



State of IWXXM

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Overview

- IWXXM Status
- Why IWXXM
- SWIM & AIXM/FIXM Linkages
- Who is 'Working' IWXXM
- IWXXM Issues
- Global Implementation

ICAO Meteorological Exchange Model (IWXXM)

- ICAO Weather Exchange Model
 - ✦ Format for *exchanging* Wx information in XML
 - NOT for “visualizing”
- Extensible* Markup Language (XML)
 - ✦ XML emphasize simplicity, generality and usability across the internet and applications
 - ✦ Is a markup language which defines a set of rules for encoding documents
- Defined by free open standards
 - ✦ International Organization for Standardization (ISO)
 - ✦ Open Geospatial Consortium (OGC)



IWXXM Status

- IWXXM version 2.1 implemented April 2017
- IWXXM version 3.0 to be implemented March 2019
 - Full version updates to align with ICAO Annex 3 amendment cycle
 - Full alignment difficult due to WMO change processes
- ICAO Annex 3
 - November 2016, Amendment 77
 - ✦ Allows the exchange of IWXXM products as *'recommended'* practice

IWXXM Status

- Products include:
 - ✦ TAF
 - ✦ METAR & SPECI
 - ✦ SIGMET
 - ✦ AIRMET
 - ✦ Volcanic Ash Advisory
 - ✦ Tropical Cyclone Advisory
 - ✦ *Space Wx
 - » Effective November 2018
 - ✦ SIGWX
 - » “Test” status by 2021, Operational 2022
 - ✦ **Future – Data centric rather than Product Centric**

IWXXM Status

- ICAO Annex 3
 - November 2020 Amendment 79
 - ✦ Will make the [International] exchange of IWXXM products a *'mandatory'* practice
- Two main phases of implementation
 - Now through November 2020
 - ✦ Get the 9 legacy Annex 3 products into IWXXM 'as-is'
 - 2021 & beyond: Add Value
 - ✦ Better resolution
 - ✦ "Information Service" based concept



Why IWXXM?

- Many ICAO SARPs and formats are based on limited technical capabilities of legacy communications systems
 - ✦ Improve ‘Business Rules’ & Regulations
- XML, specifically IWXXM, overcomes these technical limitations and enables the exchange of more meaningful (weather) information
- IWXXM also utilizes the World Meteorological Organization’s (WMO) METeorological Community Exchange Model (METCE)
- Compatible with System Wide Information Management (SWIM) Concepts



Why IWXXM?

- Why would we move from a 1-2 line TAC METAR to a 5-page IWXXM METAR?
 - ✦ Enables a commonality across the aviation system domains (e.g., weather, flight, and aeronautical information)
 - ✦ Allows the geographic position and time of information to be easily integrated with multiple systems
 - ✦ Supports ‘modernization’ of MET information
 - Higher resolution met information
 - User-definable visualization and integration
 - Modern/future communications infrastructure
 - ✦ *Separates the **exchange** of the information from the **use** of the information



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Why IWXXM

- Essentially makes information “digital”
 - ✦ Supports multiple uses, applications, and integration
 - Unlike BUFR or GRIB; follows International Standards
- TAC supports human reading only
- IWXXM supports multiple formats & uses
 - ✦ Digital (machine to machine)
 - Flight planning systems
 - Integration with decision support tools
 - Graphical output
 - ✦ Mapping integration
 - Google maps, GPS
 - ✦ Text output/Human consumption



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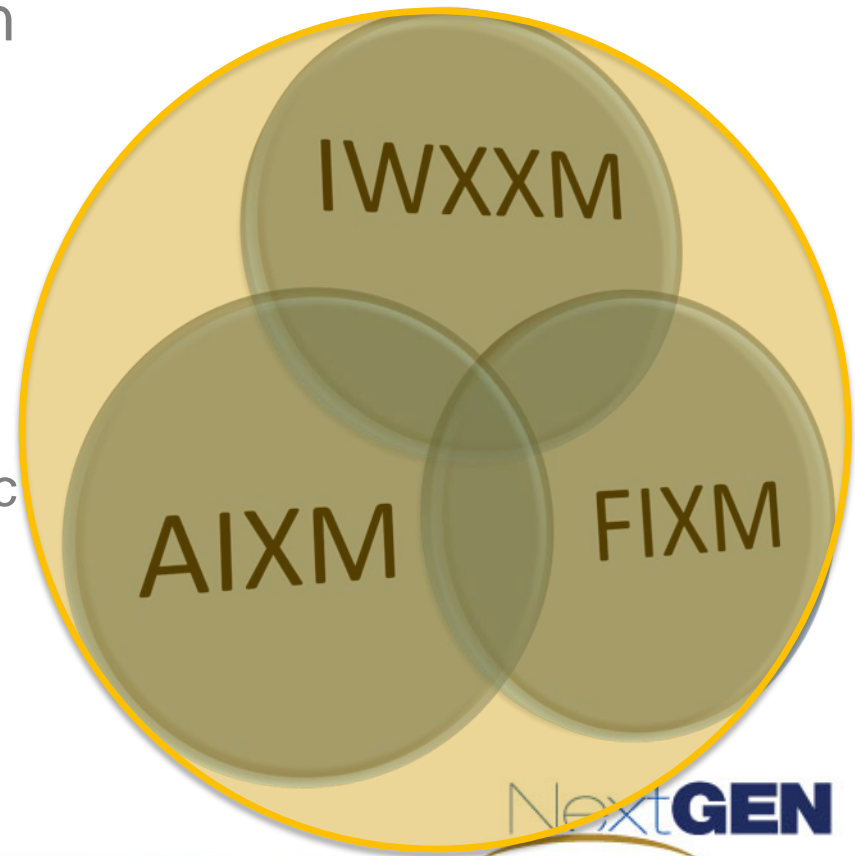
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The 'Other' XMs

- One of three information sets used by aviation
 - ✦ Aeronautical Information (AIXM)
 - Routes, Aerodromes, FIRs
 - Traffic, Traffic Management
 - NOTAM
 - Airspace Restrictions
 - ✦ Flight Information (FIXM)
 - Flight Plan
 - Aircraft type/performance
 - Route preferences
 - ✦ Weather Information (IWXXM)

Interdependences of Information Exchange

- IWXXM is a key enabler of SWIM concepts
 - ✦ Improved Met information with IWXXM in SWIM
 - ✦ SWIM core services will enable systems
 - Request and receive information when needed
 - Subscriptions for automatic receipt
 - Publishing information & services as appropriate

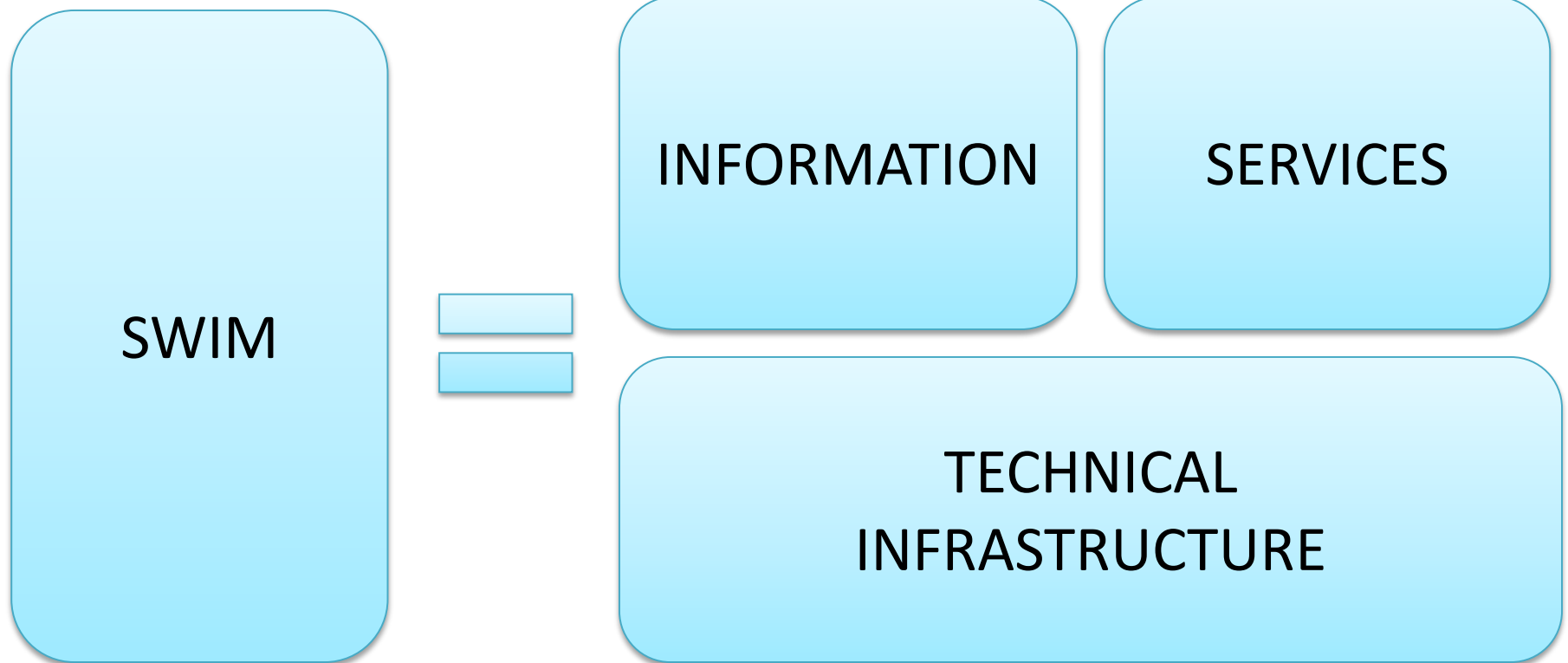


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System Wide Information Management

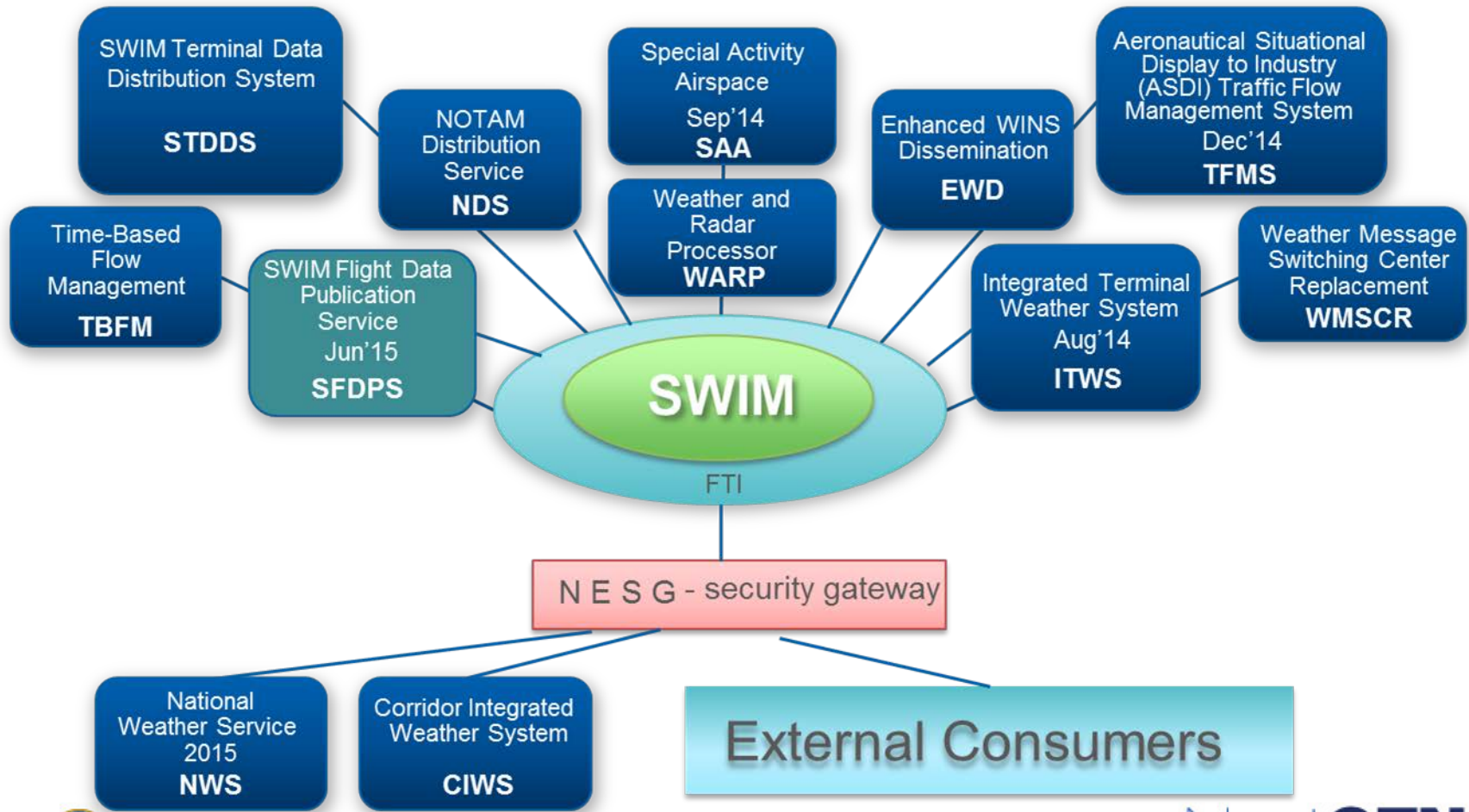
Definition



SWIM

- SWIM
 - ✦ One standard “connection” that uses universal programming language across all data
 - ✦ In the past, a new connection was created every time someone wanted to access a set of data
- SWIM allows more efficient data sharing among aviation stakeholders
 - ✦ Streamlines connections among different systems; can access multiple systems through one connection
 - ✦ SWIM utilizes standard data formats nationally and globally

SWIM consists of standards, infrastructure and governance making available a wide range of capabilities through a common infrastructure of reusable and shared services



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Who is 'Working' IWXXM Issues?

- ICAO Meteorology Panel
 - ✦ Working Groups – MRI & MISD
 - Defines MET informational needs and requirements for aviation
 - ✦ Working Group – Meteorological Information Exchange (WG-MIE)
 - Defines & implements the exchange of MET info
 - Manages the MET component of SWIM
- World Meteorological Organization
 - ✦ 'Owns' Meteorological codes (BUFR, METAR, etc.)
 - ✦ TT-AvXML develops the schema

METP WG-MIE

- Operational Issues
 - ✦ How to handle missing information elements
 - ✦ Enabling high resolution information
 - ✦ Third party “translation”
- Policy and Governance Issues
 - ✦ How & When QA occurs
 - ✦ Security, Authorized users,
 - ✦ AMHS or skip to IP
- WG-MRI
 - ✦ Re-thinking the “airport observation”
 - Hourly, single point METAR outdated

Who is 'Working' IWXXM Issues?

- ICAO Information Management Panel
 - ✦ Developing 'Information Services Concept of Operations'
 - Defines SWIM Information Services
 - ✦ 'Products' go away
 - ✦ Information Services and Data Centric
- ICAO Aeronautical Communications Panel
 - ✦ IWXXM messages won't transmit over the Aeronautical Fixed Telecommunications Network (AFTN)
 - ✦ IWXXM Messages will be exchanged over Aeronautical Message Handling System (AMHS)

ICAO Information Management Panel

- A global approach on information management (IM) is essential to ensure global interoperability and standardization across all data domains and to support activities such as
 - ✦ Flight and flow - information for a collaborative environment (FF-ICE)
 - ✦ Trajectory Based Operations (TBO)
 - ✦ NOTAM system review
- Overall ICAO SWIM development
 - ✦ Integrating AIXM, FIXM, and IWXXM

ICAO IMP

- Services Working Group
 - ✦ “Information Services” Concept Development
 - ✦ “Information Services” Requirements
 - ✦ SWIM Concept Development
- Architecture Working Group
 - ✦ SARP development
 - ✦ SWIM Manual
 - ✦ Change Configuration Board (AIXM)
- Governance Working Group
 - ✦ Authorization/Access/Security
 - ✦ Validation
 - ✦ Interoperability



IWXXM Issues Being Addressed

- Use & standards for the inclusion of ‘extensions’
 - ✦ Enabling ‘State’ Extensions
 - Key concept of ‘XML’
 - Agreed to by METP Oct 2016
 - ✦ Users have stated IWXXM must provide added value over Traditional Alphanumeric Characters (TAC)
- “Freezing” TAC
 - ✦ METP agreed no further development of Annex 3 TAC product templates
 - Only for clear safety of flight issues

IWXXM Issues Being Addressed

- Guidance to ICAO Regions on transitioning to IWXXM
 - ✦ When and where translation from TAC to IWXXM occurs
 - Only translate once
 - How to deal with both TAC and IWXXM messages in the global communications system
 - Where and who 'translates'
 - Partially translated messages
 - ✦ Validation of IWXXM messages
 - ✦ Roles of Regional OPMET Databanks and Centers
 - ✦ Developing Regional transition plans and training workshops

IWXXM Issues Being Addressed

- Information Resolution Improvements
 - ✦ IWXXM has potential for more detail than TAC messages
 - ✦ ‘Better’ information in IWXXM vs TAC
 - Will encourage adoption and transition to IWXXM
 - ✦ Example:
 - METAR uses rounded values
 - ✦ Measured overcast cloud height of 990 feet reported as OVC009
 - ✦ IWXXM can report both the METAR rounded value, as well as the actual measured value for better precision in support of Trajectory Based Operations (TBO)

Global Implementation

- International exchange of IWXXM messages expected by 2020
 - ✦ Full implementation of SWIM much later than this
- ICAO Regions Planning and Implementation Regional Groups (PIRG)
 - ✦ Guidance on transition from TAC to IWXXM
 - ✦ How does the world work with both IWXXM and TAC messages?

Assimilation & Adoption

- Yes, Many States will not be able to transition to IWXXM by November 2020.
- Two lanes:
 - ✦ In the foreseeable future, some users will remain with TAC, i.e., the slow lane
 - ✦ Other, high-end users will be in the fast lane
- Best equipped, best served
 - ✦ Those who adopt will reap benefits



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TAC vs IWXXM

- Traditional Alphanumeric Code (TAC)

METAR YUDO 221630Z 24004MPS 0600 R12/1000U DZ FG SCT010 OVC020
17/16 Q1018 BECMG TL1700 0800 FG BECMG AT1800 9999 NSW

● IWXXM

```
<iwxxm:METAR xmlns:iwxxm="http://icao.int/iwxxm/1.0" mlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gml="http://www.opengis.net/gml/3.2" xmlns:om="http://www.opengis.net/om/2.0"
  xmlns:metce="http://def.wmo.int/metce/2013"
  xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"
  xmlns:sf="http://www.opengis.net/sampling/2.0"
  xmlns:saf="http://icao.int/saf/1.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://icao.int/iwxxm/1.0 http://schemas.wmo.int/iwxxm/1.0/iwxxm.xsd
  http://def.wmo.int/metce/2013 http://schemas.wmo.int/metce/1.0/metce.xsd"
  gml:id="metar-YUDO-20120822163000Z"
  status="NORMAL"
  automatedStation="false">
<iwxxm:observation>
  <om:OM_Observation gml:id="obs-03839-20120824T12Z">
    <om:type xlink:href="http://codes.wmo.int/49-2/observation-type/IWXXM/1.0/MeteorologicalAerodromeObservation" xlink:title="Aerodrome
Observation"/>
    <!-- time at which the observation actually occurred -->
    <om:phenomenonTime>
      <gml:TimeInstant gml:id="ti-201208221630Z">
        <gml:timePosition>2012-08-22T16:30:00Z</gml:timePosition>
      </gml:TimeInstant>
    </om:phenomenonTime>
    <!-- time at which the results of the observation were made available (10-minutes later) -->
    <om:resultTime>
      <gml:TimeInstant gml:id="ti-201208221640Z">
        <gml:timePosition>2012-08-22T16:40:00Z</gml:timePosition>
      </gml:TimeInstant>
    </om:resultTime>
    <om:procedure>
      <metce:Process gml:id="p-49-2-metar">
        <gml:description>WMO No. 49 Volume 2 Meteorological Service for International Air Navigation APPENDIX 3 TECHNICAL SPECIFICATIONS
RELATED TO METEOROLOGICAL OBSERVATIONS AND REPORTS</gml:description>
```



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</metce:Process>
  </om:procedure>
  <om:observedProperty xlink:href="http://codes.wmo.int/49-2/observable-property/MeteorologicalAerodromeObservation" xlink:title="Observed
properties for METAR and SPECI (Meteorological Aerodrome Reports)"/>
  <om:featureOfInterest>
    <!-- featureOfInterest type and shape must refer to a point -->
    <sams:SF_SpatialSamplingFeature gml:id="sampling-point-03839">
      <sf:type xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingPoint" xlink:title="SF_SamplingPoint"/>
      <sf:sampledFeature>
        <!-- The aerodrome at which this observation took place -->
        <saf:Aerodrome gml:id="uuid.dd062d88-3e64-4a5d-bebd-89476db9ebea">
          <gml:identifier codeSpace="urn:uuid:">dd062d88-3e64-4a5d-bebd-89476db9ebea</gml:identifier>
          <saf:designator>YUDO</saf:designator>
          <saf:name>DONLON/INTERNATIONAL</saf:name>
          <saf:locationIndicatorICAO>YUDO</saf:locationIndicatorICAO>
          <saf:ARP>
            <gml:Point gml:id="pt52284-32035" srsName="http://www.opengis.net/def/crs/EPSSG/0/4326">
              <gml:pos>12.34 -12.34</gml:pos>
            </gml:Point>
          </saf:ARP>
        </saf:Aerodrome>
      </sf:sampledFeature>
      <sams:shape>
        <!-- This is where the observation took place, assumed to be representative of the entire aerodrome -->
        <gml:Point gml:id="point-5225-3201" srsDimension="2" srsName="http://www.opengis.net/def/crs/EPSSG/0/4326">
          <gml:pos>12.34 -12.34</gml:pos>
        </gml:Point>
      </sams:shape>
    </sams:SF_SpatialSamplingFeature>
  </om:featureOfInterest>
  <!-- The result of the observation -->
  <om:result>
    <iwxxm:MeteorologicalAerodromeObservationRecord gml:id="or1" cloudAndVisibilityOK="false">
      <iwxxm:airTemperature uom="Cel">17.0</iwxxm:airTemperature>
      <iwxxm:dewpointTemperature uom="Cel">16.0</iwxxm:dewpointTemperature>
      <iwxxm:qnh uom="hPa">1018</iwxxm:qnh>
      <iwxxm:surfaceWind>
        <iwxxm:AerodromeSurfaceWind variableDirection="false">
          <iwxxm:meanWindDirection uom="deg">240</iwxxm:meanWindDirection>
          <iwxxm:meanWindSpeed uom="m/s">4.0</iwxxm:meanWindSpeed>
        </iwxxm:AerodromeSurfaceWind>
      </iwxxm:surfaceWind>
    </iwxxm:MeteorologicalAerodromeObservationRecord>
  </om:result>

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</iwxxm:AerodromeSurfaceWind>
  </iwxxm:surfaceWind>
  <iwxxm:visibility>
    <iwxxm:AerodromeHorizontalVisibility>
      <iwxxm:prevailingVisibility uom="m">600</iwxxm:prevailingVisibility>
    </iwxxm:AerodromeHorizontalVisibility>
  </iwxxm:visibility>
  <iwxxm:rvr>
    <iwxxm:AerodromeRunwayVisualRange pastTendency="UPWARD">
      <iwxxm:runway>
        <saf:RunwayDirection gml:id="uuid.b1947d80-b7f7-11e2-9e96-0800200c9a66">
          <gml:identifier codeSpace="urn:uuid:">b1947d80-b7f7-11e2-9e96-0800200c9a66</gml:identifier>
          <saf:designator>12</saf:designator>
          <saf:trueBearing uom="deg">118.23</saf:trueBearing>
          <saf:elevationTDZ uom="m">20.5</saf:elevationTDZ>
          <saf:usedRunway>
            <saf:Runway gml:id="uuid.2f864fc0-b7f8-11e2-9e96-0800200c9a66">
              <gml:identifier codeSpace="urn:uuid:">2f864fc0-b7f8-11e2-9e96-0800200c9a66</gml:identifier>
              <saf:designator>12/30</saf:designator>
              <saf:associatedAirportHeliport xlink:href="#uuid.dd062d88-3e64-4a5d-bebd-89476db9ebea"/>
            </saf:Runway>
          </saf:usedRunway>
        </saf:RunwayDirection>
      </iwxxm:runway>
      <iwxxm:meanRVR uom="m">1000</iwxxm:meanRVR>
    </iwxxm:AerodromeRunwayVisualRange>
  </iwxxm:rvr>
  <iwxxm:presentWeather xlink:href="http://codes.wmo.int/306/4678/DZ" xlink:title="Moderate Drizzle"/>
  <iwxxm:presentWeather xlink:href="http://codes.wmo.int/306/4678/FG" xlink:title="Fog"/>
  <iwxxm:cloud>
    <iwxxm:AerodromeObservedClouds>
      <iwxxm:layer>
        <iwxxm:CloudLayer>
          <iwxxm:amount xlink:href="http://codes.wmo.int/bufr4/codeflag/0-20-008/2" xlink:title="Scattered"/>
          <iwxxm:base uom="ft">1000</iwxxm:base>
        </iwxxm:CloudLayer>
      </iwxxm:layer>
      <iwxxm:layer>
        <iwxxm:CloudLayer>

```



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```

<iwxxm:amount xlink:href="http://codes.wmo.int/bufr4/deflag/0-20-008/4" xlink:title="Overcast"/>
    <iwxxm:base uom="ft">2000</iwxxm:base>
    <iwxxm:CloudLayer>
    </iwxxm:CloudLayer>
    <iwxxm:layer>
    </iwxxm:layer>
    <iwxxm:AerodromeObservedClouds>
    </iwxxm:cloud>
    </iwxxm:MeteorologicalAerodromeObservationRecord>
</om:result>
</om:OM_Observation>
</iwxxm:observation>
<iwxxm:trendForecast>
    <om:OM_Observation gml:id="trend-fcst-1">
    <om:type xlink:href="http://codes.wmo.int/49-2/observation-type/IWXXM/1.0/MeteorologicalAerodromeTrendForecast" xlink:title="Aerodrome Trend
Forecast"/>
    <!-- time at which the forecast conditions actually occur -->
    <om:phenomenonTime>
    <gml:TimePeriod gml:id="tp-201208221630Z-201208221700Z">
    <gml:beginPosition>2012-08-22T16:30:00Z</gml:beginPosition>
    <gml:endPosition>2012-08-22T17:00:00Z</gml:endPosition>
    </gml:TimePeriod>
    </om:phenomenonTime>
    <!-- time at which the results of the observation were made available -->
    <om:resultTime xlink:href="#ti-201208221640Z"/>
    <om:procedure xlink:href="#p-49-2-metar" xlink:title="WMO 49-2 METAR procedure"/>
    <om:observedProperty xlink:href="http://codes.wmo.int/49-2/observable-property/MeteorologicalAerodromeTrendForecast" xlink:title="METAR trend
forecast properties"/>
    <om:featureOfInterest xlink:href="#sampling-point-03839"/>
    <om:result>
    <iwxxm:MeteorologicalAerodromeTrendForecastRecord gml:id="trend-fcst-record-03839-201208221630Z-201208221700Z"
changeIndicator="BECOMING" cloudAndVisibilityOK="false">
    <iwxxm:prevailingVisibility uom="m">800</iwxxm:prevailingVisibility>
    <iwxxm:forecastWeather xlink:href="http://codes.wmo.int/306/4678/FG" xlink:title="Fog"/>
    </iwxxm:MeteorologicalAerodromeTrendForecastRecord>
    </om:result>
    </om:OM_Observation>
</iwxxm:trendForecast>
<iwxxm:trendForecast>
<om:OM_Observation gml:id="trend-fcst-2">
    <om:type xlink:href="http://codes.wmo.int/49-2/observation-type/IWXXM/1.0/MeteorologicalAerodromeTrendForecast" xlink:title="Aerodrome Trend
Forecast"/>
    <!-- time at which the forecast conditions actually occur -->

```



```

<om:phenomenonTime>
  <gml:TimePeriod gml:id="tp-201208221800Z-201208221900Z">
    <gml:beginPosition>2012-08-22T18:00:00Z</gml:beginPosition>
    <gml:endPosition>2012-08-22T19:00:00Z</gml:endPosition>
  </gml:TimePeriod>
</om:phenomenonTime>
<!-- time at which the results of the observation were made available -->
<om:resultTime xlink:href="#ti-201208221640Z"/>
<om:procedure xlink:href="#p-49-2-metar" xlink:title="WMO 49-2 METAR procedure"/>
<om:observedProperty xlink:href="http://codes.wmo.int/49-2/observable-property/MeteorologicalAerodromeTrendForecast" xlink:title="METAR trend
forecast properties"/>
<om:featureOfInterest xlink:href="#sampling-point-03839"/>
<om:result>
  <iwxxm:MeteorologicalAerodromeTrendForecastRecord gml:id="trend-fcst-record-03839-201208221800Z-201208221900Z"
changeIndicator="BECOMING" cloudAndVisibilityOK="false">
    <iwxxm:prevailingVisibility uom="km">10</iwxxm:prevailingVisibility>
    <iwxxm:prevailingVisibilityOperator>ABOVE</iwxxm:prevailingVisibilityOperator>
    <iwxxm:forecastWeather nilReason="http://codes.wmo.int/common/nil/nothingOfOperationalSignificance"/>
  </iwxxm:MeteorologicalAerodromeTrendForecastRecord>
</om:result>
</om:OM_Observation>
</iwxxm:trendForecast>
</iwxxm:METAR>

```

