



# **James Webb Space Telescope Project Science Update for the JSTUC, Sep 9, 2019**



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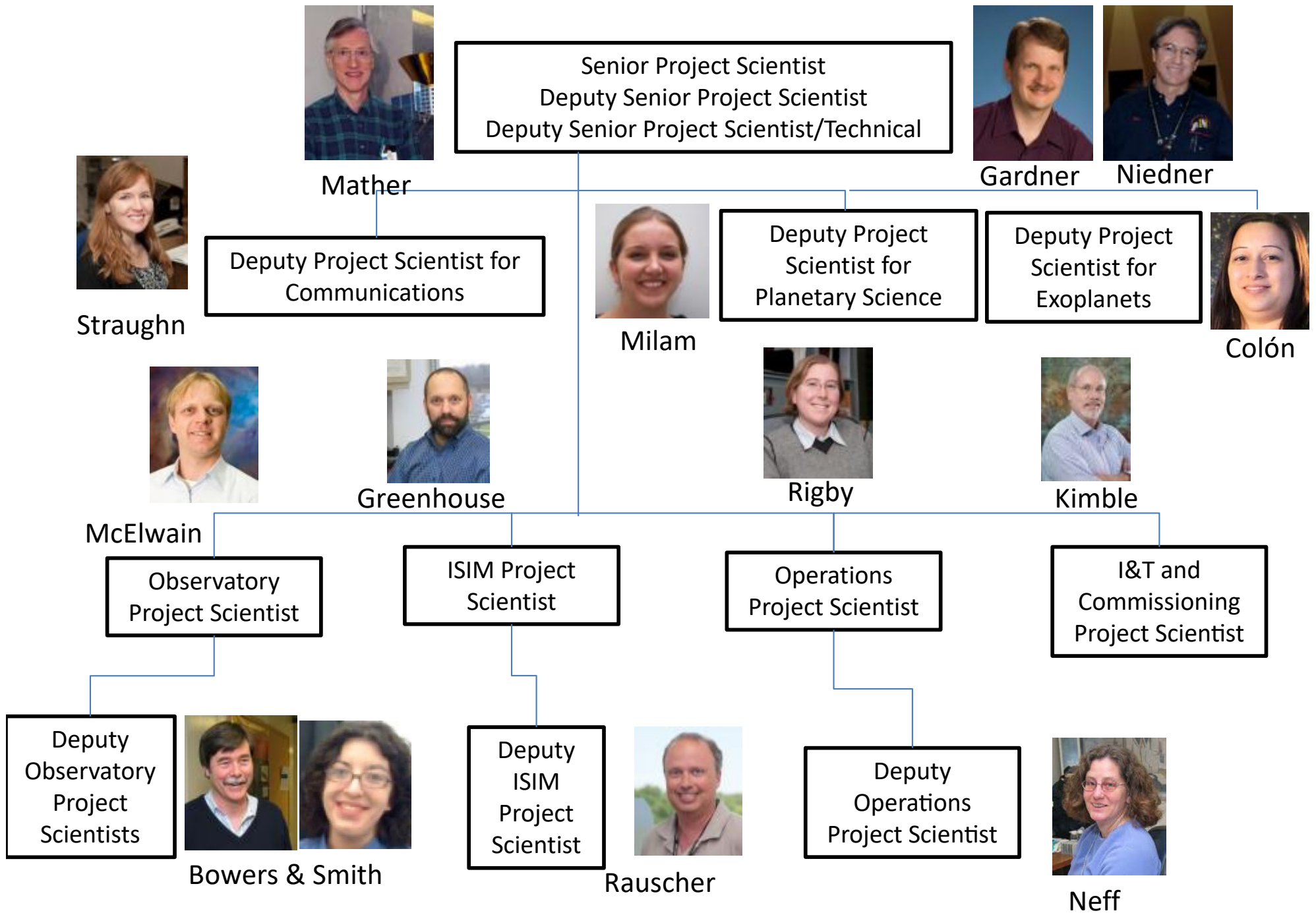
**on behalf of 7.7 billion current humans, ~10,000 future observers, ~ 3000  
engineers and technicians, ~ 100 scientists worldwide, 3 space agencies**



# **My questions for the JSTUC**

- 1) Future of JSTUC membership. The charter says 2 yr terms, extendable to 3 yr.**
- 2) Future of data analysis tools. Balance shifting from IDL and IRAF toward astropy and Jupyter notebooks. Please provide feedback on what tools exist now, what the Data Science Office is suggesting for the future, and how STScI can provide data analysis tools that serve a diverse software user community given finite resources. Are we over-estimating the willingness of users to switch tools?**
- 3) Mix of small, medium, and large programs in Cycle 1. We have a better understanding of JWST overheads than when we first wrote the Cycle 1 Call for Proposals. We therefore have a much better sense of what is small vs medium vs large. Please discuss the boundaries between small, medium, and large; and the provisional division of hours into each category.**





# JWST Project Science Team at Goddard



# GSFC Project Scientist Roles and Responsibilities

- Advise Project Manager (Mather, Deputy Gardner, Technical Deputy Niedner)
  - Chair Science Working Group (Mather, Deputy Gardner)
  - Defined and documented detailed scientific requirements
    - Scientific Requirements Document (SRD) ([Link to public version Rev A](#))
    - Space Science Review article (PDF online) ([link to free Springer version](#))
    - Science Requirements Analysis Board (SRAB) to manage possible changes (Niedner)
  - Work side by side with management and engineering teams to ensure requirements are met.  
Accept single point accountability to me for the science performance of their mission elements:
    - Telescope/Spacecraft/Sunshield (McElwain, Deputies Bowers & Smith)
    - ISIM (Greenhouse, Deputy Rauscher)
    - Integration, Test, & Commissioning (Kimble)
    - Operations (Rigby, Deputy Neff)
    - Planetary Science (Milam), Exoplanets (Colón)
    - Communications (Straughn)
  - My PS staff has authority commensurate with the above accountability.
  - Deputy Project Scientist for Communications (Straughn)
  - PI for NIRSpec detectors (Rauscher)
- Also essential (not members of official GSFC PS team):
- PI for MIRI detector system, NASA Project Scientist for the MIRI (Ressler, JPL)



# Project Science (GSFC) Activities

- Weekly coordination meeting with all Project Scientists (OSWG)
  - Chaired by M. McElwain
  - Actions tracked by C. Bowers
  - Ensures awareness of technical issues and current meetings
- I have weekly tagups or telecons with:
  - Project Manager, Program Scientist (Smith, deputies Hasan & Sheth, with Gardner & Niedner), each Project Scientist
- Project Science Team works with STScI
  - Extensive collaboration with STScI on all aspects of the ground system
  - Mather telecons with STScI Director and Mission Head (Sembach, Stiavelli)
  - Thursday telecons on operations
  - Participation at monthly Project-STScI "Roundtable" meetings
  - Outreach, coordinate events, materials, and web updates
  - Rehearsals of launch, deployments, commissioning, and normal operations
  - User training events (workshops and webinars for proposal preparation, eventually also for data analysis)
  - Extensive interactions with community documentation (JDox and "how-to" videos)



# JWST SWG

- Chair: Senior Project Scientist
- Reporting: Program Scientist (HQ), Project Manager (GSFC)
- Membership: IDS's, instrument leads, Telescope Scientist, ex officio
- Responsibilities
  - Advise on all matters affecting science
    - Requirements and goals
    - Advises SRAB on descope, threats to requirements, requirements changes or requirements waivers
    - I&T questions – on request and presentation from Project Scientist team
    - Policy issues regarding GO, GTO, proprietary time, etc. (advisory to Program Scientist)
    - Coordinate GTO plan
    - Respond to specific questions from Program Scientist or Project Manager
  - Outreach: professional outreach, white papers, conferences, media outreach and public talks
  - Carry out research proposed at selection in 2002 (IDS's, TS)
- Meeting schedule
  - 3x/yr face to face
  - Weekly telecons on rotating list of topics
  - Recent meetings: Apr 3-4, 2018, STScI; July 11-12, UKATC; next Nov 14-15, STScI
  - Larger science community, monthly telecon



# JWST Science Working Group (17 yrs!)

- Chartered in 2002 by HQ, advisory to Program Scientist (E. Smith) and Project Manager (W. Ochs)
- 6 Interdisciplinary Scientists (IDS's) chosen by HQ: H. Hammel, S. Lilly, J. Lunine, M. McCaughrean, M. Stiavelli, R. Windhorst
- Instrument Team Lead/ Science Representative: M. Rieke (NIRCam), G. Rieke and G. Wright (MIRI), Chris Willott (NIRISS science rep), Santiago Arribas (rotating scientist member, NIRSpec)
- Telescope Scientist: M. Mountain
- Ex Officio: J. Mather (Chair), J. Gardner, M. Greenhouse, J. Valenti (replaced Lewis), M. McElwain, M. Niedner, J. Rigby (replaced Sonneborn), P. Ferruit, R. Doyon

# JWST Science Working Group



John Mather,  
Senior Project Scientist,  
Chair



Santiago Arribas,  
NIRSpec Science



Rene Doyon,  
CSA PS



Pierre Ferruit,  
ESA PS



Jonathan Gardner,  
Dep Sr PS



Matt Greenhouse,  
ISIM PS



Heidi Hammel,  
IDS



Simon Lilly,  
IDS



Jonathan Lunine,  
IDS



Mark McCaughrean,  
IDS



Mike McElwain,  
Observatory PS



Matt Mountain,  
Telescope Scientist



Mal Niedner,  
DSPS/Technical



George Rieke,  
MIRI Science Lead



Marcia Rieke,  
NIRCam PI



Jane Rigby,  
Ops PS



Massimo Stiavelli,  
IDS



Jeff Valenti  
SOC



Rogier Windhorst,  
IDS



Chris Willott,  
NIRISS Science



Gillian Wright,  
MIRI European Lead



**JWST SWG Meeting, 11-12 July 2019, UKATC, Higgs Center conference room**

	<b>Time</b>	<b>Who</b>	<b>What</b>
<b>Thu 11 July</b>			
8:30			
8:30	30		Arrive
9:00	15		Welcome, logistics information
9:15	45	Marco Sirianni	ESA archive and ESA JWST archive plans
10:00	30	Eric Smith	HQ update
10:30	30		Break
11:00	30	Jane Rigby	Commissioning and Operations Rehearsals and Exercises
11:30	60	Peter Rumler	Launch campaign, launcher issues and improvements
12:30	45		Lunch
13:15	15	(video)	Arianespace presentation/film
13:30	30	Marco Sirianni	ESA community engagement plan
14:00	30	Pierre-Olivier Lagage	European exo-planet studies with JWST
14:30	30	Javier Alvarez	Mid IR Spectroscopy of high redshift galaxies in GTO
15:00	30		Break
15:30	60	Jeff Valenti	S&OC update and Cycle 1 preparations
16:30	30	Giovanna Giardino	Cosmic Ray Impact Study
17:00	60		Executive Session Discussion
18:00			
18:00		Adjourn	
18:00			

**Fri 12 July**

8:30			
8:30	30		Arrive
9:00	30		ESA Sky
9:30	60	Chuck Bowers	Observatory Update
10:30	30	Kate Isaak	Mission talk - CHEOPS
11:00	30		Break
11:30	30	Günther Hasinger (video)	ESA Science Program
12:00	30	Pierre Ferruit	NIRSpec Data Simulations based on MUSE
12:30	45		Lunch
13:15	30	Chris Evans	ELT
13:45	15		
14:00	30	Timo Prusti (video)	Mission talk - GAIA
14:30	30	Eric Smith	Publications and Press Releases
15:00	30		Executive Session Discussion
15:30			
15:30		Adjourn	



# Current Observatory Activities

(McElwain, Niedner, Bowers, Kimble, Smith)



- **OTIS** = Optical Telescope Element + Integrated Science Instrument Module
  - Team analyzed JSC test results, helped develop repair strategy for plastic sheets (frill and closeouts) that were improperly tensioned, risking optical instability in flight
  - OTIS is warm until after launch – few functional tests possible
- Monitoring contamination results from NGAS and GSFC team
- Advised re recovery from direct moisture path from hinge to secondary mirror, and from outgassing primary mirror structure to secondary
- Collaborated on anomalous modeled wavefront errors for extreme thermal slews (extreme pointing cases), identifying trouble with the covers (“epaulets”) over the sunshade spreader bars



# Operations Planning



- Rigby and Neff to ensure readiness for launch, commissioning, and science operations
- Reviewed and contributed content to the JWST documentation (JDox) and the calls for proposals (now live at <https://jwst-docs.stsci.edu/>)
- Participating in rehearsals
- Planning commissioning activities to measure stray light background levels, thermal stability, and any ice contamination
- Working with STScI to complete the pipeline and data analysis tools given the changing landscape of astronomical software
- Working with STScI on plans for user training, leading up to the Cycle 1 proposal deadline



## Commissioning 1/2



- Project Science has multiple roles in commissioning:
  - Provide scientific advice to the project
  - Weigh in on key decisions
  - Help resolve anomalies and other performance issues
  - Provide science oversight during launch, deployments, and commissioning
  - Analyze & trend data
  - Track science performance
  - Communicate with stakeholders (including SWG and JSTUC)
  - Enforce compliance with data policies during commissioning
  - Support rehearsals
- PS & STScI have developed a plan to monitor and characterize science performance during commissioning (led by Kimble and Rigby for PS team, and S. Friedman at STScI.) Stakeholders include instrument development teams, telescopes team, and systems engineering.





## Commissioning 2/2



- Commissioning data policies:
  - Commissioning data will be embargoed until the end of the commissioning period, as per the 2010 HQ JWST policy document.
  - At the end of commissioning, the commissioning data go public in the archive.
  - Project Science will communicate the detailed policies to the commissioning team, and will enforce the embargo.
  - Spelled out in the JWST Science Data Management Plan (Rigby, in prep.)
    - We can halt papers submitted during the embargo, by working with arXiv and the journals.
    - Social media will be a challenge.
  - Some commissioning data merit publication. Commissioning team members may have a head start (0--6 weeks for SI commissioning data). An outstanding question: should there be a “cooling off period” for team members, in the range 0–30 days? What’s fair and enforceable?



## **SRAB (Science Requirements Analysis Board)**

- Created May 2008 by Mather
- Chaired by DPS/T (Niedner) on behalf of Senior Project Scientist
- Board consists of the JWST Project Science Team
- Receives alerts on possible failures to meet scientific requirements
- Analyzes consequences, considers alternatives, solicits detailed feedback from the SWG
- Considered so far: wavefront sensing requirements, NIRCам wavefront accuracy, pointing stability requirements, MIRI sensitivity requirement, revisions to Science Requirements Document as result of TF conversion to NIRISS, encircled energy stability requirement, field of regard, WF stability
- Many other topics remained as engineering issues with Project commitment to meet requirements: e/g: stray light and jitter, contamination



## Communications

- Amber Straughn as Communications Scientist, with Laura Betz of PAO (HQ PAO is overall in charge)
- Media coverage very positive
- Communications Implementation Plan up-to-launch now in work



## Summary and Conclusions – Still good!

- JWST science teams deeply and actively engaged in technical efforts worldwide
- All engineering teams have assigned scientific contacts
- Scientific performance codified in the Science Requirements Document (2003, latest revisions in July 2012) and published in Space Science Reviews (2006) still expected almost everywhere.
  - Image quality as expected
  - Stray light meets spec, thanks to serious work by many many people
  - Wavefront stability meets spec, thanks to JSC test, analyses, and repairs
  - Pointing stability supports image quality
    - Non-sidereal tracking enabled for non-linear track rates sufficient for solar system objects at or outside the orbit of Mars
  - Instrument payload (ISIM) compliant with all baseline science performance requirements, including sensitivity
  - Solar System observable from Mars outwards