Towards timelier, sub-seasonal to seasonal streamflow forecasts in Australia to better meet user needs

2016 HEPEX Workshop

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LAND AND WATER
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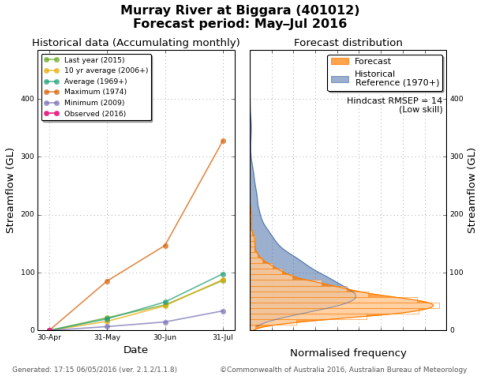
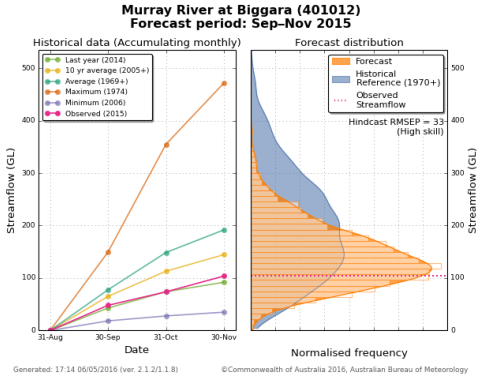
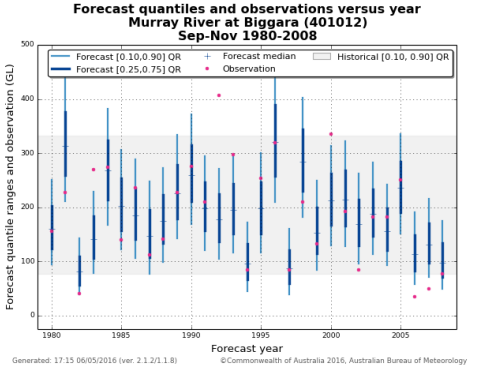
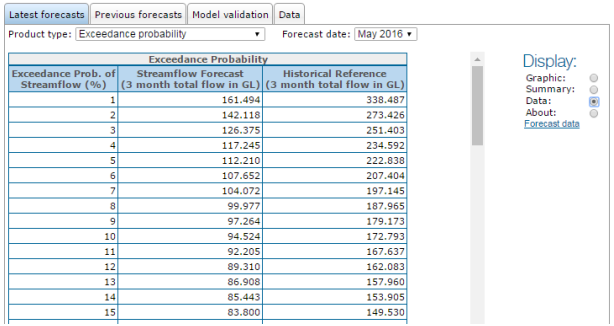
Seasonal streamflow forecasting in Australia

www.bom.gov.au/water/ssf



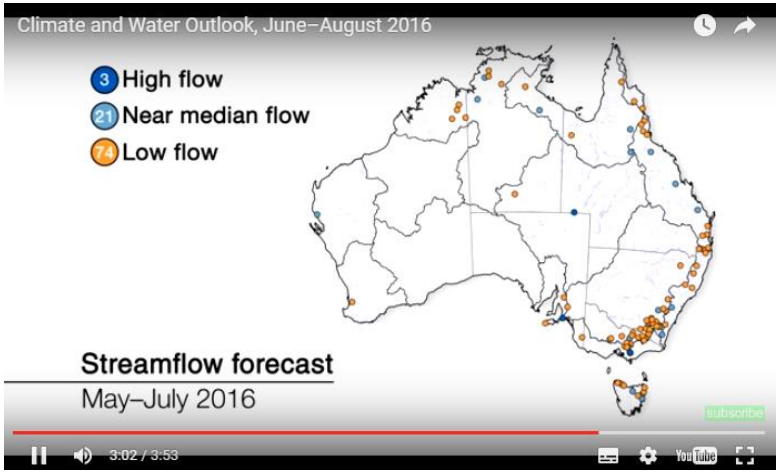


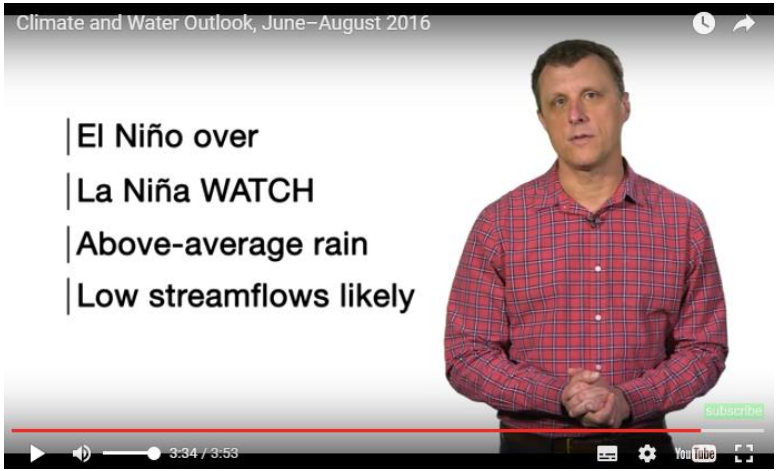




Exceedance Probability		
Exceedance Prob. of Streamflow (%)	Streamflow Forecast (3 month total flow in GL)	Historical Reference (3 month total flow in GL)
1	161.494	338.487
2	142.118	273.426
3	126.375	251.403
4	117.245	234.592
5	112.210	222.838
6	107.652	207.404
7	104.072	197.145
8	99.977	187.965
9	97.264	179,173
10	94.524	172.793
11	92.205	167.637
12	89.310	162.083
13	86.908	157.960
14	85.443	153.905
15	83.800	149.530

Seasonal streamflow forecasting in Australia





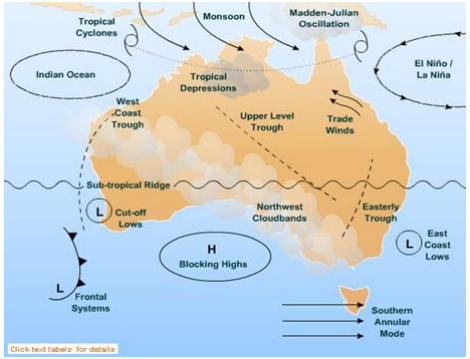
www.bom.gov.au/water/ssf
www.bom.gov.au/climate/ahead

Upgrading the service to better meet user needs

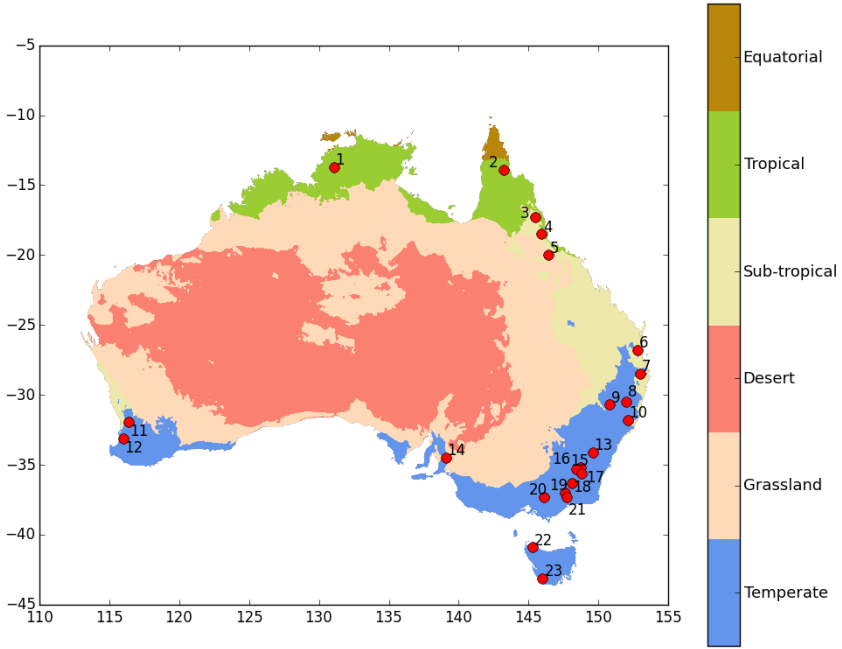
- Sub-seasonal forecasts
  - Forecast in the first month
  - Monthly breakdown
- Timelier forecast release
  - Forecasts currently released at least 7 days late

The Bayesian joint probability (BJP) modelling approach

- **Catchment + climate predictors –> Streamflow predictands**
- **Issues**
  - Heteroscedasticity
  - Zero value
  - Data
- **The BJP solution**
  - Transformations
  - Censored data
  - A joint probability model, with Bayesian inference



The BJP approach can be used to produce sub-seasonal and timelier forecasts



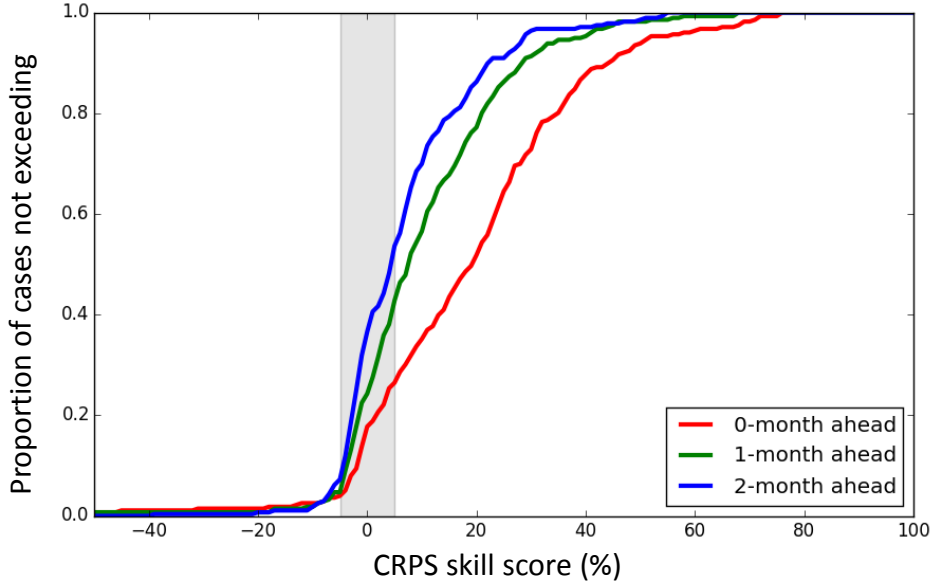
- 23 catchments
- Leave-five-years-out cross-validation
- 1982-2011

Sub-seasonal to seasonal forecasts

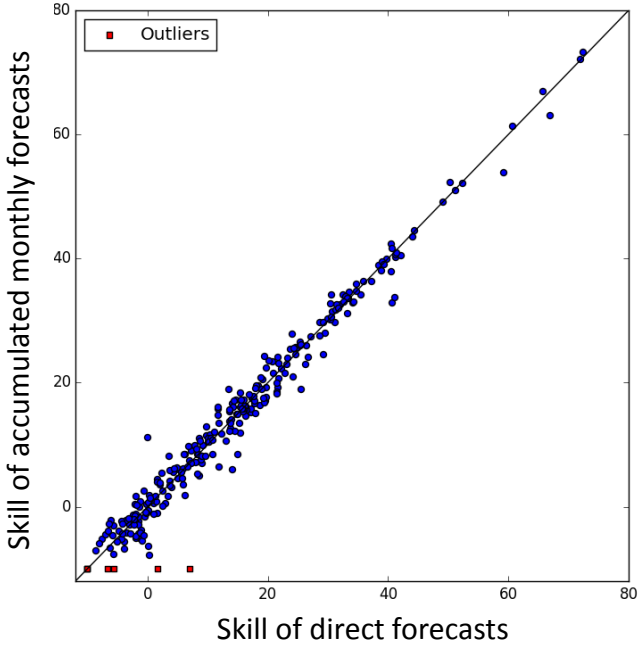
- We can take advantage of BJP to:
  - Jointly forecast several months ahead
  - Obtain ensemble time series output
- Monthly forecasts can be accumulated to seasonal totals

Skill of sub-seasonal to seasonal forecasts

Monthly skill

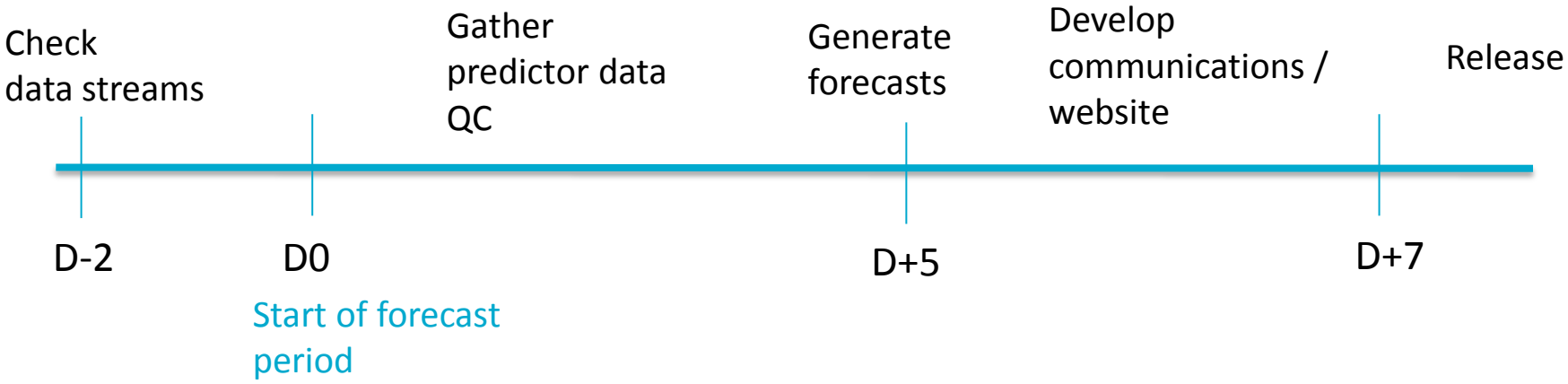


Seasonal skill



Current forecast release process

- Current BJP models rely on delayed monthly data sets
- 0-month lead time forecasts

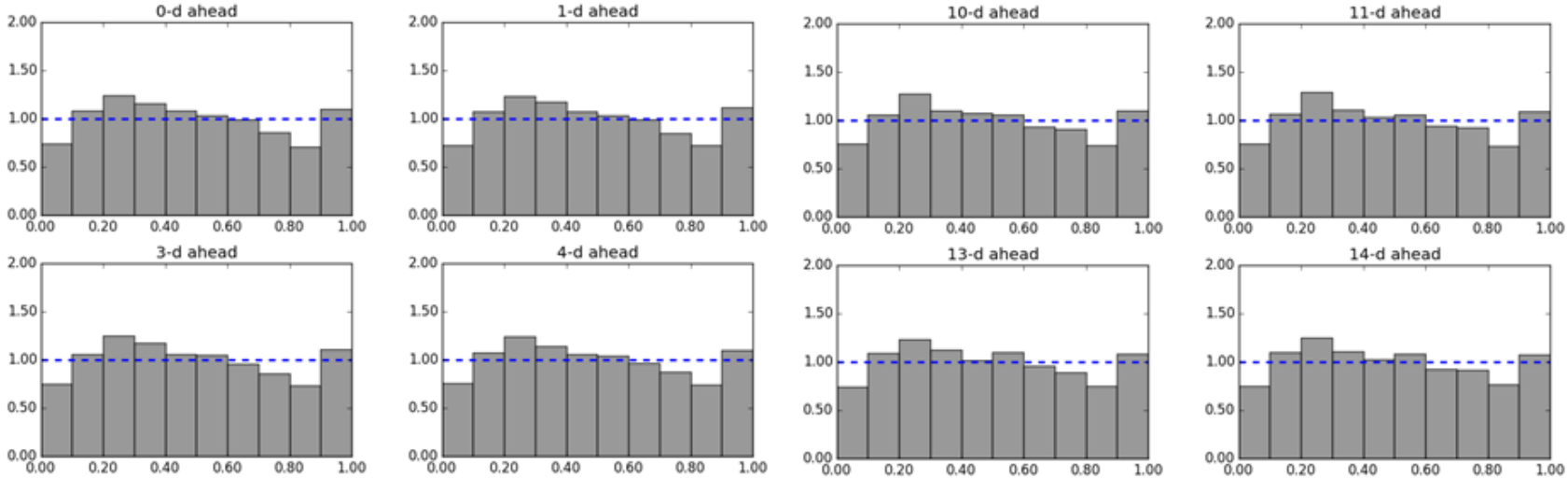


How to release timelier forecasts?

- Allow for N-day lead forecasts
- Establish predictors using 28-day sliding windows
- Derive streamflow and climate predictors from daily data

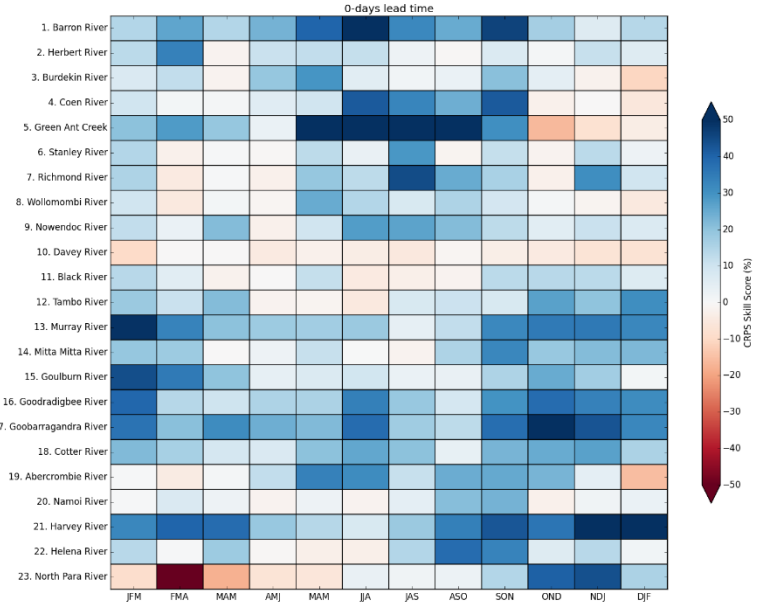
Reliability of timelier forecasts

Reliability with lead time

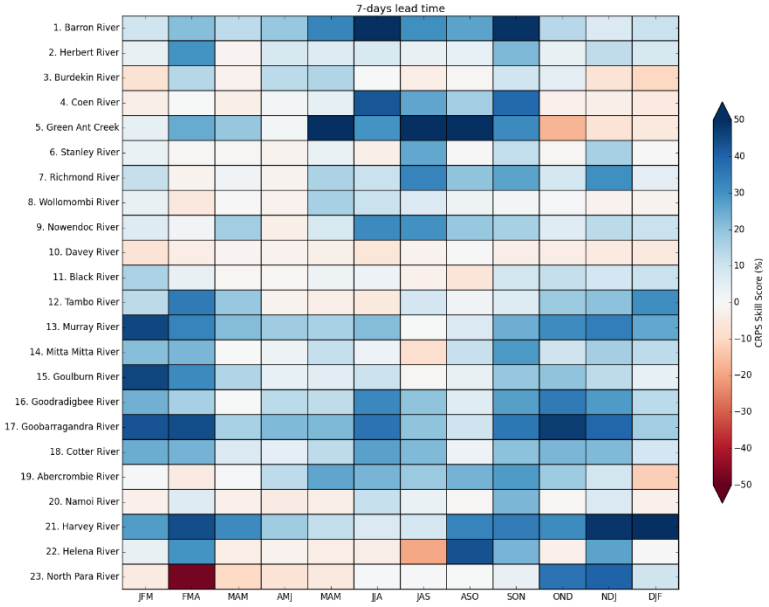


Skill of timelier forecasts

0-days lead time

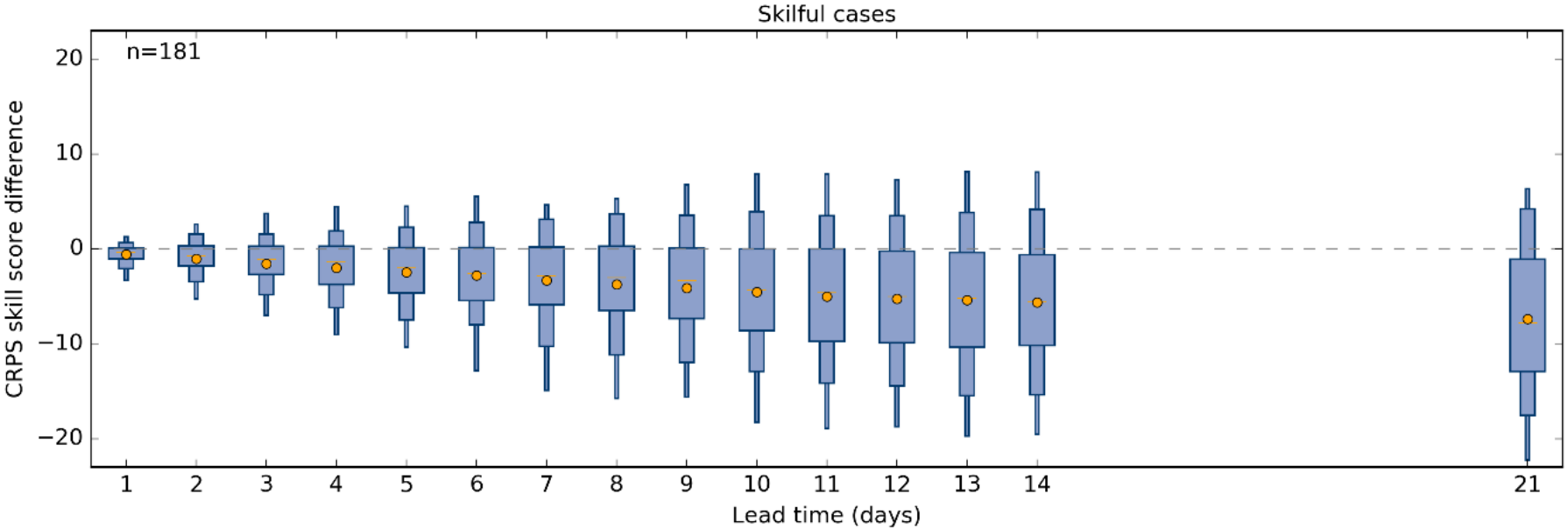


7-days lead time



Skill of timelier forecasts

Change in CRPS skill score as lead time increases



What is the optimal forecast lead time?

- The forecast release schedule should allow for:
  - Forecast preparation
  - Communication
  - User comprehension and use
- The N-days lead time system will allow flexibility

Conclusion

- The BJP model is robust for producing sub-seasonal forecasts
  - Ensemble time series forecasts
  - Seasonal forecasts through accumulations

- Timelier forecasts are possible
  - Use only daily streamflow and SST
  - Reliability is maintained
  - Small-moderate reductions in skill over 1-2 weeks

- Likely to transfer to operations through 2017

Thank you

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