International Civil Aviation Organization

INFORMATION PAPER

Asia and Pacific (APAC)
Thirteenth Meeting of the Meteorological Requirements Working Group (MET/R WG/13)

Bangkok, Thailand, 22 to 26 April 2024

Agenda Item 3: Collaboration between MET and ATM stakeholders

ESTABLISHING AN INTEGRATED WEATHER INFORMATION SUPPORT CONCEPT FOR AIR TRAFFIC CONTROL SERVICES IN THE REPUBLIC OF KOREA

(Presented by the Republic of Korea)

SUMMARY

In order to enhance the utilization of weather information by air traffic controllers, the Republic of Korea has delineated a strategy to enhance aviation weather information and introduce the concept of integrated weather information support through comprehensive interviews and surveys.

1. INTRODUCTION

1.1 To improve the accessibility of aviation weather information for users, there is a necessity to transition from a producer-centric model to a consumer-centric approach in aviation weather services.

1.2 The Aviation Meteorological Office (AMO) of the Korea Meteorological Administration (KMA) has devised a tailored weather information support framework to facilitate the timely utilization of the most current weather data in air traffic control, which serves as the linchpin for safe aviation operations.

2. DISCUSSION

Derivation of Directions for Enhancing Aviation Weather Information

2.1 By conducting face-to-face interviews and surveys targeting air traffic controllers, we gained insights into the current utilization of aircraft weather information during air traffic control operations, enabling us to identify three avenues for enhancement: (1) integrated display of dispersed information, (2) customizable weather information selection, and (3) proactive update notifications.

[Current Utilization Status of Aircraft Weather Information in Air Traffic Control Operations]

	Status (As-Is)		Inconvenience (Gap)		Directions for Improvement (To-be)
Information Collection	Checking various weather sources across multiple display systems	▶	Dispersed weather information	▶	**Streamlined display based on control tasks**
		▶	Difficulty in accessing requisite information		**Capability to select pertinent weather information items and details**
Information Content	Limited information availability in both abbreviated and comprehensive formats	▶	Lack of detailed information	▶	
Update Cycle	Continuous real-time monitoring of a plethora of data	▶	Challenges in isolating and verifying the most recent weather updates	▶	**Prompt notification of critical weather updates**

Establishment of Fundamental Principles for Weather Information Support

2.2 We have formulated the foundational principles of weather information support in alignment with the objective of enhancing aviation weather information. The initial principle emphasizes the provision of tailored information for each operational scenario. Our approach entails delivering information of high-frequency utility or significance consistently, while judiciously supplementing with additional data during occurrences of pivotal weather phenomena. To achieve this, we conducted a thorough investigation into the requisite weather information for each control service.

[Weather Information Requirements for Each Control service]

	Always	During Phenomena
Control Tower	· (Airport) Wind direction, wind speed, visibility, ceiling, atmospheric pressure, etc. ※ AMOS, LLWAS, TDWR	· Real-time updates on rapidly changing winds and convective cloud intensity and position · Upper-level wind conditions at the airport (within 3,000ft) · Hourly airport forecasts · Prompt notifications of significant weather changes ※ Visibility and instrument flight standards, airport advisories, special observations, etc.
Approach Control	· (Airport) Wind direction, wind speed, visibility, ceiling, atmospheric pressure, etc. · (Airspace) Wind direction and speed at various altitudes ※ AMOS, LLWAS, TDWR, website	· Location and classification of convective clouds (e.g., thunderstorms, hail, icing), along with cloud top altitudes and movement directions · Hourly airport forecasts · Prompt notifications of significant weather changes ※ Visibility and instrument flight standards, airport advisories, special observations, etc.
Area Control	· (Airport) Wind direction, wind speed, atmospheric pressure · (Airspace) Wind direction and speed at various altitudes ※ AMOS, website	· Location and classification of convective clouds (e.g., thunderstorms, hail, icing), along with cloud top altitudes and movement directions

2.3 The second principle underscores the integration of display. Our objective is to amalgamate diverse display systems into a singular interface, facilitating seamless and intuitive access to requisite weather information for each task.

3. ACTION BY THE MEETING

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

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APPENDIX [A]

[Interview Results on Air Traffic Controller Weather Information Utilization Status and Improvement Requests]

○ Interview Summary: From August to September 2023, a comprehensive survey was conducted among personnel responsible for various air traffic control services (control tower, approach control, and area control) at the Seoul and Jeju Regional Aviation Administration and Incheon Air Traffic Control Center, focusing on the current utilization of weather information, essential meteorological elements for each service, and enhancement requisites.

<table>
<tr><th></th><th>Control Tower</th><th>Approach Control</th><th>Area Control</th></tr>
<tr><td>Means of Accessing Weather Information</td><td>AMOS, LLWAS, ATIS, website</td><td>TDWR, control radar, AMOS, LLWAS, website</td><td>website</td></tr>
<tr><td>Essential Elements</td><td>wind direction, wind speed, visibility (RVR), wind shear</td><td>wind direction, wind speed, visibility (RVR), precipitation clouds, wind shear</td><td>precipitation clouds, QNH*, upper-level winds
* Required when flying below FL140</td></tr>
<tr><td>Additional Elements</td><td>METAR, airport forecast (website)</td><td>airport forecast (website)</td><td>airspace forecast (website)</td></tr>
<tr><td>Element Change Threshold</td><td>instrument or visual flight phase, low visibility procedures</td><td>hazardous clouds
※ Controller's arbitrary judgment is challenging</td><td>hazardous clouds
※ Controller's arbitrary judgment is challenging</td></tr>
<tr><td>Alarm Function Necessity</td><td colspan="2">not required except for wind shear (TDWR, LLWAS)</td><td>unnecessary</td></tr>
<tr><td rowspan="4">When Weather Information is Checked

Improvement Requests</td><td>AMOS checked regularly; other information provided upon pilot request</td><td>upon pilot request</td><td>upon pilot request</td></tr>
<tr><td colspan="2">LLWAS: Display observation information within 10 minutes
※ Provide observation information to pilots within 10 minutes</td><td></td></tr>
<tr><td>AMOS: Display instrument and visual flight phase threshold changes</td><td colspan="2">identification of hazardous cloud types, cloud base, and cloud top height
※Assist in determining hazardous clouds using weather radar and satellite images</td></tr>
<tr><td>wind information on takeoff and landing routes</td><td colspan="2">upper-level winds (per 3,000 ft)</td></tr>
<tr><td rowspan="4">Others</td><td colspan="3">Required Forecast Information</td></tr>
<tr><td>airport cloud base altitude, runway direction changes</td><td>movement of hazardous clouds, runway direction changes</td><td>movement of hazardous clouds</td></tr>
<tr><td colspan="2">Streamline display screens (by integrating information display)</td><td rowspan="3">upper-level winds crucial in winter; convection clouds crucial in summer</td></tr>
<tr><td colspan="2">Minimize manipulation to verify information
Limit AMOS to information display functions (limited operation)</td></tr>
<tr><td colspan="2">Maintain the current design as much as possible (preferably an adapted display system)</td></tr>
</table>

APPENDIX [B]

[Survey Results on Air Traffic Controller Weather Information Utilization Status and Improvement Requests]

○ Survey Overview: In Sptember 2023, a comprehensive survey was conducted among 59 air traffic controllers from the Seoul, Busan, Jeju Regional Aviation Administration, and Air Traffic Management Office, focusing on frequently used meteorological elements and points of improvement in the current display system.

○ Frequently Used Meteorological Elements: Wind direction (85%), wind speed (83%), visibility and atmospheric pressure (73%)

○ Important Meteorological Elements: Wind direction, wind speed, visibility, atmospheric pressure, and convection clouds

< Priority Index of Weather Elements for Each Control Service >

	Control Tower	Approach Control	Area Control	Overall
Snowfall	3	2	3	3
Precipitation	3	3	7	4
Wind shear	4	4	0	3
Atmospheric pressure	4	5	7	5
Turbulence	1	1	5	2
Convective clouds	1	3	9	4
Freezing altitude	0	0	0	0
Visibility	8	8	2	7
Ceiling	5	5	4	5
Cloud cover	2	2	2	2
Icing	0	1	1	1
Wind speed	9	8	6	9
Wind direction	9	9	5	9

※ High (9–7) Medium (6–4) Low (3–0)

※ The priority index is calculated using the Min-Max Normalization method, assigning integer values from 0 to 9 based on the controllers' high "usage" and "importance."

※ Index calculation formula = (importance of each meteorological element* - minimum value) / (maximum value - minimum value) × (maximum integer value)

* Importance of each meteorological element: (usage of each element) + (importance of each element) / number of survey participants

○ Frequently Used Display Systems: (in the order of) AMOS, ATIS, LLWAS, website

○ Shortcomings of the Current Display System: Scattered weather information and lack of detailed information, etc.

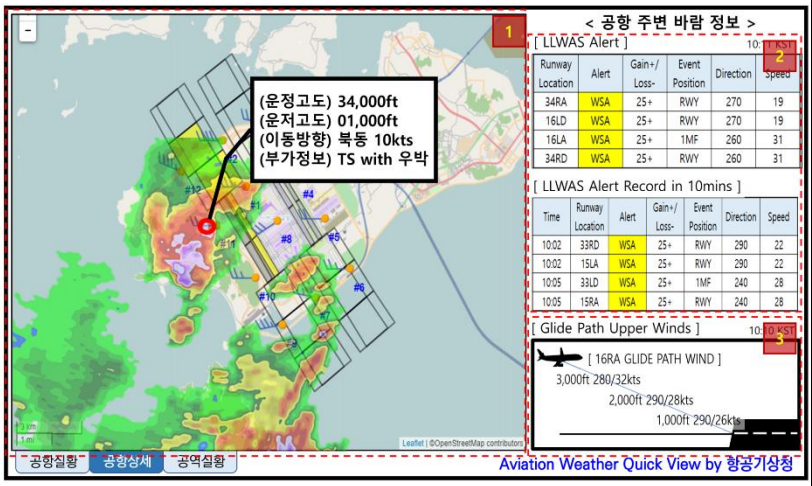
○ Directions for Improvement: Real-time information updates, consolidation of necessary weather information on one screen, addition of user selection (filter) function for necessary information.

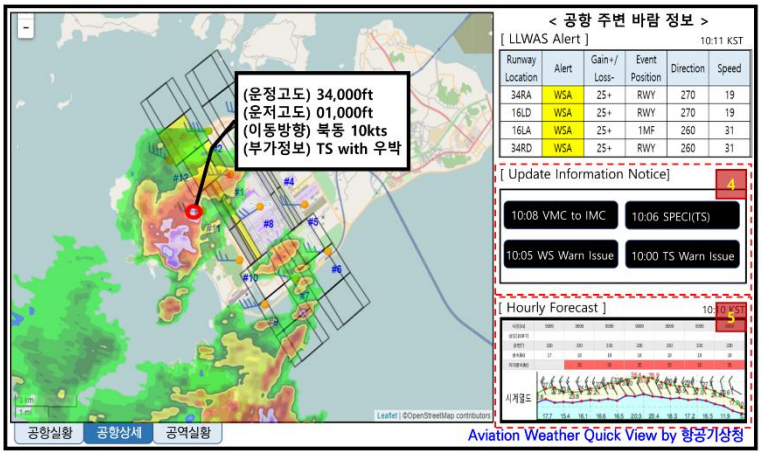
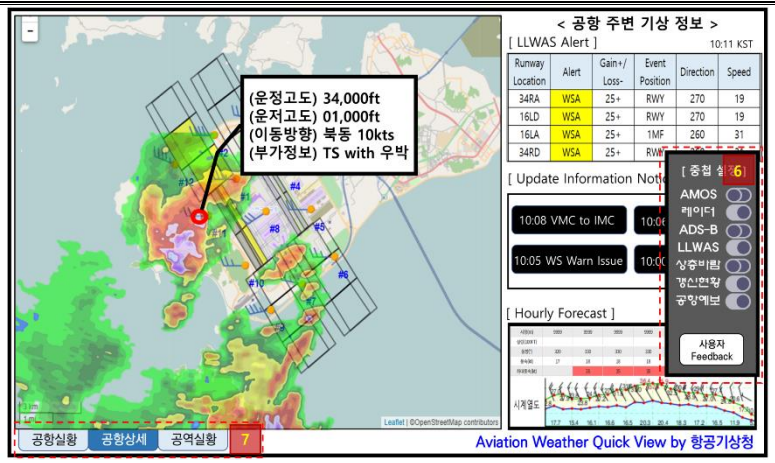
○ Additional Display Elements Required: Altitude correction values for all airports on the map, wind direction and speed by altitude, CB (or cloud) distribution by altitude, etc.

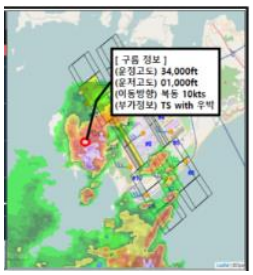
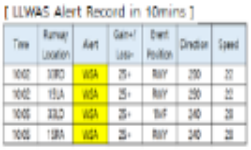
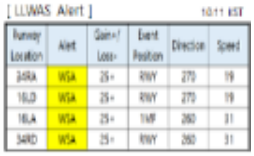
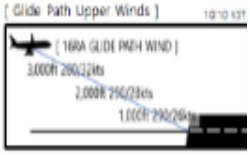
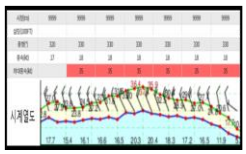
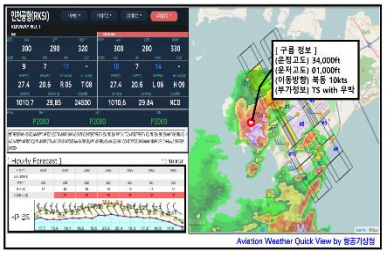
APPENDIX [C]

[Draft for Integrated Weather Information Support System]

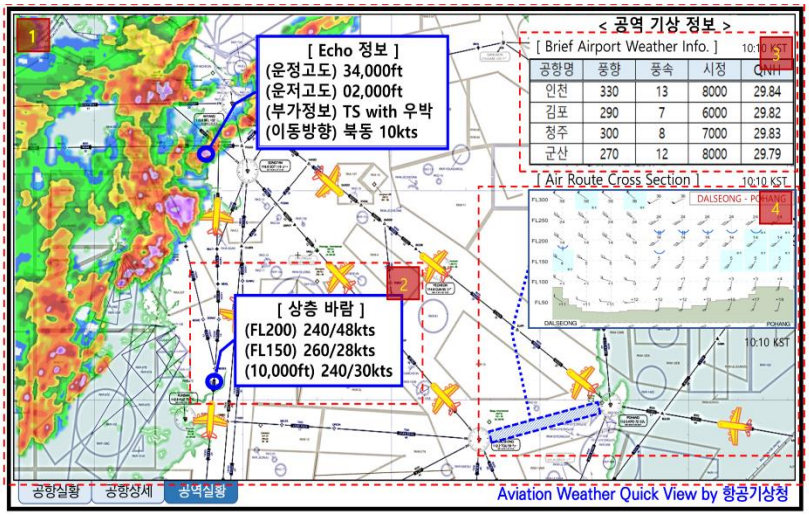
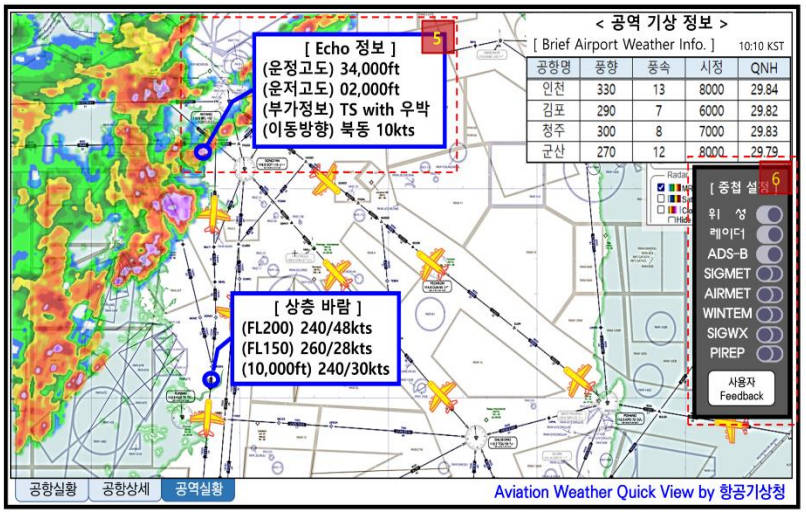
○ Integrated Weather Information for Control Tower Support

	Display Screen	Content
During Normal Operations		The current AMOS information (wind direction, wind speed, visibility, atmospheric pressure, etc.)
During Significant Weather Events		① Real-time weather conditions around the airport - Wind shear, thunderstorm location, and intensity ※ LLWAS, radar-based - Cloud information at the nearest location upon clicking a specific location ※ Utilizing satellite and radar information to determine cloud top altitude ② Real-time wind shear monitoring and records within 10 minutes ※ Based on LLWAS ③ Upper-level wind information for take-off and landing paths (GP, glide path) ※ Based on KLAPS or WISSDOM

	Display Screen	Content
Airport Forecast Display		④ Recently updated weather information ※ METAR, SPECI, TAF, airport warnings, etc. ※ Displaying notifications only; details are available in pop-up based on settings ⑤ 1-hour or more detailed airport forecast ※ Based on TAF ※ Items to review: including Numerical models-based, hazardous weather scenarios
Nesting Settings		⑥ Screen display settings - Weather information display and alarm selection - Controllers' feedback ※ Feedback is regularly collected ⑦ Quick-change tab for display screen

	Display Screen	Content
Customized Display	[Modular Weather Information]  < AMOS >  < TDWR >  < LLWAS >  < LLWAS Records >  < GP Upper-level Wind >  < Hourly Airport Forecast > [Customized Display]  < AMOS + TDWR + Airport Forecast >  <AMOS + LLWAS + GP Upper-level Wind >	Modularization allows for flexible and selective deployment for each user or task

○ Integrated Weather Information for Approach and Area Control Support

	Display Screen	Content
During Normal Operations		① GIS-based information - Routes, airspace, and tracks (ADS-B) ② Location details - Upper -level wind by altitude upon clicking a specific location ※ KLAPS or WISSDOM ③ Airport weather information - AMOS at a selected airport within airspace ④ Vertical cross-section of route - Wind direction, wind speed, cloud base, and cloud top altitude (when CB clouds are present) by altitude along a selected route, etc.
Location Details		⑤ Location details - Detailed echo (cloud) information at a specific location ※ Cloud top altitude, cloud base altitude, phenomenon (TS, hail, etc.), and movement direction, etc. ⑥ Screen display settings - Weather information display and alarm selection - Controllers' feedback ※ Feedback is regularly collected