

4th New Zealand Aviation Meteorology Symposium

Meeting Report

Date: 1 October 2020
 Venue: CAA Teams Meeting
 Actions: Refer Appendix 1
 Participants: Refer Appendix 3

Time: 0900-1445
 Host: CAA NZ
 Agenda: Refer Appendix 2

Discussion Summary

Item	Discussion/Action
Opening and introductions	<p>Shelley Turner, acting Director Civil Aviation, made the opening remarks, welcoming attendees to the meeting.</p> <p>Shelley acknowledged the impact of COVID-19 on the aviation sector, both domestically and internationally – and also on the organisations that supply services to aviation, who, as a result are having to innovate more than ever before to keep pace with change and demands.</p> <p>Shelley encouraged participants to listen and engage in the discussions, ask questions, and then take some time to consider how everyone can work together to ensure that the aviation community is getting the right MET information at the right time, and is making the most of it to help inform good decision making on the ground and on the flight deck.</p>
Actions Review	Refer Appendix 1
Presentations	<p>The PowerPoint (PPT) presentations mentioned below are available on the CAA web site <i>Meteorology</i> pages under <i>Met Developments</i>. (refer to: https://www.aviation.govt.nz/airspace-and-aerodromes/meteorology/met-developments/)</p>
International MET Developments – Peter Lechner (Chair of ICAO MET Panel)	<ul style="list-style-type: none"> • The value of MET information was highlighted <ul style="list-style-type: none"> ○ Noted that it was critical to aviation safety risk management and in turn, to the global economy ○ The safe and efficient aircraft operation, with minimal effect on the atmosphere, will always require good MET information. • The challenges associated with upcoming changes were highlighted <ul style="list-style-type: none"> ○ With the move to phenomenon-based MET information in digital format at higher spatial and temporal resolution, there will be an associated significant increase in data size ○ As global systems are implemented (rather than State/FIR based), issues with cost recovery become complicated ○ Not all States can progress at the same rate ○ Need to consider how private MET sector can be integrated ○ A question was raised via Pigeonhole about how non-Part 174 information can be used in flight planning and pilot briefing solutions – particularly relevant in a SWIM environment (eg; international meteorological information). Paula advised that following an issue assessment, CAA has an action to shape a policy project focused on ensuring the regulatory framework for MET is fit for purpose. • Concept of stewardship introduced

	<ul style="list-style-type: none"> ○ The nature of the aviation MET information is derived from and managed through various joint user/provider efforts ○ The providers must ensure good stewardship of aviation MET information through their development, provision, distribution, and cost recovery where appropriate ○ Effective stewardship of aviation MET information should reduce the cost burden on aviation users, and assist in the further development of aviation MET information, its reliable distribution and integration in aviation operations <ul style="list-style-type: none"> ● The MET Panel working group and work stream structure was highlighted (see slide). ● ICAO MET Development process was covered with regard to the inputs from many parties including users and the WMO. ● Noted that work was underway to split Annex 3 into two – the standards being retained in the Annex and the means of compliance being removed into a separate “PANS-MET”, which will likely be updated annually (while Annex 3 now on 3 yearly amendment cycle). ● The MET Panel, like other ICAO Panels, are now having to progress work via virtual channels, meaning many a late-night meeting. At this stage, no delays are expected to the ANC Job Card implementation due to the pandemic. ● ICAO MET Panel has been working with WMO on a more joined up approach to respective development obligations and better use of available expert capacity nominated by States. First space weather advisory issued on 28 September, advising of a space weather event in progress, affecting the mid and high northern latitudes and impacting higher HF com frequency bands. The system works!
<p>Pacific Update – Paula Acethorp (CAA) and Nicole Ranger (MetService)</p>	<ul style="list-style-type: none"> ● Reminder of outcomes of 5th Meeting of Pacific MET Council (PMC-5) - as proposed by expert panel Pacific Island Aviation Weather Services (PIAWS) Panel. A PIAWS Panel task team was formed to address ICAO Air Navigation Deficiencies in MET field and to work on IWXXM capability of the south Pacific states: <ul style="list-style-type: none"> ○ MetService, as the Wellington Regional OPMET Centre, is looking at the possibility of providing IWXXM translation services on behalf of the Nadi Regional OPMET Centre. ○ Of the current 12 deficiencies in place for south Pacific States, seven work plans have been developed, plus assistance provided towards resolution of two more deficiencies. ● VAAC Wellington outlined three of the deficiency resolution activities it has been involved in during the past year: <ul style="list-style-type: none"> ○ VAACs Wellington and Darwin worked with the Solomon Islands Meteorological Services (SIMS) on a volcanic ash SIGMET exercise in August, where each VAAC would issue an exercise VAA and SIMS would issue a SIGMET in response. ○ VAAC Wellington worked with Tonga Meteorological Services (TMS) on a series of volcanic activity reporting exercises during June and August. ○ The ICAO VOLCEX 20/02 volcanic ash exercise held on 17 July simulated the eruption of the Tongan volcano Tofua, providing TMS further opportunity to demonstrate the provision of information on volcanic activity.
<p>New Southern Sky SWIM Sub-Group Update</p>	<ul style="list-style-type: none"> ● Progress is continuing towards the digital provision of meteorological information in New Zealand:

<p>on MET – David Wills (CAA)</p>	<ul style="list-style-type: none"> ○ Extended Aeronautical Message Handling System (AMHS) links now established to Australia and USA: <ul style="list-style-type: none"> ▪ Enables transmission of IWXXM files (old AFTN network is unable to handle these due to size and character set limitations) to other AMHS nodes around the world. ○ Test IWXXM messages exchanged with Australia and USA: <ul style="list-style-type: none"> ▪ NZ is prepared for the November 2020 Annex 3 mandate. ○ MetService can translate TAC to IWXXM (and vice versa): <ul style="list-style-type: none"> ▪ Translation will occur when IWXXM is not made from source (eg METAR). ▪ Data from other agencies will not be translated, unless by explicit agreement.
<p>MetService – Ray Thorpe, Anna D’Arcy, Kevin Alder, DhiresH Hansaraj, Marcel Roux, Iman Soltanzadeh</p>	<ul style="list-style-type: none"> ● Highlighted the business practice goals for supporting aviation: <ul style="list-style-type: none"> ○ Strong strategic relationships with customers and regulators that contribute to a safe and efficient New Zealand aviation system. ○ Reshaped service provision to ensure long term sustainability of aviation safety services at reduced air traffic levels. ● Noted the effects of COVID-19 on Industry and revenue but stressed that there was a forward-looking focus on resilience and on supporting the aviation industry in its new forms. ● The MetService Safety Manager shared her reflections of the past 10 months: <ul style="list-style-type: none"> ○ The security, integrity and availability of our services are pivotal to the critical safety role we provide. ○ ‘Just Culture’ programme and benefits of CAA Part 174 certification advantage all of their customers. ○ Noted that their SMS processes and emergency planning served them well when dealing with the CV-19 crisis. ● The observations programme overview highlighted a number of improvements in the last year: <ul style="list-style-type: none"> ○ METAR AUTO Observations with cloud / visibility now available for Kaitaia and Kaikoura. ○ METAR AUTO basic observations (no cloud or visibility information) now available for Alexandra, Ardmore, Waiouru, Wairoa, and Mount Cook Airports. ○ Aerodrome reporting enhancements e.g. adding QNH to Ashburton. ○ Reviewing / improving instrumentation exposure at NZGS, NZTG, NZWR, NZWK ○ Otago weather radar delayed by COVID-19 pandemic, and is now currently expected to be operational by end of 2020, enhancing Otago coverage. ● New platforms and products <ul style="list-style-type: none"> ○ Due to COVID-19 pandemic, change in focus to more 'nailing the basics' and less 'brand new stuff'. ○ MetJet and MetFlight user interfaces getting a refresh ○ The runway dials page has been updated and about to be released. ○ New tools available in the MetOps platform: <ul style="list-style-type: none"> ▪ Lightning Prediction Algorithm (LPA). ▪ SE Asia ‘Points of Interest’ (aka Lightning circles) using the new Lightning API).

	<ul style="list-style-type: none"> ○ A focus on overall resilience of aviation met data, with the delivery mechanism ultimately being the API: <ul style="list-style-type: none"> ▪ All aviation products will be available to all users from this API; either directly, via MetService aviation portals, or third-party applications. ● Forecasting services update: <ul style="list-style-type: none"> ○ Overview of how forecast operations were conducted during COVID-19 alert level 3 and 4, with physical separation and operations from home for some staff. ○ Moving towards a change in forecaster role, providing advice to support meteorological data information provision. ○ Future work in progress: <ul style="list-style-type: none"> ▪ Integrating WAFC gridded data into the overall service provision. ▪ Further investigation into the provision of supplementary airport graphical forecasts. ● Research update – discussed how the New Zealand high resolution models are run and outlined future innovation (high resolution rapid refresh updates)
<p>Airways –lan Dore, Trent Clarke (Aeropath)</p>	<ul style="list-style-type: none"> ● Highlighted update to IFIS portal, where space weather advisories are now available (when issued). ● Overview of extended AMHS connection to Australia. <ul style="list-style-type: none"> ○ A question was raised on Pigeonhole about any updates on NZ’s connections to the APAC CRV. ○ Airways responded that they have replaced New Zealand's two dedicated point-to-point connections for International Aeronautical Message exchange (one to Australia and one to the USA) with two connections into the Common AeRONautical VPN (CRV, and formerly known as the Common Regional VPN). One connection into CRV is from Christchurch and the other from Auckland. This is to provide redundant connections with geographic diversity. Both the Australian and USA AMHS connections are running over CRV. Having CRV connectivity should enable Airways to open up direct AFTN/AMHS connections to other States connected to the CRV (if there was the need), without having to put in additional physical network connections. ● Aeropath AIM to AIS update: <ul style="list-style-type: none"> ○ AIM ConOps for 2023+ recently published by the New Southern Sky Working Group. ○ Integration of AIM and MET data a key step in roadmap. ● Airways International Ltd & MetService are exploring the joint development of a one stop shop pre-flight briefing site – will be demonstrated to industry via the New Southern Sky working group.
<p>Volcano Observatories – Nico Fournier (GNS)</p>	<ul style="list-style-type: none"> ● Highlighted that volcano observatories primarily focus on acute risk to life safety near volcanoes: <ul style="list-style-type: none"> ○ This does not mean they are not also focused on aviation safety. ● Three main phases when monitoring volcanoes: <ol style="list-style-type: none"> 1. Detecting monitoring and unrest – something is going on; the volcano is becoming active. 2. Short term eruption forecast – the most difficult part – evaluating the activity and attempting to turn that into an evaluation of likelihood of eruption in the near term.

	<ul style="list-style-type: none"> 3. Detection eruption – via a variety of methods – webcam, seismic monitoring, satellite, visual report (often combination of these) <ul style="list-style-type: none"> ○ Following eruption, the phases cycle through again. ● Impact of volcanic eruptions to aviation <ul style="list-style-type: none"> ○ Ashfall at aerodromes, requiring ongoing clean-up and monitoring of “remobilisation” (ash on the ground being re-suspended in the air by wind) ○ Damage to aircraft when ingested into engines, and critical aircraft systems, or causing abrasion on leading edges (including windscreen). ○ Disruption to airspace during large eruptions that spread ash far and wide (eg Eyjafjallajokull, Cordon Caulle, and Agung over recent years). ● How volcano observatories help <ul style="list-style-type: none"> ○ Provide forecasts of ashfall on the ground – critical for aerodrome planning during an eruption. Note, ash deposition can occur quite some distance from the volcano. <ul style="list-style-type: none"> ▪ Example of cumulative ashfall graphs – expected to be available in future (see presentation). ○ Provide intelligence to the VAAC – good observations of ash clouds inform good forecasts of ash dispersion in the atmosphere ● Information on what to do during an eruption is available on the GNS website, including advice for airport operators.
<p>ICAO Developments in Volcanic Hazard Information – Paula Acethorp (CAA) and Jarrad Denman (VAAC Darwin)</p>	<ul style="list-style-type: none"> ● VONA elevation: <ul style="list-style-type: none"> ○ States with active (or potentially active) volcanoes must arrange for volcano observatories to provide information to the local ACC/FIC, MWO and VAAC – but no requirement on format of that data. ○ Proposal to elevate VONA (Volcano Observatory Notice to Aviation) to be a recommended practice for sharing volcanic activity information, likely November 2023. ○ Will allow greater awareness of pre-eruptive activity (ie volcano unrest, possibly indicating higher chance of eruption) via the usual aviation channels (along with MET warnings and information). ○ GNS Science, MetService and CAA working on a proposal for a south Pacific VONA web portal, to provide tool for south Pacific volcano observatories to easily disseminate information on activity to aviation (will include IWXXM format). ● Sulphur dioxide information: <ul style="list-style-type: none"> ○ ICAO MET Panel is working on a trial volcanic sulphur dioxide (SO₂) service, targeting concentrations in the atmosphere that exceed World Health Organisation recommended limits. ○ If you can smell something like a “just struck match”, the SO₂ concentration is likely higher than the WHO threshold. ○ The London VAAC will develop the trial global SO₂ forecast capability – no timeline agreed as yet, just determining “the art of the possible”. ● Quantitative volcanic ash information: <ul style="list-style-type: none"> ○ Meeting reminded/informed that several years ago Rolls Royce declared a volcanic ash dosage tolerance for their RB211 and Trent engines, following a significant amount of ground-breaking research. Other manufacturers encouraged by FAA to follow suit.

	<ul style="list-style-type: none"> ○ Means that planners can determine a safe route through a volcanic ash cloud when the volcanic ash concentrations are well known. ○ Global VAACs are now developing a quantitative volcanic ash information service to assist in this, with VAACs Darwin and London creating examples of charts for a hypothetical eruption: <ul style="list-style-type: none"> ▪ Charts show the probability of exceeding a certain threshold of ash concentration (see presentation). ▪ Based on 18-member ensemble forecasts, the “probability” is the percentage of ensemble members with ash above the stated threshold (so not true probability as does not encompass uncertainty in eruption parameters – eg how much ash released). ▪ Charts show three “deep” altitude layers: SFC-FL200, FL200-350 and FL350-550. ○ Expected to be a recommended practice from November 2023. The information will include “volcanic objects” in IWXXM format similar to a VAA polygon, likely based on a contour line in the data. ○ Feedback on the charts and any potential improvements was requested to be provided to VAAC Wellington (action 2020/3), with updates on the service to be provided as a standing agenda item (action 2020/4).
<p>NZ VAAS Refresh – Paula Acethorp (CAA)</p>	<ul style="list-style-type: none"> ● NZ Volcanic Ash Advisory System (VAAS) is effectively the local implementation of the ICAO International Airways Volcano Watch, describing the actions expected of Airways, MetService, GNS Science, CAA and pilots during periods of volcanic activity. ● The NZ VAAS is described in Living with Volcanic Ash Episodes in New Zealand, which has been recently updated to: <ul style="list-style-type: none"> ○ Include more recent templates of various volcanic activity messages ○ Update the information flow table to reflect the global requirement for an “initial VAA” to be issued quickly upon confirmation of a new eruption – it will not include any forecast information (that will come in an update within 30-60min), and is intended to serve as an early message to warn aviation of the potential ash hazard. ● The Volcanic Hazard Zone NOTAM template has now also been updated to include a reference to the current Volcanic Alert Level, plus refers users to GeoNet.org.nz for the relevant Volcanic Alert Bulletin detailing the volcanic hazards. ● Further updates planned: <ul style="list-style-type: none"> ○ Volcanic Hazard Zone review: <ul style="list-style-type: none"> ▪ Planned review of Volcanic Hazard Zones in 2021. Is the coverage appropriate? Are they all required? Are they still fit for purpose? ▪ Part 91.137 currently requires pilots to consider relevant NOTAMs, SIGMETs and other Part 174 issued information provided “for this purpose”. How will VONA fit in? ○ VONA elevation: <ul style="list-style-type: none"> ▪ Currently emailed to a distribution list (ACC/VAAC etc) – not sustainable going forward when becomes a recommended practice. ▪ How should the VONA be made available once a recommended practice? ○ Flying Around Volcanoes GAP booklet:

	<ul style="list-style-type: none"> ▪ Planned to be a summary of the sort of information operators in NZ volcanic regions can use when planning and conducting flights and what they are telling you. ▪ Will include an overview of the sorts of volcanic hazards that may be present including volcanic gases.
Further discussion	<p>Questions were predominantly asked through the Pigeonhole website Q&A session set up for the meeting.</p> <p>An overview of discussions held during the meeting (either via the Teams meeting or via Pigeonhole) are as follows:</p> <ul style="list-style-type: none"> • The difficulties for West Coast operators was raised, whereby there are few aviation spec automatic weather stations or TAFs available across the region and there was concern that closing action 2019/1 was premature. A new action (2020/2) was formed to request MetService to continue briefing this forum on the work of the Aviation Transformation Services Group, noting the industry expectation for services to be optimised to support the safety and efficiency of all aviation operations. • Regarding action 2018/6, concern was raised around outreach activities falling off the radar if the action was closed. MetService said that if any aviation organisation hosting an event that might benefit from meteorological input, consider inviting MetService to participate either virtually or where possible in person – noting advance notice is required due to rostering. Further it was agreed that outreach activities such as educational webinars would be a useful tool to share information on meteorological matters with the aviation industry – see action 2020/1. • A question was asked around where to find the current assigned Aviation Colour Codes for the NZ volcanoes, supported by another comment noting that GA operators in the central North Island would like to have access to the Colour Codes on a daily basis. Currently, the Colour Codes are included as part of each Volcanic Alert Bulletin (VAB) issued, as well as in each VONA issued. See GeoNet.org.nz to find the latest VAB for each volcano and then at the top of these, the current Aviation Colour Code is provided. • Greg Reeve informed the participants that he had now finished writing his MET for CPL book and it was now awaiting publication. He is now working on a MET for ATPL book.

Next Meeting	
Date:	TBC Sep/Oct 2021
Place:	CAA, Wellington
Time:	Full day

Appendix 1 – Consolidated Actions and Updates

Mtg	Action / Decision	Description and comment	State	Who/Lead
2017	7	Investigate and implement, if possible, access to Fiji Airways AMDAR. The implementation of a Fiji AMDAR Programme with Fiji Airways is the responsibility of the Fiji Meteorological Service. Should it get up and running, the data will be available to all WMO member countries including New Zealand.	Closed	MetService
2017	8	Investigate the potential implementation and costs of meteorologist direct link to airport/ATM/airline operations. Work in progress with discussions held with various organisations over past two years, however difficult to progress further in COVID-19 environment.	Open	MetService
2017	9	Work with aerodromes to implement key MET input into A-CDM. To include runway condition and radar scanning concepts and costing. Now implemented at Wellington International Airport. ICAO requirement for airport reporting requirements deferred to Nov 2021 – MetService will work with other airports as the need arises. .	Closed	MetService
2017	16	Implement a programme of investigation into the probable MET requirements of UAV/RPAS including low-level smaller aircraft through to unmanned heavy metal aircraft (eg B747 freighters) at cruising levels. MetService work continues with the Air, Land, Marine components of NZDF on current and future requirements for RPAS/UAV, as well as other entities such as CHC based Zephyr Airwork for current concept UAV designs & testing. MetOPs display has applications here as well for operational bases.	Closed	MetService
2017	18	Review the utility of TREND in context of operator need for short term forecast window on probable aerodrome conditions – noting the recent work completed by BoM in this regard Initial work complete, awaiting MetService supporting data. CAA view is that any further proposal to remove TREND should be led by MetService as part of aviation services review, outlining rationale and providing evidence. In light of COVID, MetService advises this has been a lower priority this FY and is deferred to next FY21/22. Action proposed to be closed until such time it is reformed in the future.	Closed	CAA
2018	1	Share the domestic TAF provision policy with industry for feedback and progress its implementation. Now complete, shared with Aviation Transformation Services Group for feedback.	Closed	MetService
2018	2	Progress the new air navigation-based MET charging model in conjunction with Airways, in close liaison with CAA, recognising that a change to current legislation may be required. CAA issue assessment complete, agreed action “to shape a future policy project focussed on ensuring our regulatory framework for MET is fit for purpose.” MetService will present options back to stakeholders April-June 2021.	Open	CAA & MetService

Mtg	Action / Decision	Description and comment	State	Who/Lead
2018	6	Encourage better user/forecaster interactions and mutual understanding by involvement in events hosted by RNZAC, NZAWA and attending annual CAA instructor and examiner seminars. <i>This is now BAU as opportunities arise, with the aviation community encouraged to consider whether including a MET perspective/presence would be useful for any future events. Further, new action agreed – 2020/1.</i>	Closed	MetService & CAA
2019	1	MetService to continue to carry out a review of services to aviation, to ensure that services provided to the aviation community are optimised to support the safety and efficiency of aviation operations. As part of this, MetService are invited to review services to the GA, helicopter and small operator sectors, including conducting workshops, to ensure services provided meet the needs of those sectors, while keeping in mind MetService's obligations as an SOE. <i>Being actioned through the Aviation Transformation Services Group. New action 2020/2.</i>	Closed	MetService
2019	2	Progress on activities of the New Southern Sky SWIM Sub-Group (as related to MET) to be reported at the next MET Symposium <i>Presentation to be made – future updates be added to standing agenda.</i>	Closed	CAA
2019	3	CAA to undertake a review of current processes, as they relate to space weather advisories. CAA also to make available education material on space weather and its impacts, as well as the space advisory system and how users (in particular operators and ATC) may make use of those advisories. <i>Education material available on CAA website, along with space weather article in Vector. Space weather exercise now in early planning stage, tentatively planned for first quarter 2021.</i>	Open	CAA
2020	1	CAA and MetService work together to develop education and outreach material for the aviation industry, utilising a variety of interactive means.	New	CAA & MetService
2020	2	MetService to report back to the next MET Symposium on progress of the Aviation Transformation Services Group activities, noting the industry expectation for services to be optimised to support the safety and efficiency of all aviation operations. Note, regular updates are also provided to the New Southern Sky working group.	New	MetService
2020	3	Aviation industry encouraged to provide feedback to VAAC Wellington on the proposed quantitative volcanic ash information – in particular, the utility of the presented charts and how they may be used in operations.	New	All
2020	4	Updates on the implementation of quantitative volcanic ash information to be a standing agenda item within the MET Symposium.	New	CAA

Appendix 2 – Agenda

#	Item	Covering	Presenter
1.	Opening and introductions	<ul style="list-style-type: none"> Opening Remarks Virtual introductions, housekeeping 	Shelley Turner - Acting DCA Paula Acethorp - CAA
2.	Open Actions - Status	<ul style="list-style-type: none"> Review of all open actions (refer Appendix 1 – updates to be provided ahead of time) 	Paula Acethorp - CAA
3.	International meteorological system developments and progress.	<ul style="list-style-type: none"> Brief overview of ICAO MET Panel developments 	Peter Lechner - CAA (MET Panel Chair)
4.	Pacific MET Activities	<ul style="list-style-type: none"> Activities of PIAWS Panel Task Team 	Paula Acethorp - CAA Nicole Ranger - MetService
5.	NSS SWIM Sub-Group update	<ul style="list-style-type: none"> Brief update on the implementation of SWIM enablers 	David Wills - CAA
6.	<i>Short break</i>		
7.	Part 174 Certificate holder updates	<ul style="list-style-type: none"> Their experiences, issues, and future directions 	MetService Airways
8.	Review	<ul style="list-style-type: none"> Issues - identified Actions - allocated 	Paula Acethorp - CAA
9.	<i>Mid-Symposium break</i>		
10.	Volcano Observatories	<ul style="list-style-type: none"> Why they matter and how they can help 	Nico Fournier - GNS Science
11.	ICAO developments in volcanic hazard warnings	<ul style="list-style-type: none"> Elevation of VONA SO2 forecast development Quantitative volcanic ash information 	Paula Acethorp - CAA Jarrad Denman – VAAC Darwin
12.	<i>Short break</i>		
13.	NZ VAAS refresh	<ul style="list-style-type: none"> An overview of actions underway 	Paula Acethorp - CAA
14.	Review and close	<ul style="list-style-type: none"> Any further issues identified; actions allocated Meeting close 	Paula Acethorp - CAA

Appendix 3 – Participants¹

Aeropath	Matt Day	Trent Clarke			
Air NZ	Markus Kraettli				
Airways	Mark Blanchard	Johl Steel-Brown	Ian Dore	Hamish Helm	Katie Wilkinson
	Graham Wadeson	Frances Dowdle	Alan Davies		
ALPA	Frank Usmar				
AOPA	Don Ryder				
BoM Australia	Ashwin Naidu	David Farr	Jarrad Denman	Amber Raman	
CAA	Paula Acethorp	Peter Lechner	David Wills	Sean Rogers	Carlton Campbell
	Joe Franklin	Lorcan Byrne	Steve Smyth	James Black	
Garden City Helicopters	Matthew Boulcott				
Glacier Country Helicopters	John Funnell				
GNS Science	Natalia Deligne	Nico Fournier			
IATA	Graham Rennie				
Jetstar	Glenn Johnston				
Ministry of Transport	Garrick Wood				
MetService	Rob Harrison	Ray Thorpe	Marcel Roux	Nicole Ranger	Amy Dreverman
	Ramon Oosterkamp	Peter Lowe	Greg Reeve	Anna D’Arcy	DhiresH Hansaraj
	Iman Soltanzadeh	Marijke Willemse	Kevin Alder		
Navigatus	Geraint Bermingham				
NIWA	Mark Bojesen-Trepka	Bernard Miville			
NZAWA	Dee Bond				
OzRunways	Ellen Franklin				
Vanuatu Meteorology and Geo-Hazards Dept	Jerry Timothy				
Volcanic Air	Tim Barrow				
Wellington International Airport	Lachlan Thurston				
Other attendees	Andrew McGregor	Keith Mackersy	George Walker	Mike Haines	Joanna

¹ Names taken from Teams meeting participant record.