

# HST Deep Fields Working Group: Frontier Fields Program

## Context

After consultation with the Space Telescope Users Committee and the science community, the Space Telescope Science Institute's Director, Matt Mountain, has decided to explore devoting a substantial fraction of his Director's Discretionary time in observing Cycles 21-23 to a new Hubble Space Telescope Deep Fields Initiative. The primary goal of this initiative is to extend our knowledge of the cosmic frontier at high redshifts through the collection of data that only HST is capable of obtaining. A secondary goal is to lay the groundwork for future observations of the early universe with the James Webb Space Telescope. Although there are many areas of the sky that have deep HST observations, there is presently only one field with the depth and wavelength coverage of the Hubble Ultra Deep Field (UDF).

The prime aim of the Hubble Deep Fields Initiative (HDFI) is to identify the most effective strategy for complementing and supplementing the HUDF. Additional deep fields could permit investigations of cosmic variance, a more thorough assessment of the inventory and evolution of galaxies in the early universe, and the onset of star-formation in the youngest galaxies ever observed. A possible approach might be the creation of two or more multi-wavelength HUDF-like fields, well separated on the sky from the current HUDF. These might be supplemented by additional fields chosen for observation at ultraviolet-visible wavelengths with HST, with the expectation that the observing community will propose follow-up observations at longer wavelengths with HST and/or JWST. Other options are possible, and the Working Group is encouraged to explore the most effective means of achieving the high-level science goals it identifies.

If implemented, the HDFI will occur in Cycles 21-23 (October 2013 – September 2015), after the completion of the HST Multi-Cycle Treasury Programs in Cycle 20. Approximately 600-1000 orbits of Director's Discretionary time are expected to be available for this initiative over those cycles. We expect the Working Group's recommendations will help define the scope of the program. All HDFI data will be non-proprietary. Opportunities to supplement these core observations and perform archival research will be available through the standard yearly HST Call for Proposals, with the Cycle 21 call to be released in December 2012. The HDFI will be coordinated with observations from NASA's other Great Observatories (Chandra and Spitzer). Coordination with JWST, ALMA, and large ground-based telescopes is also desirable.

## Charter

The HST Deep Fields Working Group is charged with the following primary tasks:

- a) Define the science case and a set of science goals for a new set of ultra-deep imaging fields with sensitivity depths comparable to those of the HUDF and HUDF-09 infrared follow-up. Provide an assessment of the urgency of pursuing this science.
- b) Assess the prospects for near-field science that can be achieved with these deep-field observation;
- c) Recommend the locations and number of fields that should be obtained to meet the science goals defined for the HDFI;
- d) Recommend the suite of filters and exposure times necessary to accomplish the science goals defined for the HDFI;
- e) Solicit input from the astronomical community in defining the science goals and recommendations described in the above tasks;
- f) Produce a short (10-15 page) white paper describing the results of the above tasks by October 1, 2012.

By forming this Working Group, STScI is hoping to ensure that many voices are heard in the formulation of the science case for the HDFI and its eventual data products. Our goal is to maximize the science return and legacy value of the observations. An open request for input by the astronomical community will be issued by STScI to support the Working Group's efforts. In defining the science case for the HDFI, the Working Group should take into account both the archival research value of the planned observations and the coordination of these observations with other observatories. The final products of the Working Group will be reported to the STScI Director for consideration.

The Working Group will comprise approximately 8-10 members of the astronomical community selected by the STScI and the Working Group Chair, Professor James Bullock of the University of California, Irvine. The Chair of the Working Group will organize the meetings of the Working Group, and STScI will provide logistical (travel, meeting, telecon, etc) support as needed. We expect that the Working Group will have at least one face-to-face meeting, supplemented by regular telecons and email exchanges.

The primary STScI contacts for the Working Group will be Ken Sembach (STScI HST Mission Office Head) and Neill Reid (STScI Science Mission Office Head). Both will be ex officio members of the Working Group.

## Membership

Chair: James Bullock (UC Irvine)

Members: Mark Dickinson (NOAO), Steven Finkelsein (UT Austin), Adriano Fontana (INAF, Rome), Ann Hornscheimer Cardiff (GSFC), Jennifer Lotz (STScI), Priya Natarajan (Yale), Alexandra Pope (U. Mass), Brant Robertson (Arizona), Brian Siana (UC Riverside), Jason Tumlinson (STScI), Michael Wood-Vasey (Pittsburgh).

Contact scientists: Peter Capak (Spitzer), Paul Green (Chandra)

## Constituted

July 2012

## Report

This HDFI report was submitted in November 2012 : [SWG Report 2012](#).

## Outcome

The Frontier Fields program was executed in Cycles 21, 22 and 23 (2014 through 2016), with ACS and WFC3 observations of two galaxy clusters (plus the associated parallel fields) each cycle. Full details on the program, including the detailed implementation plan, scheduling and subsequent data releases, can be found at: [HST Frontier Fields](#).