THE APPLICATION USABILITY LEVEL FRAMEWORK

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Heliophysics research, like many research areas, has increasingly evolved to include more than just pure science inquiries. Opportunities for interdisciplinary research and transitioning research to an operational environment are ever increasing. Thus, a need for a framework to aid in communicating a project's progress has been identified. In response to this need, the Assessment of Understanding and Quantifying Progress working group, which is part of the international Forum for Space Weather Capabilities Assessment, developed the Application Usability Level (AUL) framework.

The AUL framework identifies and includes many best practices for working with research collaborators and end users. It marks where clear communication is necessary to define the requirements and metrics of the application and encourages continued communication between researchers and users. Within the framework, there are multiple levels that assess the feasibility and viability of the project and validation within the specified environments.

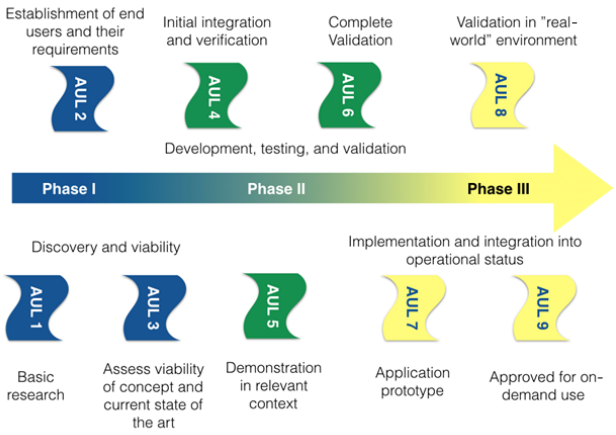

Figure 1. A summary of the AUL framework, phases, and levels

There are many users of research outcomes and products. Many of these users are other researchers who may have different needs and requirements than an industry user or forecaster. The AUL framework has been developed with this in mind, providing flexibility to adapt to the researcher and user needs for a specific application. This flexibility allows the AUL framework to become a standard tool for most collaborations and projects, allowing for a familiarity and consistency across projects.

Although many current projects utilize these best practices, the AUL framework establishes a systematic approach that can be used to track and communicate a project's progress. Below, we identify the AUL phases, levels, and milestones necessary to complete in order to progress through the framework.

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.

AUL 1: *This level is where the basic scientific concepts and projects are created and potential applications identified. A project is considered to have an AUL 1 if the following milestones are achieved:*

Milestones

A. Ideas for how project output may enhance decisionmaking or be applied to an end-user application.
B. Research is documented and disseminated for the project, so that the usability may be assessed by way of the AUL method.
C. Potential interested end users are identified, but not necessarily contacted.

AUL 2: *In this level, the application concept is formalized. An interested end user is contacted, and their needs for a specific application are identified. A project is considered to have an AUL 2 if the following milestones are achieved:*

Milestones

A. Formalization of the application.
B. An end user is contacted, and avenues of communication are established.
C. Identification and formalization of the requirements and metrics necessary for successful application of the project for the end user's needs.

AUL 3: *The feasibility and viability of achieving success for the specific application, under the requirements set out in AUL 2, should be carefully assessed by the end users and researchers.*

Milestones

A. Documentation and dissemination of the expected advancements and proposed metrics from the current state of the art.
B. Components of the application, model/data analysis effort are tested and validated.
C. Detailed characterization of the baseline performance and limitations with respect to the application are completed.
D. A convincing case for the viability and feasibility of the proposed project toward improving upon the state of the art for the identified application is made.

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.

AUL 4: *The basic prototype is completed and initial integration into the end-user application is started. To achieve AUL 4, it must be verified that all components work together.*

Milestones

A. Integration of the system into the application.
B. Organizational challenges and human process issues (if applicable) are identified and managed.

AUL 5: *In this level, the potential of the new model/data analysis efforts is determined for the specified relevant environment (e.g. storm, substorm, or quiet-time conditions).*

Milestones

A. The project team must articulate and disseminate the potential for the improvement upon the state of the art.
B. Application components integrated into a functioning application system for use during the given relevant environmental parameters.

AUL 6: *The potential is fully demonstrated, and this is stated as a major increase in the applications usability and ability to become the new standard used for the end user. Any application components already deployed in the end user's operational environment are tested in their operational and/or decisionmaking context.*

Milestones

A. Prototype application system beta-tested in a simulated operational environment.
B. Projected improvements in performance of the state-of-the-art and/or decisionmaking activity demonstrated in simulated operational environment.
C. Publication of the specific application and associated metrics and the project's progress towards this application.

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.

AUL 7: *All portions of the new project are integrated into the end user's application, and the functionality has been established.*

Milestones

A. The system must be fully integrated into the operational environment specified by the end user.
B. The system's functionality is tested and demonstrated in the end user's specified relevant environment.
C. Project team must demonstrate the functionality of the new system for the end user's application and disseminate the results.

AUL 8: *The new project is fully integrated into the end user application system and is validated by the end user. The application is proven to work in its final form under the expected condition, either meeting or surpassing the initially identified requirements and metrics. In addition, user documentation, training documentation, and maintenance documentation are completed.*

Milestones

A. The end user must approve the addition of the new project to their application for their operational use.
B. Finalized application system tested, proven operational, and shown to operate within the specified requirements and metrics.
C. Applications qualified and approved by the end user for their use.
D. User documentation and training completed.

AUL 9: *The project is the new state of the art and has been proven to work in a sustained manner. Continued validation efforts are performed for the project's sustained use in the operational environment.*

Milestones

A. Sustained and repeated use of the application by the specified end users.
B. The continued validation of the project in the operational environment.
C. Publication of the validation efforts, metrics, and new state-of-the-art project to the community for the specific application.

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, more to learn, and improvements to be made.

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

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