



20 years

Crew Autonomy through Self-Scheduling: Operational Characterization

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Investigators' Workshop





Team Members – just in 2024

- Co-Investigators:

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- John Bresina, Ph.D. (NASA Ames)

- Research Assistants

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- Support Staff

- Ivy Deliz (ASRC/NASA Ames)
- Anthony Robertson (SJSU/NASA Ames)
- Bob Kanefsky



What is Self-Scheduling?

- **Self-scheduling** is the ability for an astronaut to autonomously manipulate their own spaceflight schedule.
- Self-scheduling as a proxy for crew autonomy is a new concept of operations that our team has been exploring for years.





Self-Scheduling in HERA Campaign 6 & 7

Required self-
scheduling by HERA
analog crew

Spontaneous self-
scheduling by HERA
analog crew



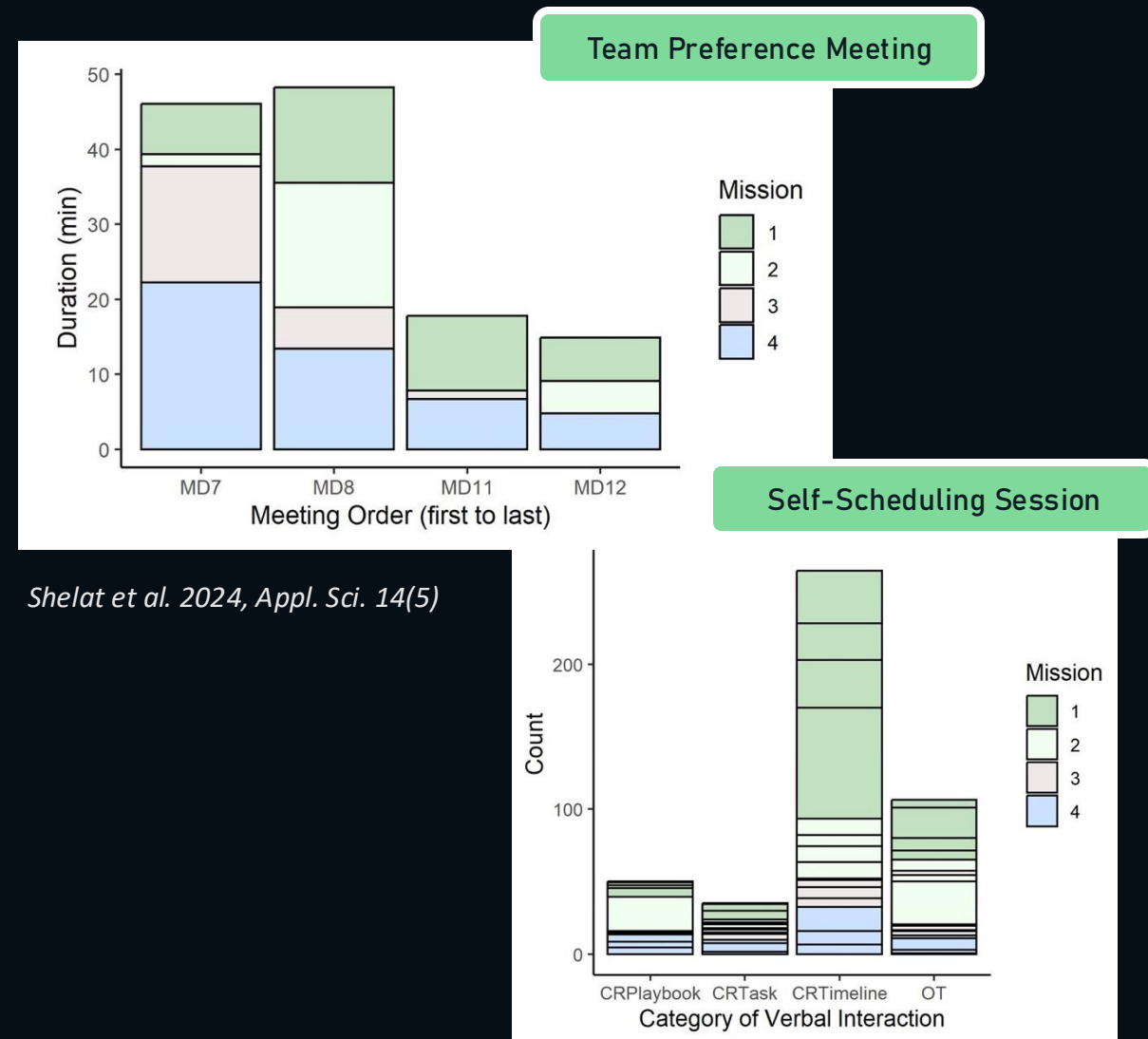
Self-Scheduling in HERA Campaign 6 & 7

Analog crew given a list of activities they had to schedule for everyone on a particular day.

Analog crew presented schedule with flexible activities that they could choose to reschedule.

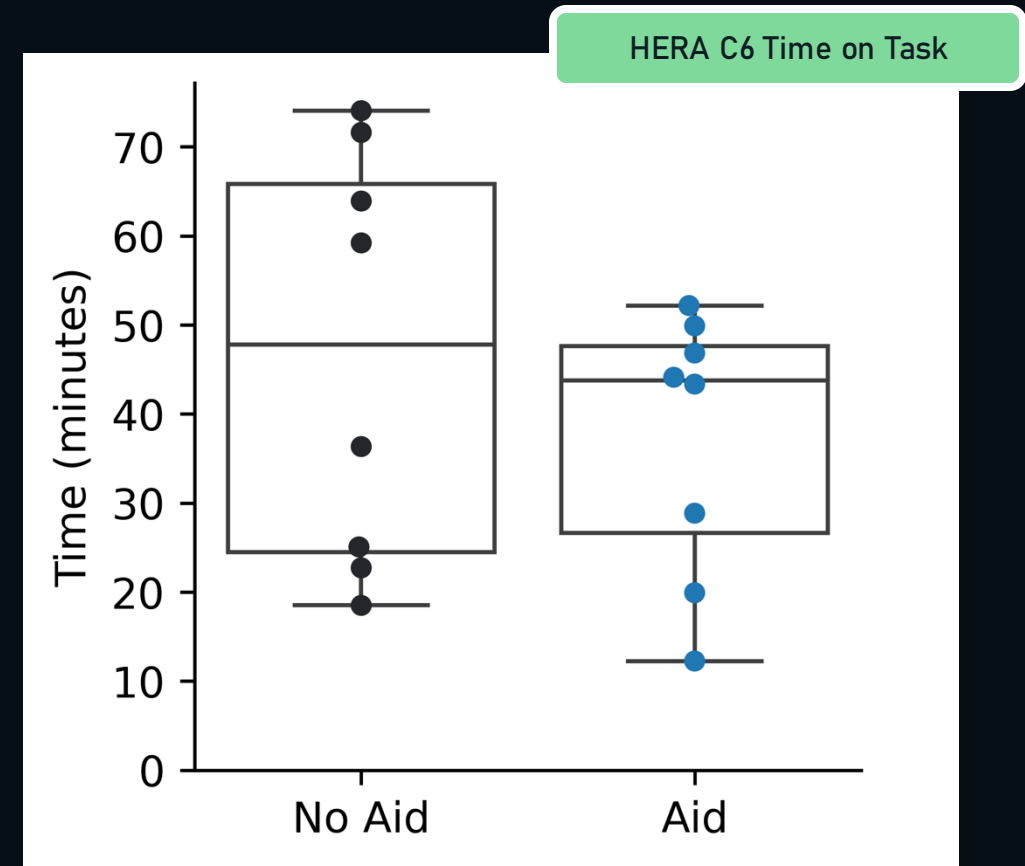
Planning Time

- Based on previous analog experiences, we requested crew have discussion time to elaborate on day and team preferences.
- In HERA C6, we allotted 30 min x 4 times.
 - Crew did not necessarily develop ways of tracking preferences.
- *Recommendation:* weekly or biweekly 15-20 min team preference check-ins suffice.



Scheduling Time

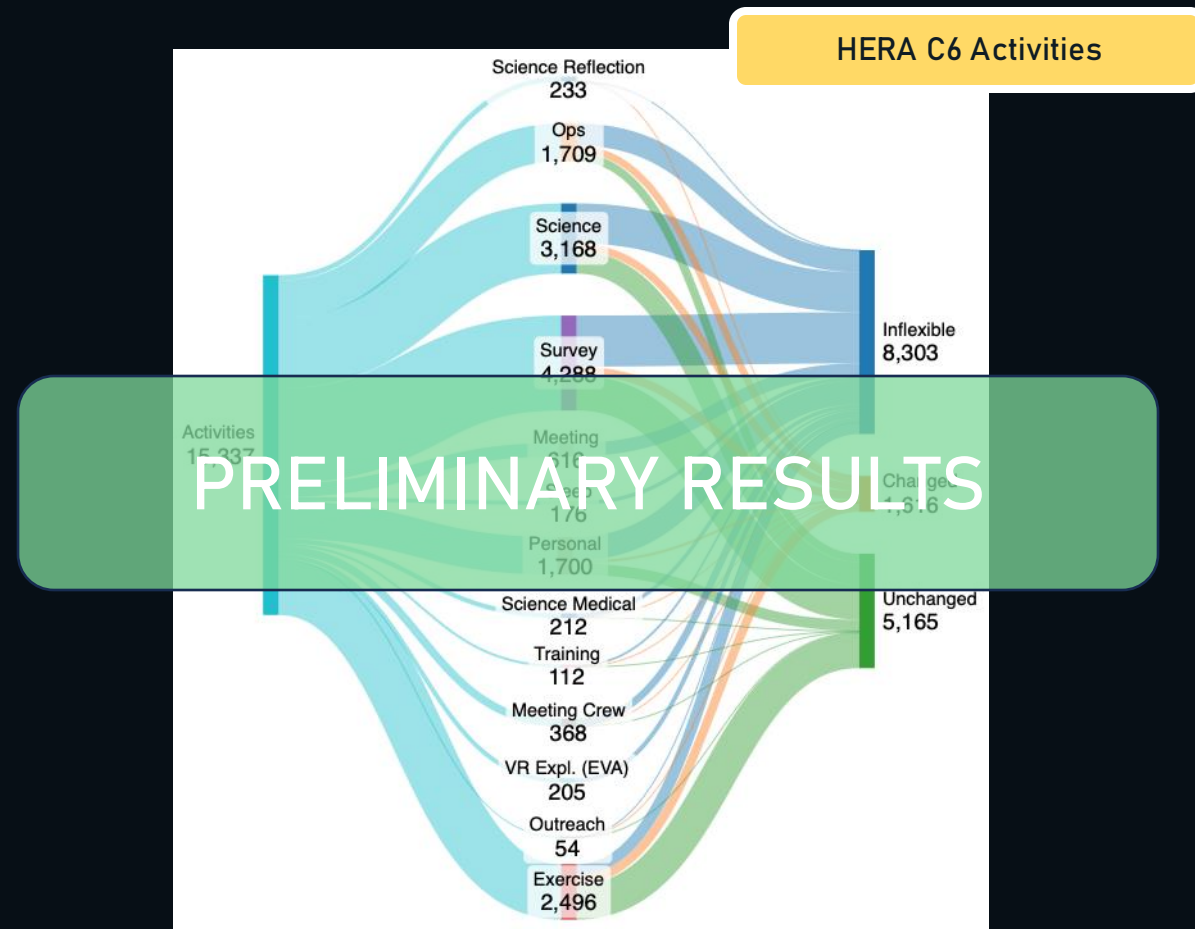
- Based on previous analog experiences and complexity of activities' constraints, we requested each crew be given 75 min to schedule one day for team.
- *Recommendation* *: Given countermeasure aids, a single crew can create a complex schedules in under an hour.
 - *Waiting for complimentary HERA C7 data.



Karasinski, Shelat, & Marquez 2025, AIAA SciTech

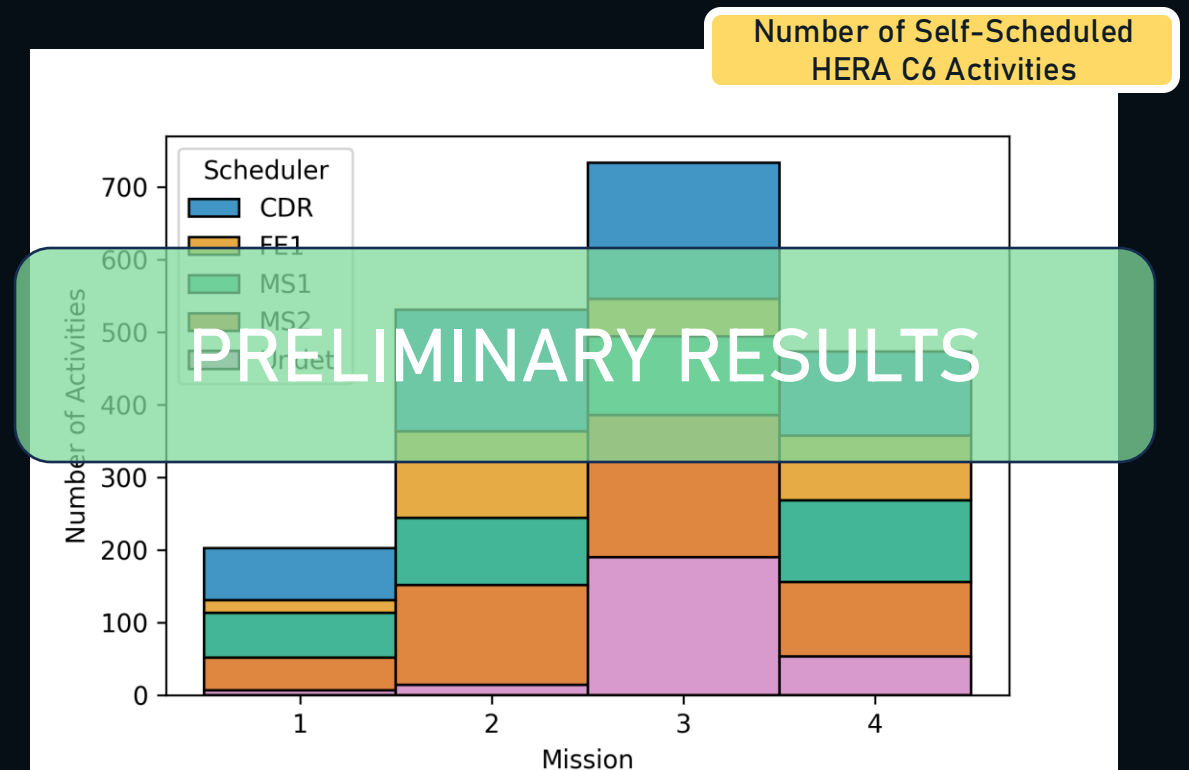
Scheduling Time

- While we do not have how much time crew spent on spontaneous self-scheduling, we see that crew **choose** to reschedule **1 out of 4** flexible activities.
- Barrier to entry for self-scheduling is relatively low.



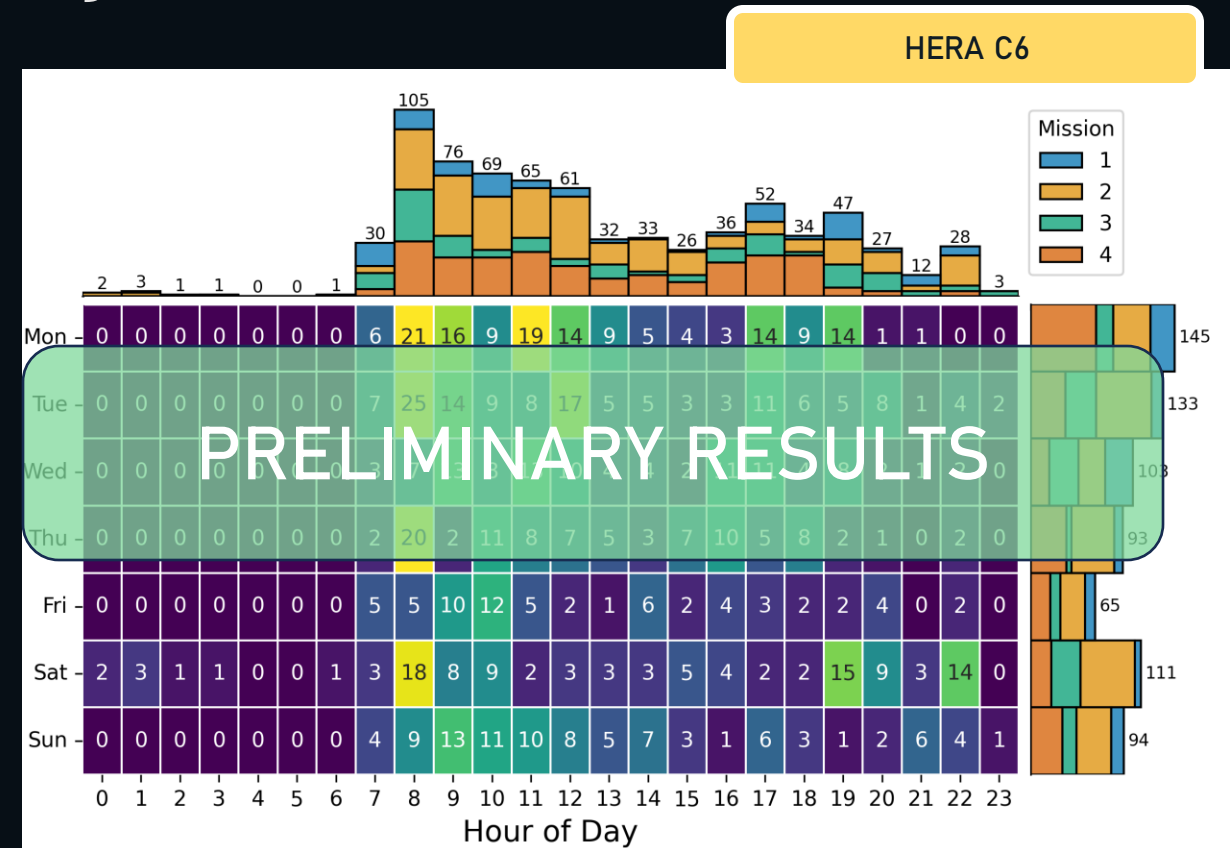
● Frequency by Mission

- Self-scheduling frequency across missions varies.
- Self-scheduling frequency across crew roles varies.
- No clear indicator **yet** of factors that might suggest reason behind variability.
 - Not significant correlations with predisposition to autonomy, IPIP personality traits, or age.



Frequency: Time of day / week

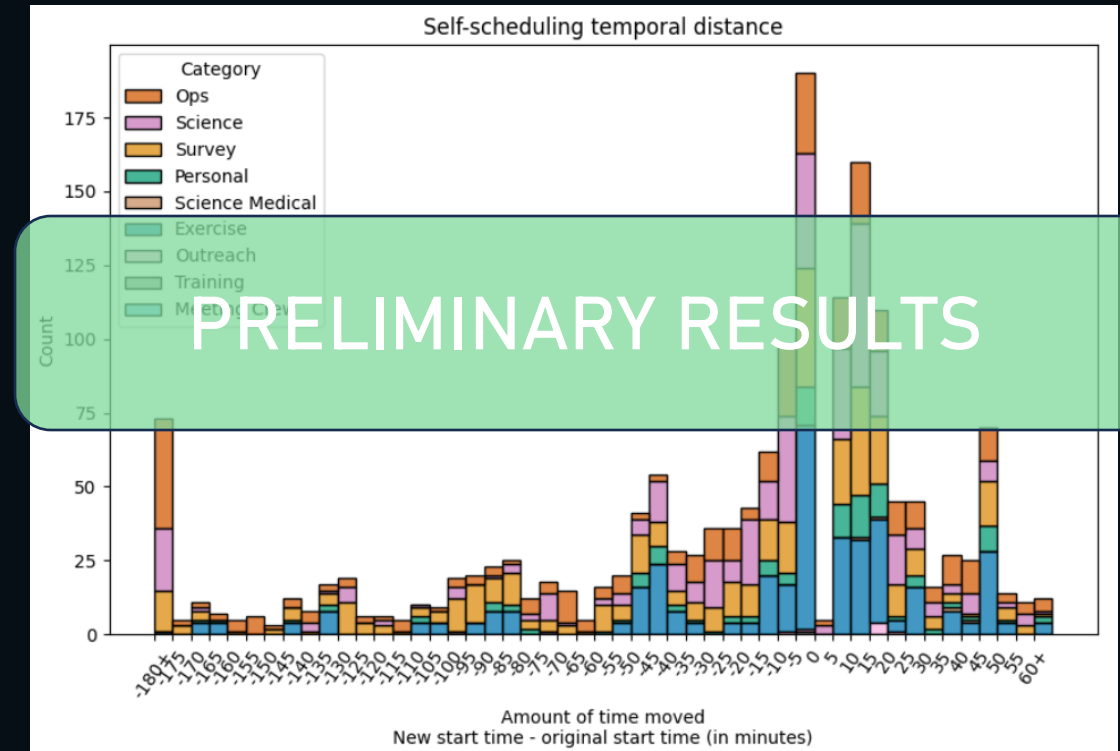
- Crew most likely self-scheduled early in the week.
- Crew most likely self-schedule early in the day.
- Crew also self-scheduled as soon as schedule was available for the following week (Saturday).



Characterization of Self-Scheduling Changes

- Evaluating just the start time changes:
 - About **half** of the activities' start times were rescheduled **± 30 min.**
 - About a **third** of the activities' start times were rescheduled **± 10 min.**
 - About a **sixth** of the activities' start times were rescheduled **± 5 min.**
- Even **small changes** to the schedule are considered **valuable** enough to spend self-scheduling time on.

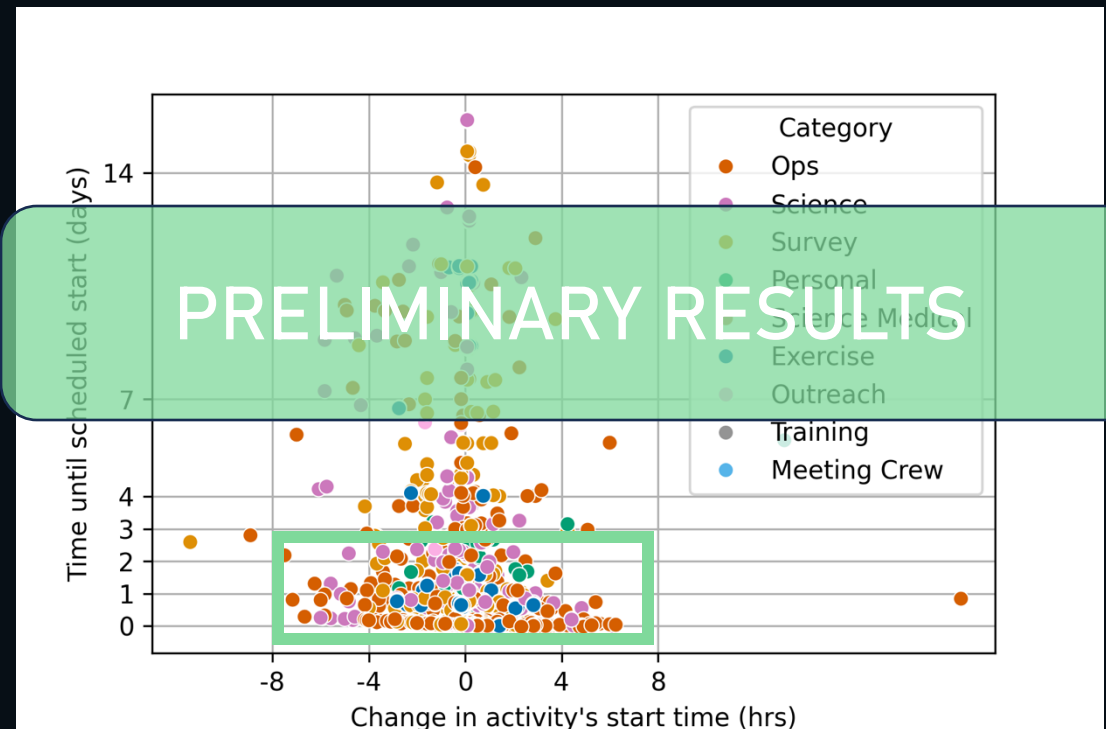
HERA C6



Characterization of Self-Scheduling Changes

- Evaluating just the start time changes **and** the time between the self-scheduling event's start and when the activity's scheduled start time:
 - X-Axis: Change in an activity's start time.
 - Positive values indicate an activity was rescheduled to occur later
 - Negative values indicate they were rescheduled to occur earlier
 - Y-Axis: Time between the self-scheduling event's start and when the activity's scheduled start time.
 - Positive values indicate an **activity was schedule for the future**
 - Negative values indicate **activity already occurred**

HERA C6 activity changes

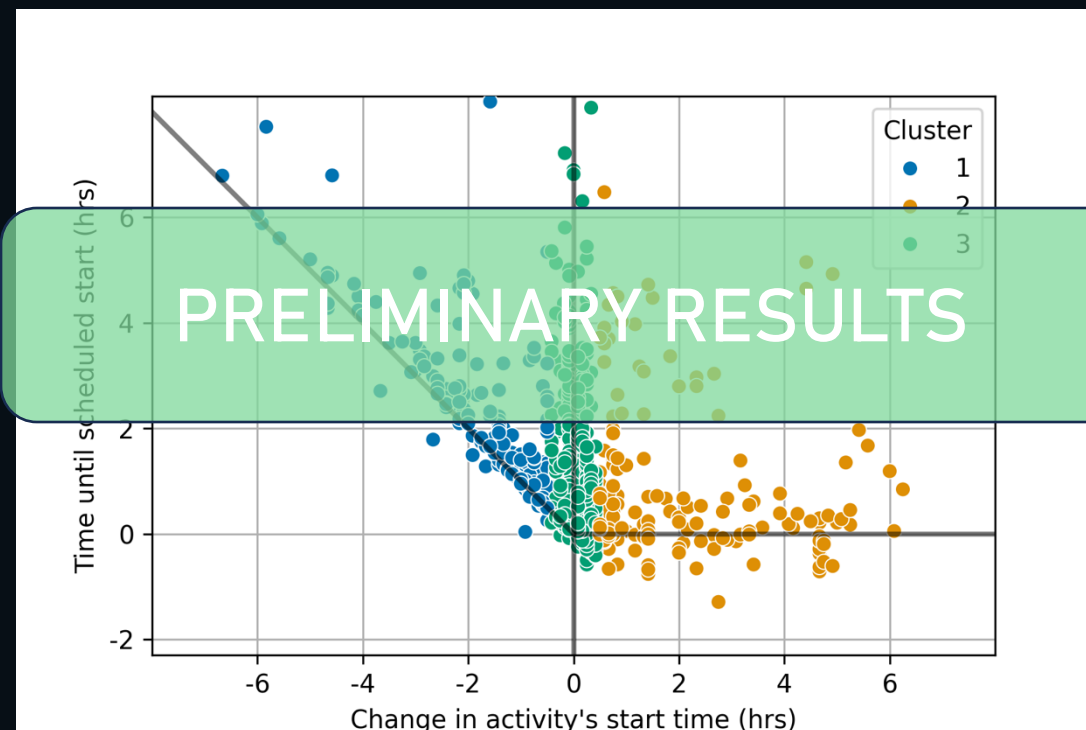


See upcoming IEEE Aero publication (Abbott et al, 2025)

Characterization of Self-Scheduling Changes

- Three behaviors emerge:
 - Group 1 (Blue/Left): Activities that were scheduled for the future and moved to “now”.
 - Group 2 (Green/Middle): Activities that were scheduled for the future and had their start time slightly adjusted.
 - Group 3 (Orange/Right): Activities that were scheduled for now but moved to start later.
- Crew are using self-scheduling to **actively** and **accurately reflect current execution** as well as **projecting adjustments** to schedule **based on execution**.

HERA C6 activity changes
(zoom)



See upcoming IEEE Aero publication (Abbott et al, 2025)



Future Work

- We just completed data collection in HERA C7.
 - Similar experimental design set up except there are additional planned self-scheduling days.
 - Data set for both campaigns will be merged.
- Analysis for evaluating countermeasure aids both in HERA and controlled lab experiment.
- Additional support provided through data sharing agreements with:
 - Kathy Mosier (SFSU)
 - Ute Fischer (Georgia Tech)
 - Suzanne Bell (NASA JSC)



Questions?

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Types of Activities

Category	Total # activities	# Flexible activities	% Flexible activities	# Activities changed	% Flexible activities changed
All Categories	15,337	6,802	44.4%	1,616	23.8%
Exercise	2,496	1,984	79.5%	404	20.4%
Outreach	54	34	62.9%	10	29.4%
Survey	4,288	1,984	46.3%	393	19.8%
Science	3,168	1,356	42.8%	351	25.9%
Ops	1,709	712	41.7%	329	46.2%
Personal	1,700	624	36.7%	123	19.7%
Science Medical	212	32	15.1%	3	9.4%
Training	112	14	12.5%	1	7.1%
Meeting Crew	368	40	10.9%	1	2.5%
Meeting	616	16	2.6%	0	0%
VR Exploration (EVA)	205	5	2.4%	0	0%
Science Reflection	233	1	0.4%	1	100%
Sleep	176	-	-	-	-