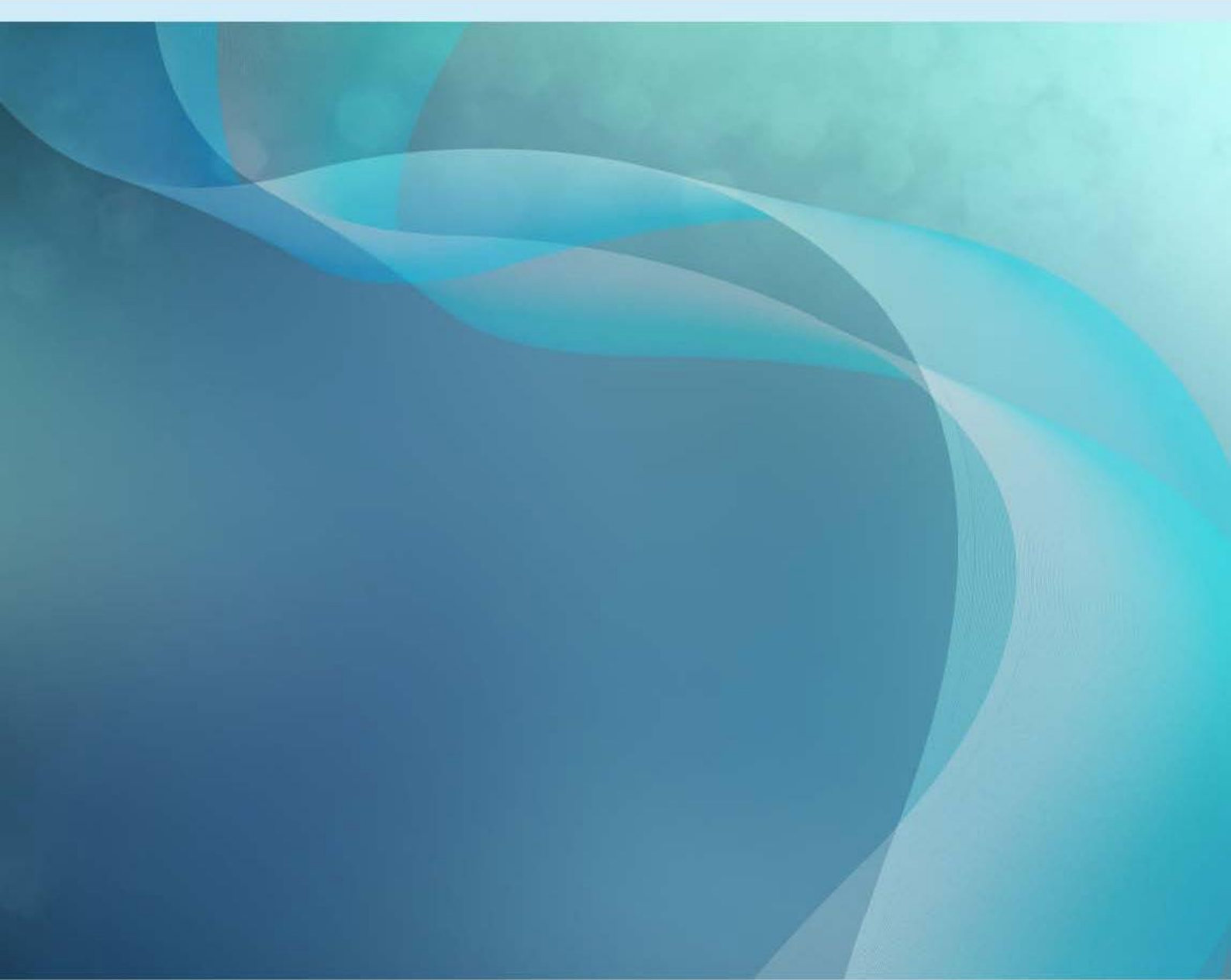




Australian Government
Bureau of Meteorology

Report on the 2016 Major Airports Survey

by Andrew McCrindell, Major Airport Services



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Executive Summary

The Bureau's Major Airports Survey was conducted over November and December 2016 and the results are representative for an estimated population of 25000. The major airports considered were Sydney, Melbourne, Brisbane, Perth, Adelaide, Gold Coast, Cairns, Canberra, Darwin and Hobart.

Background:

- Respondents 210 of an estimated population of 25000
- Respondents by organisation – Qantas 22.4%, Virgin Australia 11.9%, Qantaslink 11.9%, Jetstar 4.8%, Airservices 8.1% Defence 9.5% and representation from other operators such as the Royal Flying Doctor Service (RFDS), and general aviation operators including charter, and private pilots.
- Respondents by role/function – Pilot 73.8%, Air Traffic Services 14.3%, Management 5.3%, and others.
- There were representative figures for the airports of importance to operations.

Results:

- Overall satisfaction with major airport products and services was 78.5%
- The TTF and TAF were considered the most important products.
- Accuracy 79.3% +/- 5.4%.
- Bureau forecasts are perceived as conservative.
- Timeliness of amendment 68.8%.
- Accessibility 90.9% - useful suggestions made for improvements to access.
- Optimisation of payload – 79.4% indicated payloads were optimised more than 60% of the time.
- Optimisation of air traffic services - 97% indicated air traffic services were optimised more than 60% of time.

Key areas of concern:

- Accuracy for forecasting thunderstorms including Terminal Area (TMA): Brisbane, Sydney, Darwin and Melbourne.
- Accuracy for forecasting fog – Perth, Sydney, Melbourne, Adelaide, Canberra and Brisbane.
- Most common impacts of untimely forecast: increased workload, increased stress and trust issues with subsequent forecasts.
- Most common concerns with untimely forecasts: insufficient fuel, lack of alternate option, safety compromised and unnecessary diversion.

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1 Introduction

The Bureau of Meteorology (Bureau) conducts regular surveys of its products and services to ensure a process of continuous improvement within its ISO 9001 Quality Management System. There are a large number of aviation stakeholders that regularly use aviation meteorological products at the major airports including the major airlines, Airservices personnel, smaller regional operators and general aviation. Feedback from the 2016 survey will be used to identify priority areas for improvement and will assist the Bureau in a better understanding of any changing forecast requirements.

The major airports considered in the survey were Sydney, Brisbane, Melbourne, Perth, Adelaide, Gold Coast, Cairns, Canberra, Darwin, and Hobart. These airports are within the portfolio of the Manager Major Airports and receive a premium forecasting service that includes TAF, TTF¹, Aerodrome briefings and special warnings.

The survey questions were developed from the 2014 Major Airports Survey with the aim of benchmarking key issues for the Bureau and industry stakeholders. The survey was organised and distributed by the Bureau's industry communications and liaison manager. This survey was disseminated through the Civil Aviation Safety Authority (CASA) monthly e-bulletins and social media channels, Australian Federation of Air Pilots (AFAP) technical briefings and publications including Airwaves, Australian & International Pilots Association (AIPA) publications Altitude and Insight, the Bureau's aviation website and emails to key industry stakeholders.

The population that regularly use Major Airport Weather Services for their operations was estimated to be 25,000, and consists largely of pilots, airline operations, dispatch and Airservices controllers.

A good representative sample for any survey is 1-3% of the population and a sample of 4-5% is considered outstanding. The survey had 210 respondents (0.84%) from a diverse operational background.

Statistical margins (Confidence Intervals) for this survey based on a 95% Confidence Level for a 50% survey result is + or – 6.75% and an 80% response is + or – 5.40%². The Confidence Intervals have not been quoted on every statistic in this report.

The descriptive responses in the survey were professional, constructive and provided valuable insight. Written responses in this report have been summarised into similar themes and ideas.

This report describes the results of the survey.

¹ Gold Coast and Hobart have no TTF service.

² Confidence Intervals were calculated using the statistic tool at <http://www.nss.gov.au/nss/home.NSF/pages/Sample+size+calculator>.

2 Background information

2.1 Organisation or group

The respondents to the survey including the key organisations or groups regularly accessing major airport services are represented in Figure 1. Qantas provided 22% of the responses, Virgin Australia and Qantaslink 12% each, Defence/RAAF 9%, Airservices Australia 8% and Jetstar 5% with good representation from other airlines including helicopter operators, air freight and the RFDS.

Organisation	Count	
Qantas	47	22.4%
Airservices Australia	17	8.1%
Virgin Australia	25	11.9%
Jetstar	10	4.8%
RFDS	9	4.3%
Rex	3	1.4%
General Aviation	14	6.7%
Qantaslink	25	11.9%
Defence/RAAF	20	9.5%
Cobham	2	1.0%
Air North	1	0.5%
CASA/ATSB	3	1.4%
Tiger Airways	1	0.5%
Flight Training	14	6.7%
Queensland Government air rescue	2	1.0%
Charter Operators	2	1.0%
Others	15	7.1%
Total	210	

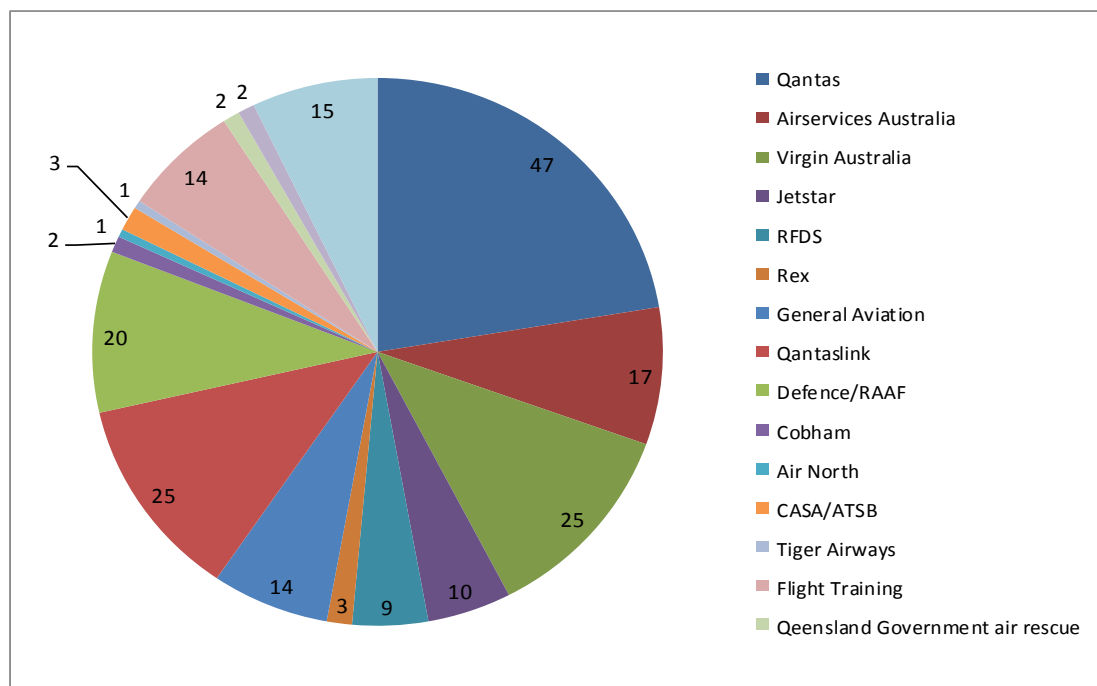


Figure 1: Table and pie chart representing survey respondents by organisations or groups

2.1.1 Role or function

Roles and functions of survey respondents are provided in Figure 2. Pilots made up the majority of respondents (73.8%), air traffic services 14.3% and airline operations personnel 1.4%.

Role or function	Count	%
Pilot	155	73.8
Air Traffic Services	30	14.3
Airline Operations	3	1.4
Airline Management	6	2.9
Airservices Management	5	2.4
Instructor/Flight Training	3	1.4
Flying Operations Inspector	2	1.0
Airport Operations	2	1.0
Management and pilot	2	1.0
Student Pilot	1	0.5
Other	1	0.5
Total	210	

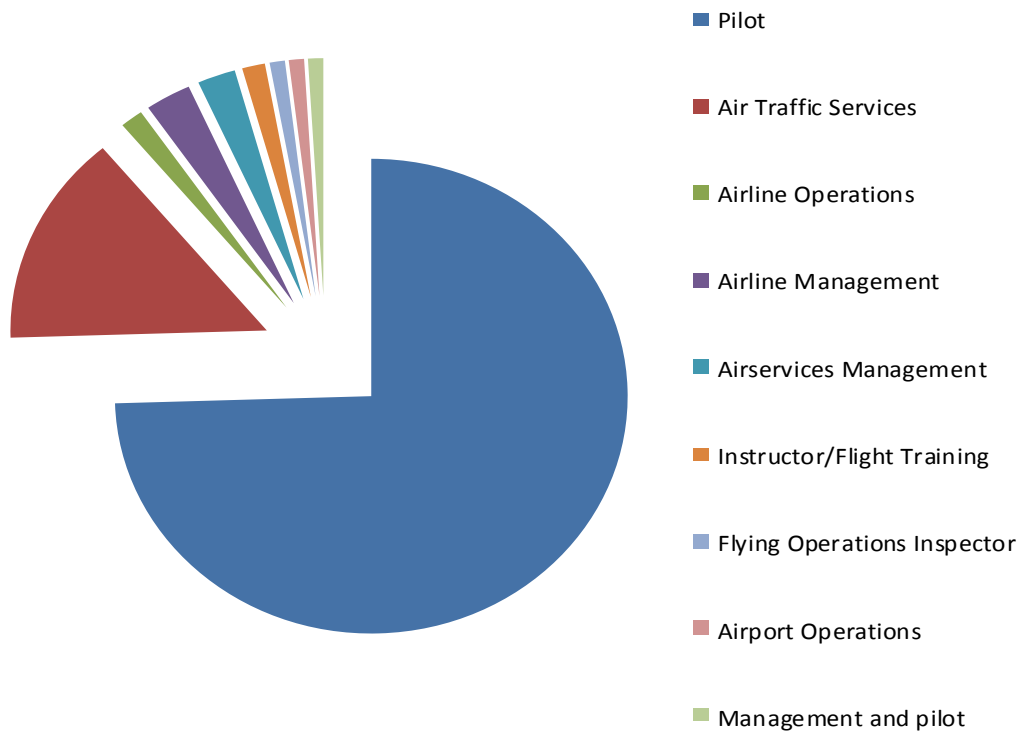


Figure 2: Table and pie chart representing survey respondents by role or function

2.1.2 Comparison with previous surveys

Survey respondents' role or function from the 2016 Major Airports Survey is compared to the previous surveys in Table 1.

Table 1: Role or function comparison with previous surveys

Role or Function	2012	2014	2016
Pilot	347	400	155
Air Traffic Services	83	20	30
Airline Operations	9	9	3
Airline Management	2	8	6
Airservices Management			5
Instructor		3	3
Ground Crew		1	0
Safety		1	0
Airport Operations		1	2
Flying Operations Inspector			2
Researcher		1	0
Network Management		1	0
Management and pilot		1	2
Student Pilot			1
Other		1	1
	441	447	210

2.2 Major airports relevant to the survey respondents

The survey allowed multiple airports to be highlighted with a total count of 903 indicating that most of the respondents regarded numerous major airports as important to their operations. Figure 3 lists the responses.

Which major airports are relevant to you?	Count	%
Sydney	115	12.7%
Melbourne	104	11.5%
Brisbane	122	13.5%
Perth	75	8.3%
Adelaide	95	10.5%
Gold Coast	81	9.0%
Cairns	88	9.7%
Canberra	87	9.6%
Darwin	88	9.7%
Hobart	48	5.3%
Total	903	

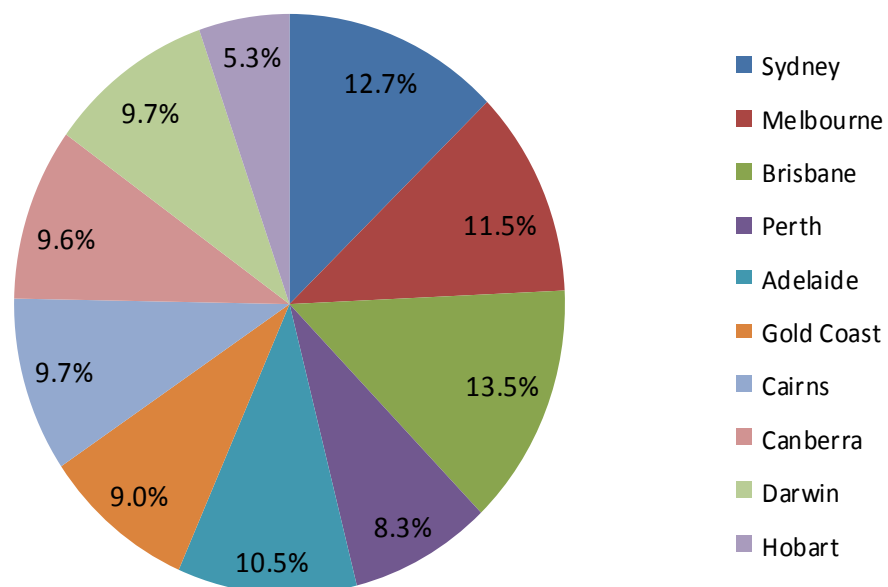


Figure 3: Table and pie chart of the proportion of major airports relevant to operations

3 Overall Satisfaction

Respondents were asked to consider their overall satisfaction with the Bureau's aviation weather services for major airports. 78.5% of respondents indicated that they were satisfied overall (Figure 4: Pie chart of the proportion of respondents overall satisfaction). This figure was very similar to Accuracy 79.3% which could mean the same thing in the context of this survey.

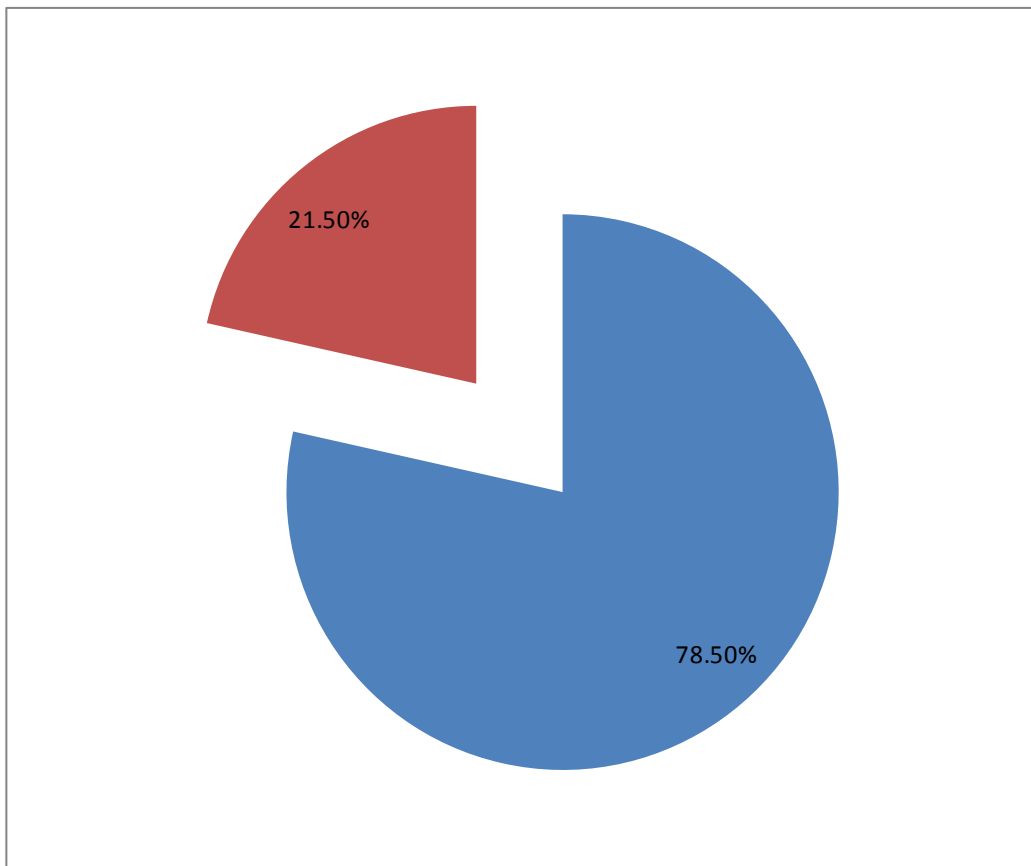


Figure 4: Pie chart of the proportion of respondents overall satisfaction

4 Usage of aviation products and services

The monthly usage of products and services are illustrated at Figure 5: Monthly usage of aviation products . Usage of more than 10 times per month is displayed in green, 6 to 10 times per month in yellow, 1-5 times per month in orange, and not at all in red.

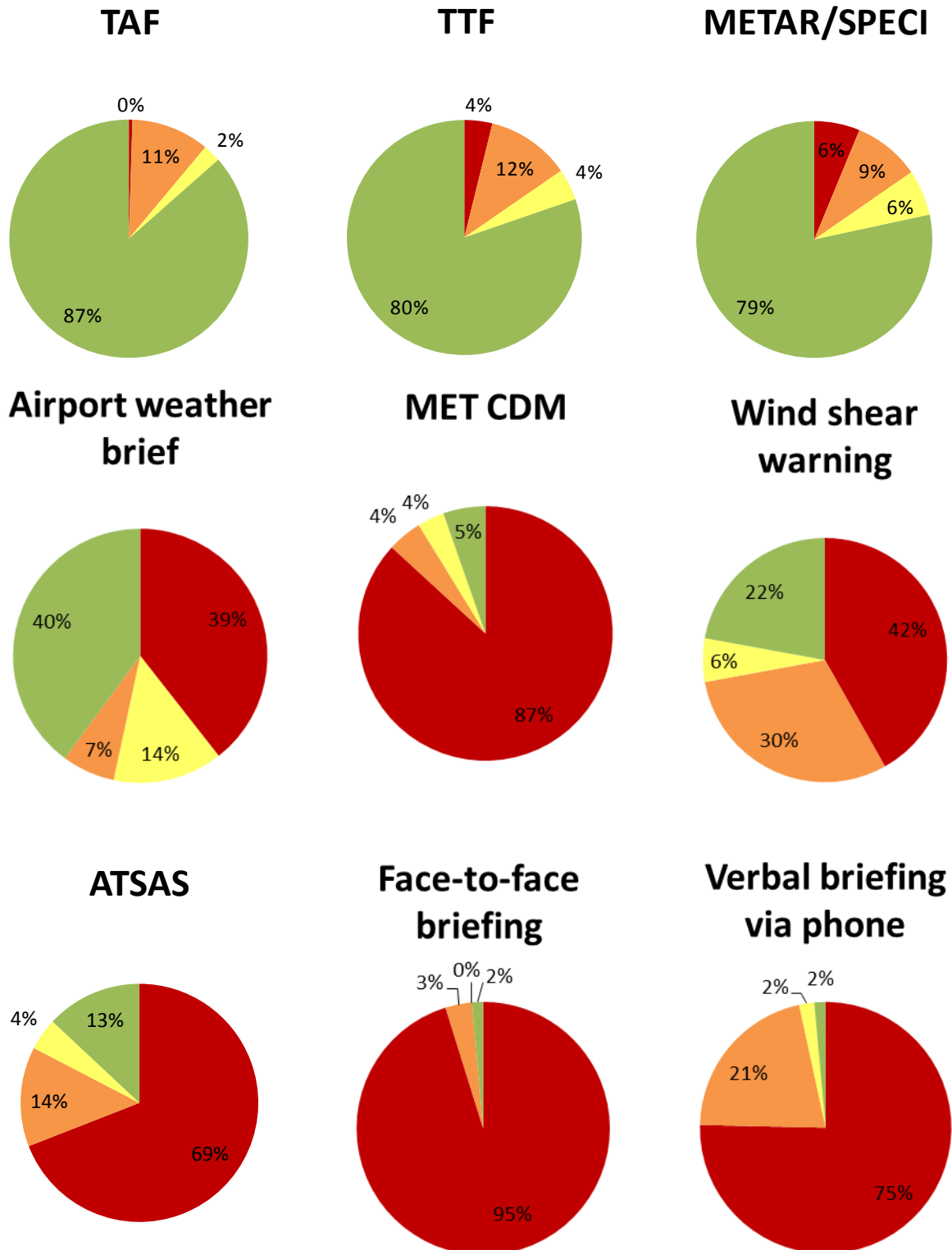


Figure 5: Monthly usage of aviation products

4.1.1 Comparison with previous surveys

Survey responses regarding the frequency of usage of the TAF and TTF from the 2016 Major Airports Survey is compared to the previous 2012 and 2014 Major Airports Surveys in Table 2. Data for 2016 is very similar to 2014.

Table 2: Comparison usage of TAF and TTF

TAF	2012	2014	2016
More than 10 times per month	92.6	87.5	86.5
6-10 times per month	3.4	5.2	2.4
1-5 times per month	3.8	6.0	10.6
Not at all	0.2	1.3	0.5
TTF	2012	2014	2016
More than 10 times per month	87.8	80.4	80.3
6-10 times per month	5.1	5.9	4.3
1-5 times per month	6.0	10.1	11.5
Not at all	1.2	3.6	3.9

4.2 Which products are the most important?

A written response was required to this question and multiple answers were accepted. There were 210 text responses to the comment on product importance and they have been summarised in Figure 6. The TAF, and TTF to a lesser degree, are the most important product or service to aviation users.

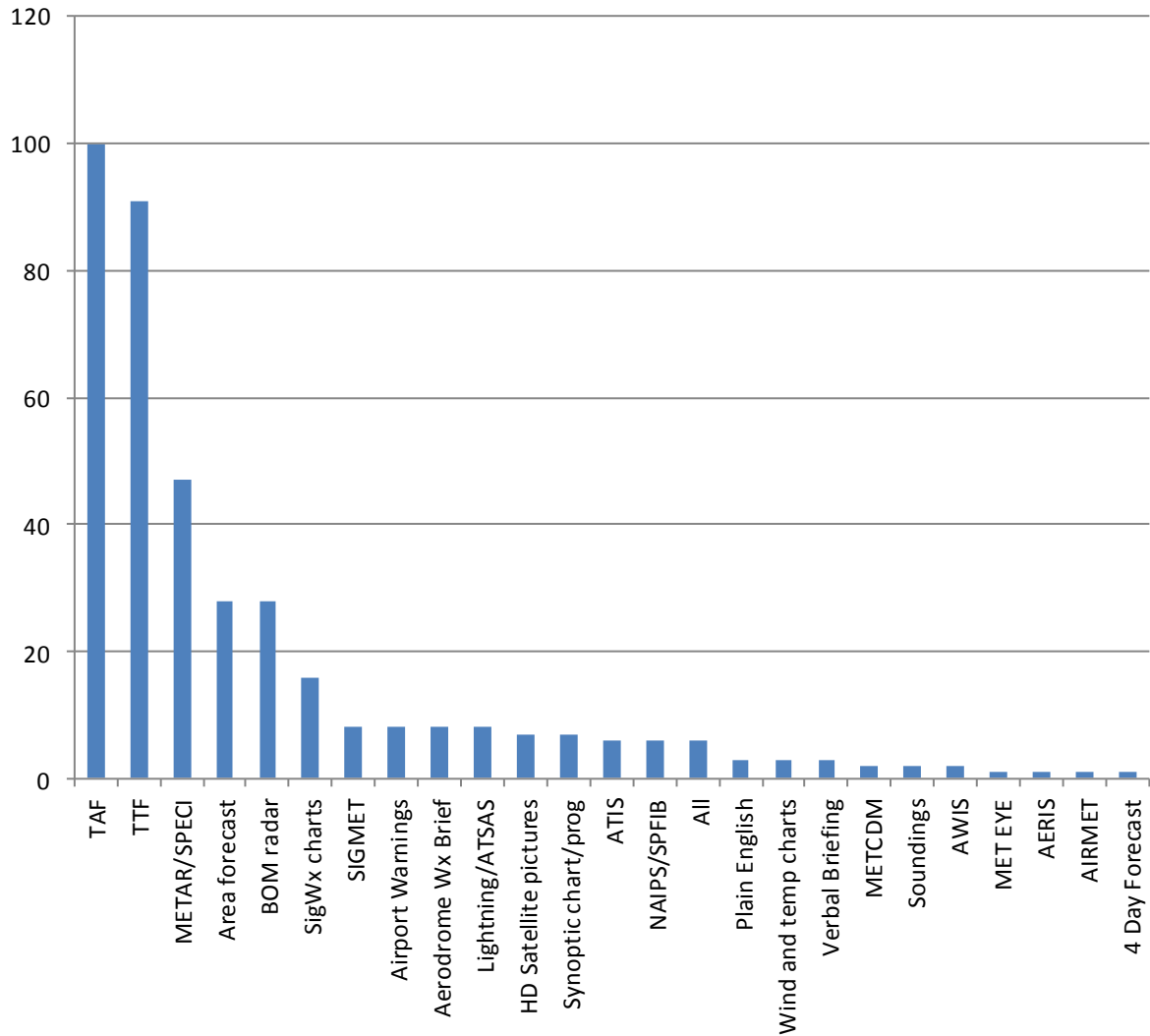


Figure 6: Product and service importance to survey respondents

5 Accuracy

5.1 Accuracy

Results show that 79.3% of respondents thought forecasts were always or mostly accurate (Figure 7: Table and pie chart of overall accuracy.).

Overall accuracy	Count	%
Always accurate	5	2.4
Mostly accurate	160	76.9
Half the time accurate	38	18.3
Rarely accurate	5	2.4
Total	208	

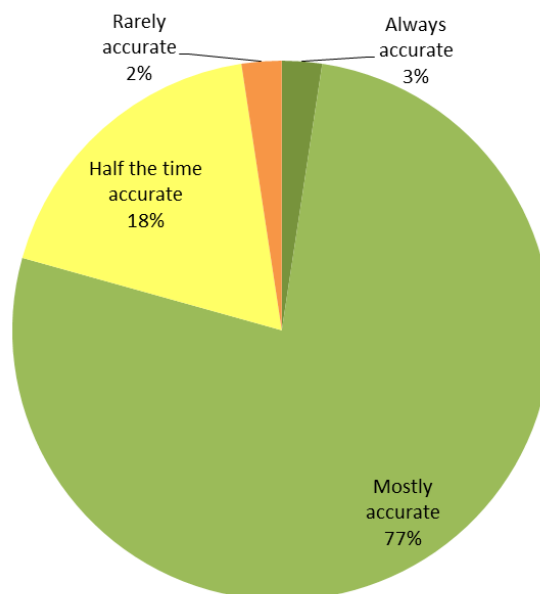


Figure 7: Table and pie chart of overall accuracy.

5.1.1 Comparison with previous surveys

Survey responses for overall accuracy of aviation products and services in 2016 are compared in Table 3. There is a slight decrease in the perception of accuracy since 2014.

Table 3: Comparison with previous surveys

Overall accuracy	%			Change
	2012	2014	2016	
Always accurate	4.3	3.9	2.4	-1.5
Mostly accurate	73.9	80.5	76.9	-3.6
Half the time accurate	14.4	14.3	18.3	4.0
Rarely accurate	6.7	1.4	2.4	1.0
Never accurate	0.7	0.0		

5.2 Conservatism

Forecast conservatism and the requirement for more or less of it was a feature of many of the text responses in other sections of the survey. Conservatism was defined in the question as:

“Conservative Forecasting is the forecasting of poor conditions that either regularly don’t eventuate or regularly occur over briefer periods than in the forecast.”

Survey respondents indicated that the Bureau’s aviation products and services are always or mostly conservative 55.5% of the time (refer Figure 8). 35.0% have a neutral perspective.

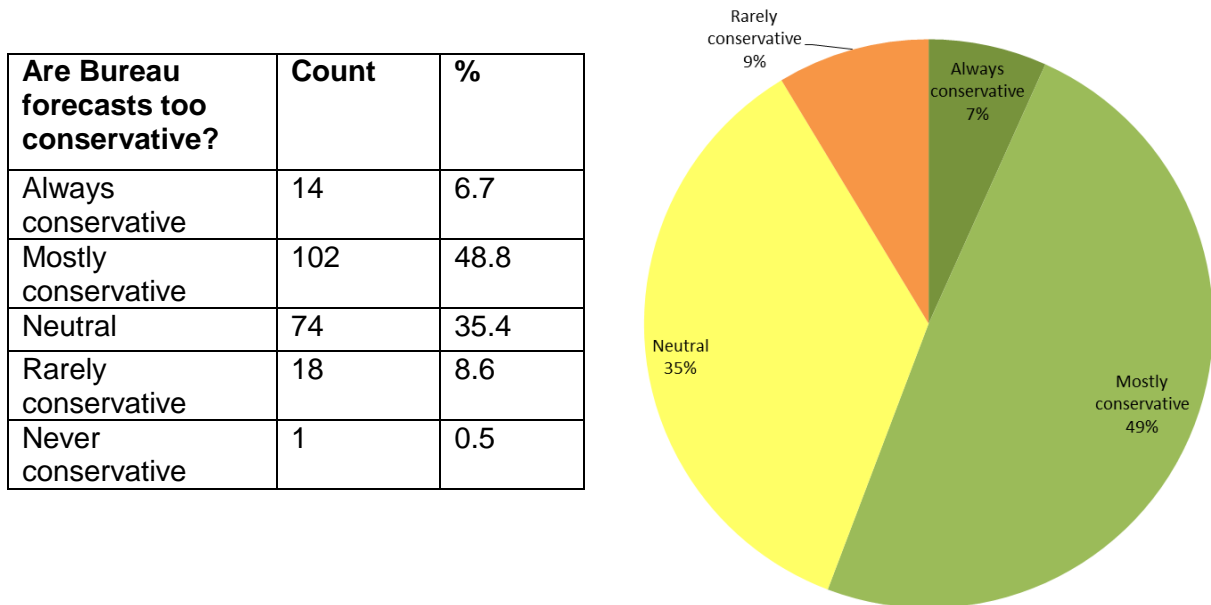


Figure 8: Table and pie chart of conservatism responses

5.2.1 Comparison with previous surveys

Conservatism responses from the 2016 Major Airports Survey are compared to previous years’ survey data in Table 4. The response indicates a slightly less conservative approach compared with 2014.

Table 4: Conservatism comparison with previous years

Conservatism	%			Change
	2012	2014	2016	
Always conservative	9.0	10.4	6.7	-3.7
Mostly conservative	22.0	52.1	48.8	-3.3
Neutral	37.3	33.0	35.4	2.4
Rarely conservative	27.2	4.5	8.6	4.1
Never conservative	4.5	0.0	0.5	0.5

5.3 Improved Accuracy

The survey asked respondents where they would like to see improved accuracy in aviation products and services. Responses included a major airport location and a weather phenomenon. In some cases a weather phenomenon was noted without a corresponding airport, or the remark contained all airports. Figure 9 shows the number of responses per weather phenomena in which there was no airport specified.

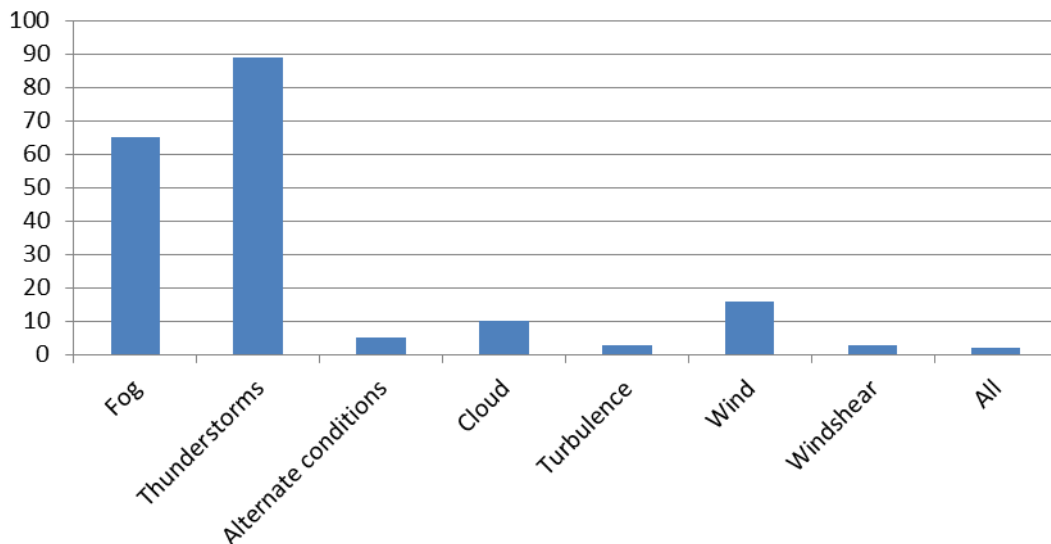


Figure 9: Bar graph of weather phenomena requiring accuracy improvement

Numerous phenomena and products were remarked upon however the overwhelming phenomena mentioned were fog and thunderstorms. Further responses which contained both fog and thunderstorms with a corresponding airport are illustrated in Figure 10.

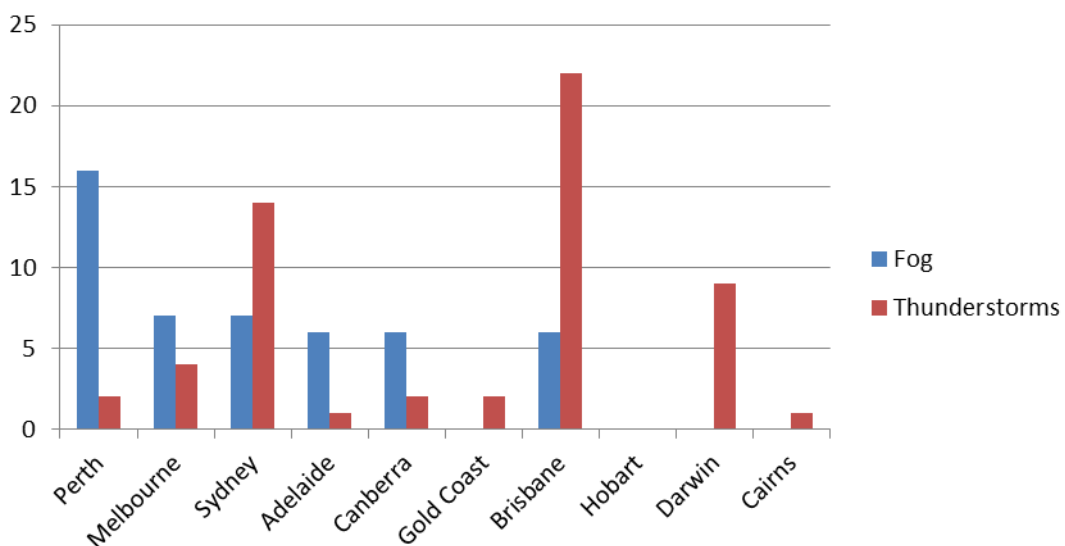


Figure 10: Bar graph for fog and thunderstorms requiring accuracy improvement

The survey indicates that improved fog forecasting is of greatest importance at Perth and improved accuracy in thunderstorm forecasting is of significant importance at Sydney and Brisbane airports. This is a very similar result to the 2014 survey.

5.3.1 Comparison with previous surveys - Fog

Survey responses for where an improvement in fog forecasting is required are compared with the previous years at Figure 11. Improved accuracy in fog forecasting at Perth is foremost with similar levels of requirement for Melbourne, Sydney, Adelaide, Canberra and Brisbane airports.

FOG	%			
Improved accuracy	2012	2014	2016	
Perth	27.3	31.9	33.3	1.4
Melbourne	13.1	20.3	14.6	-5.7
Sydney	13.7	19.6	14.6	-5.0
Adelaide	8.2	16.7	12.5	-4.2
Canberra	10.9	5.8	12.5	6.7
Gold Coast	6.6	3.6	0.0	-3.6
Brisbane	11.5	0.7	12.5	11.8
Hobart	7.1	0.7	0.0	-0.7
Darwin	0.5	0.7	0.0	-0.7
Cairns	1.1	0.0	0.0	0.0

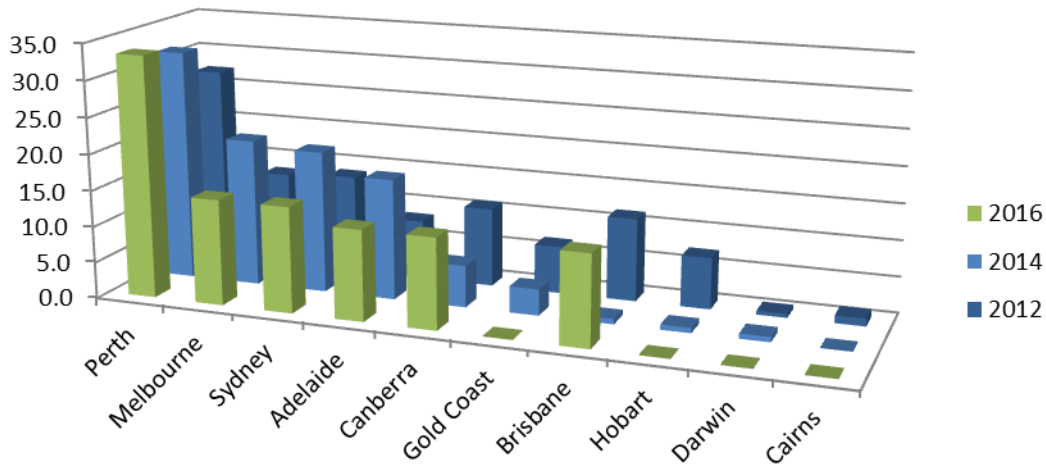


Figure 11: Comparative table and bar graph of requirement for accuracy improvement in fog forecasting

Comparison with previous surveys - Thunderstorms

Survey responses for improvement in thunderstorm forecasting are compared with previous years in Figure 12. There has been an increase in the percentage of respondents wanting to see improved accuracy for Brisbane and Darwin airports; Sydney is the second highest response.

THUNDERSTORMS	%			Change
	2012	2014	2016	
Improved accuracy				
Perth	12.5	7.3	3.5	-3.8
Melbourne	9.3	8.9	7.0	-1.9
Sydney	15.0	30.1	24.6	-5.5
Adelaide	6.8	3.3	1.8	-1.5
Canberra	7.9	1.6	3.5	1.9
Gold Coast	8.2	6.5	3.5	-3.0
Brisbane	13.9	22.8	38.6	15.8
Hobart	6.8	0.0	0.0	0.0
Darwin	10.7	11.4	15.8	4.4
Cairns	8.9	8.1	1.8	-6.4

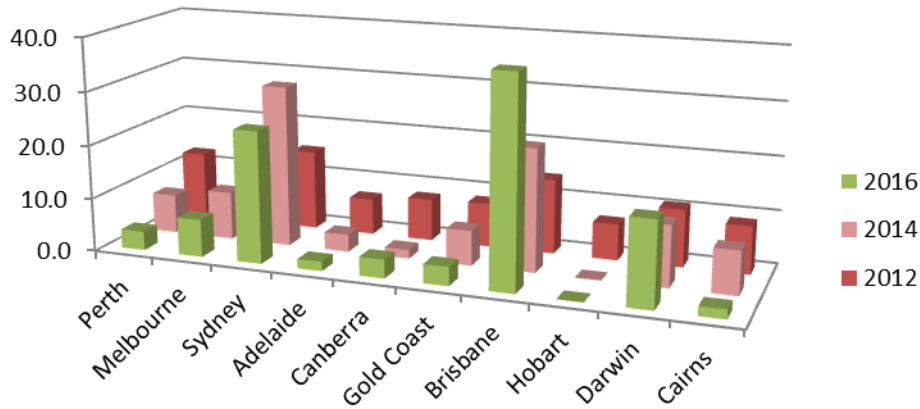


Figure 12: Comparative table and bar graph of requirement for accuracy improvement in thunderstorm forecasting

5.4 Timeliness of amendment

68.8% of survey respondents indicated that timeliness of amendment occurred mostly or always on time (Figure 13). A total of 24% have a neutral perspective. This figure is significantly lower than the overall accuracy of forecast (79.3%).

Timeliness of amendment		
	Count	%
Always on time	32	15.4
Mostly on time	111	53.4
Neutral	49	23.6
Rarely on time	14	6.7
Never on time	2	1.0

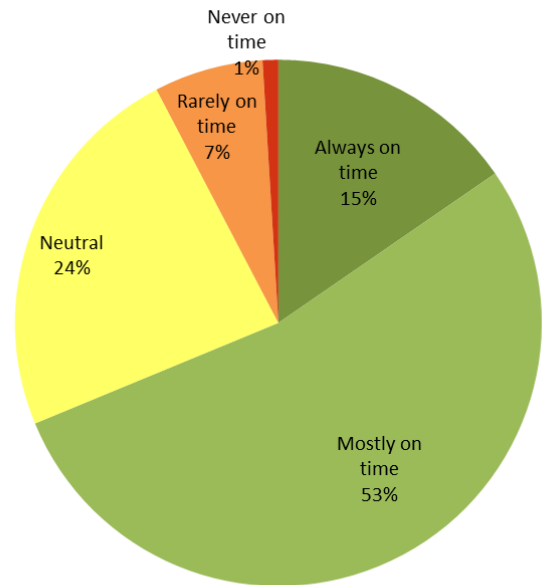


Figure 13: Pie chart regarding timeliness of amendment of aviation products from survey participants

5.4.1 Comparison with previous surveys

Survey responses for timeliness of amendment are compared with the previous surveys in Table 5. There appears to be a slight reduction in the timeliness of amendment of aviation products and services over the last two years.

Table 5: Timeliness of amendment comparison with previous surveys

Timeliness of amendment	%			Change
	2012	2014	2016	
Always on time	14.5	15.8	15.4	-0.4
Mostly on time	43.4	54.8	53.4	-1.4
Neutral	29.4	21.1	23.6	2.5
Rarely on time	10.8	7.3	6.7	-0.6
Never on time	2.1	0.9	1.0	0.0

5.5 Effect of Late Forecasts

The sequence of questions associated with timeliness of amendment was aimed at gaining better insight into the difficulties that stakeholders experience when they receive a late forecast. Meteorologists need to be cognisant of the cause and effect of less accurate forecasts and to understand the benefits that improvements in the science and forecasting processes could bring. Table 6 shows that 36.9% of the survey respondents had been affected by a late forecast in the last two years. The respondents were then asked the following questions:

- Describe an instance when you were affected by a late forecast?
- What weather phenomenon was involved and where?
- What was the impact of late receipt of the forecast?
- What is your greatest concern with receiving late forecasts?

Table 6: Receipt of late aviation forecasts

Late Forecast		
	Count	%
No	133	63.3
Yes	77	36.7
Total	210	

5.5.1 Comparison with previous surveys

Comparison with previous surveys (Figure 14) shows that fewer respondents had experienced a late forecast than in 2014, though the figures over the 3 surveys are similar.

	%		
Late Forecast	2012	2014	2016
No	64.6	60.8	63.3
Yes	35.4	39.2	36.7

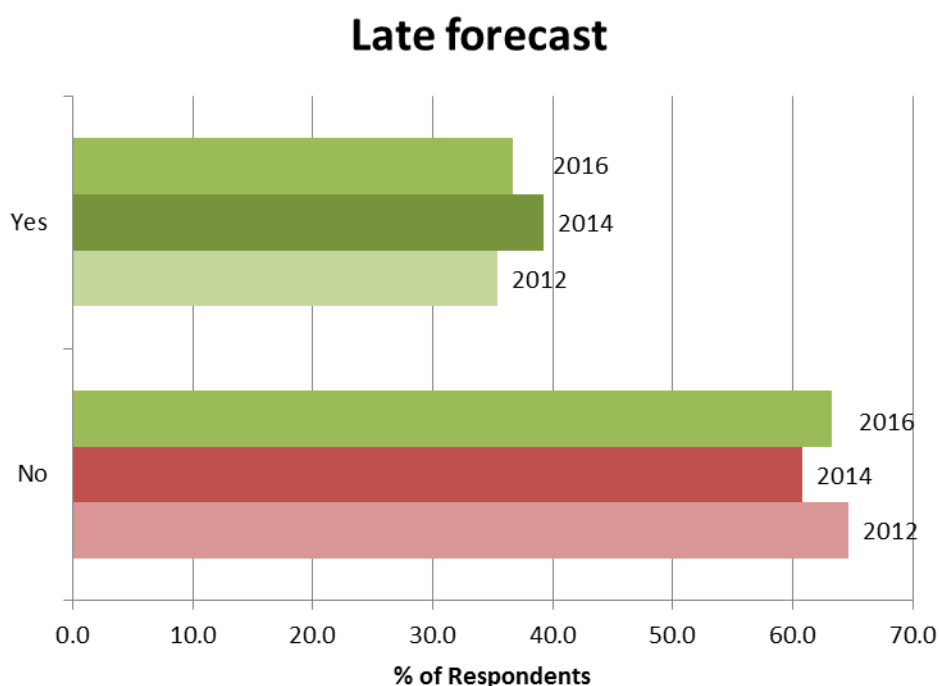


Figure 14: Percentage of respondents affected by a late forecast

5.6 Weather phenomena involved

The weather phenomena and locations involved in the late forecast provided by survey respondents have been graphed in Figure 15. Not all respondents provided a location therefore a graph of the total responses per phenomena has been provided in Figure 16. Untimely thunderstorm forecasts for Sydney, Brisbane and Darwin featured highly as well as fog forecasts at Sydney and Melbourne airports. Many of the descriptions of thunderstorm events illustrated the importance of forecasting thunderstorms in the Terminal Area (TMA) as well as timely provision of TAF updates. The fog results indicate that there was a greater number of late forecast fog events affecting Sydney, Melbourne and Adelaide than Perth.

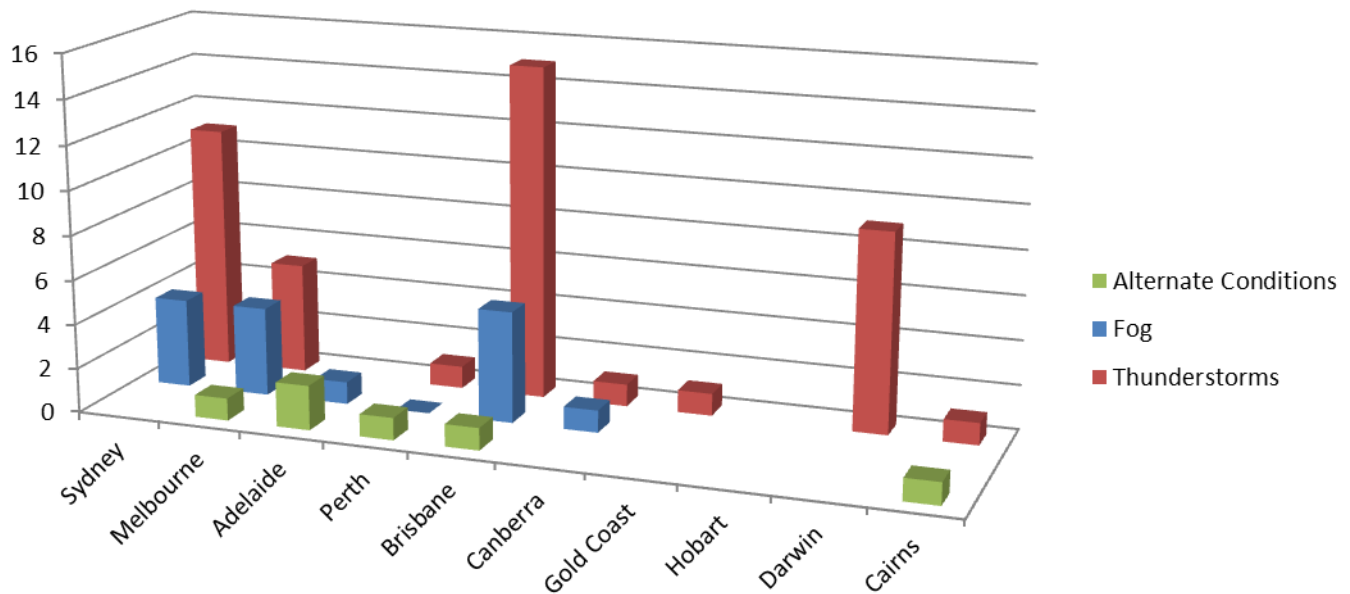


Figure 15: Late forecast fog, thunderstorm and alternate events by location in personal experience.

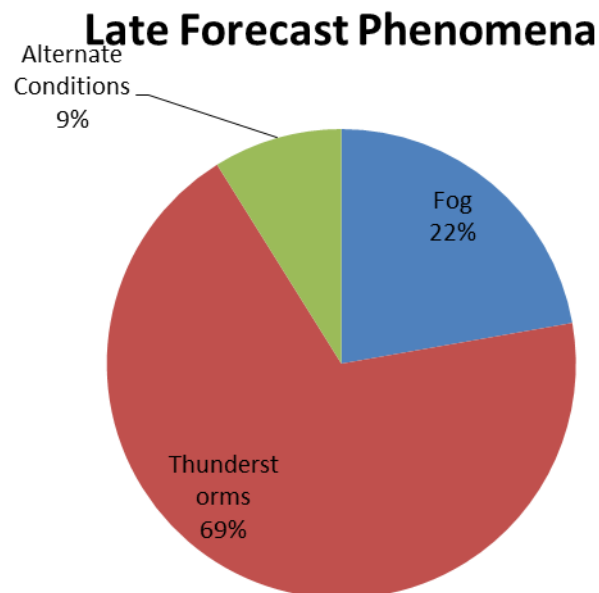


Figure 16: Total phenomena response involved in late forecast event.

5.7 Impacts of late receipt

Survey respondents were asked to select answers from a pre-determined list based on comments collected from the 2012 survey. An option to supply an alternative answer to those provided was also available. The responses are at Figure 17.

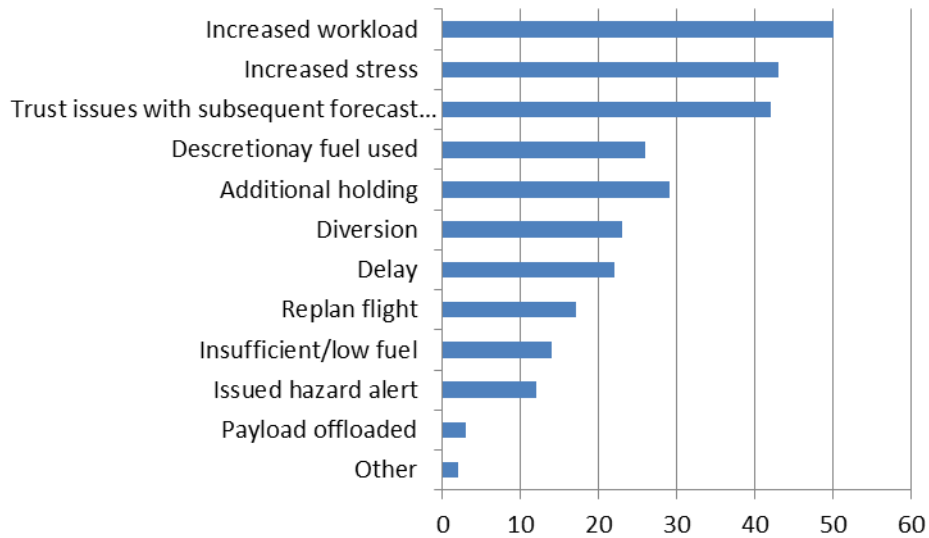


Figure 17: Bar graph of the consequences of late receipt of a forecast

The greatest consequences were increased workload, increased stress and trust issues with subsequent forecasts. The top two responses seem to relate to the immediate consequences affecting decision making, whereas most of the remaining responses were more focused on operational and procedural issues.

5.8 Concerns associated with late receipt of forecasts

The survey asked about concerns with the late receipt of a forecast. Pre-determined answers were provided based on comments from the 2012 survey. An option to supply an alternative answer to those was available (Figure 18).

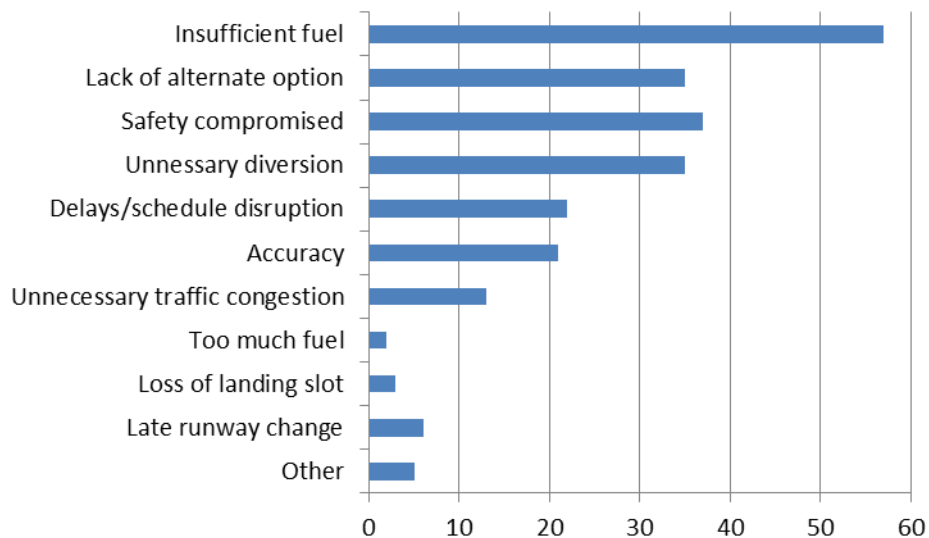


Figure 18: Bar graph of respondents concern with the late receipt of forecasts

Insufficient fuel, a lack of alternate option, safety and unnecessary diversions were the four greatest concerns of the aviation community when receiving a late forecast. The first three responses were concerned with the ability to land an aircraft safely. Most of the remaining responses were related to the operational impact of the new forecast.

6 Accessibility

6.1 Accessibility to aviation products and services

The Bureau’s aviation products and services are always or mostly accessible 90.9% of the time (Figure 19). Aviation products for flight planning purposes are accessed through the Airservices National Aeronautical Information Processing System (NAIPS).

Accessibility	Count	%
Always easy to access	100	48.1
Mostly easy to access	89	42.8
Neutral	15	7.2
Rarely easy to access	4	1.9
Never easy to access	0	

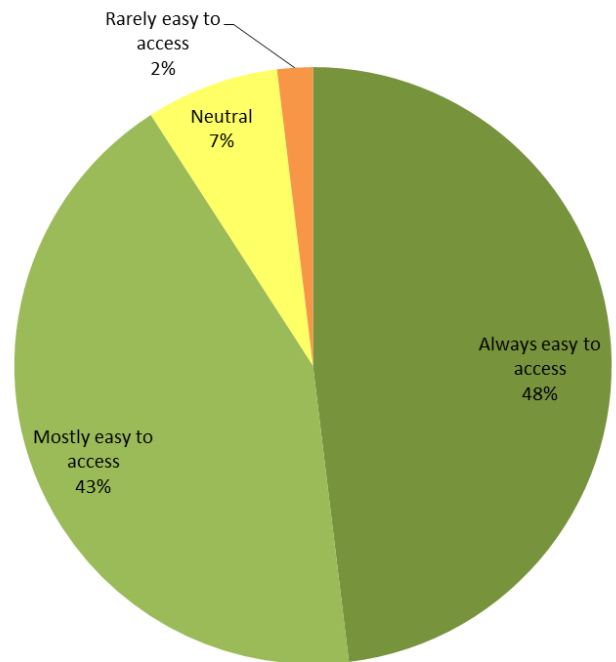


Figure 19: Accessibility of major airport meteorological services.

6.2 Difficulties with access

Survey respondents were asked to describe any difficulties they had with accessing the Bureau's aviation products and services. Written responses for improvements to accessibility have been grouped by theme and presented in Figure 20. The number of difficulties is small compared to the number of people that completed the survey.

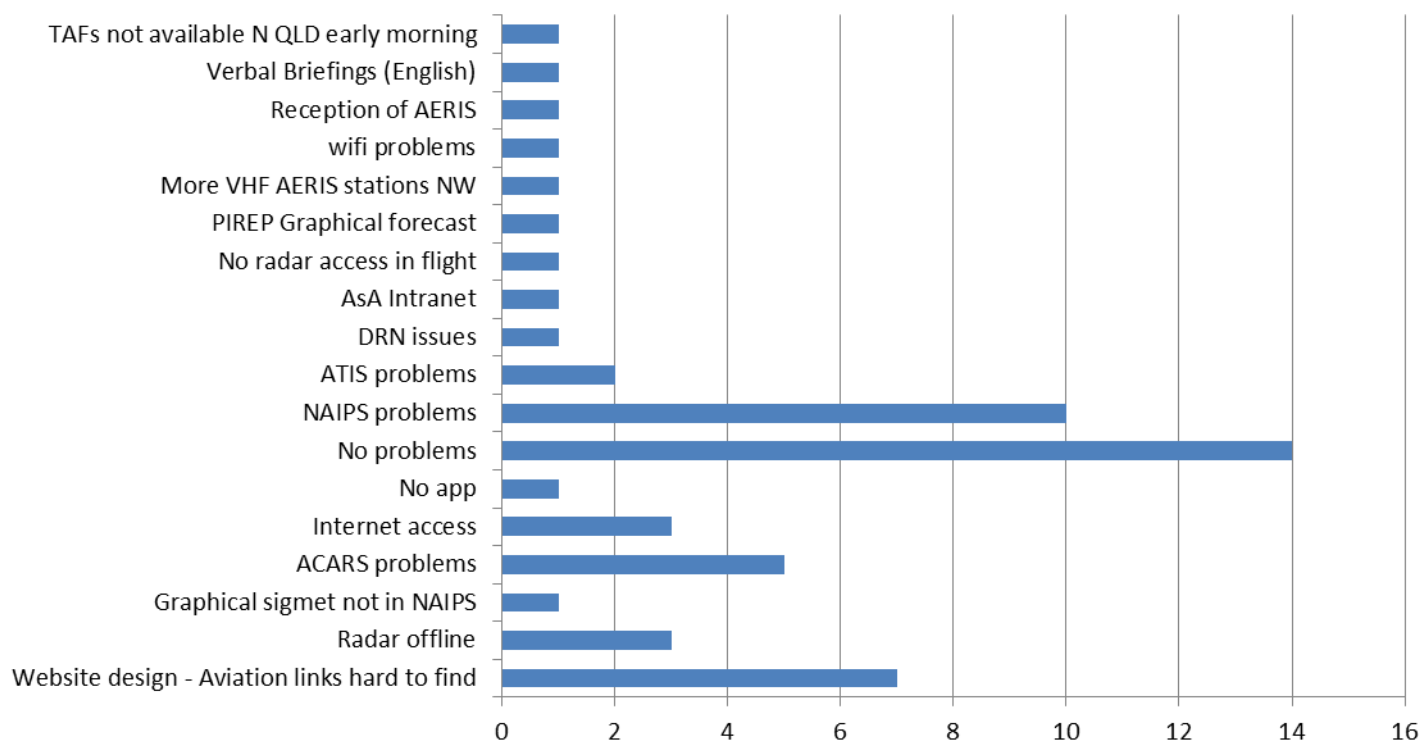


Figure 20: Difficulties with accessing major airport meteorological services

The most common difficulty experienced by survey respondents in accessing major airport products and services was attributed to the NAIPS program. Written responses were largely complimentary and reported no problems in accessing aviation products and services. Additional difficulties listed by survey respondents included:

- The lack of internet access in 3G/4G networks;
- The unavailability of Aircraft Communications Addressing and Reporting System (ACARS) or inability to access specific products through the system;
- The inability to view sigmets graphically in NAIPS;
- Aviation links on the Bureau homepage are hidden from view on opening;
- Graphical sigwx products are not easily accessible in NAIPS;
- Website design; and
- Radars occasionally offline.

The Bureau works closely with Airservices and will continue to address problems specific to NAIPS where possible.

7 Optimisation as a consequence of forecasting

7.1 Optimisation of payload

The optimisation of payload question was aimed at deriving the value of major airport forecasts to commercial aviation. Figure 21 indicates that 79.4% of respondents thought the aviation forecasts helped optimise their payloads more than 60% of the time.

Optimisation of payload	Count	%	%
Unable to Comment	62	35.6	--
More than 90% of the time	51	29.3	45.5
60-90% of the time	38	21.8	33.9
40-60% of the time	13	7.5	11.6
10-40% of the time	2	1.2	1.8
Less than 10% of the time	8	4.6	7.1
Total (those able to comment only)	112		
Total responses	174		

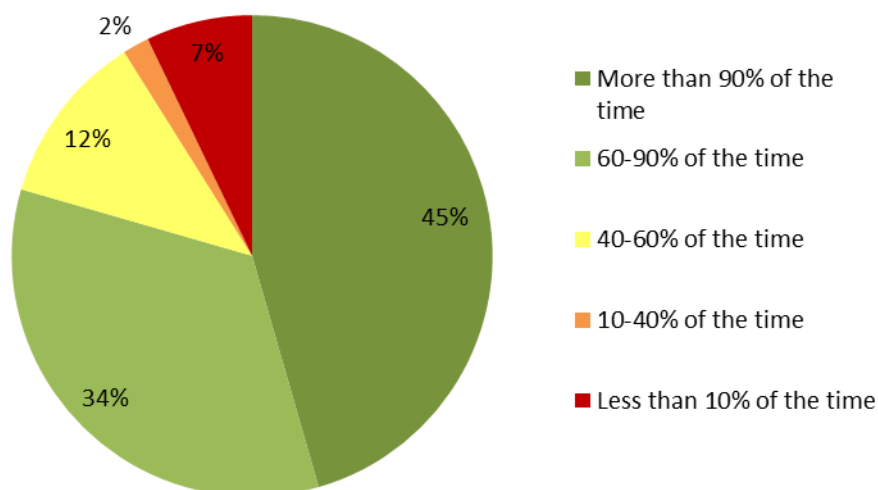


Figure 21: Payload optimisation attributed to aviation products and services.

There were 62 survey participants that were unable to comment on whether major airport products and services produced by the Bureau enabled the optimisation of their payload.

Additional written comments include mention of:

- Concerns with forecast accuracy and trust lead to conservative fuel uplift;

- Conservative forecasts do not optimise payloads; and
- Some aircraft are not payload limited.

7.2 Optimisation of air traffic services

Airservices and RAAF personnel were asked whether the major airport forecasts optimised air traffic services. Figure 22 indicates that 97% of respondents thought the aviation forecasts helped optimise air traffic services more than 60% of the time. However, it is important to note that there were only 34 respondents in this case and the sample may not be statistically representative.

Optimisation of air traffic services	Count	%
Unable to Comment	2	5.9
More than 90% of the time	13	38.2
60-90% of the time	18	52.9
40-60% of the time	1	2.94
10-40% of the time	0	0
Less than 10% of the time	0	0
Total	34	

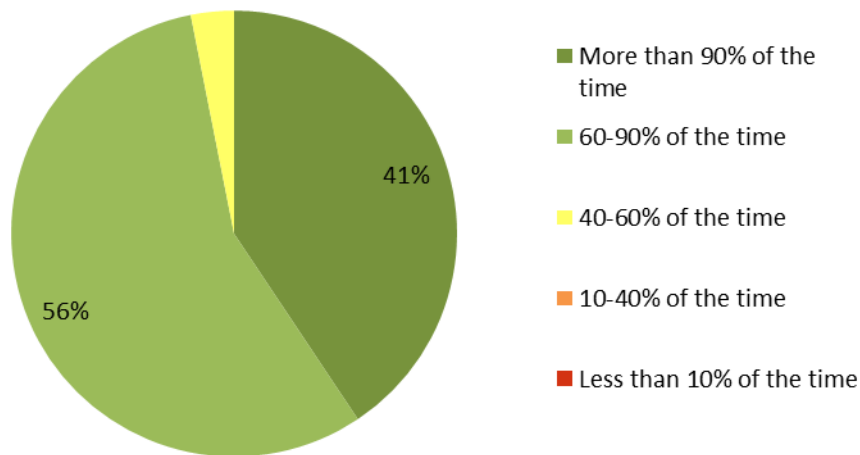


Figure 22: Response from Airservices and RAAF personnel regarding air traffic optimisation.

8 Additional Feedback

Written responses from the additional feedback section of the survey have been grouped by theme and presented in Figure 23.

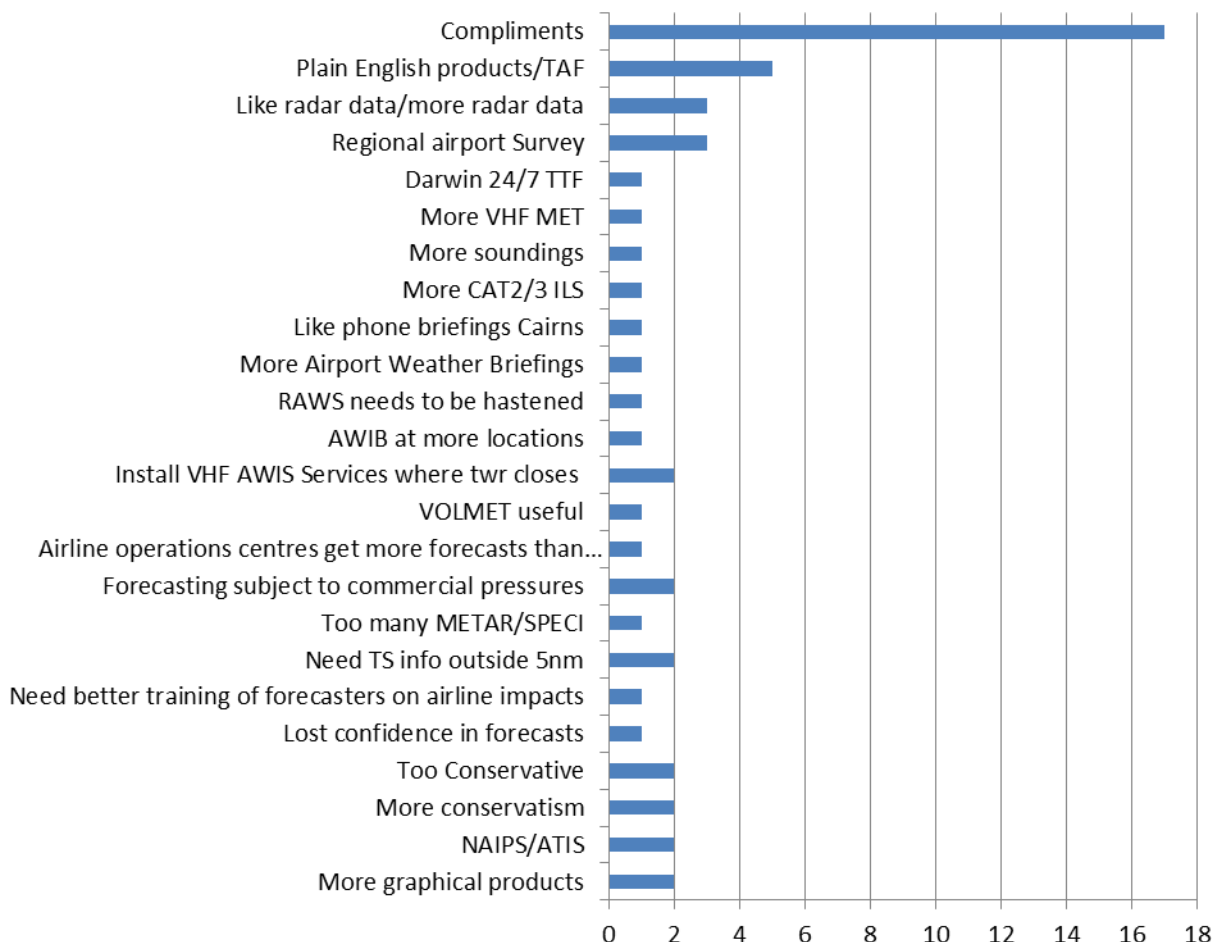


Figure 23: Further comments related to the survey.

Respondents provided mostly complimentary feedback however survey participants reiterated that they would like to see plain English forecasts. Comments outside of the scope of this survey included feedback on Airservices facilities and Bureau regional airports which will be forwarded to the appropriate areas of responsibility.

Additional graphical products are under development by Aviation Weather Services in the Bureau and the aviation knowledge centre is being further developed. Unfortunately, some rainfall radars are required to obtain upper air information during certain periods of the day and will remain unavailable during these times.

Further feedback was appreciated and will be used constructively to remediate problems where appropriate and to address issues important to the aviation community. The Bureau will use the results of this survey in support of strategies, plans and investment to address the issues raised by the aviation community.