

Open Geospatial Consortium

Approval Date: 2012-01-11

Publication Date: 2012-05-15

External identifier of this OGC® document: <http://www.opengis.net/doc/ER/ows-8-mobile-object-processing>

Reference number of this document: OGC 11-108

Category: Public Engineering Report

Editor: Ingo Simonis

OWS-8 Analysis of OGC Standards for Supporting Mobile Object Processing Implementation (Engineering Report)

Copyright © 2012 Open Geospatial Consortium, Inc.

To obtain additional rights of use, visit <http://www.opengeospatial.org/legal/>.

Warning

This document is not an OGC Standard. This document is an OGC Public Engineering Report created as a deliverable in an OGC Interoperability Initiative and is not an official position of the OGC membership. This document is distributed for review and comment. It is subject to change without notice and may not be referred to as an OGC Standard. Further, any OGC Engineering Report should not be referenced as required or mandatory technology in procurements.

Document type:	OpenGIS® Public Engineering Report
Document subtype:	NA
Document stage:	Approved for public release
Document language:	English

License Agreement

Permission is hereby granted by the Open Geospatial Consortium, Inc. ("Licensor"), free of charge and subject to the terms set forth below, to any person obtaining a copy of this Intellectual Property and any associated documentation, to deal in the Intellectual Property without restriction (except as set forth below), including without limitation the rights to implement, use, copy, modify, merge, publish, distribute, and/or sublicense copies of the Intellectual Property, and to permit persons to whom the Intellectual Property is furnished to do so, provided that all copyright notices on the intellectual property are retained intact and that each person to whom the Intellectual Property is furnished agrees to the terms of this Agreement.

If you modify the Intellectual Property, all copies of the modified Intellectual Property must include, in addition to the above copyright notice, a notice that the Intellectual Property includes modifications that have not been approved or adopted by LICENSOR.

THIS LICENSE IS A COPYRIGHT LICENSE ONLY, AND DOES NOT CONVEY ANY RIGHTS UNDER ANY PATENTS THAT MAY BE IN FORCE ANYWHERE IN THE WORLD.

THE INTELLECTUAL PROPERTY IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NONINFRINGEMENT OF THIRD PARTY RIGHTS. THE COPYRIGHT HOLDER OR HOLDERS INCLUDED IN THIS NOTICE DO NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE INTELLECTUAL PROPERTY WILL MEET YOUR REQUIREMENTS OR THAT THE OPERATION OF THE INTELLECTUAL PROPERTY WILL BE UNINTERRUPTED OR ERROR FREE. ANY USE OF THE INTELLECTUAL PROPERTY SHALL BE MADE ENTIRELY AT THE USER'S OWN RISK. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR ANY CONTRIBUTOR OF INTELLECTUAL PROPERTY RIGHTS TO THE INTELLECTUAL PROPERTY BE LIABLE FOR ANY CLAIM, OR ANY DIRECT, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, OR ANY DAMAGES WHATSOEVER RESULTING FROM ANY ALLEGED INFRINGEMENT OR ANY LOSS OF USE, DATA OR PROFITS, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR UNDER ANY OTHER LEGAL THEORY, ARISING OUT OF OR IN CONNECTION WITH THE IMPLEMENTATION, USE, COMMERCIALIZATION OR PERFORMANCE OF THIS INTELLECTUAL PROPERTY.

This license is effective until terminated. You may terminate it at any time by destroying the Intellectual Property together with all copies in any form. The license will also terminate if you fail to comply with any term or condition of this Agreement. Except as provided in the following sentence, no such termination of this license shall require the termination of any third party end-user sublicense to the Intellectual Property which is in force as of the date of notice of such termination. In addition, should the Intellectual Property, or the operation of the Intellectual Property, infringe, or in LICENSOR's sole opinion be likely to infringe, any patent, copyright, trademark or other right of a third party, you agree that LICENSOR, in its sole discretion, may terminate this license without any compensation or liability to you, your licensees or any other party. You agree upon termination of any kind to destroy or cause to be destroyed the Intellectual Property together with all copies in any form, whether held by you or by any third party.

Except as contained in this notice, the name of LICENSOR or of any other holder of a copyright in all or part of the Intellectual Property shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Intellectual Property without prior written authorization of LICENSOR or such copyright holder. LICENSOR is and shall at all times be the sole entity that may authorize you or any third party to use certification marks, trademarks or other special designations to indicate compliance with any LICENSOR standards or specifications.

This Agreement is governed by the laws of the Commonwealth of Massachusetts. The application to this Agreement of the United Nations Convention on Contracts for the International Sale of Goods is hereby expressly excluded. In the event any provision of this Agreement shall be deemed unenforceable, void or invalid, such provision shall be modified so as to make it valid and enforceable, and as so modified the entire Agreement shall remain in full force and effect. No decision, action or inaction by LICENSOR shall be construed to be a waiver of any rights or remedies available to it.

None of the Intellectual Property or underlying information or technology may be downloaded or otherwise exported or reexported in violation of U.S. export laws and regulations. In addition, you are responsible for complying with any local laws in your jurisdiction which may impact your right to import, export or use the Intellectual Property, and you represent that you have complied with any regulations or registration procedures required by applicable law to make this license enforceable.

Preface

This document describes the usability of OGC services and encodings to implement the OWS-8 observation fusion and tracking thread in an abstract way. The real deployment and an actual perspective on the engineering and technology viewpoint can be found in OWS-8 engineering report OGC 11-134, ‘OWS-8 Tracking: Moving Target Indicator Process, Workflows and Implementation Results’. In addition, it describes an XML-Schema based implementation of the UML information models defined in OWS-8 engineering report “Information Model for Moving Target Indicators and Moving Object Bookmarks” (OGC 11-113).

The report is also based on the results of the VMTI/GMTI and STANAG 4676 realization in the OGC concept of operations study; performed as part of OWS 8 and the EC co-funded research project Emergency Support System - ESS” (contract number 217951).

Contents	Page
1 Introduction.....	1
1.1 Scope.....	1
1.2 Document contributor contact points.....	1
1.3 Revision history	1
1.4 Future work.....	1
1.5 Forward.....	2
2 Terms and definitions	2
2.1 Motion Imagery	2
3 Conventions	3
3.1 Abbreviated terms.....	3
3.2 UML notation.....	3
4 Management Summary	4
5 UAV Motion Imagery Data and Metadata.....	4
6 VMTI, GMTI and STANAG 4676 in the OGC Concept of Operations	6
7 VMTI, GMTI, and STANAG 4676 XML Schemas	8
8 Annex A XML Schema Documents	9
8.1 of_tracking_4676.xsd.....	9
8.2 4676.xsd.....	9
8.3 of_tracking_mti.xsd	31
8.4 4607_GMTI.xsd.....	31
8.5 vmti0903.2.xsd.....	49
8.6 bookmark.xsd.....	65

Figures	Page
Figure 1: Exemplary system architecture (NATO4609v3).....	5
Figure 2: VMTI, GMTI, and STANAG 4676 in the OGC concept of operations	6

OWS-8 Observation Fusion & Tracking

1 Introduction

1.1 Scope

This document analyzes the usability of OGC services and encodings to implement the information models defined in OWS-8 engineering report “Information Model for Moving Target Indicators and Moving Object Bookmarks” (OGC 11-113).

In addition, it describes the XML-Schemas derived from the UML information models. It complements the engineering report OGC 11-134 “OWS-8 Tracking: Moving Target Indicator Process, Workflows and Implementation Results ER”, which describes the concrete implementation performed in OWS-8.

1.2 Document contributor contact points

All questions regarding this document should be directed to the editor or the contributors:

Name	Organization
Ingo Simonis	iGSI GmbH

1.3 Revision history

Date	Release	Editor	Primary clauses modified	Description
September 28, 2011	1.0.0	Ingo Simonis	All	Initial version

1.4 Future work

As OWS-8 comes to end with the release of this document, no further updates can be expected. On the other hand, the topic itself requires further analysis in terms of serving

video and radar data at OGC interfaces. At the moment, there are no specialized interfaces available. Though this gap can potentially be bridged by WCS implementations to provide access to radar data, efficient access of video material is not covered by any OGC specification.

1.5 Forward

Attention is drawn to the possibility that some of the elements of this document may be subject of patent rights. The Open Geospatial Consortium Inc. shall not be held responsible for identifying any or all such patent rights.

Recipients of this document are requested to submit, with their comments, notification of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the standard set forth in this document, and to provide supporting documentation.

2 Terms and definitions

All terms and definitions are used according to corresponding NATO and MISB standards. For a list of standards, please consult the bibliography at the end of this document.

2.1 Motion Imagery

[Definition from [MISB2010] Motion Imagery is defined as imagery [a likeness or representation of any natural or man-made feature or related object or activity] utilizing sequential or continuous streams of images that enable observation of the dynamic, (temporal), behavior of objects within the scene. Motion Imagery temporal rates—nominally expressed in frames per second—must be sufficient to characterize the desired dynamic phenomena. Motion Imagery is defined as including metadata and nominally beginning at frame rates of 1 Hz (1 frame per second) or higher within a common field of regard. Full Motion Video (FMV) falls within the context of these standards. Within motion imagery, the following domains are currently specified:

- ☐ Electro Optical (including video and television)
- ☐ Infrared (including low-light television)
- ☐ LVSD – Large Volume Streaming Data
- ☐ Multispectral (MSI) / Hyperspectral (HSI)

3 Conventions

3.1 Abbreviated terms

ConOps	Concept of Operations
FoI	Feature of Interest
FOV	Field of View
GMTI	Ground Moving Target Indicator
HFOV	Horizontal Field of View
HIS	Hyperspectral
KLK	Key-Length-Value
LDS	Local Data Set
MI	Motion Imagery
MISB	Motion Imagery Standards Board
MPEG	Moving Picture Experts Group
MSI	Multispectral
NATO	North Atlantic Treaty Organization
SMPTE	Society of Motion Picture Television Engineers
UAS	Unmanned Air System
UML	Unified Modeling Language
VFOV	Vertical Field of View
VMTI	Video Moving Target Indicator
VSS	VMTI Source Sensor
WAPS	Wide Area Persistent Surveillance

3.2 UML notation

This report does not make use of UML. Though, it describes an implementation of the UML information models defined in OWS-8 Engineering Report “Information Model for Moving Target Indicators and Moving Object Bookmarks” (OGC 11-113).

4 Management Summary

OGC services and encodings, extended by the XML-Schema-based implementation described in this report, allow access to target information data and tracking data based on VMTI, GMTI, and STANAG 4676 information. All tracking information can be exchanged between services implementing WFS or SOS specifications. The encodings themselves can get implemented as GML application profiles (further based on Observation & Measurement version 2 and the SWE Common Data Model). All serialization has been performed successfully and compliant to the GML 3.2 encoding rules. Thus, using the schemas bundled to this report, a VMTI, GMTI, STANAG 4676 and Bookmarking infrastructure can get set up.

All tracking information can be provided at WFS and SOS interfaces and accessed by any WFS or SOS client or service. All information gets preserved.

Gaps have been identified regarding the access to the original data, sometimes called “evidence data”. As these data origin from either motion imagery capturing devices or radar devices, dedicated access interfaces would be required that acknowledge the key characteristics of this data. It gets delivered as streams or individual dwell sets – but is not necessarily available for all track data. In particular the motion imagery data requires proper interfaces that allow accessing individual frames as well as video snippets, whereas WCS services might support radar data sufficiently once extended with specialized coverage offerings and corresponding encodings.

5 UAV Motion Imagery Data and Metadata

In order to be used in further validation studies, this OWS-8 reports assumes proper synchronization between metadata timestamps and MI timestamps. It further assumes that UAV LDS is provided together with MI data. Otherwise no evidence data could be provided. The following excerpt from NATO 4609v3 illustrates this concept.

“Any combination of metadata items can be included in a UAS Local Data Set packet. Also the items within the UAV LDS can be arranged in any order. However, the timestamp is always positioned at the beginning of an LDS packet, and similarly the checksum always appears as the last metadata item to support algorithms surrounding its computation and creation.

The typical data collection and dissemination process is illustrated in the figure below.

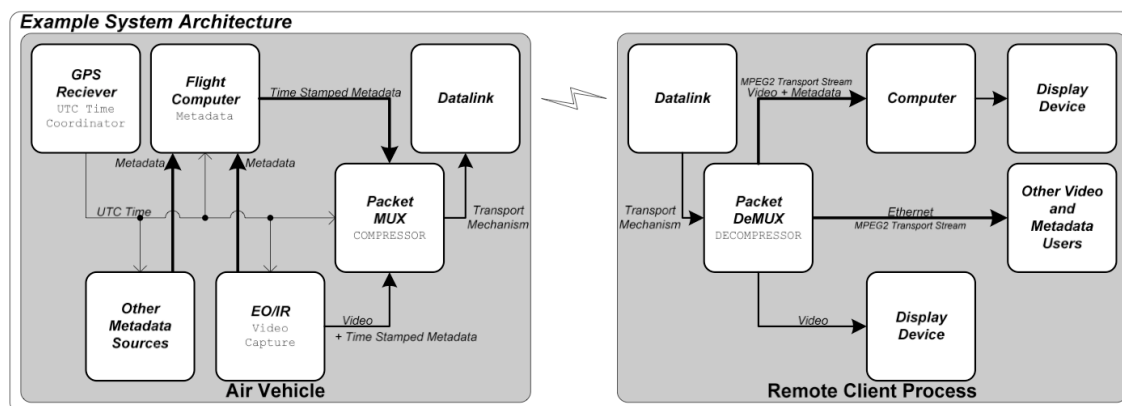


Figure 1: Exemplary system architecture (NATO4609v3)

Sensors and other metadata sources pass metadata to the flight computer. The flight computer (or equivalent) places a timestamp into the UAS LDS packet prior to the Video Encoder / Packet Multiplexer. The flight computer merges all metadata items, the timestamp, and the checksum into a LDS packet, which is then sent to the video encoder and Packet Multiplexer. The Packet Multiplexer merges the encoded video with the LDS metadata packet onto a transport mechanism for communication over a link to a remote client process. Subsequently, the client demultiplexes the encoded video and metadata after removal from the transport mechanism, decodes the video and processes the metadata. The motion imagery and metadata can then be displayed and distributed as appropriate.” (NATO4609v3).

Further information on time definition and synchronization can be found in clause 5.4 of (MISB0601.4).

In summary, the architecture described further below depends on availability and proper synchronization of raw data. If no or unsynchronized raw data is provided, no evidence tracing will be possible. Nevertheless, the processing of VMTI and GMTI data still allows building tracks, just without the opportunity to double check any raw material.

6 VMTI, GMTI and STANAG 4676 in the OGC Concept of Operations

The OGC Web services interfaces SOS-T and WFS-T can get used to serve VMTI, GMTI, and STANAG 4676 feature data as illustrated in the figure below.

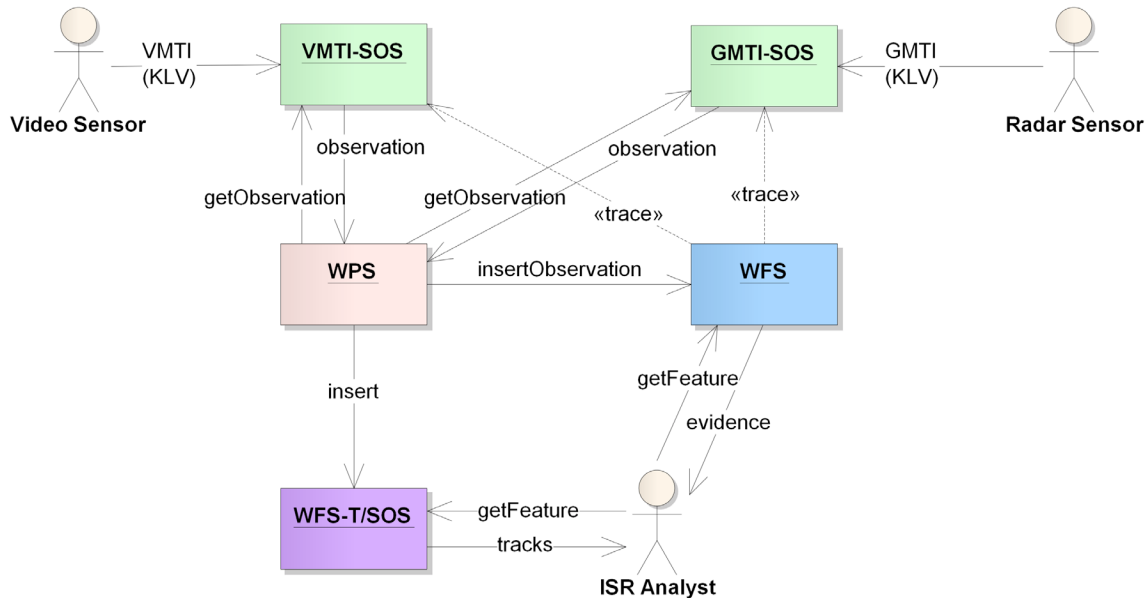


Figure 2: VMTI, GMTI, and STANAG 4676 in the OGC concept of operations

The video capturing and processing systems provide naked or embedded VMTI data to the VMTI-SOS. This import does not use any of the transactional interfaces of SOS-T, but uses proprietary channels instead, because the VMTI data is delivered in its native format and transported as either a continuous data stream or as individual files (both, the VMTI-SOS as well as the GMTI-SOS could be replaced by WFS, as the transactional interface is not used in both cases). In any case, incoming data is not compliant to the OGC feature model.

In a first step, the service stores all incoming data locally. The level of processing to re-organize and to structure the data depends on the incoming data itself. In terms of VMTI, it depends on the transport mode. Naked VMTI has to be processed differently from embedded VMTI data. In the first case, the data is already enriched with localization information, whereas in the latter, some data is given relative to the base values of the embedding stream. The details of the different approaches are described in full detail in OGC 11-113.

In terms of GMTI, it depends on the data itself. GMTI does not transport the original radar data in the format itself and is delivered in no “predefined order or sequence other than the requirement to preface data segments with appropriate header segments” (STANAG 4607). Therefore, it is the responsibility of the service to convert this data according to the exploitation classes ‘situation awareness’, ‘targeting and tracking’, and ‘targeting and tracking high resolution’, as defined in OGC 11-113 on the basis of the STANAG 4607 implementation guide. The three classes contain:

- Situation Awareness (SA): The minimum data required for Moving Target Indicator (MTI) target display.
- Targeting and Tracking (TT): The minimum data required for targeting and tracking of MTI targets using current or advanced automatic tracking algorithms or precision location systems such as the Global Positioning System (GPS).
- Targeting and Tracking with High Range Resolution (HT): The minimum data required for targeting and tracking of MTI targets using current or advanced automatic tracking algorithms or precision location systems and High Range Resolution/Range-Doppler (HRR/R-D) analysis of associated MTI targets

Instance of all three exploitation classes are made available in the form of OGC features and can get served at WFS and SOS interfaces.

Using the mechanisms described above, all VMTI and GMTI data can get made available according to the OGC feature model. Served at SOS or WFS, the data gets integrated into the OGC services-based infrastructure. Other services or client applications working on OGC interfaces, such as WPS, can access the data now. As illustrated in the figure above, any WPS can access VMTI and GMTI data to run tracking algorithms on top of the data. The resulting tracking data can get served as STANAG 4676 compliant data. In order to remain in OGC services based infrastructures, the data can get sent to other transactional OGC services if encoded according to the OGC feature model. For this reason, an OGC implementation of STANAG 4676 has been produced and documented in OGC11-113. All resulting tracking information is encoded as specializations of om:observations. Therefore, it can get inserted into a WFS or SOS either way. Clients can access this information and use the tracking data for further analysis and decision-making. If required and if available, raw data can get accessed if the WPS inserted bookmarks into a feature server (WFS).

The bookmarking model – as it stands – represents only a first and currently insufficient approach. Only first tests have been performed to generate bookmarks and to store those bookmarks at a WFS service. It became obvious that further research is required in order to establish an efficient and secure bookmarking model. In addition, efficient access to raw data would involve specialized service interfaces for video material. More discussion on access and filter capabilities of such a specialized service interface is definitely required, e.g. on delivery formats to decide if individual frames or full video sequences

shall serve as appropriate evidence formats. This work item shall get addressed in future OGC testbed activities.

In OGC11-113, we developed an UML information model that maps VMTI, GMTI, and 4676 data to the OGC concept of operations. Here, we mapped the model to XML Schemas implemented as GML application profiles (based on Observation & Measurement v2.0). The XML Schemas are described further below.

7 VMTI, GMTI, and STANAG 4676 XML Schemas

All UML information models developed and documented in OGC 11-113 have been serialized in XML Schema using the encoding rules defined in annex ‘E’ of the ‘OpenGIS® Geography Markup Language (GML) Encoding Standard’ (OGC 07-036).

“These encoding rules are compliant with the rules for GML application schemas and are based on ISO 19118.

The rules are derived from the rules for the GML model and syntax as described in Clauses 7 to 21, especially Clause 7. The encoding rules of ISO 19118:2005, Annex A, are used whenever possible and feasible.

The rules listed in this annex aim at an automatic mapping from an ISO 19109 and ISO/TS 19103 conformant UML application schema to a GML application schema (in accordance with the rules defined in Clause 21). As a result of this automation, the resulting GML application schema will not make full use of the capabilities of XML and XML Schema, but will provide an XML implementation conformant to the ISO 19100 series of International Standards with a well-defined, predictable XML grammar. [...]

The schema encoding rules are based on the general idea that the class definitions in the application schema are mapped to type and element declarations in XML Schema, so that the objects in the instance model can be mapped to corresponding element structures in the XML document.” (OGC07-036).

The XML documents are listed below and part of the OWS-8 engineering report submission package to simplify the usage of the schemas. Please be aware that the schemas use a number of imports, as other schemas are used to model base types and dependencies.

Six schemas have been produced in total with the following content:

- ☐ of_tracking_4676.xsd: loader for 4676.xsd
- ☐ of_tracking_mti.xsd: loader for all VMTI, GMTI, and bookmark models
- ☐ 4676.xsd: XML Schema of STANAG 4676

- 4607_GMTI.xsd: XML Schema of GMTI information model as defined in OGC 11-113
- vmti0903.2.xsd: XML Schema of VMTI information model as defined in OGC 11-113
- bookmark.xsd: XML Schema of Bookmark information model as defined in OGC 11-113

8 Annex A

XML Schema Documents

In addition to this document, this report includes several XML Schema Documents. These XML Schema Documents are bundled in a zip file with the present document.

8.1 of_tracking_4676.xsd

```
<?xml version="1.0" encoding="UTF-8"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:owl="http://www.opengis.net/ows8/of/tracking/4676"
  targetNamespace="http://www.opengis.net/ows8/of/tracking/4676"
  elementFormDefault="qualified" attributeFormDefault="unqualified">
  <include schemaLocation="4676.xsd"/>
</schema>
```

8.2 4676.xsd

```
<?xml version="1.0" encoding="UTF-8"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:om="http://www.opengis.net/om/2.0"
  xmlns:owl="http://www.opengis.net/ows8/of/tracking/4676"
  targetNamespace="http://www.opengis.net/ows8/of/tracking/4676"
  elementFormDefault="qualified" attributeFormDefault="unqualified">
  <import namespace="http://www.opengis.net/gml/3.2"
    schemaLocation="http://schemas.opengis.net/gml/3.2.1/gml.xsd"/>
  <import namespace="http://www.opengis.net/om/2.0"
    schemaLocation="http://schemas.opengis.net/om/2.0/observation.xsd"/>
  <!-- ===== -->
  <element name="SurveillanceArea" type="owl:SurveillanceAreaType"
```

```

substitutionGroup="gml:AbstractFeature">
  <annotation>
    <documentation>Area of interest for 4676 tracking data</documentation>
  </annotation>
</element>
<complexType name="SurveillanceAreaType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="name" type="string"/>
        <element name="area" type="gml:GeometryPropertyType"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="SurveillanceAreaPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:SurveillanceArea"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="TrackInformation" type="owl:TrackInformationType"
substitutionGroup="owl:TrackItem"/>
<complexType name="TrackInformationType">
  <complexContent>
    <extension base="owl:TrackItemType"/>
  </complexContent>
</complexType>
<complexType name="TrackInformationPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:TrackInformation"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="ESMInformation" type="owl:ESMInformationType"
substitutionGroup="owl:TrackInformation"/>
<complexType name="ESMInformationType">
  <complexContent>
    <extension base="owl:TrackInformationType">
      <sequence>
        <element name="agility" type="boolean" minOccurs="0"/>
        <element name="spectrum" type="owl:FrequencyPropertyType"
minOccurs="0"/>
        <element name="staggered" type="boolean" minOccurs="0"/>

```

```

    <element name="pulseRepetitionFreq" type="owl:FrequencyPropertyType"
minOccurs="0"/>
    <element name="modulation" type="string" minOccurs="0"/>
    <element name="pulseWidth" type="double" minOccurs="0"/>
    <element name="power" type="double" minOccurs="0"/>
  </sequence>
</extension>
</complexContent>
</complexType>
<complexType name="ESMInformationPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:ESMInformation"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="TrackMessage" type="owl:TrackMessageType"
substitutionGroup="gml:AbstractFeature"/>
<complexType name="TrackMessageType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="stanagVersion" type="string"/>
        <element name="messageSecurity" type="owl:SecurityPropertyType"/>
        <element name="messageCreatedTime" type="gml:TimeInstantPropertyType"/>
        <element name="senderID" type="owl:IdDataPropertyType"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="TrackMessagePropertyType">
  <sequence minOccurs="0">
    <element ref="owl:TrackMessage"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="TrackLineageInformation"
type="owl:TrackLineageInformationType"
substitutionGroup="owl:TrackInformation"/>
<complexType name="TrackLineageInformationType">
  <complexContent>
    <extension base="owl:TrackInformationType">
      <sequence>
        <element name="relation" maxOccurs="unbounded">
          <complexType>

```

```

        <sequence>
          <element ref="owl:LineageRelation"/>
        </sequence>
      </complexType>
    </element>
  </sequence>
</extension>
</complexContent>
</complexType>
<complexType name="TrackLineageInformationPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:TrackLineageInformation"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="VideoInformation" type="owl:VideoInformationType"
substitutionGroup="owl:TrackInformation"/>
<complexType name="VideoInformationType">
  <complexContent>
    <extension base="owl:TrackInformationType">
      <sequence>
        <element name="band" type="owl:SymbolicSpectralRangeType"
minOccurs="0"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="VideoInformationPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:VideoInformation"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="TrackingObservation" type="owl:TrackingObservationType"
substitutionGroup="om:OM_Observation"/>
<complexType name="TrackingObservationType">
  <complexContent>
    <extension base="om:OM_ObservationType"/>
  </complexContent>
</complexType>
<complexType name="TrackingObservationPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:TrackingObservation"/>
  </sequence>

```

```

    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
<!-- ===== -->
  <element name="TrackPoint" type="ow1:TrackPointType"
substitutionGroup="ow1:TrackItem"/>
  <complexType name="TrackPointType">
    <complexContent>
      <extension base="ow1:TrackItemType">
        <sequence>
          <element name="displayPosition" type="ow1:GeodeticPositionPropertyType"/>
          <element name="type" type="ow1:TrackPointTypeType" minOccurs="0"/>
          <element name="detail" minOccurs="0">
            <complexType>
              <sequence>
                <element ref="ow1:TrackPointDetails"/>
              </sequence>
            </complexType>
          </element>
          <element name="source" type="ow1:TrackPointSourceType" minOccurs="0"/>
          <element name="objectMask" type="gml:SurfacePropertyType" minOccurs="0"/>
          <element name="status" type="ow1:TrackPointStatusType" minOccurs="0"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="TrackPointPropertyType">
    <sequence minOccurs="0">
      <element ref="ow1:TrackPoint"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
<!-- ===== -->
  <element name="TrackingResult" type="ow1:TrackingResultType"
substitutionGroup="gml:AbstractFeature"/>
  <complexType name="TrackingResultType">
    <complexContent>
      <extension base="gml:AbstractFeatureType">
        <sequence>
          <element name="segments" type="ow1:TrackSegmentPropertyType"
maxOccurs="unbounded"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="TrackingResultPropertyType">
    <sequence minOccurs="0">

```

```

    <element ref="ow1:TrackingResult"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
  <element name="TrackClassificationInformation"
type="ow1:TrackClassificationInformationType"
substitutionGroup="ow1:TrackInformation"/>
  <complexType name="TrackClassificationInformationType">
    <complexContent>
      <extension base="ow1:TrackInformationType">
        <sequence>
          <element name="classification" type="ow1:ClassificationType" minOccurs="0"/>
          <element name="classificationSource" type="ow1:ClassificationSourceType"
minOccurs="0"/>
          <element name="classificationCredibility" type="ow1:ConfidencePropertyType"
minOccurs="0"/>
          <element name="strength" type="integer" minOccurs="0"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="TrackClassificationInformationPropertyType">
    <sequence minOccurs="0">
      <element ref="ow1:TrackClassificationInformation"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
<!-- ===== -->
  <element name="TrackSegment" type="ow1:TrackSegmentType"
substitutionGroup="gml:AbstractFeature">
    <annotation>
      <documentation>Aggregation of any number of track points. Comes optionally with
track information.</documentation>
    </annotation>
  </element>
  <complexType name="TrackSegmentType">
    <complexContent>
      <extension base="gml:AbstractFeatureType">
        <sequence>
          <element name="information" type="ow1:TrackInformationPropertyType"
minOccurs="0"/>
          <element name="points" type="ow1:TrackPointPropertyType"
maxOccurs="unbounded"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>

```

```

    </complexContent>
  </complexType>
  <complexType name="TrackSegmentPropertyType">
    <sequence minOccurs="0">
      <element ref="owl:TrackSegment"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="TrackingProcess" type="owl:TrackingProcessType"
substitutionGroup="gml:AbstractFeature"/>
  <complexType name="TrackingProcessType">
    <complexContent>
      <extension base="gml:AbstractFeatureType"/>
    </complexContent>
  </complexType>
  <complexType name="TrackingProcessPropertyType">
    <sequence minOccurs="0">
      <element ref="owl:TrackingProcess"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="TrackManagementInformation"
type="owl:TrackManagementInformationType"
substitutionGroup="owl:TrackInformation"/>
  <complexType name="TrackManagementInformationType">
    <complexContent>
      <extension base="owl:TrackInformationType">
        <sequence>
          <element name="trackerType" type="owl:TrackerTypeType" minOccurs="0"/>
          <element name="trackProductionArea" type="owl:AreaPropertyType"
minOccurs="0"/>
          <element name="environment" type="owl:TrackEnvironmentType"
minOccurs="0"/>
          <element name="quality" type="integer" minOccurs="0"/>
          <element name="alertIndicator" type="boolean" minOccurs="0"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="TrackManagementInformationPropertyType">
    <sequence minOccurs="0">
      <element ref="owl:TrackManagementInformation"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>

```

```

</complexType>
<!-- ===== -->
<element name="AreaObservation" type="owl:AreaObservationType"
substitutionGroup="om:OM_Observation"/>
<complexType name="AreaObservationType">
  <complexContent>
    <extension base="om:OM_ObservationType"/>
  </complexContent>
</complexType>
<complexType name="AreaObservationPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:AreaObservation"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="TrackItem" type="owl:TrackItemType"
substitutionGroup="gml:AbstractFeature"/>
<complexType name="TrackItemType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="itemUUID" type="string"/>
        <element name="itemSecurity" type="owl:SecurityPropertyType"/>
        <element name="itemTime" type="gml:TimeInstantPropertyType"/>
        <element name="itemSource" type="string" minOccurs="0"/>
        <element name="itemComment" type="string" minOccurs="0"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="TrackItemPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:TrackItem"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Track" type="owl:TrackType"
substitutionGroup="gml:AbstractFeature"/>
<complexType name="TrackType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="trackUUID" type="string"/>
        <element name="trackNumber" type="string"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>

```

```

    <element name="exerciseIndicator" type="ow1:ExerciseIndicatorType"/>
    <element name="simulationIndicator" type="ow1:SimulationIndicatorType"/>
    <element name="trackSecurity" type="ow1:SecurityPropertyType"/>
    <element name="trackComment" type="string"/>
    <element name="message" type="ow1:TrackMessagePropertyType"/>
  </sequence>
</extension>
</complexContent>
</complexType>
<complexType name="TrackPropertyType">
  <sequence minOccurs="0">
    <element ref="ow1:Track"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="TrackIdentityInformation" type="ow1:TrackIdentityInformationType"
substitutionGroup="ow1:TrackInformation"/>
<complexType name="TrackIdentityInformationType">
  <complexContent>
    <extension base="ow1:TrackInformationType">
      <sequence>
        <element name="identity" type="ow1:IdentityType" minOccurs="0"/>
        <element name="identityAmplification" type="ow1:IdentityAmplificationType"
minOccurs="0"/>
        <element name="identificationSource" type="ow1:IdentitySourceType"
minOccurs="0"/>
        <element name="identityCredibility" type="ow1:ConfidencePropertyType"
minOccurs="0"/>
        <element name="iifCode" type="ow1:IFFcodePropertyType" minOccurs="0"/>
        <element name="unitName" type="string" minOccurs="0"/>
        <element name="unitSymbol" type="string" minOccurs="0"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="TrackIdentityInformationPropertyType">
  <sequence minOccurs="0">
    <element ref="ow1:TrackIdentityInformation"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="GeodeticPosition" type="ow1:GeodeticPositionType"
substitutionGroup="ow1:Position"/>
<complexType name="GeodeticPositionType">

```

```

<complexContent>
  <extension base="ow1:PositionType">
    <sequence>
      <element name="latitude" type="double"/>
      <element name="longitude" type="double"/>
      <element name="altitude" type="double" minOccurs="0"/>
    </sequence>
  </extension>
</complexContent>
</complexType>
<complexType name="GeodeticPositionPropertyType">
  <sequence minOccurs="0">
    <element ref="ow1:GeodeticPosition"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="PolarVelocity" type="ow1:PolarVelocityType"
substitutionGroup="ow1:Velocity"/>
<complexType name="PolarVelocityType">
  <complexContent>
    <extension base="ow1:VelocityType">
      <sequence>
        <element name="speed" type="double"/>
        <element name="course" type="double"/>
        <element name="elevationAngle" type="double" minOccurs="0"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="PolarVelocityPropertyType">
  <sequence minOccurs="0">
    <element ref="ow1:PolarVelocity"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Security" type="ow1:SecurityType"
substitutionGroup="gml:AbstractGML"/>
<complexType name="SecurityType">
  <complexContent>
    <extension base="gml:AbstractGMLType">
      <sequence>
        <element name="securityClassification" type="string"/>
        <element name="securityPolicyName" type="string"/>
        <element name="securityCategory" type="string"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>

```

```

    </sequence>
  </extension>
</complexContent>
</complexType>
<complexType name="SecurityPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:Security"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Confidence" type="owl:ConfidenceType"
substitutionGroup="gml:AbstractGML"/>
<complexType name="ConfidenceType">
  <complexContent>
    <extension base="gml:AbstractGMLType">
      <sequence>
        <element name="valueUncertainty" type="integer"/>
        <element name="sourceUncertainty" type="integer"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="ConfidencePropertyType">
  <sequence minOccurs="0">
    <element ref="owl:Confidence"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Area" type="owl:AreaType"
substitutionGroup="gml:AbstractGML"/>
<complexType name="AreaType">
  <complexContent>
    <extension base="gml:AbstractGMLType"/>
  </complexContent>
</complexType>
<complexType name="AreaPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:Area"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="CircularArea" type="owl:CircularAreaType"
substitutionGroup="owl:Area"/>

```

```

<complexType name="CircularAreaType">
  <complexContent>
    <extension base="owl:AreaType">
      <sequence>
        <element name="centre" type="owl:PositionPropertyType"/>
        <element name="radius" type="double"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="CircularAreaPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:CircularArea"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="IdData" type="owl:IdDataType"
substitutionGroup="gml:AbstractGML"/>
<complexType name="IdDataType">
  <complexContent>
    <extension base="gml:AbstractGMLType">
      <sequence>
        <element name="stationID" type="string"/>
        <element name="nationality" type="string"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="IdDataPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:IdData"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Position" type="owl:PositionType"
substitutionGroup="gml:AbstractGML"/>
<complexType name="PositionType">
  <complexContent>
    <extension base="gml:AbstractGMLType"/>
  </complexContent>
</complexType>
<complexType name="PositionPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:Position"/>
  </sequence>

```

```

    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="LocalCoordinateSystem" type="owl:LocalCoordinateSystemType"
substitutionGroup="gml:AbstractGML"/>
  <complexType name="LocalCoordinateSystemType">
    <complexContent>
      <extension base="gml:AbstractGMLType">
        <sequence>
          <element name="origin" type="owl:PositionPropertyType"/>
          <element name="roll" type="double"/>
          <element name="pitch" type="double"/>
          <element name="yaw" type="double"/>
          <element name="covRPY" type="owl:CovarianceMatrixPositionPropertyType"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="LocalCoordinateSystemPropertyType">
    <sequence minOccurs="0">
      <element ref="owl:LocalCoordinateSystem"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="CovarianceMatrix" type="owl:CovarianceMatrixType"
substitutionGroup="gml:AbstractGML"/>
  <complexType name="CovarianceMatrixType">
    <complexContent>
      <extension base="gml:AbstractGMLType">
      </complexContent>
    </complexType>
  <complexType name="CovarianceMatrixPropertyType">
    <sequence minOccurs="0">
      <element ref="owl:CovarianceMatrix"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="PolarAcceleration" type="owl:PolarAccelerationType"
substitutionGroup="owl:Acceleration"/>
  <complexType name="PolarAccelerationType">
    <complexContent>
      <extension base="owl:AccelerationType">
        <sequence>

```

```

        <element name="azimuth" type="double"/>
        <element name="elevation" type="double"/>
        <element name="range" type="double"/>
    </sequence>
</extension>
</complexContent>
</complexType>
<complexType name="PolarAccelerationPropertyType">
    <sequence minOccurs="0">
        <element ref="owl:PolarAcceleration"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="CartesianVelocity" type="owl:CartesianVelocityType"
substitutionGroup="owl:Velocity"/>
<complexType name="CartesianVelocityType">
    <complexContent>
        <extension base="owl:VelocityType">
            <sequence>
                <element name="velx" type="double"/>
                <element name="vely" type="double"/>
                <element name="velz" type="double"/>
            </sequence>
        </extension>
    </complexContent>
</complexType>
<complexType name="CartesianVelocityPropertyType">
    <sequence minOccurs="0">
        <element ref="owl:CartesianVelocity"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="LocalPolarPosition" type="owl:LocalPolarPositionType"
substitutionGroup="owl:Position"/>
<complexType name="LocalPolarPositionType">
    <complexContent>
        <extension base="owl:PositionType">
            <sequence>
                <element name="azimuth" type="double"/>
                <element name="elevation" type="double"/>
                <element name="range" type="double"/>
                <element name="localSystem"
type="owl:LocalCoordinateSystemPropertyType"/>
            </sequence>
        </extension>
    </complexContent>
</complexType>

```

```

    </extension>
  </complexContent>
</complexType>
<complexType name="LocalPolarPositionPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:LocalPolarPosition"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="PolygonArea" type="owl:PolygonAreaType"
substitutionGroup="owl:Area"/>
<complexType name="PolygonAreaType">
  <complexContent>
    <extension base="owl:AreaType">
      <sequence>
        <element name="areaBoundaryPoints" type="owl:PositionPropertyType"
minOccurs="3" maxOccurs="unbounded"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="PolygonAreaPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:PolygonArea"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Acceleration" type="owl:AccelerationType"
substitutionGroup="gml:AbstractGML"/>
<complexType name="AccelerationType">
  <complexContent>
    <extension base="gml:AbstractGMLType"/>
  </complexContent>
</complexType>
<complexType name="AccelerationPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:Acceleration"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Frequency" type="owl:FrequencyType"
substitutionGroup="gml:AbstractGML"/>
<complexType name="FrequencyType">

```

```

<complexContent>
  <extension base="gml:AbstractGMLType">
    <sequence>
      <element name="frequencyUnit" type="owl:FrequencyUnitTypeType"/>
      <element name="frequency" type="double"/>
      <element name="bandwidth" type="double"/>
    </sequence>
  </extension>
</complexContent>
</complexType>
<complexType name="FrequencyPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:Frequency"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="CartesianAcceleration" type="owl:CartesianAccelerationType"
substitutionGroup="owl:Acceleration"/>
<complexType name="CartesianAccelerationType">
  <complexContent>
    <extension base="owl:AccelerationType">
      <sequence>
        <element name="accx" type="double"/>
        <element name="accy" type="double"/>
        <element name="accz" type="double"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="CartesianAccelerationPropertyType">
  <sequence minOccurs="0">
    <element ref="owl:CartesianAcceleration"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="LocalCartesianPosition" type="owl:LocalCartesianPositionType"
substitutionGroup="owl:Position"/>
<complexType name="LocalCartesianPositionType">
  <complexContent>
    <extension base="owl:PositionType">
      <sequence>
        <element name="x" type="double"/>
        <element name="y" type="double"/>
        <element name="z" type="double"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>

```

```

    <element name="localSystem"
type="ow1:LocalCoordinateSystemPropertyType"/>
  </sequence>
</extension>
</complexContent>
</complexType>
<complexType name="LocalCartesianPositionPropertyType">
  <sequence minOccurs="0">
    <element ref="ow1:LocalCartesianPosition"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="CovarianceMatrixPosition"
type="ow1:CovarianceMatrixPositionType"
substitutionGroup="ow1:CovarianceMatrix"/>
<complexType name="CovarianceMatrixPositionType">
  <complexContent>
    <extension base="ow1:CovarianceMatrixType">
      <sequence>
        <element name="sigmaPosx" type="double"/>
        <element name="sigmaPosy" type="double"/>
        <element name="sigmaPosz" type="double" minOccurs="0"/>
        <element name="rhoPosxPosy" type="double" minOccurs="0"/>
        <element name="rhoPosxPosz" type="double" minOccurs="0"/>
        <element name="rhoPosyPosz" type="double" minOccurs="0"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="CovarianceMatrixPositionPropertyType">
  <sequence minOccurs="0">
    <element ref="ow1:CovarianceMatrixPosition"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Velocity" type="ow1:VelocityType"
substitutionGroup="gml:AbstractGML"/>
<complexType name="VelocityType">
  <complexContent>
    <extension base="gml:AbstractGMLType"/>
  </complexContent>
</complexType>
<complexType name="VelocityPropertyType">
  <sequence minOccurs="0">

```

```

    <element ref="ow1:Velocity"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="IFFcode" type="ow1:IFFcodeType"
substitutionGroup="gml:AbstractGML"/>
<complexType name="IFFcodeType">
  <complexContent>
    <extension base="gml:AbstractGMLType">
      <sequence>
        <element name="mode" type="ow1:IffModeType"/>
        <element name="value" type="string"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="IFFcodePropertyType">
  <sequence minOccurs="0">
    <element ref="ow1:IFFcode"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="CovarianceMatrixPositionVelocity"
type="ow1:CovarianceMatrixPositionVelocityType"
substitutionGroup="ow1:CovarianceMatrixPosition"/>
<complexType name="CovarianceMatrixPositionVelocityType">
  <complexContent>
    <extension base="ow1:CovarianceMatrixPositionType">
      <sequence>
        <element name="sigmaVelx" type="double"/>
        <element name="sigmaVely" type="double"/>
        <element name="sigmaVelz" type="double" minOccurs="0"/>
        <element name="rhoPosxVelx" type="double" minOccurs="0"/>
        <element name="rhoPosxVely" type="double" minOccurs="0"/>
        <element name="rhoPosxVelz" type="double" minOccurs="0"/>
        <element name="rhoPosyVelx" type="double" minOccurs="0"/>
        <element name="rhoPosyVely" type="double" minOccurs="0"/>
        <element name="rhoPosyVelz" type="double" minOccurs="0"/>
        <element name="rhoPoszVelx" type="double" minOccurs="0"/>
        <element name="rhoPoszVely" type="double" minOccurs="0"/>
        <element name="rhoPoszVelz" type="double" minOccurs="0"/>
        <element name="rhoVelxVely" type="double" minOccurs="0"/>
        <element name="rhoVelxVelz" type="double" minOccurs="0"/>
        <element name="rhoVelyVelz" type="double" minOccurs="0"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>

```

```

        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="CovarianceMatrixPositionVelocityPropertyType">
    <sequence minOccurs="0">
      <element ref="ow1:CovarianceMatrixPositionVelocity"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="TrackPointDetails" type="ow1:TrackPointDetailsType"/>
  <complexType name="TrackPointDetailsType">
    <sequence>
      <element name="position" type="ow1:PositionPropertyType"/>
      <element name="velocity" type="ow1:VelocityPropertyType" minOccurs="0"/>
      <element name="acceleration" type="ow1:AccelerationPropertyType"
minOccurs="0"/>
      <element name="covarianceMatrix" type="ow1:CovarianceMatrixPropertyType"/>
    </sequence>
  </complexType>
  <complexType name="TrackPointDetailsPropertyType">
    <sequence minOccurs="0">
      <element ref="ow1:TrackPointDetails"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="LineageRelation" type="ow1:LineageRelationType"/>
  <complexType name="LineageRelationType">
    <sequence>
      <element name="relatedTrackNumber" type="string"/>
      <element name="relatedTrackUUID" type="string"/>
      <element name="relation" type="ow1:LineageRelationTypeType"/>
    </sequence>
  </complexType>
  <complexType name="LineageRelationPropertyType">
    <sequence minOccurs="0">
      <element ref="ow1:LineageRelation"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <simpleType name="TrackerTypeType">
    <restriction base="string">
      <enumeration value="AUTOMATIC_TRACKER"/>
    </restriction>
  </simpleType>

```

```

    <enumeration value="SEMIAUTOMATIC_TRACKER"/>
    <enumeration value="MANUAL_TRACKER"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="IdentityType">
  <restriction base="string">
    <enumeration value="UNKNOWN"/>
    <enumeration value="ASSUMED_FRIEND"/>
    <enumeration value="NEUTRAL"/>
    <enumeration value="SUSPECT"/>
    <enumeration value="HOSTILE"/>
    <enumeration value="FRIEND"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="ClassificationSourceType">
  <restriction base="string">
    <enumeration value="DOPPLER_SIGNATURE"/>
    <enumeration value="IMAGE_SIGNATURE"/>
    <enumeration value="HUMINT"/>
    <enumeration value="DATALINK"/>
    <enumeration value="MIXED"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="TrackPointStatusType">
  <restriction base="string">
    <enumeration value="MAINTAINING"/>
    <enumeration value="DROPPING"/>
    <enumeration value="TERMINATED"/>
    <enumeration value="INITIATING"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="ClassificationType">
  <restriction base="string">
    <enumeration value="UNKNOWN"/>
    <enumeration value="WHEELED"/>
    <enumeration value="TRACKED"/>
    <enumeration value="HELICOPTER"/>
    <enumeration value="UNMANNED_AERIAL_VEHICLE"/>
    <enumeration value="TRAIN"/>
    <enumeration value="INDIVIDUAL"/>
    <enumeration value="GROUP"/>
    <enumeration value="AIRCRAFT"/>

```

```

    </restriction>
  </simpleType>
<!-- ===== -->
<simpleType name="TrackEnvironmentType">
  <restriction base="string">
    <enumeration value="surface"/>
    <enumeration value="subsurface"/>
    <enumeration value="land"/>
    <enumeration value="air"/>
    <enumeration value="space"/>
    <enumeration value="unknown"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="FrequencyUnitType">
  <restriction base="string">
    <enumeration value="THz"/>
    <enumeration value="GHz"/>
    <enumeration value="MHz"/>
    <enumeration value="KHz"/>
    <enumeration value="Hz"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="TrackPointSourceType">
  <restriction base="string">
    <enumeration value="RADAR"/>
    <enumeration value="VIDEO"/>
    <enumeration value="ESM"/>
    <enumeration value="OTHER"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="SimulationIndicatorType">
  <restriction base="string">
    <enumeration value="real"/>
    <enumeration value="simulated"/>
    <enumeration value="synthesized"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="IffModeType">
  <restriction base="string">
    <enumeration value="MODE1"/>
    <enumeration value="MODE2"/>
    <enumeration value="MDOE3"/>

```

```

    <enumeration value="MODE4"/>
    <enumeration value="MODE5"/>
    <enumeration value="MODE_S"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="IdentitySourceType">
  <restriction base="string">
    <enumeration value="nffi"/>
    <enumeration value="iff"/>
    <enumeration value="mixed"/>
    <enumeration value="humint"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="LineageRelationType">
  <restriction base="string">
    <enumeration value="PARENT"/>
    <enumeration value="CHILD"/>
    <enumeration value="SIBLING"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="IdentityAmplificationType">
  <restriction base="string">
    <enumeration value="faker"/>
    <enumeration value="joker"/>
    <enumeration value="kilo"/>
    <enumeration value="traveller"/>
    <enumeration value="zombie"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="SymbolicSpectralRangeType">
  <restriction base="string">
    <enumeration value="LWIR"/>
    <enumeration value="MWIR"/>
    <enumeration value="SWIR"/>
    <enumeration value="NIR"/>
    <enumeration value="VIS"/>
    <enumeration value="UV"/>
    <enumeration value="UNKNOWN"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="TrackPointType">

```

```

    <restriction base="string">
      <enumeration value="MEASURED"/>
      <enumeration value="MANUAL_ESTIMATED"/>
      <enumeration value="AUTOMATIC_ESTIMATED"/>
      <enumeration value="MANUAL_PREDICTED"/>
      <enumeration value="AUTOMATIC_PREDICTED"/>
    </restriction>
  </simpleType>
  <!-- ===== -->
  <simpleType name="ExerciseIndicatorType">
    <restriction base="string">
      <enumeration value="operational"/>
      <enumeration value="exercise"/>
      <enumeration value="test"/>
    </restriction>
  </simpleType>
</schema>

```

8.3 of_tracking_mti.xsd

```

<?xml version="1.0" encoding="UTF-8"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:ows="http://www.opengis.net/ows8/of/tracking/gmtivmti"
  targetNamespace="http://www.opengis.net/ows8/of/tracking/gmtivmti"
  elementFormDefault="qualified" attributeFormDefault="unqualified">
  <include schemaLocation="4607_GMTI.xsd"/>
  <include schemaLocation="vmti0903.2.xsd"/>
  <include schemaLocation="bookmark.xsd"/>
</schema>

```

8.4 4607_GMTI.xsd

```

<?xml version="1.0" encoding="UTF-8"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:om="http://www.opengis.net/om/2.0"
  xmlns:ows="http://www.opengis.net/ows8/of/tracking/gmtivmti"
  xmlns:swe="http://www.opengis.net/swe/2.0"
  targetNamespace="http://www.opengis.net/ows8/of/tracking/gmtivmti"
  elementFormDefault="qualified" attributeFormDefault="unqualified">
  <import namespace="http://www.opengis.net/gml/3.2"
    schemaLocation="http://schemas.opengis.net/gml/3.2.1/gml.xsd"/>
  <import namespace="http://www.opengis.net/swe/2.0"

```

```

schemaLocation="http://schemas.opengis.net/sweCommon/2.0/swe.xsd"/>
<import namespace="http://www.opengis.net/om/2.0"
schemaLocation="http://schemas.opengis.net/om/2.0/observation.xsd"/>
<!-- ===== -->
<element name="GMTI" type="ow2:GMTIType"
substitutionGroup="gml:AbstractFeature"/>
<complexType name="GMTIType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="versionID" type="string"/>
        <element name="nationality" type="string">
          <annotation>
            <documentation>compare FIPS Pub 10-4</documentation>
          </annotation>
        </element>
        <element name="security" type="ow2:SecurityPropertyType"/>
        <element name="exerciseIndicator" type="ow2:ExerciseIndicatorType"/>
        <element name="platformID" type="string">
          <annotation>
            <documentation>An alphanumeric field that identifies the platform. For aircraft
the platform ID shall be the tail number. For a space-based platform the platform ID shall
be the satellite name with an appropriate numerical designator. For other systems, an
appropriate unique designator shall be used. Unused bytes shall be filled with the BCS
space character (hex 0x20). In all cases, the platform ID is determined by the nation
owning the platform, whose responsibility it is to ensure that all its platforms are
uniquely identified within the set of platforms it owns.</documentation>
          </annotation>
        </element>
        <element name="missionID" type="integer">
          <annotation>
            <documentation>An integer field, assigned by the platform identified in Field
P8, that uniquely identifies the mission for the platform.</documentation>
          </annotation>
        </element>
        <element name="jobID" type="integer">
          <annotation>
            <documentation>A platform-assigned number identifying the specific request or
task to which the packet pertains. The Job ID shall be unique within a mission. A Job ID
of 0 (hex 0x00) indicates there is no reference to any specific request or task.the Job ID in
the Packet Header is 0 (hex 0x00), then the packet can not contain Dwell, HRR, or
Range-Doppler segments.</documentation>
          </annotation>
        </element>
      </sequence>
    </extension>
  </complexContent>
</complexType>

```

```

    </complexContent>
  </complexType>
  <complexType name="GMTIPropertyType">
    <sequence minOccurs="0">
      <element ref="ow2:GMTI"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="HRR" type="ow2:HRRType"
substitutionGroup="gml:AbstractFeature">
    <annotation>
      <documentation>The HRR Segment corresponds to a specific Target Report in the
Dwell Segment and is sent each time an HRR dwell is processed. The HRR Segment
includes Scatterer Reports and additional data that can be used to create a Range-Doppler
chip of the target. The HRR Segment (Table 2-5) provides data on High-Range
Resolution (HRR) targets or High Range Resolution Range Doppler Maps (RDM) for a
specified area. Data may also be formatted Range-Pulse format if desired. It is referenced
to the MTI Report Index field (Conditional) of the corresponding Target Report in the
Dwell Segment and shall be sent each time an HRR dwell is processed. Range Doppler
Maps (RDMs) that have no corresponding target detections may be packaged into this
segment. Consequently, the MTI Report Index is Conditional and omitted in such a
case.</documentation>
    </annotation>
  </element>
  <complexType name="HRRType">
    <complexContent>
      <extension base="gml:AbstractFeatureType"/>
    </complexContent>
  </complexType>
  <complexType name="HRRPropertyType">
    <sequence minOccurs="0">
      <element ref="ow2:HRR"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="GMTIObservation" type="ow2:GMTIObservationType"
substitutionGroup="om:OM_Observation">
    <annotation>
      <documentation>Common observation type, used by all three GMTI specializations.
The phenomenon time represents the dwell time.</documentation>
    </annotation>
  </element>
  <complexType name="GMTIObservationType">
    <complexContent>

```

```

    <extension base="om:OM_ObservationType">
      <sequence>
        <element name="mission" type="ow2:MissionPropertyType"/>
        <element name="gmti" type="ow2:GMTIPropertyType"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="GMTIObservationPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:GMTIObservation"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="JobDefinition" type="ow2:JobDefinitionType"
substitutionGroup="gml:AbstractFeature">
  <annotation>
    <documentation>The Job Definition Segment provides information pertaining to the
radar job to be performed and is sent before the first revisit of a job and periodically at
least once every thirty seconds thereafter. The Job Definition Segment (Table 2-7)
provides the means for the platform to pass information pertaining to the sensor job that
will be performed and details of the location parameters (terrain elevation model and
geoid model) used in the measurement. It includes a definition of the geographic area for
sensor service, the Bounding Area, which is defined as a four-corner polygon, with the
four points of the polygon chosen to define a convex quadrilateral. The Job Definition
Segment shall be sent before the first visit of a job with the bounding area representing
the tasked area, and shall be updated and resent with the bounding area set to represent
the actual scanned area when the scanned area differs from the area sent in the previous
Job Definition Segment. The Job Definition Segment shall be sent periodically at least
once every 30 seconds thereafter.</documentation>
  </annotation>
</element>
<complexType name="JobDefinitionType">
  <complexContent>
    <extension base="gml:AbstractFeatureType"/>
  </complexContent>
</complexType>
<complexType name="JobDefinitionPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:JobDefinition"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="GMTIProcess" type="ow2:GMTIProcessType"

```

```

substitutionGroup="gml:AbstractFeature"/>
  <complexType name="GMTIProcessType">
    <complexContent>
      <extension base="gml:AbstractFeatureType">
        <sequence>
          <element name="sensorPosition" type="gml:PointPropertyType"/>
          <element name="sensorPositionAlongTrackUncertainty"
type="swe:QuantityPropertyType"/>
          <element name="sensorPositionAltitudeUncertainty"
type="swe:QuantityPropertyType"/>
          <element name="sensorPositionCrossTrackUncertainty"
type="swe:QuantityPropertyType"/>
          <element name="sensorSpeed" type="swe:QuantityPropertyType"/>
          <element name="sensorTrack" type="swe:QuantityPropertyType"/>
          <element name="sensorVerticalVelocity" type="swe:QuantityPropertyType"/>
          <element name="minimumDetectableVelocity"
type="swe:QuantityPropertyType"/>
          <element name="platformOrientationHeading"
type="swe:QuantityPropertyType"/>
          <element name="platformOrientationPitch" type="swe:QuantityPropertyType"/>
          <element name="platformOrientationRoll" type="swe:QuantityPropertyType"/>
          <element name="scaleFactorLatitude" type="swe:QuantityPropertyType"/>
          <element name="scaleFactorLongitude" type="swe:QuantityPropertyType"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="GMTIProcessPropertyType">
    <sequence minOccurs="0">
      <element ref="ow2:GMTIProcess"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="DwellArea" type="ow2:DwellAreaType"
substitutionGroup="gml:AbstractFeature">
    <annotation>
      <documentation>Feature of interest for all GMTI observation
types.</documentation>
    </annotation>
  </element>
  <complexType name="DwellAreaType">
    <complexContent>
      <extension base="gml:AbstractFeatureType">
        <sequence>
          <element name="center" type="gml:PointPropertyType"/>

```

```

        <element name="dwellAngleHalfExtent" type="gml:MeasureType"/>
        <element name="rangeHalfExtent" type="gml:MeasureType"/>
    </sequence>
</extension>
</complexContent>
</complexType>
<complexType name="DwellAreaPropertyType">
    <sequence minOccurs="0">
        <element ref="ow2:DwellArea"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="FreeText" type="ow2:FreeTextType"
substitutionGroup="gml:AbstractFeature">
    <annotation>
        <documentation>The Free Text Segment (Table 2-8) provides a means of sending
Basic Character Set (BCS) alphanumeric text messages. Refer to Appendix 1 for
allowable text characters. The Free Text Segment shall be sent as
required.</documentation>
    </annotation>
</element>
<complexType name="FreeTextType">
    <complexContent>
        <extension base="gml:AbstractFeatureType"/>
    </complexContent>
</complexType>
<complexType name="FreeTextPropertyType">
    <sequence minOccurs="0">
        <element ref="ow2:FreeText"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="TargetingAndTrackingObservation"
type="ow2:TargetingAndTrackingObservationType"
substitutionGroup="ow2:GMTIObservation">
    <complexType name="TargetingAndTrackingObservationType">
        <complexContent>
            <extension base="ow2:GMTIObservationType"/>
        </complexContent>
    </complexType>
<complexType name="TargetingAndTrackingObservationPropertyType">
    <sequence minOccurs="0">
        <element ref="ow2:TargetingAndTrackingObservation"/>
    </sequence>

```

```

    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
<!-- ===== -->
  <element name="SituationAwarenessObservation"
type="ow2:SituationAwarenessObservationType"
substitutionGroup="ow2:GMTIObservation">
    <annotation>
      <documentation>Observation class to provide the minimum data required for Moving
Target Indicator (MTI) target display.</documentation>
    </annotation>
  </element>
  <complexType name="SituationAwarenessObservationType">
    <complexContent>
      <extension base="ow2:GMTIObservationType"/>
    </complexContent>
  </complexType>
  <complexType name="SituationAwarenessObservationPropertyType">
    <sequence minOccurs="0">
      <element ref="ow2:SituationAwarenessObservation"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
<!-- ===== -->
  <element name="TargetingAndTrackingHRRObservation"
type="ow2:TargetingAndTrackingHRRObservationType"
substitutionGroup="ow2:GMTIObservation">
    <complexType name="TargetingAndTrackingHRRObservationType">
      <complexContent>
        <extension base="ow2:GMTIObservationType"/>
      </complexContent>
    </complexType>
    <complexType name="TargetingAndTrackingHRRObservationPropertyType">
      <sequence minOccurs="0">
        <element ref="ow2:TargetingAndTrackingHRRObservation"/>
      </sequence>
      <attributeGroup ref="gml:AssociationAttributeGroup"/>
    </complexType>
<!-- ===== -->
  <element name="Mission" type="ow2:MissionType"
substitutionGroup="gml:AbstractFeature">
    <annotation>
      <documentation>The Mission Segment (Table 2-3) provides information concerning
the mission and shall be sent periodically at least once every two minutes. It includes
information on the mission and flight plans, the type and configuration of the platform,
and the reference time. Note that the Dwell Time (field D6) specified in any associated
Dwell Segments is referenced to the Reference Time (fields M5-M7) in the Mission

```

Segment, and will not be resolved as to the day of the mission until the Mission Segment is received from the transmitting platform.

```

</annotation>
</element>
<complexType name="MissionType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="missionPlan" type="string">
          <annotation>
            <documentation>An alphanumeric field that identifies the mission, and which
            shall be unique for all the missions defined for that platform. For aircraft or land-based
            systems, the Mission Number from the Air Tasking Order (ATO) or an equivalent
            document shall be used. For space-based platforms, the mission identifier or a suitable
            designator such as &ldquo;yymmhhnn&rdquo;, where yy (year), mm (month),
            and hh (hour) indicate the time the collection mission began and nn is the identifying
            number of the satellite, shall be used. If there is no Mission Plan to be sent, or if there are
            unused bytes in the field, the field shall be filled with the BCS space character (hex
            0x20).</documentation>
          </annotation>
        </element>
        <element name="flightPlan" type="string">
          <annotation>
            <documentation>An alphanumeric field that identifies the flight plan. This field
            provides a unique identification of the flight plan. If the flight plan is not available from
            the ATO or an equivalent source, a suitable unique identifier may be inserted in this field.
            If there is no Flight Plan to be sent, or if there are unused bytes in the field, the field shall
            be filled with the BCS space character (hex 0x20).</documentation>
          </annotation>
        </element>
        <element name="platformType" type="ow2:PlatformTypeType"/>
        <element name="platformConfiguration" type="string">
          <annotation>
            <documentation>An alphanumeric field indicating the particular variant of the
            platform. Identifies sensor complements, upgrades, or other identifying information.
            Examples would be a model number, software release number, clarifications of
            differences in platform types, or identification of the platform as a test article. A
            recommended default value is an identification of the software and/or hardware version.
            If there is no Platform Configuration to be sent, the fields shall be filled with the BCS
            space character (hex 0x20).</documentation>
          </annotation>
        </element>
        <element name="referenceTime">
          <annotation>
            <documentation>The date in which the mission originated. For airborne
            platforms, this shall be the takeoff time. For spaceborne platforms, this shall be an epoch

```

time, which shall be selected suitable for the collection. For ground-based platforms, a time reference suitable for collection shall be selected.</documentation>

```

    </annotation>
  </element>
</sequence>
</extension>
</complexContent>
</complexType>
<complexType name="MissionPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:Mission"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Dwell" type="ow2:DwellType"
substitutionGroup="gml:AbstractFeature">
  <annotation>
    <documentation>The Dwell Segment, which may include Target Reports, is
transmitted for every packet in which the Job ID is non-zero (i.e., for every radar job
specified in the packet header). It is sent whether or not any targets are observed during a
given dwell. A Dwell Segment is a report on a grouping of zero or more target reports for
which the sensor provides a single time, sensor position, reference position on the ground
with simple estimates for the observed area at the reported time, and other pertinent data.
A Dwell Segment may be associated with a radar dwell but need not be. The Dwell
Segment (Table 2-4) presents data pertinent to MTI targets. Dwell Segments shall be sent
for each logical grouping of target reports. A Dwell Segment shall be transmitted even if
no targets are observed. A Dwell Segment may be sent only if the Job ID in the
associated Packet Header is not equal to zero (hex 0x00).</documentation>
    </annotation>
  </element>
  <complexType name="DwellType">
    <complexContent>
      <extension base="gml:AbstractFeatureType"/>
    </complexContent>
  </complexType>
  <complexType name="DwellPropertyType">
    <sequence minOccurs="0">
      <element ref="ow2:Dwell"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="TargetingHRRReport" type="ow2:TargetingHRRReportType"
substitutionGroup="gml:AbstractGML"/>
  <complexType name="TargetingHRRReportType">

```

```

    <complexContent>
      <extension base="gml:AbstractGMLType">
        <sequence>
          <element name="target"
type="ow2:TargetingAndTrackingHRRReportPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="TargetingHRRReportPropertyType">
    <sequence minOccurs="0">
      <element ref="ow2:TargetingHRRReport"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="TargetingReport" type="ow2:TargetingReportType"
substitutionGroup="gml:AbstractGML"/>
  <complexType name="TargetingReportType">
    <complexContent>
      <extension base="gml:AbstractGMLType">
        <sequence>
          <element name="target" type="ow2:TargetingAndTrackingReportPropertyType"
minOccurs="0" maxOccurs="unbounded"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="TargetingReportPropertyType">
    <sequence minOccurs="0">
      <element ref="ow2:TargetingReport"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="SituationAwarenessReport"
type="ow2:SituationAwarenessReportType" substitutionGroup="gml:AbstractGML"/>
  <complexType name="SituationAwarenessReportType">
    <complexContent>
      <extension base="gml:AbstractGMLType">
        <sequence>
          <element name="target"
type="ow2:SituationAwarenessTargetReportPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>

```

```

    </extension>
  </complexContent>
</complexType>
<complexType name="SituationAwarenessReportPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:SituationAwarenessReport"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="TargetingAndTrackingHRRReport"
type="ow2:TargetingAndTrackingHRRReportType"
substitutionGroup="ow2:TargetingAndTrackingReport"/>
<complexType name="TargetingAndTrackingHRRReportType">
  <complexContent>
    <extension base="ow2:TargetingAndTrackingReportType">
      <sequence>
        <element name="centerFrequency" type="swe:QuantityPropertyType"
minOccurs="0"/>
        <element name="clutterPower" type="swe:CountPropertyType"/>
        <element name="compressionFlag" type="swe:CountPropertyType"/>
        <element name="detectionThreshold" type="swe:CountPropertyType"/>
        <element name="dopplerBinSpacing" type="swe:QuantityPropertyType"/>
        <element name="dopplerOfOrigin" type="swe:QuantityPropertyType"
minOccurs="0"/>
        <element name="dopplerResolution" type="swe:QuantityPropertyType"/>
        <element name="dopplerWeightingFunctionType"
type="swe:CountPropertyType"/>
        <element name="electricalLengthUncertainty" type="swe:QuantityPropertyType"
minOccurs="0"/>
        <element name="hrrScattererRecords"
type="ow2:ScattererRecordPropertyType"/>
        <element name="indexOfZeroVelocityBin" type="swe:CountPropertyType"
minOccurs="0"/>
        <element name="maximumPixelPower" type="swe:QuantityPropertyType"/>
        <element name="maximumRCS" type="swe:CountPropertyType"
minOccurs="0"/>
        <element name="numberBytesMagnitude" type="swe:CountPropertyType"/>
        <element name="numberBytesPhase" type="swe:CountPropertyType"/>
        <element name="numberOfDopplerSamples" type="swe:CountPropertyType"
minOccurs="0"/>
        <element name="numberOfTargetScatterers" type="swe:CountPropertyType"/>
        <element name="processingMask" type="ow2:ProcessingTechniqueTypesType"/>
        <element name="rangeBinSpacing" type="swe:QuantityPropertyType"/>
        <element name="rangeExtentInPixels" type="swe:CountPropertyType"
minOccurs="0"/>

```

```

    <element name="rangeOfOrigin" type="swe:QuantityPropertyType"
minOccurs="0">
    <annotation>
    <documentation>When the RDM does not correlate to a single MTI report index
or when the center range bin does not correlate to the center of the dwell; provide the
range sample offset in meters from Dwell Center (positive is away from the sensor) of the
first scatterer record. This field must be used in conjunction with HRR/RDM data type 4
and 6, as defined in Para. 2.5.23. This field is optional for all other HRR/RDM data
types.</documentation>
    </annotation>
    </element>
    <element name="rangeResolution" type="swe:QuantityPropertyType"/>
    <element name="rangeToNearestEdgeInChip" type="swe:CountPropertyType"
minOccurs="0"/>
    <element name="rangeWeightingFunctionType"
type="swe:CountPropertyType"/>
    <element name="targetRadialElectricalLength" type="swe:QuantityPropertyType"
minOccurs="0"/>
    <element name="typeOfHRRRDM" type="ow2:HRRRDMDTypeType"/>
    <element name="scatterer" minOccurs="0" maxOccurs="unbounded">
    <complexType>
    <sequence>
    <element ref="ow2:ScattererRecord"/>
    </sequence>
    </complexType>
    </element>
    </sequence>
    </extension>
    </complexType>
    <complexType name="TargetingAndTrackingHRRReportPropertyType">
    <sequence minOccurs="0">
    <element ref="ow2:TargetingAndTrackingHRRReport"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
    </complexType>
    <!-- ===== -->
    <element name="SituationAwarenessTargetReport"
type="ow2:SituationAwarenessTargetReportType"/>
    <complexType name="SituationAwarenessTargetReportType">
    <sequence>
    <element name="targetLocationDeltaLatitude" type="swe:QuantityPropertyType"
minOccurs="0">
    <annotation>
    <documentation>The North-South position of the reported detection, expressed as
degrees North (positive) or South (negative) from the Dwell Area Center Latitude (the

```

```

Reference Point)</documentation>
    </annotation>
  </element>
  <element name="targetLocationDeltaLongitude" type="swe:QuantityPropertyType"
minOccurs="0">
    <annotation>
      <documentation>The East-West position of the reported detection, expressed as
degrees East (positive) from the Dwell Area Center Longitude (the Reference
Point)</documentation>
    </annotation>
  </element>
  <element name="targetLocationHighResolution" type="gml:PointPropertyType"
minOccurs="0"/>
  <element name="uncertainty">
    <complexType>
      <sequence>
        <element ref="ow2:TargetMeasurementUncertainty"/>
      </sequence>
    </complexType>
  </element>
</sequence>
</complexType>
<complexType name="SituationAwarenessTargetReportPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:SituationAwarenessTargetReport"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
  <element name="TargetingAndTrackingReport"
type="ow2:TargetingAndTrackingReportType"
substitutionGroup="ow2:SituationAwarenessTargetReport"/>
  <complexType name="TargetingAndTrackingReportType">
    <complexContent>
      <extension base="ow2:SituationAwarenessTargetReportType">
        <sequence>
          <element name="targetClassification" type="ow2:TargetClassificationType"/>
          <element name="targetClassificationProbability"
type="swe:QuantityPropertyType"/>
          <element name="targetLocationGeodeticHeight"
type="swe:QuantityPropertyType"/>
          <element name="targetSNR" type="swe:QuantityPropertyType"/>
          <element name="targetVelocityLOSComponent"
type="swe:QuantityPropertyType"/>
          <element name="targetWrapVelocity" type="swe:QuantityPropertyType"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>

```

```

    </extension>
  </complexContent>
</complexType>
<complexType name="TargetingAndTrackingReportPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:TargetingAndTrackingReport"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="TargetMeasurementUncertainty"
type="ow2:TargetMeasurementUncertaintyType">
  <annotation>
    <documentation>Uncertainties for various target measurements.</documentation>
  </annotation>
</element>
<complexType name="TargetMeasurementUncertaintyType">
  <sequence>
    <element name="crossRange" type="swe:QuantityPropertyType"/>
    <element name="slantRange" type="swe:QuantityPropertyType"/>
    <element name="height" type="swe:QuantityPropertyType"/>
    <element name="targetRadialVelocity" type="swe:QuantityPropertyType"/>
  </sequence>
</complexType>
<complexType name="TargetMeasurementUncertaintyPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:TargetMeasurementUncertainty"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="ScattererRecord" type="ow2:ScattererRecordType">
  <annotation>
    <documentation>A Scatterer Set is an array of Scatterer Records for each target pixel
that exceeds the target detection threshold. Alternatively, a complete range- doppler map,
regardless of threshold, may be sent without respective range/doppler indices for each
scatterer. A set of HRR/Range-Doppler Scatterer Records shall be transmitted for the
associated MTI target (HRR only) and shall be sent for each dwell processed. Scatterer
records within the record shall be ordered in range order (For Example: All Doppler
samples at range 1 then all Doppler samples at range 2....) starting at near range. Doppler
samples shall be arranged sequentially from negative to positive doppler. Hence the
origin is the scatterer at the nearest range and least Doppler value. In the case of Range-
Pulse data the origin would be the first pulse. The Phase of each scatterer is
optional.</documentation>
  </annotation>
</element>

```

```

<complexType name="ScattererRecordType">
  <sequence>
    <element name="dopplerIndex" type="swe:CountPropertyType">
      <annotation>
        <documentation>Scatterer's Doppler index relative to Range-Doppler
chip, where increasing index equates to increasing Doppler. Must be used when the
Range-Doppler matrix is sparsely populated.</documentation>
      </annotation>
    </element>
    <element name="rangeIndex" type="swe:CountPropertyType">
      <annotation>
        <documentation>Scatterer's Range index relative to Range-Doppler
chip, where increasing index equates to increasing range. Must be used when the Range-
Doppler matrix is sparsely populated.</documentation>
      </annotation>
    </element>
    <element name="scattererMagnitude" type="swe:CountPropertyType">
      <annotation>
        <documentation>Scatterer's power magnitude, quantized to 1 or 2
bytes per Para. 2.5.25, normalized to peak scatterer, and expressed in quarter-decibels
(dB/4). The value is calculated by: (a) converting the Scatterer Magnitude to decibels
(dB), with the maximum value constrained to 63.75 dB (H25=1) or 16383.75 dB
(H25=1); (b) multiplying that value by 4; and (c) rounding to the nearest
integer.</documentation>
      </annotation>
    </element>
    <element name="scattererPhase" type="swe:CountPropertyType" minOccurs="0">
      <annotation>
        <documentation>Scatterer's complex phase in degrees, quantized to 1
or 2 bytes per Para. 2.5.26, and expressed as a quantized rotation in units of  $2\pi/256$ 
(H26=1) or  $2\pi/65536$  (H26=2).</documentation>
      </annotation>
    </element>
  </sequence>
</complexType>
<complexType name="ScattererRecordPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:ScattererRecord"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Security" type="ow2:SecurityType"/>
<complexType name="SecurityType">
  <sequence>
    <element name="classification" type="ow2:SecurityClassificationType"/>

```

```

    <element name="classificationSystem"
type="ow2:SecurityClassificationSystemType"/>
    <element name="code" type="ow2:SecurityCodeType"/>
  </sequence>
</complexType>
<complexType name="SecurityPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:Security"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<simpleType name="ExerciseIndicatorType">
  <restriction base="string">
    <enumeration value="OperationRealData"/>
    <enumeration value="OperationSimulatedData"/>
    <enumeration value="OperationSynthesizedData"/>
    <enumeration value="ExerciseRealData"/>
    <enumeration value="ExerciseSimulatedData"/>
    <enumeration value="ExerciseSynthesizedData"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="ProcessingTechniqueTypesType">
  <restriction base="string">
    <enumeration value="ClutterCancellation"/>
    <enumeration value="SingleAmbiguityKeystoning"/>
    <enumeration value="MultiAmbiguityKeystoning"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="SecurityClassificationType">
  <restriction base="string">
    <enumeration value="TOPSECRET"/>
    <enumeration value="SECRET"/>
    <enumeration value="CONFIDENTIAL"/>
    <enumeration value="RESTRICTED"/>
    <enumeration value="UNCLASSIFIED"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="TargetClassificationType">
  <restriction base="string">
    <enumeration value="No Information, Live Target"/>
    <enumeration value="Tracked Vehicle, Live Target"/>
    <enumeration value="Wheeled Vehicle, Live Target"/>
  </restriction>
</simpleType>

```

```

<enumeration value="Rotary Wing Aircraft, Live Target"/>
<enumeration value="Fixed Wing Aircraft, Live Target"/>
<enumeration value="Stationary Rotator, Live Target"/>
<enumeration value="Maritime, Live Target"/>
<enumeration value="Beacon, Live Target"/>
<enumeration value="Amphibious, Live Target"/>
<enumeration value="Person, Live Target"/>
<enumeration value="Vehicle, Live Target"/>
<enumeration value="Animal, Live Target"/>
<enumeration value="Large Multiple-Return, Live Land Target"/>
<enumeration value="Large Multiple-Return, Live Maritime Target"/>
<enumeration value="Other, Live Target"/>
<enumeration value="Unknown, Live Target"/>
<enumeration value="No Information, Simulated Target"/>
<enumeration value="Tracked Vehicle, Simulated Target"/>
<enumeration value="Wheeled Vehicle, Simulated Target"/>
<enumeration value="Rotary Wing Aircraft, Simulated Target"/>
<enumeration value="Fixed Wing Aircraft, Simulated Target"/>
<enumeration value="Stationary Rotator, Simulated Target"/>
<enumeration value="Maritime, Simulated Target"/>
<enumeration value="Beacon, Simulated Target"/>
<enumeration value="Amphibious, Simulated Target"/>
<enumeration value="Person, Simulated Target"/>
<enumeration value="Vehicle, Simulated Target"/>
<enumeration value="Animal, Simulated Target"/>
<enumeration value="Large Multiple-Return, Simulated Land Target"/>
<enumeration value="Large Multiple-Return, Simulated Maritime Target"/>
<enumeration value="Tagging Device"/>
<enumeration value="Other, Simulated Target"/>
<enumeration value="Unknown, Simulated Target"/>
</restriction>
</simpleType>
<!-- ===== -->
<simpleType name="HRRRDMDTypeType">
  <restriction base="string">
    <enumeration value="1-DHRRChip"/>
    <enumeration value="2-DHRRChip"/>
    <enumeration value="SparseHRRChip"/>
    <enumeration value="OversizedHRRChip"/>
    <enumeration value="FullRDM"/>
    <enumeration value="PartialRDM"/>
    <enumeration value="FullRangePulseData"/>
  </restriction>
</simpleType>
<!-- ===== -->
<simpleType name="SecurityCodeType">

```

```

    <restriction base="string">
      <enumeration value="NONE"/>
      <enumeration value="NOCONTRACT"/>
      <enumeration value="ORCON"/>
      <enumeration value="PROPIN"/>
      <enumeration value="WINTTEL"/>
      <enumeration value="etc"/>
    </restriction>
  </simpleType>
<!-- ===== -->
  <simpleType name="PlatformTypeType">
    <union memberTypes="ow2:PlatformTypeEnumerationType
ow2:PlatformTypeOtherType"/>
  </simpleType>
  <simpleType name="PlatformTypeEnumerationType">
    <restriction base="string">
      <enumeration value="ACS"/>
      <enumeration value="ARL-M"/>
      <enumeration value="zz_etc"/>
      <enumeration value="Sentinel"/>
      <enumeration value="Unidentified"/>
    </restriction>
  </simpleType>
  <simpleType name="PlatformTypeOtherType">
    <restriction base="string">
      <pattern value="other: [A-Za-z0-9_]{2,}" />
    </restriction>
  </simpleType>
<!-- ===== -->
  <simpleType name="SecurityClassificationSystemType">
    <union memberTypes="ow2:SecurityClassificationSystemEnumerationType
ow2:SecurityClassificationSystemOtherType"/>
  </simpleType>
  <simpleType name="SecurityClassificationSystemEnumerationType">
    <restriction base="string">
      <enumeration value="BE"/>
      <enumeration value="BU"/>
      <enumeration value="etc"/>
    </restriction>
  </simpleType>
  <simpleType name="SecurityClassificationSystemOtherType">
    <restriction base="string">
      <pattern value="other: [A-Za-z0-9_]{2,}" />
    </restriction>
  </simpleType>

```

</schema>

8.5 vmti0903.2.xsd

```
<?xml version="1.0" encoding="UTF-8"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:om="http://www.opengis.net/om/2.0"
  xmlns:ow2="http://www.opengis.net/ows8/of/tracking/gmtivmti"
  targetNamespace="http://www.opengis.net/ows8/of/tracking/gmtivmti"
  elementFormDefault="qualified" attributeFormDefault="unqualified">
  <import namespace="http://www.opengis.net/gml/3.2"
    schemaLocation="http://schemas.opengis.net/gml/3.2.1/gml.xsd"/>
  <import namespace="http://www.opengis.net/om/2.0"
    schemaLocation="http://schemas.opengis.net/om/2.0/observation.xsd"/>
  <!-- ===== -->
  <element name="VFeature" type="ow2:VFeatureType"
    substitutionGroup="gml:AbstractFeature">
    <annotation>
      <documentation>This class contains data that describes the properties or features of a
target.</documentation>
    </annotation>
  </element>
  <complexType name="VFeatureType">
    <complexContent>
      <extension base="gml:AbstractFeatureType">
        <sequence>
          <element name="schema" type="string"/>
          <element name="feature" type="gml:FeaturePropertyType"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="VFeaturePropertyType">
    <sequence minOccurs="0">
      <element ref="ow2:VFeature"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="UASProcess" type="ow2:UASProcessType"
    substitutionGroup="gml:AbstractFeature">
    <annotation>
      <documentation>contains among others sensor/platform data from MISB STD
0601.4.</documentation>
```

```

    </annotation>
  </element>
  <complexType name="UASProcessType">
    <complexContent>
      <extension base="gml:AbstractFeatureType"/>
    </complexContent>
  </complexType>
  <complexType name="UASProcessPropertyType">
    <sequence minOccurs="0">
      <element ref="ow2:UASProcess"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="VMTI" type="ow2:VMTIType"
substitutionGroup="gml:AbstractFeature">
    <annotation>
      <documentation>sampling feature for the sampled feature 'Frame' and ultimate
feature of interest SurveillanceArea.</documentation>
    </annotation>
  </element>
  <complexType name="VMTIType">
    <complexContent>
      <extension base="gml:AbstractFeatureType">
        <sequence>
          <element name="checksum" type="double" minOccurs="0"/>
          <element name="timestamp" type="gml:TimeInstantPropertyType">
            <annotation>
              <documentation>either directly received from VMTI KLV data or from
embedding 0601 LDS.</documentation>
            </annotation>
          </element>
          <element name="VMTISystemName" type="string"/>
          <element name="VMTILDSVersionNumber" type="double"/>
          <element name="numberOfDetectedTargets" type="integer"/>
          <element name="numberOfReportedTargets" type="integer"/>
          <element name="videoFrameNumber" type="integer"/>
          <element name="frameWidth" type="integer"/>
          <element name="frameHeight" type="integer"/>
          <element name="VTMISourceSensor" type="string"/>
          <element name="VMTISensorHFOV" type="double"/>
          <element name="VMTISensorVFOV" type="double"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>

```

```

<complexType name="VMTIPROPERTYType">
  <sequence minOccurs="0">
    <element ref="ow2:VMTI"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="SurveillanceArea" type="ow2:SurveillanceAreaType"
substitutionGroup="gml:AbstractFeature">
  <annotation>
    <documentation>Ultimate feature of interest for all "frame sampling
features"</documentation>
  </annotation>
</element>
<complexType name="SurveillanceAreaType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="name" type="string"/>
        <element name="area" type="gml:GeometryPropertyType"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="SurveillanceAreaPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:SurveillanceArea"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="TargetObservation" type="ow2:TargetObservationType"
substitutionGroup="om:OM_Observation">
  <annotation>
    <documentation>Binds frames and detection data. Each TargetObservation provides
information for exactly one target.</documentation>
  </annotation>
</element>
<complexType name="TargetObservationType">
  <complexContent>
    <extension base="om:OM_ObservationType"/>
  </complexContent>
</complexType>
<complexType name="TargetObservationPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:TargetObservation"/>
  </sequence>

```

```

    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="VMTIObservation" type="ow2:VMTIObservationType"
substitutionGroup="om:OM_Observation">
    <annotation>
      <documentation>Observation featuring the VMTI-oriented perspective. The goal is to
transport as much of the original VMTI LDS plus required 0601 LDS.</documentation>
    </annotation>
  </element>
  <complexType name="VMTIObservationType">
    <complexContent>
      <extension base="om:OM_ObservationType"/>
    </complexContent>
  </complexType>
  <complexType name="VMTIObservationPropertyType">
    <sequence minOccurs="0">
      <element ref="ow2:VMTIObservation"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
  <!-- ===== -->
  <element name="VTargetPack" type="ow2:VTargetPackType"
substitutionGroup="gml:AbstractFeature">
    <annotation>
      <documentation>Delivers metadata for individual targets. Each VTargetPack
supports one target.</documentation>
    </annotation>
  </element>
  <complexType name="VTargetPackType">
    <complexContent>
      <extension base="gml:AbstractFeatureType">
        <sequence>
          <element name="newDetectionTargetHistoryFlag" type="integer"/>
          <element name="percentTargetPixels" type="integer"/>
          <element name="targetCentroidPixelNumber" type="integer" minOccurs="0"/>
          <element name="targetColor" type="integer"/>
          <element name="targetConfidenceLevel" type="integer"/>
          <element name="targetID" type="integer"/>
          <element name="targetIntensity" type="integer"/>
          <element name="targetPriority" type="integer" minOccurs="0"/>
          <element name="targetBoundary" minOccurs="0">
            <complexType>
              <sequence>
                <element ref="ow2:Boundary"/>
              </sequence>
            </complexType>
          </element>
        </sequence>
      </extension>
    </complexContent>
  </complexType>

```

```

    </sequence>
  </complexType>
</element>
<element name="targetLocation" minOccurs="0">
  <complexType>
    <sequence>
      <element ref="ow2:Location"/>
    </sequence>
  </complexType>
</element>
<element name="boundingBoxGeoOffset" minOccurs="0">
  <complexType>
    <sequence>
      <element ref="ow2:BoundingBoxGeoOffset"/>
    </sequence>
  </complexType>
</element>
<element name="boudingBox" minOccurs="0">
  <complexType>
    <sequence>
      <element ref="ow2:BoundingBoxPixel"/>
    </sequence>
  </complexType>
</element>
<element name="tagetLocationOffset" minOccurs="0">
  <complexType>
    <sequence>
      <element ref="ow2:LocationOffset"/>
    </sequence>
  </complexType>
</element>
<element name="vObject" type="ow2:VObjectPropertyType" minOccurs="0"/>
<element name="vTracker" minOccurs="0">
  <complexType>
    <sequence>
      <element ref="ow2:VTracker"/>
    </sequence>
  </complexType>
</element>
<element name="vFeature" type="ow2:VFeaturePropertyType" minOccurs="0"/>
<element name="vChip" type="ow2:VChipPropertyType" minOccurs="0"/>
<element name="vMask" minOccurs="0">
  <complexType>
    <sequence>
      <element ref="ow2:VMask"/>
    </sequence>
  </complexType>
</element>

```

```

    </complexType>
  </element>
</sequence>
</extension>
</complexContent>
</complexType>
<complexType name="VTargetPackPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:VTargetPack"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="VChip" type="ow2:VChipType"
substitutionGroup="gml:AbstractFeature">
  <annotation>
    <documentation>This class specifies a &ldquo;chip&rdquo; of the image
frame, capturing the target image.</documentation>
  </annotation>
</element>
<complexType name="VChipType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="image" type="base64Binary" minOccurs="0"/>
        <element name="imageType" type="string"/>
        <element name="imageURI" type="anyURI"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="VChipPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:VChip"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="TargetResult" type="ow2:TargetResultType"
substitutionGroup="gml:AbstractFeature">
  <annotation>
    <documentation>Result of TargetObservation. Supports target-oriented
perspective.</documentation>
  </annotation>
</element>
<complexType name="TargetResultType">

```

```

<complexContent>
  <extension base="gml:AbstractFeatureType">
    <sequence>
      <element name="vmtiLDS" type="ow2:VMTIPROPERTYTYPE"/>
      <element name="target" type="ow2:VTargetPackPropertyType"/>
      <element name="evidence" type="ow2:FramePropertyType" minOccurs="0"
maxOccurs="unbounded"/>
    </sequence>
  </extension>
</complexContent>
</complexType>
<complexType name="TargetResultPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:TargetResult"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="TargetObservationCollection"
type="ow2:TargetObservationCollectionType"
substitutionGroup="gml:AbstractFeature">
  <annotation>
    <documentation>convenience class to aggregate any number of TargetObservation
elements.</documentation>
  </annotation>
</element>
<complexType name="TargetObservationCollectionType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="member" type="ow2:TargetObservationPropertyType"
minOccurs="0" maxOccurs="unbounded"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="TargetObservationCollectionPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:TargetObservationCollection"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Frame" type="ow2:FrameType"
substitutionGroup="gml:AbstractFeature">
  <annotation>

```

```

    <documentation>The video frame that was used to generate the VMTI data
from.</documentation>
  </annotation>
</element>
<complexType name="FrameType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="image" type="base64Binary" minOccurs="0">
          <annotation>
            <documentation>the image encoded as base 64 or a reference to the
image.</documentation>
          </annotation>
        </element>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="FramePropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:Frame"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="VObject" type="ow2:VObjectType"
substitutionGroup="gml:AbstractFeature">
  <annotation>
    <documentation>This class is data that describes the class or type of a
target.</documentation>
  </annotation>
</element>
<complexType name="VObjectType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="ontology" type="string"/>
        <element name="class" type="string"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<complexType name="VObjectPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:VObject"/>
  </sequence>

```

```

    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>
<!-- ===== -->
<element name="VTracker" type="ow2:VTrackerType">
  <annotation>
    <documentation>The VTracker class is composed of data describing spatial and
temporal information to assist motion imagery tracking algorithms in creating better
tracks from the VMTI target information.</documentation>
  </annotation>
</element>
<complexType name="VTrackerType">
  <sequence>
    <element name="targetID" type="integer"/>
    <element name="detectionStatus" type="integer"/>
    <element name="startTimeStamp" type="gml:TimeInstantPropertyType"/>
    <element name="endTimeStamp" type="gml:TimeInstantPropertyType"/>
    <element name="boundingBox" type="ow2:BoundaryPropertyType"/>
    <element name="algorithm" type="string"/>
    <element name="confidence" type="integer"/>
    <element name="numberOfPoints" type="integer"/>
    <element name="Locus" type="ow2:LocationPropertyType"/>
    <element name="acceleration" minOccurs="0">
      <complexType>
        <sequence>
          <element ref="ow2:Acceleration"/>
        </sequence>
      </complexType>
    </element>
    <element name="velocity" minOccurs="0">
      <complexType>
        <sequence>
          <element ref="ow2:Velocity"/>
        </sequence>
      </complexType>
    </element>
  </sequence>
</complexType>
<complexType name="VTrackerPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:VTracker"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="BoundingBoxPixel" type="ow2:BoundingBoxPixelType">
  <annotation>

```

<documentation>As gml:Envelop uses directPosition, which contains two coordinate points (direct positions), this union has been defined.</documentation>

```

</annotation>
</element>
<complexType name="BoundingBoxPixelType">
  <sequence>
    <element name="bottomRight" type="integer"/>
    <element name="topLeft" type="integer"/>
  </sequence>
</complexType>
<complexType name="BoundingBoxPixelPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:BoundingBoxPixel"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="VMask" type="ow2:VMaskType">
  <annotation>
    <documentation>This class captures the shape of the target. Shape is specified as a
    simple geometry.</documentation>
  </annotation>
</element>
<complexType name="VMaskType">
  <sequence>
    <element name="polygon" type="ow2:PixelNumberPropertyType"
    maxOccurs="unbounded"/>
    <element name="bitMask" minOccurs="0" maxOccurs="unbounded">
      <complexType>
        <sequence>
          <element ref="ow2:BitMask"/>
        </sequence>
      </complexType>
    </element>
  </sequence>
</complexType>
<complexType name="VMaskPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:VMask"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="PixelNumber" type="ow2:PixelNumberType">
  <annotation>
    <documentation>This class specifies the position of a pixel within the frame. The

```

calculation of the pixel number uses the equation: $X + ((Y-1) \times \text{Frame Width})$. The top left pixel of the frame equates to $(X,Y) = (1,1)$ and a pixel number of 1</documentation>

```

</annotation>
</element>
<complexType name="PixelNumberType">
  <sequence>
    <element name="pixel" type="integer" maxOccurs="unbounded"/>
  </sequence>
</complexType>
<complexType name="PixelNumberPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:PixelNumber"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Boundary" type="ow2:BoundaryType">
  <annotation>
    <documentation>This class provides geo coordinates for the boundary around an area
or volume of interest.</documentation>
  </annotation>
</element>
<complexType name="BoundaryType">
  <sequence>
    <element name="location" maxOccurs="unbounded">
      <complexType>
        <sequence>
          <element ref="ow2:Location"/>
        </sequence>
      </complexType>
    </element>
  </sequence>
</complexType>
<complexType name="BoundaryPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:Boundary"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Acceleration" type="ow2:AccelerationType">
  <annotation>
    <documentation>This class provides acceleration data about a moving
object.</documentation>
  </annotation>
</element>

```

```

<complexType name="AccelerationType">
  <sequence>
    <element name="xCcomponent" type="double">
      <annotation>
        <documentation>West to East</documentation>
      </annotation>
    </element>
    <element name="yComponent" type="double">
      <annotation>
        <documentation>South to North</documentation>
      </annotation>
    </element>
    <element name="zComponent" type="double">
      <annotation>
        <documentation>vertical acceleration</documentation>
      </annotation>
    </element>
    <element name="sigmaX" type="double" minOccurs="0"/>
    <element name="sigmaY" type="double" minOccurs="0"/>
    <element name="sigmaZ" type="double" minOccurs="0"/>
    <element name="rhoXY" type="double" minOccurs="0"/>
    <element name="rhoXZ" type="double" minOccurs="0"/>
    <element name="rhoYZ" type="double" minOccurs="0"/>
  </sequence>
</complexType>
<complexType name="AccelerationPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:Acceleration"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="LocationOffset" type="ow2:LocationOffsetType">
  <annotation>
    <documentation>Offset of the target from the frame center
coordinates.</documentation>
  </annotation>
</element>
<complexType name="LocationOffsetType">
  <sequence>
    <element name="latitude" type="double"/>
    <element name="longitude" type="double"/>
  </sequence>
</complexType>
<complexType name="LocationOffsetPropertyType">
  <sequence minOccurs="0">

```

```

    <element ref="ow2:LocationOffset"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="BitMask" type="ow2:BitMaskType">
  <annotation>
    <documentation>A run-length encoding of a bit mask describing the pixels that
subtend the target within the video frame.</documentation>
  </annotation>
</element>
<complexType name="BitMaskType">
  <sequence>
    <element name="pixelNumber" type="ow2:PixelNumberPropertyType"
maxOccurs="unbounded"/>
    <element name="runLength" type="integer"/>
  </sequence>
</complexType>
<complexType name="BitMaskPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:BitMask"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="BoundingBoxGeoOffset" type="ow2:BoundingBoxGeoOffsetType">
  <annotation>
    <documentation>This class defines a bounding box around the target consisting of
two pixel numbers, one for the upper left and one for the lower right</documentation>
  </annotation>
</element>
<complexType name="BoundingBoxGeoOffsetType">
  <sequence>
    <element name="latitudeOffsetTopLeft" type="double"/>
    <element name="longitudeOffsetTopLeft" type="double"/>
    <element name="latitudeOffsetBottomRight" type="double"/>
    <element name="longitudeOffsetBottomRight" type="double"/>
  </sequence>
</complexType>
<complexType name="BoundingBoxGeoOffsetPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:BoundingBoxGeoOffset"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->

```

```

<element name="VMTIResult" type="ow2:VMTIResultType">
  <annotation>
    <documentation>Provides result elements for a Frame-based VMTI
observation.</documentation>
  </annotation>
</element>
<complexType name="VMTIResultType">
  <sequence>
    <element name="vmtiLDS" type="ow2:VMTIPropertyType"/>
    <element name="target" type="ow2:VTargetPackPropertyType" minOccurs="0"
maxOccurs="unbounded"/>
  </sequence>
</complexType>
<complexType name="VMTIResultPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:VMTIResult"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Velocity" type="ow2:VelocityType">
  <annotation>
    <documentation>This class provides velocity data about a moving
object.</documentation>
  </annotation>
</element>
<complexType name="VelocityType">
  <sequence>
    <element name="xComponent" type="double">
      <annotation>
        <documentation>West to East</documentation>
      </annotation>
    </element>
    <element name="yComponent" type="double">
      <annotation>
        <documentation>South to North</documentation>
      </annotation>
    </element>
    <element name="zComponent" type="double">
      <annotation>
        <documentation>vertical velocity</documentation>
      </annotation>
    </element>
    <element name="sigmaX" type="double" minOccurs="0">
      <annotation>
        <documentation>standard deviation</documentation>

```

```

    </annotation>
  </element>
  <element name="sigmaY" type="double" minOccurs="0">
    <annotation>
      <documentation>standard deviation</documentation>
    </annotation>
  </element>
  <element name="sigmaZ" type="double" minOccurs="0">
    <annotation>
      <documentation>standard deviation</documentation>
    </annotation>
  </element>
  <element name="rhoXY" type="double" minOccurs="0">
    <annotation>
      <documentation>correlation coefficient for &lt;&gt;Component
elements</documentation>
    </annotation>
  </element>
  <element name="rhoXZ" type="double" minOccurs="0">
    <annotation>
      <documentation>correlation coefficient for &lt;&gt;Component
elements</documentation>
    </annotation>
  </element>
  <element name="rhoYZ" type="double" minOccurs="0">
    <annotation>
      <documentation>correlation coefficient for &lt;&gt;Component
elements</documentation>
    </annotation>
  </element>
</sequence>
</complexType>
<complexType name="VelocityPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:Velocity"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
<!-- ===== -->
<element name="Location" type="ow2:LocationType">
  <annotation>
    <documentation>This class provides geo coordinates for a point on or near the
surface of the Earth.</documentation>
  </annotation>
</element>
<complexType name="LocationType">

```

```

<sequence>
  <element name="position" type="gml:PointPropertyType" minOccurs="0"/>
  <element name="height" type="double" minOccurs="0"/>
  <element name="sigmaLatitude" type="double" minOccurs="0">
    <annotation>
      <documentation>standard deviation</documentation>
    </annotation>
  </element>
  <element name="sigmaLongitude" type="double" minOccurs="0">
    <annotation>
      <documentation>standard deviation</documentation>
    </annotation>
  </element>
  <element name="sigmaHeight" type="double" minOccurs="0">
    <annotation>
      <documentation>standard deviation</documentation>
    </annotation>
  </element>
  <element name="rhoLatLon" type="double" minOccurs="0">
    <annotation>
      <documentation>correlation coefficient between position
elements</documentation>
    </annotation>
  </element>
  <element name="rhoLatHeight" type="double" minOccurs="0">
    <annotation>
      <documentation>correlation coefficient between position
elements</documentation>
    </annotation>
  </element>
  <element name="rhoLonHeight" type="double" minOccurs="0">
    <annotation>
      <documentation>correlation coefficient between position
elements</documentation>
    </annotation>
  </element>
</sequence>
</complexType>
<complexType name="LocationPropertyType">
  <sequence minOccurs="0">
    <element ref="ow2:Location"/>
  </sequence>
  <attributeGroup ref="gml:AssociationAttributeGroup"/>
</complexType>
</schema>

```

8.6 bookmark.xsd

```

<?xml version="1.0" encoding="UTF-8"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:ow2="http://www.opengis.net/ows8/of/tracking/gmtivmti"
  targetNamespace="http://www.opengis.net/ows8/of/tracking/gmtivmti"
  elementFormDefault="qualified" attributeFormDefault="unqualified">
  <import namespace="http://www.opengis.net/gml/3.2"
  schemaLocation="http://schemas.opengis.net/gml/3.2.1/gml.xsd"/>
  <include schemaLocation="vmti0903.2.xsd"/>
  <include schemaLocation="4607_GMTI.xsd"/>
  <!-- ===== -->
  <element name="Bookmark" type="ow2:BookmarkType"
  substitutionGroup="gml:AbstractFeature">
    <annotation>
      <documentation>The bookmark acts as a linker between tracks, verified targets and
frames (evidence).</documentation>
    </annotation>
  </element>
  <complexType name="BookmarkType">
    <complexContent>
      <extension base="gml:AbstractFeatureType">
        <sequence>
          <element name="trackUUID" type="string"/>
          <element name="vmtiEvidence" type="gml:ReferenceType" minOccurs="0"
maxOccurs="unbounded">
            <annotation>
              <appinfo>
                <gml:targetElement>ow2:Frame</gml:targetElement>
              </appinfo>
            </annotation>
          </element>
          <element name="gmtiEvidence" type="gml:ReferenceType" minOccurs="0"
maxOccurs="unbounded">
            <annotation>
              <appinfo>
                <gml:targetElement>ow2:Dwell</gml:targetElement>
              </appinfo>
            </annotation>
          </element>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <complexType name="BookmarkPropertyType">

```

```
<sequence minOccurs="0">  
  <element ref="ow2:Bookmark"/>  
</sequence>  
<attributeGroup ref="gml:AssociationAttributeGroup"/>  
</complexType>  
</schema>
```

Bibliography

- OGC07-036 OGC (2007): OpenGIS® Geography Markup Language (GML) Encoding Standard; OGC 07-036
- OGC11-113 Simonis, I. (2011): OWS-8 Information Model for Moving Target Indicators and Moving Object Bookmarks (Engineering Report). OGC 11-113
- OGC11-134 Cass, R. (2011): OWS-8 Tracking: Moving Target Indicator Process, Workflows and Implementation Results ER. OGC 11-134
- NATO4609v3 NATO (2009) STANAG 4609 JAIS (Edition 3) - NATO Digital Motion Imagery Standard, *NATO*
- MISB0601.4 MISB (2010), 'MISB STD 0601.4: UAS Datalink Local Metadata Set', MISB, Technical report, MISB.