Welcome! We will begin shortly….

Teaming in a Virtual World: What Network Science and Research on Astronauts Can Teach Us About Working Together When We Are Apart

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Northwestern | Kellogg

Executive Education

Agenda

- Welcome and Zoom Webinar user tips
- Today's session on **Teaming in a Virtual World: What Network Science and Research on Astronauts Can Teach Us About Working Together When We Are Apart**
- Q&A

Please Note

- This webinar is being recorded
- A link to the recording will be emailed to you in a few days

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How to Participate

Check Audio Settings here

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Ask our host and speaker questions by clicking here

“Like” other people’s questions by clicking on the thumbs up next to their question

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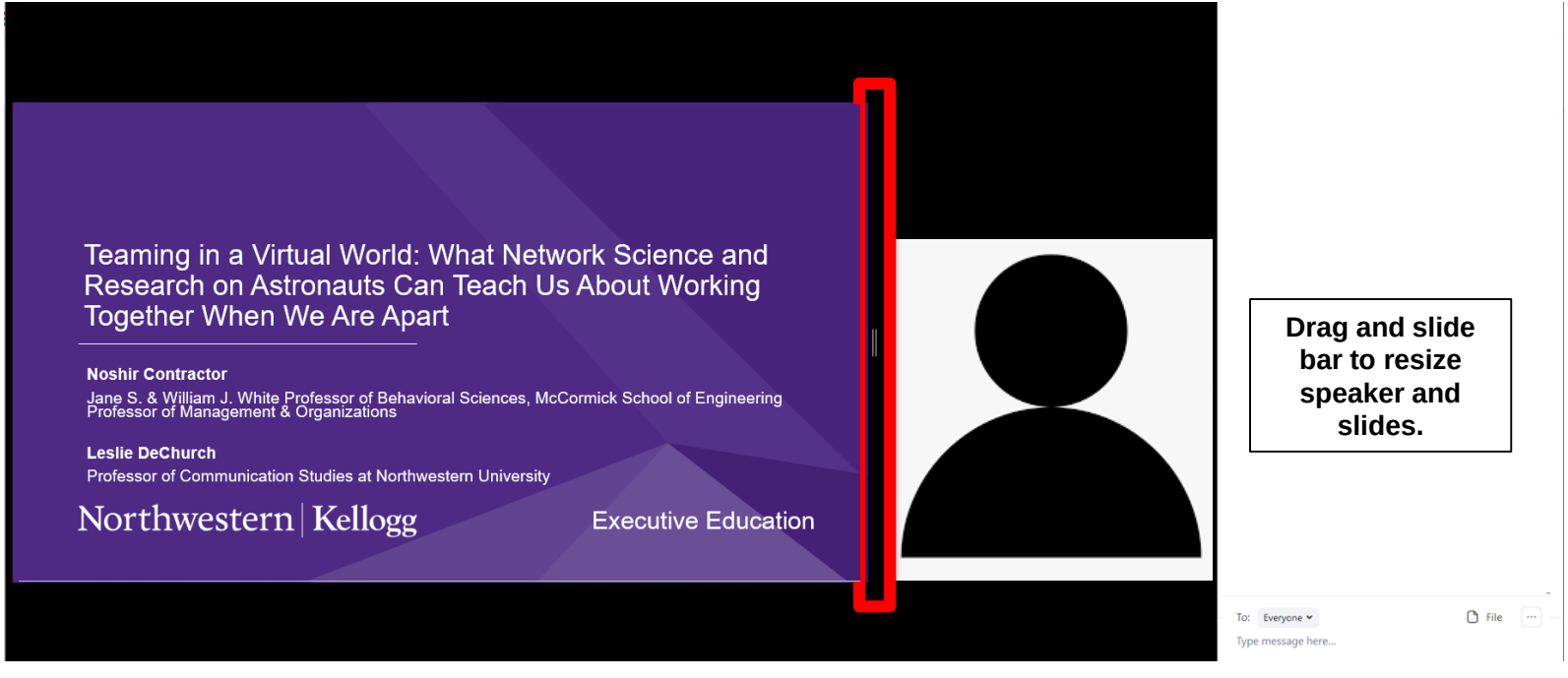
How to Control Your View



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Teaming in a Virtual World:

What network science and research on astronauts can teach us about working together when we are apart

Noshir Contractor & Leslie DeChurch

Note. This material is based upon work supported by NASA under awards 80NSSC18K0221, NNX15AM32G, 80NSSC18K0276, & NNJ15ZSA001N. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration.


Humans
will become an
interplanetary
species


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NASA'S JOURNEY TO MARS

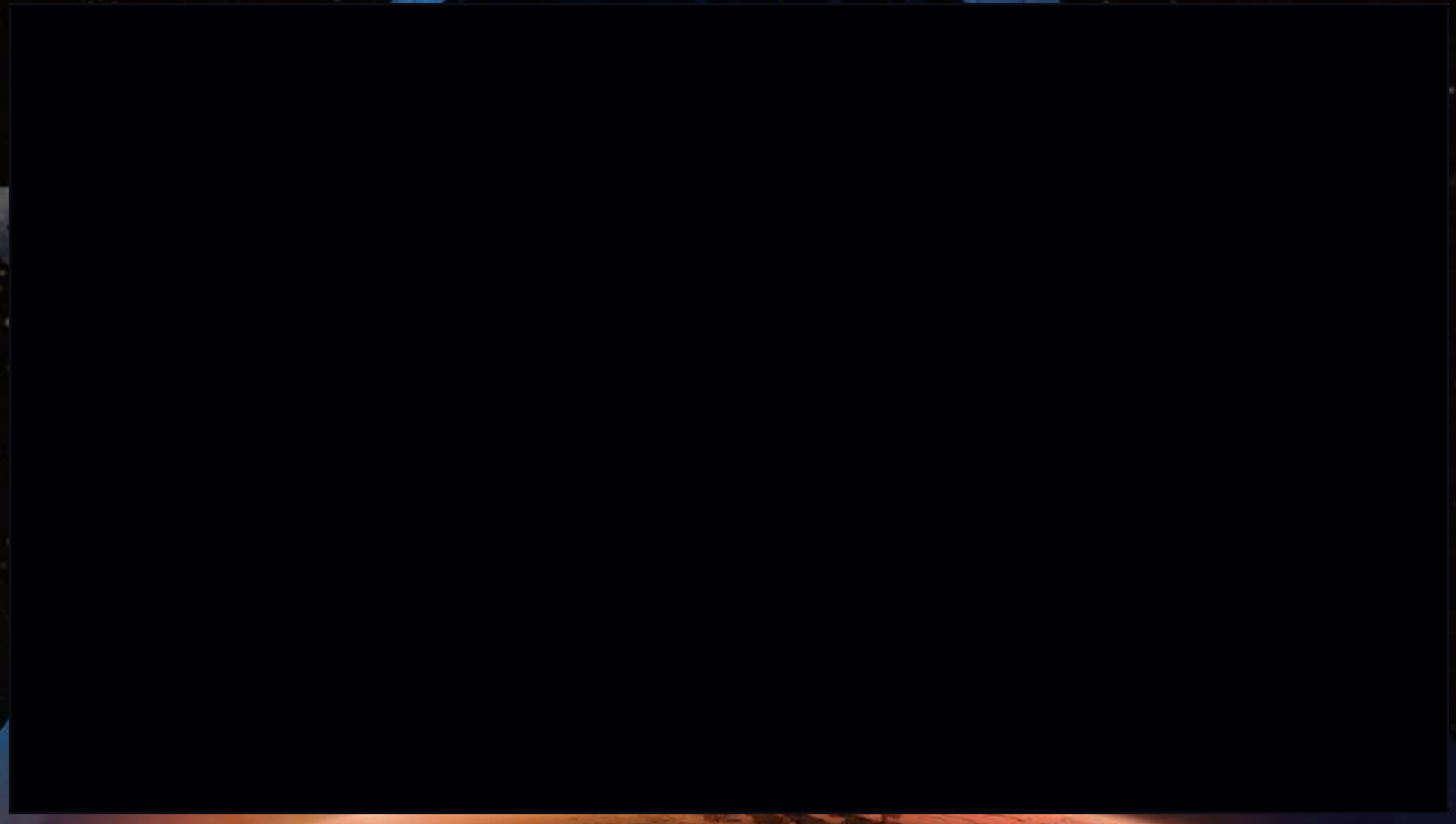
Risk of Performance and Behavioral Health Decrements Due to Inadequate Cooperation, Coordination, Communication, and Psychosocial Adaptation within a Team

Short Title: Team
Last Published: 07/31/19 10:05:29 AM (Central)
Element: Human Factors and Behavioral Performance (HFBP)
Evidence: Report
Risk Master Logic Diagram: Diagram
Point of Contact: Lauren Landon
HRP Risk Status:

Risk Ratings and Dispositions per Design Reference Mission (DRM) Category

DRM Categories	Mission Duration	Operations		Long-Term Health	
		LxC	Risk Disposition *	LxC	Risk Disposition *
Low Earth Orbit	6 months	3x2	Accepted with Monitoring	2x2	Accepted
	1 year	3x2	Accepted with Monitoring	2x2	Accepted
Deep Space Sortie	1 month	3x2	Accepted with Monitoring	2x2	Accepted
Lunar Visit/ Habitation	1 year	3x2	Accepted with Monitoring	2x2	Accepted
Deep Space Journey/Habitation	1 year	3x3	Requires Mitigation	2x2	Accepted
Planetary	3 years	3x4	Requires Mitigation	3x2	Accepted with Monitoring

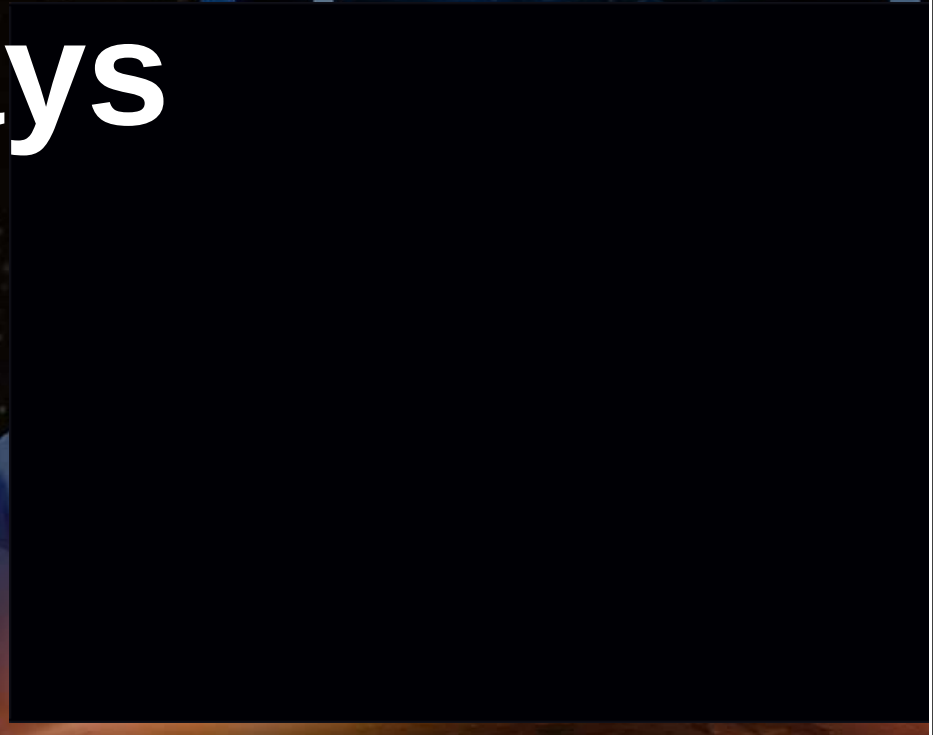
Mission Duration~ 259 Days



NASA'S JOURNEY TO MARS

Add slide on current mission launches to Mars this month

Travel Time: 259 Days



Depart from	AU	Years	AU/Year	J2000
Earth	1.0000	1.0000	6.2832	100.4644
Arrive at				
Mars	1.5237	1.8808	5.0902	355.4533

Synodic Period	2.1354 Years	Perihelion DV	2.9448 km/sec
		Aphelion DV	2.6490 km/sec
Trip Time	0.7087 Years	Total DV	5.5937 km/sec

Leave	Month	Day	Year	Arrive	Month	Day	Year
2001.2495	3	30	2001	2001.9582	12	15	2001
2003.3849	5	19	2003	2004.0936	2	4	2004
2005.5202	7	7	2005	2006.2290	3	22	2006
2007.6556	8	26	2007	2008.3643	5	11	2008
2009.7910	10	15	2009	2010.4997	6	30	2010
2011.9264	12	4	2011	2012.6351	8	19	2012
2014.0618	1	22	2014	2014.7705	10	7	2014
2016.1972	3	11	2016	2016.9059	11	26	2016
2018.3326	4	30	2018	2019.0413	1	15	2019
2020.4679	6	18	2020	2021.1767	3	4	2021
2022.6033	8	7	2022	2023.3120	4	22	2023
2024.7387	9	26	2024	2025.4474	6	11	2025
2026.8741	11	15	2026	2027.5828	7	30	2027
2029.0095	1	3	2029	2029.7182	9	19	2029
2031.1449	2	22	2031	2031.8536	11	7	2031
2033.2803	4	11	2033	2033.9890	12	26	2033
2035.4156	5	30	2035	2036.1244	2	15	2036
2037.5510	7	18	2037	2038.2597	4	4	2038
2039.6864	9	7	2039	2040.3951	5	22	2040
2041.8218	10	26	2041	2042.5305	7	11	2042
2043.9572	12	15	2043	2044.6659	8	30	2044
2046.0926	2	3	2046	2046.8013	10	18	2046
2048.2280	3	22	2048	2048.9367	12	7	2048
2050.3633	5	11	2050	2051.0721	1	26	2051
2052.4987	6	30	2052	2053.2074	3	15	2053
2054.6341	8	18	2054	2055.3428	5	3	2055
2056.7695	10	7	2056	2057.4782	6	22	2057
2058.9049	11	26	2058	2059.6136	8	11	2059
2061.0403	1	14	2061	2061.7490	9	30	2061
2063.1756	3	3	2063	2063.8844	11	18	2063
2065.3110	4	22	2065	2066.0198	1	7	2066
2067.4464	6	11	2067	2068.1551	2	26	2068
2069.5818	7	29	2069	2070.2905	4	15	2070
2071.7172	9	18	2071	2072.4259	6	3	2072
2073.8526	11	7	2073	2074.5613	7	22	2074
2075.9880	12	26	2075	2076.6967	9	11	2076
2078.1233	2	14	2078	2078.8321	10	30	2078
2080.2587	4	3	2080	2080.9674	12	18	2080
2082.3941	5	22	2082	2083.1028	2	7	2083
2084.5295	7	11	2084	2085.2382	3	26	2085
2086.6649	8	29	2086	2087.3736	5	14	2087
2088.8003	10	18	2088	2089.5090	7	3	2089
2090.9357	12	7	2090	2091.6444	8	22	2091
2093.0710	1	26	2093	2093.7798	10	11	2093
2095.2064	3	14	2095	2095.9151	11	29	2095
2097.3418	5	3	2097	2098.0505	1	18	2098
2099.4772	6	22	2099	2100.1859	3	7	2100
2101.6126	8	11	2101	2102.3213	4	26	2102

NASA'S JOURNEY T

Mars is far ...

Are you there Earth?
It’s me, Mars.

3 - 22
minutes each way

Distance

...means CREW Autonomy

“All the conditions necessary for murder are met if you shut two men in a cabin measuring 18 by 20 and leave them together for two months.”

-Valery Ryumin, Cosmonaut

What happens to teamwork under extended periods of isolation & confinement?

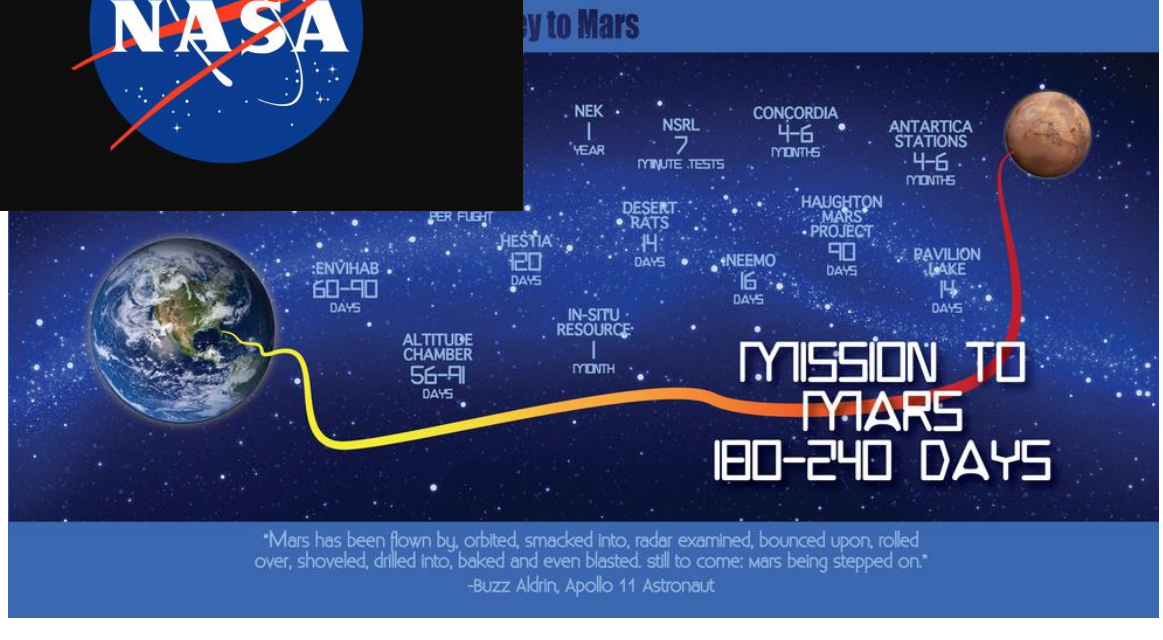
Wouldn’t it be nice to have a human petri dish?

A human petri dish?

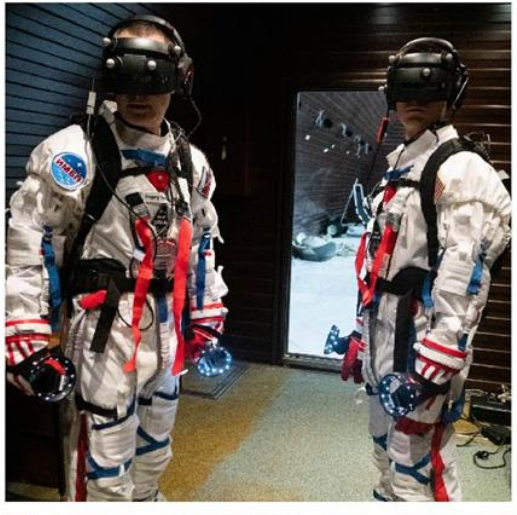
- … where we could manipulate people's isolation and sensory deprivation for 100s of days
- … while making them do complex and boring tasks and
- … monitoring them 24/7 physiologically and via audio/video, administering unlimited surveys?
- … *Zimbardo's dream ..?*

That’s exactly what we are doing

NASA's HERA Space Analog








SIRIUS-19

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Japan's Isolation Chamber

European Space Agency

Concordia (S. Pole)

Caves (Sardinia)

Pangaea-X Moon base (Canary Islands)

Now that we have a petri dish...

What happens to teamwork under extended periods of isolation & confinement?

Can you imagine?

Living & working while...

1. socially isolated from friends & family
2. confined to a relatively small space
3. under conditions that make it difficult to work (e.g., sleep deprivation, distraction, potential health concerns)
4. for an extended period of time

5 lessons from space teams to virtual teams...

Lesson 1.
If you’re not with the team you love then love the team you're with

Exploring the cosmos

The problems of flying to Mars

Astronauts will have to worry about space radiation—and also each other

Print edition | Science and technology

Feb 21st 2019 | WASHINGTON, DC

insert re-pairing slide and

Lesson 2.
The new Covid team competency:
Small group living

Table 1. Mission profiles for astronaut job analysis.

Mission Type	**A**	**B**	**C**	**D**
Duration (up to)	6 Months	12 Months	12 Months	12 - 36 Months
Distance from Earth	Low Earth Orbit	Low Earth Orbit	Deep Space Exploration	Deep Space Exploration
Crew Size	6	6	4	4-6
Vehicle Size	Large	Large	Medium/Small	Medium/Small
Communication Delay (one-way)	.5 – 3 Seconds	.5 – 3 Seconds	8 – 10 Minutes	10 – 20 Minutes

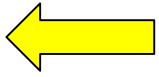
Note: Adapted from Barrett et al., 2015.

Source: Landon, L., Vessey, W., & Barrett, J. Evidence report: Risk of performance and behavioral health decrements due to inadequate cooperation, coordination, communication, and psychosocial adaptation within a team

Table 2. Competency importance ratings derived from the updated astronaut job analysis for each mission.

	Type A	*M*	Type B	*M*	Type C	*M*	Type D	*M*
1	Teamwork	82.33	Teamwork	82.71	Self-Care	93.93	Self-Care	95.14
2	Communication	79.40	Self-Care	82.57	Small Group Living	92.29	Technical	94.21
3	Adaptability	79.20	Judgment	81.07	Teamwork	90.50	Small Group Living	94.07
4	Self-Care	79.13	Adaptability	80.43	Judgment	90.21	Judgment	92.57
5	Judgment	78.67	Communication	80.21	Technical	90.00	Motivation	92.00
6	Situational Followership	78.60	Small Group Living	78.86	Autonomous Worker	89.07	Teamwork	91.50
7	Technical	75.80	Situational Followership	78.57	Motivation	88.07	Adaptability	91.00
8	Motivation	75.60	Motivation	76.79	Adaptability	87.79	Autonomous Worker	89.59
9	Learner/Teacher	75.00	Sociability	76.36	Communication	87.07	Communication	88.86
10	Sociability	74.40	Learner/Teacher	75.59	Situational Leadership	87.00	Situational Leadership	87.64
11	Confidence	73.67	Situational Leadership	75.14	Sociability	83.43	Emotional Independence	86.00
12	Operations Orientation	72.73	Confidence	74.21	Emotion Management	83.00	Sociability	85.79
13	Small Group Living	71.13	Technical	74.07	Operations Orientation	82.71	Operations Orientation	84.14
14	Situational Leadership	70.40	Operations Orientation	73.57	Situational Followership	82.07	Emotion Management	83.71
15	Autonomous Worker	69.27	Emotion Management	71.57	Emotional Independence	81.07	Situational Followership	83.29
16	Emotion Management	68.80	Autonomous Worker	70.43	Learner/Teacher	80.14	Learner/Teacher	81.93
17	Family	62.73	Family	66.71	Confidence	79.43	Confidence	81.00
18	Emotional Independence	60.20	Emotional Independence	66.36	Family	75.64	Family	75.86

Note: *M* = mean score of SME ratings on a 100-point scale. Colors call attention to ratings of importance, within each mission type. Adapted from Barrett et al., 2015.

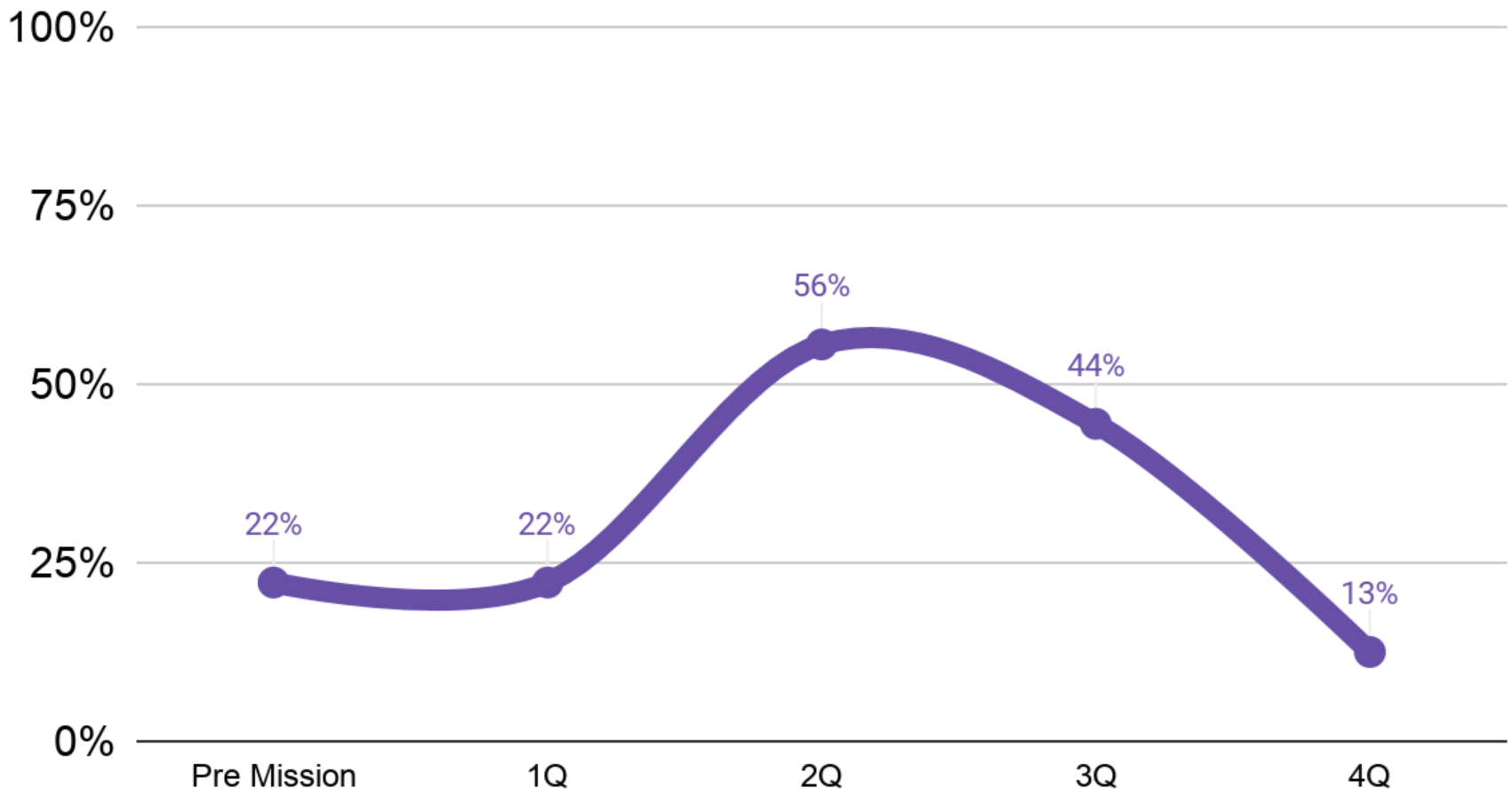


Add legend on what is Type A, Type B, Type C and Type D

Source: Landon, L., Vessey, W., & Barrett, J. Evidence report: Risk of performance and behavioral health decrements due to inadequate cooperation, coordination, communication, and psychosocial adaptation within a team

Lesson 3.
The third-quarter phenomenon

Decision Accuracy by Mission Phase (5 Phases)



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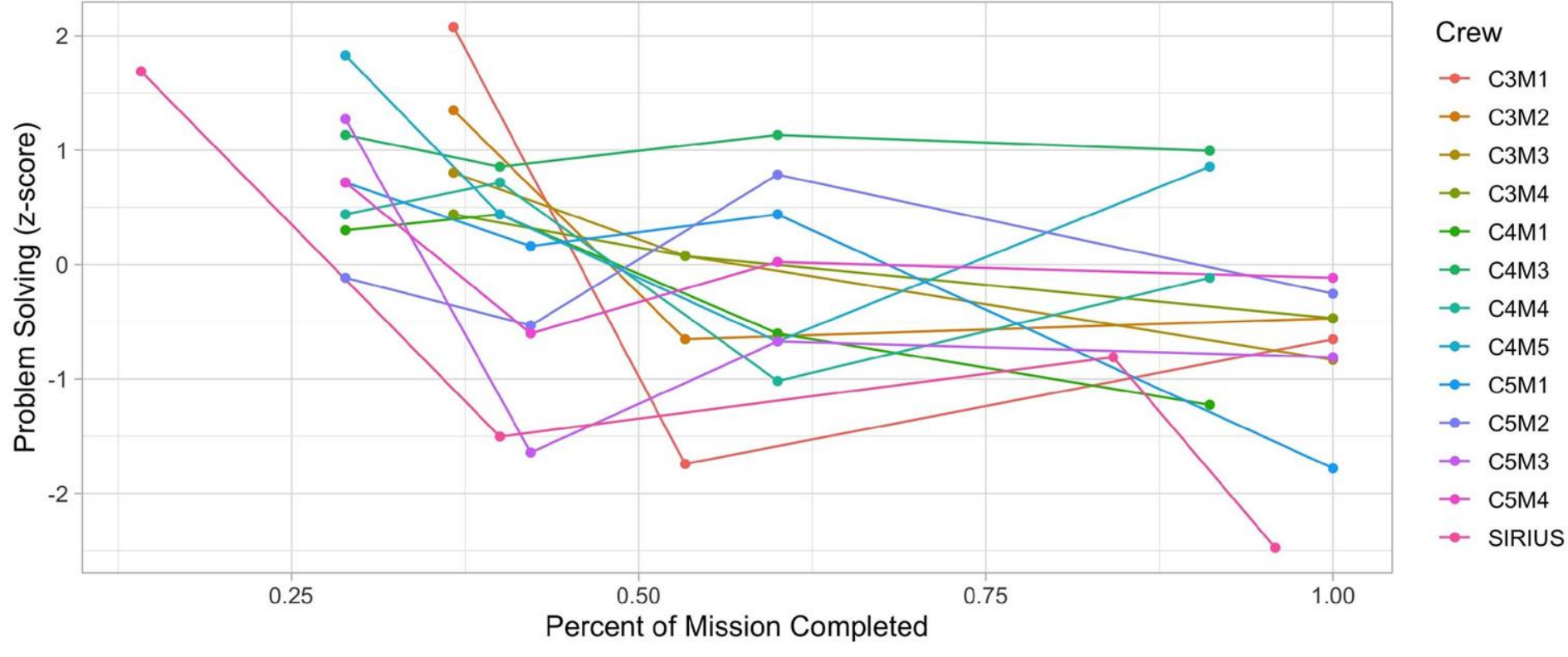
HERA C4, C5, & SIRIUS ‘19, *N* = 9 crews

Problem Solving Task Performance



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Lesson 4.
Create structure & meaningful routines

Shackleton’s Crew

Lesson 5.
Humor is a coping style

shackleton’s cook

View terms

Babbage from Economist Radio

Babbage: Joker AAAStronauts

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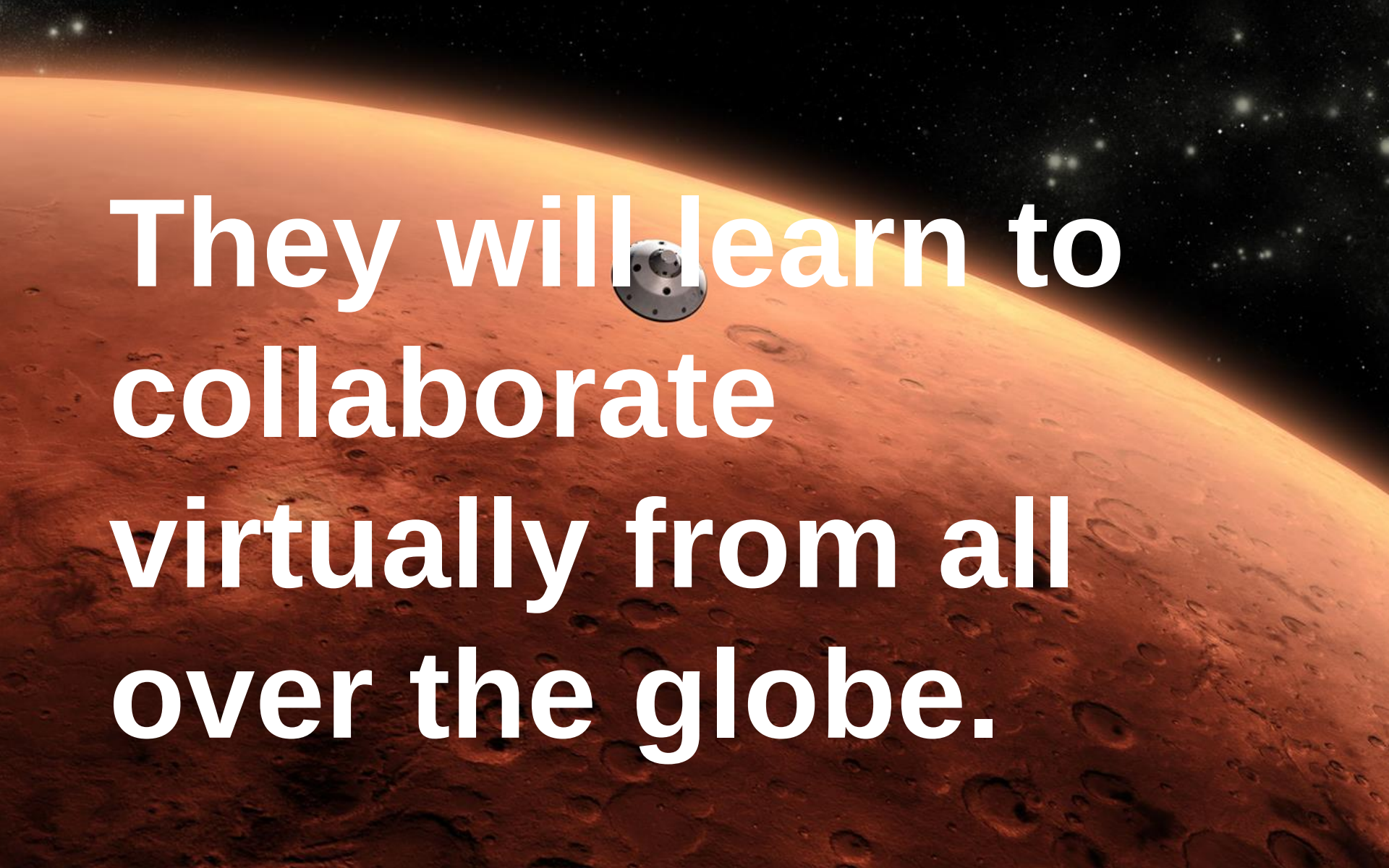
Humans
will become an
interplanetary
species...but first


They will learn to
collaborate
virtually from all
over the globe.

Teaming in a Virtual World

1. Re-pair your team
2. Promote positive small-group living
3. Manage the third quarter
4. Create structure & meaningful routines
5. Remember that humor is a coping style

THANK YOU

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