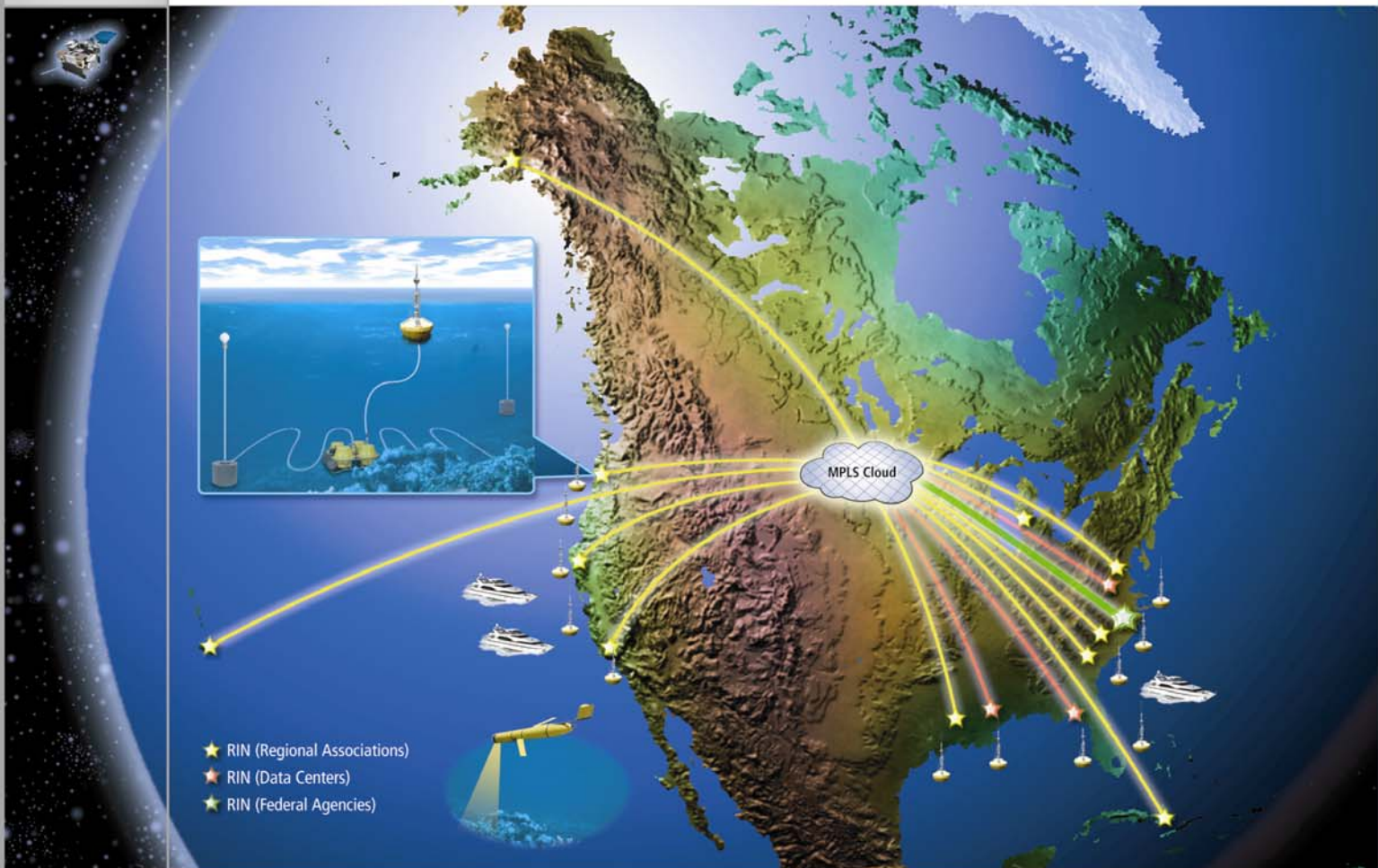




**IOOS**

U.S. Integrated Ocean Observing System

## Marine Mammal Avoidance



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## 1 Marine Mammal Avoidance Use Case

From contract #: N00039-04-C-0016 Final Report For IOOS Demonstration Project NORTHROP GRUMMAN MISSION SYSTEMS, Defense Mission Systems and APPLIED SCIENCE ASSOCIATES, INC. (NG/ASA) this Marine Mammal Avoidance Use Case has been derived to allow incorporation of an important example as directed by NOAA/NESDIS of an IOOS activity. We summarize the relevant information for the use case as developed by Northrop-Grumman.

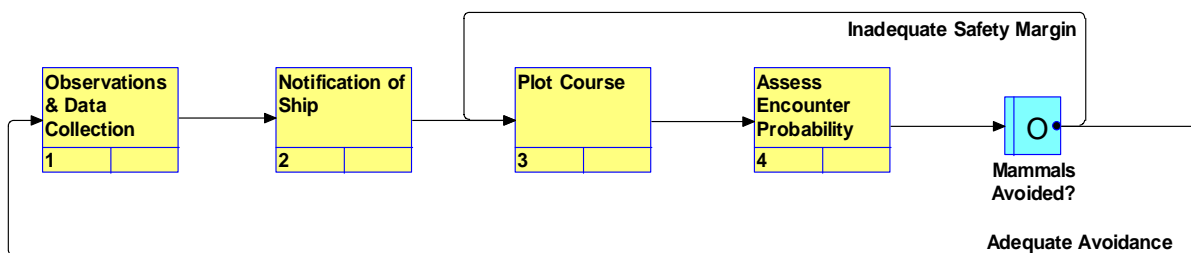
One of the greatest hazards to near surface marine life is collision with ships, particularly near breeding and feeding grounds. This is particularly stressful to many species of large marine mammals – whales and dolphins. Seven species living along the Atlantic coast and Gulf of Mexico are listed as endangered according to the Endangered Species Act. Eleven species from the Pacific are listed. Despite current efforts to provide information to allow vessels to avoid marine mammals, data on large mammal location is hard to come by and often doesn't exist until the vessels involved actually site the mammals. This has resulted in cancellation of in-progress Naval sea exercises as well as commercial vessels striking large mammals and killing or seriously harming them. To mitigate this the NOAA National Marine Fishery Service has instituted plans to reduce the chance of striking marine mammals. For instance, the proposed Rule for Right Whale Ship Strike Reduction is provided in Federal Register Vol. 69, No. 105, June 1, 2004.

An avoidance system would provide users with a map based, common operational picture of the location and status of all vessels in the area of concern, the location of marine mammals and sea turtles (either as individuals, groups or general regions), and the location of all United States Coast Guard (USCG) vessel traffic management lanes. The operator would be able to estimate the probability of a vessel impacting a marine mammal if the vessel continued on its proposed route and what the impact on the probability would be if the vessel changed either its course, speed, or both.

For the Marine Mammal Avoidance demonstration NG/ASA “applied the system to the analysis of North Atlantic right whales (*Eubalaena glacialis*) and their risk of being impacted by shipping traffic in Cape Cod Bay and nearby Cape Cod Canal (CCC). CCC, which connects Cape Cod Bay to Buzzards Bay, is one of the principal coastal marine transportation corridors connecting the port of Boston to the ports of Providence, Quonset, New Haven, and New York/New Jersey. This case example was selected for the following reasons:

- It is typical of other ship marine mammal interactions that occur in the coastal waters of the US.
- North Atlantic right whales are an endangered species with a population of only 300 to 350 and one that has not shown any significant recovery in the last three decades.
- The biology and behavioral characteristics of the right whales are as well known as any marine mammal species. Since the right whale spends large amounts of time near the sea surface and doesn't display particular avoidance of ships it is highly vulnerable to ship strikes.
- The leading known cause of right whale mortality is collisions with ships.

- Cape Cod Bay has been designated as a Federal Critical Habitat for right whales since 1994 in recognition of its seasonal importance (December through May) for feeding, socializing, and a nursery area for mothers and calves.
- The USCG has recently initiated a Port Access Routes (PAR) study of the potential for vessel routing measures to reduce the vessel strikes on North Atlantic right whales. One of the primary focus areas will be Cape Cod Bay and the nearby area off Race Point and Great South Channel. (Federal Register, Vol. 70, No. 33, Friday, February 18, 2005)
- There is a moderate level of marine traffic in the area, primarily barge and tug and coastal tankers moving through Cape Cod Canal; one of the three major routes to the port of Boston.
- The US Army Corp of Engineers operates the Cape Cod Canal and has a manned vessel traffic control center.
- Nichols and Kite-Powell (2005) have recently completed an analysis of the risk to north right whales from shipping traffic in Cape Cod Bay for the NOAA Northeast Fisheries Science Center. This study also explored the impact of rerouting vessels to determine its impact on whale strike probability.”



**Figure 1, Marine Mammal Avoidance – OV-6a Use Case**

Figure 1 is extracted from Telelogic’s System Architect where it resides as an OV-6a diagram.

## 2 External Actors

The US Army Corps of Engineers designed and installed an integrated Marine Traffic Control System (MTCS) for the Cape Cod Canal in the early 1970’s. The current version has evolved to an advanced display and decision support system allowing the Marine Traffic Controller on duty to monitor and manage vessel traffic through the waterway and have a comprehensive operational picture of environmental conditions in the area.

The system integrates radars, closed circuit television cameras, Very High Frequency (VHF) radio, tide elevation, and sensors for wind speed, air and water temperature. Automatic processing of all data collected presents a complete picture of vessels and conditions in the canal to support management of the 17.4-mile waterway. Data on vessel movements and communication are recorded for playback.

The Cape Cod Canal Marine Traffic Control center entered into a cooperative agreement with The Center for Coastal Studies, Right Whale Early Warning System. The agreement’s goal is to reduce commercial vessel collisions with endangered right whales through broadcasting right

whale sighting reports to vessel operators so collisions with right whales may be avoided. The Canal's Marine Traffic Controller is responsible for monitoring right whale activity reports and broadcasting Mariner Notices to all commercial vessel traffic using the Canal. The Marine Traffic Controller will dispatch a patrol-boat to establish a safety zone around a right whale or any large marine mammal observed in the Canal or its approach channels. Therefore the target user for the demonstration was a US Army Corp of Engineers Marine Traffic Controller for the Cape Cod Canal. This operator represents an ideal user since (1) it is his responsibility to provide real-time information to vessels transiting the CCC to assist them in avoiding right whales and (2) the infrastructure to support the operation of the system (personal, facilities, and communications systems) are already in place.

### 3 Interfaces

The interfaces are both real-time data access and historical data access (for the demo NG/ASA used historical data.) The USACE MTCS for the Cape Cod Canal interfaces with the Center for Coastal Studies, Right Whale Early Warning System. Mariner Notices and the dispatches of Coast Guard patrol-boats are additional interfaces that could be supported by IOOS subscription services and/or broadcast services.

### 4 Functional Flows

#### 4.1 Primary Flow – Detection and Avoidance of Marine Mammal within Area of Coverage

##### 4.1.1 Pre-Condition

The pre-condition is the MTCS and Right Whale Early Warning System are in a nominal operational state.

##### 4.1.2 Trigger

The trigger is the monitoring of right whale travel patterns in time coincidence with ship transits.

##### 4.1.3 Process Description

Use Case Steps	Architecture Viability Assessment
<p><b>Step 10: Observations &amp; Data Collection</b> A Marine Traffic Controller views all available Environmental, AIS tracks, and marine mammal sightings/density information.</p>	<p>IOOS provides Sensor/Telemetry data directly and provides products based on data assimilation/modeling.</p>
<p><b>Step 20: Notification of Ship</b> The Marine Traffic Controller receives notification of a ship course and destination upon leaving the Cape Cod Canal.</p>	<p>This is an MTC function. IOOS records and archives notifications for historical trending.</p>

<p><b>Step 30: Plot Course</b> The Marine Traffic Controller plots the course</p>	<p>IOOS supports development of common tools and services usable by a MTC wherever necessary. The CD supports course plotting with integrated applications via RINs</p>
<p><b>Step 40 Assess Encounter Probability</b> The potential for a marine mammal encounter is computed the expected whale encounter from the course provided is of concern, the Marine Traffic Controller plots a second course to avoid high-density marine mammal regions.</p>	<p>IOOS supports development of common tools and services usable by a MTC wherever necessary. The CD supports encounter probability evaluation with integrated applications via RINs</p>
<p><b>Step 50: Junction: Mammals Avoided?</b> If potential for a marine mammal encounter is to high, loop back to Step 30 and compute a new course. If potential for a marine mammal encounter is acceptable, loop back to Step 10 and continue monitoring.</p>	<p>Normal processing junction.</p>

#### **4.1.4 Post Condition:**

The post condition is the same as the pre-condition.