JWST Data Analysis Advisory Group Report

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This report summarizes the recommendations of the JWST Data Analysis Advisory Group (DAAG) that were presented to the JWST Users Committee on December 11, 2020.

Background: Over the period of July–December 2020 the DAAG focused its attention on the general landscape of data analysis tools that will be available to the JWST community. Specifically, we considered how rapid and flexible exploitation of JWST data, particularly in the first year of operations, can be enabled through a combination of new and existing tools.

Input from community groups was gathered through a Data Analysis Tools Survey. The survey was sent to ERS teams, GTO teams, and other community members with the aim of obtaining (i) feedback on how well the tools developed by STScI appear to meet their data analysis needs, (ii) input on how future efforts at STScI could be directed, and (iii) priorities for enabling existing tools to work with JWST data. In total we received 17 responses, primarily from ERS teams. The individual responses have been communicated to STScI and are available upon request[1].

The main result from this survey was a consensus that JWST users expect to analyze their data using a wide variety of tools, and that the best way to support rapid exploitation of JWST data is therefore to foster an ecosystem of new and existing tools that is reliable and robust. Specific takeaways from the survey include the following:

- Among the new tools developed by STScI that had been made public at the time of the survey, respondents placed the highest value on tools for visualization (`jdaviz`) and for producing science-ready data products (e.g., spectral extraction and photometric tools).

- Requests for new tools tended to focus on those that addressed JWST-specific data characteristics (rather than general-purpose tools that can be applied to non-instrument-specific data).

- A large majority of teams expect to rely heavily on existing tools not originally intended for JWST or new tools that they will develop themselves.

- Many existing tools will need to be adapted to JWST. This requires realistic simulated data that has been processed through the calibration pipeline.

- Interaction with the calibration pipeline (i.e., using outputs from multiple stages) is likely to be critical for many teams.

- Concerns exist about how geometric solutions will be obtained for Solar System targets, and about how the information needed to calculated these solutions (via backplanes) will be propagated through the calibration pipeline.

Recommendations: In light of the above results the DAAG makes the following recommendations:

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**1.	New tool development at STScI should focus on tools that work with JWST-specific (i.e., pipeline-processed) data to produce analysis-ready data products.** This is particularly true in cases where tools for higher-level analysis already exist. Examples include flexible spectral extraction (as opposed to spectral modeling) and multi-band PSF-corrected photometry (as opposed to SED fitting, photometric redshift estimation, etc.). Specific requests from the survey have been communicated to STScI. We recognize that including top-level analysis in some notebooks may help to demonstrate their science applications. In those cases the time required for the DAT team to implement them should be weighed against the potential community benefits.

**2.	Steps should be taken to maximize the impact of existing and custom tools.** The DAAG has previously emphasized the critical role of realistic (pipeline-processed) simulated data for software testing. We therefore support STScI's efforts, including those coordinated with the NIRSpec IDT/GTO team, to organize and make available both the simulation tools and the simulated data themselves. In order to further prepare for a wide range of tools to be applied to JWST data we recommend that:

- ASDF interpreters be created for non-Python languages, including C/C++ and IDL

- STScI coordinate with community groups to ensure compatibility for at least a small number of widely-used existing tools. These should include `ds9`, `QFitsView`, `SExtractor`, and potentially other tools that are of especially high value. Any lessons learned that may be applicable to other existing software tools should be shared on the JDox website.

**3.	Requirements for mapping solar system objects should be evaluated and implemented.** The DRP and DAT teams should consult with Solar System (SS) ERS and GTO teams in order to (i) establish the requirements for constructing backplanes for SS observations, (ii) ensure that these requirements are met by the calibration pipeline, and (iii) identify any new software tools that may be needed to compute backplanes and construct mosaics, especially for MIRI and NIRSpec.

**4.	Support for the use of intermediate DRP products should be enhanced.** Although the DAAG did not attempt to evaluate the calibration pipeline we consistently heard from community groups that intermediate-level data products, including stage 1, will be critical to their science. These groups also related difficulty in running the pipeline and uncertainty about data attributes. We therefore urge the DRP team to resolve any remaining uncertainties in the characteristics of the processed data, including header keywords, at all stages. We further encourage the DRP team to interact regularly with the DAT team and community groups in order to maintain awareness of user needs. STScI may wish to consider appointing a DRP project scientist who could help facilitate these interactions.