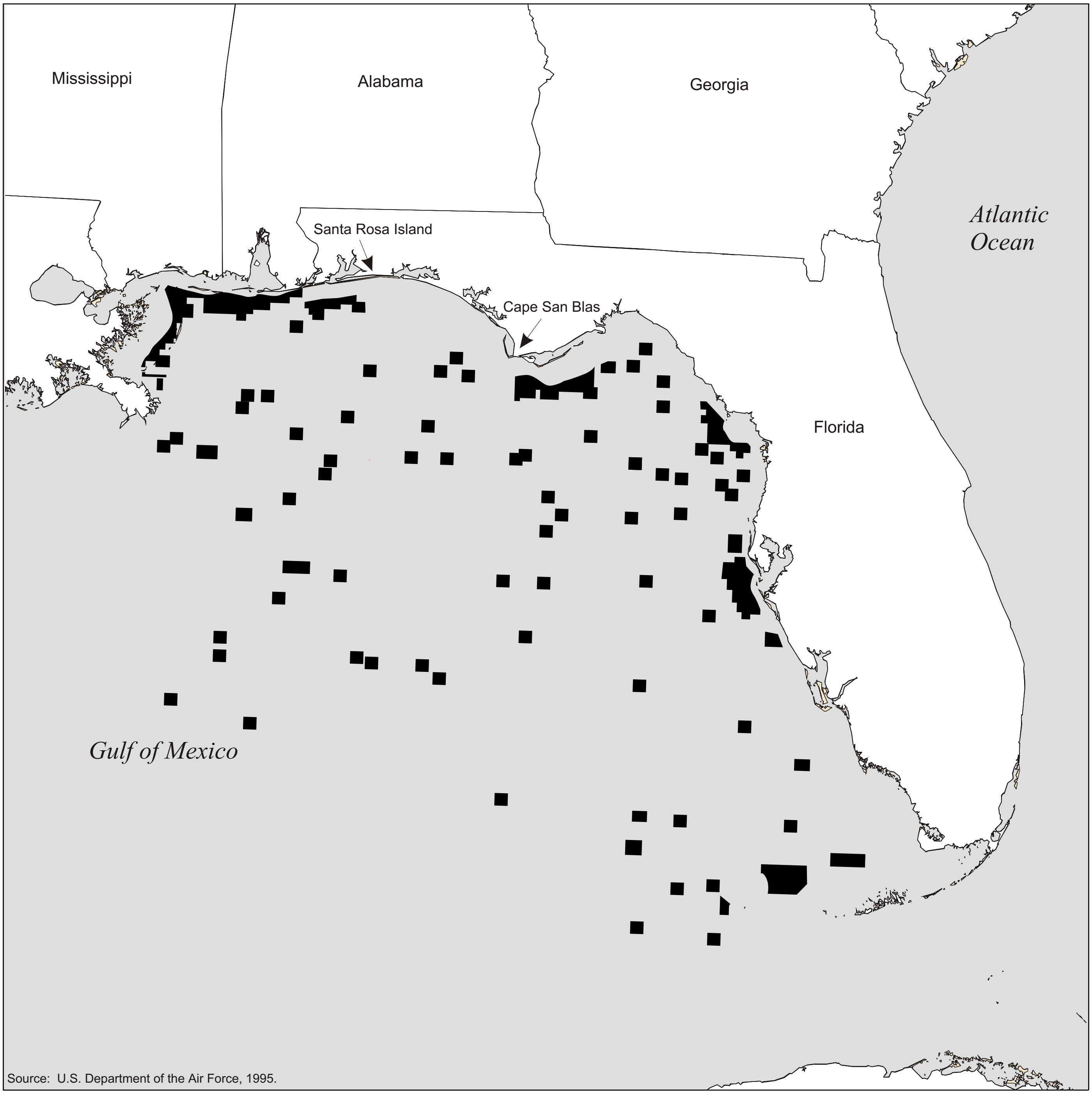
0 100 200 Kilometers

NORTH

Eastern Gulf of Mexico

Figure 3.2.4-1

Gom-6m-3cult001



EXPLANATION

■ High-Probability Zones Requiring a Historic Shipwreck Survey

High Probability Zones for Shipwrecks

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

NORTH

Eastern Gulf of Mexico

Figure 3.2.4-2

gom-6m-3cult002

Due to the wide dispersion of debris over the Gulf of Mexico, intercept debris areas and booster drop zones are included in the ROI for cultural resources.

3.2.4.3 Affected Environment

No systematic surveys for submerged prehistoric sites have been completed in the area of the ROIs for the Gulf of Mexico. Both the Cape San Blas and Santa Rosa Island ROIs are located in areas of high probability for submerged cultural resources as both are located within the 45 bathymetric contour that represents an approximation of the 10,000 B.C. shoreline.

The MMS high probability zones for historic shipwrecks developed by the MMS indicate that the ROI located offshore from Santa Rosa Island is in an area of low probability for the presence of historic shipwrecks. The ROI located offshore from Cape San Blas is located in an area of high probability for the presence of shipwrecks.

The ROIs composed of the intercept debris areas and booster drop zones consist of both high and low probability areas for submerged prehistoric and shipwrecks.

The existence of historic shipwrecks or submerged prehistoric sites or shipwrecks within the launch platform ROIs is unknown.

3.2.4.4 Environmental Impacts and Mitigations

No-action Alternative

Under the no-action alternative, the proposed TMD activities would not be implemented. Current operations at Eglin AFB would continue.

Continuing Eglin AFB operations in the Gulf of Mexico would have negligible effects on potentially eligible NRHP sites. Natural processes would continue to affect existing cultural resources within the Gulf.

Site Preparation Activities

The sea-launch platform for interceptor launches is another alternative to the preferred alternative. The proposed location of the sea-launch platform offshore from Santa Rosa Island is in an area of high probability for the presence of submerged prehistoric sites. Therefore, the construction of the launch platform has the potential to disturb undiscovered submerged prehistoric sites.

The proposed location of the sea launch platform offshore from Cape San Blas is in an area of high probability for the presence both submerged prehistoric sites and shipwrecks. Therefore, the construction of the launch platform has the potential to disturb undiscovered submerged prehistoric sites as well shipwrecks. In the event of contact of construction activities with a shipwreck such disturbance could result in the loss of archaeological data on maritime culture for the time period from which the ship dates. In the event of contact of construction activities with a prehistoric site such disturbance could result in the loss of data prehistoric migration, settlement patterns, and subsistence strategies.

Given siting survey requirements, TMD flight test activities would avoid affecting submerged cultural sites or shipwrecks.

Flight Test Activities

The potential for impact to submerged prehistoric sites and shipwrecks within the Gulf Flight Test Corridor from expended booster motors, impact debris, or failed launches exists for each of the alternatives considered. However, the possibility of these types of impacts occurring is very remote considering the wide distribution of shipwrecks and the low density of intercept debris as described in section 2.1.4.1. Similarly, Air Drop target launch would not be expected to affect submerged cultural resources.

Cumulative Impacts

Natural gas and oil exploration, which has occurred in the Gulf for nearly 40 years, is expected to continue at the current pace of development for the foreseeable future.

Current levels of sea floor disturbance could be increase by TMD activities. The potential for this increase to affect submerged cultural resources is expected to be very low.

Mitigations Considered

Should the sea launch platform launch alternative be selected, a review of the geophysical and geological oceanographic literature for information regarding the forces, processes, or physical factors that would influence the preservation of a shipwreck would be conducted in consultation with the appropriate agencies.

Bathymetric surveys would be performed to avoid drowned terrestrial sites for siting sea-launch platforms.

3.2.5 GEOLOGY AND SOILS

ite preparation activities for a launch platform would have a temporary impac n the nearshore sea floor.

3.2.5.1 Resource Description and Evaluative Methods

Geology and soils includes the evaluation of geology, topography, soil types, and oil and gas exploration and extraction within potential project offices. Refer to section 3.1.5.1 for a more in-depth description of geology and soils.

3.2.5.2 Region of Influence

The ROI for geology and soils in the Gulf of Mexico includes the ocean floor beneath the proposed offshore platforms and the ocean floor beneath the LHA, booster drop zones, and debris impact areas. Refer to section 2.2, Proposed Action, for a description of the flight corridor and debris impact areas.

3.2.5.3 Affected Environment

Submarine Geology

The continental margin in the project area is dominated by the Florida Platform, consisting of a massive sequence of carbonate and evaporite deposits. The nearshore sediments on the continental shelf are primarily sand-sized. Sediment grain size generally decreases to silt then clay with increasing depth to the southwest, toward to central Gulf of Mexico abyssal plain, and to the west, toward the Mississippi River delta (U.S. Army Space and Strategic Defense Command, 1994a).

Shelf deposits, marine deposits, and abyssal plain map units generally coincide with the sand-sized deposits on the continental shelf and the finer-grained deposits extending from the mouth of the Mississippi River to the abyssal plain. Quaternary deposits have accumulated from the deposition of the Mississippi River sediment load. Located away from these deposits, the continental slope, which starts at a depth of about 365 meters (1,200 feet) and continues to the abyssal plain, predominantly consists of older, Pliocene to Miocene-aged slope deposits. A relatively thin band of Cretaceous-aged slope deposits are exposed near the base of the continental slope (U.S. Army Space and Strategic Defense Command, 1994a).

The area has several regional-scale structural features, including the Apalachicola Embayment, the Ocala Uplift, and the South Florida Basin (U.S. Army Space and Strategic Defense Command, 1994a).

Geography and Geology

Pequegnat (1983) identified the major physiographic provinces of the Gulf of Mexico as the continental shelf, continental slope, the continental rise, and the abyssal plain. Within the eastern Gulf of Mexico, specific bathymetric features and regions include the Mississippi-Alabama Shelf, the West Florida Shelf, the DeSoto Canyon, the Florida Middle Ground, the Upper Continental Slope, the Florida Escarpment, the Lower Mississippi Fan, and the Florida and Sigsbee (abyssal) Plains (U.S. Department of the Air Force, 1996). Geologically, the continental margin of the Gulf of Mexico is separated into two parts—the Gulf Coast Geosyncline, east of Cape San Blas, and the West Florida margin. The surface, known as the Mississippi-Alabama-Florida (MAFLA) Sand Sheet is composed of patchy veneer of shell debris, forminifera, algal, and oolitic sands. This sand sheet also extends westward into the Mississippi delta. Another feature, the West Florida margin, comprising Jurassic Age carbonate and evaporitic rocks, also lies within this area. The clay mineralogy of the MAFLA and West Florida margin are dominated by smectite and kaolinite, respectively (U.S. Department of the Interior, Minerals Management Service, 1990). Hard bottoms, important geological and biological formations, are dispersed throughout certain areas of the shelf.

Physical Features

The outer continental shelf comprises submerged lands beyond the coastal state waters of the United States. The shelf has an enormous abundance of the flora and fauna as well as unique geological formations such as canyons and escarpments.

The continental slope drops off steeply from the continental shelf down to the edge of the abyssal plain. The topography of the slope is irregular, with numerous landforms and occasional large smooth areas (U.S. Department of the Air Force, 1996).

The abyssal plains cover more than 350,000 square kilometers (square miles) of seafloor. In the eastern Gulf of Mexico, the plain consists primarily of the area between the Campeche and Florida Escarpments.

The Mississippi-Alabama shelf extends from the southern Louisiana waters of the Chandeleur Islands eastward to Cape San Blas and southward to DeSoto Canyon, a moderately sloped submarine valley (figure 3.2.5-1). The shelf runs roughly parallel with the Florida Panhandle, breaking sharply southward at about 30°N latitude. The DeSoto Canyon is located near this shelf break (U.S. Department of the Air Force, 1996; U.S. Department of the Interior, Minerals Management Service, 1990). Geological features of the Mississippi-Alabama shelf include linear ridges, pinnacles, wave fields, spaced ridges, boulder fields, areas of patchy and extensive hard bottoms, and low to moderate topographic features (U.S. Department of the Interior, Minerals Management Service, 1990).

The West Florida Shelf is a broad expanse of the continental shelf extending approximately 200 kilometers (124.3 miles) out from the west Florida coast. The shelf stretches from Cape San Blas to the Florida Keys out to the 100-meter (328-foot) bathymetric mark. The Florida Middle Ground and Southwest Florida reef trend are located at the northern and southernmost ends of the shelf, respectively. A multitude of shelf-edge filled embayments and several basin structures are behind shelf-edge reef complexes at the edge of the Platform (U.S. Department of the Interior, Minerals Management Service, 1990).

EXPLANATION

Depth in meters(feet).

Geographical Features of the Eastern Gulf of Mexico Floor

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

NORTH

Eastern Gulf of Mexico

Figure 3.2.5-1

Gom-6m-3geo001

The deep ocean environment consists of three important geological formations: the DeSoto Canyon, the Florida Escarpment, and the Mississippi Fan. The Florida shelf is approximately 185 kilometers (115 miles) wide and gradually steepens from 80 meters (262.5 feet) to approximately 200 meters (656.2 feet). There is gentle sloping and then a slope down to 550 meters (1,804.5 feet). Along the slope, there are coral reefs, hills, and sand ridges (U.S. Department of the Air Force, 1996).

The DeSoto Canyon, situated 100 kilometers (62.1 miles) south (29°N-87°30'W) of Santa Rosa Island (U.S. Department of the Air Force, 1996), differs from most submarine canyons in that it has a gentle slope and is S-shaped (Pequegnat, 1983). The importance of the DeSoto Canyon as a channel for drawing nutrient rich water from deeper regions as well as influencing Loop Current intrusions has been suggested by Gilbes et al. (1996).

Some of the highest values for surface primary production in the Gulf of Mexico have been recorded from the DeSoto Canyon area (U.S. Department of the Interior, Minerals Management Service, 1990; U.S. Department of the Air Force, 1996).

Seismic reflected records of the Florida Escarpment show thick carbonate deposits. The largest structure within these deposits is the Middle Ground Arch. The arch is an east-west basement feature that separates the zone of diapiric structures (salt domes) to the west from the regions to the south which lack these features (U.S. Department of the Interior, Minerals Management Service, 1990).

In the east-central Gulf of Mexico, a vast fan-shaped area of seafloor known as the Mississippi Fan spreads 160,000 to 300,000 kilometers (99,422 to 186,416 miles) across the abyssal regions. The fan slopes near 1,200 meters (3,937 feet), at a 0.25-degree surface gradient until it merges with the Florida and Sigsbee abyssal plains. The Mississippi Fan marks the original watercourse of the Mississippi River and is the largest feature of its kind in all the world's oceans (U.S. Department of the Air Force, 1996).

3.2.5.4 Environmental Impacts and Mitigation

No-action Alternative

Under the no-action alternative, the proposed TMD test activities would not be implemented. Current operations in the EGTR would continue. Continuing Eglin AFB test and training activities would have a negligible effect on submarine geological resources.

Site Preparation Activities

The construction of the proposed launch platforms may result in a temporary disturbances of the submarine geologic substrate. However, this disturbance is expected to be confined to within a few meters of the footprint of platform supports and would be short-term in nature. As a result, impacts resulting from site preparation activities are considered negligible.

Flight Test Activities

The potential impact to marine substrate within the Gulf Flight Test Corridor from expended booster motors, impact debris, or failed launches would be primarily associated with the corrosion of hardware and decomposition of solid propellants on the ocean floor. The potential for these impacts would be the same with either Air Drop or land-based target launches.

Cumulative Impacts

Missile hardware typically consists of aluminum, steel, plastics, fiber-reinforced plastics, and electronic components. A large number of different compounds and elements are used in small amounts in rocket vehicles and payloads; for example, lead and tin in soldered electrical connections, silver in silver-soldered joints, cadmium from cadmium-plated steel fitting, and copper from wiring. The rate of corrosion of such materials is slow and due to the mixing and dilution rates in the water environment, toxic concentrations of metal ions within the geologic substrate would not result. In addition, miscellaneous materials (such as battery electrolytes) are present in such small quantities that only extremely localized and temporary effect would be expected (U.S. Army Space and Strategic Defense Command, 1994a).

Solid propellants are primarily composed of plastics or rubbers such as polyvinylchloride, polyurethane, polybutadiene, polysulfide, etc., mixed with ammonium perchlorate. The plastics and rubbers are generally considered nontoxic and, in the water, would be expected to decompose and disperse at a very slow rate. Due to dilution rates in the water environment, toxic concentrations of ammonium perchlorate within the geologic substrate would be expected only within a few meters (yards) of the source (U.S. Army Space and Strategic Defense Command, 1994a).

Cumulative Impacts

Natural gas and oil exploration, which has occurred in the Gulf of Mexico for nearly 40 years, is expected to continue at the current pace of development for the foreseeable future.

Mitigations Considered

Notification to oil companies operating drilling platforms in the clearance areas would be made in advance of any launches.

3.2.6 HAZARDOUS MATERIALS AND HAZARDOUS WASTES

Iazardous materials comprise approximately 1 percent of the mass of th ıissiles. Deposition of these materials in the Gulf of Mexico as a result of fligh ɜst activities would be in small amounts and will have no effect on the marin nvironment.

3.2.6.1 Resource Description and Evaluative Methods

Hazardous materials are used in a variety of operations and activities in the overwater test areas for Eglin AFB. Corrosion of these materials may deposit various metal ions into the water environment. Petroleum hydrocarbons, in the form of lubricants and petroleum-based products from the deterioration of plastic and rubber may also be released into Gulf of Mexico waters. Other components such as solid fuel propellants and electronic components may be released into the environment. (U.S. Department of the Air Force, 1995)

The materials used to construct munitions and missiles include aluminum, steel, plastics, fiber-reinforced plastics, and electronic components. A large number of other compounds and elements are used in smaller amounts in missiles and rocket vehicles and their payloads (for example, lead and tin in soldered electronic connections, silver in silver soldered joints, cadmium from cadmium-plated steel fittings, and copper from wiring).

Solid propellants are also generated in small amounts and are primarily composed of plastics or rubbers such as polybutadiene and ammonium perchlorate. However, plastics and rubber are generally considered nonhazardous. The ammonium perchlorate found in solid propellants is contained within the matrix of rubber or plastic.

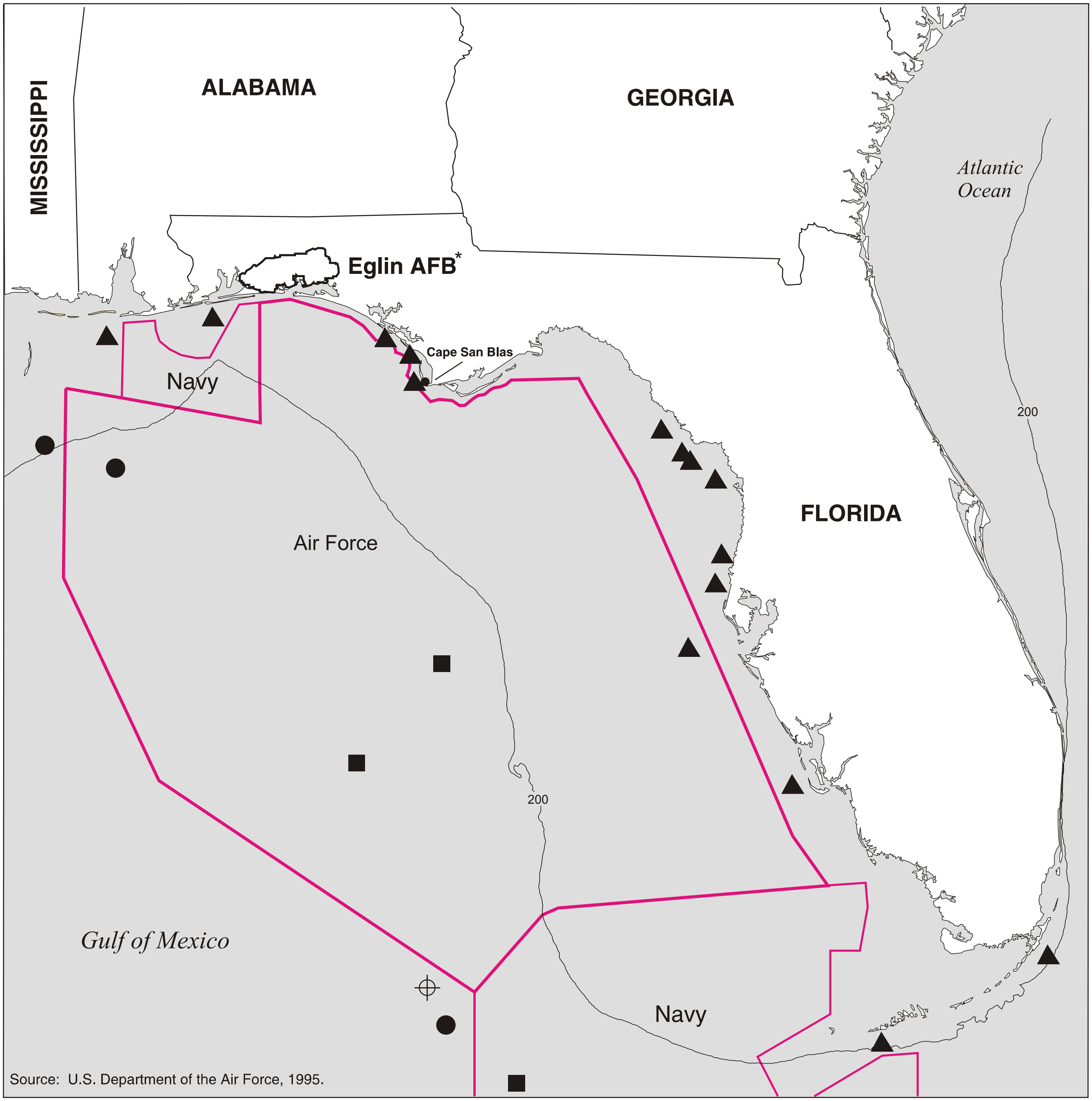
Refer to section 3.1.6.1 for a more in-depth description of hazardous materials and hazardous wastes.

3.2.6.2 Region of Influence

The ROI includes the ocean floor beneath the proposed offshore platforms, beneath the flight corridor and the booster motor, debris, whole body, and payload miss impact areas less than or equal to 183 meters (100 fathoms). Refer to section 2.3, Proposed Action, for a description of the flight corridor and debris impact areas.

3.2.6.3 Affected Environment

It is estimated that approximately 13.6 thousand metric tons (15 thousand short tons) of petroleum hydrocarbons enter the Gulf of Mexico each day from urban runoff. Figure 3.2.6-1 provides the locations of known active and inactive permitted hazardous substance disposal sites. These sites include hazardous waste, radioactive waste, and explosive ordnance disposal areas. The Air Force utilizes the Gulf of Mexico for weapon systems testing and development but is not known to have participated in ocean disposal of hazardous substances. (U.S. Department of the Air Force, 1995)



EXPLANATION:

- DoD Overwater Test Range Areas
- Explosives and Ammunition Disposal Site
- Industrial Wastes Disposal Site (Inactive)
- Dredged Material Disposal Site
- Radioactive Waste Disposal Site (Inactive)

*Note: Eglin AFB is not known to have participated in ocean disposal of hazardous substances.

Depth in Meters

Scale
0 39.4 78.7 Miles
0 63.5 127 Kilometers

NORTH

098egl

Permitted Hazardous Substance Disposal Sites

Gulf of Mexico

Figure 3.2.6-1

3.2.6.4 Environmental Impacts and Mitigations

No-Action Alternative

Under the no-action alternative, the proposed TMD test activities would not be implemented. Current operations in the EGTR would continue. Continuing Eglin AFB testing and training activities over the Gulf of Mexico would have minimal effects on hazardous wastes in the Gulf of Mexico.

Site Preparation

TMD site preparation activities associated with the construction of an offshore launch platform may release small amounts of hazardous materials into the marine environment. The installation of a prefabricated platform would be accomplished in approximately 1 month. Using the conservative estimate of shore construction hazardous waste generation rates this should release 100 kilograms (220.5 pounds) into the water.

Flight Test Activities

Normal TMD missile launch operations would produce small amounts of hazardous waste at EGTR. However, a launch mishap may result in the deposition of waste materials within the mission-designated LHA. These materials, as well as all nonhazardous debris, would be recovered. Any hazardous materials would be segregated and packaged for appropriate disposal following completion of any safety investigations. Disposal would be accomplished by the TMD program but is considered to be a not significant impact since such disposal would not be routinely encountered during TMD operations and would consist of only small quantities of solid propellant, partially damaged structural materials, and some flight components containing hazardous materials.

During successful intercept tests, it is expected that some missile components will impact into designated debris impact zones. Unsuccessful intercepts would also result in missile impact in separately designated impact zones. The types of hazardous material potentially produced as a result of either a successful or unsuccessful intercept are less numerous than those from a launch mishap, since it is expected that all solid and liquid fuels would have been expended. Table 3.2.6-1 displays the materials and Hera respective percentage of the weight of interceptor and target missiles. The remaining materials which could be considered hazardous waste would include only structural materials (beryllium) and some missile components (batteries). The hazardous waste impact of this debris would be not significant, since only small amounts of hazardous waste would be produced.

The target vehicles, whether Air Drop or land-launched, would consist of a steel housing assembly, optical sensors, guidance and control electronics, radio transmitters and receivers, a power supply (may include lithium or nickel-cadmium batteries), and a payload section for biological or chemical munition simulants, packaged either in bulk or submunitions. The MTV would also be equipped with stabilizer fins and cold-gas (nitrogen) thrusters to control roll, pitch, and yaw during final flight.

Table 3.2.6-1: Hazardous Materials Entering the Gulf of Mexico

Hazard			Hazardous Materials	% Weight
Interceptor[a]	Intercept Debris		Lithium (Kill Vehicle Batteries)	3.8
			Total (Percent of KV Weight)	3.8
	Flight Termination Debris	Boost	Propellant*	10.7
			Lithium (Kill Vehicle Batteries)	0.6
			Lithium Sulfur Dioxide (FTS Batteries)	0.2
			Lithium (TVC Batteries)	1.0
			Other	<0.03
			Total (Percent of Launch Weight)	~13
		Kill Vehicle	Lithium (Kill Vehicle Batteries)	3.8
			Total (Percent of KV Weight)	3.8
Target[b]	Intercept Debris	RV Only	None	0
		Unitary	Potassium Hydroxide (Batteries)	0.5
			Other Materials	<0.01
			Total	0.5
	Flight Termination Debris	Second Stage	Potassium Hydroxide (Batteries)**	0.5
			Other Materials	<0.01
			Total	0.5

[a]THAAD Subsystem Hazard Report LMSC-P049345 Revision C, 26 September 1994

[b]Theater Missile Defense Target Program Subsystem Hazard Analysis, TMD/CO/SFRP/93003

*HTPB is the toxic constituent in the interceptor booster propellant. The propellant is made up of less than 10 percent of HTPB, but it is assumed, for the sake of conservatism, that all of the propellant is toxic. The percent weight of the propellant is based on the amount of propellant remaining when flight termination of the interceptor booster first places the pupfish habitat at risk.

**Approximately one-half of battery weight is assumed to be toxic materials.

Reference: U.S. Space and Strategic Defense Command, 1995.

In the event of a missed intercept, the simulant in the target vehicle may be dispersed at some altitude in order to reduce the concentration of the simulant before it reaches ground level or to evaluate its dispersion. This would be accomplished through the detonation of a linear-shaped charge in the payload section. This system is independent of the FTS.

Studies for a simulated missile intercept at Holloman AFB suggest that about 80 percent of the triethyl phosphate (see appendix H) in a target payload would be destroyed at intercept (U.S. Army Space and Strategic Defense Command, 1993). It is expected that the remaining 20 percent would be quickly dispersed in the atmosphere, with no significant concentration reaching the ground. In addition, because of the small volume of triethyl phosphate that may be used and its chemical characteristics, any impact from the accidental release of this compound into the surface water would be transient and is considered to be a not significant impact.

Under normal intercept scenarios, debris from intercept, the second stage of the target missile, and any defensive missile booster will impact in the EGTR. In the case of a failed intercept, the reentry vehicle, debris from the terminated defensive missile, and any defensive missile booster would also impact in the EGTR.

Cumulative Impacts

Eglin AFB has been involved in testing and training activities over the Gulf of Mexico since the 1950s, and the trend toward increasing the use of the Gulf of Mexico for large-scale weapons testing will likely continue for the foreseeable future. In addition, natural gas and oil exploration, which has occurred in the Gulf of Mexico for nearly 40 years, is expected to continue at the current pace of development for the foreseeable future.

Hazardous materials comprise approximately 1 percent of the mass of the target missile. This 90 kilograms (198 pounds) of debris distributed per launch over 204,000 hectares (788 square miles) will have no perceptible effect on the marine environment.

Mitigations Considered

Hazardous material which would be introduced into the Gulf of Mexico by the TMD program would have no effect due to the small quantities involved; therefore, no specific mitigations are proposed beyond continued compliance with Air Force policy.

3.2.7 LAND AND WATER USE

TMD activities would have little effect on the oil and gas exploration use in the Gulf of Mexico.

3.2.7.1 Resource Descriptions and Evaluative Methods

The primary effects of the proposed action to land and water use are to oil and gas exploration. Potential impacts to fishing and shipping are in sections 3.2.10 and 3.2.11, respectively. The assessment of effects of the proposed action and its alternatives on oil and gas leases is in the following terms: the number of leases and the total surface areas of all leases that are within the clearance zones for the proposed action and its alternatives, and the proportion of total leases and surface area of leases in the Gulf of Mexico that are within the clearance zones for the proposed action and its alternatives.

3.2.7.2 Region of Influence

The ROI for oil and gas exploration follows the planning area for the most current and known near-term leasing activities in the Eastern Gulf of Mexico west of longitude 87 degrees (almost due south of Santa Rosa Island) and north of latitude 28 degrees (figure 3.2.7-1). There are no currently planned surface structures in the Eastern Gulf of Mexico planning area (Blount, 1997).

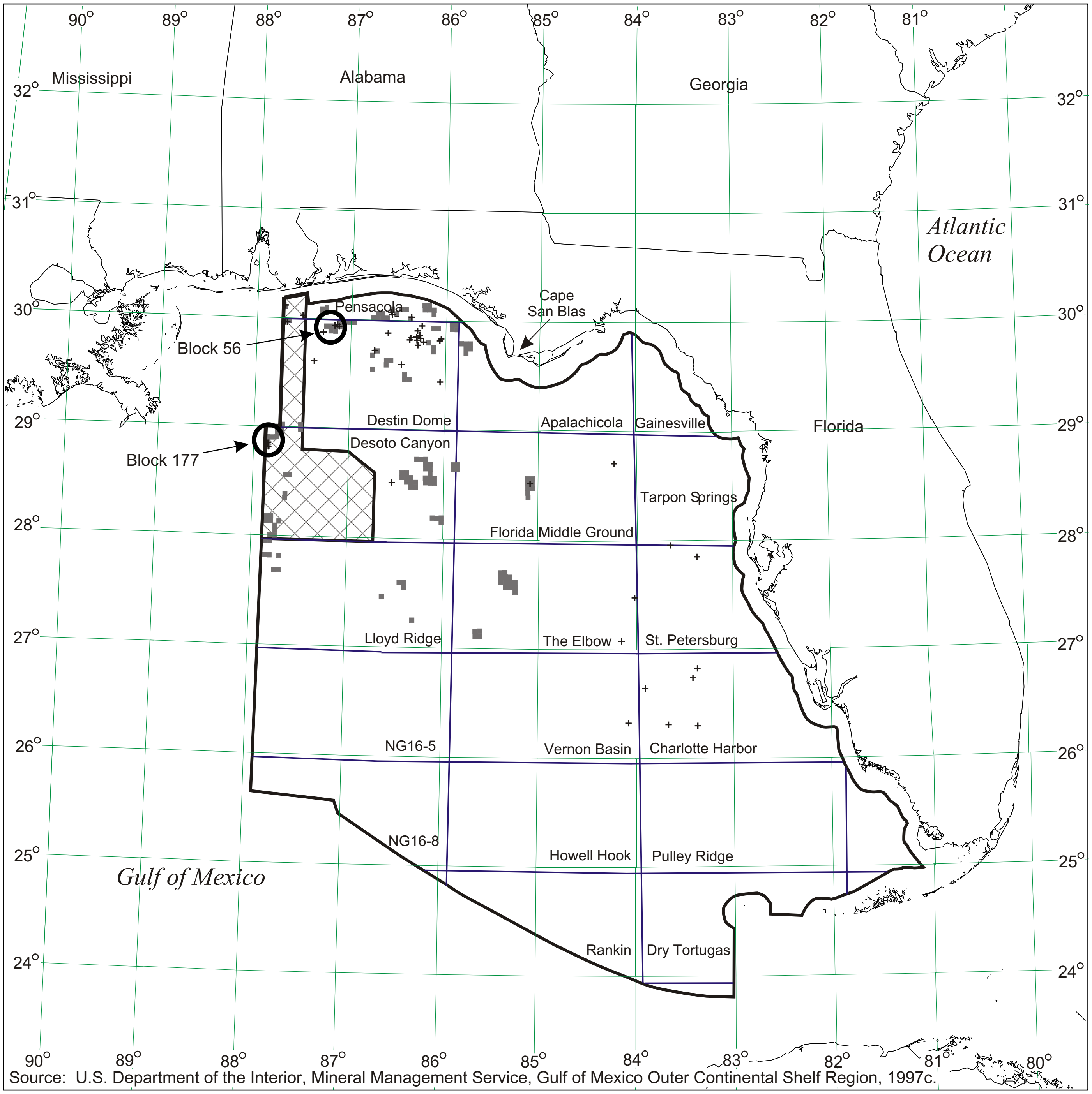
The ROI for TMD testing and training is located within the MMS Eastern Gulf of Mexico (EGOM) planning area. The jurisdiction of the MMS includes Federal waters extending from Texas to Florida and is divided into Western, Central, and Eastern planning areas. The EGOM planning area begins approximately 16 kilometers (10 miles) off the coast and extends approximately 1,100 kilometers (700 miles) from Baldwin County, Alabama, southward to the tip of the Florida Keys (U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico Outer Shelf Region, 1997c) (figure 3.2.7-1).

3.2.7.3 Affected Environment

Oil and Gas Exploration and Extraction Operations

State of Florida Waters. Along the Florida Gulf coast, state lands extend approximately 16 kilometers (10 miles) offshore. With the exception of those leases entered into before 7 June 1991, the lease of offshore state lands and the permitting of oil and gas exploration activities within such areas is currently not being considered (Garrett, 1997).

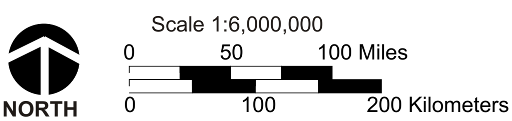
Federal Waters. Oil and gas exploration and extraction activities within Federal waters are under the jurisdiction of the MMS, Gulf of Mexico Outer Continental Shelf Region (GOMR). The GOMR is one of three regional offices of the MMS, an agency of the U.S. Department of the Interior.



Source: U.S. Department of the Interior, Mineral Management Service, Gulf of Mexico Outer Continental Shelf Region, 1997c.

EXPLANATION

- Active Leases
- Area Proposed for Leasing Consideration
- MMS Scenario Development Blocks
- ROI and Planning Area Boundary
- Lease Block Grid Names
- Exploratory Wells



Oil and Gas Exploration Areas

Eastern Gulf of Mexico

Figure 3.2.7-1

gom-6m-3gen006

For the past 37 years, drilling for natural gas or oil has occurred in the EGOM offshore Alabama and Florida. In 1959, the first of 10 natural gas and oil lease sales were held offshore from Florida. Twenty-three oil and gas leases were issued, and three wells were drilled. Additional lease sales were held in the EGOM planning area in 1973, 1976, 1978, 1981, 1982, 1983, 1984, 1985, and 1988. No lease sales have occurred since 1988. Currently, there are 30.8 million hectares (76 million acres) and 156 active leases in the EGOM planning area.

Once a company acquires a lease, it must prepare and submit to the MMS an exploration plan in order to drill a well. If a discovery of gas or oil is made, the company is required to prepare and file with MMS a development plan for approval. To date, 47 exploratory wells have been drilled in the EGOM, of which 46 have been either plugged and abandoned, or temporarily abandoned, and one has been indefinitely postponed. Although eight of these wells are expected to produce hydrocarbons in commercial quantities, all are located off the Alabama/Florida Panhandle coast. Recent activities within the eastern Gulf of Mexico planning area are located in the Destin Dome and Pensacola areas (U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico Outer Continental Shelf Region, 1997c).

The Destin Dome Block 56 Unit is located approximately 40.2 kilometers (25 miles) south of Pensacola, Florida. (A unit is two or more lease blocks that have been joined together by agreement of the lease operators, such that all blocks in the unit are operated as a single lease.) The Destin Dome 56 Unit comprises six blocks originally leased to Conoco Inc, and subsequent additions included in the Destin Dome Block 56 Unit. The 11 blocks to which Chevron was designated the successor unit operator are Destin Dome Blocks 12-16, 54-57, and 99-100. On 27 November 1996, Chevron U.S.A., in association with Murphy Exploration and Production Company and Conoco Inc., filed with the MMS a proposed Development Plan to develop and produce natural gas reserves. The plan covers 11 lease blocks in the Destin Dome 56 Unit. In August 1997, the MMS determined and notified Chevron that the Development Plan was complete. Approval of a development plan, which would include the preparation of a NEPA document, could take up to 24 months from the publication of the NOI in the Federal Register on 22 August 1997.

Mobil Oil Exploration and Producing Southwest Inc. (Mobil) filed an Exploration Plan (EP) with the MMS in September 1989. The EP proposed to drill exploratory wells on each of the following six lease blocks: Pensacola Blocks 845, 846, 889, 890, 993, and 934. The MMS approved the EP in March 1990.

OEDC Exploration and Production, L.P., filed two plans with MMS for activities offshore from Alabama on 15 November 1996; one for a development proposal on Pensacola Block 881 (19 kilometers [12 miles] offshore from Alabama) and one at Destin Dome Blocks 1 and 2 (27 kilometers [17 miles] offshore from Alabama). MMS is evaluating the Development Operations Coordination Document (DOCD) and the States of Alabama and Florida have received review copies. Amoco also filed three pipeline right-of-way applications to construct pipelines to carry natural gas as part of the development of these two areas. MMS is reviewing these pipeline applications:

- A 20.3-centimeter (8-inch) pipeline to transport bulk gas from OEDC's Caisson No. 1 in the Destin Dome Block 2 to OEDC's Platform A in the Mobile Block 960
- A 10.2-centimeter (4-inch) bulk gas pipeline from Caisson No. 1 to a 20.3-centimeter (8-inch) subsea tie-in, all in Destin Dome Block 1
- A 15.2-centimeter (6-inch) pipeline to transport bulk gas from OEDC's Caisson No. 1 in Mobile Block 960

Amoco Production Company filed a revised Plan of Exploration with MMS on 31 October 1997 to drill an exploratory well in Desoto Canyon Block 177. On 22 January 1997, Amoco's revised plan was approved by MMS and in February 1997, Amoco began drilling operations. The drill site was located more than 160 kilometers (100 miles) offshore from Florida and in waters deeper than 1,900 meters (6,200 feet). The well was completed in March 1997, and the rig was removed from the site in mid-April 1997.

The 5-year OCS Oil and Gas Leasing Program for 1997 to 2002 (Program) was approved on 14 November 1996. The Program essentially provides for a moratorium on oil and gas drilling operations within areas located south of the parallel 26° North through the year 2002. In addition, the program allows for a total of 16 lease sales throughout all of the OCS planning areas during the period ranging from 1997 through 2002. Of these, only one lease sale (Sale 181) is located within the OCS Eastern Gulf planning area. Sale 181 is scheduled to occur in the year 2001 and is located south of the Alabama/Florida Panhandle (Defenbaugh, 1997).

The current 5-year OCS leasing program schedules only one OCS lease sale in the Eastern Gulf. This sale is currently scheduled for late 2001. The decision process from the sale, lasting about 3 years, will begin with a Call for Information and Nominations/Notice of Intent to Prepare an EIS and will include extensive consultations with the States, Federal Agencies, and other interested parties. This proposed sale may result in the issuance of additional leases in the Eastern Gulf, followed by as yet unknown levels of exploration and development activity. A decision on whether there may be additional lease sales scheduled in the Eastern Gulf in the future will be made in the context of the development of the next 5-year program, which would cover the years 2002-2007. There are a number of currently active leases in the Eastern Gulf.

No petroleum or natural gas is currently being produced in the EGTR. Drilling is prohibited in Florida state waters in the eastern Gulf of Mexico, and no active wells are known to be present there (U.S. Department of the Air Force, 1995).

3.2.7.4 Environmental Impacts and Mitigations

No-action Alternative

Under the no-action alternative, the proposed TMD test activities would not be implemented. Oil and gas exploration would not be affected. Continuing Eglin AFB testing and training activities over the Gulf of Mexico would have negligible effects on land and water use.

Flight Test Activities

The majority of current and known near-term leasing activities in the EGOM are occurring west of longitude 87 degrees (almost due south of Santa Rosa Island) and north of latitude 28 degrees. No surface structures associated with oil and gas extraction activities are currently located in the EGOM planning area (Blount, 1997). Therefore, no surface structures would be presently located in the launch hazard, booster drop, or debris impact areas, known collectively as clearance areas. As a result, TMD activities including Air Drop target launch would not conflict with nor affect any existing physical oil and gas facilities.

The number of lease blocks, total hectares (acres), and number of wells located within the clearance areas for each of the test examples is presented in table 3.2.7-1. The clearance areas of each test example in relation to oil and gas lease and well locations are presented in figures 3.2.7-2 through 3.2.7-5, respectively.

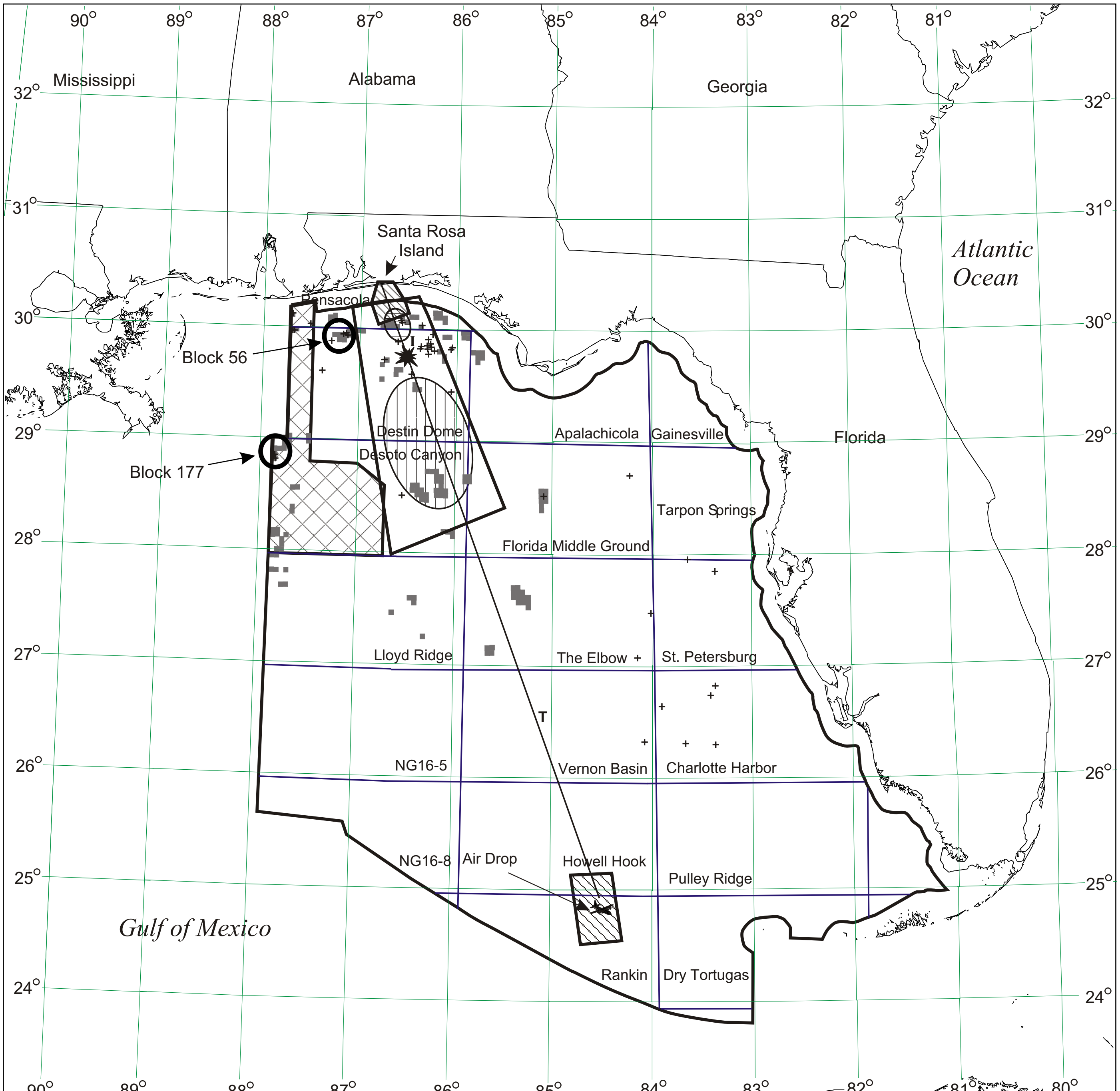
Table 3.2.7–1: Lease Blocks and Existing Wells Located Within Clearance Areas

Test Example	Target Launch Location	Interceptor Launch Location	Lease Blocks Number	Lease Blocks Acres	Number of Wells[1]
Example 1	Air Dropped	Platform Launched	22	130,560	1
Example 2	Cape San Blas	Ship Launched	0	0	0
Example 3	Florida Keys	Cape San Blas	26	153,600	1
Example 4	Ship Launched	Santa Rosa Island and Cape San Blas	98	579,840	21

Note: Clearance Zones are defined as launch hazard, booster, and debris impact areas. Refer to corresponding figures 3.2.7-2 through 3.2.7-5

[1]Wells are non-producing, capped, and/or abandoned.

Two blocks of potential near-term oil and gas exploration and production activity (Destin Dome Block 56 and Desoto Canyon Block 177), identified by MMS, were evaluated for potential conflicts with proposed TMD activities in the EGTR. These two blocks are indicated (circled) on figures 3.2.7-2 through 3.2.7-5. The two blocks are outside, to the west, of any example TMD clearance areas evaluated. There would be no clearance of Blocks 56 or 177 required; therefore, there would be no foreseeable near-term economic, transportation, operational, or safety impacts to oil and gas exploration or



Source: U.S. Department of the Interior, Mineral Management Service, Gulf of Mexico Outer Continental Shelf Region, 1997c.

EXPLANATION

- Active Leases
- Area Proposed for Leasing Consideration
- Planning Area Boundary
- Lease Block Grid Boundary
- I Interceptor Ground Track
- T Target Ground Track
- MMS Scenario Development Blocks
- Exploratory Wells
- Interceptor Debris
- Target Debris
- Representative Evacuation Areas
- Launch Hazard Area
- Booster Drop Zone

NORTH

Scale 1:6,000,000

0 50 100 Miles

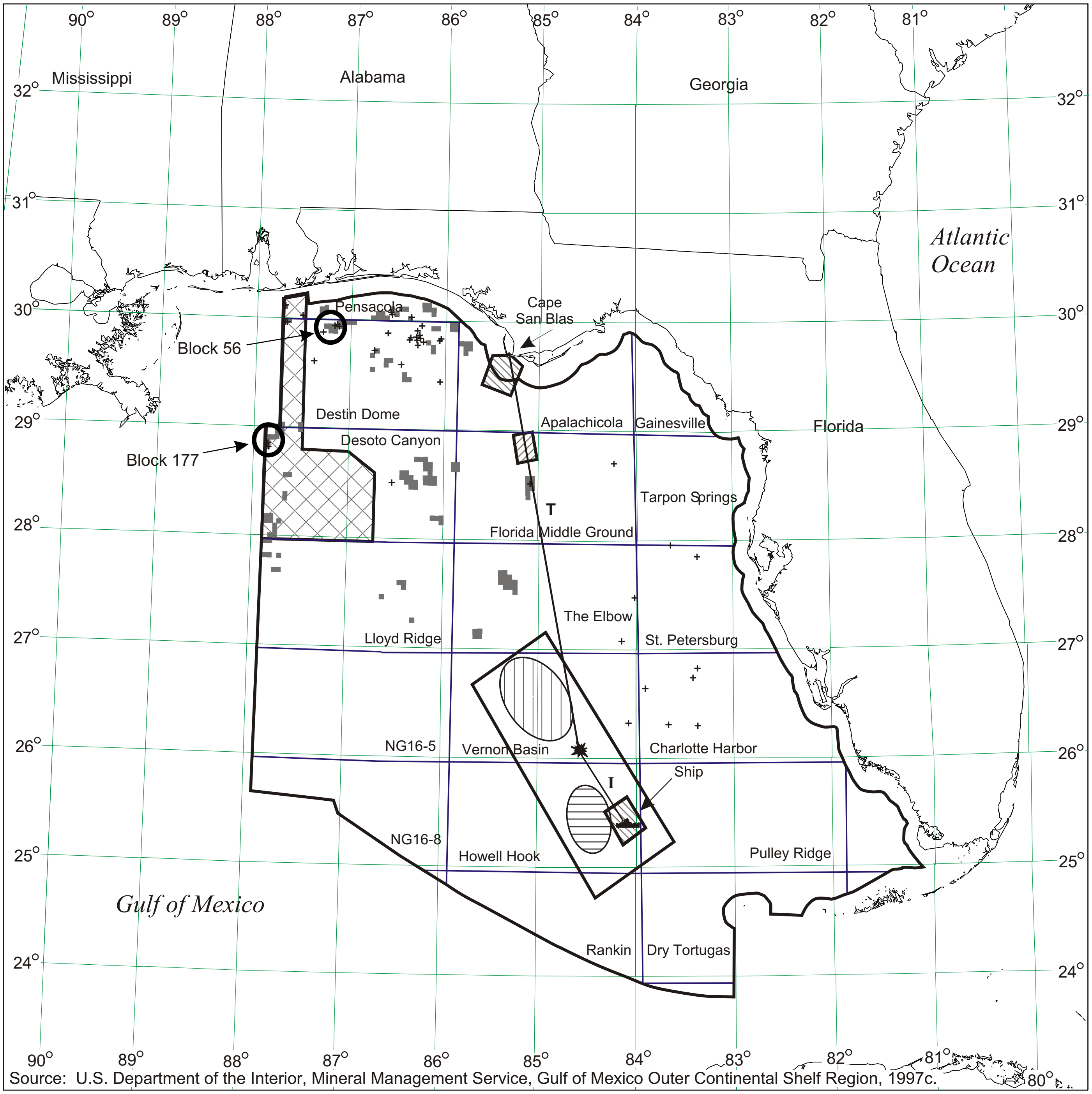
0 100 200 Kilometers

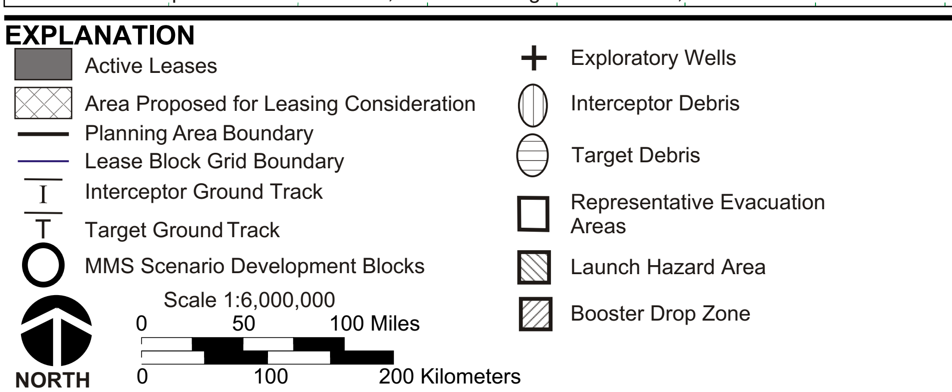
Example 1 - Clearance Areas and Oil and Gas Leases

Eastern Gulf of Mexico

Figure 3.2.7-2

gom-6m-4land005



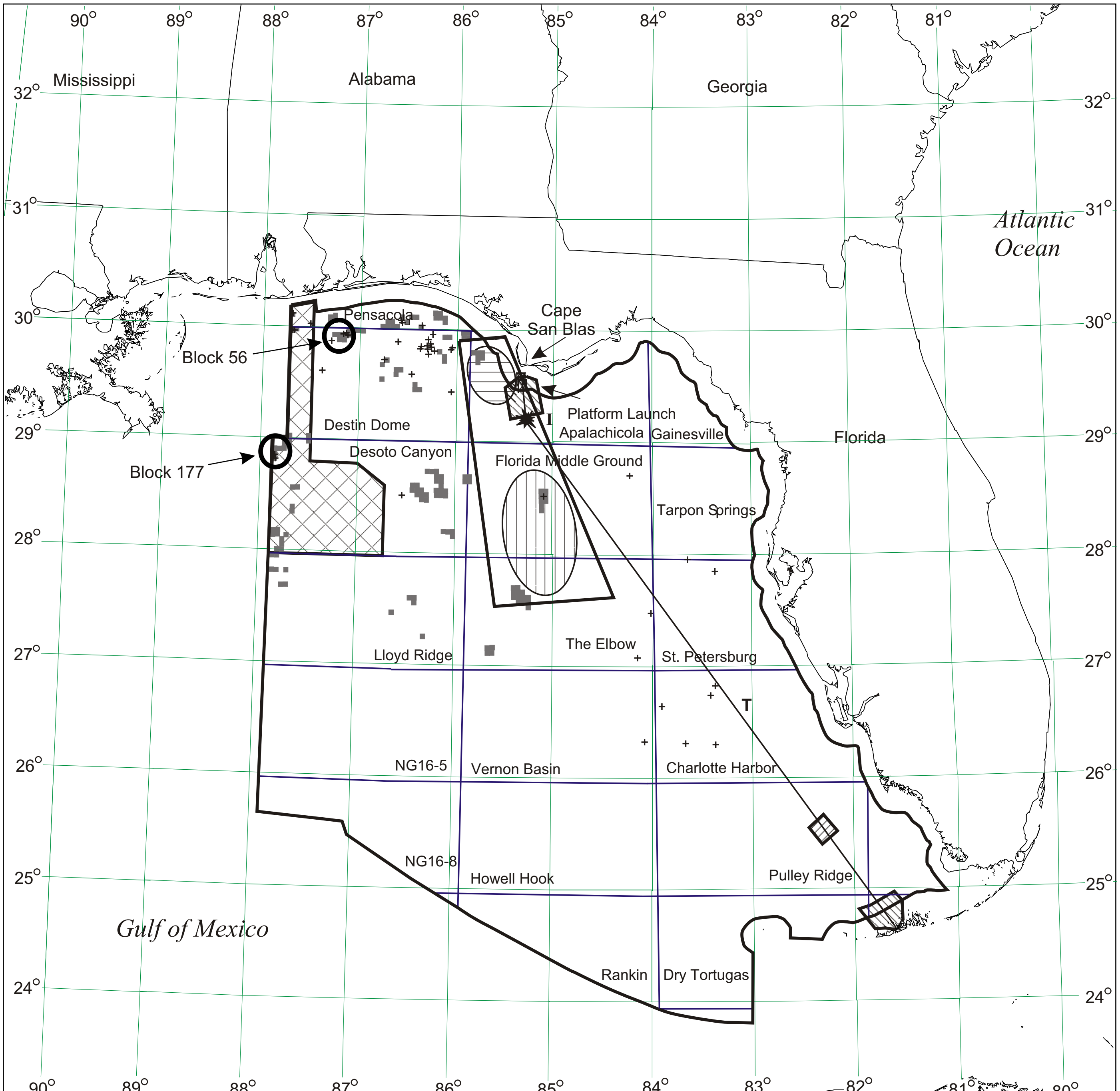


Example 2 - Clearance Areas and Oil and Gas Leases

Eastern Gulf of Mexico

Figure 3.2.7-3

gom-6m-4land006



Source: U.S. Department of the Interior, Mineral Management Service, Gulf of Mexico Outer Continental Shelf Region, 1997c.

EXPLANATION

- Active Leases
- Area Proposed for Leasing Consideration
- Planning Area Boundary
- Lease Block Grid Boundary
- I Interceptor Ground Track
- T Target Ground Track
- MMS Scenario Development Blocks
- Exploratory Wells
- Interceptor Debris
- Target Debris
- Representative Evacuation Areas
- Launch Hazard Area
- Booster Drop Zone

NORTH

Scale 1:6,000,000

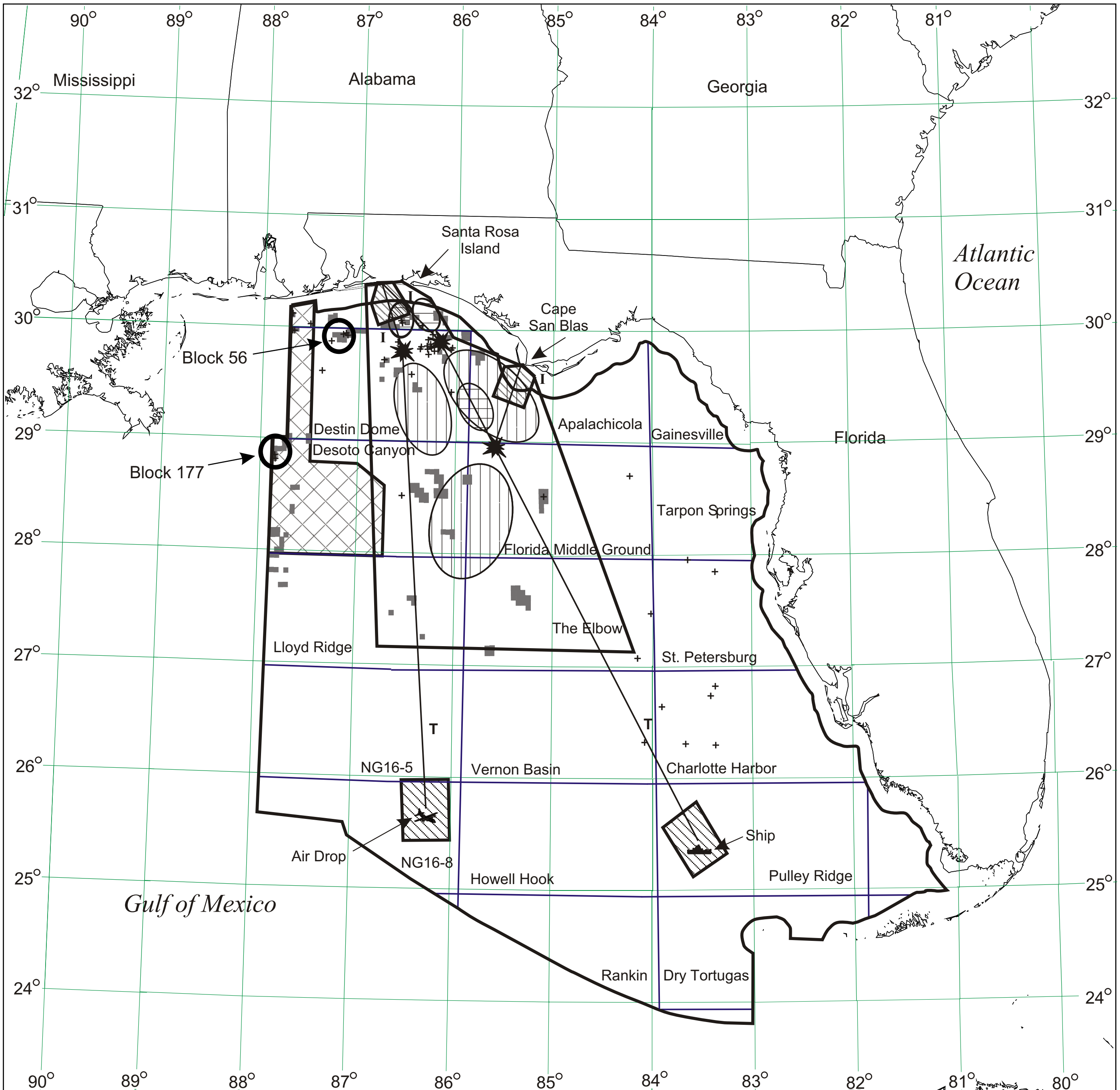
0 50 100 Miles

0 100 200 Kilometers

Example 3 - Clearance Areas and Oil and Gas Leases

Eastern Gulf of Mexico

Figure 3.2.7-4



Source: U.S. Department of the Interior, Mineral Management Service, Gulf of Mexico Outer Continental Shelf Region, 1997c.

EXPLANATION

- Active Leases
- Area Proposed for Leasing Consideration
- Planning Area Boundary
- Lease Block Grid Boundary
- I Interceptor Ground Track
- T Target Ground Track
- MMS Scenario Development Blocks
- Exploratory Wells
- Interceptor Debris
- Target Debris
- Representative Evacuation Areas
- Launch Hazard Area
- Booster Drop Zone

NORTH

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

Example 4 - Clearance Areas and Oil and Gas Leases

Eastern Gulf of Mexico

Figure 3.2.7-5

gom-6m-4land008

production activities, structures, or infrastructure in these two blocks resulting from proposed TMD activities. (Minerals Management Service, 1998)

As the TMD program matures, and oil and gas activities extend into the eastern Gulf of Mexico, there would likely develop potential safety and economic issues over space and time scheduling in areas of the eastern Gulf of Mexico used by both the Air Force and oil and gas interests. These issues would be resolved in the ongoing consultation between the Air Force and MMS.

Cumulative Impacts

Natural gas and oil exploration, which has occurred in the Gulf of Mexico for nearly 40 years, is expected to continue at the current pace of development for the foreseeable future. The clearance areas overlap lease blocks that may contain surface structures in the future. Though unlikely, due to the relatively small size of the surface structures in relation to the lease block area, it is remotely possible that missile debris could strike a surface structure resulting in damage to the well, or even release of hazardous materials. Over the 10-year program life, risk of effects to oil and gas wells associated with the impact of missile debris could increase if development occurs.

Oil and gas exploration activities are being pursued. These could have a negligible contribution to the cumulative impacts of TMD activities on the water use of the Gulf of Mexico.

Oil and gas exploration has been proposed for areas of the eastern Gulf of Mexico. Depending on the test scenario, from 0 to 98 lease blocks covering up to 234,726 hectares (580,000 acres) may fall within proposed clearance areas. Personnel onboard the rigs or in supply boats would either have to clear the area or go indoors under shelter during test events. Future NEPA documentation of oil and gas activities in the Gulf of Mexico would address TMD activities as accumulative impact.

Mitigations Considered

Possible mitigations would include:

- Provide and distribute advance notification of closure dates and durations to the local public, FMP, USCG, DEM, marinas, and oil and gas companies.

- Coordinate timing and location of test events with MMS and the oil and gas exploration interests for both oil and gas explorations and platform siting in the Gulf.

3.2.8 NOISE

The reentry of target missiles would be expected to generate sonic booms. These sonic booms would be expected to occur over the Gulf of Mexico. Due to the steep angle of the target missiles' reentry, most of the energy of the sonic boom would be expected to be propagated directly into the underlying water.

3.2.8.1 Resource Description and Evaluative Methods

This section analyzes the effects of TMD flight test noise upon the Gulf of Mexico. This is primarily the result of sonic booms from target missile reentry. The extent and intensity of these sonic booms will be described.

3.2.8.2 Region of Influence

The ROI for noise is defined as those regions of the EGTR that have the potential to experience sonic booms with overpressures equal to or greater than 0.1 kilopascal (kPa) (2.0 psf). Air delivery of target missiles would cause sounds, but without human receptors nearby, this would not be considered noise.

3.2.8.3 Affected Environment

Ambient noise is the existing background noise of the environment. Common sources of background noise for large bodies of water, such as the Gulf of Mexico, are tidal currents and waves; wind and rain over the water surface; water turbulence and infrasonic noise; biological sources (e.g., marine mammals); and human-made sounds (e.g., ships, boats, low-flying aircraft). The ambient noise levels from natural sources are expected to vary according to numerous factors including wind and sea conditions, seasonal biological cycles, and other physical conditions. Noise levels from natural sources can be as loud as 120 dB (re: 1μPa at 1 meter) in major storms (Heindsman, Smith, and Ameson, 1995). (Advanced Research Projects Agency, 1995)

Noise associated with human sources varies with the characteristics of the specific noise source. The primary human-made noise source within the ROI is expected to be associated with ship and vessel traffic. This source may include commercial tankers and container ships transiting the Gulf of Mexico, commercial fishing boats, and military surface vessels and aircraft (see section 3.2.2 and 3.2.11). Vessel noise is primarily associated with propeller and propulsion machinery. In general, noise levels increase with vessel size, speed, and load. Noise levels from large ships can reach levels of 180-190 dB (re 1μPA at 1 meter), whereas smaller vessels range from approximately 100-160 dB (re 1μPA at 1 meter) (Collier, 1997; Advanced Research Projects Agency, 1995). In 1979 over 3,000 vessels passed through the EGTR, with ship sizes varying from small coastal vessels to super-tankers.

3.2.8.4 Environmental Impacts and Mitigation

No-action Alternative

Under the no-action alternative, the proposed TMD test activities would not be implemented. Current maritime operations and commercial fishing in the EGTR would continue. Continuing Eglin AFB testing and training activities would result in minimal changes in noise levels over the Gulf of Mexico.

Site Preparation Activities

Of the site preparation activities, only the development of an offshore platform has the potential to produce noise which could propagate through the water column. Installation of a prefabricated platform should take about 1 month. Underwater noise effects to marine mammals are addressed in section 3.2.3.4.

Flight Test Activities

Air Drop target launch would involve a standard C-130 aircraft, which would not appreciably affect noise levels over the Gulf of Mexico.

Interceptor missiles may be launched from offshore platforms. The peak noise levels of an interceptor launch would last for a few seconds. Marine life in the vicinity of a platform during launch of an interceptor may be temporarily affected by the short-term increase in the underwater noise levels due to an interceptor launch.

Target missiles would reenter the atmosphere at velocities several times the speed of sound. They would decelerate due to atmospheric friction. If the interceptor fails to hit the target, the target may potentially still be traveling at supersonic speeds when it reaches the water of the Gulf of Mexico.

As a missile moves through the air, the air in front is displaced to make room for the missile and then returns once the missile passes. In subsonic flight, a pressure wave (which travels at the speed of sound) precedes the missile and initiates the displacement of air around the missile. When a missile exceeds the speed of sound, referred to as Mach 1, the pressure wave, which cannot travel faster than the speed of sound, cannot precede the aircraft, and the parting process is abrupt. As a result, a shock wave is formed initially at the front of the missile when the air is displaced around it and lastly at the rear when a trailing shock wave occurs as the air recompresses to fill the void after passage of the missile.

The shock wave that results from supersonic flight is commonly called a sonic boom. A sonic boom differs from most other sounds because it is impulsive (similar to a double gunshot), there is no warning of its impending occurrence, and the magnitude of the peak levels is usually higher. Sonic booms are measured in C-weighted decibels or by changes in air pressure. For a vehicle flying straight, the maximum sonic boom amplitudes will occur along the flight path and decrease gradually to either side. Because of the effects of the atmosphere, there is a distance to the side of the flight path beyond which the sonic booms are not expected to reach the ground. This distance is normally referred to as the lateral cut-off distance.

Sonic booms will result during normal target flight; that is, they are planned occurrences. Depending upon the specific missile trajectory, sonic booms of 0.10 kPa (2 psf) could enclose an area of up to 21,000 hectares (52,000 acres).

The procedure developed by the National Research Council of the National Academy of Sciences (National Academy of Sciences, 1981; National Academy of Sciences, National Research Council, 1977), used by the USEPA (U.S. Environmental Protection Agency, 1982), and adopted by the American National Standards Institute (American National Standards Institute, 1986) is used to assess the impact of exposure to high-energy impulsive noise, including sonic booms, on humans. The procedure relates the long-term average C-weighted day-night equivalent sound levels (CDNL) produced by booms to the number of people that would be highly annoyed by the booms. The procedure is based upon results from several laboratory studies and social surveys.

A 1973 FAA-sponsored study, using a database of unpublished static test results provided by Libbey-Owens Ford Company, was conducted using a statistical analysis to determine the probability of glass breakage for various overpressures. If all flight paths are considered equally likely (that is, the aircraft could approach the structure from any direction), then the probability of breakage for good glass at various nominal peak overpressures is listed in table 3.2.8-1 (Federal Aviation Administration, 1973).

Table 3.2.8–1: Overpressures and Probability of Glass Breakage

Overpressure in kPa (psf)	Probability of Breakage
0.05 (1.0)	0.000001
0.10 (2.0)	0.000023

Source: Federal Aviation Administration, 1973.

If the flight were to approach head-on or perpendicular to the plane of the window, which is approximately the most sensitive scenario, the probability would increase as shown in table 3.2.8-2.

Table 3.2.8–2: Overpressures and Increased Probability of Glass Breakage

Overpressure in kPa (psf)	Probability of Breakage
0.05 (1.0)	0.000023
0.10 (2.0)	0.000075
0.14 (3.0)	0.000300
0.19 (4.0)	0.001200
0.24 (5.0)	0.002300
0.29 (6.00)	0.004000

Source: Federal Aviation Administration, 1973.

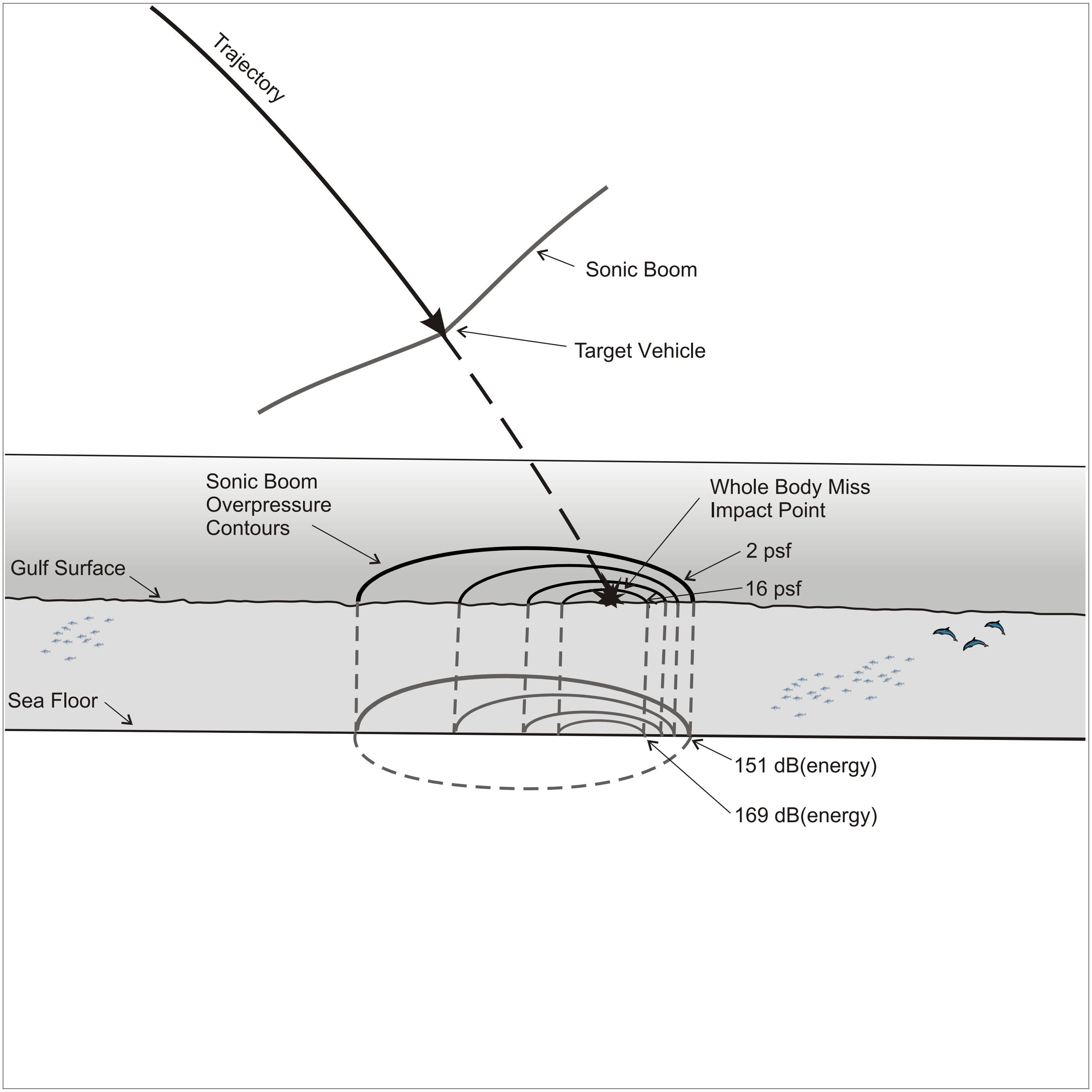
A recent survey of existing models to predict sonic boom impacts on conventional structures has developed a new method of developing loss estimates for glass, plaster, and bric-a-brac (Haber and Nakaki, 1989). This method improves on the model presented above, and a summary of the possible damage to structures based on this method is presented in table 3.2.8-3.

Table 3.2.8–3: Possible Damage to Structures from Sonic Booms

Sonic Boom Peak Overpressure	Item Affected	Type of Damage
0.5 - 2 psf	Cracks in plaster	Fine; extension of existing; more in ceilings; over door frames; between some plaster boards
	Cracks in glass	Rarely shattered; either partial or extension of existing
	Damage to roof	Slippage of existing loose tiles or slates; sometimes new cracking of old slates at nail hole
	Damage to outside walls	Existing cracks in stucco extended
	Bric-a-brac	Those carefully balanced or on edges can fall; fine glass, e.g. large goblets
	Other	Dust falls in chimneys
2 - 4 psf	Glass, plaster, roofs, ceilings	Failures show which would have been difficult to forecast in terms of their existing localized condition; nominally in good condition
4 - 10 psf	Glass	Regular failures within a population of well-installed glass; industrial as well as domestic; green houses; ships; oil rigs
	Plaster	Partial ceiling collapse of good plaster; complete collapse of very new, incompletely cured or very old plaster
	Roofs	High probability rate of failure in nominally good slate, slurry-wash; some chance of failures in tiles on modern roofs; light roofs (bungalow) or large area can move bodily
	Walls (outside)	Old, free-standing walls in fairly good condition can collapse
	Walls (inside)	"Party" walls known to move at 10 psf
Greater than 10 psf	Glass	Some good glass will fail regularly to sonic booms from the same direction; glass with existing faults could shatter and fly; large window frames move
	Plaster	Most plaster affected
	Ceilings	Plaster boards displaced by nail popping
	Roofs	Most slate or slurry roofs affected, some badly; large roofs having good tile can be affected; some roofs bodily displaced causing gable-end and wall-plate cracks; domestic chimneys - dislodgment if not in good condition
	Walls	Internal party walls can move even if carrying fittings such as hand basins or taps; secondary damage due to water leakage
	Bric-a-brac	Some nominally secure items can fall, e.g. large pictures; especially if fixed to party walls

Source: Haber and Nakaki, 1989.

Sonic booms that would occur over the Gulf of Mexico would create corresponding pressure surges in the underlying water. According to the latest modeling in this area (Sparrow, 1997), for the reentry of missiles, the magnitude of the pressure surge in the water would be equal to or slightly less than the overpressures of the sonic boom in the overlying air (figure 3.2.8-1).



EXPLANATION

2 psf (surface) = 151 dB re 1µPa^2- sec (underwater)
16 psf (surface) = 169 dB re 1µPa^2- sec (underwater)
psf = pounds per square foot

Effect of Sonic Boom Overpressures on the Water Column

Figure 3.2.8-1

033egl

The computer program PCBOOM was used to predict the sonic booms that would result from representative Hera trajectories (figures 3.2.8-2 and 3.2.8-3). Figure 3.2.8-2 illustrates representative sonic boom overpressure contours resulting from a lofted trajectory flight. Lofted means that it is a high altitude flight path. Figure 3.2.8-3 illustrates overpressures resulting from a depressed trajectory. Depressed means that it is a low altitude flight path.

When assessing the potential impacts to marine mammals from underwater noise it is useful to express the noise in terms of its energy content. One way to do this is to reference the noise levels to 1 μPa^2-second. Using the assumption that the duration of the sonic booms would be 250 milliseconds, table 3.2.8-4 gives the underwater noise levels that correspond to each of the pressure contours shown in figures 3.2.8-1, 3.2.8-2, and 3.2.8-3. Potential impacts to marine mammals are discussed in section 3.2.3.4.

Table 3.2.8–4: Underwater Noise Levels Corresponding to Sonic Boom Peak Overpressures

Peak Overpressures in kPa (psf)	Underwater Noise Levels in dB re 1 μPa^2-sec (1)
0.1 (2)	151
0.2 (4)	157
0.3 (6)	160
0.4 (8)	163
0.6 (12)	166
0.8 (16)	169

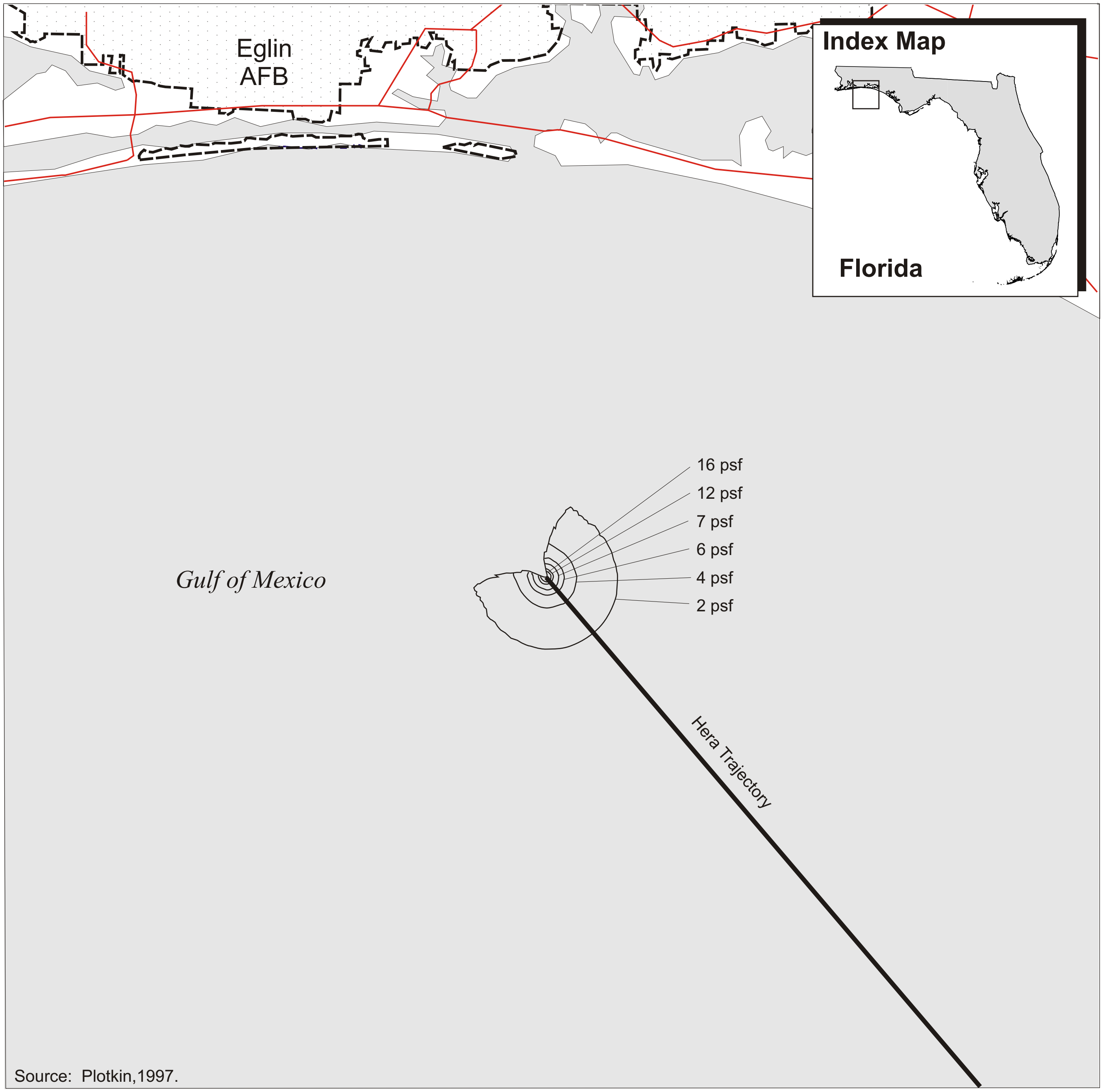
(1) Assumes sonic boom duration of 250 milliseconds

Cumulative Impacts

The sonic booms that may be generated by the reentry of a Hera missile are discrete events. The impacts of concern from these and other noise events in the Gulf of Mexico are on biological resources, and thus the cumulative impacts are addressed under section 3.2.3.4, biological resources.

Mitigations Considered

TMD noise impacts to the Gulf of Mexico would primarily affect marine life in the vicinity of target missile reentry impact. Mitigations would be developed in continuing consultation with the appropriate agencies, including USFWS, NMFS, FGFWFC, FDEP, and FDCA.



EXPLANATION

Roads

Eglin AFB Boundary

Eglin AFB

psf = pounds per square foot.

NORTH

Scale 1:500,000

0 4 8 Miles

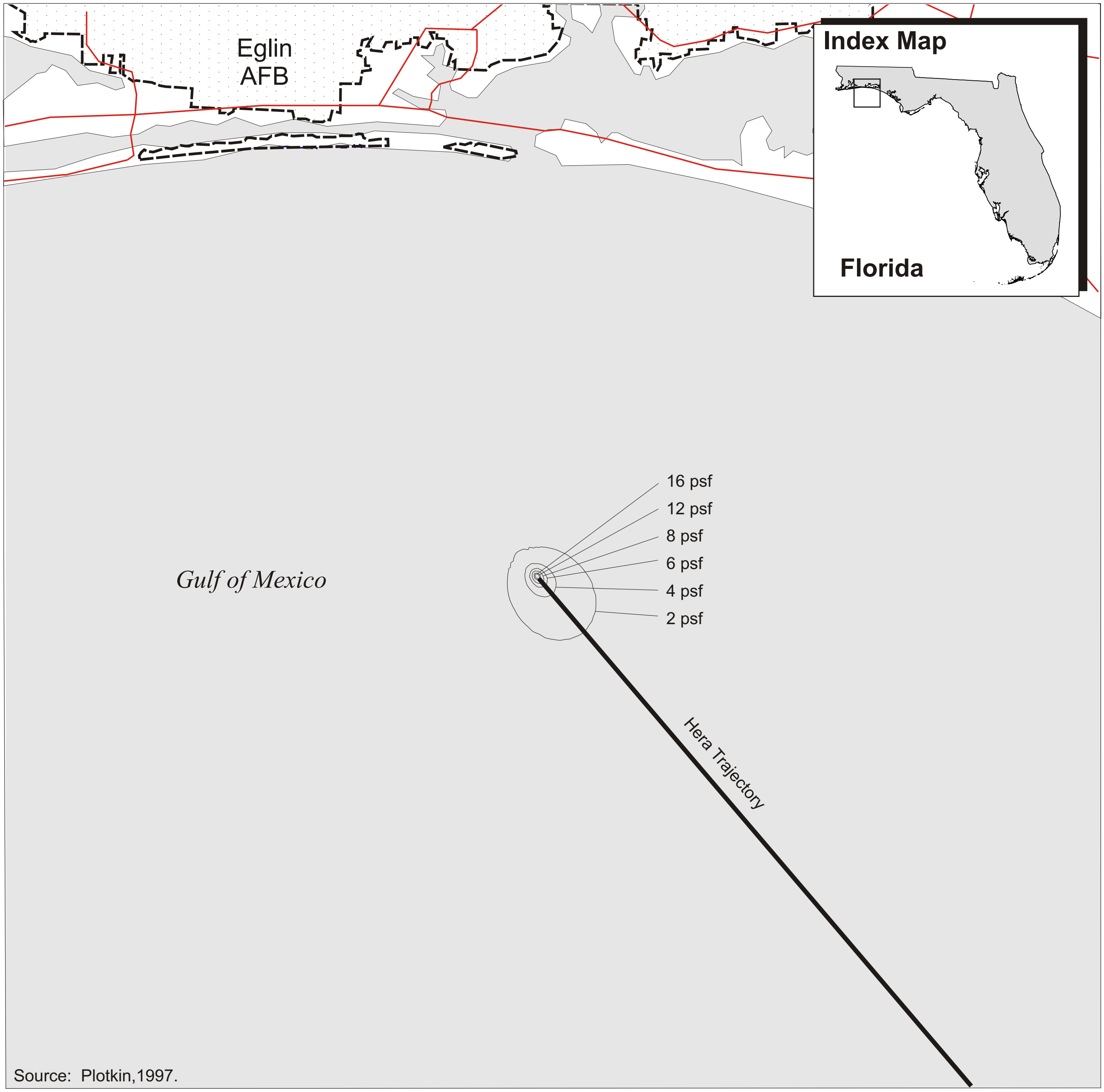
0 6.5 13 Kilometers

sri-500k-4noise002

Hera Target Missile Reentry Sonic Boom- Lofted Trajectory

Eglin AFB, Florida

Figure 3.2.8-2



EXPLANATION

Roads

Eglin AFB Boundary

Eglin AFB

psf = pounds per square foot.

NORTH

Scale 1:500,000

0 4 8 Miles

0 6.5 13 Kilometers

Hera Target Missile Reentry Sonic Boom - Depressed Trajectory

Eastern Gulf of Mexico

Figure 3.2.8-3

sri-500k-4noise003

3.2.9 SAFETY

Safety issues for the Gulf of Mexico are addressed in section 3.1.9.

3.2.10 SOCIOECONOMICS

TMD activities, including clearance of safety areas, will have temporary impacts upon commercial fishing within the Gulf of Mexico.

3.2.10.1 Resource Description and Evaluative Methods

Commercial Fishing

A number of new regulations and management measures enacted within the past several years have and will continue to change commercial fishing practices and the nature of some of the key fisheries resources in the Florida Waters of the Gulf of Mexico. Among these changes are an amendment to the Florida Constitution, Article X, Section 16, limiting marine net fishing (Florida Department of State, 1995), implementation of by-catch reduction devices in the Gulf shrimp fishery (Gulf Fisheries Management Council, 1997), and the implementation of fisheries management measures under the Florida Keys National Marine Sanctuary Management Plan (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1995a).

These trends are important in characterizing the affected commercial fishing industry and in projecting the potential impacts and cumulative impacts of the proposed action over the next 10 years. In light of these changes, statistics on past commercial fishing effort and harvest are now less useful in predicting trends for the future. Predictions about the future are even more difficult for some fisheries without data on the implications of these new and evolving regulations. Because many stocks of commercial fish are considered to be over-fished, evolving regulations to protect fish stocks will result in further changes.

3.2.10.2 Region of Influence

The ROI comprises the waters of the Gulf of Mexico where economic activities might be affected by TMD test or training activities. The ROI for commercial fisheries includes all marine and estuarine waters within the flight test corridors (LHA, booster drop zones, and debris impact areas) that must be cleared during missile launching and tests. Additionally, the ROI would also include and consider commercial fishing ports in the vicinity of flight test corridors to the extent that missile tests interfere with normal daily activities within the ports, such as blockage of normal boat travel to fishing grounds and preventing the delivery and landing of catch. Examples may include fishing ports at Block Island, Marathon Key, and Key West in South Florida, and Panama City and Destin near Eglin AFB.

Because the bulk of the catch and value of commercial fishing within the area of the proposed action is represented by landings reported in the State of Florida, landings reported in other states will not be considered directly. The recreational and commercial fishing industries are closely intertwined because, for example, in the Florida Keys many recreational fishermen and back-country guides are commercial fishermen during the off-tourist season.

3.2.10.3 Affected Environment

The affected environment represents the waters of the Gulf of Mexico as a location where economic activity such as fishing or marine transportation takes place.

Oil and Gas

A detailed analysis of the oil and gas fields affected may be found in section 3.2.7.

Marine Transportation

A detailed analysis of the marine transportation affected may be found in section 3.2.11.

Commercial Fishing

Commercial fishing activity within the areas potentially affected by the proposed action will be described by the number of commercial fishing trips and landings of commercial fish.

The commercial fishing industry of the Gulf of Mexico is an important economic component of the United States. The Gulf of Mexico provides nearly 20 percent of the commercial fish landings in the continental United States. Total commercial fish landings from the west coast of Florida, which represents the bulk of landings from the ROI, ranked third among the Gulf States during 1993, with an estimated 127 million pounds landed, valued at $152 million. The major commercial fisheries of Florida and Gulf of Mexico waters can be divided into invertebrates and shellfish (such as shrimp, spiny lobster, stone crab) and finfish (such as reef fish, bottom fish, king mackerel, inshore and open water pelagic fishes, etc.).

Participation in Gulf of Mexico and State of Florida fisheries areas is not limited to fishermen from within Florida. Vessels originate from other Gulf States and other countries. However, for the area of the proposed action, the majority of commercial fishing trips and landings are reported in Florida. The number of commercial fishing trips and fish and shellfish landings by Florida county, and their proportional contribution to west coat Florida totals, indicate the location of important commercial fishing areas and ports (figure 3.2.10-1).

The nearshore waters of Florida and the Gulf of Mexico contain some of the richest fishing grounds in the United States. A total of about 400,000 successful commercial fishing trips were reported in Florida during 1995 (University of Florida, Bureau of Economic and Business Research, College of Business Administration, 1995; 1996). Nearly one-half of those trips originated from or ended in ports in western Florida counties potentially affected by the proposed action. The most important concentrations of commercial fishing in the ROI are the Florida Keys (Monroe County), the Central Florida Gulf (Tampa-St. Petersburg), and the Northern Gulf of Mexico in the vicinity of Gulf County (figure 3.2.10-2).

EXPLANATION

Pink Shrimp Grounds

Outer Limits of Major Finfish Harvest Area

Lobster

Major Commercial Fisheries Areas of the Gulf of Mexico off the Florida Coast

Scale 1:6,000,000

0 50 100 Miles

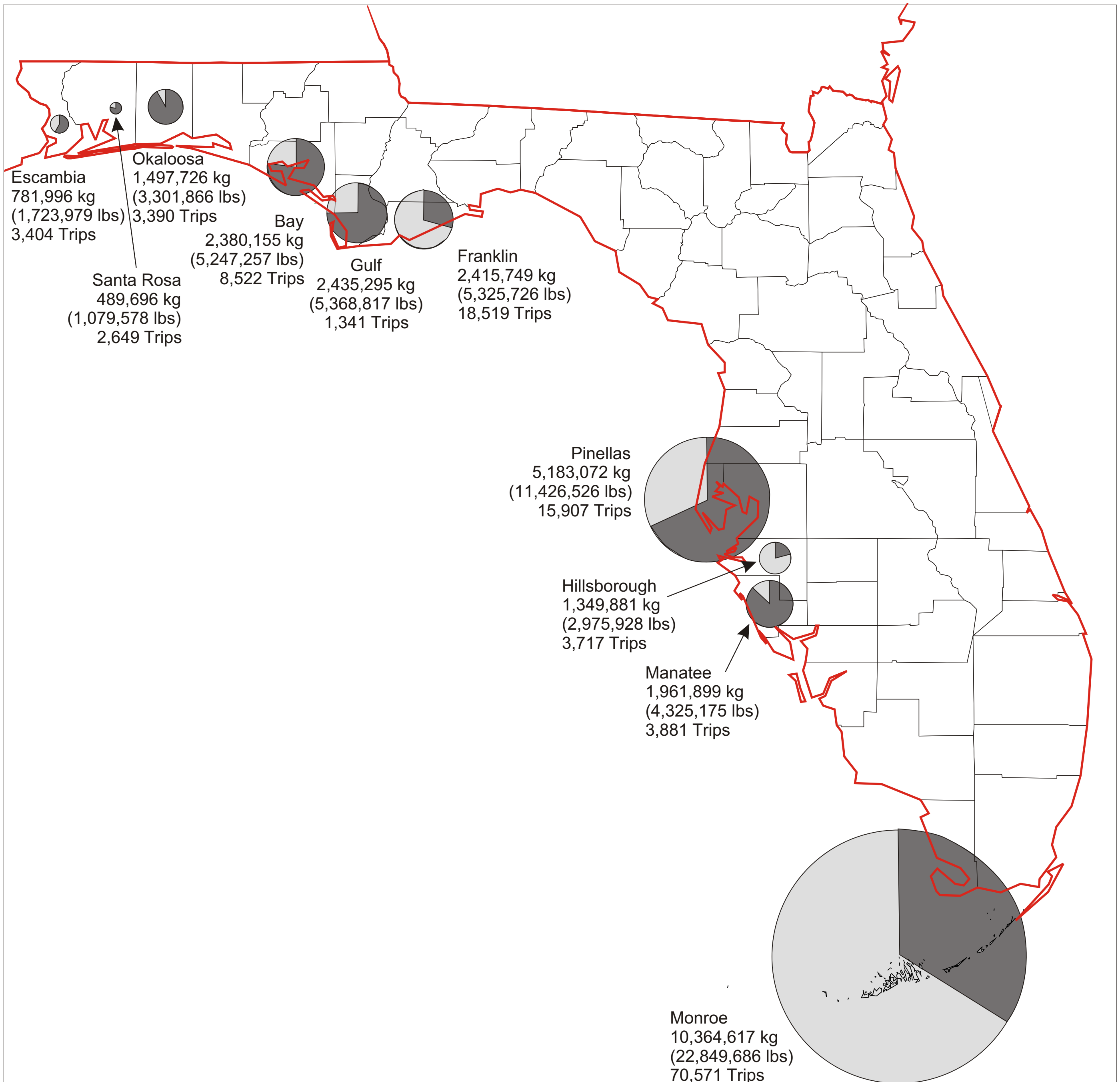
0 100 200 Kilometers

NORTH

Eastern Gulf of Mexico

Figure 3.2.10-1

gom-6m-3gen007



Source: University of Florida, Bureau of Economic and Business Research, College of Business Administration, 1996.

EXPLANATION

Fish - Includes all finfish harvested for commercial sale

Shellfish - Includes clams, conch, crabs, lobster, octopus, oysters, scallops shrimp, sponges, and squid

Note:
Total Landings (kilograms) - Based on whole weight of species with some exceptions, e.g., stone crabs.

Trips - Only successful trips of fishermen.

Landings are recorded only in counties with greater than 1 million pounds of commercial fish harvested.
Data are preliminary.

Commercial Fishing by County

Florida

Figure 3.2.10-2

053egl

The effect of the missile testing clearance areas on commercial fishing in Florida waters of the Gulf of Mexico were measured by:

- Number of commercial fishing trips precluded as a percentage of total fishing trips expected
- Landings of commercial fish precluded as a percentage of total landings expected

There have been several new regulations enacted in the past 3 years. These regulations significantly change past practices of fishing, but have not yet been in place long enough to have their impacts become entirely apparent. Predictions about the future are even more difficult for some fisheries without data on the implications of these new and evolving regulations. Many stocks of commercial fish are considered to be over-fished, and regulations to protect fish stocks will continue to evolve.

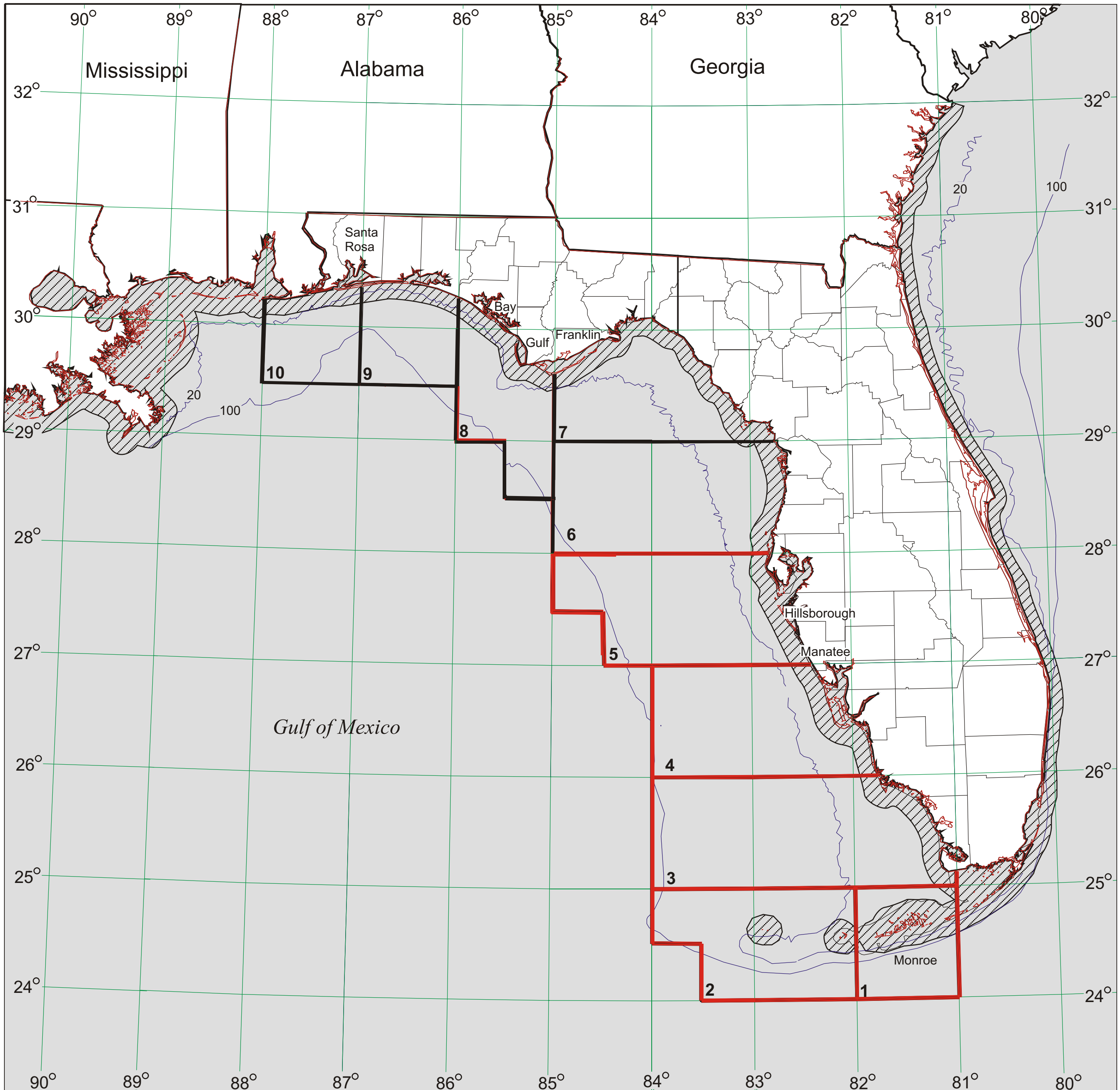
Of the Florida counties and ports, Key West is the most prominent. Ranked the 25th most-important fishing port in the United States during 1990 (University of Florida, Bureau of Economic and Business Research, College of Business Administration, 1996), Key West and Marathon Key together account for about 80 percent of the commercial landings and value of the Florida Keys.

Seasons for various fisheries include lobster (6 August through 31 March) and stone crab (15 October through 15 May; regulatory seasons), as well as king mackerel (winter fishery in the Florida Keys) and shrimp (winter fishery off the Dry Tortugas). The catch of many other species is regulated by a quota system. Most species are caught year round with some peaks occurring. For example, commercial lobster harvest is controlled by restricting harvest to the August–March period and limiting the total number of traps in the fishery. However, most legal sized lobster are removed each year during the harvest season (Banerrot, 1990).

The FDEP collects and tabulates information on commercial fishing for purposes of research and management. All dealers buying fish from fishermen or fishing for them, must report the amounts of all species landed on each fishing trip. The reporting system and database are collectively referred to as the Marine Fisheries Information System (MFIS) (Bohnsack, Harper, and McClellan, 1994).

The MFIS database includes information on dealer, date, time, area and gear fished, size and amount of each species landed, and the unit price and total value per trip. The Florida coast is divided into 18 individual reporting areas (the 10 reporting areas of the Gulf of Mexico are shown in figure 3.2.10-3).

All records of the MFIS are confidential under the Florida Confidentiality Rule 370.07. This is especially true of aspects of the information that affect the fishing or economic success of individual fishermen. As a result, the detail of available information was limited to summary-level information, and analyses were conducted by request to the FMRI.



Source: Eglin Air Force Base, Natural Resources Branch, 1997.

EXPLANATION

Bathometric Lines (Measured in Fathoms)

State Waters

Federal Waters

Depth in Meters

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

NORTH

Commercial Fishing Zones of the Florida Marine Fisheries Information System (MFIS) - Gulf of Mexico

Figure 3.2.10-3

gom-6m-3land001

In general, fishing activity was about three times greater in state waters of the Gulf of Mexico than in Federal waters. The number of fishing days averaged 1,076 days/area/month in state waters versus 334 days/area/month in Federal waters. Lobster, shrimp, stone crab, and reef fish fisheries primarily accounted for the bulk of the activity in state waters. In state waters:

- Lobster fishermen were active almost exclusively in the Florida Keys (areas 1 and 2) from August through December.
- Shrimp fishermen were primarily active in the Dry Tortugas (area 2) from January through August, and were active at moderate levels year-round in state waters of central Florida and the central Panhandle.
- Stone crab activity occurs from October through May from the Keys northward to the eastern Panhandle (areas 6 and 7).

3.2.10.4 Environmental Impacts and Mitigation

No-action Alternative

Under the no-action alternative, socioeconomic activities generated from commercial and industrial activity would continue to develop at existing rates of growth. Continuing Eglin AFB operations would have a generally constant effect on the region.

Commercial Fisheries

Continuing Eglin AFB activities over the Gulf of Mexico would result in temporary changes to local or regional socioeconomic factors.

Site Preparation Activities

The construction of the proposed launch platforms could cause some short-term, localized economic effects due to the cost of purchasing and installing such a platform off the coast of Sites A-15 or D-3A.

Of the site-preparation activities, only the development of an offshore launch platform has the potential to affect commercial fishing activity in the ROI. This activity would influence a very small area of total area of fishing area within the Gulf of Mexico. Based on the current literature on the effects of artificial reef and platform-type structures, it is debatable as to whether the effect on commercial fishing would be positive or negative. Such structures yield cover and hard substrates for fish and invertebrates and are known to concentrate fish. However, these structures can also impede the operation of trawls or other gear and it is debatable as to whether they increase productivity or simply congregate fish.

Flight Test Activities

The effect of the clearance of commercial fishing activities from the clearance areas on the number of commercial fishing trips and landings of fish and shellfish was estimated as follows. The percentage of each of the MFIS reporting areas precluded from commercial fishing activity was computed for each representative test example. The percentage of each MFIS reporting areas cleared was multiplied by the average daily landings (or number of trips) of each major fishery (total annual catch of a species or species group divided by 365 days). The result was an estimate of fishing trips or landings forgone as a result of a 1-day clearance (equivalent to one missile test scenario). These areas would be cleared for periods no longer than 4 hours, but for analytical purposes it was assumed that fishermen would not go out for a full day because of the limits. These procedures would apply to either Air Drop or land-based target launches.

The computation of landings or fishing trips forgone required some assumptions about the commercial fishing data. It was assumed that commercial fishing effort (number of trips) and catch (landings) occurred uniformly throughout each reporting area and throughout the year. This assumption was necessitated by the lack of specific data on area fished and by the confidentiality of the MFIS data. Therefore, the computed numbers for trips and landings represent per-day estimates based on annually and spatially-averaged estimates.

A small fraction of the commercial fishing activity and fish harvest from the Gulf of Mexico off Florida would be prevented from occurring as a result of a single missile test, regardless of the test scenario. In all cases, the number of fishing trips and catch of fish prevented as a result of a daily missile test is generally less than two tenths of one percent of the total annual fishing activity or catch.

The estimates of fishing activity and landings forgone are believed to be representative of the potential impacts of missile testing on the commercial fishing activity within the Gulf of Mexico.

The estimated effect of missile testing on commercial fishing was based on four representative test examples. There are many possible combinations of launch scenarios, and the exact location and shape of the clearance areas are expected to vary with launch requirements. The estimates of commercial fishing activity and landings forgone provided above are believed to be representative of a range of possible clearance areas for two reasons. First, the analysis is based on MFIS monthly average catch data, so position shifts in the clearance area within MFIS areas make no difference in the results. Second, the conclusion that 24 test events per year would result in the clearance of just less than 1 percent is based more on the low percent of total potential fishing time lost than on the position or total area of the clearance area. Therefore, small changes in the position and total area of the clearance area are expected to make little difference in the results and conclusions presented here.

Certain fisheries would be less influenced than others. Fisheries that rely in part or entirely on traps, such as lobster or stone crab, may be less heavily influenced by missile testing clearance areas. With advance warning of missile tests, fishermen could set or check traps to work around the short clearance time periods associated with individual tests. Typical time period for which these traps are normally left in the water fishing (called “soak time”) is greater than 1 day. This is greater than the typical clearance period, and with advance notice and planning, some adjustments may be made by some commercial fishermen so that disturbance to commercial fishing activity could be minimized.

There are potential beneficial impacts that may occur as a result of the reduction of fishing activity and harvest associated with fishing area clearances during missile testing. Fishing activities and harvest are well understood to have some negative effects on marine habitats (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1995b), the health of fisheries stocks (U.S. Department of the Interior, Minerals Management Service, 1996), and populations of non-target species caught incidentally to the catch of target fish (Gulf Fisheries Management Council, 1997). Examples include destruction of coral and hard bottom habitats by traps and trawls, overfishing of certain species, and harm to marine turtles caught in shrimp trawls. Missile tests could reduce fishing activity and harvest of fish and shellfish. However, the actual clearance of fishing activity and harvest is expected to be small relative to the total annual in coastal Florida and the Gulf of Mexico. The associated positive benefits would be expected to be correspondingly small.

Commercial fishing in the Gulf of Mexico accounts for 57.6 million kilograms (127 million pounds) annually, and about 20 percent of the commercial fish landings in the continental U.S. A total of about 400,000 successful commercial fishing trips were reported in Florida during 1995. Depending on the particular test, TMD flight test activities could divert between 1 and 26 fishing trips with between 816.5 and 7,983.4 kilograms (1,800 and 17,600 pounds) of daily catch during a test event as many as approximately 24 times per year (figures 3.2.10-4 through 3.2.10-7). Most fishing activity occurs closer to shore than the areas that would need to be cleared for TMD testing. In terms of trips foregone or tonnage foregone, neither approaches 1 percent loss due to TMD activities.

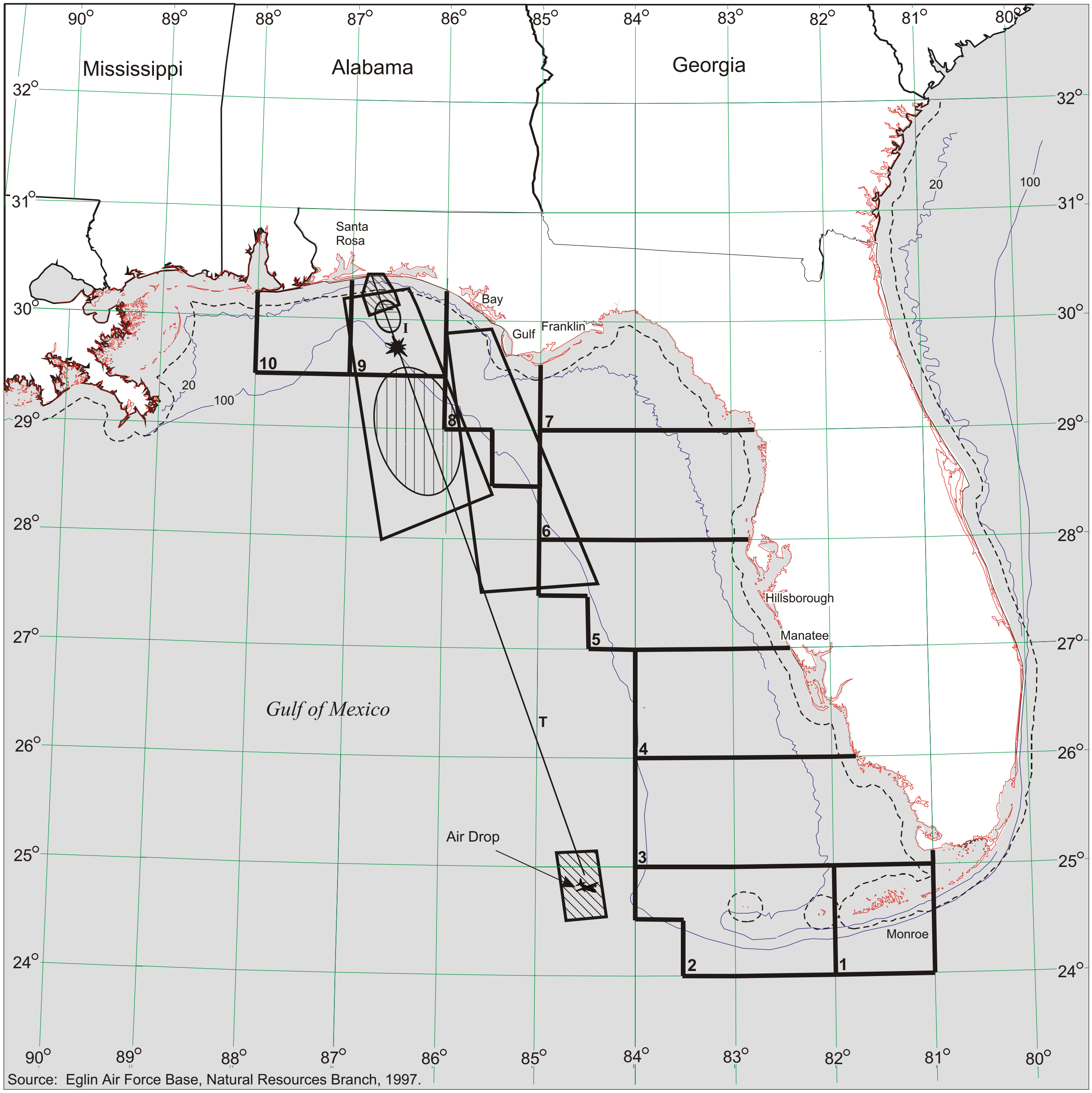
Cumulative Impacts

Flight test activities in the Gulf of Mexico would require the definition of various clearance zones that will operate before, during, and after tests, for up to 4 hours. These zones could have a small economic impact on leisure and commercial fishing.

The commercial fishing industry in the Gulf of Mexico is undergoing structural change in response to changing fish stocks. Small periods of exclusion from particular waters could add very marginally to the much greater impact of this economic dislocation.

Mitigations Considered

TMD activities would have little effect upon commercial fishing economics in the Gulf of Mexico; but short periods of high value fishing activity would be considered in test planning. Such periods include the beginning of the lobster season in early August each year and the preceding lobster sports day on the last Wednesday and Thursday of July each year.



EXPLANATION

- Bathometric Lines (Measured in Fathoms)
- I Interceptor Ground Track
- T Target Ground Track
- Intercept
- State/Federal Waters Border
- Interceptor Debris
- Target Debris
- Representative Evacuation Areas
- Launch Hazard Area
- Booster Drop Zone

Depth in Meters

Scale 1:6,000,000

0 50 100 Miles

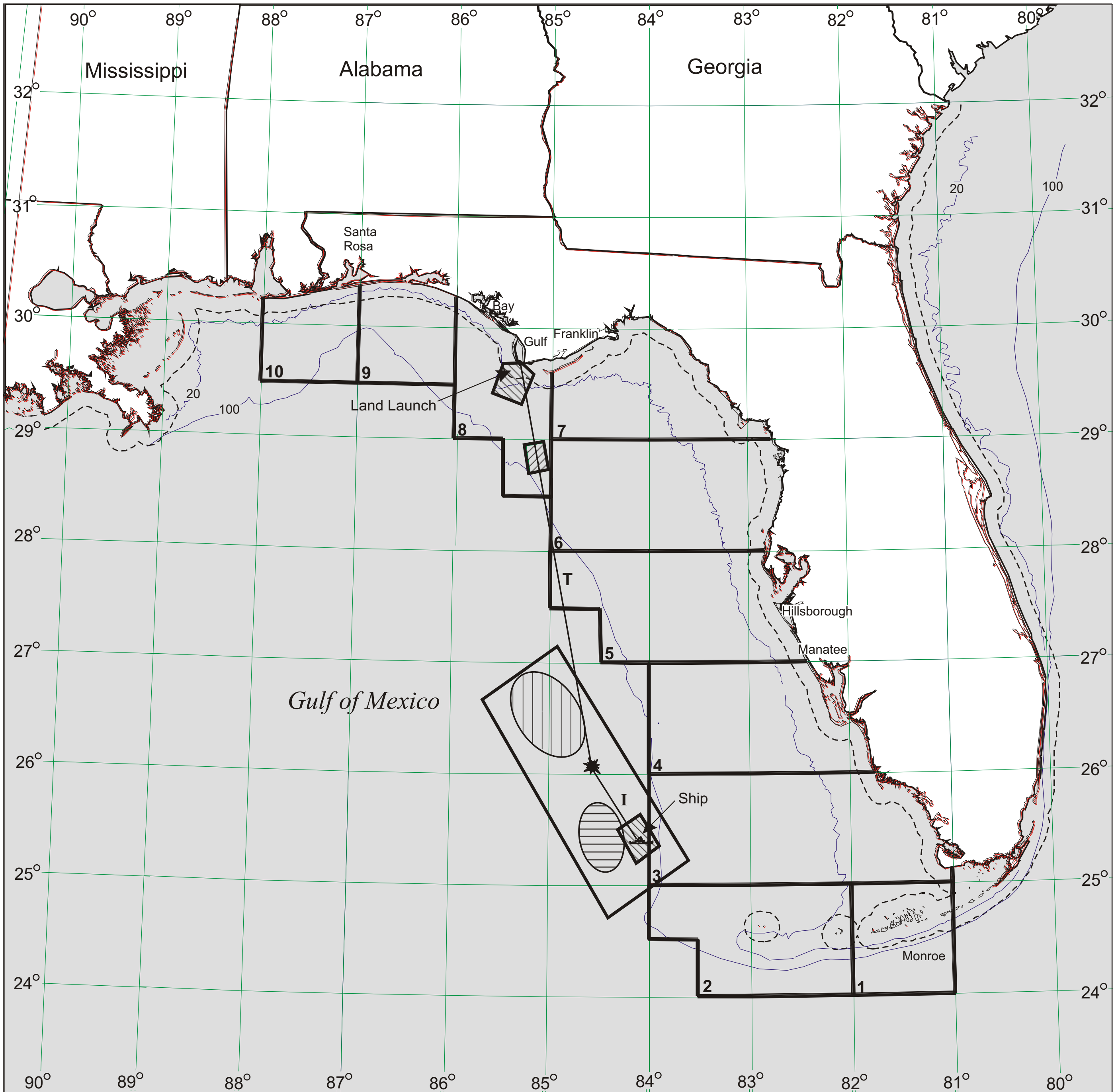
0 100 200 Kilometers

NORTH

Representative Effect on MFIS Commercial Fishing Areas and Example 1

Figure 3.2.10-4

gom-6m-4land001



Source: Eglin Air Force Base, Natural Resources Branch, 1997.

EXPLANATION

- Bathometric Lines (Measured in Fathoms)
- I Interceptor Ground Track
- T Target Ground Track
- Intercept
- State/Federal Waters Border
- Interceptor Debris
- Target Debris
- Representative Evacuation Areas
- Launch Hazard Area
- Booster Drop Zone

Depth in Meters

Scale 1:6,000,000

0 50 100 Miles

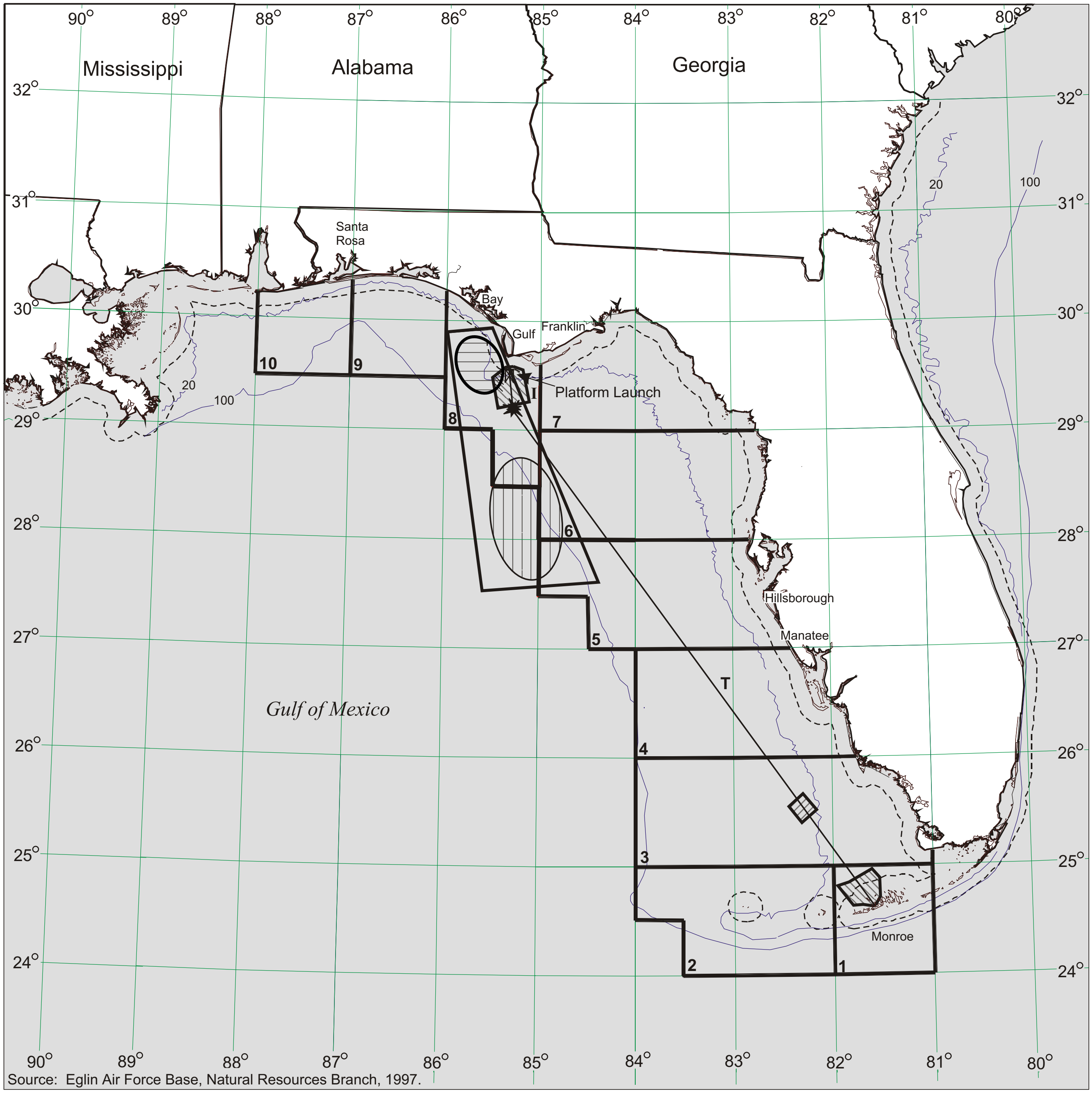
0 100 200 Kilometers

NORTH

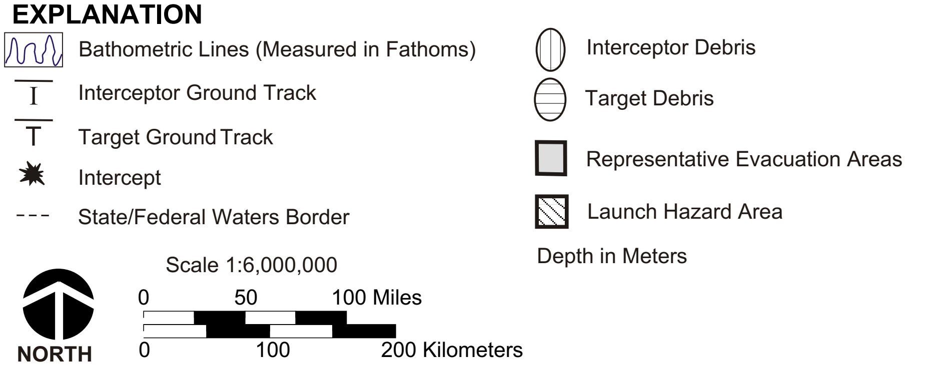
Representative Effect on MFIS Commercial Fishing Areas and Example 2

Figure 3.2.10-5

gom-6m-4land002



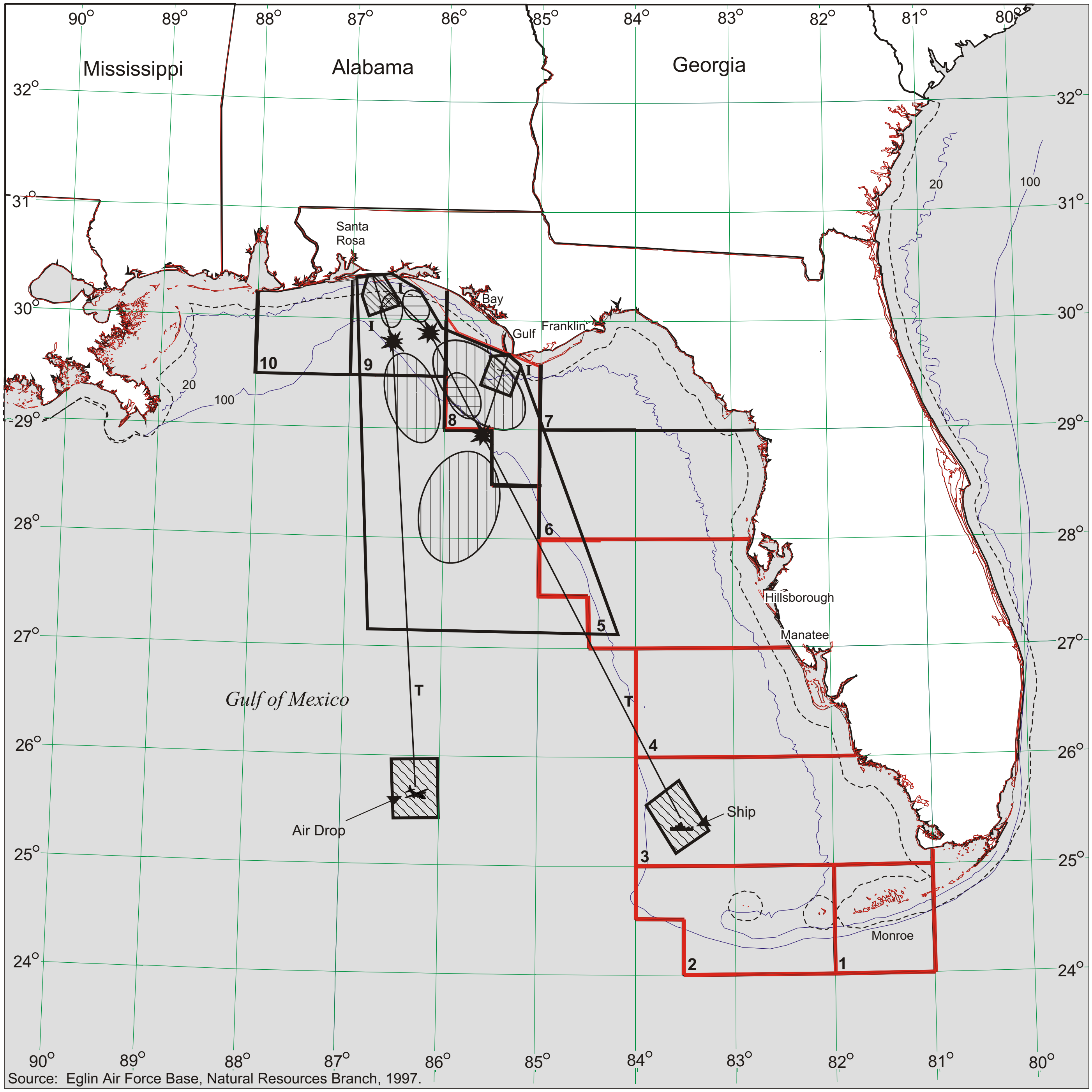
EXPLANATION



Representative Effect on MFIS Commercial Fishing Areas and Example 3

Figure 3.2.10-6

gom-6m-4land003



EXPLANATION

- Bathometric Lines (Measured in Fathoms)
- I Interceptor Ground Track
- T Target Ground Track
- Intercept
- ---- State/Federal Waters Boundary
- Interceptor Debris
- Target Debris
- Representative Evacuation Areas
- Launch Hazard Area
- Booster Drop Zone

Depth in Meters

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

NORTH

Representative Effect on MFIS Commercial Fishing Areas and Example 4

Figure 3.2.10-7

gom-6m-4land004

3.2.11 TRANSPORTATION

Some marine shipping activities will have to be temporarily re-routed due to TMD testing and training.

3.2.11.1 Resource Description and Evaluative Methods

The potential transportation issue related to the proposed action and its alternatives in the Gulf of Mexico is that of marine shipping. Marine shipping refers to the conveyance of freight, commodities, and passengers via mercantile vessels. Within the Gulf of Mexico, there are two primary water courses for marine shipping—the shipping lanes of the open sea and the Intracoastal Waterway (IWW) system which continues north along the Florida coast.

The transportation issue related to the proposed action and its alternatives in the Gulf of Mexico is that of marine shipping. Marine shipping refers to the conveyance of freight, commodities, and passengers via mercantile vessels. There are two primary water courses for marine shipping—the shipping lanes of the open sea and the intracoastal waterway system.

Measures used to assess the impact on marine shipping in the Gulf of Mexico and the Gulf Intracoastal Waterway (GIWW) are as follows:

- Proposed Action: Number of ships in the Gulf of Mexico and GIWW between Pensacola and Key West that would be diverted or excluded because of the proposed action
- Impacts of the Proposed Action: Proportion of the total number of ships in the Gulf of Mexico and GIWW between Pensacola and Key West that would be diverted or excluded because of the proposed action
- Ferries between Marco Island and Key West

Gulf Shipping Lanes

Shipping lanes, or routes, are defined as the preferred paths traveled by dry cargo ships, tanks ships, and barges for port-to-port travel within the Gulf of Mexico and destinations outside the Gulf of Mexico (U.S. Department of Commerce, 1985; U.S. Department of the Air Force, 1995).

Waterborne commerce has maintained a presence in the Gulf of Mexico for more than 150 years. As time passed, an extensive shipping pattern developed in relation to the locations of the major Gulf of Mexico ports and the Straits of Florida (located between the Florida Keys and Cuba). To minimize conflict between oil and gas activities and marine transportation, a series of safety fairways or traffic separation schemes was established, segregating vessels from structures within the Gulf of Mexico. Fairways play an important role in the avoidance of collisions on the outer continental shelf, but not all vessels remain within their confines. Many vessels, such as fishing boats and support vessels for the outer continental shelf, travel outside of established fairways.

Intracoastal Waterway

The IWW links inland ports with ocean-going traffic, connecting major shipping ports along the Gulf and Atlantic coasts in one relatively contiguous navigable inland channel, including numerous canals. For transportation of commodities within the Gulf of Mexico, the GIWW is the most frequently used route (figure 3.2.11-1). Though utilized by barges transporting heavy freight, the GIWW is also important to recreational activities, and pleasure craft constitute a major portion of waterway traffic.

Near Eglin AFB, the GIWW traverses Choctawhatchee Bay, entering Santa Rosa Sound near Fort Walton Beach. It then passes through the length of Santa Rosa Sound before entering Pensacola Bay near the city of Gulf Breeze.

The GIWW spans the area along the Gulf of Mexico, following the coastline inshore and through bays and estuaries between Brownsville, Texas (on the Rio Grande, at the Mexican border) and St. Marks, Florida, and providing over 2,092.1 kilometers (1,300 miles) of sailable waters (U.S. Army Corps of Engineers, Galveston District, undated). On the west Florida coast, the canal resumes its protected passage at Tarpon Springs, extending southward 241.4 kilometers (150 miles) to Fort Myers. At Fort Myers, the GIWW crosses Florida along the Okeechobee Waterway, providing a 241.4-kilometer (150-mile) connection with the Atlantic Intracoastal Waterway (AIWW) (U.S. Army Corps of Engineers, Galveston District, undated).

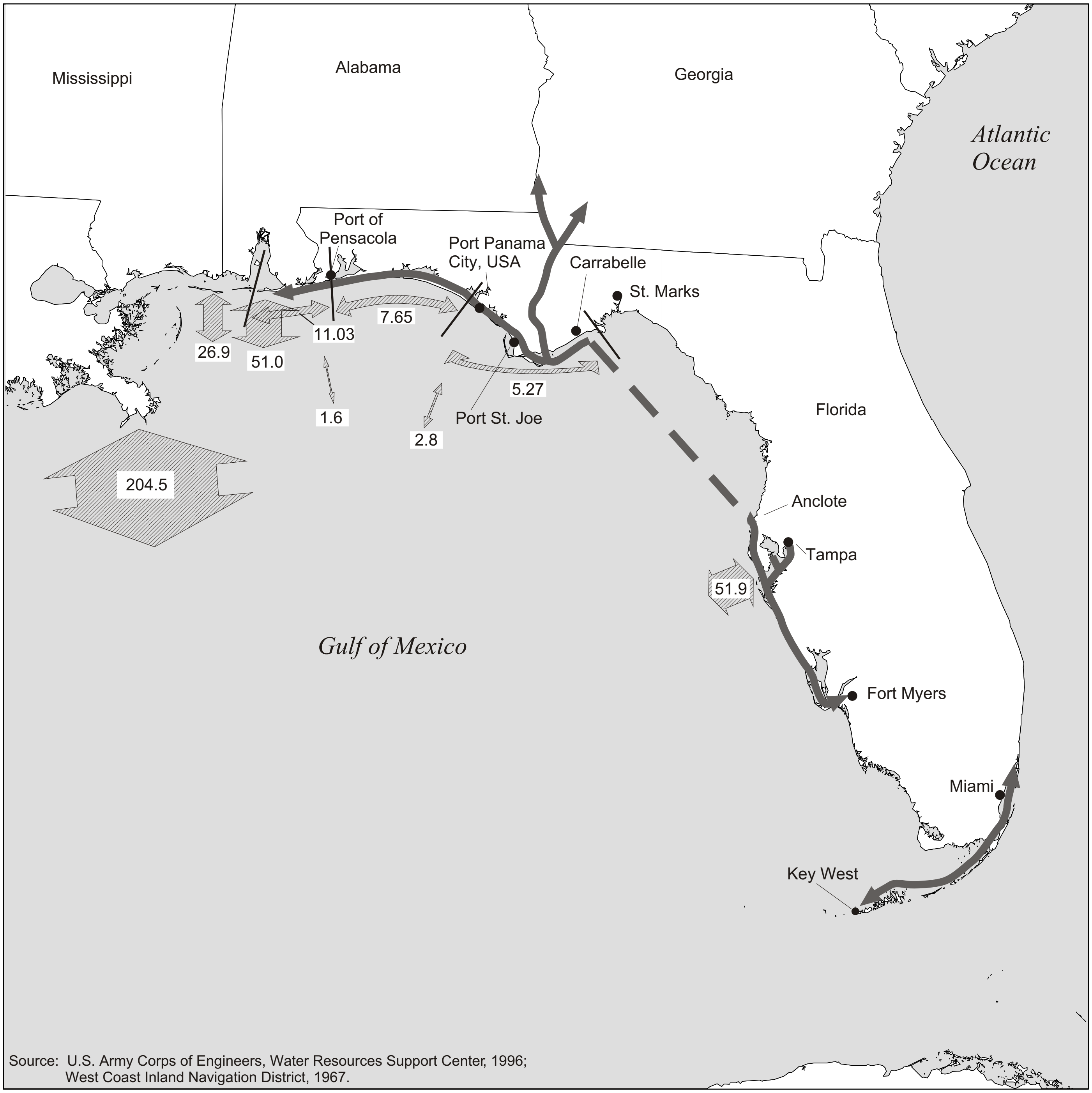
Marked for marine navigation by the U.S. Coast Guard, the GIWW provides suitable facilities and access to the Mississippi River system, the Tennessee-Tombigbee, the Savannah River, and other navigable waterways, thus allowing products carried on the waterway to be easily distributed to the inland United States.

3.2.11.2 Region of Influence

Northern Gulf of Mexico

Gulf Shipping Lanes. The ROI incorporates all major routes crossing the Eglin AFB overwater test areas, and major ports connected to these routes, including Key West. Gulf shipping routes within the vicinity of Eglin AFB overwater areas include port-to-port travel within the Gulf of Mexico (figure 3.2.11-2) and transit to destinations outside the Gulf of Mexico (figure 3.2.11-3). Routes depicted on these figures denote typical, not actual, shipping routes.

Intracoastal Waterway. For the GIWW, the Eglin ROI incorporates the portion of the GIWW from Pensacola Bay to Apalachee Bay, located east of Cape San Blas on Florida's west coast, a distance of approximately 394.3 kilometers (245 miles). This segment runs from Apalachee Bay through Saint George Sound, turning inland via the Saint James River and canals to East Bay and Saint Andrews Bay east of Panama City. From Panama City, the waterway extends through West Bay and enters another canal system before entering Choctawhatchee Bay, south of Eglin AFB (U.S. Department of the Air Force, 1995).



EXPLANATION

Intracoastal Waterway

Carrabelle to Anclote (Open Bay Section)

Annual Traffic Into and Out of Ports

Note: Values in millions of tons.
Portion of waterway from Miami to Key West is section of Atlantic Intracoastal Waterway.

NORTH

Scale 1:6,000,000

0 50 100 Miles

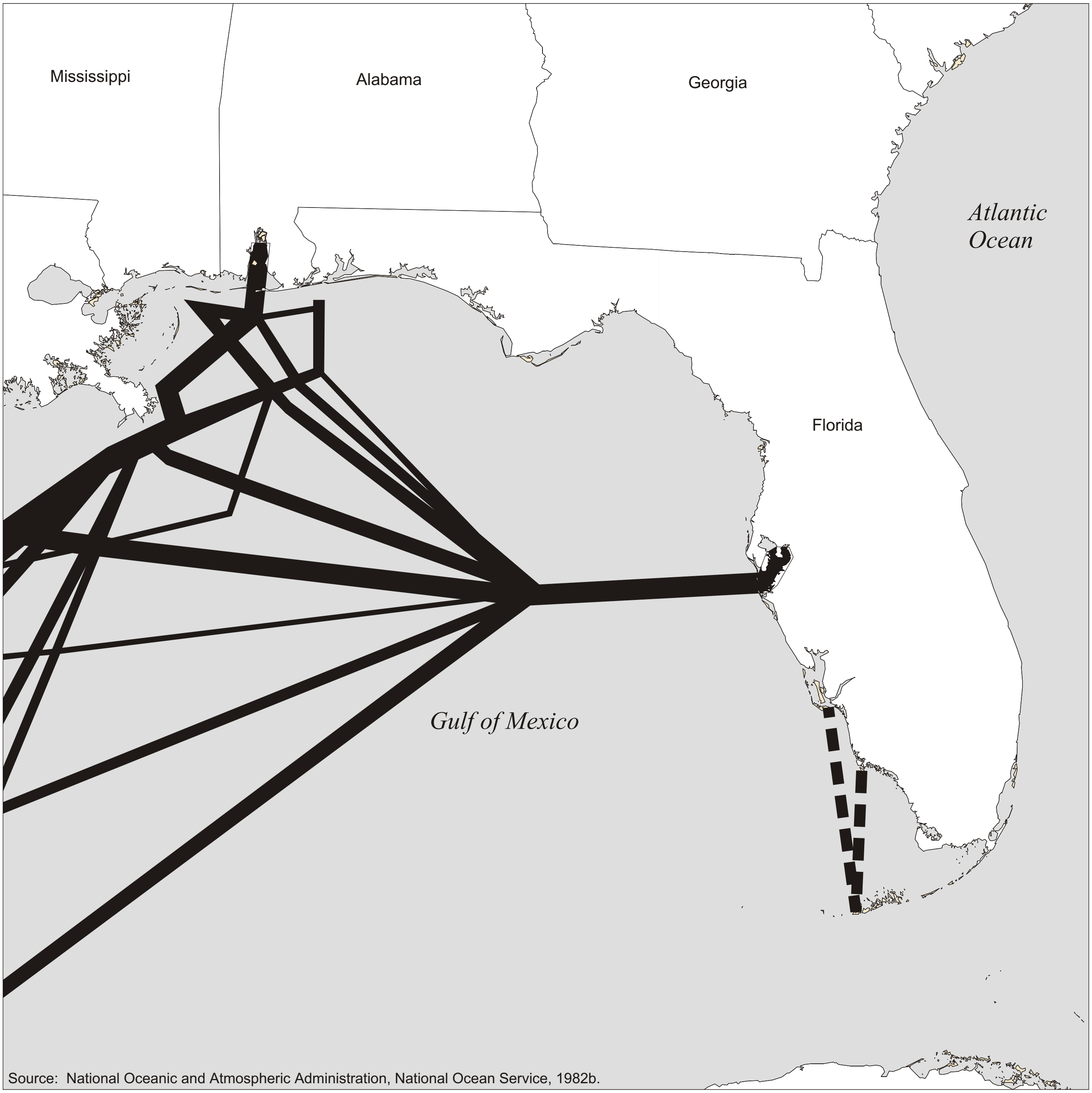
0 100 200 Kilometers

Gulf Intracoastal Waterway and Deep-water Ports-Annual Traffic in Tons

Eastern Gulf of Mexico

Figure 3.2.11-1

gom-6m-3trans005



EXPLANATION

Shipping Trips per Year

- 1-499
- 500-1,499
- 1,500-2,999
- 3000-4,999
- 5000 or greater

Ferry Routes

Scale 1:6,000,000

0 50 100 Miles

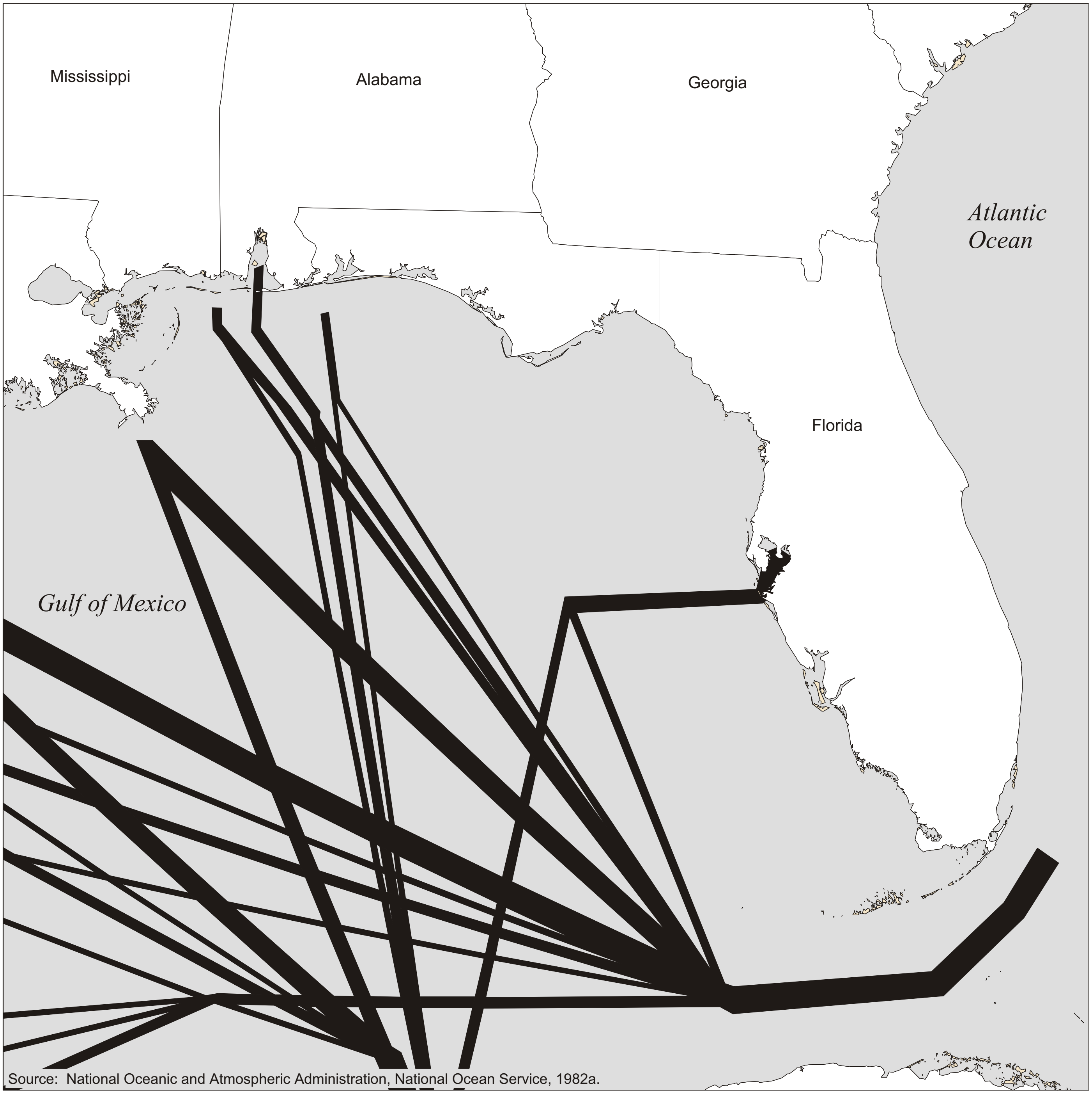
0 100 200 Kilometers

NORTH

Typical Shipping Routes Within the Gulf

Eastern Gulf of Mexico

Figure 3.2.11-2



EXPLANATION

Shipping Trips per Year

- 1-499
- 500-1,499
- 1,500-2,999
- 3000-4,999
- 5000 or greater

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

NORTH

Typical Shipping Routes From Outside the Gulf

Eastern Gulf of Mexico

Figure 3.2.11-3

gom-6m-3trans003

Southern Gulf of Mexico

Gulf Shipping. Most Gulf water shipments in transit to outside destinations pass through the Florida Straits (located between the Florida Keys and Cuba). Other shipments travel through the Yucatan Channel (located between the Yucatan Peninsula and the western end of Cuba) (U.S. Department of the Air Force, 1995).

3.2.11.3 Affected Environment

Intracoastal Waterway

A substantial amount of domestic waterborne commerce along the Gulf Coast does not use open Gulf of Mexico waters. Again, for transportation of commodities, the GIWW is the primary route; it is estimated that 40 percent of the world's commerce passes within 1.5 days' sailing time of the port of Key West (U.S. Department of the Air Force, 1995).

Primary canals in the GIWW include the New Orleans–Rigolet Cut, the Port Arthur–Corpus Christi Channel, and the Inner Harbor Navigational Canal at New Orleans (Columbia University Press, 1993.)

Figure 3.2.11-1 summarizes data available for the GIWW/Mississippi River system totals for U.S. flag passenger and cargo vessels.

Commerce in the GIWW has grown appreciably over the years, from 5.978 billion kilograms (6.59 million tons) in 1938 to 91.625 billion kilograms (101 million tons) in 1985 (U.S. Army Corps of Engineers, Galveston District, undated).

Northern Gulf of Mexico

Within the ROI, 1995 total tonnage (including domestic coastwise tonnage) for the GIWW was 107.05 billion kilograms (118.0 million tons); this was an increase of 0.3 percent over 1994 (U.S. Army Corps of Engineers, Navigation Data Center, 1996). For this same period, 3.688 billion kilograms (4.065 million tons) were transported between Apalachee Bay and Panama City; 6.94 billion kilograms (7.651 million tons) were transported from Panama City to Pensacola; and 10.002 billion kilograms (11.025 million tons) were transported from Pensacola to Mobile Bay, Alabama (U.S. Army Corps of Engineers, Water Resources Support Center, 1996). Commodities shipped included coal, petroleum, chemical products, fuels, and manufactured goods.

Based upon March 1997 estimates, this total decreased slightly by 1.8 percent to 105.051 billion kilograms (115.8 million tons) in 1996 (U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 1997). This averages to approximately 10.9 percent of the internal U.S. waterways' national domestic total for the 2 years (U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 1997).

Eglin AFB and Hurlburt Field are served by barge via the GIWW for the delivery of petroleum, oils, and lubricants. Barge deliveries are generally made twice a month, with average monthly deliveries of 36,000 and 20,000 barrels a month, respectively.

The barges use the GIWW, entering Eglin through Weekly Bayou. Shipments to Hurlburt Field are off-loaded at a fuel dock on the mainland north of Santa Rosa Island near the Hurlburt Field Main Gate. (Air Force Development Test Center, 1995b)

Southern Gulf of Mexico

The AIWW as it exists within the Florida Keys ROI is predominately employed for recreational purposes, rather than commerce. The Port of Key West is the only deep-water port in the area.

Gulf Shipping Lanes

Figure 3.2.11-4 provides a graphical representation of ships' location within the Gulf of Mexico at a single point in time (4:43 p.m., 20 August) during 1997 (4,786 locations are presented). The major shipping lanes will normally have two or more vessels tracking to its next port of call throughout the day.

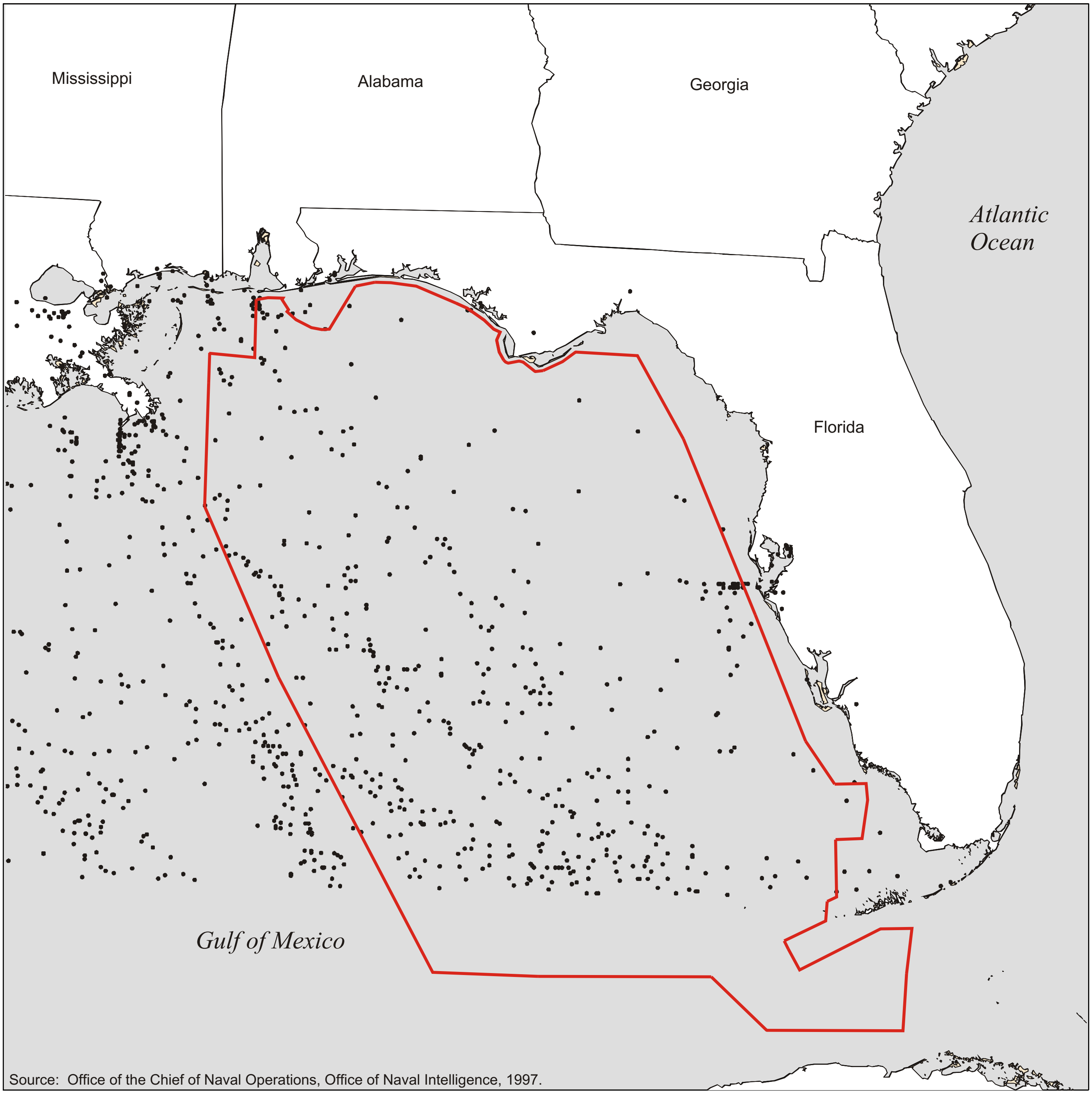
Table 3.2.11-1 provides the average number of ships in the Gulf of Mexico ports during 1994–1995.

Table 3.2.11–1: Top Ten Gulf Ports in 1995 Based on Total of Ships

Port	Number of Ships	Number of Ship Movements
1. New Orleans, Louisiana	2,894	13,539
2. Houston, Texas	1,842	12,022
3. Tampa, Florida	759	3,723
4. Mobile, Alabama	704	2,377
5. Corpus Christi, Texas	589	3,256
6. Galveston, Texas	559	1,847
7. Texas City, Texas	491	2,449
8. Lake Charles, Louisiana	453	1,991
9. Beaumont, Louisiana	410	1,611
10. Port Arthur, Texas	392	1,380
TOTAL	9,093	44,195

Source: Office of the Chief of Naval Operations, Office of Naval Intelligence, 1997.

Port-to-port travel within the Gulf of Mexico accounts for approximately 31 percent of the tank ships and 36 percent of the cargo ships leaving American ports. About 80 percent of the tank ships and 70 percent of the cargo ships leaving Mexican ports travel to other ports in the region. Major commodities shipped between ports in the region include crude oil, iron and steel products, iron ore, industrial and agricultural chemicals, coal, marine shells, sand, gravel, containerized cargo (such as processed food and equipment), and refined petroleum products. (U.S. Department of the Air Force, 1995) Over 3,000 vessels passed through the Eglin ROI in 1979.



EXPLANATION

- • Ship
- Eglin Gulf Test Range (Proposed)

Density of Shipping - Single Point in Time

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

NORTH

Eastern Gulf of Mexico

Figure 3.2.11-4

gom-6m-3trans007

Some 61 percent of the vessels entering and leaving the region move through the Florida Straits (U.S. Department of Commerce, 1985). This traffic passes back and forth under EWTAs 1, 2, 3, 4, 5, and 6 before converging under Warning Area 174 (Navy) to enter or exit the Gulf of Mexico. The remaining vessels travel through the Yucatan Channel and pass under EWTAs 1, 2, and 4 or pass just west of the Eglin Water Test Area Boundary.

The Gulf of Mexico has 490 public and private seaports with a total of 787 berths, accounting for 25.6 percent of the Nation's total. Seven of the top ten U.S. ports are located in the Gulf region, testament to its importance in U.S. commerce. For 1995, the Port of South Louisiana (ranked first in U.S. port tonnage) handled 26.2 billion kilograms (28.87 million tons) of imported goods and 62.3 billion kilograms (68.64 million tons) of exports (table 3.2.11-2) (U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 1997).

Table 3.2.11–2: 1995 Waterborne Tonnage by Gulf Coast States

State	Shipping to Domestic in kilograms (tons)	Shipping to Foreign in kilograms (tons)	Receiving - Domestic in kilograms (tons)	Receiving - Foreign in kilograms (tons)
Alabama	8.28 billion (9.12 million)	13.34 billion (14.18 million)	15.94 billion (17.57 million)	10.62 billion (11.71 million)
Florida	12.4 billion (13.67 million)	20.68 billion (22.8 million)	50.13 billion (55.26 million)	20.35 billion (22,432)
Georgia	701.25 million (773,000)	7.39 billion (8.15 million)	2.90 billion (3.19 million)	6.74 billion (7.44 million)
Louisiana	88.68 billion (97.76 million)	111.02 billion (122.38 million)	127.42 billion (140.47 million)	97.76 billion (107.76 million)
Mississippi	11.98 billion (13.21 million)	3.13 billion (3.46 million)	7.75 billion (8.54 million)	14.51 billion (16 million)
Texas	43.9 billion (48.39 million)	47.66 billion (52.54 million)	24.25 billion (26.73 million)	156.85 billion (172.88 million)

Note: Date does not allow differentiation between Gulf and Atlantic shipping for Georgia and Florida
Source: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 1997

Fifteen of the top 50 U.S. ports for non-containerized materials such as coal, petroleum, food, and farm products are in the Gulf of Mexico (table 3.2.11-3).

Northern Gulf of Mexico

There are three deep-water ports within close proximity to the ROI: Port Panama City USA, the Port of Pensacola, and Port St. Joe (figure 3.2.11-1). Port-to-port shipments pass under EWTAs 1, 2, and 3. Shipments between Mobile or Pensacola to Tampa Bay pass through Warning Areas W-151C and Navy Warning Areas W-155A and W-155B. Most Florida ports are primarily engaged in domestic trade; in tonnage, phosphate is Florida's major export and coal and petroleum are its major imports (Florida State University, Institute of Science and Public Affairs, 1996).

Table 3.2.11–3: 1995 Nationwide Rankings of Gulf Ports Based on Total U.S. Waterborne Commerce

Rank	Port	Total in kilograms (tons)	Percent Change (1994-1995)
1	Port of South Louisiana, Louisiana	185.55 billion (204.5 million)	10.6
2	Houston, Texas	122.65 billion (135.2 million)	-5.9
4	Baton Rouge, Louisiana	75.84 billion (83.6 million)	-3.1
6	New Orleans, Louisiana	69.85 billion (77.0 million)	5.0
7	Port of Plaquemine, Louisiana	66.13 billion (72.9 million)	12.6
8	Corpus Christi, Texas	63.96 billion (70.5 million)	-9.8
10	Tampa, Florida	47.08 billion (51.9 million)	0.0
11	Mobile, Alabama	46.27 billion (51.0 million)	13.3
12	Texas City, Texas	45.72 billion (50.4 million)	13.6
13	Port Arthur, Texas	45.18 billion (49.8 million)	9.2
16	Lake Charles, Louisiana	42.27 billion (46.6 million)	-3.6
25	Pascagoula, Mississippi	24.40 billion (26.9 million)	-10.4
30	Beaumont, Texas	18.96 billion (20.9 million)	-1.2
33	Freeport, Texas	17.87 billion (19.7 million)	12.7
35	Port Everglades, Florida	16.69 billion (18.4 million)	1.3

Note: Tonnage comprises Domestic and Foreign totals.
Source: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 1997

In FY96, the Port of Pensacola received 50 ships from shipping lanes in the Gulf of Mexico and 88 barges from the GIWW; 1997 January through July figures indicate 29 ships and 127 barges have been received (Wharton, 1997). In 1995, the port handled 1.47 billion kilograms (1.622 million tons) of cargo occurred in 1991, when the port handled 4.32 billion kilograms (4.76 million short tons) (U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, 1997).

Port St. Joe, located near Cape San Blas (figure 3.2.11-1), has been inactive since the mid-1980's (Pitts, 1997); however, the Port Authority of Port St. Joe is negotiating the purchase of a deep-water parcel in order to develop port operations. A designated channel, the Gulf County canal, allows access from the GIWW for limited deliveries to the county paper plant (Pitts, 1997). A total of 90.72 million kilograms (100,000 tons) of residual fuel oil and sodium hydroxide were transported in 1995 (U.S. Army Corps of Engineers, Water Resources Support Center, 1996).

Southern Gulf of Mexico

Although the Florida Keys are the juncture of five major trade routes (which overlap nearby), the only deep-water port, Key West, handles no cargo-like vessels at all, but is rather a port of call for cruise ships (Minski, 1997). However, tankers occasionally transport jet fuel to NASKW, and an occasional barge delivers fuel to the city electric plant (Crusoe, 1995).

Cruise ships arriving in Key West currently dock at one of three places: Mallory Dock, Pier B, or the Outer Mole at Truman Annex. There are no other ports in the Florida Keys capable of handling cruise ships. Currently, the Outer Mole is being utilized under the fourth modification of a lease agreement; this allows usage for 90 days (Barrera, 1997). Negotiations are currently underway for an extended lease under the Base Realignment and Closure (BRAC) agreement (Barrera, 1997). For 1994–1995, Key West had 418 port calls, with about 600,000 passengers (Hamlin, 1995). For 1995-96, there were 333 port calls with 393,345 passengers (Barrera, 1997). Current figures (October 1996 through April 1997) indicate 306 port calls with 386,101 passengers (Barrera, 1997).

Within the Key West area, ferry services are another mode of transportation made available. Currently, services are limited during the tourism off-season to a high-speed catamaran, the Friendship 4. Daily trips are made year round, with the point of origin alternating between Marco Island and Fort Myers Beach and with Key West Bight as the destination (figure 3.2.11-2). The other ship in this line, Friendship 5, is not currently scheduled to run (McCune, 1997).

Also scheduled for the Key West area are trips by the Yankee Freedom, running 5 days a week and transporting approximately 95 passengers (Gallen, 1997). This ferry travels a route between Key West (Land's End Marina/Margaret St. Historic Seaport) across Rebecca Channel to Fort Jefferson on Garden Key in the Dry Tortugas.

During the tourist season, the area's ferry traffic increases substantially. The Miss Barnegat Light runs daily (Van Nocker, 1997) from Fort Myers Beach to Key West-Conch Harbor (Owens, 1997). This ferry also make special weekend trips to the Dry Tortugas as scheduled. The Falcon Fleet maintains two ferries, one servicing the area between Marco Island and Key West and the other originating in Fort Myers Beach (Minogue, 1997).

Within the next one to one and-a-half years, two new companies are scheduled to open, adding four new boats to the current level of ferry traffic. Two of the boats, under the auspices of The New SeaEscape Cruise, LTD, will transit a to-be-determined area between either Fort Lauderdale or Miami with a destination of Key West. The high-speed ferries will make daily trips; it is anticipated each will carry about 300 people (Sotgiu, 1997). The second company, Buquesbus (Florida, Inc.), will ultimately make two round-trips daily by hydrofoil from Fort Myers (for each of their boats), carrying about 350 people on the smaller ferry and 450 on the larger (Summers, 1997).

The tourism season begins in November and runs through May; certain estimates of annual ferry traffic can be made. Totals for ferry lines currently schedules to navigate the area between Key West and Fort Myers Beach/Marco Island indicate in excess of 1,020 trips annually. Including the Key West-Garden Key route, the estimated total surpasses 1,281 trips. With the eventual addition of the two new lines, totals could reach over 3,471 round-trip ferry excursions per year.

3.2.11.4 Environmental Impacts and Mitgations

No-action Alternative

Under the no-action alternative the TMD program would not employ the Gulf of Mexico for testing. Other ongoing or planned military test activities would continue in the Gulf of Mexico. Shipping in the Gulf of Mexico would not be affected, nor would the ferry traffic from Fort Myers to Key West. Continuing Eglin AFB aircraft and missile testing and training activities would have minimal effects on transportation in the Gulf of Mexico.

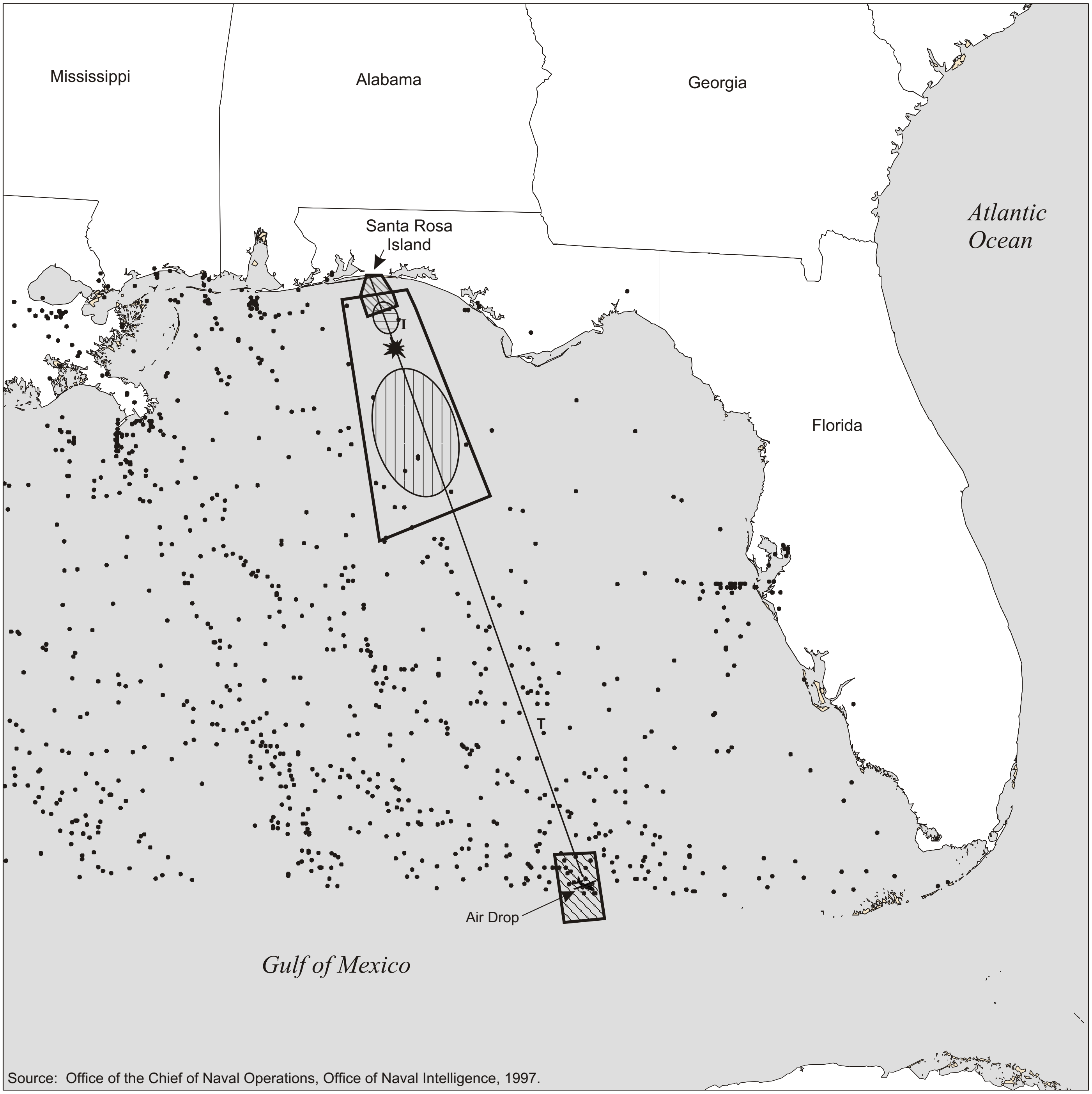
Site Preparation Activities

Site preparation activities, including the installation of sea-launch platforms, would not affect commercial shipping routes or ferry traffic.

Flight Test Activities

Ships in the Gulf of Mexico could be delayed or diverted from debris safety clearance areas which would be temporarily closed to shipping due to launch activities. Two main types of launch activities may result in debris from high over the Gulf of Mexico falling into the clearance areas: interceptor (defensive missiles) launches from Eglin AFB and/or ships; and target launches from land in the Florida Keys or Eglin AFB and/or from aircraft from the southern Gulf of Mexico. Figures 3.2.11-5 through 3.2.11-8 indicate the potential, based on 1996 ship movements within the Gulf of Mexico reported on a monthly basis, for the highest number of ships to be in the clearance areas during launch scenarios. The figures provide a graphical representation of the ship density in the clearance areas at any given time (note: very little information, regardless of geographic area, is available on coastal trade, and private and pleasure crafts). The density plots represent a tentative "without missile launch/intercept" condition within areas impacted by the proposed testing activities. Once a launch activity is scheduled, the standard sequence of notification and coordination procedures discussed in section 2.1.4 would be used. These procedures would apply to either Air Drop or land-based target launches.

During a typical launch period, as many as 45 ships would need to be cleared in advance of a planned test event, and other ships outside the test areas would experience an approximate 1-hour wait before occupying the clearance area. The most shipping activity that would be within the clearance areas represents roughly 3 percent of the total number of ships in the Gulf of Mexico during a scheduled launch. Impacts would be felt most by domestic waterborne commerce utilizing the Gulf Intracoastal Waterway; dry cargo ships, tank ships, and barges utilizing shipping routes for port-to-port travel within the Gulf of Mexico and destinations outside the Gulf of Mexico; and, to a lesser extent, cruise ships, ferry boats, and other scheduled traffic. This rerouting or rescheduling would not have more effect than the variations required to avoid hazardous weather conditions in the Gulf of Mexico.



EXPLANATION

- I Interceptor Ground Track
- T Target Ground Track
- Intercept
- Interceptor Debris
- Target Debris
- Representative Evacuation Areas
- Launch Hazard Area
- Booster Drop Zone

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

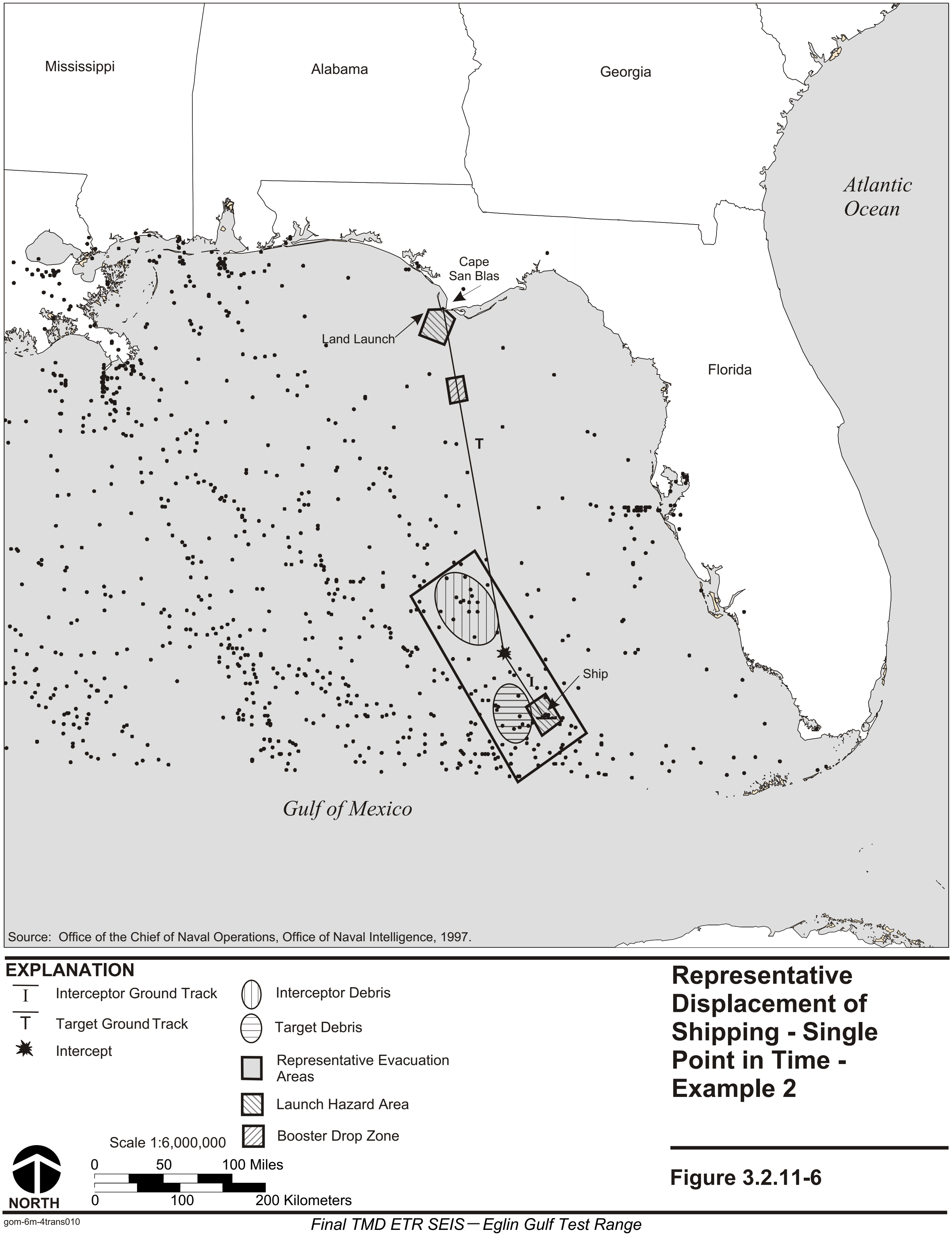
NORTH

Representative Displacement of Shipping - Single Point in Time - Example 1

Eastern Gulf of Mexico

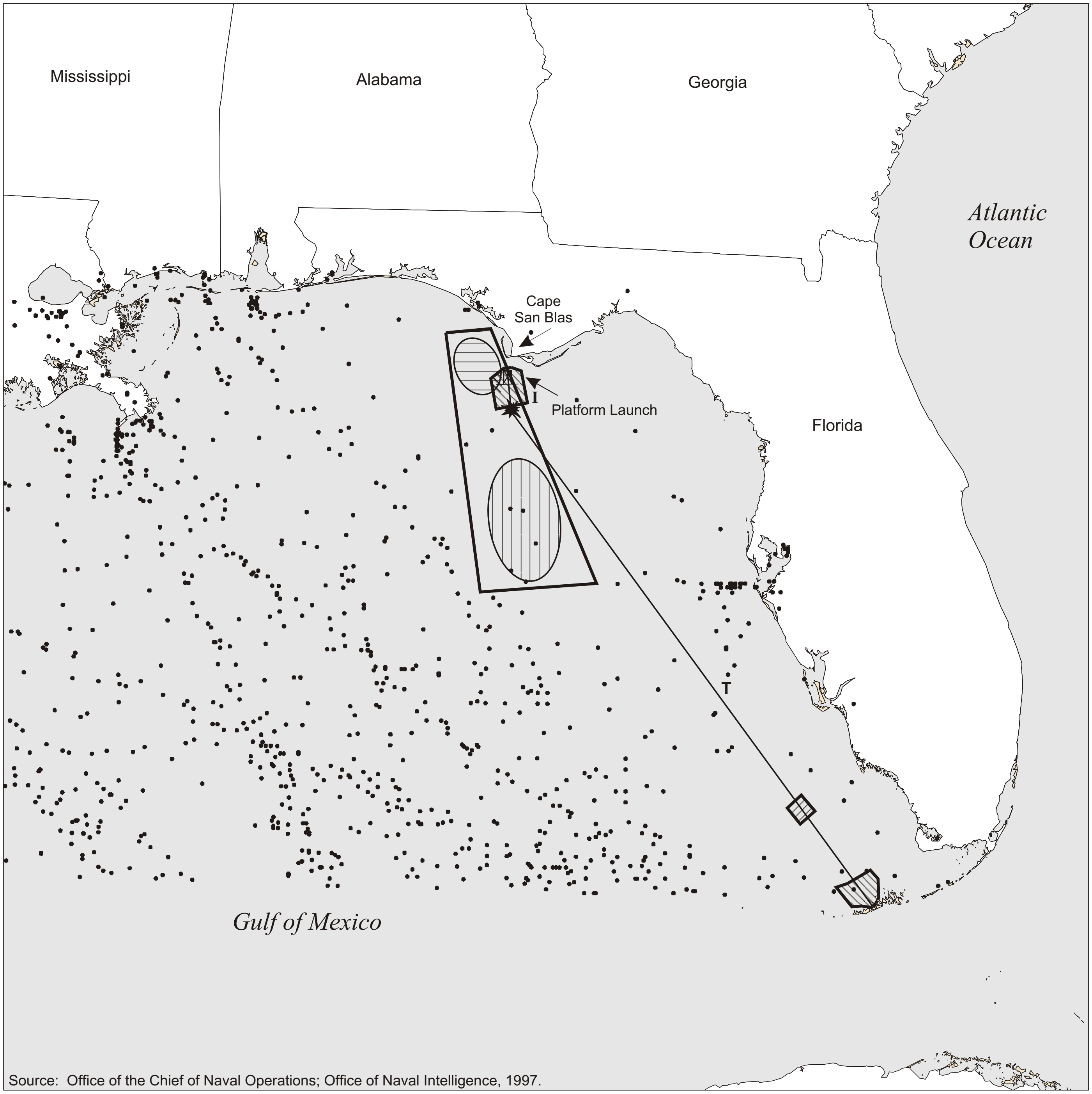
Figure 3.2.11-5

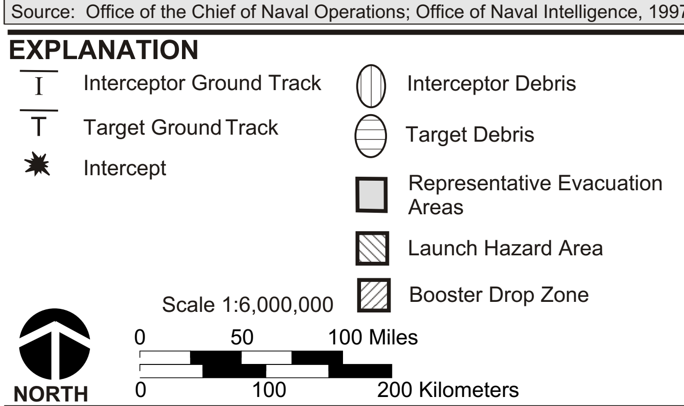
gom-6m-4trans009



Representative Displacement of Shipping - Single Point in Time - Example 2

Figure 3.2.11-6

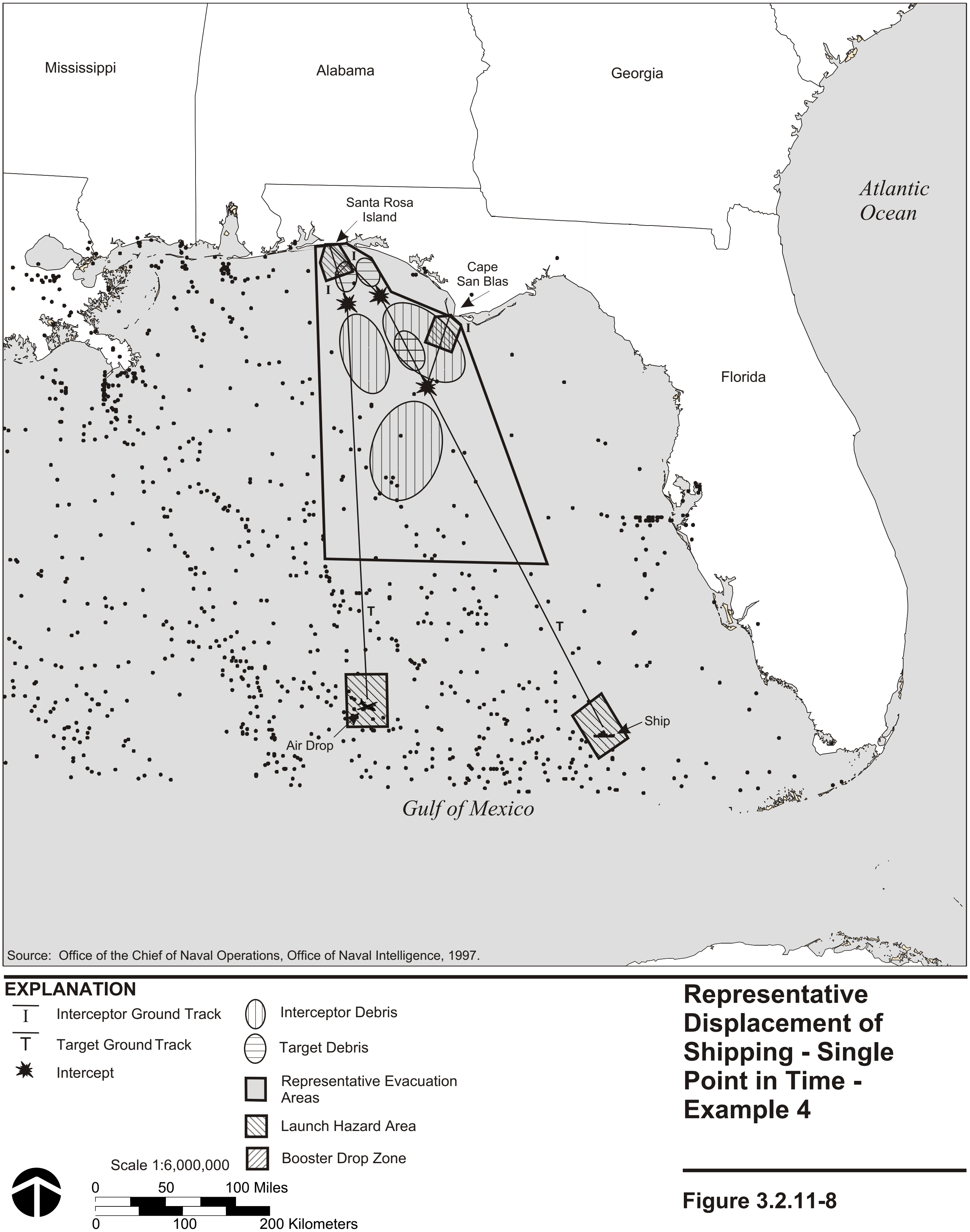




Representative Displacement of Shipping - Single Point in Time - Example 3

Figure 3.2.11-7

gom-6m-4trans011



Representative Displacement of Shipping - Single Point in Time - Example 4

Figure 3.2.11-8

gom-6m-4trans012

Two ports in the Gulf of Mexico may have ship movement traffic affected by TMD test activities. According to table 3.2.11-1, Tampa, Florida, was visited by 759 ships in 1995, resulting in approximately 3,700 ship movements that year. This averages approximately 10 movements per day. A 4-hour closure twice a month would likely affect two ship movements per month. Mobile, Alabama, was visited by 704 ships in 1995, resulting in approximately 2,400 ship movements. This averages approximately 6.5 movements per day. A 4-hour closure twice a month would likely affect one ship movement per month.

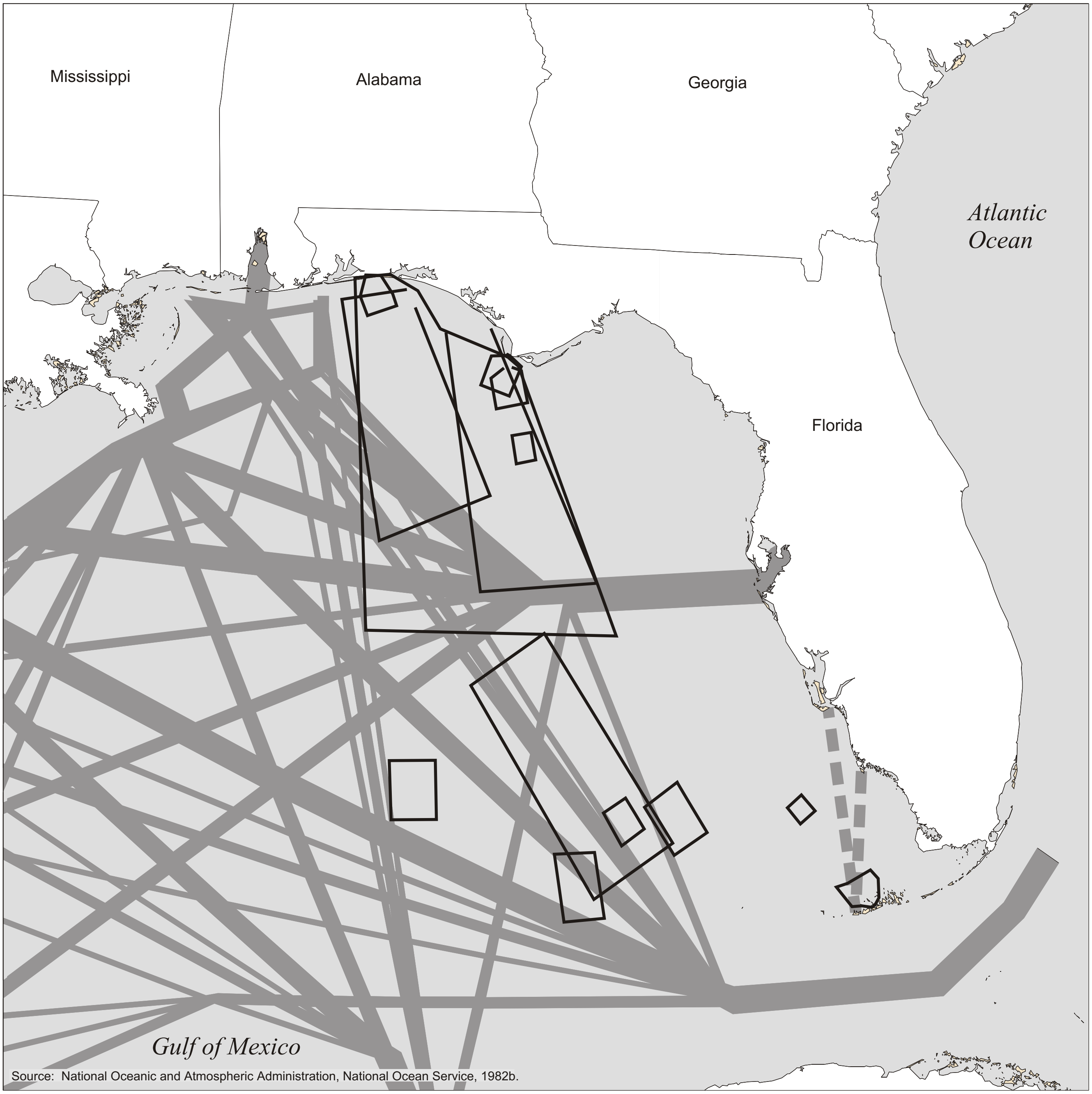
Ferry service between Fort Myers and Key West runs daily during the October to April tourist season. Once a month, TMD target booster drop zone clearance during ferry transit could delay the scheduled ferry run (figure 3.2.11-9).

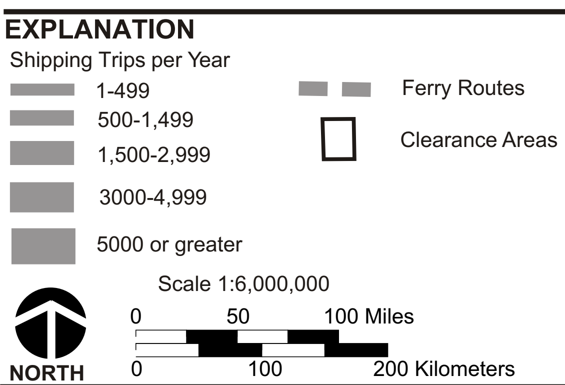
Cumulative Impacts

The TMD program would be one of many military training and testing activities using the Gulf of Mexico. The cumulative effects of these programs on redistributing patterns of waterborne transportation in Gulf of Mexico sea lanes (figure 3.2.11-9) and in the Intracoastal Waterway (figure 3.2.11-10) would result in temporary changes to existing transportation activities.

Mitigations Considered

Notification to the various ports and major shipping lines would precede launches. NOTMARs would be filed with the Coast Guard.



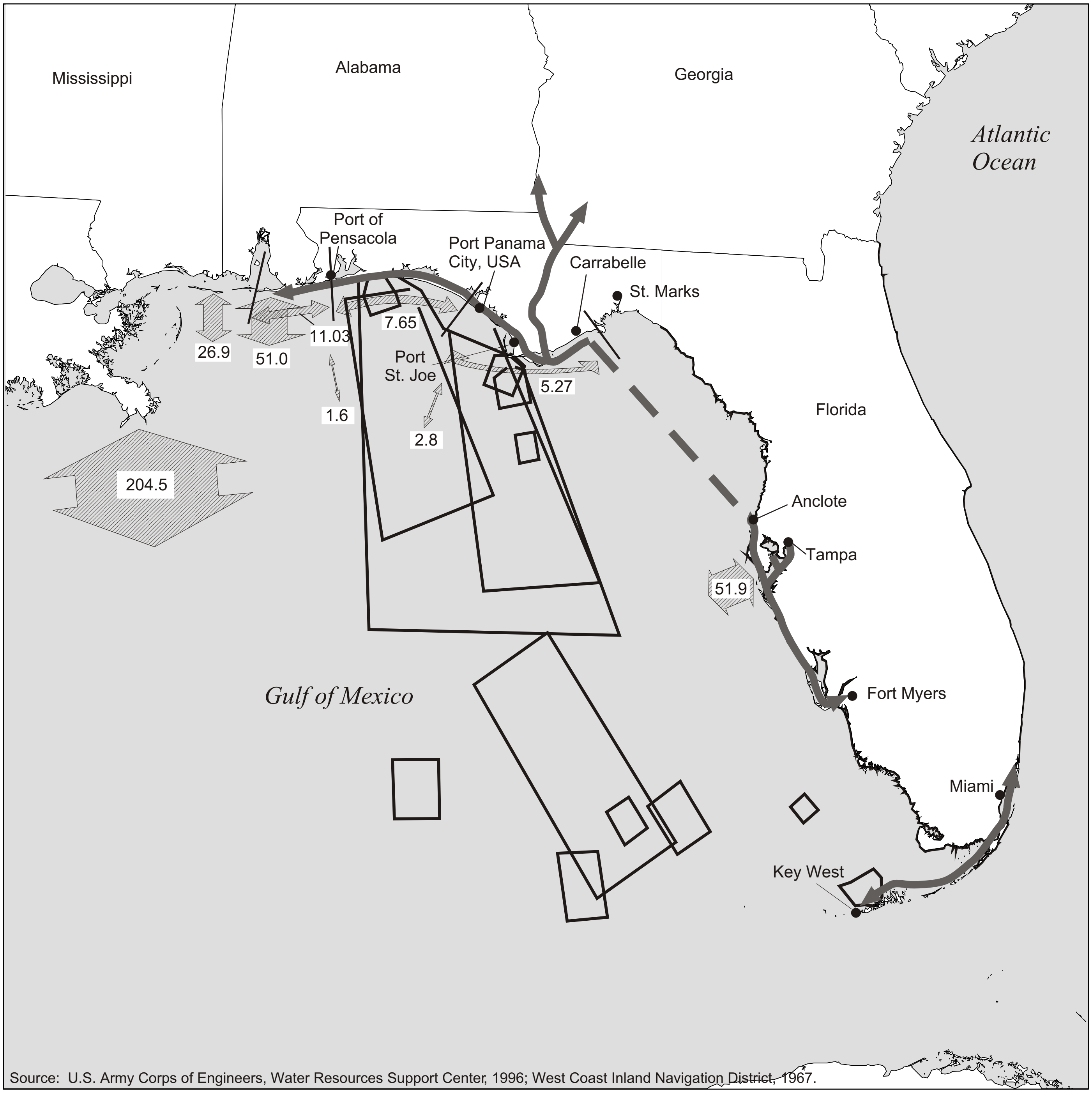


Cumulative Effect on Gulf Shipping - Examples 1 Through 4

Eastern Gulf of Mexico

Figure 3.2.11-9

gom-6m-4trans013



EXPLANATION

Clearance Areas

Intracoastal Waterway

Carrabelle to Anclote (Open Bay Section)

Annual Traffic Into and Out of Ports (See Table 3.2.11-3)

Note: Values in millions of tons.
Portion of waterway from Miami to Key West is section of Atlantic Intracoastal Waterway.

Scale 1:6,000,000

0 50 100 Miles

0 100 200 Kilometers

NORTH

Cumulative Effect on Gulf Intracoastal Waterway and Deep-water Ports Traffic

Eastern Gulf of Mexico

Figure 3.2.11-10

gom-6m-4trans015

3.2.12 UTILITIES

TMD test and training operations within the Gulf of Mexico would not affect utilities other than those described in sections 3.1.12.4 and 3.3.12.4.

3.2.13 VISUAL AESTHETICS

There would be visual impacts from TMD activities in the Gulf of Mexico. The launch plume from a missile launch would be visible for several minutes. The offshore platform could be visible.

3.2.13.1 Resource Description and Evaluative Methods

Refer to section 3.1.13 for a description of visual aesthetics as presented in this document.

3.2.13.2 Region of Influence

The region of influence includes the EGTR in the Gulf of Mexico and the launch platform alternative.

3.2.13.3 Affected Environment

The affected environment is the open ocean of the Gulf of Mexico and the ocean areas offshore. There are no visual features except occasional ships, the water, horizon, and sky. The western Gulf of Mexico offshore areas have oil platforms as a visual feature; there are very few in the ROI.

3.2.13.4 Environmental Impacts and Mitigation

No-action Alternative

Under the no-action alternative, the proposed TMD test activities would not be implemented. Current operations in the EGTR would continue. Continuing Eglin AFB aircraft and missile testing and training operations would result in negligible changes in visual aesthetics.

Site Preparation Activities

Test activities that take place in the Gulf of Mexico would occur within clearance areas that are imposed for any launch location. The construction of the proposed launch platform may be visible to the naked eye under highly favorable meteorological and atmospheric conditions. Unfavorable meteorological conditions would make construction of the launch platform less visibly apparent. Under the conservative assumption that the only limit to visibility is the curvature of the earth, it is possible to construct a mathematical estimate of the visibility of an object based on the height of the observer and the height of the object being viewed. These mathematical formulas are derived from nautical references (www.Boatsaf.com/nauticalknowhow/distance.htm).

For example, based on mathematical formulas regarding the distance visible over the horizon due to the curvature of the earth, a structure 20 meters (65 feet) tall would be visible over the horizon to a person whose eye was 1.6 meters (5 feet) above sea level at a distance of 21.8 kilometers (13.5 miles). The distance visible from a 20-meter (65 foot) high hotel room would be 34.1 kilometers (21.2 miles). Thus, under an unconstrained situation, a platform located 8 kilometers (5 miles) from shore may be visible to the naked eye from beach locations near shore. However, these visibility ranges would often be impractical because of prevailing meteorological and atmospheric conditions.

Offshore Platform

An option being considered for launching interceptor missiles at Santa Rosa Island and at Cape San Blas is an offshore platform constructed of steel or concrete (see section 2.1.1.2.2 and figure 2.1.1-4). The platform would be located between 8 and 20.9 kilometers (5 and 13 miles) offshore. The platform would be approximately 30.5 by 30.5 meters (100 by 100 feet) in size and approximately 20 meters (65 feet) above the water line. An interceptor missile and related support equipment would be located on the platform.

The visual impact of the sea platform and launch equipment could be assessed from two vantage points—from shore and from marine craft. From the vantage point of the shoreline of Santa Rosa Island or Cape San Blas, it is highly unlikely that the sea platform would be distinctly visible because of the viewing distance. From the standpoint of marine traffic, it is possible that shipping traffic using the Gulf sea lanes and intracoastal waterway may pass within visibility range of the platform. Most of these vessels would be large cargo ships, not vessels with passengers who represent sensitive viewers. From their vantage point, the appearance of the platform would be very similar to the appearance of oil platforms that are also located offshore in the western Florida Panhandle.

The platform has a high level of contrast with the prevalent landscape from land or sea because of its mass, line, scale, and color. However, it would not become a dominant form in the landscape unless viewed from relatively close range (3 to 5 kilometers [2 to 3 miles]). Because of its location outside viewing distance from land, its visibility would be an infrequent occurrence for sensitive viewers. Therefore, the sea platform is unlikely to have an adverse visual and aesthetic impact.

Flight Test Activities

Flight test activities that take place in the Gulf of Mexico would occur within clearance areas that are imposed for any launch location. The launch emissions would be visible from a distance greater than 8 kilometers (5 miles).

The degree of obtrusiveness of smoke from a launch is a function of the color, opacity, size, duration, and turbidity of the plume and the population that could see such a launch plume.

TMD Air Drop target launch or sea-launch interceptor or target launches would take place far out in the Gulf of Mexico for safety reasons. Although the launch plume would be at high altitudes and persist for some period, it is unlikely that it would be visible to observers on land.

Cumulative Impacts

There would be no cumulative visual impacts.

Mitigations Considered

No mitigations are proposed.

3.2.14 WATER RESOURCES

Site preparation activities would result in a short-term temporary increase in marine water turbidity due to platform construction. Test activities may introduce rocket propellants, combustion emission products, and materials originating from missile hardware.

3.2.14.1 Resource Description and Evaluative Methods

A general discussion of water resources impacts analysis is presented in section 3.1.14.1.

3.2.14.2 Region of Influence

The ROI for water resource issues in the flight corridor includes the Gulf of Mexico beneath the LHA, booster drop zones, and debris impact areas. In general, the ROI for marine water resources extends from the Florida Keys northwesterly to Eglin AFB. (The coastal marine environments of Santa Rosa Island, Cape San Blas, and the Florida Keys are discussed in sections 3.1.14 and 3.3.14.)

3.2.14.3 Affected Environment

The Gulf of Mexico is a Mediterranean-type basin with a surface area of approximately 564,200 square kilometers (217,855 square miles) and a maximum depth of approximately 3,850 meters (12,631 feet). Ocean currents within the Gulf of Mexico are dominated by the Loop Current, which enters through the Yucatan Strait, bends eastward and southward, and exits through the Straits of Florida (U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico Outer Continental Shelf Region, 1997a). Average depths within the ROI range from less than 200 meters (656.2 feet) to approximately 500 meters (1,640.4 feet) below MSL. Water in this region is alkaline and has a pH of 8.0 or greater, which is typical for marine waters.

3.2.14.4 Environmental Impacts and Mitigations

No-action Alternative

Under the no-action alternative, the proposed ground-based TMD test activities would not be implemented. Current operations at EGTR would continue. Continuing Eglin AFB aircraft and missile testing and training operations would have minimal effects on water resources in the Gulf of Mexico.

Site Preparation Activities

The construction of the proposed launch platforms may result in a temporary increase in marine water turbidity associated with disturbances of the ocean floor during the construction period. However, this increase in turbidity would be short-term in nature, and would occur within only a few meters (feet) of the construction zone due to dispersion from ocean currents.

Flight Test Activities

Potential impacts to marine water quality from TMD activities are associated primarily with the introduction of rocket propellants, combustion emission products, and soluble materials originating from hardware and miscellaneous materials (see sections 3.1.1.4, 3.2.1.4, and 3.1.3.4). Numerous previous studies have shown that even in the most conservative case, environmental effects would be minimal.

For a normal flight test event with Air Drop target launch and either land- or ship-based interceptor launch, introduction of rocket propellants into water should be slight. The propellant is consumed in achieving its purpose of propelling the missile along the intended trajectory. When the expended first stage booster falls back to earth, it will be an empty cylinder with slight traces of unburned propellant remaining inside the casing. Similarly, the second stage booster propellant will also be consumed before intercept or impact. A flight termination is the case where propellants may enter the water.

SRM propellants are composed primarily of a fuel element, an oxidizer, and a binder which holds the fuel and oxidizer together in solid form. The solid rocket motors proposed for use in both the interceptor and target missiles would consist primarily of ammonium perchlorate and a polybutadiene rubber (HTPB) binder. The primary issue of concern is the aqueous leaching of ammonium perchlorate from an SRM propellant. The dissolution of ammonium perchlorate when in a HTPB binder would be minimal because the binder is not water soluble. Although fractured areas of the SRM would allow for the penetration of water molecules and the dissolution of ammonium perchlorate, penetration beyond the fracture areas would be extremely slow due to the not water soluble characteristics of the binder (Kataoka, 1997). Air Force studies have confirmed that a slow dissolution (leaching) of ammonium perchlorate occurs when in the form of a solid propellant with an HTPB rubber binding agent (Nasser, 1987; Air Force Wright Aeronautical Laboratories, 1984). In one study, involving propellant pieces (ammonium perchlorate and HTPB) submerged in sea water, water penetration was limited to about 1.3 centimeters (0.5 inch) over a period of 1 month (Air Force Wright Aeronautical Laboratories, 1984).

Although no environmental studies have been identified which specifically evaluate the fate of ammonium perchlorate in a marine environment, information can be obtained from various studies to determine the predicted changes in marine water chemistry and toxicity levels. For example, a study prepared on behalf of the Department of Public Sanitation of Moscow, Russia, concluded that ammonium perchlorate within a fresh water environment does not substantially affect the biochemical consumption of oxygen, nor the processes of growth among saprophytic microflora (Shigan, 1994). Additional studies provide findings which indicate that ammonium perchlorate would not result in significant changes in pH and nitrogen levels (Merrill, 1983; Naqvi and Latif, 1974). Based on the findings of these studies, ammonium perchlorate would not result in appreciable changes in marine water chemistry (that is, pH, BOD, and nitrogen levels).

The NASA conducted an evaluation of the effects of missile systems in the marine environment as part of the EIS prepared for its Sounding Rocket Program. It concluded that the release of hazardous materials and decaying propellant would be rapidly diluted within a marine environment, and except for the immediate vicinity of the debris, would not be found at concentrations identified as producing any adverse effects (National Aeronautics and Space Administration, 1973). By comparison, the amount of ammonium perchlorate contained within a TMD rocket motor is similar to that contained within the rocket motors evaluated for the Sounding Rocket Program. Because the HTPB binding agent is essentially insoluble in water and does not seem to have an appreciable toxicity for aquatic organisms, concerns regarding increased toxicity levels would be primarily associated with that of ammonium perchlorate. However, any ammonium perchlorate leaching from the binding agent would disperse quickly and would be diluted and neutralized by the natural buffering capacity of the sea. Even in the most conservative analysis involving the impact of a fully loaded vehicle in the ocean environment, the volume of ammonium perchlorate involved is small and the effects are not considered persistent. As a result, potentially toxic concentrations within more than a few meters of the propellant would not be anticipated (National Aeronautics and Space Administration, 1973; Kataoka, 1997).

Missile hardware consists of materials used in missile assembly. The corrosion of these materials within an aqueous environment would contribute various metal ions to the surrounding environment. In major part, such hardware consists of aluminum, steel, plastics, fiber-reinforced plastics, and electronic components. A large number of different compounds and elements are used in small amounts in rocket vehicles and payloads; for example, lead and tin in soldered electrical connections, silver in silver-soldered joints, cadmium from cadmium-plated steel fittings, and copper from wiring. The rate of corrosion of such materials is slow in comparison to the mixing and dilution rates in the water environment, and hence, toxic concentrations of metal ions will not result. The miscellaneous materials (battery electrolytes) are present in such small quantities that only extremely localized and temporary effects would be anticipated.

Combustion emission are primarily of hydrogen chloride, aluminum oxide, and water. Although hydrogen chloride is very soluble in water, it does not deposit readily onto dry aerosols or other dry surfaces when the relative humidity is below 100 percent. Similarly, the deposition of aluminum oxide would be very low.

Previous studies have shown that even in the most conservative case of missile failure in which all emission products were concentrated in the Gulf of Mexico, environmental effects would be small and not persistent. On such study involved an environmental impact analysis performed by NASA for launching sounding rockets from numerous locations including Eglin AFB into the Gulf of Mexico. The Advanced Solid Rocket Motor (ASRM) program tests included in this analysis produced nearly 100 times the emissions of the proposed Hera rocket motor. Each static test of the ASRM emitted approximately 115,813 kilograms (254,789 pounds) of hydrogen chloride and 196,756 kilograms (432,885 pounds) of aluminum oxide. The assessment concluded that in general, water quality was not expected to be significantly affected. The resultant volume of ASRM emission products were not found to be persistent (such as the pollutants would disperse and degrade to values below maximum allowable concentrations within a very short time) (U.S. Army Space and Strategic Defense Command, 1994a).

By comparison the total emissions of hydrogen chloride and aluminum oxide from a normal launch of a Hera are 1,399 kilograms (3,078 pounds) and 1,765 kilograms (3,789 pounds), respectively, which is substantially lower than those of the ASRM. The ASRM also produces a significantly larger ground cloud and, therefore, distributes emissions over a much larger area than the TMD rocket motor. As a result, emission concentrations from the TMD rocket motor at any point within the ROI are expected to be lower than those analyzed for the ASRM.

During periods of high humidity, hydrogen chloride gas in the exhaust plume of the TMD missiles would dissolve into cloud water droplets, causing a temporary increase in rainwater acidity. If it were to rain shortly after a missile launch, the hydrogen chloride present in the exhaust plume would be dissolved in the rain droplets, which would result in a temporary reduction in rainfall pH. Depending on the buffering capacity of the receiving water, rainfall may result in an increase in surface water acidity. Increases in surface water acidity ranging from approximately pH 4.0 to 6.0 are generally believed to result in stress to marine life and possibly death (National Aeronautics and Space Administration, 1990). The degree and duration of any increased acidity in surface waters would depend on several variables, including surface water volume and alkalinity, as well as the amount and pH level of rainfall.

The effects of hydrogen chloride deposition were modeled for the ASRM. Under normal launch conditions when the relative humidity is less than 100 percent, deposition of hydrogen chloride gas on the surface of the sea would not be significant. Analyses for the most conservative case, where rain would be present soon after test firing the ASRM, concluded that acid deposition to surface water would not result in any impacts to larger surface water bodies in the area (U.S. Army Space and Strategic Defense Command, 1994a). This analysis was based on the buffering capacity of fresh water, which is considerably lower than the buffering capacity of sea water; therefore, it is expected that even for the most conservative case condition where all of the hydrogen chloride emission falls over the Gulf of Mexico, the pH level would not be depressed by more than 0.2 standard units for more than a few minutes. Thus, the Florida standard for Class III waters would be met. Class III waters are intended to maintain a level of water quality suitable for recreation and the production of fish and wildlife communities.

Mathematical modeling results of ASRM tests indicate the maximum deposition of aluminum oxide would measure about 1.6 mg/m^2. Aluminum oxide is not considered toxic under natural conditions but may contribute potentially harmful species of soluble aluminum forms under acidic conditions. It is difficult to quantify the portion of aluminum oxide that reacts with hydrogen chloride to form additional toxic aluminum species. The most conservative approach assumes that all of the aluminum oxide deposited reacts with hydrogen chloride. With this extremely conservative assumption, the deposition of about 1.6 mg/m^2 of aluminum oxide equals approximately 0.0054 mg/L aluminum at a water depth of 0.15 meter (0.5 foot) (National Aeronautics and Space Administration, 1990). This analysis was based on the assumption that it would not be raining at the time of the test event or within 2 hours after the event. Rain would increase the amount of deposition; however, even a substantial increase in this amount would be well below the state's water quality standard for Class III waters not exceeding 1.5 mg/L aluminum.

The assessment concluded that effects to general water quality are expected to be minimal. In addition, hydrogen chloride would be expected to disperse quickly and be diluted and neutralized by the natural buffering capacity of the sea. Aluminum oxide is essentially insoluble in water and does not seem to have an appreciable toxicity for aquatic organisms (National Aeronautics and Space Administration, 1973).

Cumulative Impacts

TMD activities would not contribute perceptibly to the cumulative effects of ongoing maritime activities with respect to water quality within the Gulf of Mexico.

Mitigations Considered

TMD activities would have a temporary effect on water resources in the Gulf of Mexico; therefore, no mitigations are proposed.