

Application Usability Levels: Their evolution and eco-system



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Connections: Finding users for your research

Barriers for effective targeted space physics research : (from the research side)

1) Finding and knowing best how to communicate with users

Where do you find your users? At conferences? At trade shows? Can a broker help? Your friendly NASA and NOAA collaborators can often help.

2) Knowing what research will produce useful tools to aid decision making processes.

Talk with your users listen to their needs. A broker may also help translate your research into the type of product a user may be interested in.

3) Knowing the requirements and needs of the user

Continue to communicate with your user. An independent validator can help establish trust in your product for your user's application.

4) Advertising how our research could be useful

Publish/Network where you expect to find your users. We have put together AUL paper templates available at our website to help you along this path. Our group is also developing a database of applications and projects to help better advertise the communities efforts.

A New Framework for Tracking Progress:

As space physics becomes both more inter – multi- and trans - disciplinary and more intertwined with commercial and government operations, there is a need for a framework to easily identify what projects can be used for specific applications and how close each project is to routine autonomous or on-demand implementation and operation. We have developed the Application Usability Level (AUL) framework and encourage publication of instrument-like papers for delivering and publicizing AULs to help the community quantify the progress of successful applications, metrics, and validation efforts.

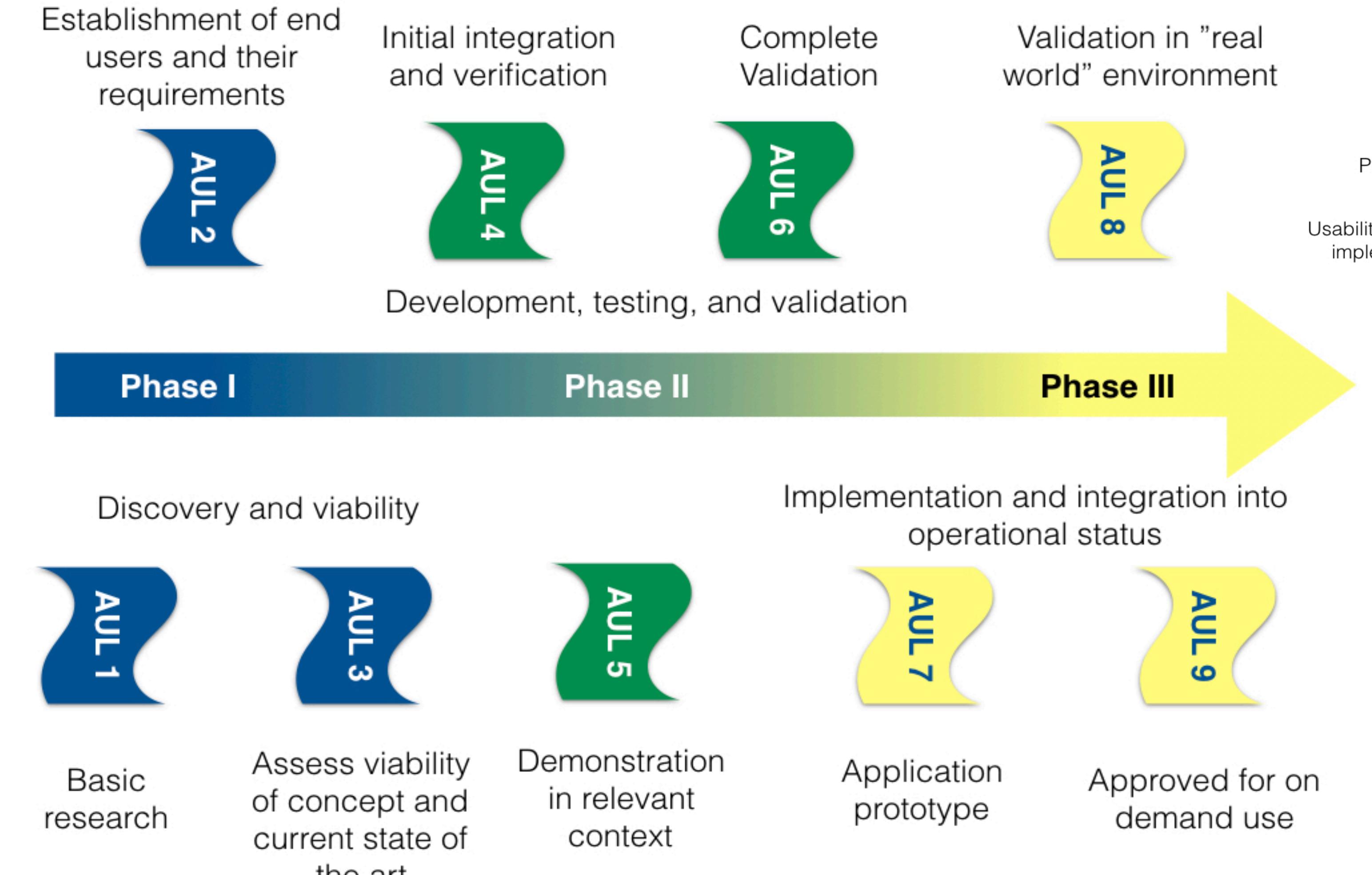
In a given project within the AUL framework there is typically a diverse ecosystem of individuals necessary to ultimately produce a useful space weather product or productive research collaboration. For example, in the case of non-academic fields, users and researchers alike may benefit from a translator, i.e. a *broker*, who may help with the effective transition from research to operations. *Independent validators* like the CCMC are another essential player for validation efforts and comparing like products for a specified application. In many cases the different players throughout the process will act in multiple roles as well as act in different roles for different projects and AUL pathways. As always, a healthy eco-system can result in benefits for the end user and new exciting research opportunities.

This work has been completed as part of the activities of the Assessment of Understanding and Quantifying Progress working group which is part of the International Forum for Space Weather Capabilities Assessment. More information can be found at

<https://ccmc.gsfc.nasa.gov/assessment/topics/trackprogress.php>

AUL: Application Usability Level

An effective framework to aid in communication, track progress of a project towards completion, and advertise user needs and research capabilities.



AUL: Application Usability Level Phases at a glance :

Phase 1: Discovery and Viability

In phase I fundamental research becomes applied. Not all research may or should progress beyond the very first AUL. However, if there is a potential user identified, whether they are a fellow researcher or an industry partner, then this phase will determine whether the project should progress to phase II.

Phase 2: Development, Testing, and Validation

In phase II there is a focus on finalizing development of the new state-of-the-art project integrating the resulting tools into the identified applications, demonstrating the feasibility of the new product and validating the new system.

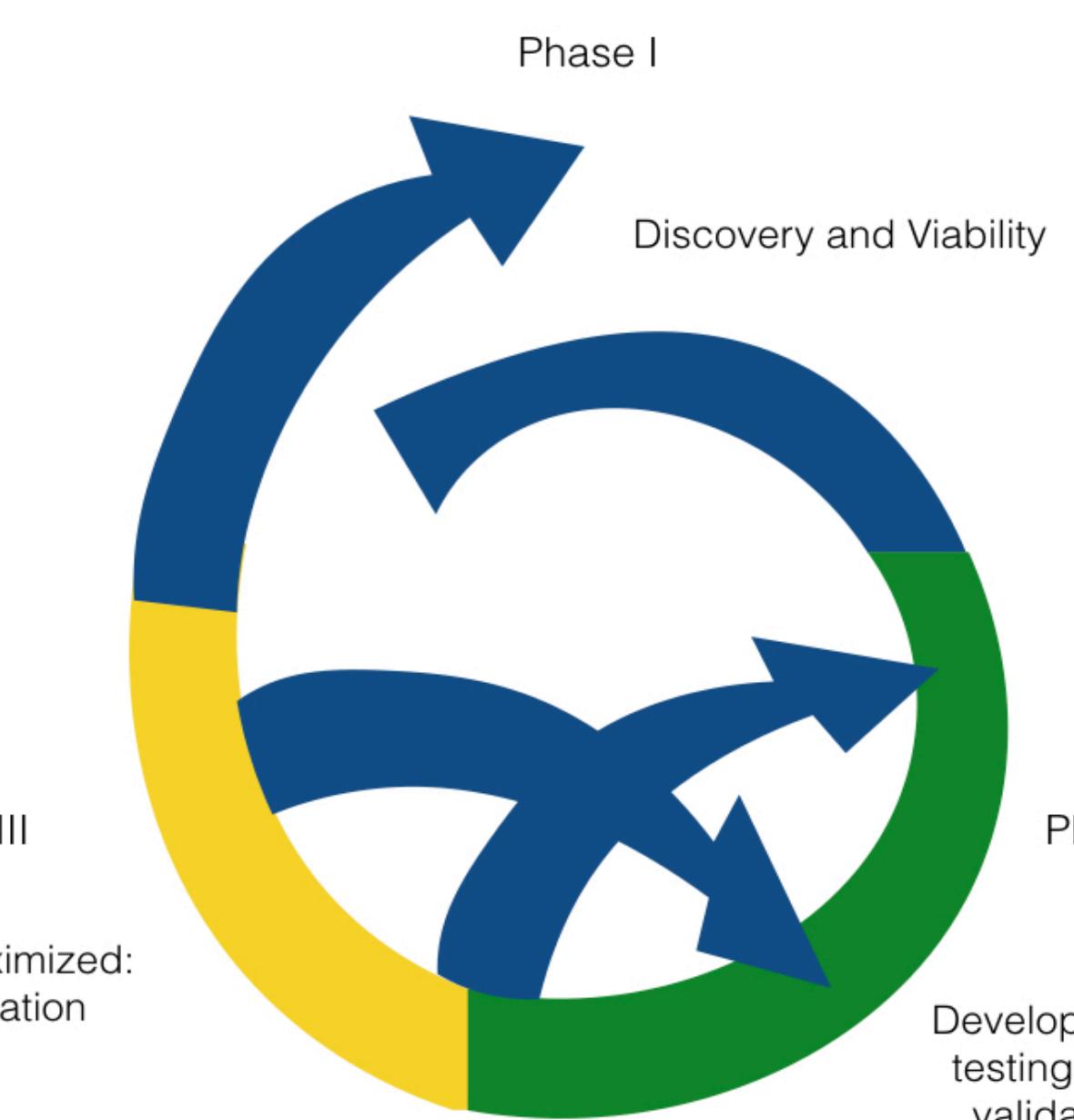
Phase 3: Implementation and integration into operational status.

The project is handed off and fully integrated into the end user's application in phase III. This also includes new validation efforts to determine how well the new application performs in a "real world" setting. Validation and continued use in an operational environment drives discovery of new science questions, problems, and of course new applications.

Beyond AUL 9:

During this process, it is likely that you have found other projects or applications. In this framework it all feels like there is a clear start and stop, but this is far from the truth. New end users, new applications, and altogether new projects are identified. Just like any good research project, there is always more to do and more to learn and improvements to be made.

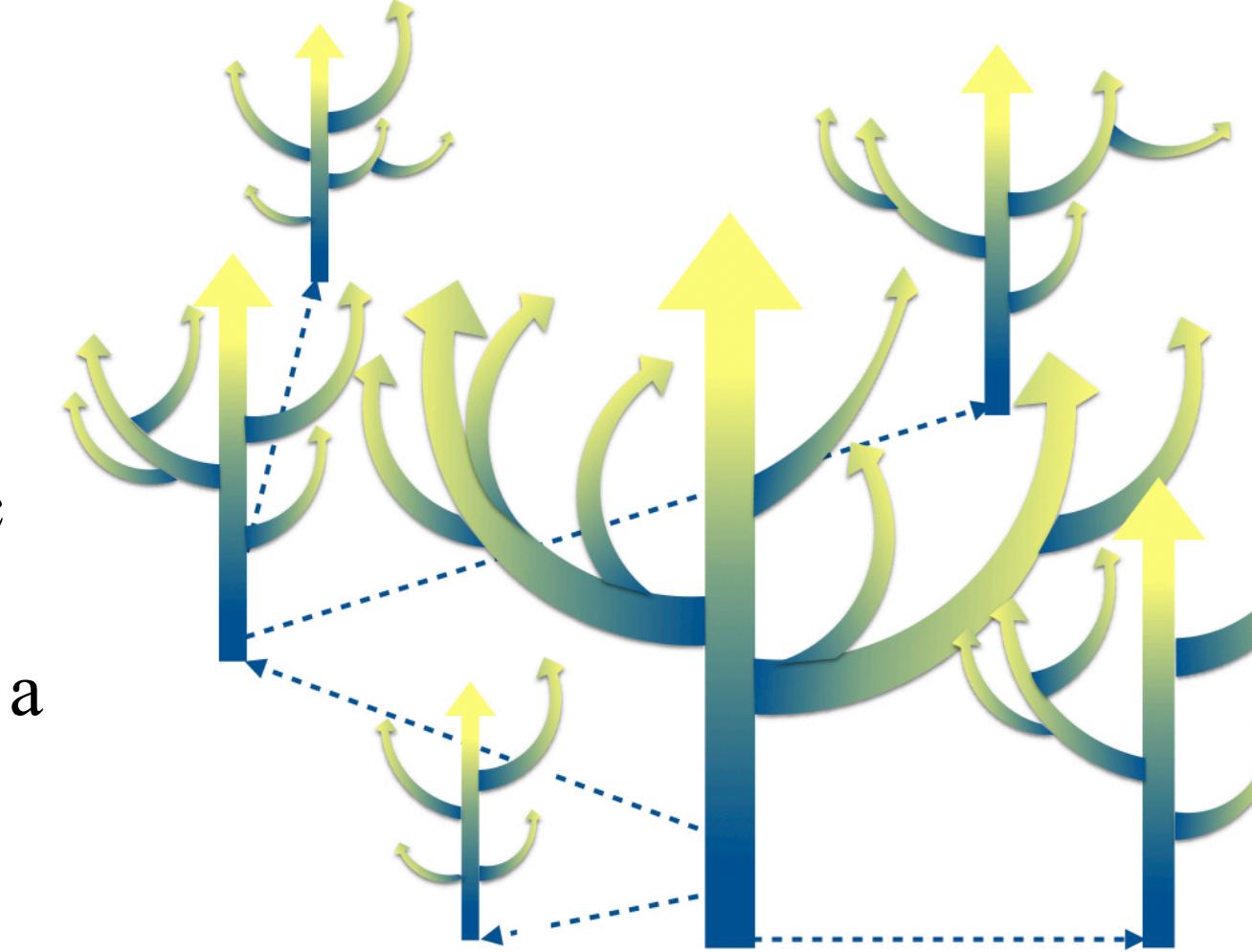
For more information on the AUL framework, recent publications, and where to track applications please contact the lead Author: Dr. Alexa Halford at Alexa.J.Halford@aero.org



Non-linear AULs

A spiral process:

As a project progresses, roadblocks, new understandings, changes to requirements may all pop up. This may mean that the project circles back to lower AUL levels for a moment until they are addressed. This is perfectly normal.



A forest of AULs:

AULs are much like an Aspen grove. The basic research foundation can give rise to many applications. It's also true that as one works on a project with a user, new applications can be discovered and pursued.

An AUL1 Project: Jeff has a new CubeSat mission and believes that their data will be useful to modelers. They have just written their instrument paper and have started considering the temporal and types of data products which will be useful as an input for modelers.

Milestones:

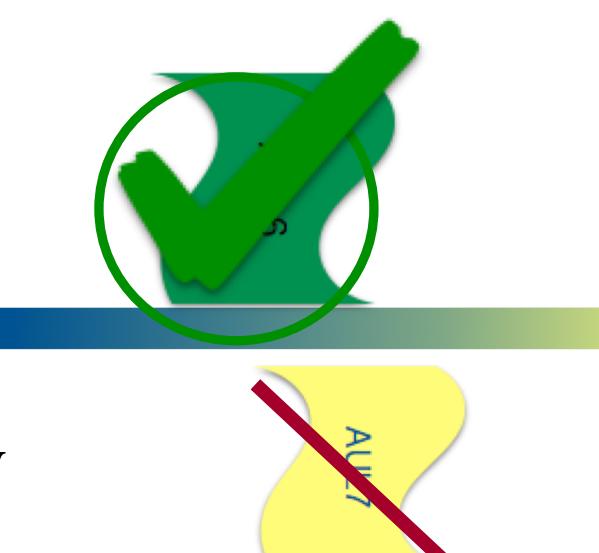
- ✓ AUL1 - Ideas for how project output may enhance decision making or be applied to an end user application.
- ✓ AUL1 - Research is documented and disseminated for the project, so that the usability may be assessed by way of the AUL method.
- ✓ AUL1 - Potential interested end users are identified, but not necessarily contacted.
- ✓ AUL2 - Formalization of the application.
- ✓ AUL2 - An end user is contacted and avenues of communication are established.
- ❑ AUL2 - Identification and formalization of the requirements and metrics necessary for successful application of the project for the end user's needs.

An AUL6 Project: Brett has a new real-time forecasting model of plasma bubbles for the Australian Bureau of Meteorology. Together they have determined specific metrics and requirements. The new model has been validated and working for the relevant environments in a simulated operational environment at RMIT and shown to be better than the current state of the art. The results were just published in Space Weather.

Milestones:

- ✓ AUL6 - Prototype application system beta-tested in a simulated operational environment.
- ✓ AUL6 - Projected improvements in performance of the state-of-the-art and/or decision making activity demonstrated in simulated operational environment.
- ✓ AUL6 - Publication of the specific application and associated metrics and the projects progress towards this application.
- ❑ AUL7 - The system must be fully integrated into the operational environment specified by the end user.
- ❑ AUL7 - The system's functionality is tested and demonstrated in the end user's specified relevant environment.
- ✓ AUL7 - Project team must demonstrate the functionality of the new system for the end user's application and disseminate the results.

Complete Validation (functionality completely validated)



Application prototype (functionality demonstrated)

