Developing Improved Incident Weather Forecasts using a Customer Centred Design process

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Introduction

Detailed fire weather forecasts for specific fire incidents are provided by the Australian Bureau of Meteorology (the Bureau), on request from fire agencies. The Incident Weather Forecast (formerly known as a Spot Fire Forecast) is the highest priority product for fire weather forecasters around the country.

In response to fire agency feedback regarding the needs of operational personnel, Monica Long (the National Manager for Fire Weather and Air Quality from the Bureau) led a Spot Fire Forecasting Services Review project between May 2017 and June 2018. The scope of this review was endorsed by the Australasian Fire and Emergency Services Authorities Council (AFAC) Predictive Services Group on 7 March 2017 as follows:

- The group will need to document current and emerging user requirements, gaps in the current service and, ideally, a roadmap for a future service design.

- The review will also need to include the following in its scope:
  - Consistent terminology (spot, special or other label?)
  - Services in support of wildfires
  - Services in support of planned burning
  - Standard forecast lengths and outlook periods based on fuel type, fire size and climatology
  - Short term achievable changes to improve the existing products
  - Recommendations for a best practice prioritisation process when multiple spot fire forecast requests are received at the same time
  - Amendment criteria for spot fire forecasts
  - Longer term plans for the next generation of weather forecasting support, linking with other related projects such as the National Fire Danger Rating System prototype.

Around this time, the Bureau's Digital Team had developed a Customer Centred Design process (see Figure 1) for major projects. This process was decided as the framework to support the review project.

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The Project Team

It was important to have a good mix of people for the project team within the Bureau to provide different views and experiences. The project team included operational fire weather forecasters Brad Santos (Western Australia), Simon Louis (New South Wales) and Matthew Michael (Victoria), Embedded Meteorologist Joey Rawson (Western Australia) and Mika Peace a fire weather researcher (South Australia). Monica Long was project leader with Evan Morgan, National Manager Extreme Weather, providing strategic support.

The Customers

For this project, our customers were identified as fire agency personnel who use our forecasts to make operational decisions at an incident. We used the already established operations working group, who sit under the AFAC Predictive Services Group, as the mechanism to coordinate this feedback from fire agency personnel around Australia. The working group members who participated were Darrin McKenzie (DELWP VIC), Laurence McCoy (NSW RFS), Alen Slijepcevic (CFA VIC), David McKenna (DEWNR SA), Tony Scherl (PCS ACT), Casey Scholten (QFES QLD), Brett Loughlin (CFS SA), Chris Collins (TFS TAS), Sandra Whight (TFS TAS), Paul Brockhoff (DELWP VIC), Andrew Turner (Bushfires NT), Lachie McCaw (DPAW WA).

The Review Process

The project followed each of the stages of the Customer Centred Design process as shown in Figure 1. Further details of the activities in each stage are shown in the following section.

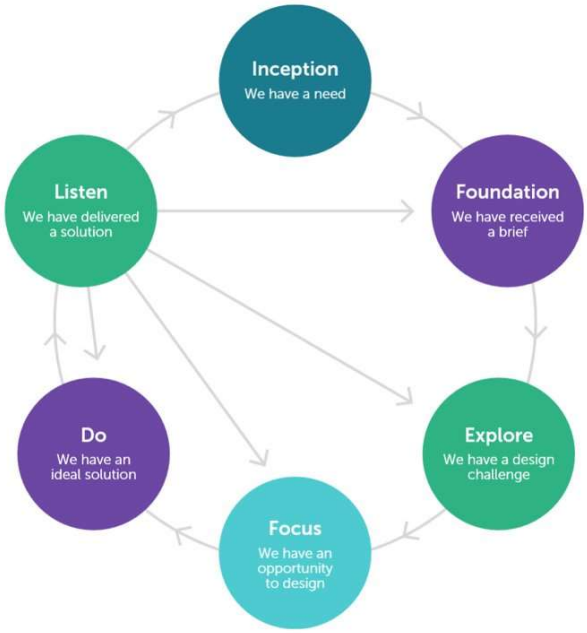

Figure 1. Customer Centred Design process as articulated by the Bureau's Digital Team

Survey (Inception Phase)

An initial survey was distributed to working group members on 20 April 2017, with feedback requested by 12 May 2017. This survey was broken into 4 sections;

a) Defining your needs
b) Gap assessment and suggestions for improvement
c) Future directions of weather forecasting support
d) Additional questions in scope of the review

Where possible, Bureau project team members met with fire agency personnel in their local area to discuss the survey questions and assist them to reach a jurisdiction consensus for their survey response.

Analysis (Foundation Phase)

Once the survey responses were received, they were analysed and summarised to determine where there were areas of commonality and areas of difference between the different jurisdictions. A document with the key themes from the feedback was distributed to all working group members.

Workshop (Explore Phase)

The Bureau project team organised a workshop in June 2017 to work through the finer detail and prioritise the suggestions to improve the forecast product. The findings from this workshop were summarised and distributed to all workshop attendees, who were given the opportunity to make corrections and clarifications. One important decision at this workshop was the agreement to change the product name to Incident Weather Forecast, to achieve national consistency.

Prototypes (Focus Phase)

With a much greater understanding of the customer needs and the priorities for improving the Incident Weather Forecast clearly articulated, the Bureau project team worked on creating a series of prototype new products. Bureau developers were also consulted to determine what was feasible from current forecast production systems. These discussions influenced the content and layout options contained in the prototypes.

From the various prototype suggestions, three were chosen and distributed to the working group members for feedback at the end of July 2017.

A second round of prototyping, incorporating feedback from round 1, was completed by the Bureau project team in August 2017.

Recommendations (Do Phase)

A paper with the key findings and recommendations from the review project was presented to the AFAC Predictive Services Group meeting in October 2017. This group endorsed the recommendations and supported the Bureau to implement the suggested service changes during 2018. Key findings from the review were:

1. Hourly time steps were just as important in a prescribed burn context as in a bushfire context.
2. Agencies were seeking guidance on how risk affects when they should request a Spot Fire Weather Forecast and when to use other weather information, such as gridded forecasts.
3. Different audiences were using the Spot Fire Weather Forecast for different decisions and purposes on various timescales. For example, FBAN's require different information to incident managers. Therefore, a tiered system of information may be required to meet different needs.
4. Data overload was an issue because the information available to fire weather forecasters and to fire agency personnel will continue to increase in the near future. Therefore, a tiered system of information may be more suited to user needs.
5. The highest priority suggestions to improve the existing Spot Fire Weather Forecast Product were:
    - Hourly time steps for the first 12 – 24 hours
    - More information about likely spatial variation of conditions on the scale of the incident, including topographic impacts
    - More detailed information about forecast uncertainty
    - More specific timing of wind changes

Implementation (Do Phase)

This phase included a series of steps:

- Work by the forecast production system support team to make changes to the actual products,
- Provision of communication and training materials, such as the flyer shown in Figure 2, to ensure that Bureau fire weather forecasters were aware of these changes, and
- Communication from the Bureau to fire agency personnel about the new Incident Weather Forecast products.

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Incident Weather Forecasts improvements

Incident Weather Forecasts for fires (previously known as Spot or Special Weather Forecasts) provide critical information to incident managers to help them make important operational decisions.

Improved Incident Weather Forecasts will provide increased precision, extra information and a more targeted forecast, focusing on key weather parameters

Why change?

Incident Weather Forecasts have been provided in a similar format for around 20 years. In that time significant advances have been made in Numerical Weather Prediction and in the past five years the Bureau has started providing gridded forecast products. To capitalise on these changes, we reviewed this service and users' needs in 2017, and the AFAC Predictive Services Group endorsed the recommendations in late 2017.

The result is the new Incident Weather Forecast. This will replicate the existing service and importantly include improvements based on the recommendations of the review.

Changing the name to Incident Weather Forecast provides a nationally consistent product name. Previously these forecasts were called Spot Fire Weather or Special Fire Weather Forecasts.

When will the Incident Weather Forecasts begin?

The improved Incident Weather Forecasts are expected to be implemented in mid to late-March 2018.

What is changing?

Previous forecast sections:

1. Weather forecast
2. Assumptions and uncertainties associated with the forecast

New forecast sections:

Three areas where Bureau of Meteorology forecasters can provide additional information on the key weather parameters critical to decision making.

1. Significant wind changes during the forecast period, including uncertainties
2. Forecast thunderstorm potential, precipitation and cloud, including uncertainties
3. Spatial variation of conditions and other important information

Extra columns in the forecast table provide important information on conditions above the surface and on thunderstorm activity.

- C-Haines: an index of atmospheric stability that can alert users to the possibility of increased or unexpected fire behaviour.
- Mixing height: used to determine smoke dispersion and expected fire behaviour.
- Thunderstorm activity level: allows for quick reference at each time step.

One-hourly time steps provide greater precision for the critical first 12 hours of the incident.

Figure 2. Flyer about the new Incident Weather Forecasts

Customer Feedback

Feedback from fire agencies on the new Incident Weather Forecasts was positive, particularly the inclusion of hourly weather data. Murray Mitchell from the Parks and Wildlife Service in Western Australia has said about the project "BoM by tapping into established national and state forums has been able to efficiently and comprehensively gather our requirements and progress rapidly without compromise to customer engagement. The benefits of national products were realised this season for WA fire agencies with deployment to Tasmania and Queensland, the familiarity of products was one less risk."

Key Learnings about the Customer Centred Design process

The professional relationships that were developed by participation in this process were beneficial to all involved. There are now clearer channels for discussion of customer needs and an understanding that when we work together, we can make improvements that benefit all stakeholders.

The key learnings for anyone who plans to run a similar project in the future can be summarised into the Top 5 tips shown below.

1. Listen to the feedback
2. Consult as widely as possible
3. Check that you understand the feedback
4. Use workshops to work through different ideas or priorities
5. Communicate regularly

Conclusion

The success of the Spot Fire Forecasting Services Review project is attributed to the valuable input of Bureau and fire agency personnel around Australia. The insights gained from the discussions, with a focus on how weather forecasts are used to support operational decision making on the fire ground, will help to inform future fire weather service development in Australia.

During 2019, the Bureau has used a similar Customer Centred Design process to test prototype outlook sections with fire agency personnel around Australia to further improve the Incident Weather Forecast. There is confidence that this process works well to generate products and services that really meet the needs of the customer.

Strengthening the partnership between the Bureau and fire agencies through participation in this project has already provided tangible outcomes for partner agencies and it is anticipated that the benefits will continue to flow in future years.

This project is just one example of many that have achieved positive outcomes because of the effective working relationship established by the Bureau and the AFAC Predictive Services Group.

Acknowledgements

A big thank you to all who participated in this project from those who provided feedback in the initial stages to those who did the coding work to implement the recommended changes into the operational system. Thanks also to Dr Mika Peace for reviewing this extended abstract.