



**STScI** | SPACE TELESCOPE  
SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

# Frontier Fields (and STScI Community Initiatives)

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Anton M. Koekemoer (STScI)

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## Context: “Community Initiatives” at STScI

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General goal: facilitate broad community science, complementary to GO process  
(see <https://outerspace.stsci.edu/display/HPR> maintained by Neill Reid) - includes:

- [Hubble Second Decade Committee \(1998-2000\)](#)
- [HST-ACS Ultra Deep Field \(2003-4\)](#)
- [HST Deep Fields Working Group: Frontier Fields Program \(2012\)](#)
- [Solar System Advisory Committee \(2014\)](#)
- [Exoplanet Advisory Committee \(2016\)](#)
- [HST Observations of Europa Advisory Committee \(2017\)](#)
- [Fundamental Physics with Hubble Working Group \(2017\)](#)
- [HST-LIGO Follow-up Working Group \(2018\)](#)
- [HST Ultraviolet Legacy DD program \(2019\)](#)
- [HST-TESS Advisory Committee \(2019\)](#)
- [Dual Anonymous Review Workshop \(September 25, 2019\)](#)



## HST Ultra Deep Field (HUDF) and Frontier Fields (HFF): Initial steps

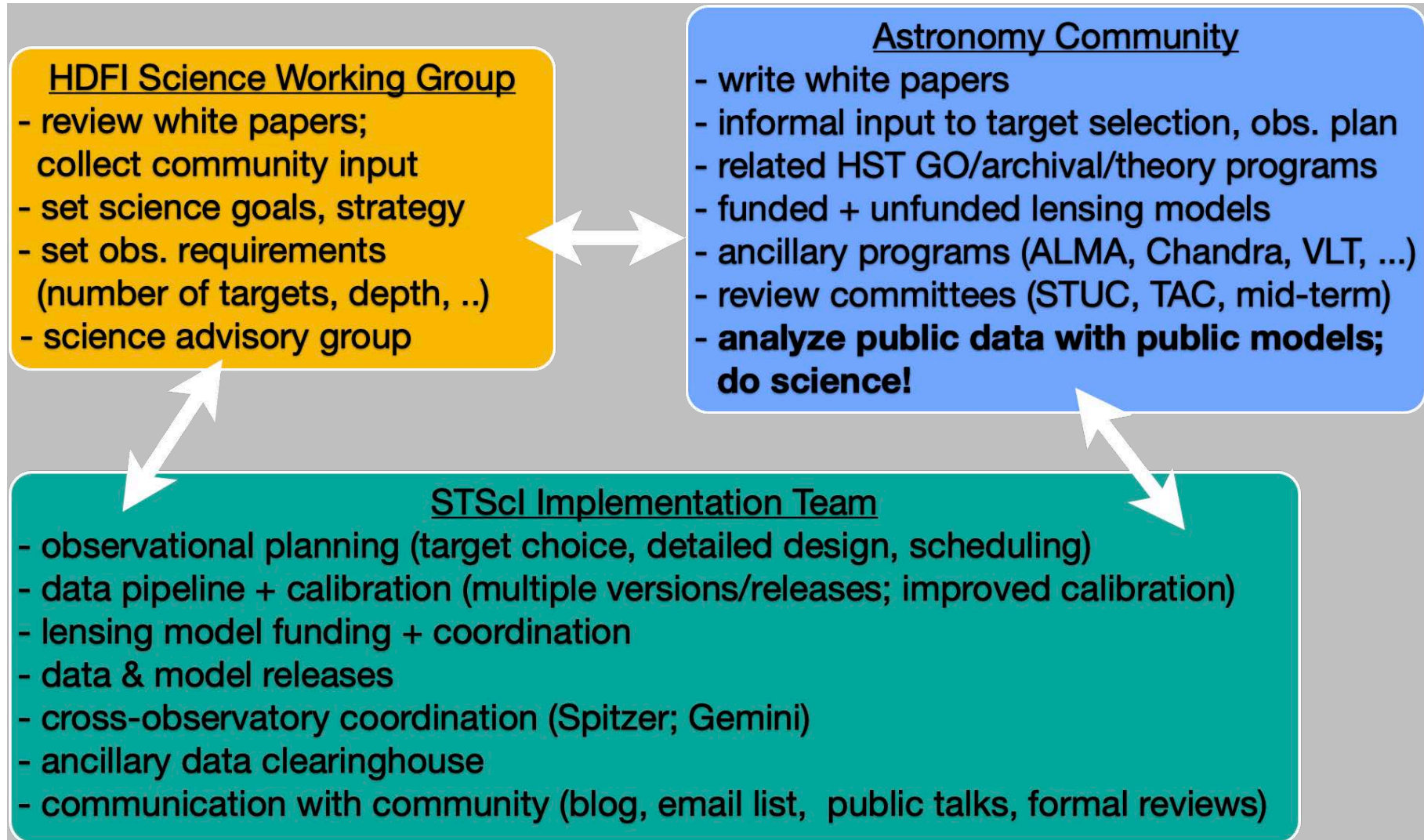
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- Each project involved discussions (and ongoing iterations) between STScI, Project, and community (including STIC/STUC)
- Overall identification of scientific need for each program, supported by community
- External Scientific Advisory Committees set up to define/recommend science goals:
  - [HUDF Scientific Advisory Committee](#) 2002 (chair: Ron Ekers)
  - HDFI Working Group which ultimately recommended HFF program in 2012 Bullock et al. SWG report: (<https://outerspace.stsci.edu/display/HPR/HST+Deep+Fields+Working+Group%3A+Frontier+Fields+Program> with Bullock et al. report "[SWG Report 2012](#)" linked near bottom of that page)
- The HDFI Working Group solicited white paper input from broad community (due Aug 2012):
  - science inputs included: deep COS spectr.; grism spectr.; another HUDF; cluster lens fields; and others
- With external committees having defined and recommended overall science goals, STScI would then become responsible for:
  - Implementation of the program (incl. instrument-specific details)
  - Execution of the observations (STScI Scheduling Working Group)
  - Calibration and data processing through to final science products (STScI Data Working Group)
  - Distribution of high-level science data archive products (STScI Science Products Working Group)
  - Frontier Fields also had additional coordination with Chandra and Spitzer, and solicitation of theoretical model work by external community Lens-model teams (also delivered to STScI archive)





# HFF model for Community Science Planning and Implementation



(from a presentation by J. Lotz)



## HST Ultra Deep Field (HUDF) and Frontier Fields (HFF): Implementation

Implementation of these large programs led to long term benefits for the community:

- Resolving scheduling challenges led to solutions that benefited full community:
  - eg, improvements in scheduling to reduce impact of bright source persistence on subsequent observations
- Resolved calibration challenges were incorporated in pipelines (benefiting future GO/AR programs):
  - HUDF led to improvements in low-level bias, flatfield, and distortion calibration
  - HFF led to improvements in persistence modelling and removal, mitigating the impact of time-variable sky emission lines, and astrometric alignment improvements
  - resulting improvements in code also made available to community for their use in other programs
- Archive distribution mechanisms were improved to enable broader community science:
  - ▶ mosaics all aligned to a common pixel grid, matching catalogs and other products (incl HFF lens models)

Resulting high quality science data products enabled immediate science by community:

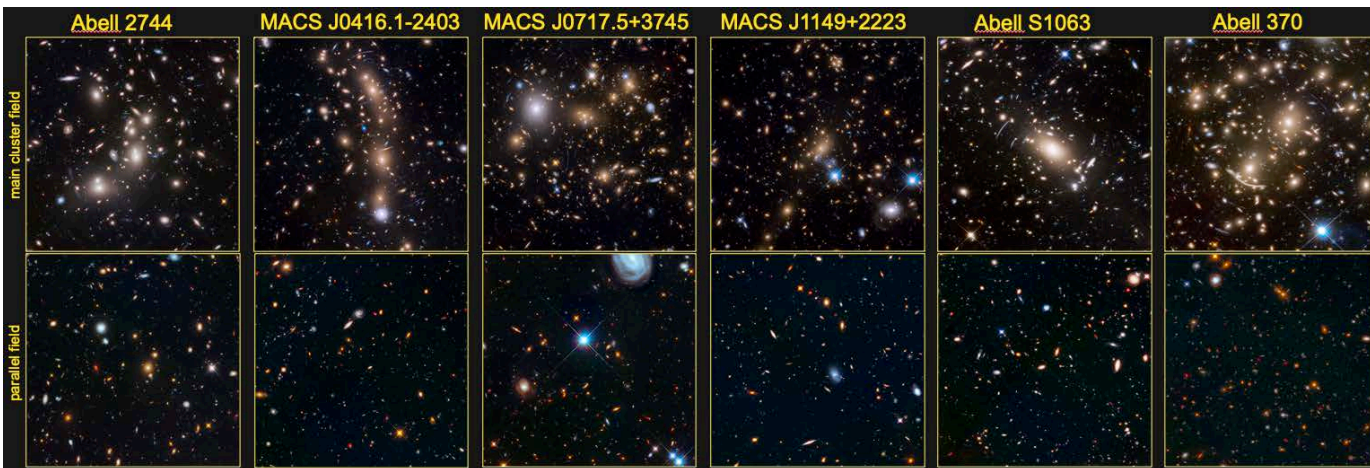
- community-led papers submitted starting immediately after data release in each case, also many subsequent proposals by community on all major ground+space facilities
- subsequent projects leveraged the original datasets and theoretical models delivered by community



# HST Ultra Deep Field (HUDF) and Frontier Fields (HFF): Outcomes

- Implementing these observational programs as community initiatives freed up the community to focus their resources on the science, and on a “level playing field”
- Providing all the high-level science data products to the entire community, as soon as they were available, helped ensure more equal access to the resulting science, to all researchers
- Solutions to challenges in implementing and execution could be propagated to the broad community (incl improvements in scheduling, calibration, and data reduction software)
- Follow-up with other facilities more easily enabled by having the high-level data products distributed as soon as they were available.

*Frontier Fields full mosaics (prime + parallel fields)*



*HFF lensing models (from external teams)*

