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Introduction

The Maritime Domain Awareness Data Sharing Community of Interest (MDA DS COI) Data Management Working Group (DMWG) was established in February 2006 to develop a repeatable process for developing and registering a community vocabulary supporting the MDA DS COI, beginning with the schematic representation of Automatic Identification System (AIS) data as it pertained to the MDA DS COI Spiral 1 pilot objectives.

Background

While under spiral 1 the MDA DS COI provided AIS data as a service, the MDA DS COI is providing several value added services under spiral 2:

- **Data Augmentation Service (DAS)** – This service provides a capability for AIS data providers to augment AIS messages with data from an authoritative reference source
- **Historical Archive Service (HAS)** – The HAS will provide users with an ability to view previous vessel locations over time.
- **Anomaly Detection Service (ADS)** – This service will be built using the previous two services. If a discrepancy exists between the AIS sensor and the authoritative reference source or if the vessel is making anomalous movements, then an anomaly has been detected and consumers of the message will be notified of such.

Purpose of Document

The primary purpose of this document is to provide sufficient information for application developers to develop and consume messages in accordance with the MDA DS COI Spiral 2 DAS information exchange schemas. The document has two specific objectives:

1. Provide a technical description of MDA DS COI Spiral 2 DAS vocabulary and information exchange schemas.
2. Provide a description of the concepts and design patterns embodied in the MDA DS COI Spiral 2 DAS information exchange schemas.

Vocabulary Development Process

Those familiar with the vocabulary development process that we employed under spiral 1 will see that the process was slightly modified under spiral 2.
Spiral 1 emphasized an automated vocabulary development process whereby the majority of modeling was performed in the Unified Modeling Language (UML). XML Schema Definition (XSD) files were then automatically generated from the UML using a suite of automated tools. While this process worked very well for the simple AIS service developed under spiral 1, this process could not support some of the requirements for the DAS without adding significant complexity to the UML models and extensive manual corrections to the generated XSDs.

In order to avoid this, the majority of modeling in support of the DAS shifted from UML to the XSDs. We no longer employed an automated process to go from UML to XSD. We started with XSDs and generated UML models afterwards. We found that one particular tool (i.e., SPARX Enterprise Architect) performed reasonably well in automatically generating UML from XSDs. That said, it could not generate all constructs resident within the XSDs and manual changes were still required to simplify the diagram. The UML artifacts in Appendix D are a result of this process.

This modified process actually proved to be quite flexible. We were no longer constrained to modeling only those XML constructs that had a corresponding UML representation. In addition, with automated generation, the resulting output often has structural inefficiencies or complexities that are a result of the automation. By modeling directly in the XSDs, many of these structural inefficiencies or complexities were circumvented.

Finally, it is incumbent on the reader to understand that the UML diagrams in Appendix D are intended for illustrative purposes and are not sufficient for code generation or any other form of model driven development.

### Namespaces

The MDA DS COI Spiral 2 schemas reference several namespaces. Table 1 lists the XML Namespaces utilized by the MDA DS COI Spiral 2 schemas.

<table>
<thead>
<tr>
<th>Prefix</th>
<th>XML Namespace</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>ism</td>
<td>urn:us:gov:ic:ism:v2</td>
<td>IC ISM 2.0</td>
</tr>
<tr>
<td>MDADSCOI</td>
<td><a href="http://metadata.dod.mil/mdr/ns/MaritimeDomainAwareness">http://metadata.dod.mil/mdr/ns/MaritimeDomainAwareness</a></td>
<td>This namespace</td>
</tr>
<tr>
<td>xsd</td>
<td><a href="http://www.w3.org/2001/XMLSchema">http://www.w3.org/2001/XMLSchema</a></td>
<td>XML Schema</td>
</tr>
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</table>

Table 1: Namespaces Employed Within the MDA DS COI Spiral 2 Schemas

### Scope of Effort

Under spiral 1, the scope of the modeling effort was focused primarily upon those data elements that were pertinent to AIS. To date, the scope of the modeling effort under Spiral 2 has primarily been in support of the DAS. The DAS provides a value-added service that leverages the AIS service developed under spiral 1 and provides an ability to cross reference...
AIS information against an authoritative data source, filling-in missing information and/or identifying conflicting information. In so doing, the DAS provides additional fidelity to the AIS messages that are published over NCES messaging.

As previously mentioned, there are two additional unclassified services that the MDA DS COI Pilot Technical Team (PTT) is developing under spiral 2. The first is a Historical Archive Service (HAS) and the second is an Anomaly Detection Service (ADS).

The HAS will provide an distributed, service-enabled archive of augmented AIS vessel position reports so that users may view and consume position reports for specific vessels over time. Under Spiral 1, users were only able to see where a vessel happened to be right now. There was no ability to determine where the vessel was 3 hours ago, yesterday, last week, or last month. The HAS will make use of the DAS.

The ADS will consume the DAS and HAS and provide alerts to authorized users whenever a report discrepancy or behavioral anomaly is discovered.

**Vocabulary Use**

The MDA DS COI continues to employ XML Schemas and Instances in the same fashion as Spiral 1. Back end data providers agree to publish their data in accordance with the XML Schema Definitions (XSD). The XSD specify the syntax and semantics for XML instances while the XML instance provides the actual message payload. Once a data provider constructs an XML instance, the provider publishes the XML instance to NCES messaging where MDA DS COI subscribers automatically receive the new message. The following diagram depicts this relationship.
Spiral 2 Use Case: Data Augmentation Service (DAS)

The DAS involves four primary types of actors: authoritative data source(s), AIS data provider(s), AIS data consumer(s), and the Net Centric Enterprise Services (NCES) Messaging Service. Figure 1 depicts each actor and the activities that a particular actor is associated with.

The Authoritative Source publishes a daily set of update records to a channel on the NCES Messaging Service that only AIS Data Providers subscribe to. For the immediate needs of Spiral 2, the data update record consists of no more than eight (8) fields for a given vessel: vessel name, Ship Control Number (SCONUM), flag, abbreviated ship type, call sign, International Maritime Organization (IMO) Number, ship class, and a Maritime Mobile Service
Identity (MMSI) number. However, if one examines the data update record schema, DAS-UpdateRecords.xsd, it becomes clear that an update record is simply of type Vessel. This means that potentially any information pertaining to a vessel could be included within the update record; the update record is not intrinsically limited to only eight fields. If authoritative sources later desire to publish vessel information beyond the eight fields, the schema can automatically support those fields without modification to DAS-UpdateRecords.xsd (although changes may be required to Vessel.xsd if those fields are not currently captured within Vessel.xsd). This promotes reusability, modularity, and extensibility and isolates DAS-UpdateRecords.xsd from changes to Vessel.xsd.

Once the Authoritative Source publishes the update record(s), NCES Messaging performs message routing and delivers the update records to authorized subscribers. In this case, the authorized subscribers are AIS data providers.

Each AIS data provider then stores the update record within a local authoritative reference set, replacing any outdated values with the more current information. Each local authoritative reference set provides an AIS data provider with information that can be used to augment and refine AIS reports before the provider publishes those reports to the community. This promotes consistency, additional fidelity, and value added to the AIS information.

In augmenting this AIS information, there are four cases that may be encountered.
   1. The AIS sensor possesses information that the authoritative reference set does not
   2. The data from the AIS sensor and the authoritative reference set coincide
   3. The authoritative reference set possesses information that the AIS sensor does not
   4. The AIS sensor and the authoritative reference set report conflicting information

Each case above corresponds to exactly one representation in the MDA DS COI schemas. Although we will not go into the details, each case is articulated under Appendix B. AIS providers and consumers should consult Appendix B in order to understand the appropriate XML representation for each.

Once the AIS provider has augmented the AIS reports, those reports are ready to publish over NCES Messaging. As was the case earlier, NCES Messaging handles all message routing and subscription management.

Just as it was important for AIS data providers to understand the four cases of data augmentation, it is also important for AIS data consumers to understand them also. Please consult Appendix B.

Schema Usage Examples

**DAS Vessel Update Record Schema and Example Instance**

This section is only applicable to providers of AIS. Consumers need not worry about this section.
The format of each vessel update record is specified within the file DAS-UpdateRecords.xsd. As indicated below, each DAS-VesselUpdateRecord is of type MDADSCOI:Vessel. As a result, potentially any information relevant to a vessel could be included within the DAS Update Record. However, for the purposes of spiral 2, only eight fields will be included: name, call sign, Ship Control Number (SCONUM), Maritime Mobile Service Identity (MMSI), International Maritime Organization (IMO) number, flag, ship class, and ship type.

Figure 3: DAS Vessel Update Record Schema

The following provides an example of a Vessel Update Record instance with all eight fields populated.

Figure 4: DAS Vessel Update Record Instance
These types of messages will be sent to AIS providers on a daily basis. Upon receipt of such a message, each AIS provider should update their local authoritative reference set with the information contained in the Vessel Update Record.

**Vessel Position Report**

This section will prove useful for both AIS data producers and consumers. To producers, it provides examples of how to employ the schemas to produce AIS position reports. For consumers, it provides examples of the types of messages that they will soon be receiving. However, it is important to stress that these are only examples. The ultimate reference should be the XML schemas themselves since these are the artifacts that are used to validate each XML instance.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2005 U (http://www.xmlspy.com)-->
<MDADSCOI:mda_Message ism:releasableTo="USA" ism:classification="U" ism:ownerProducer="GBR"
xmlns:MDADSCOI="http://metadata.dod.mil/mdr/ns/MaritimeDomainAwareness"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:ism="urn:us:gov:ic:ism:v2"
xmlns:MDADSCOI="http://metadata.dod.mil/mdr/ns/MaritimeDomainAwareness"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:ism="urn:us:gov:ic:ism:v2">
  <timeOrigin>2005-07-09T09:30:47.0Z</timeOrigin>
  <defaultInformationSource>
    Nationwide Automatic Identification System (NAIS)
  </defaultInformationSource>
  <isDistinguishingRawFromAugmentedValues>true</isDistinguishingRawFromAugmentedValues>
  <conveyance xsi:type="MDADSCOI:Vessel">
    <timeInterval>
      <start>2001-12-17T09:30:47.0Z</start>
      <end>2001-12-17T09:47.0Z</end>
    </timeInterval>
    <location locationAttribute="isAtLocation">
      <latitude>26.158</latitude>
      <longitude>80.1835</longitude>
      <s-minor>10</s-minor>
      <s-major>10</s-major>
    </location>
    <vector>
      <courseOverGround>270</courseOverGround>
      <speedOverGround>4.0</speedOverGround>
    </vector>
    <trueHeading>
      <heading>265</heading>
    </trueHeading>
    <rateOfTurn>
      <rate>0.0</rate>
    </rateOfTurn>
    <mmsi>304244000</mmsi>
    <sensor xsi:type="MDADSCOI:AIS_Transponder">
      <navigationalStatus>0</navigationalStatus>
    </sensor>
  </conveyance>
</MDADSCOI:mda_Message>
```

Figure 5: Example AIS Message Type 1, 2, 3 without Data Augmentation
Figure 6: Example AIS Message 5 without Data Augmentation
Figure 7: Example Combination of AIS Messages 1, 2, or 3, and 5 without Data Augmentation
Vessel Position Report With Data Augmentation

<?xml version="1.0" encoding="UTF-8"?>
<MDADSCOI:mda_Message ism:releasableTo="USA" ism:classification="U" ism:ownerProducer="GBR"
xsi:schemaLocation="http://metadata.dod.mil/mdr/ns/MaritimeDomainAwareness Message.xsd
http://metadata.dod.mil/mdr/ns/MaritimeDomainAwareness Vessel.xsd"
xmns:MDADSCOI=http://metadata.dod.mil/mdr/ns/MaritimeDomainAwareness
xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance
xmlns:ism=urn:us:gov:ic:ism:v2">
  <timeOrigin>2005-07-09T09:30:47.0Z</timeOrigin>
  <defaultInformationSource>Nationwide Automatic Identification System (NAIS)</defaultInformationSource>
  <isDistinguishingRawFromAugmentedValues>true</isDistinguishingRawFromAugmentedValues>
  <conveyance xsi:type="MDADSCOI:Vessel">
    <timeInterval>
      <start>2001-12-17T09:30:47.0Z</start>
      <end>2001-12-17T09:30:47.0Z</end>
    </timeInterval>
    <location locationAttribute="isAtLocation">
      <latitude>26.158</latitude>
      <longitude>80.1835</longitude>
      <s-minor>10</s-minor>
      <s-major>10</s-major>
    </location>
    <vector>
      <courseOverGround>270</courseOverGround>
      <speedOverGround>4.0</speedOverGround>
    </vector>
    <trueHeading>
      <heading>182</heading>
    </trueHeading>
    <rateOfTurn>
      <rate>0.0</rate>
    </rateOfTurn>
    <name MDADSCOI:informationSource="NAVY">Santo Angel</name>
    <callSign MDADSCOI:informationSource="NAVY">V2AJ1</callSign>
    <SCONUM MDADSCOI:informationSource="NAVY">1234567</SCONUM>
    <mmsi>304244000</mmsi>
    <imoNumber MDADSCOI:informationSource="NAVY" MDADSCOI:isSameAsSensor="true">1234567</imoNumber>
    <flag MDADSCOI:informationSource="NAVY">US</flag>
    <shipClassName MDADSCOI:informationSource="NAVY">SIR GALAHAD</shipClassName>
    <shipTypeCode MDADSCOI:informationSource="NAVY">YSF</shipTypeCode>
    <sensor xsi:type="MDADSCOI:AIS_Transponder">
      <navigationalStatus>0</navigationalStatus>
    </sensor>
  </conveyance>
</MDADSCOI:mda_Message>

Figure 8: Example AIS Message Type 1, 2, 3 with Data Augmentation
Figure 9: Example AIS Message 5 with Data Augmentation

**Expectation of Data Providers and Consumers**

Data providers and consumers should develop to the schemas in Appendix E when sharing data within the MDA DS COI. Individual providers or consumers may store data at rest in the format of their choice. However, whenever they provide information to the community, they should do so in accordance with the MDA DS COI information exchange schemas.
Adopted Standards and Guidelines

The MDA DS COI DMWG researched standards and guidelines within international, U.S. government, and industry. The International Association of Marine Aids to Navigation and lighthouse Authorities (IALA) provides guidelines on the Automatic Identification System (AIS) and actively participates in the development of AIS standards. These standards eased the design of the information exchange schemas primarily because the AIS standards include detailed information.

The following list provides the set of standards that the DMWG employed in development of the MDA DS COI DAS information exchange schemas.

**AIS GUIDLINES**

IALA Guidline No. 1028 on the AIS Volume 1, Part 1 Operational Issues (Edition 1.3, December 2004) provided the developers a ‘one-stop’ information source for both operational and technical aspects of AIS.

**UML 1.1**

This standard was primarily adopted for the UML Use-case and Class-relationship diagram.

**XML 1.0**

This applies to the generation of the XML schemas based on the output of the RSA toolset.

**ICISM V 2.0**

This was adopted to extend the DDMS profile and message attributes to include IC ISM markings. For the purpose of the MDA DS COI Pilot, the DDMS extensions will be registered to support spiral one. The IC ISM Data Element Dictionary and the IC ISM Implementation Guide provide specific details.

Lessons Learned

In the course of spirals 1 and 2, there have been an invaluable set of lessons learned:

- *Identify organizations willing to contribute* early in the process. This ensures that the proper players and subject matter expertise are engaged from start to finish.
- *Define the scope early* working closely with the implementation team to ensure all necessary data elements are included and to prevent expanding past the demonstration goals.
- *Identify tool-set as soon as possible.* We decided to use Altova XML Spy and SPARX Enterprise Architect as our tools of choice.
- *Reach closure on the schemas; not necessarily consensus* – getting all participants to fully agree that a schema is ready for use is difficult at best. It is important to set a
date for schema release and stick to it. This will ensure closure even if there is not consensus.

- **Limit the complexity of the schemas and strive for simplicity** – be mindful of the information producers and consumers. They will be mapping their information into the schema. This process should be easy to learn and perform.
- **Capture semantics, not just structure** – adequately document the meaning of terms, data constraints, and quantitative units of measurements
- **Develop and post real examples of XML instances** – the instances provide example usage, test data for development effort, and they verify that instances support scenarios and use-cases

## Way-ahead

### Universal Core

The Department of Defense (DoD) and the Intelligence Community (IC) continue to strengthen their partnership and commitment to a shared data strategy with the joint release of an information exchange schema named Universal Core (UCORE) on 1 Oct 2007.

UCORE’s goal is to make it easy for programs to share information within and across communities. It is implemented as an information exchange standard and consequently, focuses on the sharing of information across systems, not how a particular system stores its data. The key to UCORE is a consistent understanding of a small number of the most commonly used elements (when, where, what) in information exchanges.

Systems that adopt UCore will benefit by:

- leveraging a common foundation for their information exchange needs;
- gaining a level of automated information sharing across communities; and
- reducing the need for mediation and translation between systems, and contributing to agility in development;

UCore supports the DoD and IC Data Strategies by facilitating information discovery and understanding, and continues to enable the distributed definition and management of data vocabularies by Communities of Interest.

In addition to participating in the development of it, the MDA DS COI has made two commitments with regard to UCORE. First, the MDA DS COI contributes to UCORE Test and Evaluation (T&E), assessing UCORE suitability, simplicity, extensibility, and supportability for COIs. Secondly, the MDA DS COI has committed to becoming an early adopter of UCORE in FY08. We expect to migrate all spiral 2 and spiral 3 schemas to UCORE in December 2007 or January 2008. MDA DS COI producers and consumers should expect a schema update at that time.
**Maritime Information Exchange Model (MIEM)**

As part of its responsibilities, the MDA DS COI DMWG is the configuration control agent for the community’s semantic vocabulary, data models, and schemas. While spirals 1 and 2 have primarily focused upon AIS, there has always been an end goal that the MDA DS COI vocabulary would eventually contain a robust set of core elements pertaining to vessels, cargo, people, facilities, and threats.

In October 2006, after the completion of MDA DS COI spiral 1, the DMWG began to collaborate with the Comprehensive Maritime Awareness (CMA) Advanced Concept Technology Demonstration (ACTD) on development of a Maritime Information Exchange Model (MIEM) that would provide detailed elements for the core elements listed above.

At the time of this writing, the MIEM has achieved its first alpha release, indicating that the MIEM awaits full testing of all its functionality and is not yet feature complete. The CMA ACTD is working closely with US Coast Guard (USCG) and the Office of Naval Intelligence (ONI) to perform entry-level alpha testing of the MIEM. After the results of that testing are available, modifications will be made to the MIEM in preparation for its first beta release. Under a beta release, the MIEM will be more stable than it was under alpha release but still not yet mature enough to use within an operational context.

The MIEM was not used in development of the MDA DS COI Spiral 2 DAS since the MIEM is still in the relatively early stages of development and testing. Nevertheless, the DMWG will continue to monitor and contribute to the evolution of the MIEM, leveraging stabilized data elements and best practices where applicable in subsequent MDA DS COI spirals.

Both the UCORE and MIEM are important efforts that will provide wide-spread benefits to the MDA DS COI. The MDA DS COI is committed to establishing a convergence path between both efforts.

**Concluding Remarks**

While there have certainly been modifications to the Spiral 1 schemas, they are not drastic. Many of the changes have been in support of the Data Augmentation Service (DAS). If you are already familiar with the spiral 1 schemas, you will probably find the spiral 2 schemas rather intuitive after familiarizing yourself with the cases of data augmentation as outlined in Appendix B.

We certainly want to stress our availability to answer any questions that you may have regarding the Spiral 2 schemas. Should you have any questions or require further clarification, please contact Mr. Brian Freeman:

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719-572-8240
### Appendix A: Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTD</td>
<td>Advanced Capability Technology Demonstration</td>
</tr>
<tr>
<td>ADS</td>
<td>Anomaly Detection Service</td>
</tr>
<tr>
<td>AIS</td>
<td>Automatic Identification System</td>
</tr>
<tr>
<td>CMA</td>
<td>Comprehensive Maritime Awareness</td>
</tr>
<tr>
<td>COI</td>
<td>Community of Interest</td>
</tr>
<tr>
<td>DAS</td>
<td>Data Augmentation Service</td>
</tr>
<tr>
<td>DDMS</td>
<td>Department of Defense Discovery Metadata Specification</td>
</tr>
<tr>
<td>DHS</td>
<td>Department of Homeland Security</td>
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<td>Data Information Systems Agency</td>
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<td>Data Management Working Group</td>
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<td>DOD</td>
<td>Department of Defense</td>
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<td>Historical Archive Service</td>
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<td>Intelligence Community</td>
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<td>Intelligence Community Information Security Markings</td>
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<tr>
<td>IMO</td>
<td>International Maritime Organization</td>
</tr>
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<td>Maritime Domain Awareness</td>
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</tr>
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<td>Maritime Mobile Service Identity</td>
</tr>
<tr>
<td>NAIS</td>
<td>Nationwide Automatic Identification System</td>
</tr>
<tr>
<td>NCES</td>
<td>Net-Centric Enterprise Services</td>
</tr>
<tr>
<td>ONI</td>
<td>Office of Naval Intelligence</td>
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<td>Pilot Technical Team</td>
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<td>Ship Control Number</td>
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<td>Universal Core</td>
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<td>United States Coast Guard</td>
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<td>eXtensible Markup Language</td>
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<td>XSD</td>
<td>XML Schema Definition</td>
</tr>
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Appendix B: The Four Cases of Data Augmentation

As mentioned earlier, there are four discrete cases of data augmentation:

Case I: The AIS sensor possesses information that the authoritative reference set does not

Case 2: The data from the AIS sensor and the authoritative reference set coincide

Case 3: The authoritative reference set possesses information that the AIS sensor does not

Case 4: The AIS sensor and the authoritative reference set report conflicting information

The intent of Appendix B is to provide an overview for the representation of each within the MDA DS COI Spiral 2 schemas.

In each instance, we have sought simplicity and consistency. We illustrate each case in the augmentation of a vessel’s name. Once you understand the general pattern, you can apply it to the other eight fields as well.

For clarity, each instance of augmentation is highlighted in yellow.

Case 1:
Description: The AIS sensor possesses information that the authoritative reference set does not

```xml
<?xml version="1.0" encoding="UTF-8"?>
<MDADSCOI:mda_Message ism:classification="U" ism:ownerProducer="GBR"
xsi:schemaLocation="http://metadata.dod.mil/mdr/ns/MaritimeDomainAwareness Message.xsd
http://metadata.dod.mil/mdr/ns/MaritimeDomainAwareness Vessel.xsd"
xmns:MDADSCOI="http://metadata.dod.mil/mdr/ns/MaritimeDomainAwareness"
xmns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmns:ism="urn:us:gov:ic:ism:v2">
  <timeOrigin>2005-07-09T09:30:47.0Z</timeOrigin>
  <defaultInformationSource>NAIS</defaultInformationSource>
  <isDistinguishingRawFromAugmentedValues>true</isDistinguishingRawFromAugmentedValues>
  <conveyance xsi:type="MDADSCOI:Vessel">
    <name>Santo Angel</name>
  </conveyance>
</MDADSCOI:mda_Message>
```

Figure 10: Case 1 Data Augmentation

Case 2:
Description: The data from the AIS sensor and the authoritative reference set coincide
Case 3:
Description: The authoritative reference set possesses information that the AIS sensor does not.

Case 4:
Description: The AIS sensor and the authoritative reference set report conflicting information.
<?xml version="1.0" encoding="UTF-8"?>
<MDADSCOI:mda_Message
ism:classification="/" ism:ownerProducer="/"
 xmlns:MDADSCOI="/" xmlns:xsi="/"
 xmlns:ism="/">
  <timeOrigin>2005-07-09T09:30:47.0Z</timeOrigin>
  <defaultInformationSource>NAIS</defaultInformationSource>
  <isDistinguishingRawFromAugmentedValues>true</isDistinguishingRawFromAugmentedValues>
  <conveyance xsi:type="MDADSCOI:Vessel">
    <name>Santo Angel</name>
    <name MDADSCOI:informationSource="/">Lightening III</name>
  </conveyance>
</MDADSCOI:mda_Message>

Figure 13: Case 4 Data Augmentation
Appendix C: Listing of Terms within the MDA DS COI
Spiral 2 Vocabulary and Information Exchange Schemas

Note: Each term is listed within the order in which it appears within the schemas. Listings are not in alphabetical order.

**AIS_Transponder.xsd**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>aisVersionIndicator</td>
<td>AISVersionIndicator specifies the version of AIS that the vessel is using. Acceptable values are 0, 1, 2, and 3.</td>
</tr>
<tr>
<td>receiverFromBow</td>
<td>receiverFromBow specifies the distance of the AIS receiver from the Bow. This information is provided by message 5 of an AIS transmission. This distance is measured in meters. When used in conjunction with receiverFromStern, receiverFromPortBeam, and receiverFromStarboardBeam the dimensions of the vessel can be obtained.</td>
</tr>
<tr>
<td>receiverFromStern</td>
<td>receiverFromStern specifies the distance of the receiver from the stern. This information is provided by message 5 of an AIS transmission. This distance is measured in meters. When used in conjunction with receiverFromBow, receiverFromPortBeam, and receiverFromStarboardBeam the dimensions of the vessel can be obtained.</td>
</tr>
<tr>
<td>receiverFromPortBeam</td>
<td>receiverFromPortBeam specifies the distance of the receiver from the port beam. This information is provided by message 5 of an AIS transmission. This distance is measured in meters. When used in conjunction with receiverFromStern, receiverFromBow, and receiverFromStarboardBeam the dimensions of the vessel can be obtained.</td>
</tr>
<tr>
<td>receiverFromStarboardBeam</td>
<td>receiverFromStarboardBeam specifies the distance of the receiver from the starboard beam. This information is provided by message 5 of an AIS transmission. This distance is measured in meters. When used in conjunction with receiverFromStern,</td>
</tr>
</tbody>
</table>


receiverFromPortBeam, and receiverFromBow the dimensions of the vessel can be obtained.

typeOfShipAndCargoType specifies in general terms what type of ship the vessel is and what type of cargo it conveys. This information is provided by message 5 of an AIS transmission. The field is optional and it is an enumerated type.

typeOfEPFDevice specifies the type of Electronic Position Fixing Device (i.e. GPS, GLONASS, Loran-C, Integrated Navigation System, Chayka) used by the AIS transciever. This information is provided by message 5 of an AIS transmission. This field is optional and it is an enumerated type.

NavigationalStatus is provided by messages 1, 2, and 3 of AIS transmissions. It is an enumerated type. This field is optional.

**Augmentation.xsd**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>InformationSource</td>
<td>An optional xsd:string field that specifies the information source that is providing data augmentation.</td>
</tr>
<tr>
<td>isSameAsSensor</td>
<td>A optional xsd:boolean field that specifies whether the augmented value is the same as the sensor's value. &quot;True&quot; implies that the augmented value is the same as the sensor's value. &quot;False&quot; implies that the augmented value is different from the sensor's value. If the attribute is not provided, False is assumed.</td>
</tr>
<tr>
<td>Comment</td>
<td>An optional xsd:string field that specifies any accompanying comments</td>
</tr>
</tbody>
</table>

**Conveyance.xsd**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Name of the conveyance. This field is optional. Multiple values should only be reported in the case of a data augmentation</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>callSign</td>
<td>Call sign for the conveyance. This field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>image</td>
<td>Imagry for this conveyance. The field is optional. Multiplicity DOES NOT imply augmentation.</td>
</tr>
<tr>
<td>description</td>
<td>Description of the imagery</td>
</tr>
<tr>
<td>url</td>
<td>URLs that provide retrievable locations for this image</td>
</tr>
<tr>
<td>poc</td>
<td>Points of Contact for the image</td>
</tr>
<tr>
<td>date</td>
<td>The estimated date of this image</td>
</tr>
<tr>
<td>estNumberOfCrew</td>
<td>Estimated total number of crew aboard this conveyance. This field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>estNumberOfPassengers</td>
<td>Estimated total number of passengers aboard this conveyance. This number does not account for the number of crewman aboard the conveyance. This field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
</tbody>
</table>

**DAS_UpdateRecords.xsd**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAS-VesselUpdateRecord</td>
<td>Specifies a Vessel Update Record for the MDA DS COI Data Augmentation Service</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>ClassificationType</td>
<td>A simple type in which a name token is restricted to the US, non-US, and joint classification portion mark abbreviations from the CAPCO Register.</td>
</tr>
<tr>
<td>SecurityAttributesGroup</td>
<td>The group of Information Security Marking attributes in which the use of attributes 'classification' and 'ownerProducer' is required. This group is to be contrasted with group 'SecurityAttributesOptionGroup' in which use of those attributes is optional.</td>
</tr>
<tr>
<td>SecurityAttributesOptionGroup</td>
<td>The group of Information Security Marking attributes in which the use of attributes 'classification' and 'ownerProducer' is optional. This group is to be contrasted with group 'SecurityAttributesGroup' in which use of these attributes is required.</td>
</tr>
<tr>
<td>ownerProducer</td>
<td>ISO 3166-1 trigraph(s) of the owner or producer country(ies) and/or CAPCO-specified tetragraphs of international organizations. Either (a) a single trigraph or tetragraph or (b) a space-delimited list of trigraphs followed by tetragraphs. Trigraphs must be in alphabetical order and tetragraphs must be in alphabetical order.</td>
</tr>
<tr>
<td>SCIcontrols</td>
<td>Authorized abbreviation(s) of SCI control system(s). Either (a) a single abbreviation or (b) a space-delimited list of abbreviations in the order prescribed in the CAPCO Register.</td>
</tr>
<tr>
<td>SARIdentifier</td>
<td>Authorized Special Access Required program digraph(s) or trigraph(s) preceded by &quot;SAR-&quot;. Either (a) a single digraph or trigraph or (b) a space-delimited list of digraphs or trigraphs. Example: &quot;SAR-ABC SAR-DEF ...&quot;</td>
</tr>
<tr>
<td>disseminationControls</td>
<td>Authorized dissemination control portion mark abbreviation(s). Either (a) a single abbreviation or (b) a space-delimited list of abbreviations in the order shown in the CAPCO Register. Exception: For the &quot;REL&quot; abbreviation, omit the country code trigraph(s) and instead place the trigraph(s) in the &quot;releasableTo&quot; attribute value.</td>
</tr>
<tr>
<td>Field</td>
<td>Definition</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>FGIsourceOpen</td>
<td>Non-US classification portion marking for foreign government information in a document portion. Use this attribute to record a source country when the intent is to post the document to a shared space with the source identified.</td>
</tr>
<tr>
<td>FGIsourceProtected</td>
<td>Non-US classification portion marking for foreign government information in a document portion. Use this attribute to record a source country when the intent is to filter out the identity of the source prior to posting the document to a shared space.</td>
</tr>
<tr>
<td>releasableTo</td>
<td>ISO 3166-1 trigraphic codes of countries to which the associated content can be released. Include &quot;USA&quot; in all instances. Use a space-delimited list with &quot;USA&quot; first, followed by the other trigraph(s) in alphabetical order.</td>
</tr>
<tr>
<td>nonICmarkings</td>
<td>Authorized non-IC portion marking abbreviation(s) from the CAPCO Register. Either (a) a single non-IC abbreviated marking or (b) a space-delimited list of abbreviations in the order shown in the CAPCO Register.</td>
</tr>
<tr>
<td>classifiedBy</td>
<td>Use as specified by E.O. 12958.</td>
</tr>
<tr>
<td>classificationReason</td>
<td>A text string containing one or more paragraph numbers, 1.4(a) through 1.4(h), taken from E.O. 12958, as amended. Enter the paragraph references as they should appear in a classification/declassification block.</td>
</tr>
<tr>
<td>derivedFrom</td>
<td>A text string containing (a) the title and date of a specific source document, or (b) the title and date of an organization classification guide, or (c) the literal string &quot;Multiple Sources&quot;.</td>
</tr>
<tr>
<td>declassDate</td>
<td>A specific date, in the format YYYY-MM-DD, at which the applicable information is automatically declassified.</td>
</tr>
<tr>
<td>declassEvent</td>
<td>A textual description of an event that triggers declassification.</td>
</tr>
<tr>
<td>declassException</td>
<td>One or more of the exceptions to 25-year declassification: specify &quot;25X1-human&quot;, &quot;25X1&quot;, &quot;25X2&quot;, ..., &quot;25X9&quot;. If more than one exception applies, use a space delimited list. If &quot;25X1-human&quot; applies, it</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>timeOrigin</td>
<td>TimeOrigin is a time stamp placed on this message when generated. It is of type xsd:dateTime</td>
</tr>
<tr>
<td>defaultInformationSource</td>
<td>Provides the default information source for all information contained in this message. All information expressed in this message should be assumed to have originated with the DefaultInformationSource unless explicitly stated otherwise through the AugmentationAttributes of that element. Example values for this field are: NAIS, Volpe, and Navy.</td>
</tr>
<tr>
<td>isDistinguishingRawFromAugmentedValues</td>
<td>A boolean that specifies whether this particular message is differentiating/distinquishing between raw and augmented information. If the value of this element is false, the data producer is not distinguishing between raw and augmented values. An example would be the Automatic Merchant Reporting</td>
</tr>
</tbody>
</table>
System (AMRS). AMRS produces AIS vessel position reports that are already augmented with additional information. In such a case, the producer may not distinguish between a raw value and an augmented value. On the other hand, if the value of this element is true, then the producer does draw a distinction between raw and augmented information. This element defaults to true.

conveyance The instance of conveyance which this message is reporting on.

**Sensor.xsd**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>signal</td>
<td>Signal information pertaining to this sensor. This field is optional.</td>
</tr>
<tr>
<td>signalStrength</td>
<td>SignalStrength provides a measurement for the sensor's transmission in decibels relative to 1mW (dBm). This field is optional.</td>
</tr>
</tbody>
</table>

**TemporalObject.xsd**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>timeInterval</td>
<td>ComplexType &quot;TimeInterval&quot; contains four time values: StartTime and EndTime. These define an interval in time for which the event is valid. Both fields are required if an instance of TimeInterval occurs. All times are in standard dateTime format YYYY-MM-DDThh:mm:ss; e.g. 2002-10-05T17:01:14.00Z.</td>
</tr>
<tr>
<td>start</td>
<td>start defines the starting time of the event's validity interval. start and end together define an interval in time. It is of type xsd:dateTime</td>
</tr>
<tr>
<td>end</td>
<td>end defines the ending time of the event's validity interval. The start and end fields together define an interval in time. It is of type xsd:dateTime</td>
</tr>
<tr>
<td>location</td>
<td>ComplexType &quot;location&quot; specifies a location for the temporalObject. Required</td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>fields</td>
<td>are latitude, longitude, height above ellipsoid (hae), semi-minor (s-minor), semi-major (s-major), orientation, and an error range for hae (haeRange). Although an instance of location is optional, if it is specified, all fields are required.</td>
</tr>
<tr>
<td>locationAttribute</td>
<td>is a relationship between Time and Location that specifies whether the object is at a location or not at a location at a specific time.</td>
</tr>
<tr>
<td>latitude</td>
<td>Latitude based on WGS-84 ellipsoid in signed degree-decimal format (e.g. -33.350000). Range is -90 to +90.</td>
</tr>
<tr>
<td>longitude</td>
<td>Longitude based on WGS-84 ellipsoid in signed degree-decimal format (e.g. 44.383333). Range -180 to +180.</td>
</tr>
<tr>
<td>s-minor</td>
<td>Semi-minor (&quot;s-minor&quot;) is measured in meters and follows the WGS-84 Ellipsoid standard.</td>
</tr>
<tr>
<td>s-major</td>
<td>Semi-major (&quot;s-major&quot;) is measured in meters and follows the WGS-84 Ellipsoid standard.</td>
</tr>
<tr>
<td>orientation</td>
<td>Orientation is based on WGS-84 defined Earth-Centered Earth-Fixed (ECEF) orthogonal coordinate system. The field is measured in degrees.</td>
</tr>
<tr>
<td>hae</td>
<td>HAE acronym for Height Above Ellipsoid based on WGS-84 ellipsoid (measured in meters).</td>
</tr>
<tr>
<td>haeRange</td>
<td>HAERange provides a 1-sigma error on a Gaussian distribution (in meters) associated with the HAE field. This field is intended to define a height range about a latitude/longitude point. This field, along with s-minor and s-major, allow for the definition of an elliptical volume about the latitude/longitude point.</td>
</tr>
<tr>
<td>vector</td>
<td>ComplexType vector specifies the course and speed of the temporalObject. Both are relative to ground. Errors can be assigned to each but this is optional. If an instance of vector occurs, both a course and speed over ground must be specified.</td>
</tr>
</tbody>
</table>
| courseOverGround | Course Over Ground is measured in degrees relative to true north (0 ≤ COG < 360). This field is required for every...
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>speedOverGround</td>
<td>Speed Over Ground is measured in nautical miles per hour. This field is required for every instance of vector.</td>
</tr>
<tr>
<td>eCourseOverGround</td>
<td>eCourseOverGround is a 1-sigma error on a Gaussian distribution associated with the CourseOverGround attribute. This field is optional.</td>
</tr>
<tr>
<td>eSpeedOverGround</td>
<td>eSpeedOverGround is a 1-sigma error on a Gaussian distribution associated with the speedOverGround attribute. This field is optional.</td>
</tr>
<tr>
<td>trueHeading</td>
<td>ComplexType trueHeading contains two elements (heading and eHeading). Although an instance of trueHeading is optional, if one is instantiated, only heading is required. eHeading is optional.</td>
</tr>
<tr>
<td>heading</td>
<td>Heading is measured with respect to true north. Measured in degrees (0 ≤ heading ≤ 360)</td>
</tr>
<tr>
<td>eHeading</td>
<td>eHeading is a 1-sigma error on a Gaussian distribution associated with the heading attribute. This field is optional.</td>
</tr>
<tr>
<td>rateOfTurn</td>
<td>rateOfTurn is a complex type composed of two simple types (rate and eRate). Although an instance of rateOfTurn is optional, if one in instantiated, only rate is required.</td>
</tr>
<tr>
<td>rate</td>
<td>The rate field specifies the rate, per minute, at which the vessel is turning. The field is measured in degrees per minute. The field is mandatory for every instance of the RateOfTurn complex type.</td>
</tr>
<tr>
<td>eRate</td>
<td>eRate specifies a 1-sigma error on a Gaussian distribution associated with the rateOfTurn attribute. This field is optional.</td>
</tr>
</tbody>
</table>

**Vessel.xsd**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCONUM</td>
<td>SCONUM is an abbreviation for Ship Control Number. It is represented by a string. This field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different</td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>mmsi</td>
<td>MMSI is an abbreviation for &quot;Maritime Mobile Service Identity&quot;. It is a series of nine digits which are transmitted over the radio path in order to uniquely identify ship stations, ship earth stations, coast stations, coast earth stations, etc. The field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>imoNumber</td>
<td>The IMO ship identification number is a permanent number assigned to each ship for identification purposes. This number remains unchanged upon transfer of the ship to other flags and is inserted in the ship's certificates. The IMO number is a 7-digit number assigned to all ships by the Lloyd's Register Fairplay when the vessel is constructed. The field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>officialCoastGuardNumber</td>
<td>The Official United States Coast Guard Number assigned to this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>hullNumber</td>
<td>The hull identification number for this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td><strong>uprightSequence</strong></td>
<td>The coding of uprights (cranes, funnels, gantries, king posts, and masts) starting at the bow. The presence of these verticals is indicated by the letters C, for crane; F, for funnel; H, for gantry; K, for king post; and M, for mast as they are located on the ship, starting at the bow. For example, the upright sequence for a ship with a king post, followed by a king post in the forward well, a funnel amidships, and another king post in the after deck well is coded KKFK. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td><strong>flag</strong></td>
<td>The declared nationality of the vessel. This field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td><strong>portOfCall</strong></td>
<td>The ports of call for this vessel over some period of time. No meaning should be associated with the ordering of these ports. If order is important, the attribute sequenceID should be used (e.g. the first port would have sequenceID=1, the second port sequenceID=2, the third port sequence ID=3, and so on). Multiplicity has nothing to do with data augmentation.</td>
</tr>
<tr>
<td><strong>name</strong></td>
<td>The name of the port</td>
</tr>
<tr>
<td><strong>estimatedTimeOfArrival</strong></td>
<td>Estimated Time of Arrival specifies the time wherein the conveyance is or was expected to reach this port of call. The format of the field is in standard dateTime format (ISO 8601): YYYY-MM-DDThh:mm:ss.ssZ; e.g., 2002-10-05T17:01:14.00Z.</td>
</tr>
<tr>
<td><strong>actualTimeOfArrival</strong></td>
<td>Actual Time of Arrival specifies the time wherein the conveyance actually reached this port of call. The format of the field is in standard dateTime format (ISO 8601):</td>
</tr>
<tr>
<td>Vocabulary Handbook 15-Nov-07</td>
<td>YYYY-MM-DDThh:mm:ss.ssZ; e.g., 2002-10-05T17:01:14.00Z.</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>estimatedTimeOfDeparture</td>
<td>Estimated Time of Departure specifies the time wherein the conveyance is or was expected to depart this port of call. The format of the field is in standard dateTime format (ISO 8601): YYYY-MM-DDThh:mm:ss.ssZ; e.g., 2002-10-05T17:01:14.00Z.</td>
</tr>
<tr>
<td>actualTimeOfDeparture</td>
<td>Actual Time of Departure specifies the time wherein the conveyance actually departed this port of call. The format of the field is in standard dateTime format (ISO 8601): YYYY-MM-DDThh:mm:ss.ssZ; e.g., 2002-10-05T17:01:14.00Z.</td>
</tr>
<tr>
<td>homePort</td>
<td>The home port of the vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>hailingPort</td>
<td>The port that is serving as the base of operations for this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>draft</td>
<td>The depth below water's surface of the lowest part of the vessel. Values are specified in meters. The field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>shipClassName</td>
<td>The ship class name for this vessel (e.g. &quot;SIR GALAHAD&quot;, or &quot;BLUE RIDGE&quot;). This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be</td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>shipTypeCode</td>
<td>The type of ship to which this vessel belongs (e.g. Tug, Tanker, Fishing, etc). This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>numberOfStacks</td>
<td>The number of stacks on this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>numberOfHeloPads</td>
<td>The number of helicopter pads on this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>numberOfCranes</td>
<td>The number of cranes on board this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>numberOfRamps</td>
<td>The number of ramps possessed by this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>maxRangeInNauticalMiles</td>
<td>The estimated maximum range of the vessel in nautical miles. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>cruiseRangeInNauticalMiles</td>
<td>The estimated range of the vessel when traveling at cruising speed. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>maxSpeedInKnots</td>
<td>The estimated maximum attainable speed of the vessel measured in knots (nautical miles per hour). This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>cruiseSpeedInKnots</td>
<td>The estimated cruising speed of the vessel measured in knots (nautical miles per hour). This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</td>
</tr>
<tr>
<td>sensor</td>
<td>A vessel can be associated with 0 or more sensors that transmit different types of information. This element is optional. Multiple values do not imply data augmentation.</td>
</tr>
</tbody>
</table>
Appendix D: UML Spiral 2 Class Relationship Diagrams

Figure 14: UML Spiral 2 Class Relationship Diagram
Figure 15: UML Spiral 2 Class Relationship Diagram (cont’d)
Appendix E: Spiral 2 XML Schema Definitions (XSD)

AIS_Transponder.xsd

```xml
<?xml version="1.0" encoding="UTF-8"?>
    targetNamespace="http://metadata.dod.mil/mdr/ns/MaritimeDomainAwareness">
    <xsd:include schemaLocation="Sensor.xsd"/>
    <xsd:simpleType name="NavigationalStatus">
        <xsd:annotation>
            <xsd:documentation>This enumeration specifies types of navigational status as specified in the IALA Guidelines on Automatic Identification System (AIS), Volume 1, Part 1 (Operational Issues) Ed. 1.3</xsd:documentation>
        </xsd:annotation>
        <xsd:restriction base="xsd:string">
            <xsd:enumeration value="0">
                <xsd:annotation>
                    <xsd:documentation>Underway using engine</xsd:documentation>
                </xsd:annotation>
            </xsd:enumeration>
            <xsd:enumeration value="1">
                <xsd:annotation>
                    <xsd:documentation>At anchor</xsd:documentation>
                </xsd:annotation>
            </xsd:enumeration>
            <xsd:enumeration value="2">
                <xsd:annotation>
                    <xsd:documentation>not under command</xsd:documentation>
                </xsd:annotation>
            </xsd:enumeration>
        </xsd:restriction>
    </xsd:simpleType>
</xsd:schema>
```
This enumeration specifies types of ship and cargo as specified in the IALA Guidelines on Automatic Identification System (AIS), Volume 1, Part 1 (Operational Issues) Ed. 1.3

WIG; all ships of this type

WIG; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category A
<xsd:documentation>
WIG; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category B
</xsd:documentation>
</xsd:enumeration>
<xsd:enumeration value="23">
<xsd:annotation>
<xsd:documentation>
WIG; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category C
</xsd:documentation>
</xsd:enumeration>
<xsd:enumeration value="24">
<xsd:annotation>
<xsd:documentation>
WIG; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category D
</xsd:documentation>
</xsd:enumeration>
<xsd:enumeration value="29">
<xsd:annotation>
<xsd:documentation>WIG; No additional information</xsd:documentation>
</xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="30">
<xsd:annotation>
<xsd:documentation>Fishing</xsd:documentation>
</xsd:enumeration>
<xsd:enumeration value="31">
<xsd:annotation>
<xsd:documentation>Towing</xsd:documentation>
</xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="32">
Towing and length of the tow exceeds 200 meters or breadth exceeds 25 meters

Engaged in dredging or underwater operations

Engaged in diving operations

Engaged in military operations

Sailing

Pleasure Craft

High Speed Craft (HSC); All ships of this type
<xsd:enumeration value="41">
  <xsd:annotation>
    <xsd:documentation>
      High Speed Craft (HSC); Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category A
    </xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>

<xsd:enumeration value="42">
  <xsd:annotation>
    <xsd:documentation>
      High Speed Craft (HSC); Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category B
    </xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>

<xsd:enumeration value="43">
  <xsd:annotation>
    <xsd:documentation>
      High Speed Craft (HSC); Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category C
    </xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>

<xsd:enumeration value="44">
  <xsd:annotation>
    <xsd:documentation>
      High Speed Craft (HSC); Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category D
    </xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>

<xsd:enumeration value="49">
  <xsd:annotation>
    <xsd:documentation>
      High Speed Craft (HSC); No additional information
    </xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="50">
    <xsd:annotation>
        <xsd:documentation>Pilot vessel</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>

<xsd:enumeration value="51">
    <xsd:annotation>
        <xsd:documentation>Search and rescue vessels</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>

<xsd:enumeration value="52">
    <xsd:annotation>
        <xsd:documentation>Tugs</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>

<xsd:enumeration value="53">
    <xsd:annotation>
        <xsd:documentation>Port tenders</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>

<xsd:enumeration value="54">
    <xsd:annotation>
        <xsd:documentation>Vessels with anti-pollution facilities or equipment</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>

<xsd:enumeration value="55">
    <xsd:annotation>
        <xsd:documentation>Law enforcement vessels</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>

<xsd:enumeration value="58">
    <xsd:annotation>
        <xsd:documentation>Medical transports (as defined in the 1949 Geneva Conventions and Additional Protocols)</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
Ships according to Resolution No 18 (Mob-83)

Passenger Ships; All ships of this type

Passenger Ships; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category A

Passenger Ships; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category B

Passenger Ships; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category C
Passenger Ships; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category D
</xsd:enumeration>
</xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="69">
<xsd:annotation>
<xsd:documentation>Passenger Ships; No additional information</xsd:documentation>
</xsd:annotation>
</xsd:enumeration>
</xsd:enumeration>
<xsd:enumeration value="70">
<xsd:annotation>
<xsd:documentation>Cargo Ships; All ships of this type</xsd:documentation>
</xsd:annotation>
</xsd:enumeration>
</xsd:enumeration>
<xsd:enumeration value="71">
<xsd:annotation>
<xsd:documentation>Cargo Ships; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category A</xsd:documentation>
</xsd:annotation>
</xsd:enumeration>
</xsd:enumeration>
<xsd:enumeration value="72">
<xsd:annotation>
<xsd:documentation>Cargo Ships; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category B</xsd:documentation>
</xsd:annotation>
</xsd:enumeration>
</xsd:enumeration>
<xsd:enumeration value="73">
<xsd:annotation>
<xsd:documentation>Cargo Ships; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category C</xsd:documentation>
</xsd:annotation>
</xsd:enumeration>
</xsd:enumeration>
Cargo Ships; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category D

Tankers; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category A

Tankers; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category B
<xsd:documentation>
Tankers; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category C
</xsd:documentation>
</xsd:enumeration>
<xsd:enumeration value="84">
    <xsd:annotation>
        <xsd:documentation>Tankers; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category D</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="89">
    <xsd:annotation>
        <xsd:documentation>Tankers; No additional information</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="90">
    <xsd:annotation>
        <xsd:documentation>Other types of ship; All ships of this type</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="91">
    <xsd:annotation>
        <xsd:documentation>Other types of ship; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category A</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="92">
    <xsd:annotation>
        <xsd:documentation>Other types of ship; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category B</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="93">
  <xsd:annotation>
    <xsd:documentation>
      Other types of ship; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category C
    </xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>

<xsd:enumeration value="94">
  <xsd:annotation>
    <xsd:documentation>
      Other types of ship; Carrying dangerous goods, harmful substances, marine pollutants IMO hazard or pollutant category D
    </xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>

<xsd:enumeration value="99">
  <xsd:annotation>
    <xsd:documentation>
      Other types of ship; No additional information
    </xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>

This enumeration specifies types of Electronic Position Fixing (EPF) devices as specified in the IALA Guidelines on Automatic Identification System (AIS), Volume 1, Part 1 (Operational Issues) Ed. 1.3
<xsd:enumeration value="1">
    <xsd:annotation>
        <xsd:documentation>GPS</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="2">
    <xsd:annotation>
        <xsd:documentation>GLONASS</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="3">
    <xsd:annotation>
        <xsd:documentation>Combined GPS/GLONASS</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="4">
    <xsd:annotation>
        <xsd:documentation>Loran-C</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="5">
    <xsd:annotation>
        <xsd:documentation>Chayka</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="6">
    <xsd:annotation>
        <xsd:documentation>Integrated Navigation System</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="7">
    <xsd:annotation>
        <xsd:documentation>Surveyed</xsd:documentation>
    </xsd:annotation>
</xsd:enumeration>
AISVersionIndicator specifies the version of AIS that the vessel is using. Acceptable values are 0, 1, 2, and 3.

receiverFromBow specifies the distance of the AIS receiver from the Bow. This information is provided by message 5 of an AIS transmission. This distance is measured in meters. When used in conjunction with receiverFromStern, receiverFromPortBeam, and receiverFromStarboardBeam the dimensions of the vessel can be obtained.

receiverFromStern specifies the distance of the receiver from the stern. This information is provided by message 5 of an AIS transmission. This distance is measured in meters. When used in conjunction with receiverFromBow, receiverFromPortBeam, and receiverFromStarboardBeam the dimensions of the vessel can be obtained.
receiverFromPortBeam specifies the distance of the receiver from the port beam. This information is provided by message 5 of an AIS transmission. This distance is measured in meters. When used in conjunction with receiverFromStern, receiverFromBow, and receiverFromStarboardBeam the dimensions of the vessel can be obtained.

receiverFromStarboardBeam specifies the distance of the receiver from the starboard beam. This information is provided by message 5 of an AIS transmission. This distance is measured in meters. When used in conjunction with receiverFromStern, receiverFromPortBeam, and receiverFromBow the dimensions of the vessel can be obtained.

typeOfShipAndCargoType specifies in general terms what type of ship the vessel is and what type of cargo it conveys. This information is provided by message 5 of an AIS transmission. The field is optional and it is an enumerated type.

TypeOfEPFDevice specifies the type of Electronic Position Fixing Device (i.e. GPS, GLONASS, Loran-C, Integrated Navigation System, Chayka) used by the AIS transciever. This information is provided by message 5 of an AIS transmission. This field is optional and it is an enumerated type.
NavigationalStatus is provided by messages 1, 2, and 3 of AIS transmissions. It is an enumerated type. This field is optional.
An optional xsd:string field that specifies the information source that is providing data augmentation.

A optional xsd:boolean field that specifies whether the augmented value is the same as the sensor's value. "True" implies that the augmented value is the same as the sensor's value. "False" implies that the augmented value is different from the sensor's value. If the attribute is not provided, False is assumed.

An optional xsd:string field that specifies any accompanying comments
<xsd:complexType name="ImageryType">
  <xsd:sequence>
    <xsd:element name="description" type="xsd:string" minOccurs="0">
      <xsd:annotation>
        <xsd:documentation>Description of the imagery</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="url" type="xsd:anyURI" minOccurs="0" maxOccurs="unbounded">
      <xsd:annotation>
        <xsd:documentation>URLs that provide retrievable locations for this image</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="poc" type="xsd:string" minOccurs="0" maxOccurs="unbounded">
      <xsd:annotation>
        <xsd:documentation>Points of Contact for the image</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="date" type="xsd:date" minOccurs="0">
      <xsd:annotation>
        <xsd:documentation>The estimated date of this image</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
</xsd:complexType>
Name of the conveyance. This field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.

Call sign for the conveyance. This field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.
<xsd:element name="Image" minOccurs="0" maxOccurs="unbounded">
<xsd:annotation>
<xsd:documentation>
Imagry for this conveyance. The field is optional. Multiplicity DOES NOT imply augmentation.
</xsd:documentation>
</xsd:annotation>
<xsd:complexType>
<xsd:complexContent>
<xsd:extension base="MDADSCOI:ImageryType">
<xsd:attributeGroup ref="MDADSCOI:AugmentationAttributes"/>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
</xsd:element>
<xsd:element name="EstNumberOfCrew" minOccurs="0" maxOccurs="unbounded">
<xsd:annotation>
<xsd:documentation>
Estimated total number of crew aboard this conveyance. This field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.
</xsd:documentation>
</xsd:annotation>
<xsd:complexType>
<xsd:simpleContent>
<xsd:extension base="xsd:nonNegativeInteger">
<xsd:attributeGroup ref="MDADSCOI:AugmentationAttributes"/>
</xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
</xsd:element>
<xsd:element name="EstNumberOfPassengers" minOccurs="0" maxOccurs="unbounded">
<xsd:annotation>
<xsd:documentation>
Estimated total number of passengers aboard this conveyance. This number does not account for the number of crewman aboard the conveyance. This field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.

```
<xs:complexType>
  <xs:simpleContent>
    <xs:extension base="xsd:nonNegativeInteger">
      <xs:attributeGroup ref="MDADSCOI:AugmentationAttributes"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
```

**DAS-UpdateRecords.xsd**

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xs:include schemaLocation="Vessel.xsd"/>
<xs:import namespace="urn:us:gov:ic:ism:v2" schemaLocation="IC-ISM-v2.xsd"/>
<xs:element name="DAS-VesselUpdateRecord">
  <xs:annotation>
    <xs:documentation>
      Specifies a Vessel Update Record for the MDA DS COI Data Augmentation Service
    </xs:documentation>
  </xs:annotation>
</xs:element>
```
IC-ISM-v2.xsd

<?xml version="1.0"?>
<!--  UNCLASSIFIED -->
<!--  ********************************************** -->
<!--  UNCLASSIFIED -->
<!--  ********************************************** -->
<!--  This file provides an XML-based schema for specification of metadata for classification and controls markings. The goal of the IC ISM XML Schema is to provide a common set of XML attributes for implementing security-based metadata throughout the IC. The IC ISM XML Schema provides markup for the tokens that are used to format the CAPCO markings. -->

IC-ISM, Version 2.0, dated 30 April 2004

The IC ISM XML Schema is described in the IC Information Security Marking (IC ISM) Data Element Dictionary and the IC ISM Implementation Guide. It is one of the Intelligence Community (IC) Metadata Standards for Information Assurance.

IC-ISM-v2.xsd

<?xml version="1.0"?>
<!--  UNCLASSIFIED -->
<!--  ********************************************** -->
<!--  UNCLASSIFIED -->
<!--  ********************************************** -->
<!--  This file provides an XML-based schema for specification of metadata for classification and controls markings. The goal of the IC ISM XML Schema is to provide a common set of XML attributes for implementing security-based metadata throughout the IC. The IC ISM XML Schema provides markup for the tokens that are used to format the CAPCO markings. -->

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The IC ISM XML Schema is described in the IC Information Security Marking (IC ISM) Data Element Dictionary and the IC ISM Implementation Guide. It is one of the Intelligence Community (IC) Metadata Standards for Information Assurance.

IC-ISM-v2.xsd

<?xml version="1.0"?>
<!--  UNCLASSIFIED -->
<!--  ********************************************** -->
<!--  UNCLASSIFIED -->
<!--  ********************************************** -->
<!--  This file provides an XML-based schema for specification of metadata for classification and controls markings. The goal of the IC ISM XML Schema is to provide a common set of XML attributes for implementing security-based metadata throughout the IC. The IC ISM XML Schema provides markup for the tokens that are used to format the CAPCO markings. -->

IC-ISM, Version 2.0, dated 30 April 2004

The IC ISM XML Schema is described in the IC Information Security Marking (IC ISM) Data Element Dictionary and the IC ISM Implementation Guide. It is one of the Intelligence Community (IC) Metadata Standards for Information Assurance.
The IC ISM XML Schema may be incorporated into organizational XML-based schemas by (a) declaring the IC ISM v2.0 namespace and (b) inserting an "import" statement:

```xml
<xsd:schema
   xmlns="...my namespace name..."
   targetNamespace="...my namespace name..."
   xmlns:xsd="http://www.w3.org/2001/XMLSchema"
   xmlns:ism="urn:us:gov:ic:ism:v2">
   ...
</xsd:import
   namespace="urn:us:gov:ic:ism:v2"
   schemaLocation="IC-ISM-v2.xsd" />
```

IMPLEMENTATION NOTES:

1. Refer to the Data Element Dictionary and Implementation Guide for an explanation of the relationships of the IC ISM attributes and the associated controlled vocabularies. The CAPCO Register and CAPCO Implementation Manual provide business rules (that may be classified) not provided in the DED or Implementation Guide.

2. The IC ISM attributes are intended to support all CAPCO security markings. However, the attribute values are NOT intended to be verbatim pieces of portionmarks and banners. Instead, the values should be interpreted by XSLT stylesheets or other formatting specifications to produce the required portionmarks and banners.

3. The IC ISM schema is not a standalone construct; it should be imported into a parent XML schema.

4. The controlled vocabularies containing the required values for populating the attributes are defined in the Implementation Guide and maintained as separate text files. The terms of the controlled vocabularies are defined in the CAPCO Register.
5. Attribute group "SecurityAttributesGroup" should be referenced in the attribute definition list of any element that REQUIRES security metadata.

6. Attribute group "SecurityAttributesOptionGroup" may be referenced in the attribute definition list of any element for which security metadata may be appropriate but is not required (such as, an individual cell of a table).

USAGE GUIDELINES
***************************************************************
1. Use "classification" and "ownerProducer" together to specify the classification and type of classification.

   a. If "ownerProducer" equals "USA," the classification is a US classification and is restricted to "U," "C," "S" and "TS."

   b. If "ownerProducer" equals a trigraph other than "USA" or equals a tetragraph, the classification is a non-US classification.

   c. If "ownerProducer" equals two or more trigraphs or tetragraphs, the classification is a joint classification. If "USA" is one of the trigraphs, the classification values are restricted as shown in a, above. If "USA" is not listed, the permissible classification values include "R" in addition to those in a, above.

2. Use "classifiedBy" and "classificationReason" for original classifications. Use "derivedFrom" for derived classifications.
3. Use one and only one of:

"declassDate"
"declassEvent"
"declassException"
"typeOfExemptedSource"

4. If "typeOfExemptedSource" is used, "dateOfExemptedSource" must also be used.

5. Use "declassManualReview" to force the appearance of "/\MR" in header and footer marking titles. Otherwise, the applicability of manual review should be determined from the other markings in the document.

6. Attribute "FGIsourceProtected" is included for use by organizations that want to use IC ISM internally and track protected sources within the organization private spaces. It is not anticipated that this attribute will be used in documents posted to the shared spaces.

-->  ************************************************************
CHANGE HISTORY                                                                *
************************************************************

* # VERSION: 1.0
# DATE:  2002-07-05
# BY:    IC MWG
# PURPOSE: Released as a registered, production XML entity set.
*

* # VERSION: 2.0
# DATE:  2004-04-30
# BY:    IC MWG
# PURPOSE: Updated to support changes to the CAPCO Register and Implementation Manual.
* - Added "ownerProducer" as a required attribute for entity
  "SecurityAttributes" and as an optional attribute for entity
  "SecurityAttributesOption." Purpose is to provide a single method
  for specification of US, non-US, and joint classifications.
* - Changed the enumerated list that is the declared value of attribute
  "classification" in order to accommodate non-US classifications.
* - Added optional attribute "SARIdentifier" as a separate container for
  DoD/DoE special-access-required nicknames, codewords, or trigraph/
digraph to support elevation of SAR to the same level as SCI controls.
* - Added optional attributes "classifiedBy" and "classificationReason"
  to support generation of EO 12958 classification/declassification
  blocks.
* - Changed the declared value of "derivedFrom" to CDATA to allow the titles
  and dates of source documents or classification guides to be specified.
* - Replaced the single attribute "declassification" with distinct attri-
  butes for date-determined and event-determined declassification and
  for the 25X declassification exceptions.
* - Added attributes "typeOfExemptedSource" and "dateOfExemptedSource" for
  use in specifying that one or more sources was marked OADR, X1 through
  X8, or X-Foreign Relations.
* - Added attribute "declassManualReview" for use in forcing "MR" to
  appear in header and footer banners (regardless of whether any
  caveats in the portions would necessitate manual review).
* 
* ***************************************************** END CHANGE HISTORY ***************************************************** -->
<|--> ***************************************************** END CHANGE HISTORY ***************************************************** -->
W3C XML Schema for the Intelligence Community Metadata Standard for Information Security Marking (IC-ISM), which is part of the IC standards for Information Assurance.

A simple type in which a name token is restricted to the US, non-US, and joint classification portionmark abbreviations from the CAPCO Register.
<xsd:enumeration value="CTS-B"/>
<xsd:enumeration value="CTS-BALK"/>
<xsd:enumeration value="NU"/>
<xsd:enumeration value="NR"/>
<xsd:enumeration value="NC"/>
<xsd:enumeration value="NS"/>
<xsd:enumeration value="NS-S"/>
<xsd:enumeration value="NS-A"/>
<xsd:enumeration value="CTSA"/>
<xsd:enumeration value="NSAT"/>
<xsd:enumeration value="NCA"/>
</xsd:restriction>
</xsd:simpleType>

The group of Information Security Marking attributes in which the use of attributes 'classification' and 'ownerProducer' is required. This group is to be contrasted with group 'SecurityAttributesOptionGroup' in which use of those attributes is optional.

<xsd:attributeGroup name="SecurityAttributesGroup">
<xsd:annotation>
<xsd:documentation xml:lang="en">...
</xsd:documentation>
</xsd:annotation>
<xsd:attribute ref="classification" use="required"/>
<xsd:attribute ref="ownerProducer" use="required"/>
<xsd:attribute ref="SCIControls" use="optional"/>
<xsd:attribute ref="SARIdentifier" use="optional"/>
<xsd:attribute ref="DisseminationControls" use="optional"/>
<xsd:attribute ref="FGISourceOpen" use="optional"/>
<xsd:attribute ref="FGISourceProtected" use="optional"/>
<xsd:attribute ref="releasableTo" use="optional"/>
<xsd:attribute ref="nonICMarkings" use="optional"/>
</xsd:attributeGroup>
<xsd:attribute ref="classifiedBy" use="optional"/>
<xsd:attribute ref="classificationReason" use="optional"/>
<xsd:attribute ref="derivedFrom" use="optional"/>
<xsd:attribute ref="declassDate" use="optional"/>
<xsd:attribute ref="declassEvent" use="optional"/>
<xsd:attribute ref="declassException" use="optional"/>
<xsd:attribute ref="typeOfExemptedSource" use="optional"/>
<xsd:attribute ref="dateOfExemptedSource" use="optional"/>
<xsd:attribute ref="declassManualReview" use="optional"/>
</xsd:attributeGroup>
<xsd:attributeGroup name="SecurityAttributesOptionGroup">
  <xsd:annotation>
    <xsd:documentation xml:lang="en">
      The group of Information Security Marking attributes in which
      the use of attributes 'classification' and 'ownerProducer' 
      is optional. This group is to be contrasted with group 
      'SecurityAttributesGroup' in which use of these attributes 
      is required.
    </xsd:documentation>
  </xsd:annotation>
</xsd:attributeGroup>
<xsd:attribute ref="classification" use="optional"/>
<xsd:attribute ref="ownerProducer" use="optional"/>
<xsd:attribute ref="SCIcontrols" use="optional"/>
<xsd:attribute ref="SARIdentifier" use="optional"/>
<xsd:attribute ref="disseminationControls" use="optional"/>
<xsd:attribute ref="FGIsourceOpen" use="optional"/>
<xsd:attribute ref="FGIsourceProtected" use="optional"/>
<xsd:attribute ref="releasableTo" use="optional"/>
<xsd:attribute ref="nonICmarkings" use="optional"/>
<xsd:attribute ref="classifiedBy" use="optional"/>
<xsd:attribute ref="classificationReason" use="optional"/>
<xsd:attribute ref="derivedFrom" use="optional"/>
<xsd:attribute ref="declassDate" use="optional"/>
<xsd:attribute ref="declassEvent" use="optional"/>
<xsd:attribute ref="declassException" use="optional"/>
ISO 3166-1 trigraph(s) of the owner or producer country(ies) and/or CAPCO-specified tetragraphs of international organizations. Either (a) a single trigraph or tetragraph or (b) a space-delimited list of trigraphs followed by tetragraphs. Trigraphs must be in alphabetical order and tetragraphs must be in alphabetical order.

Authorized abbreviation(s) of SCI control system(s). Either (a) a single abbreviation or (b) a space-delimited list of abbreviations in the order prescribed in the CAPCO Register.
Authorized Special Access Required program digraph(s) or trigraph(s) preceded by "SAR-". Either (a) a single digraph or trigraph or (b) a space-delimited list of digraphs or trigraphs. Example: "SAR-ABC SAR-DEF ...

Authorized dissemination control portion mark abbreviation(s). Either (a) a single abbreviation or (b) a space-delimited list of abbreviations in the order shown in the CAPCO Register. Exception: For the "REL" abbreviation, omit the country code trigraph(s) and instead place the trigraph(s) in the "releasableTo" attribute value.

Non-US classification portion marking for foreign government information in a document portion. Use this attribute to record a source country when the intent is to post the document to a shared space with the source identified.
Non-US classification portion marking for foreign government information in a document portion. Use this attribute to record a source country when the intent is to filter out the identity of the source prior to posting the document to a shared space.

ISO 3166-1 trigraphic codes of countries to which the associated content can be released. Include "USA" in all instances. Use a space-delimited list with "USA" first, followed by the other trigraph(s) in alphabetical order.

Authorized non-IC portion marking abbreviation(s) from the CAPCO
Register. Either (a) a single non-IC abbreviated marking or (b) a space-delimited list of abbreviations in the order shown in the CAPCO Register.

Use as specified by E.O. 12958.

A text string containing one or more paragraph numbers, 1.4(a) through 1.4(h), taken from E.O. 12958, as amended. Enter the paragraph references as they should appear in a classification/declassification block.
A text string containing (a) the title and date of a specific source document, or (b) the title and date of an organization classification guide, or (c) the literal string "Multiple Sources".

A specific date, in the format YYYY-MM-DD, at which the applicable information is automatically declassified.

A textual description of an event that triggers declassification.

One or more of the exceptions to 25-year declassification: specify "25X1-human", "25X1", "25X2", ..., "25X9". If more than
one exception applies, use a space-delimited list. If "25X1-human" applies, it should be first in a list.

```xml
<xsd:documentation>
  One or more tokens indicating that a source that is exempted from automatic declassification applies. Specify "OADR", "X1", "X2", ..., "X8". If more than one applies, use a space-delimited list.
</xsd:documentation>
```

```xml
<xsd:attribute name="typeOfExemptedSource">
  <xsd:annotation>
    <xsd:documentation xml:lang="en">A specific date, in the format YYYY-MM-DD. Used in conjunction with attribute "typeOfExemptedSource." If there are multiple exempted sources, specify the date of the exempted source that has the most recent date.
</xsd:documentation>
</xsd:simpleType>
</xsd:attribute>
```

```xml
<xsd:attribute name="dateOfExemptedSource">
  <xsd:annotation>
    <xsd:documentation xml:lang="en">
</xsd:documentation>
</xsd:simpleType>
</xsd:attribute>
```

```xml
<xsd:attribute name="declassManualReview">
</xsd:annotation>
```

A true/false indication that manual review is required for declassification. Use this attribute to force the appearance of "/\MR " in the header and footer marking titles. Use this attribute ONLY when it is necessary to override the business logic applied to classification and control markings in the document to determine whether manual review is required.

```xml
<xs:attribute name="MR" type="xs:boolean" documentation="A true/false indication that manual review is required for declassification. Use this attribute to force the appearance of "/\MR " in the header and footer marking titles. Use this attribute ONLY when it is necessary to override the business logic applied to classification and control markings in the document to determine whether manual review is required."
</xs:attribute>
</xs:schema>

**Message.xsd**

```xml
  <xs:include schemaLocation="TemporalObject.xsd"/>
  <xs:include schemaLocation="Conveyance.xsd"/>
  <xs:import namespace="urn:us:gov:ic:ism:v2" schemaLocation="IC-ISM-v2.xsd"/>
  <xs:complexType name="MDA_Message">
    <xs:annotation>
      <xs:documentation>A message that specifies information about a particular conveyance.</xs:documentation>
    </xs:annotation>
    <xs:sequence>
      <xs:element name="timeOrigin" type="xs:dateTime">
        <xs:annotation>
          <xs:documentation>
          </xs:documentation>
        </xs:annotation>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:schema>
```
TimeOrigin is a time stamp placed on this message when generated. It is of type xsd:dateTime

Provides the default information source for all information contained in this message. All information expressed in this message should be assumed to have originated with the DefaultInformationSource unless explicitly stated otherwise through the AugmentationAttributes of that element. Example values for this field are: NAIS, Volpe, and Navy.

A boolean that specifies whether this particular message is differentiating/distinguishing between raw and augmented information. If the value of this element is false, the data producer is not distinguishing between raw and augmented values. An example would be the Automatic Merchant Reporting System (AMRS). AMRS produces AIS vessel position reports that are already augmented with additional information. In such a case, the producer may not distinguish between a raw value and an augmented value. On the other hand, if the value of this element is true, then the producer does draw a distinction between raw and augmented information. This element defaults to true.

The instance of conveyance which this message is reporting on.
<xsd:documentation>
Specifies a set of IC ISM markings that apply to this message
</xsd:documentation>

<xsd:attributeGroup ref="MDADSCOI:MessageAttributeGroup"/>
</xsd:complexType>
<xsd:complexType name="Collector">
  <xsd:complexContent>
    <xsd:extension base="MDADSCOI:TemporalObject">
      <xsd:sequence>
        <xsd:element name="DataSource" type="xsd:string">
          <xsd:annotation>
            <xsd:documentation>
            DataSource is a string that specifies the source of the collection. For the Pilot, DataSource is limited to AMRS, NAIS, and Navy Organic AIS
            </xsd:documentation>
          </xsd:annotation>
        </xsd:element>
        <xsd:element name="reportStationID" type="xsd:string">
          <xsd:annotation>
            <xsd:documentation>
            For the pilot, reportStationID specifies a station id for the collector.
            </xsd:documentation>
          </xsd:annotation>
        </xsd:element>
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
<xsd:attributeGroup name="MessageAttributeGroup">
  <xsd:attribute name="releasableToDepartment" type="xsd:string">
    <xsd:annotation>
      <xsd:documentation>
      ReleasableToDepartment specifies US Departments to which this message may be released. For the pilot, DHS and DOD are the only permissible values.
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:attributeGroup>
An element of complex type MDA_Message
</xsd:documentation>
</xsd:annotation>
</xsd:element>
</xsd:element>
</xsd:complexType>
</xsd:schema>
ComplexType "location" specifies a location for the temporalObject. Required fields are latitude, longitude, height above ellipsoid (hae), semi-minor (s-minor), semi-major (s-major), orientation, and an error range for hae (haeRange). Although an instance of location is optional, if it is specified, all fields are required.

```xml
<xsd:complexType name="location">
  <xsd:sequence>
    <xsd:element name="latitude" type="xsd:float" minOccurs="1" />
    <xsd:element name="longitude" type="xsd:float" minOccurs="1" />
    <xsd:element name="height" type="xsd:float" minOccurs="1" />
    <xsd:element name="sMinor" type="xsd:float" minOccurs="1" />
    <xsd:element name="sMajor" type="xsd:float" minOccurs="1" />
    <xsd:element name="orientation" type="xsd:float" minOccurs="1" />
    <xsd:element name="haeRange" type="xsd:float" minOccurs="1" />
  </xsd:sequence>
</xsd:complexType>
```

ComplexType vector specifies the course and speed of the temporalObject. Both are relative to ground. Errors can be assigned to each but this is optional. If an instance of vector occurs, both a course and speed over ground must be specified.

```xml
<xsd:complexType name="vector">
  <xsd:sequence>
    <xsd:element name="course" type="xsd:float" minOccurs="0" />
    <xsd:element name="speed" type="xsd:float" minOccurs="0" />
  </xsd:sequence>
</xsd:complexType>
```

ComplexType trueHeading contains two elements (heading and eHeading). Although an instance of trueHeading is optional, if one is instantiated, only heading is required. eHeading is optional.

```xml
<xsd:complexType name="trueHeading">
  <xsd:sequence>
    <xsd:element name="heading" type="xsd:float" minOccurs="0" />
    <xsd:element name="eHeading" type="xsd:float" minOccurs="1" />
  </xsd:sequence>
</xsd:complexType>
```

rateOfTurn is a complex type composed of two simple types (rate and eRate). Although an instance of rateOfTurn is optional, if one in instantiated, only rate is required.

```xml
<xsd:complexType name="rateOfTurn">
  <xsd:sequence>
    <xsd:element name="rate" type="xsd:float" minOccurs="0" />
    <xsd:element name="eRate" type="xsd:float" minOccurs="1" />
  </xsd:sequence>
</xsd:complexType>
```
start defines the starting time of the event's validity interval. start and end together define an interval in time. It is of type xsd:dateTime

end defines the ending time of the event's validity interval. The start and end fields together define an interval in time. It is of type xsd:dateTime

The rate field specifies the rate, per minute, at which the vessel is turning. The field is measured in degrees per minute. The field is mandatory for every instance of the RateOfTurn complex type.

eRate specifies a 1-sigma error on a Gaussian distribution associated with the rateOfTurn attribute. This field is optional.
Heading is measured with respect to true north. Measured in degrees (0 \( \leq \) heading \( \leq \) 360 )

eHeading is a 1-sigma error on a Gaussian distribution associated with the heading attribute. This field is optional.
locationAttribute is a relationship between Time and Location that specifies whether the object is at a location or not at a location at a specific time.

Latitude based on WGS-84 ellipsoid in signed degree-decimal format (e.g. -33.350000). Range is -90 to +90.

Longitude based on WGS-84 ellipsoid in signed degree-decimal format (e.g. 44.383333). Range -180 to +180.
Semi-minor ("s-minor") is measured in meters and follows the WGS-84 Ellipsoid standard.

Semi-major ("s-major") is measured in meters and follows the WGS-84 Ellipsoid standard.

Orientation is based on WGS-84 defined Earth-Centered Earth-Fixed (ECEF) orthogonal coordinate system.
The field is measured in degrees.

HAERange provides a 1-sigma error on a Gaussian distribution (in meters) associated with the HAE field. This field is intended to define a height range about a latitude/longitude point. This field, along with s-minor and s-major, allow for the definition of an elliptical volume about the latitude/longitude point.

HAE acronym for Height Above Ellipsoid based on WGS-84 ellipsoid (measured in meters).
<xsd:attributeGroup ref="MDADSCOI:LocationAttributeGroup">
  <xsd:annotation>
    <xsd:documentation>
      Specifies a set of attributes that apply to complexType Location
    </xsd:documentation>
  </xsd:annotation>
</xsd:attributeGroup>

<xsd:complexType name="LocationAttribute">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="isAtLocation"/>
    <xsd:enumeration value="isNotAtLocation"/>
    <xsd:enumeration value="locationAttributeGroup"/>
  </xsd:restriction>
</xsd:complexType>

<xsd:complexType name="Vector">
  <xsd:sequence>
    <xsd:element name="courseOverGround">
      <xsd:annotation>
        <xsd:documentation>
          Course Over Ground is measured in degrees relative to true north (0 \leq COG \leq 360). This field is required for every instance of vector.
        </xsd:documentation>
      </xsd:annotation>
      <xsd:simpleType>
        <xsd:restriction base="xsd:decimal">
          <xsd:fractionDigits value="1"/>
          <xsd:maxExclusive value="360"/>
          <xsd:minInclusive value="0"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:element>
    <xsd:element name="speedOverGround">
      <xsd:annotation>
        <xsd:documentation>
          Speed Over Ground is measured in nautical miles per hour. This field is required for every instance of vector.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
</xsd:complexType>
eCourseOverGround is a 1-sigma error on a Gaussian distribution associated with the CourseOverGround attribute. This field is optional.

eSpeedOverGround is a 1-sigma error on a Gaussian distribution associated with the speedOverGround attribute. This field is optional.
**Sensor.xsd**

```xml
<?xml version="1.0" encoding="UTF-8"?>
  targetNamespace="http://metadata.dod.mil/mdr/ns/MaritimeDomainAwareness">
  <xsd:complexType name="Signal">
    <xsd:sequence>
      <xsd:element name="SignalStrength" type="xsd:integer">
        <xsd:annotation>
          <xsd:documentation>
            SignalStrength provides a measurement for the transponder's transmission in decibels relative to 1mW (dBm). This field is mandatory if a Signal is instantiated.
          </xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="Sensor" abstract="true">
    <xsd:sequence>
      <xsd:element name="signal" type="MDADSCOI:Signal" minOccurs="0">
        <xsd:annotation>
          <xsd:documentation>
            Signal information pertaining to this sensor. This field is optional.
          </xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
</xsd:schema>
```

**Vessel.xsd**

```xml
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSpy v2007 sp2 (http://www.altova.com) by XMLSPY 2006 Enterprise Ed. Release 3, Installed for 5 users (with SMP from 2006-09-12 to 2007-09-13) (Assurance Technology Corp) -->
```
Estimated Time of Arrival specifies the time wherein the conveyance is or was expected to reach this port of call. The format of the field is in standard dateTime format (ISO 8601): YYYY-MM-DDThh:mm:ss.ssZ; e.g., 2002-10-05T17:01:14.00Z.

Actual Time of Arrival specifies the time wherein the conveyance actually reached this port of call. The format of the field is in standard dateTime format (ISO 8601): YYYY-MM-DDThh:mm:ss.ssZ; e.g., 2002-10-05T17:01:14.00Z.

Estimated Time of Departure specifies the time wherein the conveyance is or was expected to depart this port of call. The format of the field is in standard dateTime format (ISO 8601): YYYY-MM-DDThh:mm:ss.ssZ; e.g., 2002-10-05T17:01:14.00Z.
Actual Time of Departure specifies the time wherein the conveyance actually departed this port of call. The format of the field is in standard dateTime format (ISO 8601): YYYY-MM-DDThh:mm:ss.ssZ; e.g., 2002-10-05T17:01:14.00Z.

SCONUM is an abbreviation for Ship Control Number. It is represented by a string. This field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.
MMSI is an abbreviation for "Maritime Mobile Service Identity". It is a series of nine digits which are transmitted over the radio path in order to uniquely identify ship stations, ship earth stations, coast stations, coast earth stations, etc. The field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.

The IMO ship identification number is a permanent number assigned to each ship for identification purposes. This number remains unchanged upon transfer of the ship to other flags and is inserted in the ship’s certificates. The IMO number is a 7-digit number assigned to all ships by the Lloyd’s Register Fairplay when the vessel is constructed. The field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.
The Official United States Coast Guard Number assigned to this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.

```
<xs:element name="hullNumber" minOccurs="0" maxOccurs="unbounded">
  <xs:annotation>
    <xs:documentation>
      The hull identification number for this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.
    </xs:documentation>
  </xs:annotation>
  <xs:simpleType>
    <xs:extension base="xs:string">
      <xs:attributeGroup ref="MDADSCOI:AugmentationAttributes"/>
    </xs:extension>
  </xs:simpleType>
</xs:element>
```

The hull identification number for this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.

```
<xs:element name="uprightSequence" minOccurs="0" maxOccurs="unbounded">
  <xs:annotation>
    <xs:documentation>
      The coding of uprights (cranes, funnels, gantries, king posts, and masts) starting at the bow. The presence of these verticals is indicated by the letters C, for crane; F, for funnel; H, for gantry; K, for king post; and M, for mast as they are located on the ship, starting at the bow. For example, the upright sequence for a ship with a king post, followed by a king post in the forward well, a funnel amidships, and another king post in the after deck well is coded KKFK. This element
    </xs:documentation>
  </xs:annotation>
</xs:element>
```
is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.

The declared nationality of the vessel. This field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.

The ports of call for this vessel over some period of time. No meaning should be associated with the ordering of these ports. If order is important, the attribute sequenceID should be used (e.g. the first port would have sequenceID=1, the second port sequenceID=2, the third port sequence ID=3, and so on). Multiplicity has nothing to do with data augmentation.
<xsd:complexType>
  <xsd:complexContent>
    <xsd:extension base="MDADSCOI:PortOfCallType">
    <xsd:attribute name="sequenceID" type="xsd:positiveInteger">
      <xsd:documentation>
      An optional positive integer that specifies the sequence in which the ports were traversed. 1 implies the first port, 2 the second, 3 the third, and so on.
      </xsd:documentation>
    </xsd:attribute>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>

The home port of the vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.

The hailing port of the vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.
The port that is serving as the base of operations for this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.

The depth below water’s surface of the lowest part of the vessel. Values are specified in meters. The field is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.

The ship class name for this vessel (e.g. "SIR GALAHAD", or "BLUE RIDGE"). This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.
The type of ship to which this vessel belongs (e.g. Tug, Tanker, Fishing, etc). This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.

This attribute provides a mechanism to specify additional information about the type of vessel. For example, the shipTypeCode might specify that the vessel is a "Tanker" (i.e. "TKR") but if we wanted to provide additional specificity and declare that the vessel is a tanker for petroleum products, we could set this field to read something like "TANKER: PETROLEUM PRODUCTS". This attribute is optional. While, theoretically, this additional specificity could be included in the comment field of the augmentation attributes, it is advised that this field be used instead since the comment field may already be used to specify information pertinent to a data augmentation. If one were to use the comment field, ambiguity would result since the comment may provide information about an augmentation and/or it may also provide additional specificity about the ship type.
The number of stacks on this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.

The number of helicopter pads on this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.
<xsd:documentation>
The number of cranes on board this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.
</xsd:documentation>
</xsd:annotation>
<xsd:complexType>
<xsd:simpleContent>
<xsd:extension base="xsd:nonNegativeInteger">
<xsd:attributeGroup ref="MDADSCOI:AugmentationAttributes"/>
</xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
</xsd:element>
<xsd:element name="numberOfRamps" minOccurs="0" maxOccurs="unbounded">
<xsd:annotation>
<xsd:documentation>
The number of ramps possessed by this vessel. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.
</xsd:documentation>
</xsd:annotation>
<xsd:complexType>
<xsd:simpleContent>
<xsd:extension base="xsd:nonNegativeInteger">
<xsd:attributeGroup ref="MDADSCOI:AugmentationAttributes"/>
</xsd:extension>
</xsd:simpleContent>
</xsd:complexType>
</xsd:element>
<xsd:element name="maxRangeInNauticalMiles" minOccurs="0" maxOccurs="unbounded">
<xsd:annotation>
<xsd:documentation>
The estimated maximum range of the vessel in nautical miles. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.
</xsd:documentation>
</xsd:annotation>
</xsd:element>
<xsd:complexType>
  <xsd:simpleContent>
    <xsd:extension base="xsd:positiveInteger">
      <xsd:attributeGroup ref="MDADSCOI:AugmentationAttributes"/>
    </xsd:extension>
  </xsd:simpleContent>
</xsd:complexType>
</xsd:element>
<xsd:element name="cruiseRangeInNauticalMiles" minOccurs="0" maxOccurs="unbounded">
  <xsd:annotation>
    <xsd:documentation>The estimated range of the vessel when traveling at cruising speed. This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
</xsd:complexType>
</xsd:element>
<xsd:element name="maxSpeedInKnots" minOccurs="0" maxOccurs="unbounded">
  <xsd:annotation>
    <xsd:documentation>The estimated maximum attainable speed of the vessel measured in knots (nautical miles per hour). This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
</xsd:complexType>
The estimated cruising speed of the vessel measured in knots (nautical miles per hour). This element is optional. Multiple values should only be reported in the case of a data augmentation (i.e. different information sources are reporting different values). In which case, the value should be annotated via the name Augmentation Attributes.

A vessel can be associated with 0 or more sensors that transmit different types of information. This element is optional. Multiple values do not imply data augmentation.
<xsd:restriction base="xsd:integer">
  <xsd:maxInclusive value="999999999"/>
  <xsd:minInclusive value="000000000"/>
</xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="Draught">
  <xsd:restriction base="xsd:decimal">
    <xsd:fractionDigits value="1"/>
  </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="IMONumber">
  <xsd:restriction base="xsd:integer">
    <xsd:maxInclusive value="9999999"/>
    <xsd:minInclusive value="1"/>
  </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="ShipTypeEnumeration">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="BLK">
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