Integrating Your Research on ISS: An Overview of Complement Planning Past, Present and Future

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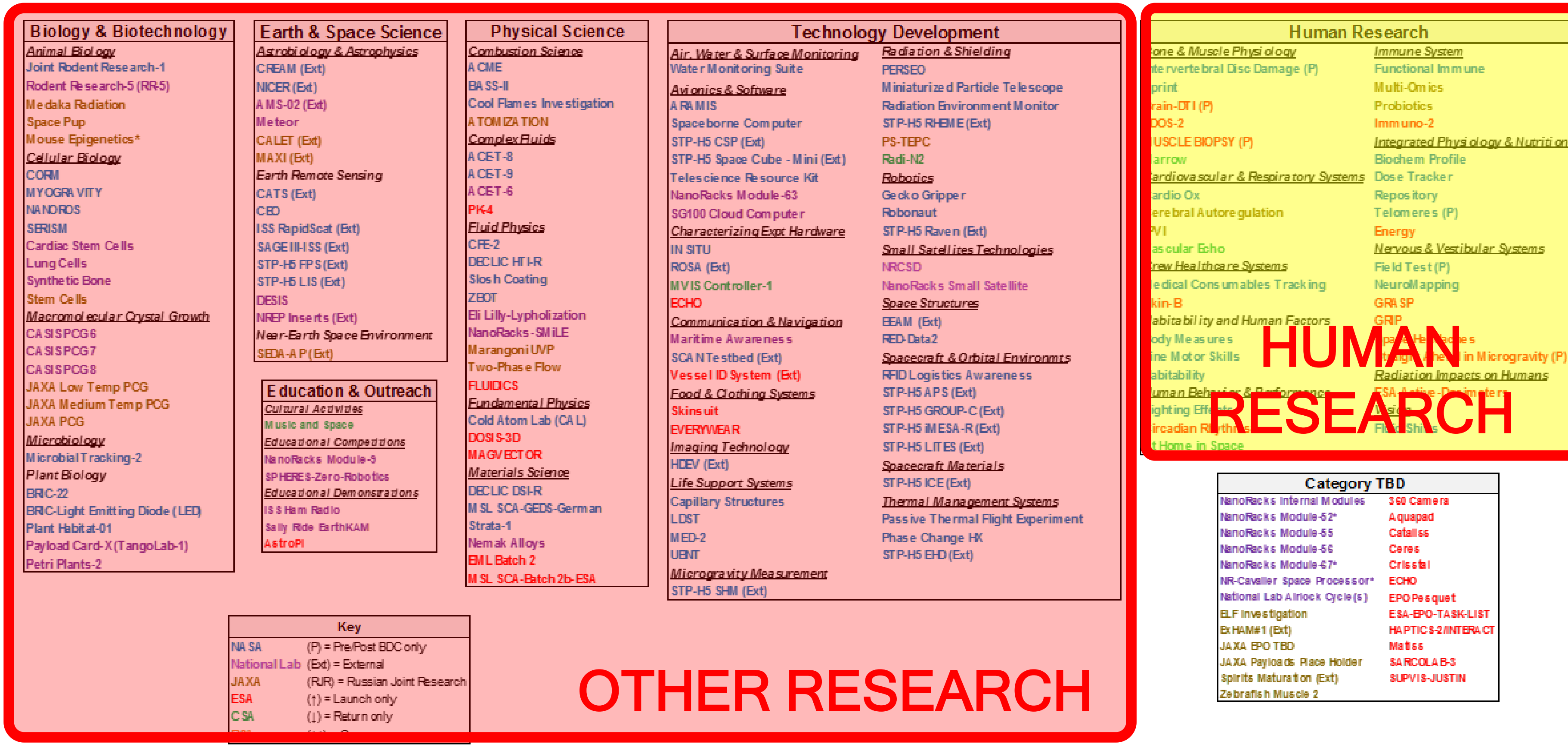
Session goals

- Maximize your science within limited resources available
  - How your research fits into a flight “complement”
  - Introduce Standard Measures cross-cutting project
  - Leverage required medical testing results
  - Processes to enhance data sharing

Flight research complement

- Unlike most ISS research, human research is voluntary

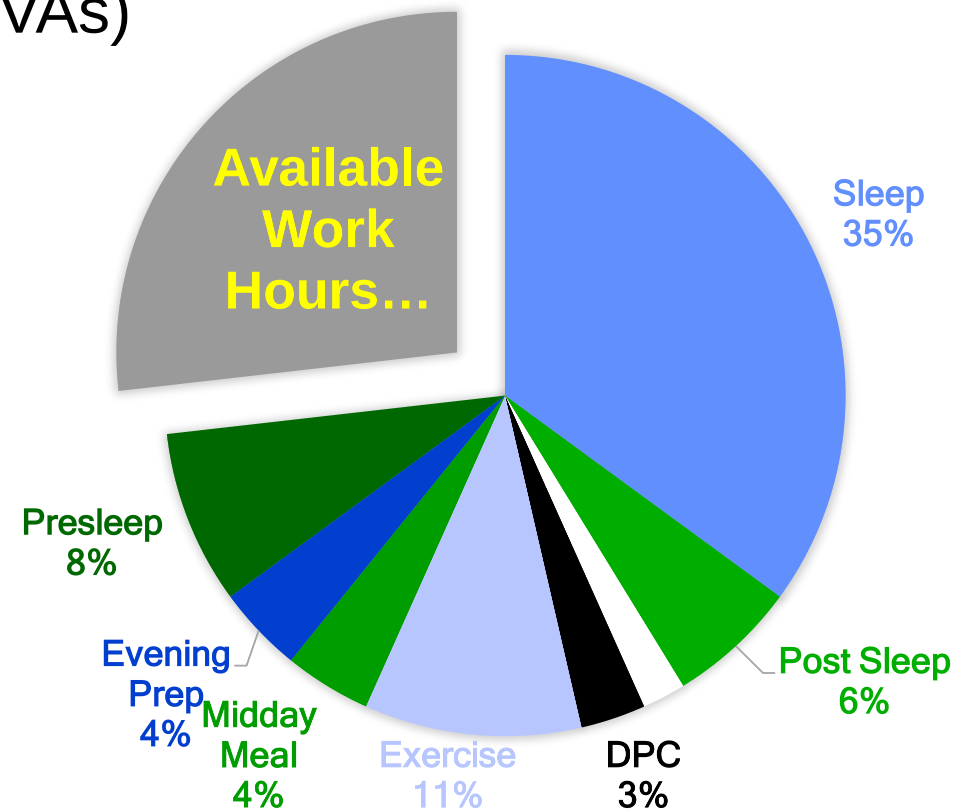


Inflight crew time

- Inflight time limits what fits in research complements
  - Crew work days 6.5 hrs with time off on weekends
  - More limited during first 2 weeks, and during other ops (e.g., vehicle docking, EVAs)

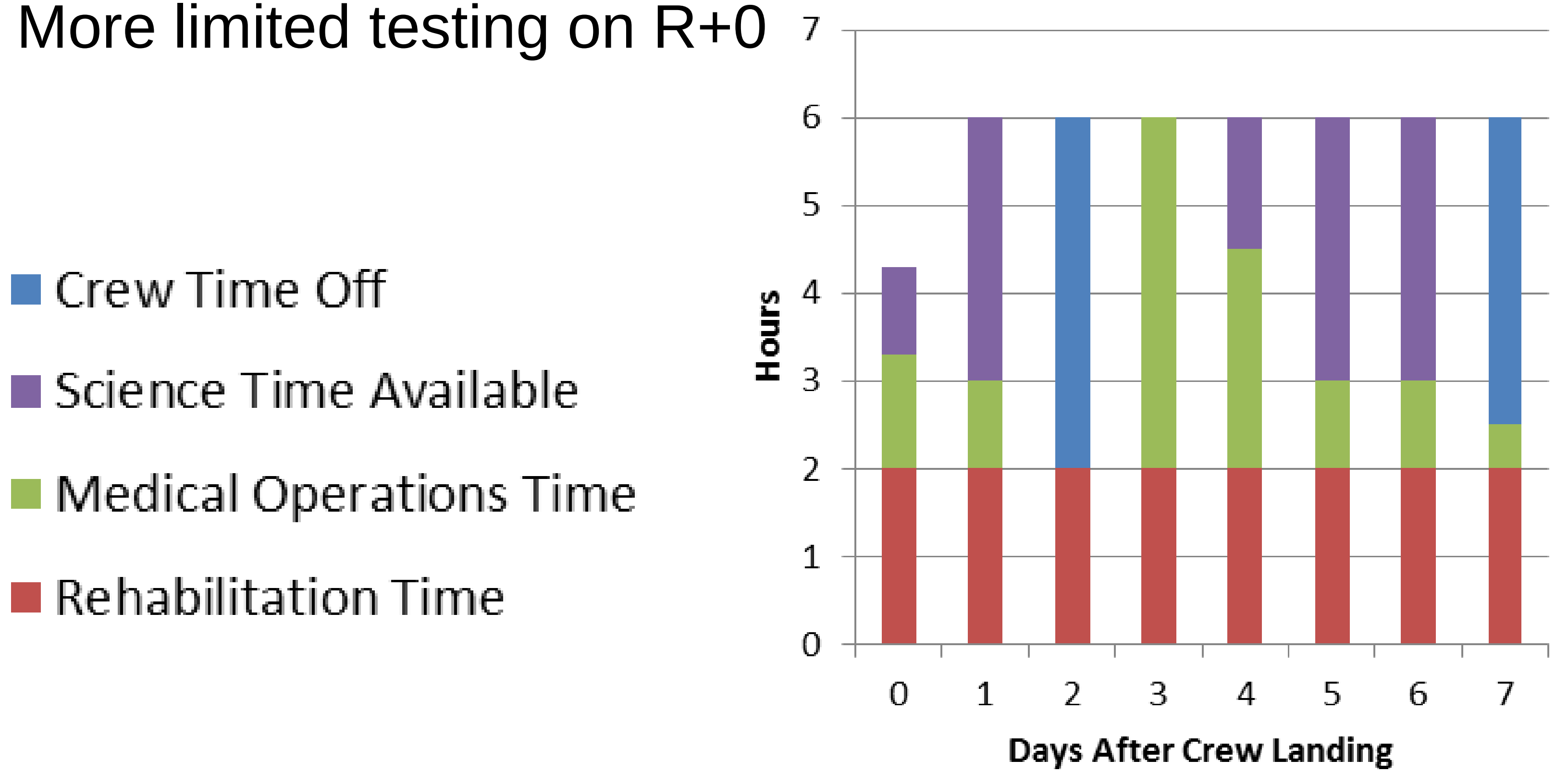
"Available Work Hours" include:

- Traffic Operations
- Medical Operations
- Onboard Training
- Routine Operations (including stowage management)
- Public Affairs Office (PAO)
- Maintenance, Resupply/Outfitting
- EVA
- **Utilization Operations = RESEARCH**



Post-flight crew time

- Postflight time limits what fits in research complements
  - Crew work day limited to 4 hours in first week for all science and medical activities
  - More limited testing on R+0



Pre-flight crew time

- Pre-flight time limits have not typically been limiting factors in complement planning, but have been more recently with accelerated crew training schedules
- For Soyuz flights, late preflight BDC is very limited since the crew spends the last ~6 weeks in Russia

2018																	
July					August				September				October				
2	9	16	23	30	6	13	20	27	3	10	17	24	1	8	15	22	29
R	R	R	R	R	R	R	R	R	R	R	R	R	R	L			
A	J	A	V	A	A/V	V	R	R	R	R	R	R	R	L			

- training in U.S.
- training in Russia
- training in Europe
- Launch Support
- training in Japan
- training in Canada
- Home week

2018																										
July					August				September				October					November				December				
2	9	16	23	30	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	3	10	17	24	31
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V	V	A	A	A	R	R	R	A	A	J	V	A	A	E	A	A	A	V	R	R	R	R	R	L		

2018																											2019																
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Blood volume limits

- Blood volume requirements limit research complements
- Inflight: 450 ml total / 6 mo mission
  - 150 ml per rolling 30 day window
  - 100 ml limit per last 30 days
- Post-flight: 300 ml total blood between R+1 & R+45
  - 120ml total on R+0 includes medical testing
  - ~60 ml available for research
- Establishing overlap between other research and medical operations is critical!

Experiment interactions

- Conflicts and constraints with competing human research and medical operations limit research complements
- Balancing flexibility with experimental control in developing constraints (“Goldilocks” approach)
- Aligning time points for common sampling (e.g., blood draws) will maximize the number of complement scenarios that a study can fit into
- See Standard Measures and MedB presentations next!

Before the complement planning

- ISSMP assigns an Experiment Support Team (EST) to work with the PI from definition to completion
- Feasibility assessments are conducted prior to Select for Flight, and will identify opportunities to leverage resources
- Experiment Documents (ED) detail the official requirements for implementation, and must be kept in synch with Institutional Review Board (IRB) approved protocols as changes are implemented
- The EDs serve as a basis for building flight research complement scenarios with international partners when determining what experiments fit together

Preflight complement planning

L-18 months

- Begin science complement planning
- Identify Candidate Experiments
- Clarify IRB submittal deadlines

L-12 months

- Conduct ICB
- Await crew input
- Discuss with Partners
- Return to crew with consent forms
- Collect candidates for Delta ICB

L-6 months

- Begin BDC
- Submit complement updates to IRB
- Conduct Delta ICB

Launch

- Kick off post-flight planning discussions
- Conduct off-nom inflight consent briefings for critical protocol updates as necessary

Return

Changes with commercial flight

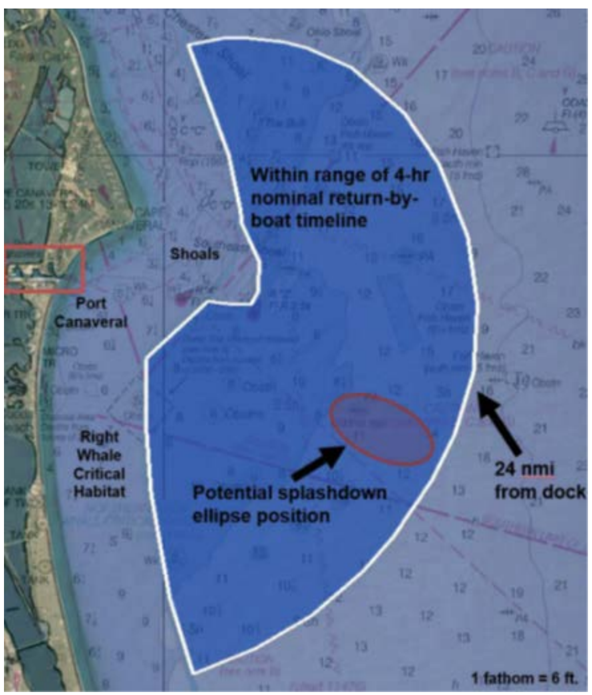
- Following ISS assembly phase, we have relied on Soyuz for launch and return of crewmembers
- Except for field-type activities and limited bio-sampling, direct return of crewmembers to US allows for postflight data collection in the US around 24+ hrs post-landing
- Commercial Boeing and SpaceX missions will launch from KSC and also plan for direct return of crewmembers to JSC

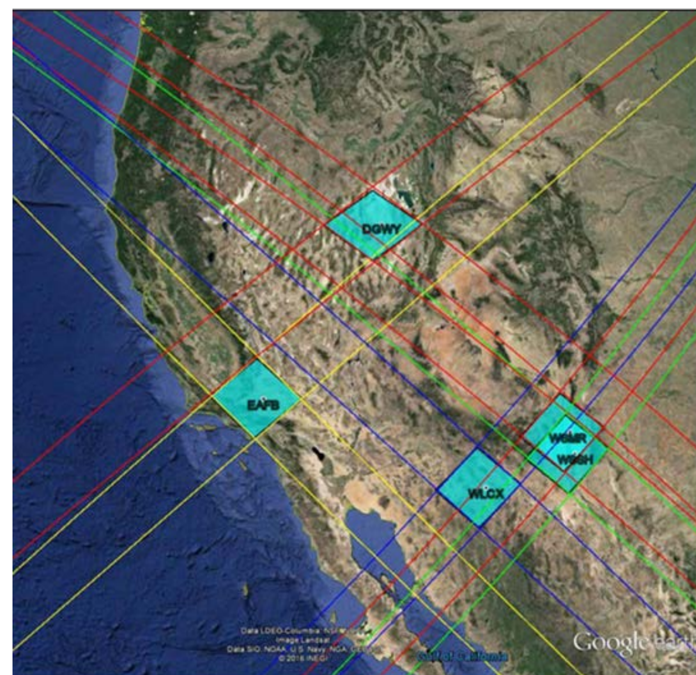
Changes with commercial flight

- Preflight USCV crew quarantine will begin at L-14 days
- The crew will be transported to KSC no later than L-7 days
- Similar to current Soyuz, rendezvous and docking will typically occur on flight day 1
- Un-crewed demo flights are planned for 2019, followed by crewed demo flights that do not currently include HRP studies
- It has not yet been determined whether the first US commercial vehicle will be SpaceX or Boeing

Commercial post-flight return

- Crewed SpaceX Dragon missions will nominally land in the water off the coast of Cape Canaveral, Florida (alternate water landing sites include Gulf of Mexico)
- Crewed Boeing CST-100 missions will nominally land at one of five designated landing sites in the western US





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