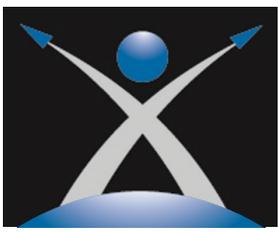


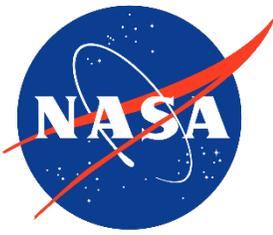
NASA Quarantine Program

Rob Mulcahy, MD, MPH

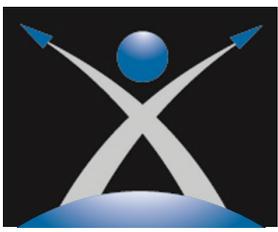
Lead Surgeon, NASA Health Stabilization Program



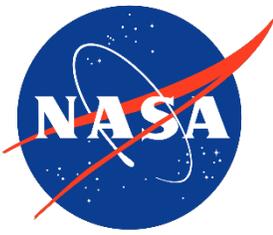
Overview



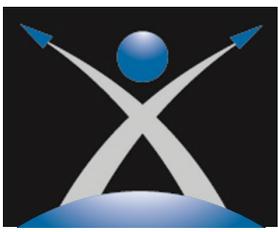
- Background
- History
- NASA Quarantine Program
- COVID Pandemic
- Russian Quarantine Program
- Questions



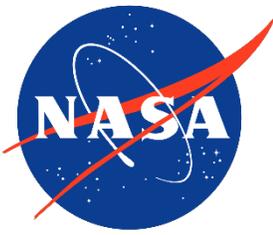
Background



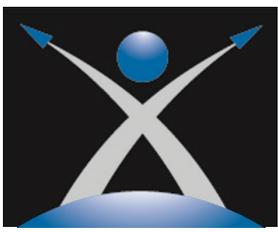
- Infections can adversely affect launch preparations or early on-orbit activities.
- Terrestrially, minor conditions such as URTIs or gastroenteritis may sideline an individual for a few days.
- During a space mission, such conditions can be more impactful. Imagine:
 - An astronaut is unable to equalize his or her ears due to a URTI and therefore cannot perform an emergency spacewalk.
 - Infection-related fatigue or malaise reduces an astronaut's productivity on exploration, research, or maintenance tasks in an environment where every moment is costly.



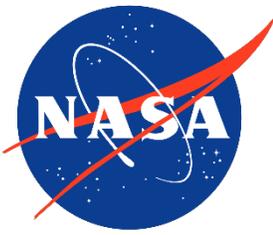
History



- Mercury
 - Short mission durations made infectious disease manifestation during a flight unlikely.
 - No organized quarantine.
- Gemini
 - Longer mission durations presented higher risk of infection emerging during the mission.
 - High ops tempo precluded development of a strict quarantine program.

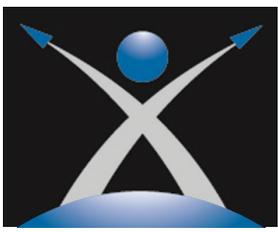


History

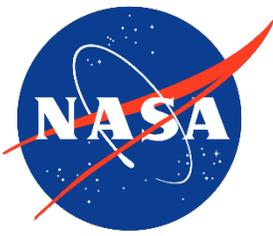


- Apollo
 - Several pre- and in-flight infections affected the early Apollo missions.
 - Pre-launch quarantine strictly implemented from Apollo 14.
 - Due to back contamination concerns, post-landing quarantine enforced for Apollo 11, 12, and 14 before being retired.

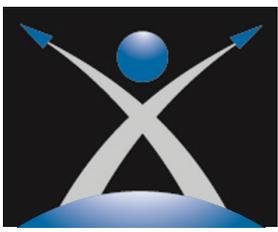




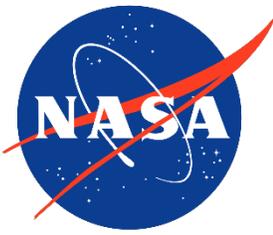
History



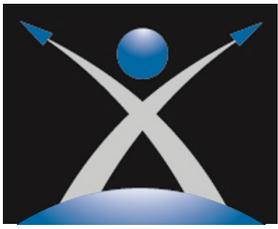
Mission	Illness	Crew Involved
Apollo 7	Upper respiratory infection	3
Apollo 8	Viral gastroenteritis	3
Apollo 9	Upper respiratory infection	3
Apollo 10	Upper respiratory infection	2
Apollo 12	Skin infection	2
Apollo 13	Rubella infection	1
Apollo 14	<- HSP Implemented ->	
Apollo 17	Skin infection	1
Skylab 3	Skin infection	2
Skylab 4	Skin infection	2
STS-36	Upper respiratory infection	1; Launch delay



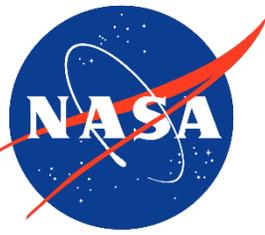
NASA Quarantine Program

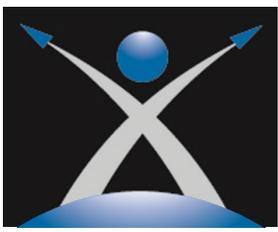


- Health Stabilization Program (HSP) = pre-launch quarantine
- Evolved over time to meet program needs and latest medical knowledge
- Key pillars remained remarkably stable:
 - Training
 - Immunizations
 - Medical screening and surveillance
 - Quarantine

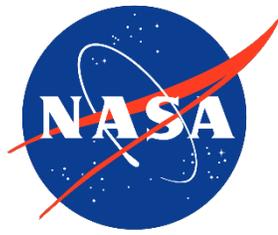


HSP

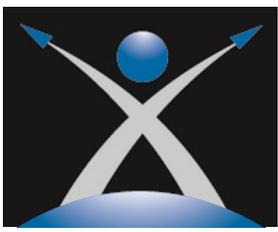




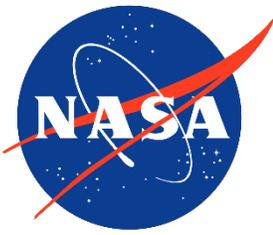
HSP Evolution



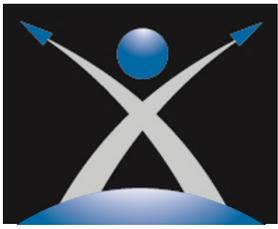
	Apollo	Skylab	Shuttle	ISS	Current
Training			Yes	Yes	Yes
Immunizations	Yes for Astros & Family	Yes for Astros & Family	Yes for Astros; Flu for all	Yes	Yes
Medical Evaluations	Yes	Yes	Yes	Yes	Yes
Surveillance	Yes	Yes	Yes	Yes	Yes
Quarantine	21 days	21 days	7 days	14 days	14 days



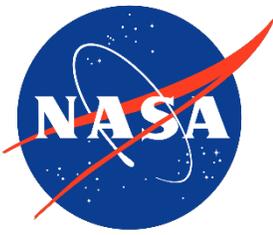
Contemporary HSP



- Quarantine begins 14 days prior to launch
- Houston-based portion can occur at home
- “HSP participants” = personnel in quarantine
- Precautions based upon risk posed by role
 - Group A (close crew contact without masking)
Examples: crew, families, quarantine facility residents
 - Group B+ (close crew contact with one-sided masking)
Examples: closeout crew, suit room personnel
 - Group B (close crew contact with universal masking)
Examples: food service, medical teams
 - Group C (6 ft social distance + universal masking)
Examples: quarantine facility admin personnel, housekeeping, pad workers



Immunizations and Medical Screening/Surveillance



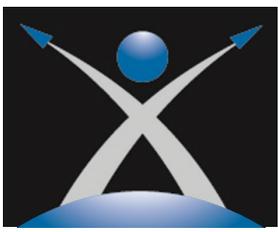
- Immunizations

- COVID
- influenza
- measles/mumps/rubella
- diphtheria/pertussis
- polio
- varicella (chicken pox)
- hepatitis A and B

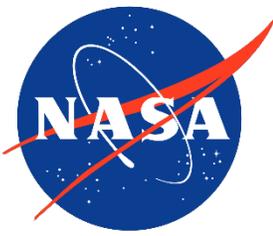
- Medical screening/surveillance

- Brief electronic or in-person health screening between L-21 and L-14 days
- Daily electronic surveys from L-14 days

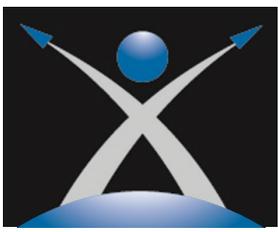




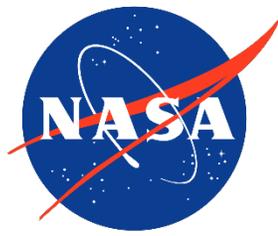
Quarantine Measures for Group A



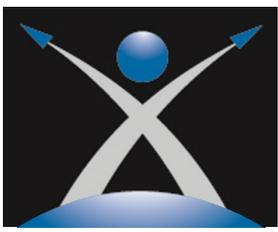
- Treat your home as though it is a quarantine facility.
- Use only delivery or contactless pick-up for food, groceries, or supplies.
- Do not go out to the store or other locations, even while wearing a mask.
- Cohabitants should not attend in-person work, school, or other activities.
- Social distancing.
- Hand hygiene.



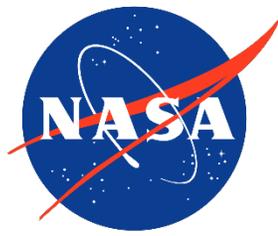
HSP Summary



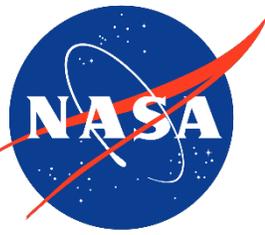
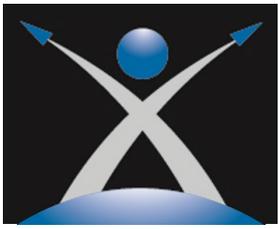
REQUIREMENT	GROUP A	GROUP B+	GROUP B	GROUP C
Education	Y	Y	Y	Y
Pre-Quarantine Medical Screening (Electronic or In-Person)	Y	Y	Y	Y
Periodic Medical Screening (Electronic or In-Person)	Y (Daily)	Y (Daily)	Y (Daily)	Y (Daily)
Immunizations	Y (Exception unlikely)	Y (Exception case-by-case)	Y (Exception case-by-case)	Y (Limited; Exception case-by-case)
Sequestered Housing	Y	N	N	N
Masking	N (Except when in close contact with personnel outside of Group A)	Y	Y	Y
Social Distancing	N	N	N	Y
Quarantine Entry After L-14 days Permitted	N	N	Y (With Observation Period)	Y (Without Observation Period)



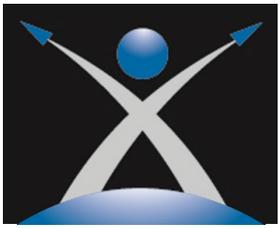
HSP Timeline Highlights



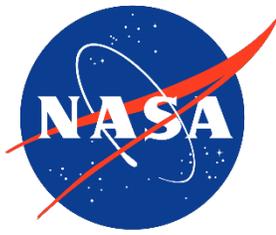
Date	Activity
L-28	Immunization completion
L-21	Training completion
L-21	Medical examinations (virtual or in-person) begin (until L-14)
L-14	Quarantine begins
L-14	e-Check-ins begin
~L-7	Crew and other key personnel travel to KSC via private aircraft
L-0	Quarantine ends after launch

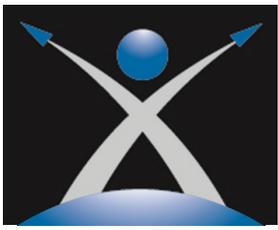


HSP in Action

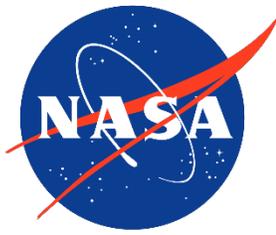


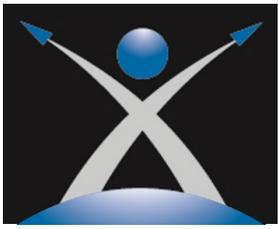
SpaceX Demo-2 Dry Dress Walkout



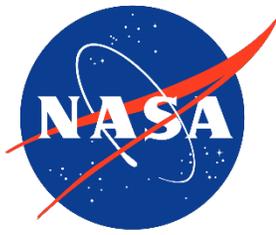


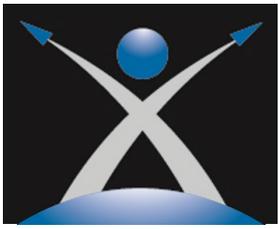
SpaceX Demo-2 Walkout



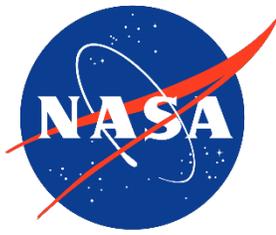


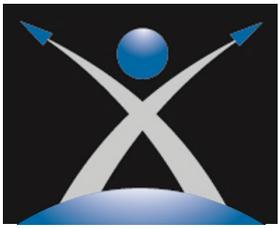
KSC Astronaut Crew Quarters Glass Window



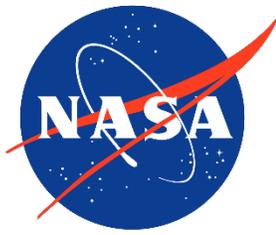


SpaceX Crew-1



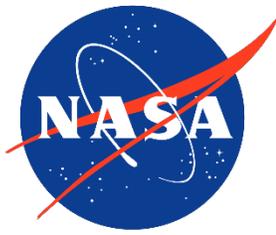


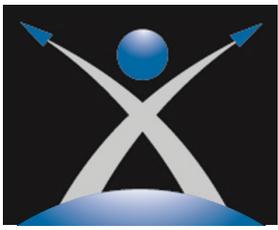
SpaceX Crew-1



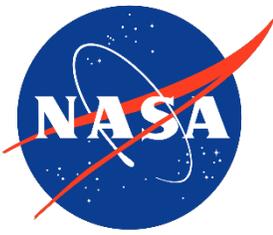


SpaceX Demo-2

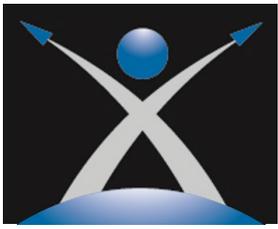




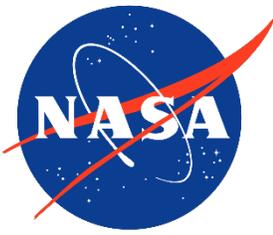
COVID Pandemic: Pre-Launch



- Standard HSP is robust
- However, in response to the pandemic, several changes implemented:
 - COVID training added in early pandemic
 - COVID testing performed
 - COVID vaccination required once available
 - Surveillance via daily symptom surveys
 - Late entry into quarantine prohibited
 - Temperature screening used in early pandemic
 - Surgical masks replaced with N95s
- Tapered with phases of pandemic

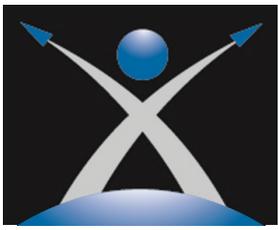


COVID Pandemic: Post-Flight

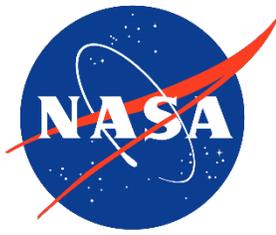


- No post-flight quarantine before COVID
- Post-Flight COVID Countermeasures (PFCC) during pandemic
- Program included:
 - COVID testing
 - COVID vaccination
 - Daily symptom surveys
 - Varying degrees of quarantine
 - PPE
- Tapered with phases of pandemic



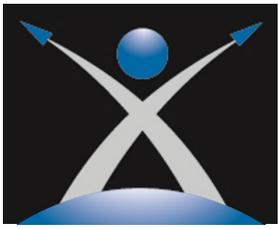


Russian Quarantine Program



- Similar in design and scope to NASA HSP (all ISS partners follow the same quarantine agreement)
- Occurs in Star City, Russia and Baikonur Cosmodrome, Kazakhstan.





Questions?

