



December 19, 2016

Dr Ken Sembach, Director
Space Telescope Science Institute
3700 San Martin Drive
Baltimore, MD 21218

Re: JSTAC recommendations regarding the JWST ERS program

Dear Director Sembach:

JWST is a mission of extraordinary power that will provide wide-ranging scientific opportunities through its extensive suite of instruments. However, its instruments, their modes of operation, and the resulting datasets are complex. If JWST's capabilities are to be used optimally, the science community will need to be both well-informed and well-educated about JWST's performance in its expected widely-used modes as rapidly as possible.

This is particularly important for a space mission of the cost of JWST whose nominal life is 5 years, and whose maximum lifetime is around 10-11 years. Clearly the science community must do all it can to maximize the science return during that relatively short lifetime. An additional factor also needs consideration. As experience with Hubble and other flagship missions has demonstrated, the planned lifetime of instruments is not always realized. Unrecoverable failures can occur at any time during a space mission. The limited lifetime and the risk of unexpected early failure should together lead to a focus on ensuring that the scientific community is positioned to be as scientifically-productive as possible, as early as possible.

The importance of having open, public datasets that would enable rapid insights by the astronomical community into JWST capabilities very early in the life of the JWST mission was recognized in the very first JSTAC discussions in 2009 and 2010. The timing for the submission of Cycle 2 proposals, just six months into Cycle 1, adds particular focus to this need. The JSTAC explicitly recommended the development of a "First Look" program of open public datasets in one of its earliest letters to the Director. This, along with a number of other recommendations regarding the proprietary period and community fields, were the key aspects for "*maximizing the science return from JWST*" highlighted by JSTAC in its early discussions. Subsequent discussions and considerations led to a more detailed enunciation of the goals and a recommendation in 2014 regarding the Early Release Science (ERS) program (renamed from "First Look").

First-Look/Early Release Science (ERS) observations – the 2014 recommendations:

The 2014 JSTAC letter highlighted the primary goals of an ERS program as being to:

- (i) educate the community as to the scientific capabilities of JWST's key instruments and modes;
- (ii) ensure rapid data availability so that the community can generate proposals for Cycle 2 that take maximal advantage of JWST's new and uniquely powerful capabilities (since the Cycle 2 deadline is part way through Cycle 1);
- (iii) involve the community in the planning of the ERS program.

The JSTAC then noted in its letter that to achieve these goals, the program should:

- (i) provide a wide range of scientifically-interesting datasets that will enhance the science proposals for Cycle 2;
- (ii) exercise a wide range of the expected-to-be most used modes for a range of science topics;
- (iii) be carried out very early in the first cycle;
- (iv) begin the planning process in an early, open way with proposals from community members.

The data from the ERS program will also allow STScI to enhance its data processing pipelines and data analysis routines, assisted through interactions with the community who will be using the open and widely accessible ERS datasets. The JSTAC has noted that the ERS program will provide great value through having hundreds, if not thousands, of eyes on JWST data at an early stage!

The JSTAC recommended in 2014 an open access ERS program with datasets that have zero proprietary period (zero exclusive access period)¹ as follows:

The JSTAC recommends that STScI work with the community to plan for implementation of an Early Release Science (ERS) program that will provide non-proprietary, open access data to the community on a wide range of science programs and modes that (i) demonstrate the scientific capabilities of JWST, (ii) quantify the observational capabilities and (iii) position the astronomy community to submit Cycle 2 proposals that are based on real-world experience with JWST, thereby allowing the community to exploit the full potential of JWST very early in its 5-year life.

The Early Release Science (ERS) program circa 2016:

The JSTAC again endorses the concept of an open access ERS program to be done as early as possible within Cycle 1, consistent with its earlier recommendations.

Since the 2014 letter the JSTAC has discussed extensively with STScI what it means to actually carry out an ERS program. The ERS has evolved to be a distinct proposal opportunity for the community that follows the delivery of the GTO target list and precedes the Cycle 1 proposal submission and selection. Thus ERS targets can be any science target, except those GTO targets protected by the usual duplication rules. The ERS targets themselves will be duplication-protected against GO selection in Cycle 1.

While the JSTAC recognizes that detailed implementation of the ERS program is the responsibility of STScI, with NASA concurrence with the procedures, the JSTAC would like to offer some broad core principles that are consistent with its many years of discussion of this program, as well as a few general considerations.

An overall summary of JSTAC's view of the ERS might best be reflected in the third item in its 2014 recommendation: *(iii) position the astronomy community to submit Cycle 2 proposals that are based on real-world experience with JWST, thereby allowing the community to exploit the full potential of JWST very early in its 5-year life.*

¹ While NASA uses the phrase "exclusive access period" instead of the phrase "proprietary period", "proprietary period" is the one most widely used in the science community to describe closed datasets and so is the one generally used in this letter.

Core principles circa 2016:

From the perspective of JSTAC, an open-access, zero proprietary time (zero exclusive access period) ERS program that would meet the goals enunciated above would be guided by a set of core principles. From its discussions and prior recommendations, the JSTAC has identified a number of such core principles that constitute a broad recommendation as to the nature of the ERS program. While JSTAC acknowledges that many of these aspects are now part of the baseline planning for the ERS at STScI, the committee considers that it is valuable to clearly enunciate its views regarding the core principles for the ERS.

The JSTAC recommends that STScI consider the following core principles when setting up the ERS program:

- 1) *provide datasets on scientifically-interesting targets that utilize the expected most widely-used modes of JWST's instruments;*
- 2) *make these datasets open-access, zero proprietary time (zero "exclusive use") to ensure that the science community can rapidly gain insights into JWST's performance;*
- 3) *carry out these observations as early as possible in Cycle 1, so that all the datasets are available well before the cycle 2 proposal deadline;*
- 4) *establish a process whereby the raw datasets are processed into higher-level interim data products as quickly as possible and made available to the community;*
- 5) *establish a peer-review process to select groups who will be judged on their ability to carry out the rapid generation of higher-level interim data products;*
- 6) *ensure that the accepted data-processing groups have the capability, commitment and focus to deliver higher-level processed data and higher-level data products very quickly to the community (within one-two months after data acquisition);*
- 7) *provide incentives to encourage groups to deliver data and, if considered necessary, disincentives to ensure that the ERS groups do not get caught up in a race to do science with the ERS data and lose focus on their responsibility to deliver processed data quickly;*
- 8) *choose science targets that are representative of important scientific issues, consistent with the above objectives;*
- 9) *provide guidance in the proposal selection process to ensure that the primary focus is on exercising the expected most-widely used instrument modes and not primarily on exploring a range of science (i.e., it is important not to focus on the science goals to the exclusion of appropriately testing and demonstrating the widely-used modes of the instruments, as noted in (i) above);*
- 10) *request that a range of targets be proposed such that the ERS program can be quickly updated to reflect any changes in the launch date or commissioning timeline. It would be prudent to provide targets that can accommodate a many-month change in the start of the ERS observations.*

Some considerations regarding the Early Release Science (ERS) program:

Given the very different goals for the ERS program from that for the normal Cycle 1 observations, the JSTAC recognized that it is quite appropriate to have a separate selection process and has consistently supported a separate ERS Call for Proposals. During its discussions the JSTAC recognized that this would most naturally occur prior to the Cycle 1 process. The JSTAC is encouraged that this approach has become the baseline plan.

As indicated above, a key aspect of the ERS program from its conception within the JSTAC discussions with the STScI staff and leadership is that the data is open, public data with zero proprietary period (zero exclusive access period). JSTAC is encouraged that this is part of the baseline for the ERS Call for Proposals being implemented by STScI.

The phrase “expected most widely-used modes” raises the question as to how to gain insight into what are such modes. Fortunately, the ERS community survey carried out by STScI provides considerable guidance as to the modes that the science community currently considers particularly important in 12 separate science areas. *The proposal process itself will add to that guidance*, but we are fortunate to have the ERS community survey to provide insight into the modes that are considered most valuable in a variety of key science areas.

A major challenge for the selection process and its evaluation criteria will be to ensure (i) that the focus is on exercising and demonstrating the expected most widely-used modes of instruments and that excitement about science opportunities not distort the program away from this central goal, and (ii) that the selected groups have the management focus and experience with data processing to ensure that they can deliver enhanced, though still interim, data products and can do so quickly in time for Cycle 2 proposal preparation. The JSTAC recognizes that the science opportunities in the ERS datasets will be numerous and exciting. However, it will be all too easy for teams to lose focus and to become enthusiastic about the science opportunities to the exclusion of carrying out their responsibility to deliver higher-level data products as quickly as needed if the ERS program is to be a success. This can affect teams of any size, but large teams will need to be particularly careful in this regard.

To ensure the rapid delivery of processed data well before the Cycle 2 proposal deadline the JSTAC suggests that the community be encouraged to plan for core groups who are focused on delivering the higher-level data products. The Hubble and Spitzer Frontier Fields team is an excellent current example where a small group out of the larger team has consistently delivered higher-level interim data products quickly to MAST (as v0.5 products) and to the SHA (Spitzer Heritage Archive). There will be intense pressure in teams of scientists, particularly large teams, to focus on getting science out, and this could result in the team failing to deliver the data products needed for ERS to be successful in that central aspect of its objectives. The teams will need to identify the core group responsible for data deliveries and ensure that the management plan demonstrates a focus on those deliverables.

Closing perspectives:

The JSTAC’s deliberations on the ERS have extended over many years. The central goal of the ERS has long been recognized to be provided by items 1), 2) and 3) of the core principles above, i.e., *providing open-access datasets with zero proprietary-time early in Cycle 1 on the expected most widely-used instrument modes of JWST for scientifically-interesting targets*. The second most-important aspect *is the delivery within an ~2 month timescale of improved, but still interim, data products and data related to instrument performance that would enhance understanding of*

JWST's capabilities before the Cycle 2 deadline. Improved data products could be early (v0.5) releases to MAST or releases through other avenues accessible to the science community.

There was broad agreement within JSTAC on these two aspects of the ERS. Together these two aspects would result in wide-ranging opportunities for the astronomy community to become familiar with the instruments and to conduct a large range of science investigations. It was noted often by JSTAC members that the whole science community will have a field day with the wide-range of science opportunities in the ERS datasets. There was also considerable discussion at JSTAC's most recent meeting in late 2016 on the value of longer-term deliverables and ERS-related activities that extended through Cycle 1 and into Cycle 2 (towards the Cycle 3 proposal deadline), but for these there was no consensus, and so we do not convey any recommendations beyond the core principles and the enunciation above of the two key aspects.

The JSTAC greatly appreciates the effort undertaken by STScI to work with the committee in the development of its recommendations regarding the ERS program. In particular, the JSTAC greatly appreciates Director Sembach's support of the program and his commitment of ~500 hours of Director's Discretionary Time (DDT) for the ERS. As always, JSTAC is happy to work with STScI to clarify any aspects of its recommendations regarding the ERS program, and to respond to any questions that may arise during implementation. The ERS is a crucially important program for maximizing the science return from JWST.

Sincerely yours, on behalf of the Committee,



Garth Illingworth
Chair, JSTAC

JSTAC members:

Roberto Abraham	University of Toronto
Neta Bahcall	Princeton University
Natalie Batalha	NASA Ames Research Center
Roger Brissenden	Smithsonian Astrophysical Observatory
Timothy Heckman	Johns Hopkins University
Kelsey Johnson	University of Virginia
Heather Knutson	California Institute of Technology
Malcolm Longair	Cavendish Laboratory, University of Cambridge
Christopher McKee	University of California, Berkeley
Bradley Peterson	Ohio State University
Lisa Storrie-Lombardi	Spitzer Science Center, Caltech
Monica Tosi	INAF – Osservatorio Astronomico di Bologna
Tommaso Treu	University of California Los Angeles

JSTAC Ex-officio observers from the Agencies:

(whose contributions to this letter were limited to factual input)

Hashima Hasan	NASA HQ
John Mather	NASA GSFC
Mark McCaughrean	ESA
Alain Ouellet / Jean Dupuis	CSA
Eric Smith	NASA HQ