*International Civil Aviation Organization*

**FIFTEENTH MEETING OF THE ASIA/PACIFIC METEOROLOGICAL INFORMATION EXCHANGE WORKING GROUP (MET/IE WG/15)**

Bangkok, Thailand, 20 – 22 March 2017

**Agenda Item 4: Planning and implementation of digital exchange of meteorological information**

# THE JOINT TEST ON IWXXM EXCHANGE OVER EXTENDED AMHS AMONG HONG KONG CHINA, THAILAND AND SINGAPORE

(Presented by Hong Kong China, Thailand and Singapore)

**SUMMARY**

This paper presents the preparation, outcome and lesson learned of the joint test on IWXXM exchange over extended AMHS conducted among Hong Kong, Thailand and Singapore and plans on further tests to be carried out in future.

## 1. INTRODUCTION

1.1 The exchange of OPMET in IWXXM[1] format is expected to become a standard in Amendment 78 to ICAO Annex 3 and be applicable in 2020. The "*Guidelines for the Implementation of OPMET data exchange using IWXXM*" (hereafter the "Guidelines") recommended the use of Extended AMHS[2] connections between States for OPMET bulletins exchange in IWXXM format. Following the discussion in MET/IE WG/14, Hong Kong China, Thailand and Singapore agreed to conduct joint tests on IWXXM exchange over Extended AMHS. Preparation work started as early as July 2016 and actual tests were conducted between November 2016 and March 2017.

## 2. DISCUSSION

### Preparation of IWXXM OPMET messages

2.1 The Hong Kong Observatory (HKO) is the originating meteorological station responsible for the preparation of live IWXXM bulletins for the test. Instead of preparing the bulletins directly by the originating personnel, HKO developed a software translator for automatic TAC-to-IWXXM OPMET message conversion to demonstrate the feasibility to translate TAC[3] OPMET messages into their IWXXM counterparts. The translator includes a parser/decoder to extract the content of different elements as stipulated in relevant templates in ICAO Annex 3, a converter/consolidator to change decoded information into the form required by the IWXXM schema with the introduction of additional metadata as necessary, and an encoder to encode the information in IWXXM format. Figure 1 shows the major processes performed by the HKO TAC-to-IWXXM

[1] IWXXM: ICAO Meteorological Information Exchange Model
[2] AMHS: ATS Message Handling System
[3] TAC: Traditional Alphanumeric Codes

OPMET message translator. Sample outputs of METAR, TAF and SIGMET in IWXXM format generated by the translator were shown in Attachment 1.

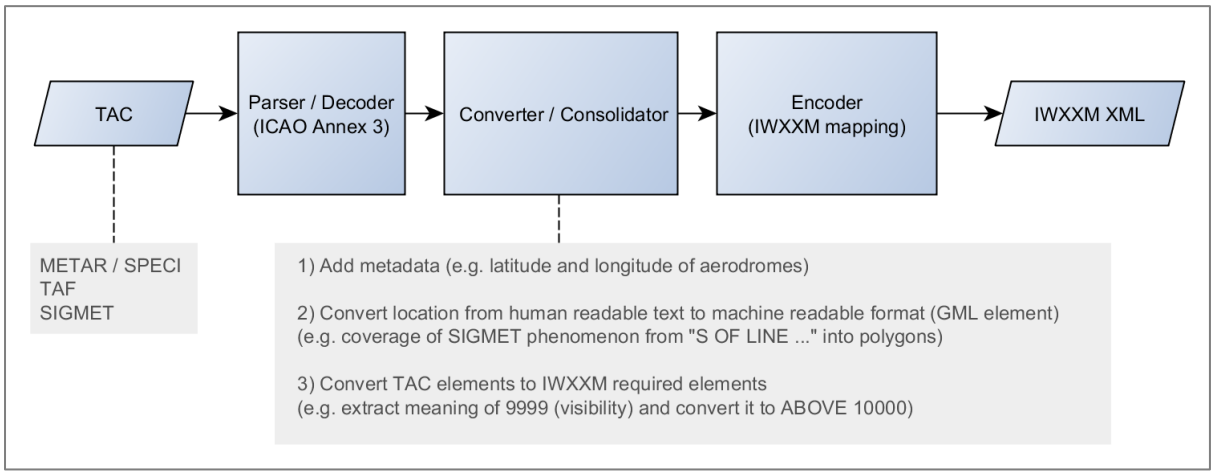


Figure 1: Flow diagram of TAC-to-IWXXM OPMET message translation software developed by HKO

**<u>Exchange of IWXXM bulletins between Hong Kong and Thailand</u>**

2.2 To mimic the function of a "Data Switch" as defined in the Guidelines in the test, AMHS connectivity supporting Extended AMHS service is required between the ROBEX centres of Hong Kong, China (Hong Kong Civil Aviation Department (HKCAD)), Thailand (Aeronautical Radio of Thailand Ltd. (AEROTHAI)) and Singapore (Civil Aviation Authority Singapore (CAAS)). AEROTHAI and HKCAD have joined hands to set up a new direct testing connection using SNDCF[4] over VPN[5] between testing Extended AMHS Message Transfer Agents (MTAs) in Hong Kong (HKG MTA) and Bangkok (BKK MTA) to ensure the operational AMHS circuit would not be affected during the test. A schematic diagram showing the configuration of the testing environment between HKG MTA and BKK MTA is shown in Figure 2.

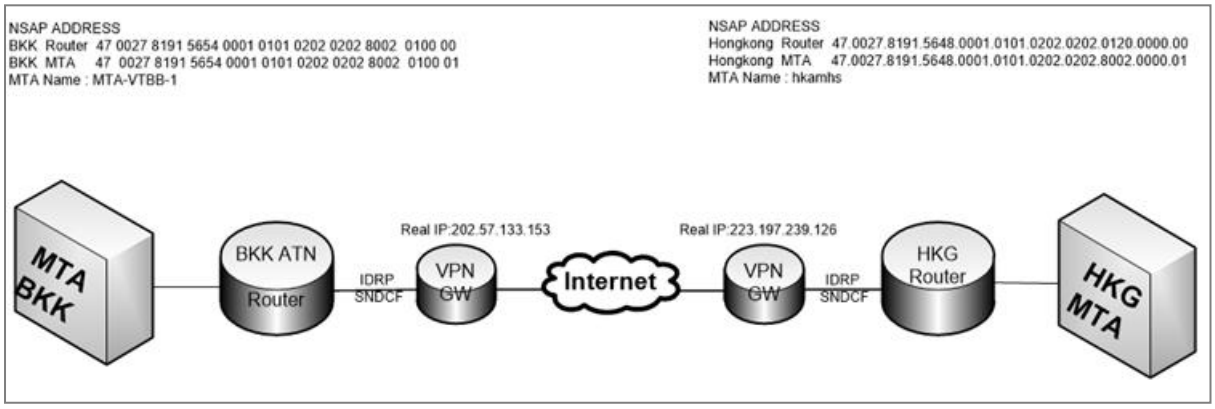


Figure 2: Configuration of the testing environment between BKK and HKG MTAs

2.3 The IWXXM bulletins prepared by HKO were sent to HKCAD, the ROBEX centre of Hong Kong, China, via a Simple Object Access Protocol (SOAP) interface to the testing AMHS system which is capable for handling Extended AMHS services. Each of the received IWXXM

[4] SNDCF: Sub Network Dependent Convergence Function
[5] VPN: Virtual Private Network

bulletins would be checked for integrity by AEROTHAI and selected IWXXM message would be used to prepare another AMHS message manually by AEROTHAI and passed back to HKO.

2.4 With the coordinated efforts of AEROTHAI and HKCAD, HKO had successfully exchanged the first IWXXM SIGMET message with AEROTHAI on 14 February 2017.

**Period of intensive exchange between Hong Kong and Thailand**

2.5 To test the reliability of IWXXM exchange through Extended AMHS, an intensive exchange test was conducted between HKO and AEROTHAI during 7-9 March 2017. During this intensive exchange test, HKO sent live half-hourly IWXXM METAR bulletins and 6-hourly IWXXM TAF bulletins immediately after their TAC counterparts to AEROTHAI.

2.6 Section 4.1.5 of the Guidelines suggested that IWXXM bulletins could be compressed to save the bandwidths for transmission. The compressed IWXXM bulletin will then be transmitted with FTBP[6] of the Extended AMHS service. In this test, all IWXXM bulletins transmitted from HKO were compressed using the GZIP software which was considered adequate for compressing IWXXM bulletins in the third meeting of the WMO Task Team on Aviation XML in 2013[7].

2.7 During the period of intensive exchange test, HKO sent and AEROTHAI received successfully 101 METARs and 8 TAFs in IWXXM format. The measured transmission times between HKG and BKK MTAs were 1 second or less.

**IWXXM Message Exchange test between Thailand and Singapore**

2.8 In November 2016, Thailand and Singapore conducted an exchange test using IWXXM messages prepared by MSS. The IWXXM messages were sent with FTBP attachment. The exchange was conducted using P3 connection over VPN between AEROTHAI and MSS. The test was successfully concluded, validating the generation and exchange of IWXXM messages between Thailand and Singapore.

**Observations and follow up activities**

2.9 During the tests between Hong Kong, China and Thailand, it was observed that attachments of file size larger than 6 KB could not be exchanged between HKG and BKK MTAs. As the test environment was built on top of SNDCF over VPN instead of X.25 in the operational environment, further tests on other test environment like X.25-over-TCP (XOT) over VPN would be conducted to confirm whether the observed issues are related to the testing environment or otherwise.

2.10 Plans are underway for further tests in a more operational-like environment. Preparation for an end-to-end test on exchanging IWXXM bulletins between meteorological offices in Singapore and Hong Kong, China is also being made at the same time:

HKO ↔ HKCAD ↔ AEROTHAI ↔ CAAS ↔ MSS

MET Service ---------- ROBEX Centres ---------- MET Service

The test is expected to be conducted later this year. It is anticipated that the joint Hong Kong, China, Thailand and Singapore end-to-end IWXXM exchange test could not only reveal issues during actual

[6] FTBP: File Transfer Body Part
[7] Final report: http://www.wmo.int/pages/prog/www/ISS/Meetings/TT-AvXML_Montreal2013/TT-AvXML-3-FinalReport-Final.doc

implementation but also provide performance statistics and suggestions to optimize IWXXM implementation in APAC.

## 3. ACTION REQUIRED BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this papers; and

b) discuss any relevant matters as appropriate.

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**Attachment 1**

Bulletin 1: A sample SIGMET bulletin in IWXXM format generated by HKO TAC-to-IWXXM translator


```xml
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<collect:MeteorologicalBulletin gml:id="bulletin-201702060302Z"
xmlns:metce="http://def.wmo.int/metce/2013" xmlns:opm="http://def.wmo.int/opm/2013"
xmlns:aixm="http://www.aixm.aero/schema/5.1.1" xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns:gmd="http://www.isotc211.org/2005/gmd" xmlns:gsr="http://www.isotc211.org/2005/gsr"
xmlns:gss="http://www.isotc211.org/2005/gss" xmlns:gts="http://www.isotc211.org/2005/gts"
xmlns:gml="http://www.opengis.net/gml/3.2" xmlns:om="http://www.opengis.net/om/2.0"
xmlns:sam="http://www.opengis.net/sampling/2.0"
xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://icao.int/iwxxm/2.0
http://schemas.wmo.int/iwxxm/2.0/iwxxm-collect.xsd http://def.wmo.int/metce/2013
http://schemas.wmo.int/metce/1.2/metce.xsd http://www.opengis.net/samplingSpatial/2.0
http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd"
xmlns:collect="http://def.wmo.int/collect/2014" xmlns:iwxxm="http://icao.int/iwxxm/2.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <collect:meteorologicalInformation>
    <iwxxm:SIGMET gml:id="sigmet-VHHK-201702060300Z" permissibleUsage="OPERATIONAL"
translatedBulletinID="WSSS20VHHH060258" translatedBulletinReceptionTime="2017-02-06T14:37:52Z"
translationCentreDesignator="VHHH" translationCentreName="Hong Kong Observatory"
translationTime="2017-02-06T07:04:59Z" status="NORMAL">
     <!-- VHHK SIGMET 1 VALID 060300/060700 VHHH- VHHK HONG KONG FIR SEV TURB FCST S OF N2030
FL220/390 MOV E 10KT WKN= -->
     <iwxxm:issuingAirTrafficServicesUnit>
       <aixm:Unit gml:id="fir-VHHK">
         <aixm:timeSlice>
           <aixm:UnitTimeSlice gml:id="fir-VHHK-ts">
             <gml:validTime/>
             <aixm:interpretation>BASELINE</aixm:interpretation>
             <aixm:name>HONG KONG FIR</aixm:name>
             <aixm:type>FIC</aixm:type>
             <aixm:designator>VHHK</aixm:designator>
           </aixm:UnitTimeSlice>
         </aixm:timeSlice>
       </aixm:Unit>
     </iwxxm:issuingAirTrafficServicesUnit>
     <iwxxm:originatingMeteorologicalWatchOffice>
       <aixm:Unit gml:id="mwo-VHHH">
         <aixm:timeSlice>
           <aixm:UnitTimeSlice gml:id="mwo-VHHH-ts">
             <gml:validTime/>
             <aixm:interpretation>BASELINE</aixm:interpretation>
             <aixm:name>VHHH MWO</aixm:name>
             <aixm:type>MWO</aixm:type>
             <aixm:designator>VHHH</aixm:designator>
           </aixm:UnitTimeSlice>
         </aixm:timeSlice>
       </aixm:Unit>
     </iwxxm:originatingMeteorologicalWatchOffice>
     <iwxxm:sequenceNumber>1</iwxxm:sequenceNumber>
     <iwxxm:validPeriod>
       <gml:TimePeriod gml:id="tp-20170206T0300Z-20170206T0700Z">
         <gml:beginPosition>2017-02-06T03:00:00Z</gml:beginPosition>
         <gml:endPosition>2017-02-06T07:00:00Z</gml:endPosition>
       </gml:TimePeriod>
     </iwxxm:validPeriod>
     <iwxxm:phenomenon xlink:href="http://codes.wmo.int/49-2/SigWxPhenomena/SEV_TURB"/>
     <iwxxm:analysis>
       <om:OM_Observation gml:id="analysis1">
         <om:type xlink:href="http://codes.wmo.int/49-2/observation-
type/IWXXM/2.0/SIGMETEvolvingConditionAnalysis"/>
         <om:phenomenonTime nilReason="missing"/>
         <om:resultTime>
           <gml:TimeInstant gml:id="ti-20170206T0300Z">
             <gml:timePosition>2017-02-06T03:00:00Z</gml:timePosition>
           </gml:TimeInstant>
         </om:resultTime>
         <om:validTime xlink:href="#tp-20170206T0300Z-20170206T0700Z"/>
         <om:procedure>
           <metce:Process gml:id="p-49-2-sigmet">
```

```
            <gml:description>WMO No. 49 Volume 2 Meteorological Service for International Air
Navigation APPENDIX 6-1 TECHNICAL SPECIFICATIONS RELATED TO SIGMET
INFORMATION</gml:description>
          </metce:Process>
        </om:procedure>
        <om:observedProperty xlink:href="http://codes.wmo.int/49-2/observation-
type/IWXXM/2.0/SIGMETEvolvingConditionAnalysis"/>
        <om:featureOfInterest>
          <sams:SF_SpatialSamplingFeature gml:id="sampling-surface-hong-kong">
            <sam:type xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-
OM/2.0/SF_SamplingSurface"/>
            <sam:sampledFeature>
              <aixm:Airspace gml:id="fir-VHHK-a">
                <aixm:timeSlice>
                  <aixm:AirspaceTimeSlice gml:id="fir-VHHK-ats">
                    <gml:validTime/>
                    <aixm:interpretation>BASELINE</aixm:interpretation>
                    <aixm:type>FIR</aixm:type>
                    <aixm:designator>VHHK</aixm:designator>
                    <aixm:name>HONG KONG FIR</aixm:name>
                  </aixm:AirspaceTimeSlice>
                </aixm:timeSlice>
              </aixm:Airspace>
            </sam:sampledFeature>
            <sams:shape nilReason="withheld"/>
          </sams:SF_SpatialSamplingFeature>
        </om:featureOfInterest>
        <om:result>
          <iwxxm:EvolvingMeteorologicalCondition gml:id="fcst1" intensityChange="WEAKEN"
timeIndicator="FORECAST">
            <iwxxm:directionOfMotion uom="deg">90</iwxxm:directionOfMotion>
            <iwxxm:geometry>
              <aixm:AirspaceVolume gml:id="as1">
                <aixm:upperLimit uom="FL">390</aixm:upperLimit>
                <aixm:upperLimitReference>STD</aixm:upperLimitReference>
                <aixm:lowerLimit uom="FL">220</aixm:lowerLimit>
                <aixm:lowerLimitReference>STD</aixm:lowerLimitReference>
                <aixm:horizontalProjection>
                  <aixm:Surface gml:id="sfc1"
srsName="http://www.opengis.net/def/crs/EPSG/0/4326" srsDimension="2" axisLabels="Lat Lon"
uomLabels="deg deg">
                    <gml:polygonPatches>
                      <gml:PolygonPatch>
                        <gml:exterior>
                          <gml:LinearRing>
                            <gml:posList>20.5 111.5 20.5 117.1 16.67 114 19.5 111.5 20.5
111.5</gml:posList>
                          </gml:LinearRing>
                        </gml:exterior>
                      </gml:PolygonPatch>
                    </gml:polygonPatches>
                  </aixm:Surface>
                </aixm:horizontalProjection>
              </aixm:AirspaceVolume>
            </iwxxm:geometry>
            <iwxxm:speedOfMotion uom="[kn_i]">10</iwxxm:speedOfMotion>
          </iwxxm:EvolvingMeteorologicalCondition>
        </om:result>
      </om:OM_Observation>
    </iwxxm:analysis>
  </iwxxm:SIGMET>
 </collect:meteorologicalInformation>
<collect:bulletinIdentifier>A_WSSS20VHHH060258_C_VHHH_20170206030000.xml</collect:bulletinIden
tifier>
</collect:MeteorologicalBulletin>
```

Bulletin 2: A sample METAR bulletin in IWXXM format generated by HKO TAC-to-IWXXM translator


```xml
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<collect:MeteorologicalBulletin gml:id="bulletin-20170308233200Z"
xmlns:metce="http://def.wmo.int/metce/2013" xmlns:opm="http://def.wmo.int/opm/2013"
xmlns:aixm="http://www.aixm.aero/schema/5.1.1" xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns:gmd="http://www.isotc211.org/2005/gmd" xmlns:gsr="http://www.isotc211.org/2005/gsr"
xmlns:gss="http://www.isotc211.org/2005/gss" xmlns:gts="http://www.isotc211.org/2005/gts"
xmlns:gml="http://www.opengis.net/gml/3.2" xmlns:om="http://www.opengis.net/om/2.0"
xmlns:sam="http://www.opengis.net/sampling/2.0"
xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://icao.int/iwxxm/2.0
http://schemas.wmo.int/iwxxm/2.0/iwxxm-collect.xsd http://def.wmo.int/metce/2013
http://schemas.wmo.int/metce/1.2/metce.xsd http://www.opengis.net/samplingSpatial/2.0
http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd"
xmlns:collect="http://def.wmo.int/collect/2014" xmlns:iwxxm="http://icao.int/iwxxm/2.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <collect:meteorologicalInformation>
    <iwxxm:METAR gml:id="metar-VHHH-20170308233000Z" permissibleUsage="OPERATIONAL"
status="NORMAL">
    <!-- TAC: METAR VHHH 082330Z 03008KT 7000 FEW022 SCT030 17/12 Q1017 NOSIG= -->
      <iwxxm:observation>
        <om:OM_Observation gml:id="observation-1">
          <om:type xlink:href="http://codes.wmo.int/49-2/observation-
type/IWXXM/2.0/MeteorologicalAerodromeObservation"/>
          <om:phenomenonTime>
            <gml:TimeInstant gml:id="ti-20170308233000Z">
              <gml:timePosition>2017-03-08T23:30:00.000Z</gml:timePosition>
            </gml:TimeInstant>
          </om:phenomenonTime>
          <om:resultTime xlink:href="ti-20170308233000Z"/>
          <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>
            </metce:Process>
          </om:procedure>
          <om:observedProperty xlink:href="http://codes.wmo.int/49-2/observable-
property/MeteorologicalAerodromeObservation"/>
          <om:featureOfInterest>
            <sams:SF_SpatialSamplingFeature gml:id="sampling-point-VHHH">
              <sam:type xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-
OM/2.0/SF_SamplingPoint"/>
              <sam:sampledFeature>
                <aixm:AirportHeliport gml:id="aerodrome-VHHH">
                  <aixm:timeSlice>
                    <aixm:AirportHeliportTimeSlice gml:id="aerodrome-VHHH-ts">
                      <gml:validTime/>
                      <aixm:interpretation>BASELINE</aixm:interpretation>
                      <aixm:designator>VHHH</aixm:designator>
                      <aixm:name>HONG KONG/INTERNATIONAL</aixm:name>
                      <aixm:locationIndicatorICAO>VHHH</aixm:locationIndicatorICAO>
                    </aixm:AirportHeliportTimeSlice>
                  </aixm:timeSlice>
                </aixm:AirportHeliport>
              </sam:sampledFeature>
              <sams:shape>
                <gml:Point axisLabels="Lat Lon" gml:id="point-2218-11354" srsDimension="2"
srsName="http://www.opengis.net/def/crs/EPSG/0/4326">
                  <gml:pos>22.308919 113.914603</gml:pos>
                </gml:Point>
              </sams:shape>
            </sams:SF_SpatialSamplingFeature>
          </om:featureOfInterest>
          <om:result>
            <MeteorologicalAerodromeObservationRecord cloudAndVisibilityOK="false"
gml:id="observation-record-1">
              <airTemperature uom="Cel">17</airTemperature>
              <dewpointTemperature uom="Cel">12</dewpointTemperature>
              <qnh uom="hPa">1017</qnh>
              <surfaceWind>
                <AerodromeSurfaceWind variableWindDirection="false">
                  <meanWindDirection uom="deg">30</meanWindDirection>
```

```
                <meanWindSpeed uom="[kn_i]">8</meanWindSpeed>
              </AerodromeSurfaceWind>
            </surfaceWind>
            <visibility>
              <AerodromeHorizontalVisibility>
                <prevailingVisibility uom="m">7000</prevailingVisibility>
              </AerodromeHorizontalVisibility>
            </visibility>
            <cloud>
              <AerodromeObservedClouds>
                <layer>
                  <CloudLayer>
                    <amount xlink:href="http://codes.wmo.int/bufr4/codeflag/0-20-008/1"/>
                    <base uom="[ft_i]">2200</base>
                    <cloudType/>
                  </CloudLayer>
                </layer>
                <layer>
                  <CloudLayer>
                    <amount xlink:href="http://codes.wmo.int/bufr4/codeflag/0-20-008/2"/>
                    <base uom="[ft_i]">3000</base>
                    <cloudType/>
                  </CloudLayer>
                </layer>
              </AerodromeObservedClouds>
            </cloud>
          </MeteorologicalAerodromeObservationRecord>
        </om:result>
      </om:OM_Observation>
    </iwxxm:observation>
    <iwxxm:trendForecast>
      <om:OM_Observation gml:id="trend-forecast-1">
        <om:type xlink:href="http://codes.wmo.int/49-2/observation-
type/IWXXM/2.0/MeteorologicalAerodromeTrendForecast"/>
        <om:phenomenonTime/>
        <om:resultTime xlink:href="ti-20170308233000Z"/>
        <om:procedure xlink:href="#p-49-2-metar"/>
        <om:observedProperty xlink:href="http://codes.wmo.int/49-2/observable-
property/MeteorologicalAerodromeTrendForecast"/>
        <om:featureOfInterest xlink:href="#sampling-point-VHHH"/>
        <om:result>
          <MeteorologicalAerodromeTrendForecastRecord
changeIndicator="NO_SIGNIFICANT_CHANGES" gml:id="trend-forecast-record-1"/>
        </om:result>
      </om:OM_Observation>
    </iwxxm:trendForecast>
  </iwxxm:METAR>
 </collect:meteorologicalInformation>
<collect:bulletinIdentifier>A_SAHK31VHHH082330_C_VHHH_20170308233000.xml</collect:bulletinIden
tifier>
</collect:MeteorologicalBulletin>
```

Bulletin 3: A sample TAF bulletin in IWXXM format generated by HKO TAC-to-IWXXM translator


```xml
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<collect:MeteorologicalBulletin gml:id="bulletin-20170308110200Z"
xmlns:metce="http://def.wmo.int/metce/2013" xmlns:opm="http://def.wmo.int/opm/2013"
xmlns:aixm="http://www.aixm.aero/schema/5.1.1" xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns:gmd="http://www.isotc211.org/2005/gmd" xmlns:gsr="http://www.isotc211.org/2005/gsr"
xmlns:gss="http://www.isotc211.org/2005/gss" xmlns:gts="http://www.isotc211.org/2005/gts"
xmlns:gml="http://www.opengis.net/gml/3.2" xmlns:om="http://www.opengis.net/om/2.0"
xmlns:sam="http://www.opengis.net/sampling/2.0"
xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"
xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://icao.int/iwxxm/2.0
http://schemas.wmo.int/iwxxm/2.0/iwxxm-collect.xsd http://def.wmo.int/metce/2013
http://schemas.wmo.int/metce/1.2/metce.xsd http://www.opengis.net/samplingSpatial/2.0
http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd"
xmlns:collect="http://def.wmo.int/collect/2014" xmlns:iwxxm="http://icao.int/iwxxm/2.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <collect:meteorologicalInformation>
    <iwxxm:TAF gml:id="taf-VHHH-20170308110000Z" permissibleUsage="OPERATIONAL"
status="NORMAL">
      <!-- TAC: TAF VHHH 081100Z 0812/0918 09010KT 7000 FEW025 SCT035 TX19/0907Z  TN16/0822Z
TEMPO 0812/0818 03010KT TEMPO 0815/0821 4000 BR -RA= -->
      <iwxxm:issueTime>
        <gml:TimeInstant gml:id="ti-20170308110000Z">
          <gml:timePosition>2017-03-08T11:00:00.000Z</gml:timePosition>
        </gml:TimeInstant>
      </iwxxm:issueTime>
      <iwxxm:validTime>
        <gml:TimePeriod gml:id="tp-20170308120000Z-20170309180000Z">
          <gml:beginPosition>2017-03-08T12:00:00.000Z</gml:beginPosition>
          <gml:endPosition>2017-03-09T18:00:00.000Z</gml:endPosition>
        </gml:TimePeriod>
      </iwxxm:validTime>
      <iwxxm:baseForecast>
        <om:OM_Observation gml:id="baseForecast-1">
          <om:type xlink:href="http://codes.wmo.int/49-2/observation-
type/IWXXM/2.0/MeteorologicalAerodromeForecast"/>
          <om:phenomenonTime xlink:href="tp-20170308120000Z-20170309180000Z"/>
          <om:resultTime xlink:href="ti-20170308110000Z"/>
          <om:validTime xlink:href="tp-20170308120000Z-20170309180000Z"/>
          <om:procedure>
            <metce:Process gml:id="p-49-2-taf">
              <gml:description>WMO No. 49 Volume 2 Meteorological Service for International
Air Navigation APPENDIX 5 TECHNICAL SPECIFICATIONS RELATED TO FORECASTS</gml:description>
            </metce:Process>
          </om:procedure>
          <om:observedProperty xlink:href="http://codes.wmo.int/49-2/observable-
property/MeteorologicalAerodromeForecast"/>
          <om:featureOfInterest>
            <sams:SF_SpatialSamplingFeature gml:id="sampling-point-VHHH">
              <sam:type xlink:href="http://www.opengis.net/def/samplingFeatureType/OGC-
OM/2.0/SF_SamplingPoint"/>
              <sam:sampledFeature>
                <aixm:AirportHeliport gml:id="aerodrome-VHHH">
                  <aixm:timeSlice>
                    <aixm:AirportHeliportTimeSlice gml:id="aerodrome-VHHH-ts">
                      <gml:validTime/>
                      <aixm:interpretation>BASELINE</aixm:interpretation>
                      <aixm:designator>VHHH</aixm:designator>
                      <aixm:name>HONG KONG/INTERNATIONAL</aixm:name>
                      <aixm:locationIndicatorICAO>VHHH</aixm:locationIndicatorICAO>
                    </aixm:AirportHeliportTimeSlice>
                  </aixm:timeSlice>
                </aixm:AirportHeliport>
              </sam:sampledFeature>
              <sams:shape>
                <gml:Point axisLabels="Lat Lon" gml:id="point-2218-11354" srsDimension="2"
srsName="http://www.opengis.net/def/crs/EPSG/0/4326">
                  <gml:pos>22.308919 113.914603</gml:pos>
                </gml:Point>
              </sams:shape>
            </sams:SF_SpatialSamplingFeature>
          </om:featureOfInterest>
          <om:result>
```

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            <iwxxm:MeteorologicalAerodromeForecastRecord cloudAndVisibilityOK="false"
gml:id="base-fcst-record-1">
              <iwxxm:prevailingVisibility uom="m">7000</iwxxm:prevailingVisibility>
              <iwxxm:surfaceWind>
                <iwxxm:AerodromeSurfaceWindForecast variableWindDirection="false">
                  <iwxxm:meanWindDirection uom="deg">90</iwxxm:meanWindDirection>
                  <iwxxm:meanWindSpeed uom="[kn_i]">10</iwxxm:meanWindSpeed>
                </iwxxm:AerodromeSurfaceWindForecast>
              </iwxxm:surfaceWind>
              <iwxxm:cloud>
                <iwxxm:AerodromeCloudForecast gml:id="aerodrome-cloud-forecast-1">
                  <iwxxm:layer>
                    <iwxxm:CloudLayer>
                      <iwxxm:amount xlink:href="http://codes.wmo.int/bufr4/codeflag/0-20-
008/1"/>
                      <iwxxm:base uom="[ft_i]">2500</iwxxm:base>
                      <iwxxm:cloudType/>
                    </iwxxm:CloudLayer>
                  </iwxxm:layer>
                  <iwxxm:layer>
                    <iwxxm:CloudLayer>
                      <iwxxm:amount xlink:href="http://codes.wmo.int/bufr4/codeflag/0-20-
008/2"/>
                      <iwxxm:base uom="[ft_i]">3500</iwxxm:base>
                      <iwxxm:cloudType/>
                    </iwxxm:CloudLayer>
                  </iwxxm:layer>
                </iwxxm:AerodromeCloudForecast>
              </iwxxm:cloud>
              <iwxxm:temperature>
                <iwxxm:AerodromeAirTemperatureForecast>
                  <iwxxm:maximumAirTemperature uom="Cel">19</iwxxm:maximumAirTemperature>
                  <iwxxm:maximumAirTemperatureTime>
                    <gml:TimeInstant gml:id="ti-20170309070000Z">
                      <gml:timePosition>2017-03-09T07:00:00.000Z</gml:timePosition>
                    </gml:TimeInstant>
                  </iwxxm:maximumAirTemperatureTime>
                  <iwxxm:minimumAirTemperature uom="Cel">16</iwxxm:minimumAirTemperature>
                  <iwxxm:minimumAirTemperatureTime>
                    <gml:TimeInstant gml:id="ti-20170308220000Z">
                      <gml:timePosition>2017-03-08T22:00:00.000Z</gml:timePosition>
                    </gml:TimeInstant>
                  </iwxxm:minimumAirTemperatureTime>
                </iwxxm:AerodromeAirTemperatureForecast>
              </iwxxm:temperature>
            </iwxxm:MeteorologicalAerodromeForecastRecord>
          </om:result>
        </om:OM_Observation>
      </iwxxm:baseForecast>
      <iwxxm:changeForecast>
        <om:OM_Observation gml:id="change-forecast-1">
          <om:type xlink:href="http://codes.wmo.int/49-2/observation-
type/IWXXM/2.0/MeteorologicalAerodromeForecast"/>
          <om:phenomenonTime>
            <gml:TimePeriod gml:id="tp-20170308120000Z-20170308180000Z">
              <gml:beginPosition>2017-03-08T12:00:00.000Z</gml:beginPosition>
              <gml:endPosition>2017-03-08T18:00:00.000Z</gml:endPosition>
            </gml:TimePeriod>
          </om:phenomenonTime>
          <om:resultTime xlink:href="ti-20170308110000Z"/>
          <om:validTime xlink:href="tp-20170308120000Z-20170309180000Z"/>
          <om:procedure xlink:href="#p-49-2-taf"/>
          <om:observedProperty xlink:href="http://codes.wmo.int/49-2/observable-
property/MeteorologicalAerodromeForecast"/>
          <om:featureOfInterest xlink:href="#sampling-point-VHHH"/>
          <om:result>
            <iwxxm:MeteorologicalAerodromeForecastRecord
changeIndicator="TEMPORARY_FLUCTUATIONS" cloudAndVisibilityOK="false" gml:id="change-forecast-
record-1">
              <iwxxm:surfaceWind>
                <iwxxm:AerodromeSurfaceWindForecast variableWindDirection="false">
                  <iwxxm:meanWindDirection uom="deg">30</iwxxm:meanWindDirection>
                  <iwxxm:meanWindSpeed uom="[kn_i]">10</iwxxm:meanWindSpeed>
```

```
                </iwxxm:AerodromeSurfaceWindForecast>
              </iwxxm:surfaceWind>
            </iwxxm:MeteorologicalAerodromeForecastRecord>
          </om:result>
        </om:OM_Observation>
      </iwxxm:changeForecast>
      <iwxxm:changeForecast>
        <om:OM_Observation gml:id="change-forecast-2">
          <om:type xlink:href="http://codes.wmo.int/49-2/observation-
type/IWXXM/2.0/MeteorologicalAerodromeForecast"/>
          <om:phenomenonTime>
            <gml:TimePeriod gml:id="tp-20170308150000Z-20170308210000Z">
              <gml:beginPosition>2017-03-08T15:00:00.000Z</gml:beginPosition>
              <gml:endPosition>2017-03-08T21:00:00.000Z</gml:endPosition>
            </gml:TimePeriod>
          </om:phenomenonTime>
          <om:resultTime xlink:href="ti-20170308110000Z"/>
          <om:validTime xlink:href="tp-20170308120000Z-20170309180000Z"/>
          <om:procedure xlink:href="#p-49-2-taf"/>
          <om:observedProperty xlink:href="http://codes.wmo.int/49-2/observable-
property/MeteorologicalAerodromeForecast"/>
          <om:featureOfInterest xlink:href="#sampling-point-VHHH"/>
          <om:result>
            <iwxxm:MeteorologicalAerodromeForecastRecord
changeIndicator="TEMPORARY_FLUCTUATIONS" cloudAndVisibilityOK="false" gml:id="change-forecast-
record-2">
              <iwxxm:prevailingVisibility uom="m">4000</iwxxm:prevailingVisibility>
              <iwxxm:weather xlink:href="http://codes.wmo.int/306/4678/-RA"/>
              <iwxxm:weather xlink:href="http://codes.wmo.int/306/4678/BR"/>
            </iwxxm:MeteorologicalAerodromeForecastRecord>
          </om:result>
        </om:OM_Observation>
      </iwxxm:changeForecast>
    </iwxxm:TAF>
  </collect:meteorologicalInformation>
<collect:bulletinIdentifier>A_FTHK31VHHH081100_C_VHHH_20170308110000.xml</collect:bulletinIden
tifier>
</collect:MeteorologicalBulletin>
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