ADS-B WX UPDATE

STEVE DARR – DYNAMIC AEROSPACE

Putting first-things first…

I SINCERELY HOPE THAT YOU AND YOURS ARE WELL, AND STAY THAT WAY. I LOOK FORWARD TO SEEING EACH OF YOU AT THE FALL FPAW.

Developments in ADS-B Wx

- December 2019
  - AOPA reported to RTCA SC-206 that General Aviation aircraft equipage with 1090 MHz Extended Squitter ADS-B (1090ES ADS-B) devices exceeds 80% of total GA equipage
  - RTCA SC-206 asked whether 1090ES ADS-B could support ADS-B PIREP downlink? (SC-206 had been planning to pursue UAT ADS-B PIREP downlink only)
    - RTCA/EUROCAE Combined Surveillance Committee (CSC) Weather Surveillance Sub-Group (WxS SG) Chair asserted technical feasibility, coordinated with stakeholders to establish support
- January 2020
  - CSC WxS SG Chair developed and presented ADS-B PIREP requirements to CSC, in conjunction with ADS-B AIREP requirements and appendix
  - CSC agreed to allow development of ADS-B PIREP test procedures and appendix, following completion of ADS-B AIREP test procedure development
- February 2020
  - WxS SG submitted complete ADS-B AIREP and PIREP requirements, test procedures, and appendices for inclusion in 1090 MHz ADS-B MOPS
- 20 March 2020: 1090ES ADS-B MOPS is approved for Final Review and Comment

Background

- Using aircraft as weather observation platforms has a long history, beginning with Pilot Reports (PIREPs) and continuing into automated Aircraft Reports (AIREPs)
- ADS-B Weather (ADS-B Wx) is part of ADS-B Version 3 (V3)
  - AIREP enables fully-automated, routine broadcast of aircraft-sensed data or data computed onboard
  - PIREP enables ADS-B submission of pilot-observed weather
- ADS-B ground receiver network is operating and updates are planned for reception and distribution of ADS-B V3 messages
  - No mandate for ADS-B V3 aircraft equipage is planned

The Future, with ADS-B Wx

ADS-Wx AIREP Impacts

- More accurate, more precise weather forecasts
- More rapid, more accurate weather awareness
- Improved avoidance of hazardous weather

ADS-Wx PIREP Impacts

- More PIREPs with fewer errors
- ATC/FSS-independent, fully automated:
  - PIREP data submission
  - PIREP encoding
- Continued PIREP dissemination via existing networks
- AIREP impacts where PIREPs are submitted

ADS-B Wx Supported Application Examples

- Air Traffic
  - Routine weather surveillance [1,2] and hazardous weather detection and avoidance [1,2]
  - Interval management [1,2]
  - Traffic awareness [2]
- Wake Turbulence
  - Hazardous wake avoidance in en route and terminal airspace [1,2]
  - Wake surfing [2]
  - Wake Encounter Reporting (with ADS-B PIREP)
- Weather Forecasting [1]
  - Rapid-update observations enable rapid-update forecasts
  - Forecast validation
  - Forecast skill improvements
  - NWP model performance improvements
  - Improved hazardous weather detection and prediction
  - Forecast feature-size reductions, e.g. icing, turbulence

[1] Ground-based

[2] Flight Deck-based

ADS-B Wx AIREP Parameters: By Message

	Weather State Message 2.2 [s] Broadcast Interval	Emergency/Priority Status Message 5.0 [s] Broadcast interval	Aircraft State Message 5.0 [s] Broadcast Interval
1	Icing Status	Mean EDR	Aircraft Configuration
2	Wind Quality Indicator	Peak EDR	Aircraft Type
3	Wind Speed	Peak EDR Offset	Gross Weight
4	Wind Direction	Water Vapor	Wingspan
5	Air Temperature		
6	Airspeed		

ADS-B Wx PIREP Parameters: By Message

	Flight Weather Message On-condition Broadcast	Temp, Wind & Turbulence Message On-condition Broadcast	Hazardous Weather Message On-condition Broadcast
1	PIREP Time	PIREP Air Temperature	PIREP Icing
2	Flight Visibility	PIREP Air Temperature Type	Airspeed Change
3	Flight Weather 1	PIREP Wind Direction	Wind Shear Height
4	Flight Weather 2	PIREP Wind Speed	Braking Action
5	Flight Weather 3	Turbulence Duration	Runway Number
6	Layer ‘A’ Height	Turbulence Intensity	Runway Position
7	Layer ‘A’ Thickness	Turbulence Location	Layer ‘C’ Height
8	Layer ‘A’ Height Type	Layer ‘B’ Height	Layer ‘C’ Thickness
9	Layer ‘A’ Coverage	Layer ‘B’ Thickness	Layer ‘C’ Height Type
10		Layer ‘B’ Height Type	Layer ‘C’ Coverage
11		Layer ‘B’ Coverage	Flight Weather 1 Vicinity Direction
12			Flight Weather 2 Vicinity Direction
13			Turbulence Type

Encoded PIREP creation from ADS-B PIREP Messages

Item	Element (Code)	Contents	ADS-B PIREP Message Source
1	3-letter station identifier (XXX)	Nearest weather reporting location to the reported phenomenon	Assigned by ground-based data processing
2	Report type (/UA UUA)	Routine or Urgent PIREP	
3	Location (/OV)	Lat/Long, or in relation to a VOR	Determined on ground from Track, based on Time
5	Altitude (/FL)	Essential for turbulence and icing reports	
4	Time (/TM)	Coordinated Universal Time	Translated on ground from PIREP Time in Flight Weather Message
6	Type Aircraft (/TP)	Essential for turbulence and icing report interpretation	Direct: Aircraft State Message Indirect: ICAO 24-Bit Address, Flight Plan, Aircraft Registration
7	Sky cover (/SK)	Cloud height and coverage (sky clear, few, scattered, broken, or overcast)	Flight Weather Message
8	Weather (/WX)	Flight visibility, precipitation, restrictions to visibility, etc.	Flight Weather Message
9	Temperature (/TA)	Degrees Celsius	Temp, Wind & Turbulence Message
10	Wind (/WV)	Direction in degrees magnetic north and speed in knots	Temp, Wind & Turbulence Message
11	Turbulence (/TB)	Intensity, Duration, Location, Type	Temp, Wind & Turbulence Message
12	Icing (/IC)	Type and Intensity	Hazardous Weather Message
13	Remarks (/RM)	For reporting elements not included or to clarify previously reported items	Required Condition Remarks, Wind Shear, Braking Action, Mountain Wave Encounter, Volcanic Odor

DO-260C (1090ES ADS-B MOPS) is open for Final Review and Comment until 07 May 2020, with publication approval expected in September 2020.

ADS-B WX DEVELOPMENT NEXT STEPS

ADS-B Wx Next Steps

- ADS-B V3 messages could be available from avionics beginning in 2022
  - Ground receipt and distribution planning for ADS-B Wx (AIREP & PIREP) information will require continued coordination with users to maximize benefits
- Integration into user systems needs to be planned and implemented
  - MOPS does not apply to ground-based systems
  - AIREP Message handling and data dissemination
  - PIREP Message handling and PIREP Encoding

Native Function vs. Optional Feature

Native Function (in the box)

- ADS-B V3 compliant avionics would implement ADS-B Wx functionality

Optional Feature (maybe in the box)

- ADS-B V3 compliant avionics may not implement ADS-B Wx functionality
  - ADS-B Wx Messages would only be implemented by manufacturers wishing to add ADS-B Wx feature

Native vs. Optional? Feedback to Date

Reasons for Native Function

- Criticality of ABO to aviation forecasts and forecast model performance
- Improved routine weather surveillance
- Improved hazardous weather and wake turbulence prediction, detection, and avoidance
- Improved cruise and terminal operations

Reasons for Optional Feature

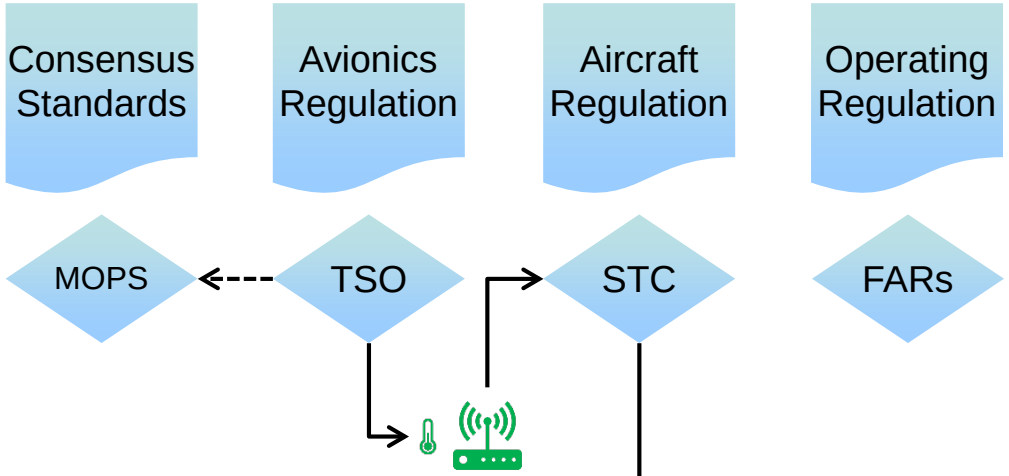
- Manufacturer costs to implement as native function
- Regulator processing of exceptions if manufacturers choose not to implement native function
- ADS-B V3 is not expected to be mandated for ADS-B Rule compliance (V2 required)

Feedback from 'mandate' to 'native' to 'optional' has been received

Implementation Questions for Regulators

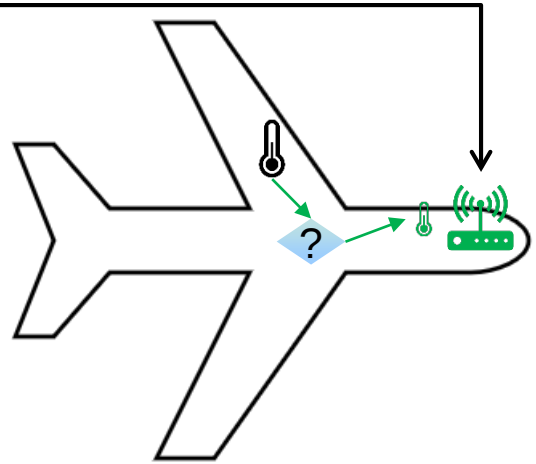
1. Should ADS-B Wx be specified as a native function or optional feature in the MOPS?
2. Should ADS-B Wx be specified as required for ADS-B V3 TSO compliance?
   a. What installation guidance should be given to operators regarding connecting inputs that support ADS-B Wx?
3. Should ADS-B Wx be mandated for entry into ADS-B airspace?
   a. For available information from installed systems, e.g. pressure, temperature, wind?
   b. For all ADS-B Wx data, including those requiring equipage, e.g. EDR and Water Vapor?

Desired Standards & Regulation Outcome



FAA and EASA are tasked to recommend ADS-B Wx as a native function or optional feature in the MOPS during Final Review and Comment, which closes on 07 May 2020.

ADS-B Wx is specified as native in the MOPS and as required by TSO, with operators free to choose which ADS-B Wx inputs to connect .



ADS-B Wx is enabled on the basis of standards, avionics regulation, and the interests of operators.

ADS-B Wx Next Steps

- Continue ADS-B Wx development (AIREP and PIREP)
  - Support MOPS FRAC and perform comment resolution
- Plan and prepare to receive ADS-Wx Messages
- Continue coordination with:
  - Weather community (FAA, NWS, AWC, WMO, FPAW, others)
  - Other standards bodies and regulators (RTCA, EUROCAE, ICAO, Eurocontrol, FAA, SAE, others)
  - Manufacturers and Operators
- Harmonize UAT ADS-B with 1090ES ADS-B Standards

ADS-B Wx Coordination

ANSPs and Operators

- ANSP Regulators
  - FAA, EASA, NATS UK
- ANSP ATC
  - FAA ATO PMO Int'l Surveillance Lead
  - FAA ATO Top 5 Program
- ANSP Wx offices
  - FAA NextGen Weather Division
- ICAO Air Navigation Commission Panels
- Airlines, A4A, IATA
- AOPA, NBAA
- Pilot unions (ALPA, APA)

Weather, Research, Safety, Others

- WMO
- National Wx offices
  - NOAA
  - Aviation Weather Center
- National research organizations
  - Aeronautical
  - Wx
  - Climate
- Aircraft and Avionics manufacturers
- NTSB
- Other affected standards committees

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QUESTIONS

ADS-B Wx InDepth

BACKUP

Changes to ADS-B: V2 to V3

- What
  - Globally-harmonized, government/industry consensus standards for ADS-B V3
    - ADS-B V2 is current global standard
- Why
  - Remove unused V2 requirements and correct errors
  - Add requirements supporting additional ADS-B In (air-to-air) and ground-based applications
- How
  - Publish RTCA/EUROCAE MOPS and ICAO standards revisions
  - Invoke standards in regulations affecting aircraft and airspace
- Who
  - RTCA/EUROCAE committees and ICAO Air Navigation Commission Panels, Aviation Regulators
- Where
  - No mandate for V3: New ADS-B Out and ADS-B In avionics for forward fit, with retrofit at operators choice
  - Going forward, ADS-B Rule Airspace compliance using V2 or V3 avionics, at operators' option
- When
  - ADS-B V3 consensus standards to be published in 2020 (1090ES) and 2021 (UAT)
  - ADS-B V3 regulations to be published in 2021 (1090ES) and 2022 (UAT)
  - ADS-B V3 avionics could be available by 2022 (1090ES) and 2023 (UAT)

ADS-B Standards and Regulations

- Equipment Standards and Regulations
  - Specify message formats, broadcast intervals, and other requirements
- Operating Regulations
  - International ADS-B rules require broadcast of 1090 MHz Extended Squitters (1090ES)
  - US ADS-B Out Rule (mandate) specifies performance and airspaces for broadcast of messages
  - US has dual-link equipage option
    - 1090ES (required for Class A airspace operations); or,
    - Universal Access Transceivers (UAT) operating on 978 MHz

ADS-B WX AIREP PARAMETERS

ADS-B AIREP: Icing Status

- One of 32 values based on aircraft capability.
  - Detection by Inflight Ice Detection System (FIDS), *or*
  - Operating state of Ice Protection System (IPS)
- FIDS reports icing conditions being encountered by aircraft
  - IPS may be operated in conditions conducive to but absent of icing. Encoded values distinguish IPS from FIDS inputs.

ADS-B AIREP: Wind

- Quality Indicator
  - Based on Roll Angle and Ground Velocity Source (if available)
- Wind Speed and Wind Direction
  - Sourced from system approved to display wind data to flight crew or as input for flight management functions

ADS-B AIREP: Air Temperature

- Static Air Temperature (preferred) *or* Total Air Temperature
- Sourced from system approved to display Air Temperature data to flight crew or as input for flight management functions

ADS-B AIREP: Airspeed

- True Airspeed (preferred) *or* Calibrated Airspeed
- Sourced from system approved to output Airspeed for display to flight crew or as input for flight management functions, e.g. TSO-C106 certified source

ADS-B AIREP: Eddy Dissipation Rate

- Derived onboard using specialized algorithms
  - For ADS-Wx, must meet minimum requirements in DO-370 and DO-260C Appendix V
- Mean Eddy Dissipation Rate (EDR)
  - Rolling Last 1-minute average of EDR values
- Peak EDR and Offset
  - Peak represents maximum of EDR values in Last 1-minute
  - Offset identifies Peak as within one of eight 7.5-second windows in Last 1-minute

Water Vapor

- Derived onboard, if equipped, by specialized, supplemental type certificated equipment
- Derivation recommendations included in DO-260C Appendix V

ADS-B AIREP: Aircraft Configuration

- Static or Dynamic depending on aircraft capability
- Static value
  - Configured during ADS-B system installation for:
    - Non-reportable slat-flap position, *and*
    - Fixed or non-reportable landing gear position
- Dynamic values
  - Slat/Flap extensions mapped into High/Medium/Low ranges by aircraft manufacturer
  - Sourced from systems approved to display slat/flap extension and landing gear positions to flight crew

ADS-B AIREP: Aircraft Type

- Static value
  - Per ICAO Doc 8643, Aircraft Type Designators
  - Configured during ADS-B system installation

ADS-B AIREP: Gross Weight

- Static or Dynamic depending on aircraft capability and operator choice
- Static value
  - Configured during ADS-B system installation
  - Certificated Maximum Takeoff Weight (MTOW)
- Dynamic values
  - Current Gross Weight based on computed preflight weight less actual consumption of inflight consumables
  - Sourced from system approved to display current gross weight to flight crew or as input for flight management functions
  - Reverts to MTOW if Current Gross Weight becomes unavailable

ADS-B AIREP: Wingspan

- Static value
  - Configured during ADS-B system installation
  - Per manufacturer specifications for aircraft Make and Model, including approved modifications
- Encoded in discrete ranges that encompass entire physical width of aircraft

ADS-B PIREP PARAMETERS

ADS-B PIREP: PIREP Time

Pilot Entry and Encoding

- Pilot enters time of weather encounter
- PIREP Time is encoded relative to current time
  - 5 bits (32 values) representing 0-31 minutes in 1 minute increments
  - Older observations not reportable via ADS-B PIREP submission

Decoding and Distribution

- Relative Time is applied from time of receipt to determine encoded PIREP Time, in UTC
  - Distributed in /TM field
- Location is determined from track position at encoded PIREP Time
  - Distributed in /OV field
- Altitude is determined from track altitude at encoded PIREP Time
  - Distributed in /FL field

ADS-B PIREP: Aircraft Type

Pilot Entry and Encoding

- Static value
  - Per ICAO Doc 8643, Aircraft Type Designators
- Not a Pilot input
  - Encoded in ADS-Wx AIREP Message, Subtype 0 (Aircraft State)
    - Configured during system installation
  - Correlated on ground from other ADS-B Message content
    - ICAO Address, Flight ID, Aircraft Registration

Decoding and Distribution

- Correlated to PIREP based on
  - "Aircraft Type" subfield in Aircraft State Message; or,
  - "ID Character" subfields in ADS-B Aircraft Identification and Category Message (database lookup); or,
    - Flight ID or Registration Number
  - "Address, Announced" subfield (part of every ADS-B message) via database lookup, if ICAO 24-bit address
- Distributed in /TP field

ADS-B PIREP: Layer A/B/C Height

Pilot Entry and Encoding

- Pilot provides known
  - Layer Base Height (MSL)
  - Layer Top Height (MSL)
- Encoding
  - Layer Height (MSL) [ft]
    - 0-18,000 in 500 [ft] increments
    - 18,000-44,000 in 1,000 [ft] increments

Decoding and Distribution

- Layer characteristics
  - Logical combinations of four subfields (Height, Thickness, Height Type, Coverage)
- Distributed in /SK, /RM fields depending on layer type
  - Encoded in hundreds of feet
  - Rules needed for encoding based on range-based reporting

ADS-B PIREP: Layer A/B/C Thickness

Pilot Entry and Encoding

- Pilot provides known
  - Layer Base Height (MSL)
  - Layer Top Height (MSL)
- Encoding
  - Layer Thickness = Layer Top Height less Layer Base Height
  - 0’-10,000’ in 500 [ft] increments
  - 10,000’-19,000’ in 1,000 [ft] incr.

Decoding and Distribution

- Layer characteristics
  - Top and/or Base determined from Layer Height, Layer Thickness, Layer Height Type
- Distributed in /SK, /RM fields depending on layer type
  - Encoded in hundreds of feet
  - Rules needed for encoding based on range-based reporting

ADS-B PIREP: Layer A/B/C Height Type

Pilot Entry and Encoding

- Pilot provides known
  - Layer Type
- Encoding
  - Icing Base or Icing Top
  - Turbulence Base or Turbulence Top
  - Fog Base or Fog Top
  - Cloud Base or Cloud Top
  - Haze Base or Haze Top
  - Smoke Base or Smoke Top
  - Dust Base or Dust Top
  - Wake or Mountain Wave Top

Decoding and Distribution

- Layer characteristics
  - Logical combinations of four subfields (Height, Thickness, Height Type, Coverage)
- Distributed in /SK, /RM fields depending on layer type

ADS-B PIREP: Layer A/B/C Coverage

Pilot Entry and Encoding

- Pilot Selects
  - None, None Below, None Above
  - FEW, FEW Below, FEW Above
  - SCT (Scattered), SCT Below, SCT Above
  - BKN (Broken), BKN Below, BKN Above
  - OVC (Overcast), OVC Below, OVC Above
- FEW, SCT, BKN, OVC apply to ‘Cloud Base’ or ‘Cloud Top’ Layer Height Types only

Decoding and Distribution

- Layer characteristics
  - Logical combinations of four subfields (Height, Thickness, Height Type, Coverage)
- Distributed in /SK, /RM fields depending on layer type

ADS-B PIREP: Flight Visibility

Pilot Entry and Encoding

- Flight Visibility value entered is as permitted by implementer
- Encoding of Flight Visibility shall be limited to:
  - Less than 1 SM (LIFR)
  - 1 SM to 3 SM (IFR)
  - 3 SM to 5 SM (MVFR)
  - 5 SM to 10 SM (VFR)
  - 10-20 SM
  - 20-40 SM
  - 40+ SM

Decoding and Distribution

- Distributed in /WX field
  - PIREP coding rules needed for encoding range values reported

ADS-B PIREP: Flight Weather 1/2/3

Pilot Entry and Encoding

- Up to three of 116 prescribed conditions defined in
  - Fed Met Handbook 12 and 1
    - Base conditions modified by intensity and proximity modifiers
- Additions based on
  - AWC ADDS PIREP Webtool
  - Community Input
    - Dry Thunderstorms
    - Lightning
    - Volcanic Odor
    - Cloud Types

Decoding and Distribution

- Abbreviations translated from “Flight Weather 1/2/3” subfields
- ‘Vicinity’ direction added from “Flight Weather 1/2 Vicinity Direction” subfields
- Distributed in /WX /RM fields
  - Certain conditions require additional Remarks entry

ADS-B PIREP: PIREP Air Temperature

Pilot Entry and Encoding

- Static Air Temperature or Total Air Temperature and Type
  - Type identified in “PIREP Air Temperature Type” subfield
- Sourced from system approved to display Air Temperature to flight crew
- Range and resolution as per ADS-Wx AIREP Message, Subtype 1 (Weather State)

Decoding and Distribution

- Validated for reasonableness against forecast at Time and Location
- For Air Temperature Type = Static Air Temperature, transcribed from Temp, Wind & Turbulence Message subfields
- For Air Temperature Type = Total Air Temperature, possible ground-based estimate of Static Air Temperature based on Surveillance and PIREP data for encoded PIREP
- Distributed in /TA field

ADS-B PIREP: PIREP Wind

Pilot Entry and Encoding

- Wind Speed and Wind Direction
  - Pilot input; calculated or sourced from system approved to display wind data to flight crew
- PIREP Wind Speed encoded as per ADS-Wx AIREP Message, Subtype 1 (Weather State)
- PIREP Wind Direction encoded in ten-degree increments relative to magnetic North

Decoding and Distribution

- Directly transcribed from ADS-Wx PIREP Message subfields
- Validated for reasonableness against forecast at time and location
- Distributed in /WV field

ADS-B PIREP: Turbulence

Pilot Entry and Encoding

- Pilot entered per AIP definitions
- Encoded in four subfields
  - Duration (2 bits)
    - Occasional/ Intermittent/ Continuous
  - Intensity (3 bits)
    - None/ Light/ Moderate/ Severe/ Extreme
  - Location (2 bits)
    - In Clear/ In Cloud/ Near Cloud
  - Type (2 bits)
    - Atmospheric/ Mountain Wave/ Wake

Decoding and Distribution

- Logical combinations of four subfields (Duration, Intensity, Location, Type)
- Layer characteristics
  - Combination of two subfields (Layer Height, Layer Thickness) for Layer Height Type = Turbulence Base or Turbulence Top
- Distributed in /TB field
- Turbulence Intensity used to characterize Wake and/or Mountain Wave Encounter Turbulence Types
  - Layer Height used for encounter altitude
  - Layer Thickness represents altitude loss
- Distributed in /RM field
- Turbulence Type = 'Wake'
  - Not processed into encoded PIREP
  - Wake encounters tallied separately from PIREPs

ADS-B PIREP: PIREP Icing

Pilot Entry and Encoding

- Pilot guidance for Icing Report elements
  - Type and Intensity, Indicated Airspeed, Outside (Static) Air Temperature
- Pilot input selected from subset of FIDS-related values
  - None
  - Types- Unknown/ Rime/ Mixed/ Clear
  - Intensity- Unknown/ Trace/ Light/ Moderate/ Severe
  - Supercooled Large Droplet Icing
  - Mixed Phase/ Ice Crystal Icing

Decoding and Distribution

- Type and Intensity determined from “PIREP Icing” Hazardous Weather Message subfield
- Distributed in /IC field
  - Air Temperature from Temp, Wind & Turbulence Message distributed in /TA field
  - Airspeed not encoded, therefore not reported via ADS-B PIREP submissions (PIREP applications can still request airspeed to prompt pilot attention to it)

ADS-B PIREP: Airspeed Change

Pilot Entry and Encoding

- Entered for Wind Shear, Mountain Wave, and Wake encounters
- Airspeed Change (4 bits)
  - 10-40 knots in 5 knot increments for Gain or Loss
  - Greater than 40 knots encoded as 40+ knots
  - 0-10 knot change not reported with Gain/Loss modifier

Decoding and Distribution

- Correlated with other valid ADS-Wx PIREP Message subfields for applicability to encounter
  - Wind Shear Height for Wind Shear encounter
  - Turbulence Type for Wake or Mountain Wave encounters
- Distributed in /RM field
  - In conjunction with Wind Shear Height and Runway information for Wind Shear
  - In conjunction with layer characteristics for Mountain Wave encounters
- Turbulence Type = 'Wake'
  - Not processed into encoded PIREP
  - Wake encounters tallied separately from PIREPs

ADS-B PIREP: Wind Shear Height

Pilot Entry and Encoding

- Entry limited to range values
  - 0’-200’ Height Above Threshold (HAT), Above Ground Level (AGL)
  - 300’ increments from 200’-2000’ HAT AGL
- Applicable only to Wind Shear
  - Not applicable to Wake Encounter reporting

Decoding and Distribution

- Wind Shear Encounter Correlated with Airspeed Change
- Distributed in /RM field
  - In conjunction with Airspeed Change and Runway information

ADS-B PIREP: Braking Action

Pilot Entry and Encoding

- Entry guidance per SAFO 19001
- Braking Action (4 bits)
  - Dry Runway
  - Good
  - Good-Medium
  - Medium
  - Medium-Poor
  - Poor
  - Nil

Decoding and Distribution

- Directly transcribed from “Braking Action” subfield in Hazardous Weather Message
- Distributed in /RM field
  - In conjunction with Runway information

ADS-B PIREP: Runway

Pilot Entry and Encoding

- Runway entry provides information for Wind Shear, Braking Action, Wake Encounter (operating to/from runway) reports
- Runway Number (6 bits)
  - 01-36 Runway Identifiers
- Runway Position (2 bits)
  - Single/L/C/R
  - Single is default

Decoding and Distribution

- Runway Position is valid only with valid Runway Number
- Distributed in /RM field
  - In conjunction with valid Wind Shear and/or Braking Action information
- Turbulence Type = 'Wake'
  - Not processed into encoded PIREP
  - Wake encounters tallied separately from PIREPs