INTERNATIONAL CIVIL AVIATION ORGANIZATION

TWENTY SEVENTH MEETING OF THE ASIA/PACIFIC AIR NAVIGATION PLANNING AND IMPLEMENTATION REGIONAL GROUP (APANPIRG/27)

Bangkok, Thailand, 5 to 8 September 2016

Agenda Item 3: **Performance Framework for Regional Air Navigation Planning and Implementation**

3.5 **MET**

COLLABORATIVE SIGMET ISSUANCE DEMONSTRATION

(Presented by Japan, Lao PDR, Myanmar, Philippines, Thailand and Viet Nam)

SUMMARY

This paper outlines a collaborative SIGMET issuance demonstration project covering six (6) Flight Information Regions (FIRs) in Asia to be conducted by the Department of Meteorology and Hydrology of Lao PDR (LDMH), the Department of Meteorology and Hydrology of Myanmar (MDMH), the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), the Thai Meteorological Department (TMD) and the Vietnam Air Traffic Management Corporation (VATM) as the test SIGMET providers and the Japan Meteorological Agency (JMA) as the test advisory provider. The first demonstration was carried out by PAGASA, VATM and JMA from 9 to 20 May 2016 with thunderstorms (TSs) as the initially considered phenomenon. Along with the other organizations, the second demonstration is planned to be carried out in September 2016.

Strategic Objectives:

A: ***Safety*** *– Enhance global civil aviation safety*

B: ***Air Navigation Capacity and Efficiency****—Increase the capacity and improve the efficiency of the global aviation system*

1. INTRODUCTION

1.1 The ICAO Meteorology Divisional Meeting (2014) noted that there had been long-standing SIGMET deficiencies in some States and expressed requirements from users for harmonized, phenomenon-based hazardous weather information. In this regard, there was an urgent need demonstrated by aviation users for the establishment of Regional Hazardous Weather Advisory Centres (RHWACs) to assist Meteorological Watch Offices (MWOs) with the provision of SIGMET information for select hazardous meteorological conditions that included, as a minimum, thunderstorms, icing, turbulence and mountain waves, but which excluded volcanic ash and tropical cyclones (given the existing volcanic ash and tropical cyclone advisory systems). Taking into account such users' requirements, the meeting fully concurred that a regional hazardous weather framework should be implemented expeditiously, while considering the development of a governance and cost recovery framework.

1.2 The ICAO APANPIRG/26 was invited to note the importance of cross-FIR-boundary coordination and alignment of the MET information provided by States for adjacent FIRs to support the enhanced operational efficiency and safety of the air transport system – especially SIGMET information provided for a hazardous phenomenon that affects multiple FIRs. The meeting agreed that such initiatives to enhance the sharing of MET information between States would help to ensure the necessary alignment of MET information provided for adjacent FIRs. In view of the above, APANPIRG/26 adopted the following conclusion:

Conclusion APANPIRG/26/62 — Cross-border MET Collaboration and Coordination

Recognizing the presence of SIGMET weather phenomena that straddles across boundaries, States/Administrations are encouraged to promote cross-border collaboration and coordination to harmonise the MET products of such phenomena between Meteorological Authorities to enhance MET support for ATM in the Asia/Pacific Region.

2. DISCUSSION

2.1 In consideration of the inter-FIR SIGMET discontinuity and the above requirements and as the first conduct of the collaborative SIGMET issuance demonstration project, the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), the Meteorological Watch Office of the Vietnam Air Traffic Management Corporation (VATM/MWO) and the Japan Meteorological Agency (JMA) have carried out the first demonstration toward an effective method for the issuance of harmonized information.

2.2 MWOs and the test advisory provider collaborated on the formulation and issuance of test SIGMET text and graphics via a JMA website dedicated to this purpose.

Outline of first demonstration

2.3 The first collaborative SIGMET issuance demonstration was carried out from 9 to 20 May 2016. During this time, PAGASA and VATM (the MWOs of the Philippines and Vietnam, respectively) issued test WS SIGMETs to their FIRs with reference to JMA's phenomenon-based test advisory information, whose coverage includes the whole target area (i.e., the Hanoi, Ho Chi Minh and Manila FIRs). Both past and real-time observation data were used to ensure an adequate number of cross-FIR-boundary coordination trials.

2.4 The target was Thunderstorms (TSs), which were among the phenomena listed at the 2014 ICAO Meteorology Divisional Meeting and are frequently observed in the target area. The information issuance times were 03, 06 and 09 UTC. If no Cumulonimbus Clouds (CB) were forecast for the day, a decision on whether to use past data was made before 03 UTC. As this was the first step, the above limitations were introduced to secure regular operation by the three organizations in parallel with the demonstration. The test information issued was shared via the dedicated website.

Participation of aviation operators in the first demonstration

2.5 PAGASA, VATM and JMA invited Air Navigation Service Providers (ANSPs) and airlines that regularly operate in the target area to assess the first demonstration. Feedback was received from 32 persons of relevant parties including the Civil Aviation Authority of the Philippines (CAAP), two VATM Area Control Centres (ACC Hanoi and ACC Ho Chi Minh), All Nippon Airways, Cebu Pacific Air, Japan Airlines, Philippine Airlines, Saudia Airlines, SEAIR International, Vietjet Air and Vietnam Airlines.

2.6 The test information issued (test WS SIGMET (text and graphical) and test advisory information (graphical)) was provided to participating operators via a dedicated web page. Satellite imagery referred to in test information issuance was also provided on the web page as an option overlaying the issued information. Samples are shown in **Appendix 1**.

Coordination before and during the first demonstration

2.7 Before the first demonstration, the three organizations had developed a test information issuance procedure in consideration of criteria differences in their regular SIGMET issuance. As a result, a decision was taken to issue test advisories only for TS areas of at least 200 x 200 km, although MWOs may issue SIGMETs for smaller areas around congested air routes (see Figure 3 in **Appendix 1**). Another possible difference considered in advance involved CB top height. In cases where a CB area spans different FIRs, the test advisory would be issued with the highest CB top of the whole system, while test SIGMETs would be issued with the highest value in each FIR.

2.8 The primary means of real-time communication during the demonstration was the Bulletin Board system (BBS) on the dedicated website. Forecasters' comments on their test information and reasons for the issuance of test SIGMETs for unspecified areas or with different heights were posted. Sample communication made via the BBS is shown in **Appendix 2**.

Highlights of the first demonstration

2.9 During the first demonstration, a total of 53 test SIGMETs, including 4 cases involving phenomena extending over the Ho Chi Min and Manila FIRs, were issued with reference to 52 lots of phenomenon-based test advisory information. The highlights of the demonstration are outlined below.

✓ Some test SIGMETs were issued when CBs covered congested air routes or areas, even when the CBs were not large enough to meet the test advisory issuance criteria. In congested airspace, there is a need for SIGMET issuance even for CBs covering relatively small areas (**Appendix 1**, Figure 3). The importance of focus on congested air routes and the sharing of such information beforehand was again recognized.

✓ The locations of weather phenomena in some test SIGMETs differed somewhat from those of advisories due to rapid CB development during the lag time between test advisory issuance and SIGMET issuance (**Appendix 1**, Figure 4).

✓ It was recognized that the highest CB top and the movement of a system may differ within each FIR concerned.

Summary of the feedback from aviation operators

2.10 A collection of aviation operator feedback is provided in **Appendix 3**. A summary is given below.

✓ The first demonstration was well received among the participating aviation operators. Information on significant weather phenomena plays an important role in their operations, and related improvement will help to enrich their services. This will in turn contribute to greater efficiency and safety in the air transport system.

✓ SIGMET users mentioned deficiency and discontinuity in recent operational SIGMET information, and requested more qualified SIGMET bulletins that are easier to use and understand.

✓ There were requests relating to extra target phenomena (turbulence, icing, etc.), issuance timing (information on developing CBs and 3/6-hour forecasting), elements (altitudes affected) and information detail (i.e., information on individual CBs rather than on the system as a whole).

✓ Respondents requested that information such as that issued during the first demonstration be made available in regular operation.

Summary of the first demonstration

2.11 The outcomes of the first demonstration are summarized below.

✓ The demonstration highlighted the role of a reliable sub-regional/regional significant-weather-phenomenon advisory system to assist multiple MWOs in defining weather phenomena (area of coverage, intensity, movement, etc.) that could affect flight operations within their areas of responsibility and also provide overviews of information on significant weather phenomena in a sub-region/region for cross-multi-FIR flights.

✓ For flight operators/pilots/ATCs, the demonstrated advisory system would provide significant benefits for regions with SIGMET information deficiencies and/or discontinuities, such as areas far offshore, over the ocean or with no radar data.

✓ Regardless of considerations directly related to advisories, the demonstration highlighted the decisive role of individual MWOs in issuing SIGMET for their areas of responsibility in relation to local significant weather phenomena and other special user-oriented considerations. Indeed, some test SIGMETs were issued when CB clouds were covering congested air routes or FIR sectors even when CB coverage was relatively minor in relation to test advisory issuance criteria.

✓ As SIGMET discontinuity (in terms of variables such as CB coverage/top/movement and SIGMET issuance times/validity periods) over FIR boundary regions causes operational issues for ATCs and pilots, collaboration between adjacent MWOs toward the harmonization of SIGMET information is needed in order to improve SIGMET quality, efficiency and reliability. To this end, an agreed standard procedure on SIGMET issuance and advanced advisory information should be shared among the MWOs concerned.

✓ SATAID software, other applications and the dedicated website for the first demonstration performed well. These resources act as a platform for satellite and NWP analysis, discussions within MWOs or with other MWOs and the test advisory provider, decision making, and SIGMET formulation and issuance. The user-friendliness of the dedicated website was of particular note.

Future plans

2.12 To enable response to user needs, a sub-regional/regional significant-weather phenomenon advisory system should be established in the near future. The system should be modified in consideration of user feedback before its introduction into regular operation. Additional limited-time demonstrations will also be needed to verify its effectiveness.

2.13 As part of the demonstration project, the three organizations engaged in:

✓ Continued development of an effective SIGMET harmonization procedure

✓ Ongoing verification to determine the necessity and effectiveness of a regional hazardous weather advisory system

✓ Calls for other MWOs in APAC regions to join the project team and collaborate toward further improvement of aviation-related regional meteorological services

2.14 Along with the Department of Meteorology and Hydrology of Lao PDR (LDMH), the Department of Meteorology and Hydrology of Myanmar (MDMH) and the Thai Meteorological Department (TMD), the second collaborative SIGMET issuance demonstration is under planning to be carried out in September 2016. The procedure, applications and the dedicated website will be modified based on the outcomes of the first demonstration.

Plan for the second demonstration

2.15 LDMH, MDMH, PAGASA, TMD, VATM and JMA are planning to carry out a demonstration toward an effective method for the issuance of harmonized information. JMA will play as the test advisory provider again, and the others will issue test WS SIGMET (TS) for their FIRs. Past data will not be used for this time since an adequate number of the target phenomenon, TSs, will be expected in September.

2.16 As PAGASA, VATM and JMA did, the six organizations invited ANSPs and airlines that regularly operate in the target area (Vientiane, Yangon, Manila, Bangkok, Hanoi and Ho Chi Minh) to assess the second demonstration. For the test information provision and assessment, same approach will be used.

3. ACTION BY THE MEETING

3.1 The meeting is invited to note the information contained in this paper.

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Appendix 1 — Test WS SIGMET and test advisory information sample

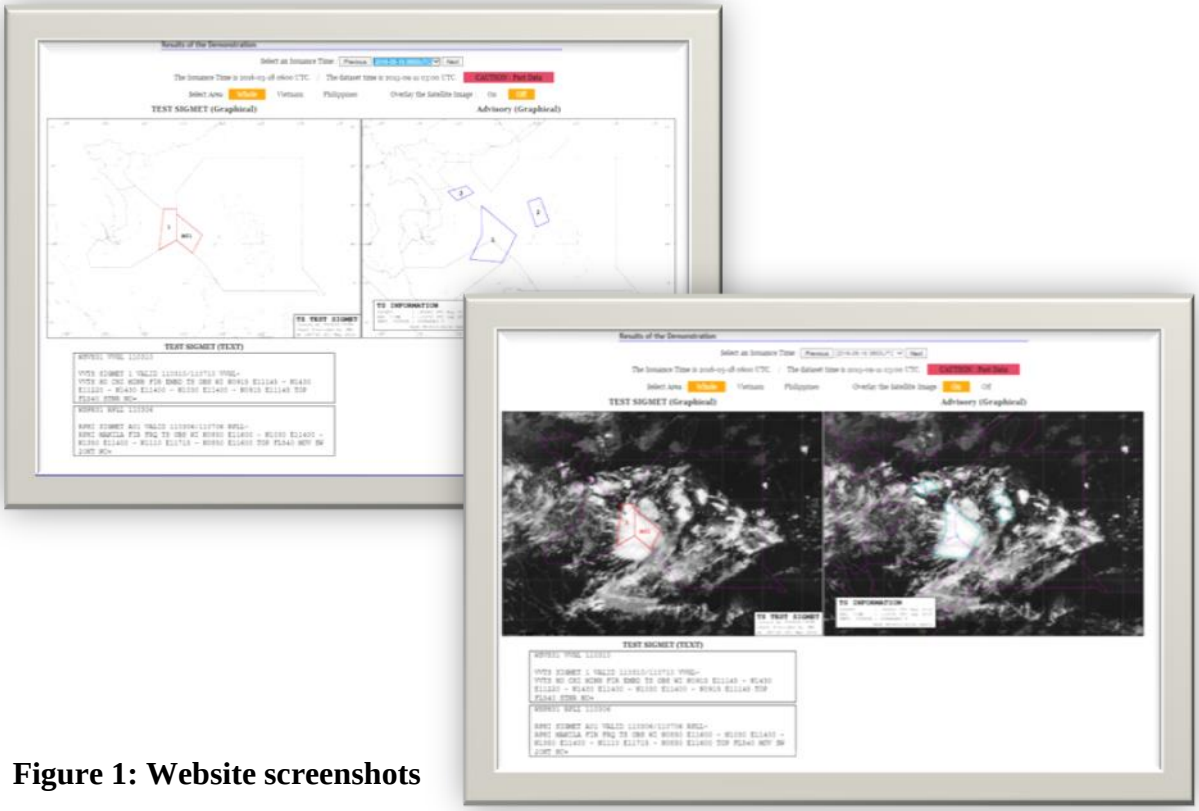


Figure 1: Website screenshots

Test SIGMETs **Test advisories**

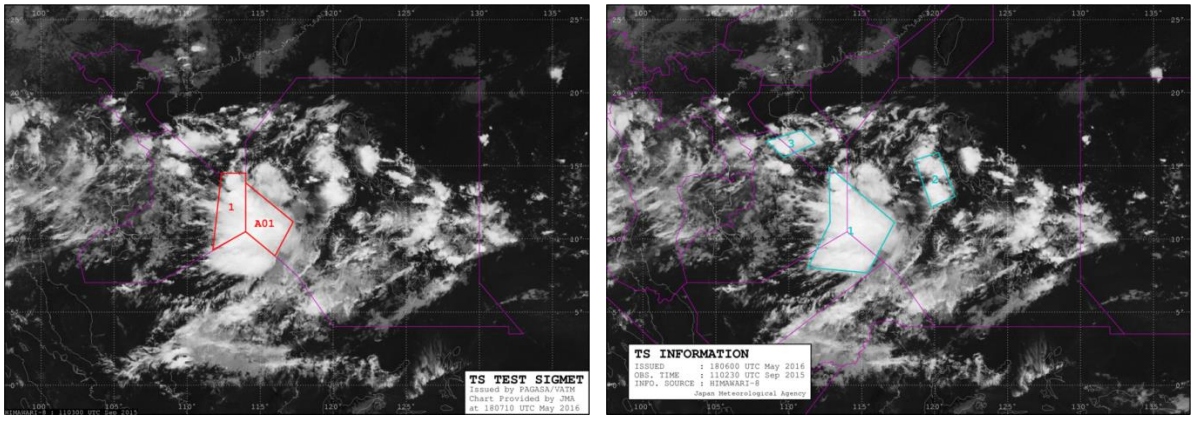


Figure 2: Test information issued at 0600 UTC on 18 May 2016 (past data)

- ✓ Test advisory information was issued for a cross-FIR-boundary CB system extending over the Ho Chi Min and Manila FIRs.
- ✓ Two "harmonized" test SIGMETs were issued for parts of the CB in each FIR with reference to test advisory information.

Test SIGMETs **Test advisories**

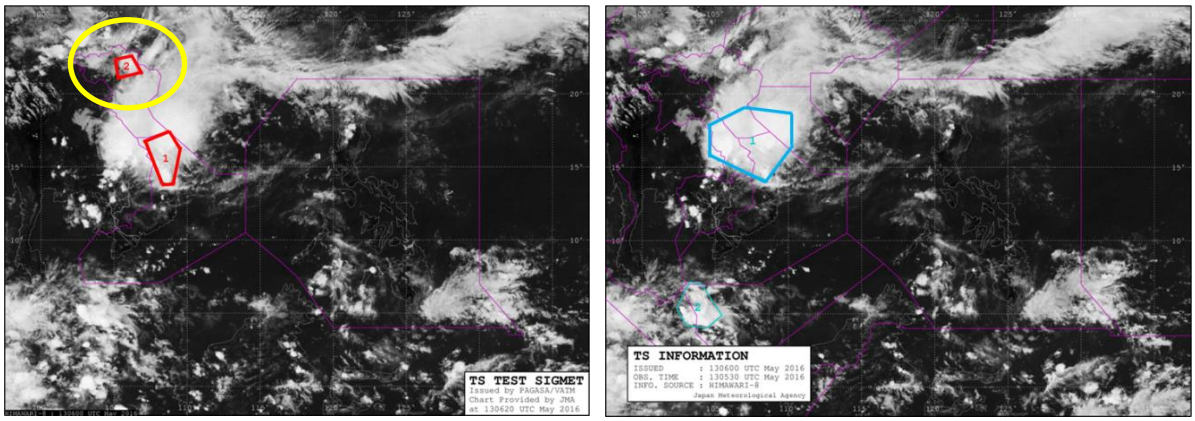


Figure 3: Test information issued at 0600 UTC on 13 May 2016 (real-time data)

- ✓ A SIGMET was issued for a relatively small CB area with no associated advisory.
- ✓ The small CB covered a congested area where even minor CBs may affect air traffic.

Test SIGMETs **Test advisories**

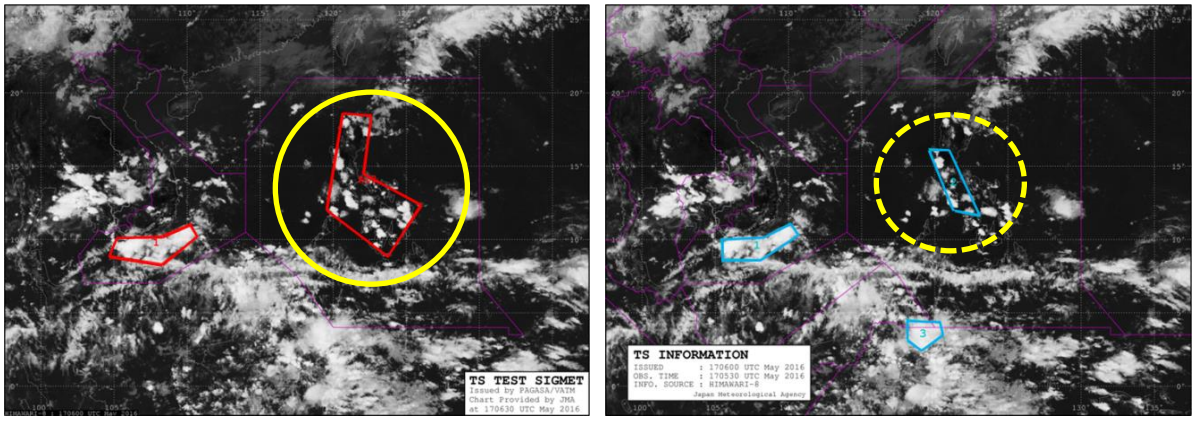


Figure 4: Test information issued at 0600 UTC on 17 May 2016 (real-time data)

- ✓ Test advisory information was issued for a CB area in the Manila FIR.
- ✓ An associated SIGMET was issued for a larger area due to the rapid development of the CB after the test advisory issuance.

Test SIGMETs **Test advisories**

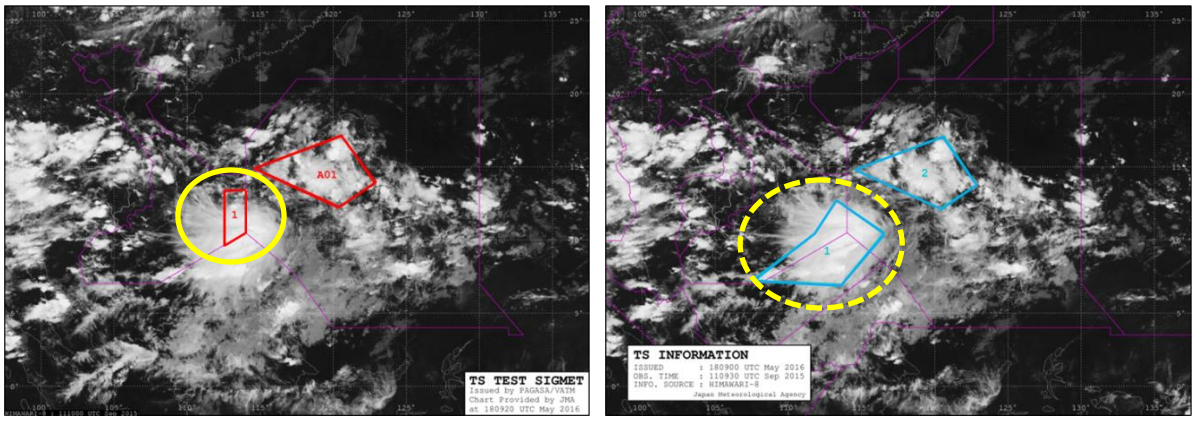


Figure 5: Test information issued at 0900 UTC on 18 May 2016 (past data)

- ✓ Test advisory information was issued for a cross-FIR-boundary CB system extending over the Ho Chi Min, Manila and Singapore FIRs.
- ✓ No associated SIGMET was issued for the Manila FIR because the related MWO forecast that the part of the CB in the Manila FIR would weaken.

Appendix 2 — BBS communication sample

Time: May 09, 2016, 09:46 UTC
From: JMA
Message: Dear VATM friends, thank you for your message. We understand the reason why VATM issued SIGMET for Ho Chi Minh FIR. If necessary, we can discuss on this matter on the web meeting on Friday.

Time: May 09, 2016, 09:28 UTC
From: VATM/MWO
Message: Dear all, there are convective clouds in the north of Ho Chi Minh FIR. This TS area is small but located along with the routes. So, we decided to issue

Time: May 10, 2016, 02:39 UTC
From: JMA
Message: Dear all, we will conduct today's demonstration as scheduled and use real-time data. CBs can be seen in the north of Hanoi FIR and convective clouds are expected in this area through 06UTC. Also, CBs are expected in the inland area of Vietnam around 09UTC (same as yesterday's situation). However, convective activity is not as strong as yesterday at the east of Mindanao Island. We will keep monitoring.

Time: May 10, 2016, 02:56 UTC
From: VATM/MWO
Message: Dear all, at the moment VATM/MWO have the same opinion with JMA on TS forecasts over Vietnam Territory for today, only TS over land in H0_CHI_MINH FIR may be weaker than yesterday due to less heat. Thank you.

Time: May 11, 2016, 09:01 UTC
From: JMA
Message: JMA has issued 3 advisories. CBs can be seen at the south of Ho Chi Minh FIR, but they were still small for advisory info at 0830 UTC. However, they are expected to continue developing... Also, there are CBs near Manila, but it was also small for advisory info.

Time: May 17, 2016, 06:32 UTC
From: PAGASA
Message: Greetings. PAGASA issued WS SIGMET A01. Warning Area is enlarged due to developing isolated CBs all over Luzon and Visayas and the trough affecting Northern Luzon.

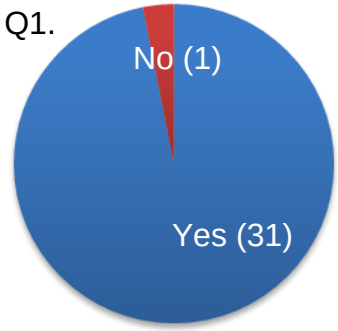
Time: May 20, 2016, 06:18 UTC
From: VATM/MWO
Message: Dear all, in the advisory 1, TSs area is small which is not enough 200x200 km. Beside, we predict that, this TSs area is weaken and do not exist over 3 hours. So we decided not to issue SIGMET. We keep

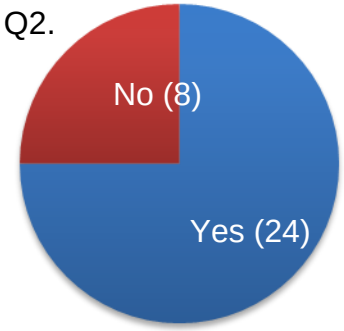
Time: May 18, 2016, 09:09 UTC
From: PAGASA
Message: 111006_TESTSIGMET_A01 UPLOADED. No SIGMET issuance for Advisory 1 because it is weakening and moving away from Manila FIR.

Appendix 3 — Feedback from aviation operators

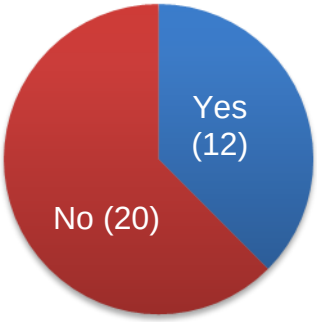
Questions and aviation operator assessment

Q1. Do you often use SIGMET information in your operations? (Yes/No)
Q2. Have you ever experienced inaccuracies (in terms of area coverage or intensity) in SIGMET (Thunderstorm, Turbulence or Icing) information? (Yes/No)



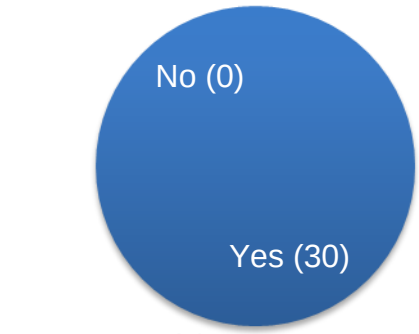


Q3. Have you ever received inconsistent SIGMET information from two MWOs for a single significant weather phenomenon spanning the FIR boundary between them? (Yes/No)

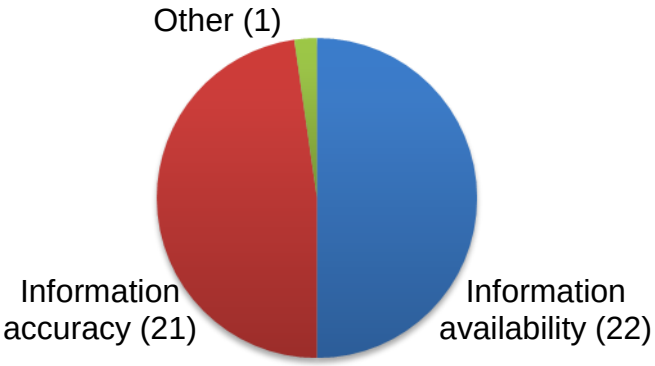


Comments:
- Even though some SIGMET information is not very accurate, it still plays an important role in supporting pilots and ATCs when aircraft need to make route deviations due to bad weather. (ATC Officer)
- Current SIGMET information does not seem not reliable enough, and is used only for reference. (Dispatcher)
- Information on the direction of weather phenomenon movement seems sometimes inaccurate (we refer to weather-related deviation requests from aircraft at the same time). (ATC Officer)
- Actual heights and those reported in SIGMET information regarding severe turbulence sometimes differ. (Dispatcher)

Q4. Do you feel collaborative WS SIGMET issuance is useful for your operations? (Yes/No)
If so, select the applicable points below to describe its usefulness and how it has helped to improve your current operations.
(Information availability/Information accuracy/Other)

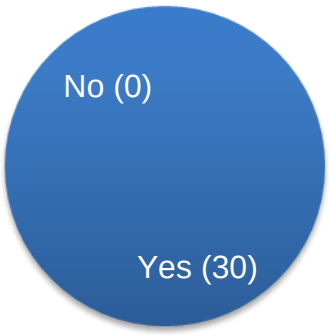


No answer (2)



Comments:
- It would be beneficial to have significant-weather phenomenon information for areas where no SIGMET information is currently issued. (Dispatcher)
- Greater information availability would help ATCs to plan flight operations over their areas of responsibility. (ATC Officer)
- Such information would help ATCs to inform and advise pilots en route, thereby improving air traffic services. (ATC Officer)
- Adoption of the test SIGMET issuance implemented in this demonstration into actual operation would be very useful to ATCs. (ATC Officer)

Q5. Do you think the demonstration worked well for improved quality/effectiveness of SIGMET information (minimization of inaccuracy and resolution of inconsistencies)? (Yes/No)



No answer (2)

Comments:
- Consistency of information between FIRs would be welcomed. Higher standards among the areas concerned should be targeted. (Dispatcher)
- ATC coordination over FIR boundaries is particularly complicated if an en route aircraft has to deviate from its track and enter the adjacent FIR to avoid adverse weather ahead and then return to its original track. The provision of accurate SIGMET information to pilots and/or ATCs ahead of time would significantly support flight route planning and reduce ATC workloads. (ATC Officer)
- Collaboration among agencies/organizations in the collection, preparation and provision of MET information would enable the provision of accurate information to support airlines' credibility regarding flight operation decisions relating to adverse weather conditions. (Dispatcher)

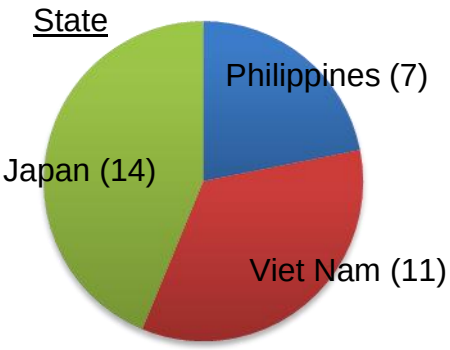
Q6. Thunderstorms (TSs) were the only target phenomenon in the first demonstration. Do you have any requests for targets in future demonstrations/operations?

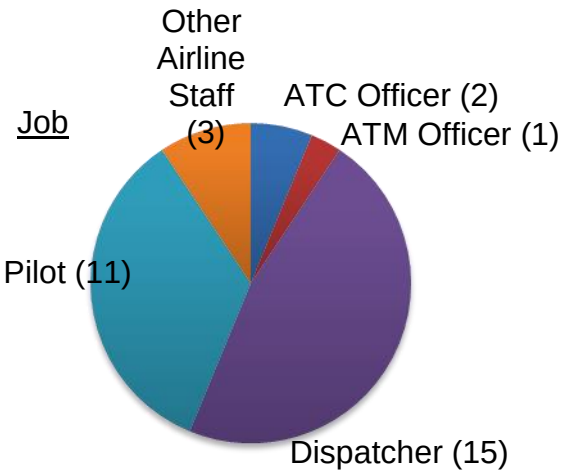
Comments:
- I'd like to see CB development information based on Himawari-8 data. (Dispatcher)
- TSs are the major significant weather phenomenon in the target region. There is no need to add other target phenomena. (Dispatcher)
- In addition to TSs, TURB is a major phenomenon for dispatchers and pilots. Information regarding turbulence and icing is also required. (Dispatcher)
- Turbulence information is more important than thunderstorm information. Whether TS information is available or not, pilots avoid individual CBs based on airborne radar data or visual observation. Although most turbulence in South East Asia is associated with TSs, information focused on TURB would also be useful. (Pilot)
- TSs are the major significant weather phenomena that may affect flight planning in the target region. As well as data on CB top height, information on altitudes where aircraft operation may be affected would also be useful. (Pilot)
- Turbulence, lightning (Dispatcher)
- If possible, please provide information on clear air turbulence (CAT) areas. (ATC Officer)
- If practicable, please provide information on thunderstorm rain, turbulence, tropical depressions/cyclones, volcanic activity and other unusual weather conditions that may affect safety in flight operations. (Dispatcher)

Q7. Feel free to note any comments you may have.

Comments:
- More detailed individual CB state data and real-time information provision would be appreciated. (Dispatcher)
- It would be useful to airlines if 3- and 6-hour TS positional forecasts could be provided. (Dispatcher)
- Current SIGMETs are not accurate enough and their coverage is often too wide. Significant-weather-phenomenon information with greater spatial precision would be useful.(Pilot)
- I'd like to see timely information provision to cockpits (via data link, ATC officers or similar). (Dispatcher)
- I'd like to see related efforts contributing to SIGMET improvement. (Dispatcher)
- I look forward to the smooth transition of this important meteorological application into actual application! (Airline Flight/Station operator)
- I look forward to the operational implementation of the results of this demonstration and to continuous access to the website. (Senior Manager, Airline Operations Control Center)
- It would be even better if other agencies shared data to help expand this project for longer international routes. (Dispatcher)

Q8. Respondent's job title





Note: Feedback from Vietnam ACCs is from user bodies rather than from individual officers.