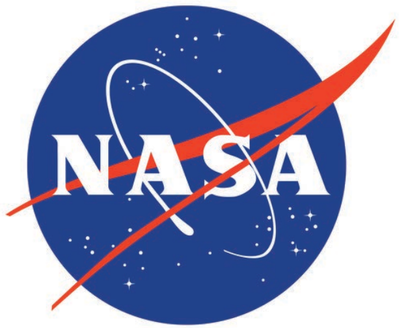
ZISO

HUMAN CENTERED DESIGN IMPACT ON HABITABILITY & MISSION SUCCESS

BY ARCH.
MICHAL
ZISO

X



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AS WE HEAD TOWARDS THE FUTURE OF HUMAN SPACE EXPLORATION AND TRAVEL, THIS TALK FOCUSES ON THE NEXT POSSIBLE STEP FOR DESIGNING ENVIRONMENTS FOR HUMANS IN SPACE.

TAKEAWAYS: BROAD PERSPECTIVE ON DESIGN IMPACT AND POTENTIAL PATHS OF INTEGRATION

ZISO

We are an architecture + innovation lab
where we imagine, design and create the future of
the built environment. We inhabit the intersection
of Architecture, Innovation, Space and Human Equality.

Michal Ziso, Architect & Founder @ZISO . theziso.com . info@theziso.com . Instagram @michal.ziso . Linkedin @Michal-Ziso . Twitter @MichalZiso

ZISO

EARTH X SPACE

@ZISO, 2022

Photograph:
James Leynse
Getty Images

when is crowded too crowded?

Photography:
Eddi Aguirre
Unsplash

Photograph:
New York
Apple Store

know your user

Photograph:
NYC Projects
The New York Times

excluding design

ZISO

FASTSLOW
WORLDARCHITECTURE

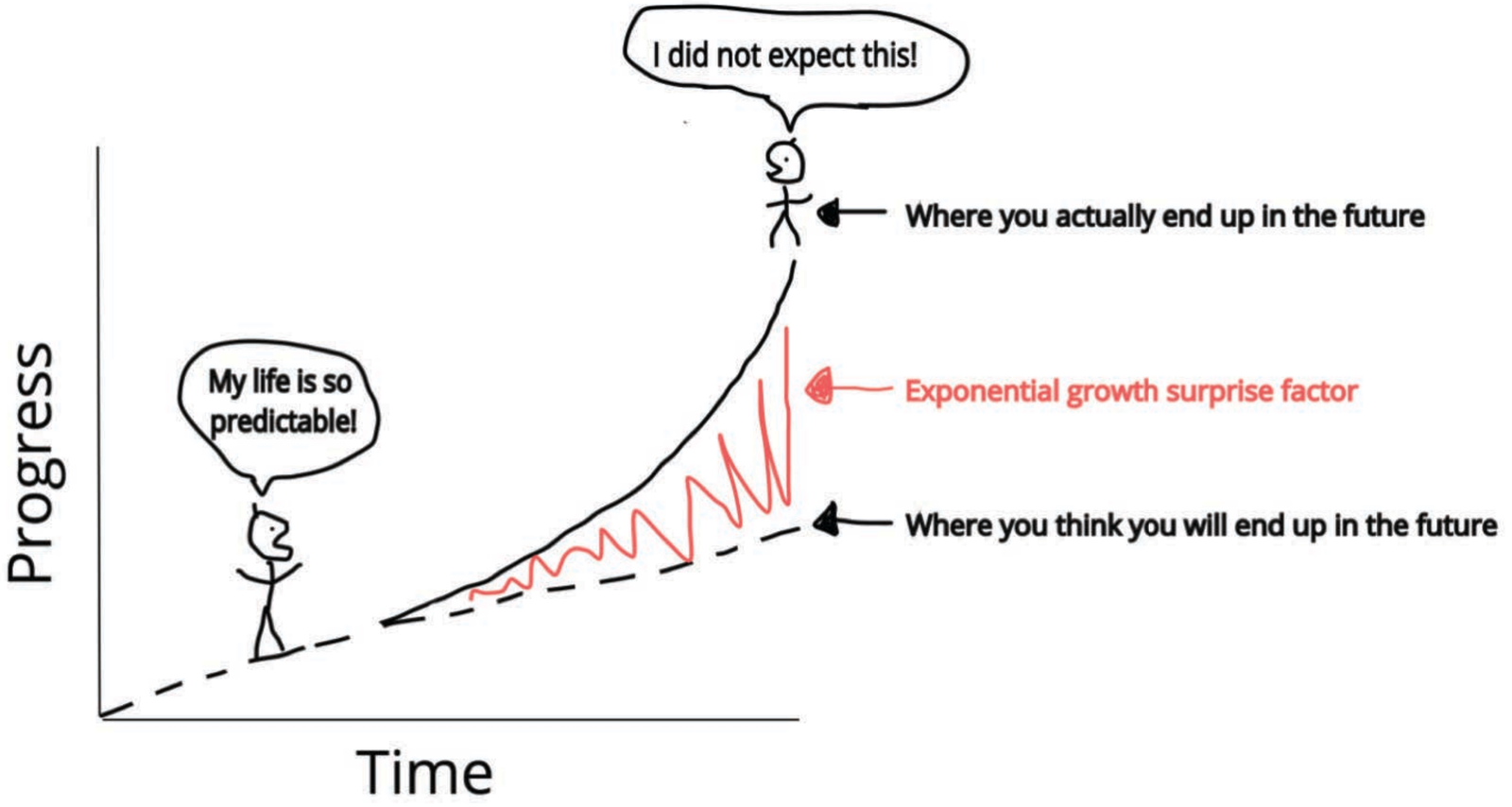


Illustration by:
Tim Urban
WaitButWhy.com

So…
I zoomed
out. ALOT

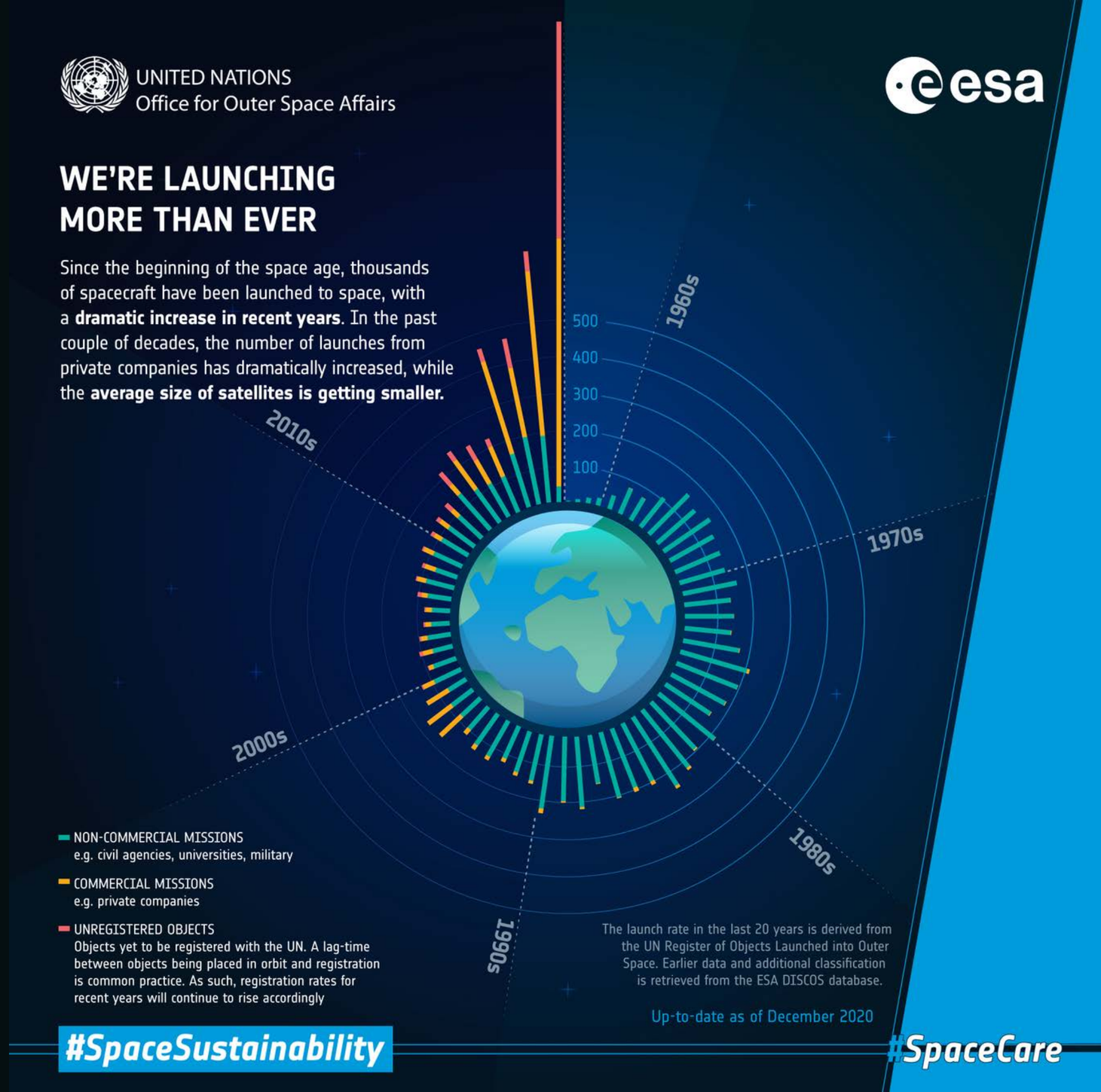


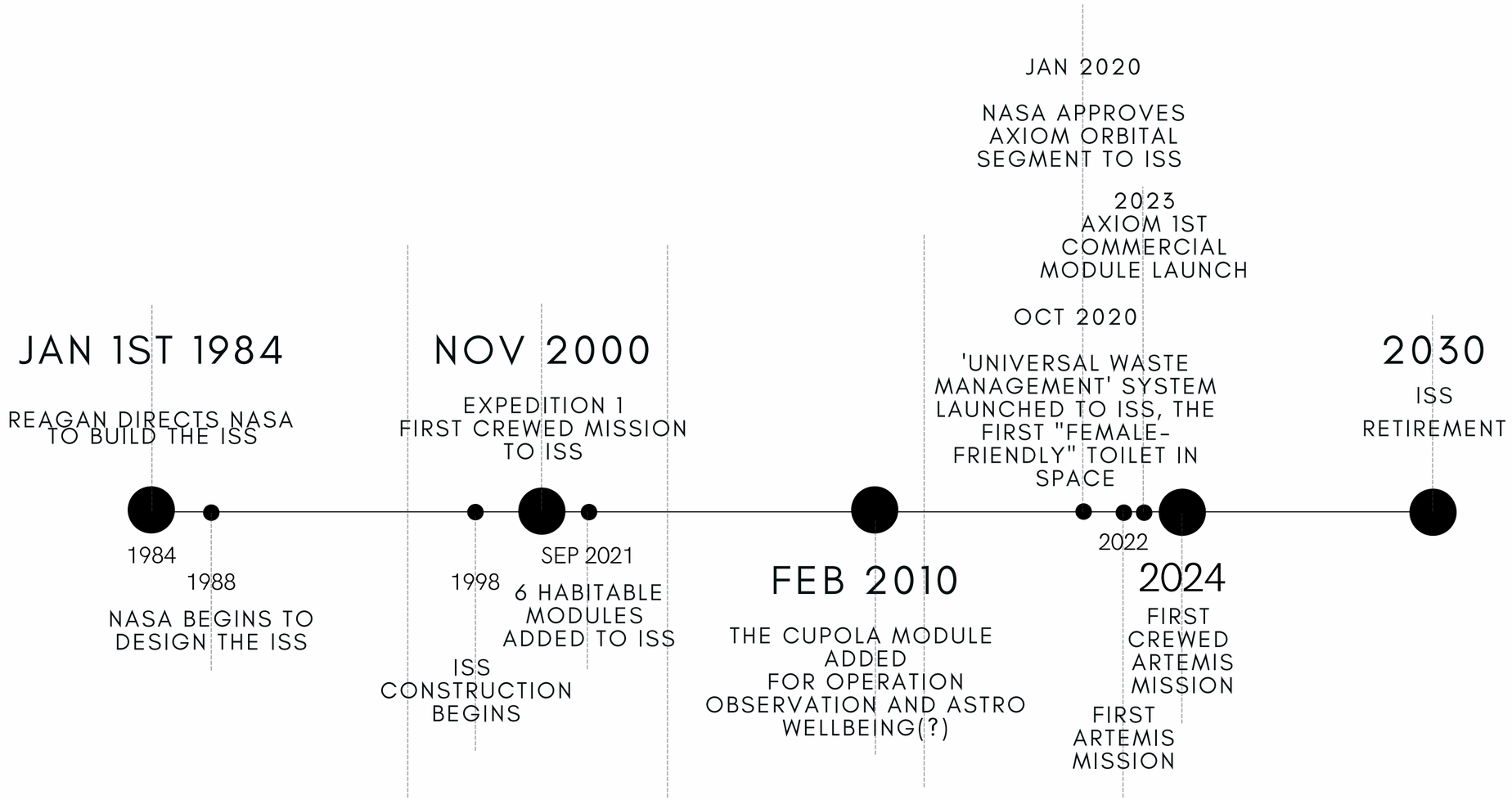
image by ESA

551
1961–2019
(58 YEARS)

12
2020
4 MISSIONS

49
2021
13 MISSIONS

ISS



WORLD CHANGES

HUMANS CHANGE

TECHNOLOGY CHANGES
MISSIONS GOALS CHANGE
MISSION SUCCESS PARAMETERS CHANGE

talk breakdown

talk breakdown

3

HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS

1

2

talk breakdown

3

HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS

1

2

talk breakdown

3

HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS

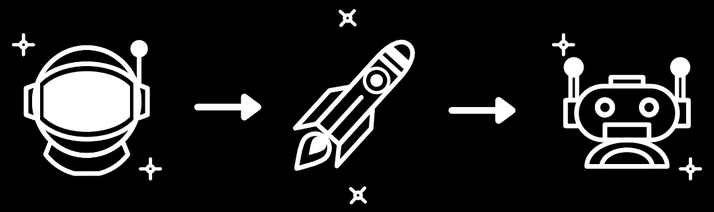
1

2

HUMAN
CENTERED
DESIGN

WHAT IS HUMAN CENTERED DESIGN ?

ONE STEP BEFORE HUMAN-MACHINE INTERACTION IS THE HUMAN-ENVIRONMENT INTERACTION AND SYMBIOSIS



HUMAN
CENTERED
DESIGN

WHAT IS HUMAN CENTERED DESIGN?

IT'S A PROCESS THAT STARTS WITH THE HUMANS YOU'RE DESIGNING FOR AND ENDS WITH NEW SOLUTIONS THAT ARE TAILOR MADE TO SUIT THEIR CHARACTERISTICS, NEEDS AND ABILITIES. IT'S ABOUT BUILDING A DEEP EMPATHY AND UNDERSTANDING WITH THE HUMANS YOU'RE DESIGNING FOR AND INVOLVING THE HUMAN PERSPECTIVE IN ALL STEPS OF THE PROBLEM-SOLVING PROCESS.

HUMAN
CENTERED
DESIGN

WHAT IS ARCHITECTURE?

PHYSICAL ENVIRONMENT
DESIGNED
FOR HUMANS
BY HUMANS

THE POWER OF ARCHITECTURE

BEHAVIOR
THOUGHTS
FEELINGS
SECURITY
SENSE OF BELONGING
COGNITIVE FUNCTIONS

▼

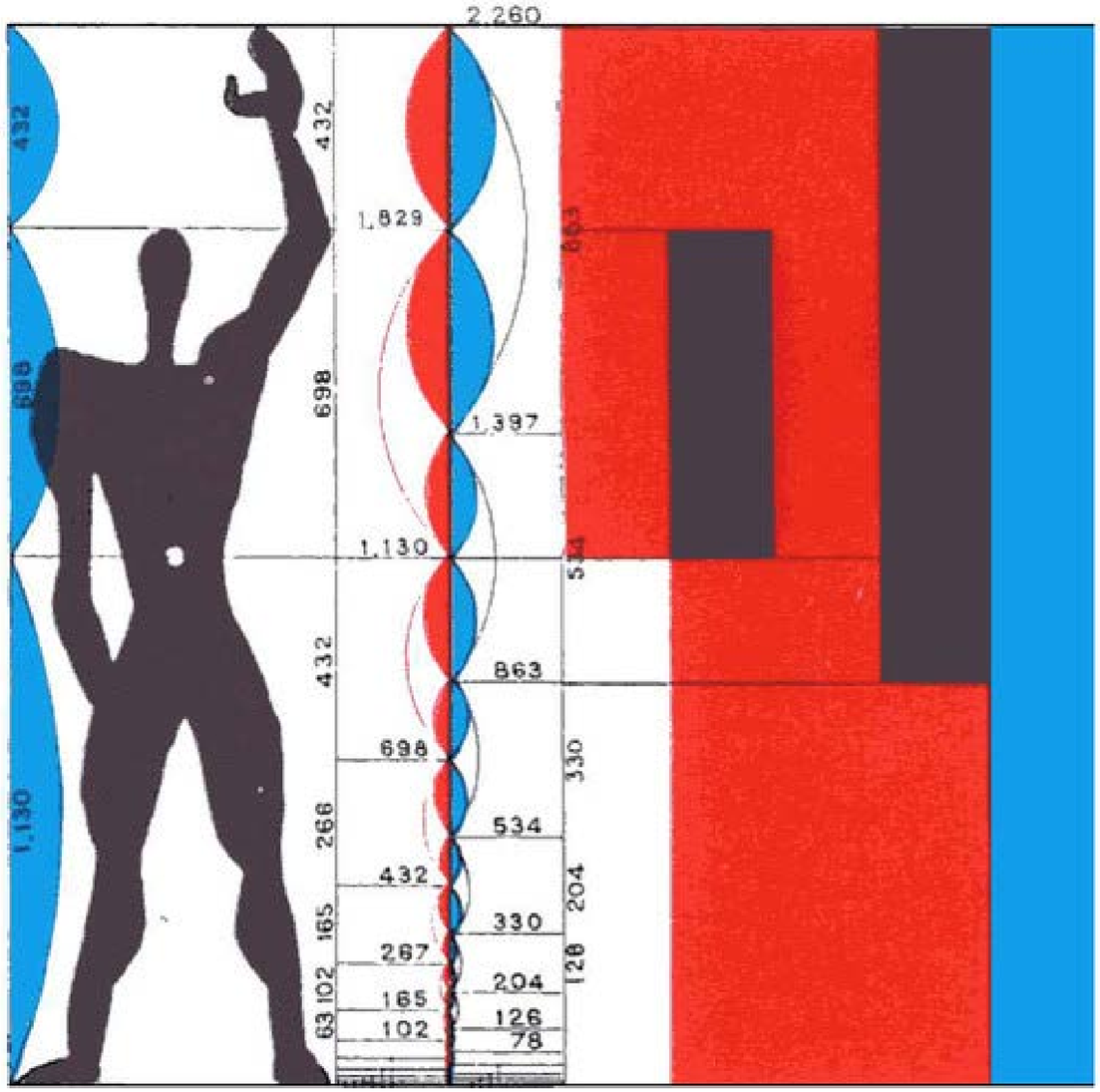
HABITABILITY
MISSION SUCCESS

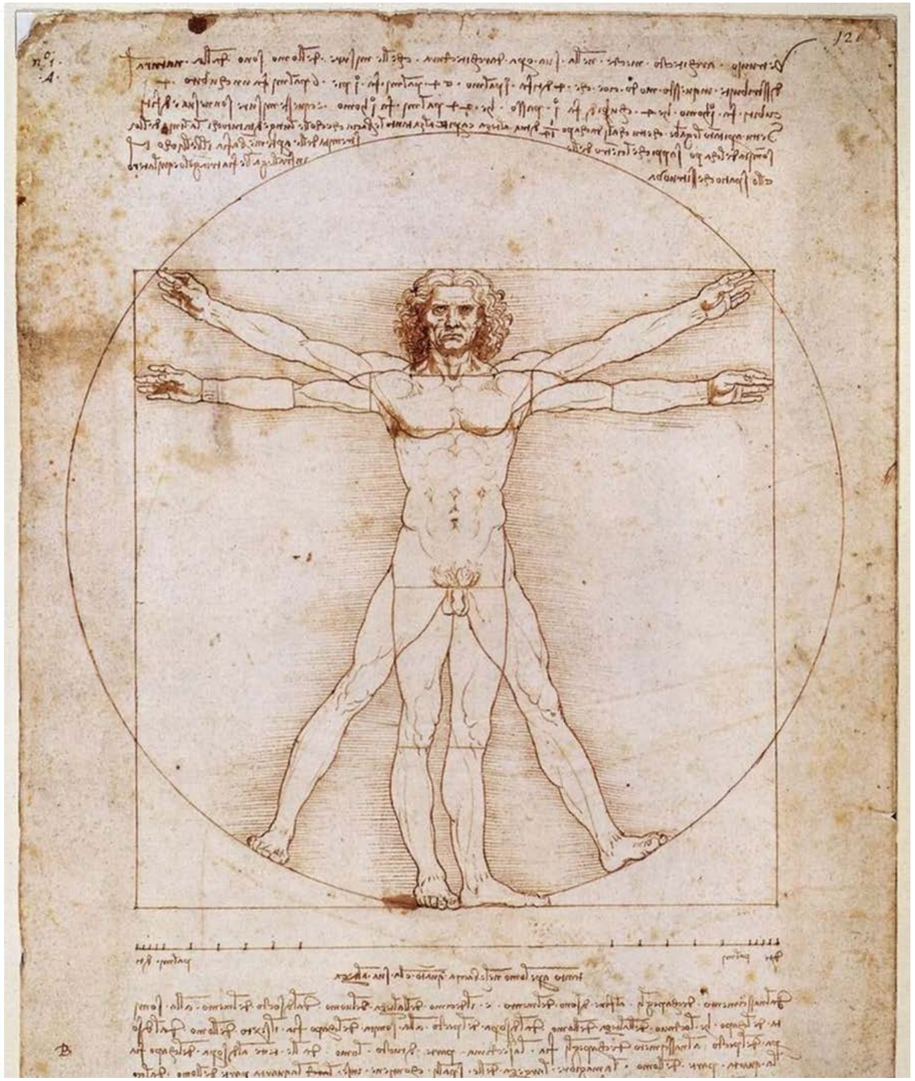
DESIGN
IMPACT

NOT HAVING A DESIGN
CHOICE IS A DESIGN CHOICE

NEGATIVE DESIGN IMPACT

HUMAN
CENTERED
DESIGN





Modulor by Le Corbusier

Vitruvian Man by Leonardo de Vinci

CAR DESIGN

WHEN WOMEN ARE INVOLVED IN CAR CRASHES
47% MORE LIKELY TO BE SERIOUSLY INJURED,
71% MORE LIKELY TO BE MODERATELY INJURED,
17% MORE LIKELY TO DIE

The new lavatory is a symbol of the agency's growing recognition of female astronauts' needs.

By Marina Koren

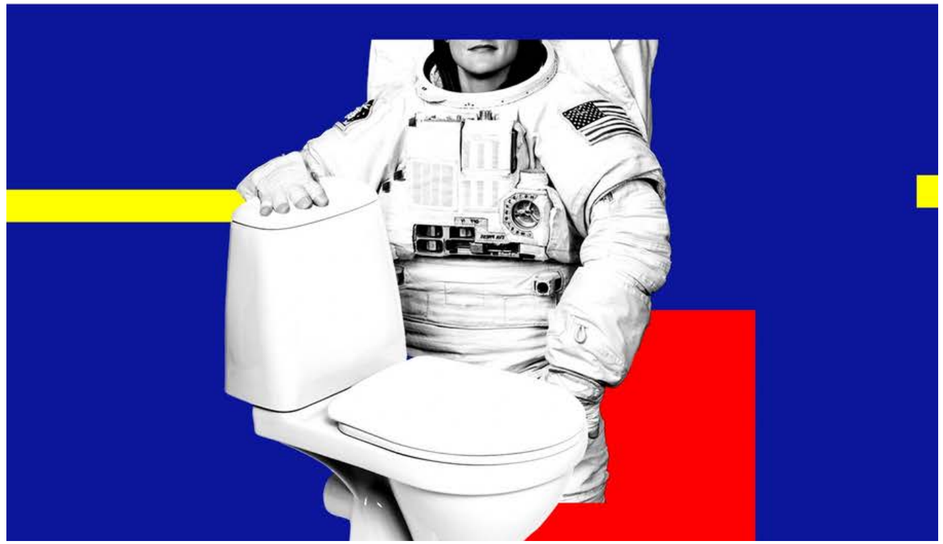


Illustration:
NASA/Shutterstock
The Atlantic

EARTH | SPACE

DESIGN
IMPACT

THE FEAR OF PUBLIC SPACES IMPACTS WOMEN'S MOBILITY AND THEIR BASIC RIGHTS OF ACCESS TO THE CITY. STUDIES FROM FINLAND, SWEDEN, THE US, CANADA, TAIWAN AND ISRAEL ALL SHOW THAT WOMEN ADJUST THEIR BEHAVIOR AND THEIR TRAVEL PATTERNS TO ACCOMMODATE THIS FEAR.

MOTION SICKNESS IN VR -
WOMEN ARE MORE SUSCEPTIBLE THAN MEN

- DEAPTH PERCEPTION RELIES ON MOTION PARALLAX AND SHAPE FROM SHADING. MEN TEND USE THE FIRST WHILE WOMEN TEND TO USE THE SECOND. VR USES THE FIRST.
- POSTURE SWAY IS DIFFERENT BETWEEN MEN AND WOMEN
- WOMEN'S POSTURE SWAY CHANGES ACROSS THEIR MENSTRUAL CYCLE

EARTH | SPACE

DESIGN
IMPACT

WOMEN TAKE 2.3 TIMES LONGER THAN MEN TO USE THE RESTROOM (WOMEN 90 SEC AVG VS MEN 60 SEC AVG)

PPE - PERSONAL PROTECTIVE EQUIPMENT, USUALLY COVERALLS MADE FOR PEEING FOR MEN

left image:
Chuck Savage
right image: NASA

EARTH

SPACE

DESIGN
IMPACT

Article: The
New York Times
Image: NASA

EARTH

SPACE

First All-Female Spacewalk Canceled

HUMAN
CENTERED
DESIGN
IMPACT ON
HABITABILITY
AND MISSION
SUCCESS

NOT DIE  **LIVE**

NEXT STEP OF HUMAN
SPACEFLIGHT IS SET
TO TAKE CARE OF THE
ASTRONAUT WELLBEING

INTERDISCIPLINARY
TEAMS ARE CRUCIAL

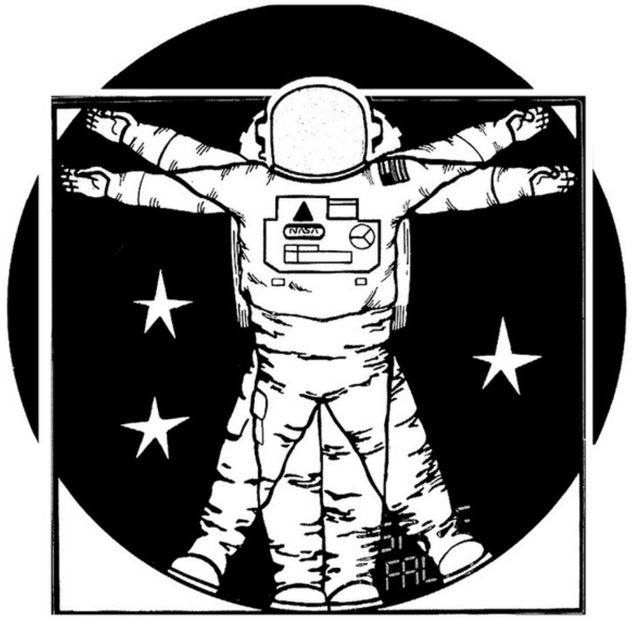
HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS

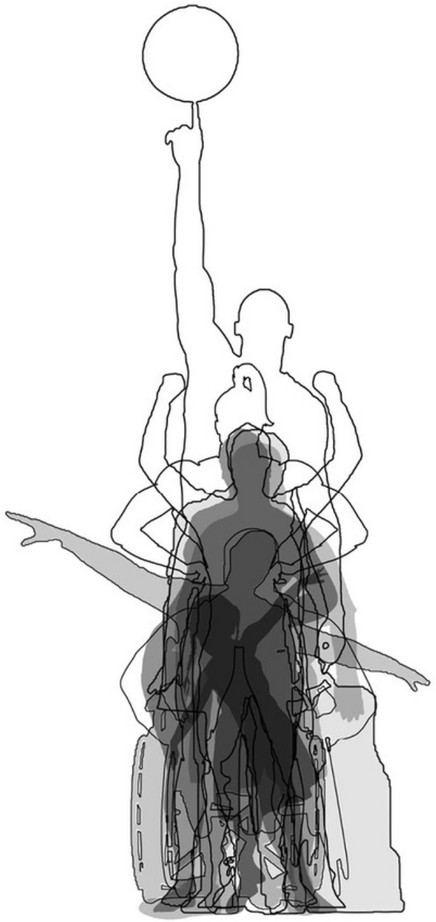
HABITABILITY FACTORS CAN INFLUENCE MISSION SUCCESS

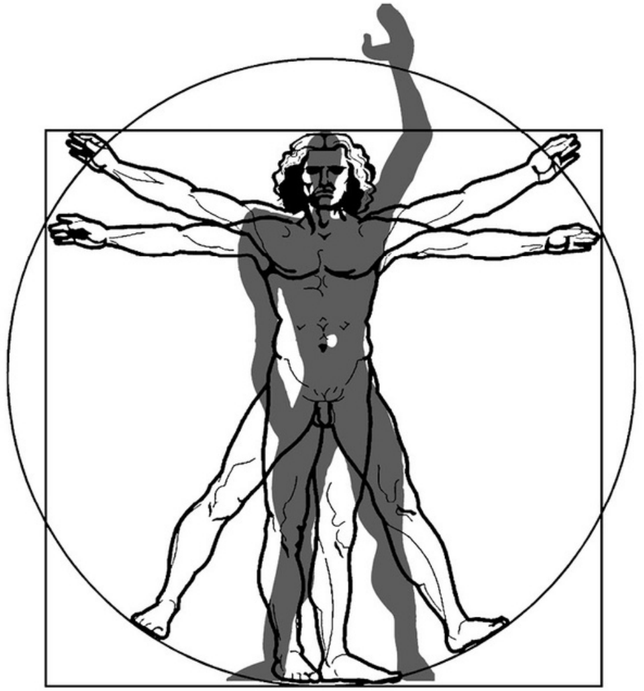
- ANTHROPOMETRY
- PHYSIOLOGICAL AND COGNITIVE ABILITIES
- COLOR IMPACT
- VISUAL OVERLOAD VS VISUAL CALMNESS & TRIGGERS
- CULTURAL & GEOGRAPHICAL BACKGROUND
- CONSCIOUS & UNCONSCIOUS NEEDS & PREFERENCES (EX. PERSONAL SPACE)
- SAFETY
- PRIVACY (ALL SENSES)
- TEMPERATURE
- AND MORE...

HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS

designing for future diversity of space travelers







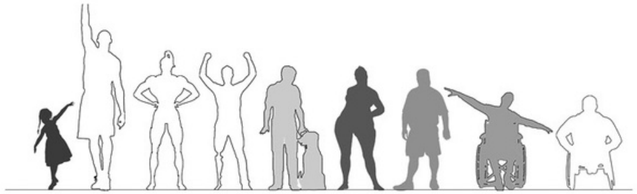


ILLUSTRATION BY ZISO

HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS

FROM DISABILITIES TO SUPERPOWERS IN SPACE EXPLORATION

How do different mental / physical / sensory abilities on earth can contribute to space exploration and become superpowers

Mental

- Down syndrome
- ADHD (Attention Deficit Hyperactivity Disorder)
- Psychological disorders

Sensory

This affects how do we interpret the world

- Autistic Spectrum
- Blindness
- Deafness
- SPD (Sensory processing disorder)

Mobility

- Lower limbs
- Upper limbs
- Fingers
- Spine
- Bones
- Muscles

ZISO Disabilities to Superpowers Research (ongoing)

disability can be derived from an accessible / inaccessible environment - making sure research applies to different body types / abilities / female cycle etc.

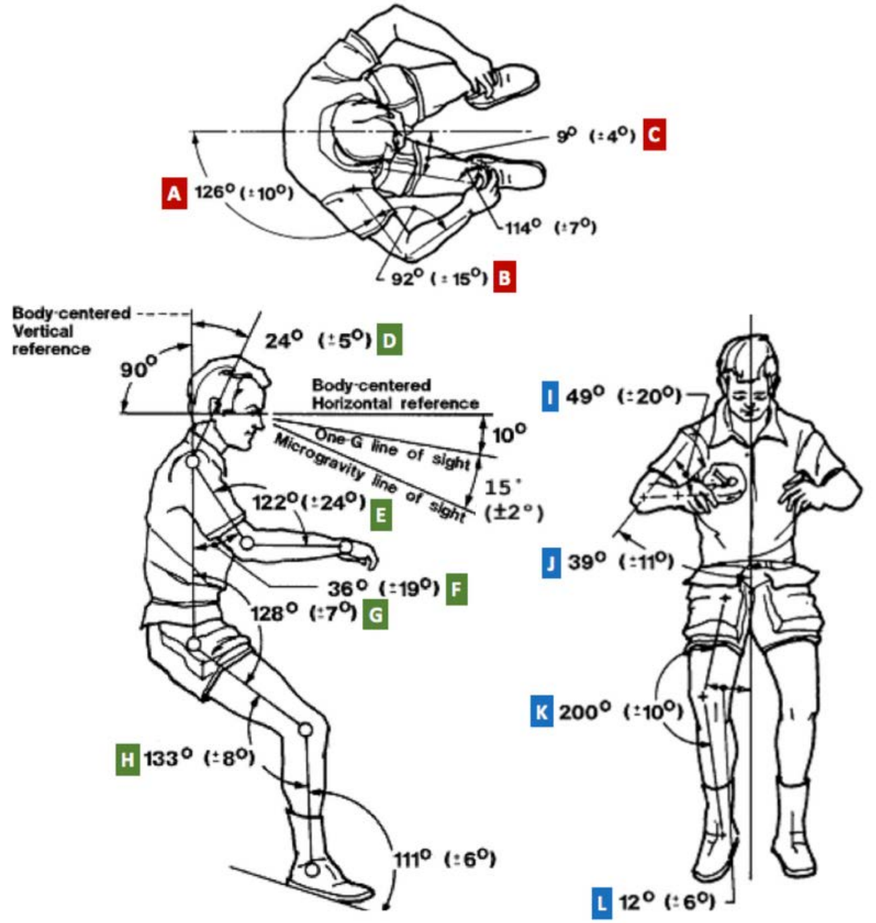
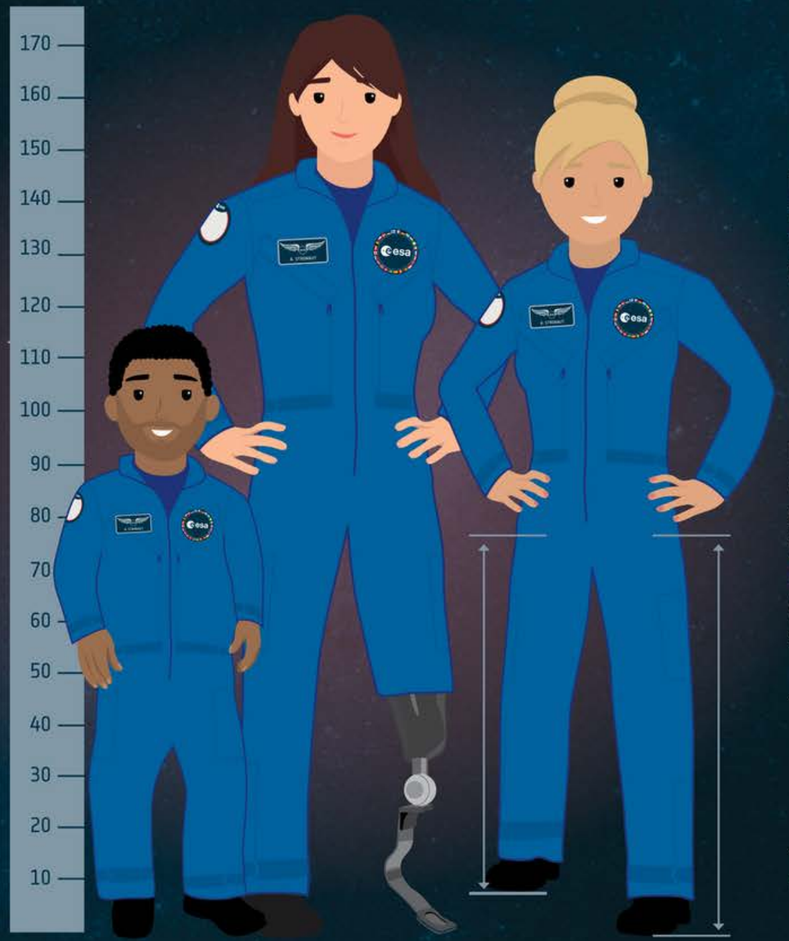


Figure 2. NASA-STD-3000 specifications for neutral body posture.

PARASTRONAUT PROJECT

As part of ESA's commitment to enhance inclusiveness and fair representation, the Agency is launching the parastronaut feasibility project to assess the conditions for including **astronauts with disabilities** to work in space. This project is a new endeavour for Europe and a global first.

The feasibility project aims at offering **professional spaceflight opportunities** to a wider pool of talents. Starting with selected disabilities to have a thorough understanding of the potential challenges in terms of safety and operations in space, the scope of disabilities may then be extended aiming at broader inclusion.



The selected candidate(s) will work with ESA to assess and optimise the conditions allowing people with physical disabilities to **work and live in space.**

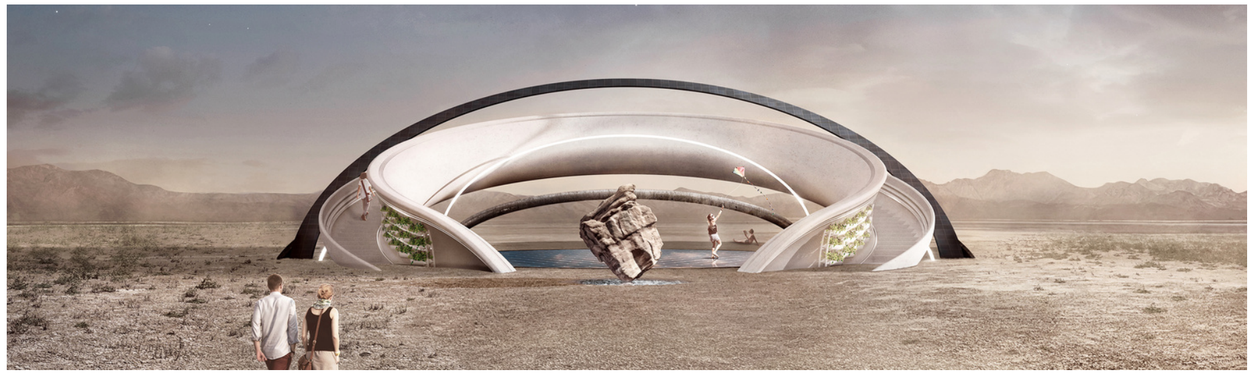
The educational and psychological requirements for these candidates are the same as for the ESA astronaut selection. However, with respect to **physical requirements,** this feasibility project will allow the inclusion of candidates with the following disabilities:

- a lower limb deficiency, as follows:
  - Single or double foot deficiency through ankle
  - Single or double leg deficiency below the knee
- a pronounced leg length difference
- a short stature (<130 cm)

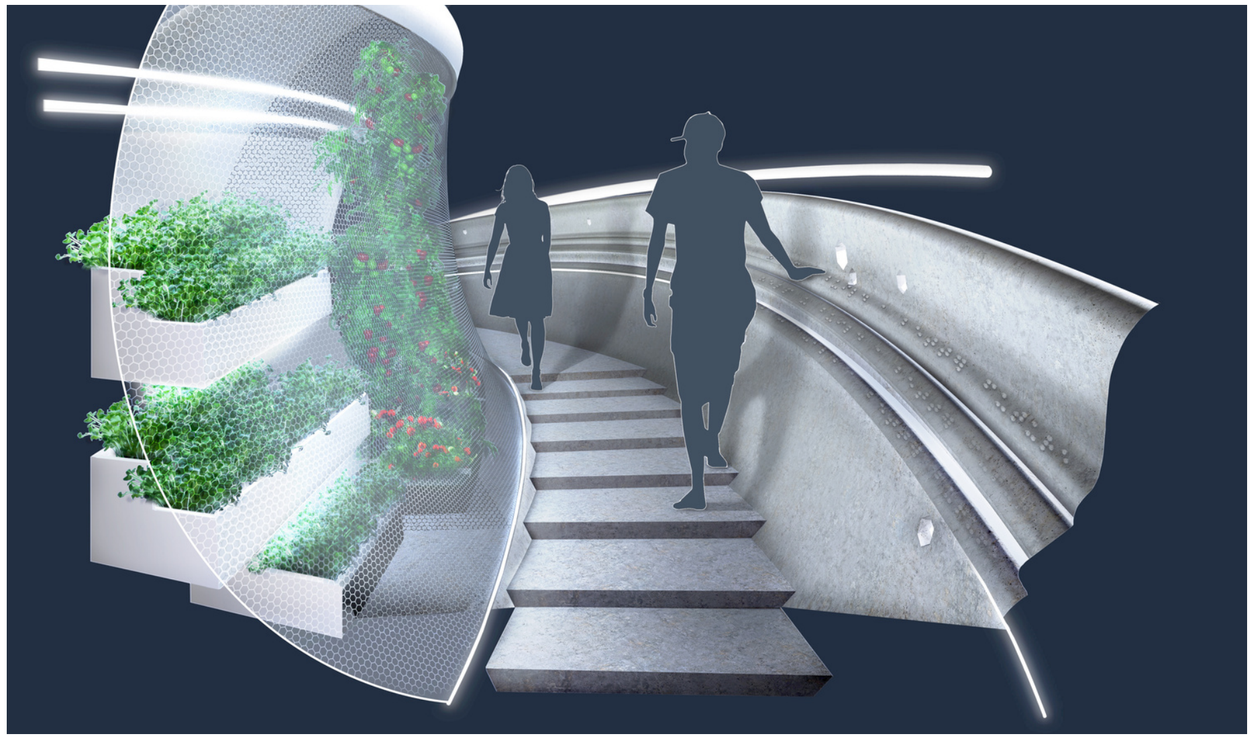
Graphics
By ESA

HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS

Space-Associated Neuro-Ocular Syndrome (SANS)



IF THERE IS A CHANCE OF VISION IMPAIRMENT OF CREW IN LONG DURATION FLIGHTS / POSSIBILITY OF FUTURE BLIND CREW MEMBERS - THE HABITAT AND TRANSPORTATION VEHICLE SHOULD BE DESIGNED FOR THEM



Renders:
ZISO + Pxl

HUMAN
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DESIGN
IMPACT ON
HABITABILITY
AND
MISSION
SUCCESS

color

- Color can influence behavior and efficiency in a working environment
- Each color has potential different effects on the human body
- People react differently to color schemes depending on their culture, education, genetics and socio-economic level
- Color influences not only mood but also wellness and productivity
- Color can also influence the perception of an area - make it seem bigger, smaller, higher, longer etc

HUMAN
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DESIGN
IMPACT ON
HABITABILITY
AND
MISSION
SUCCESS

color

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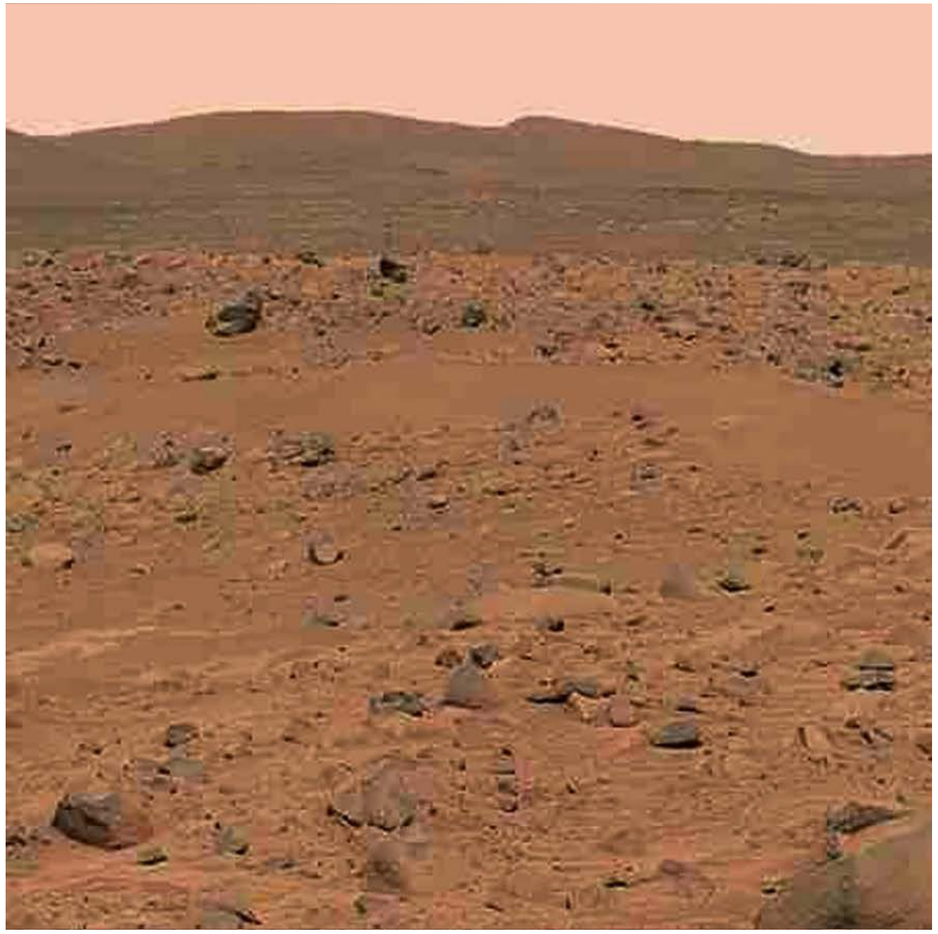
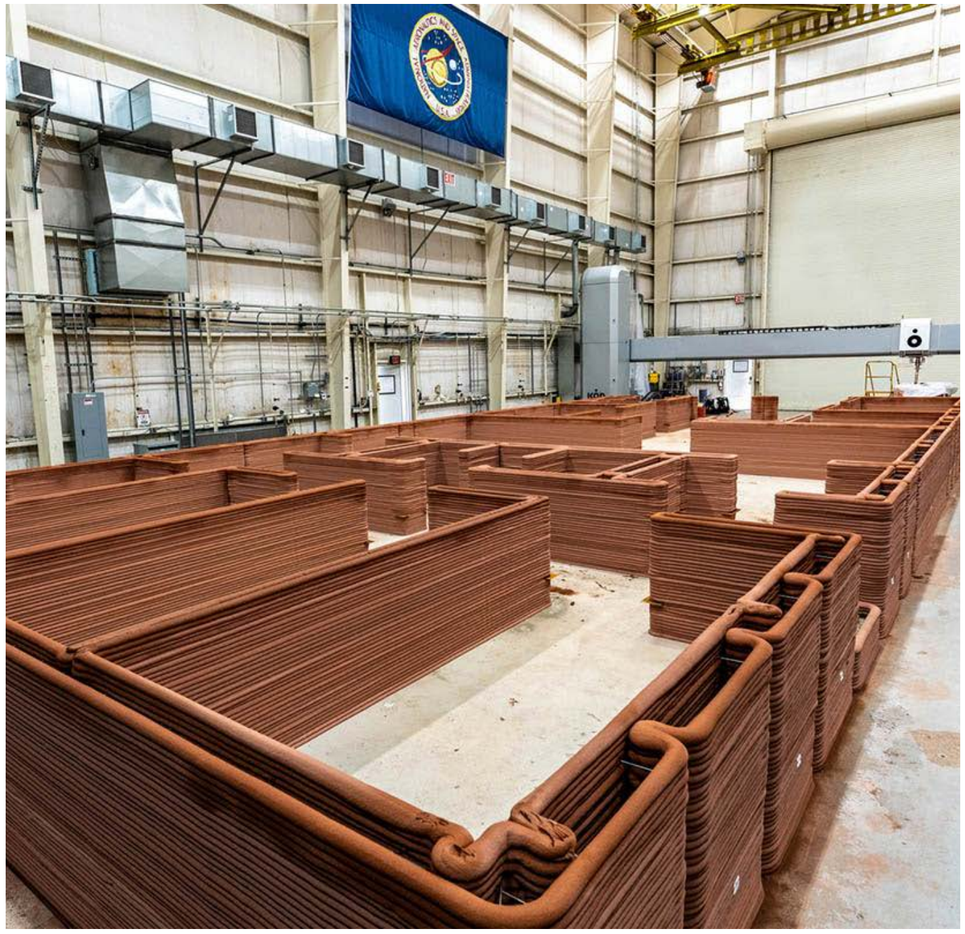
IMPACT ON
HABITABILITY
AND
MISSION
SUCCESS

color





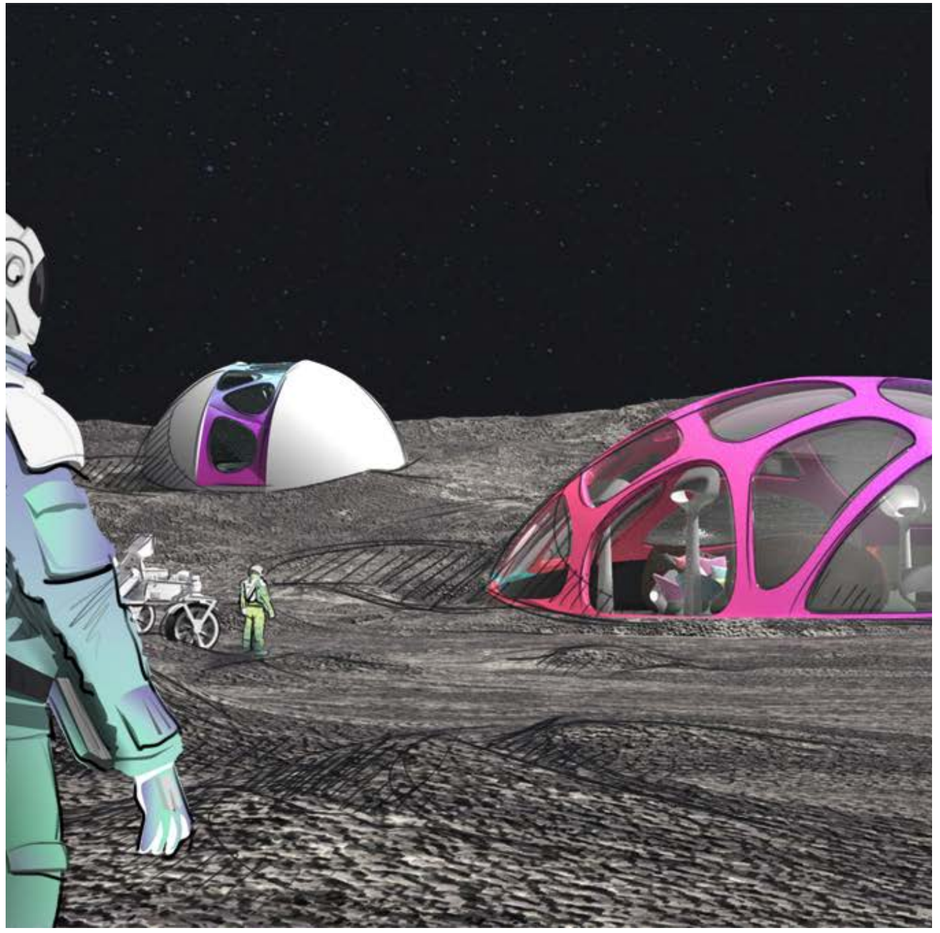
Images:
By NASA

MARS

3D PRINTED HAB - CHAPEA

HUMAN
CENTERED
DESIGN
IMPACT ON
HABITABILITY
AND
MISSION
SUCCESS

color



Left render:
Nonfiction
Right render: ZISO

MOON

MARS

HUMAN
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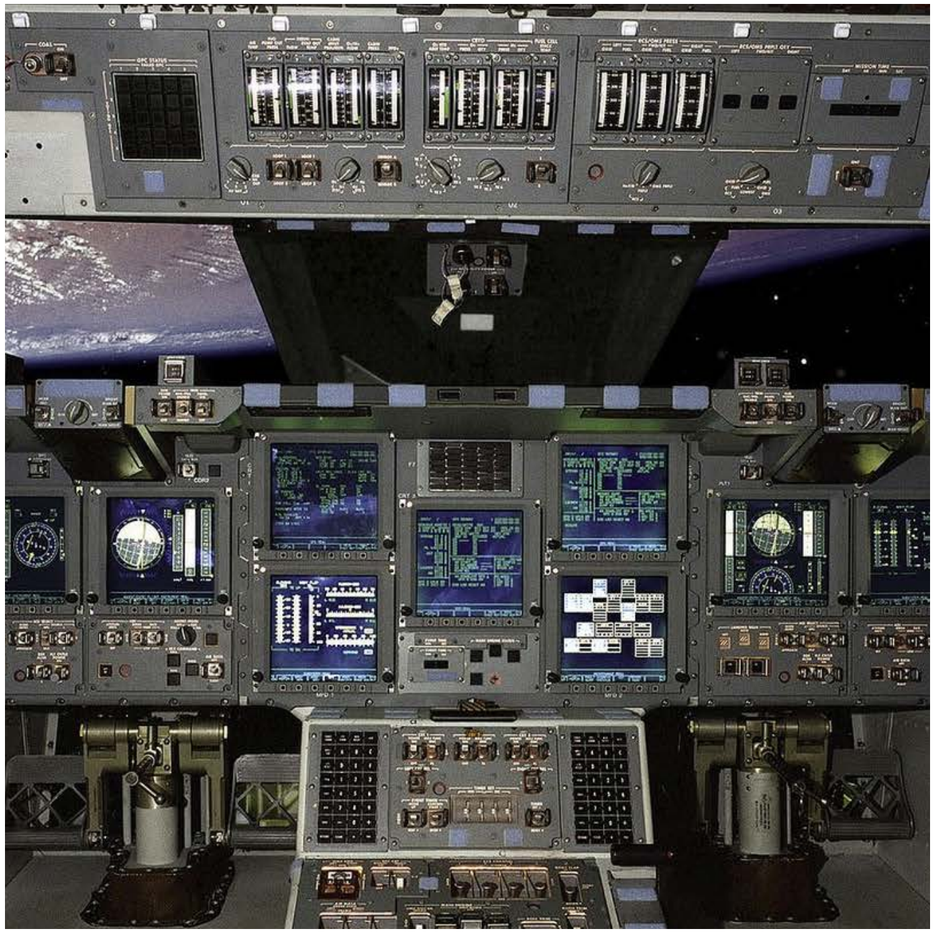
IMPACT ON
HABITABILITY
AND
MISSION
SUCCESS

visual triggers and efficiency

HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS

too many visual triggers: visual overload



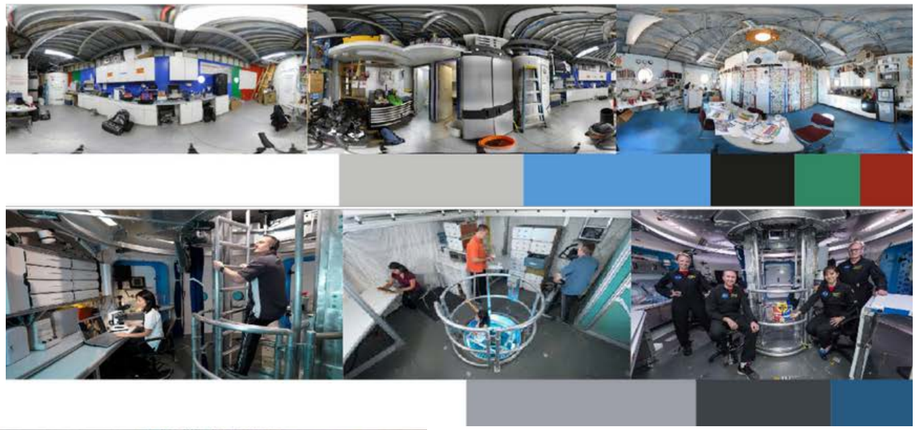
left image:
by NASA

EARTH

SPACE (SHUTTLE SPACECRAFT)

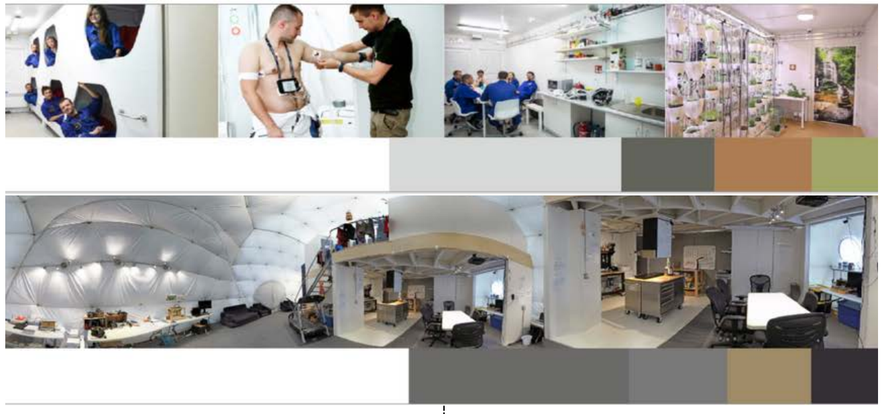
HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS

cultural and geographical background



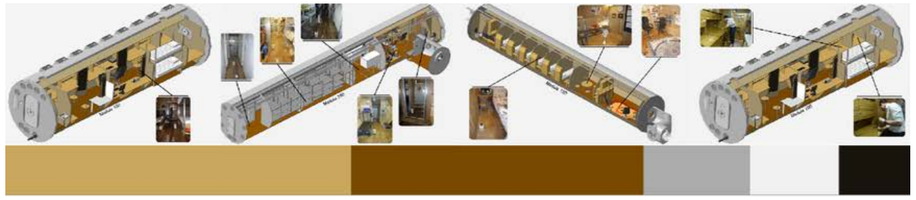
UTAH

JSC TEXAS



POLAND

HAWAII



MOSCOW

LOW TEMP LOCATIONS

HIGH TEMP LOCATIONS

ZISO
Habitability
Research
(ongoing)

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IMPACT ON
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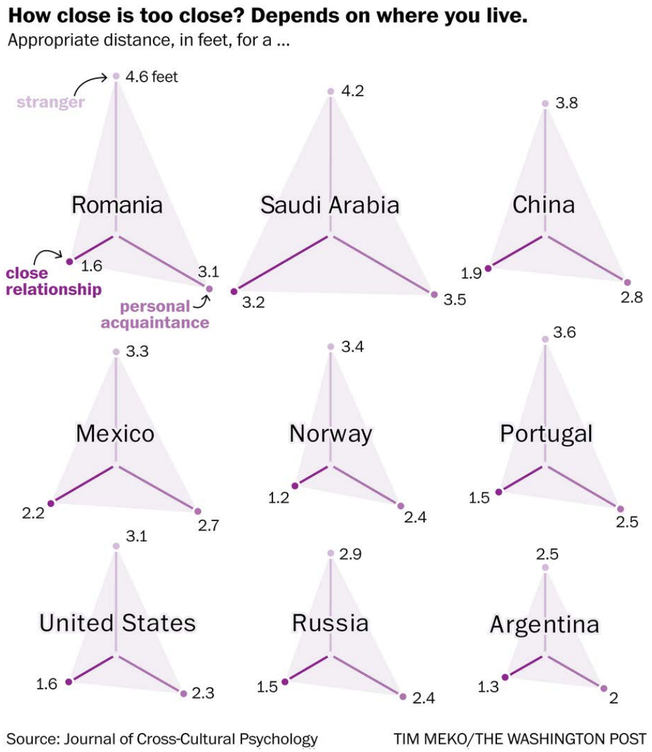
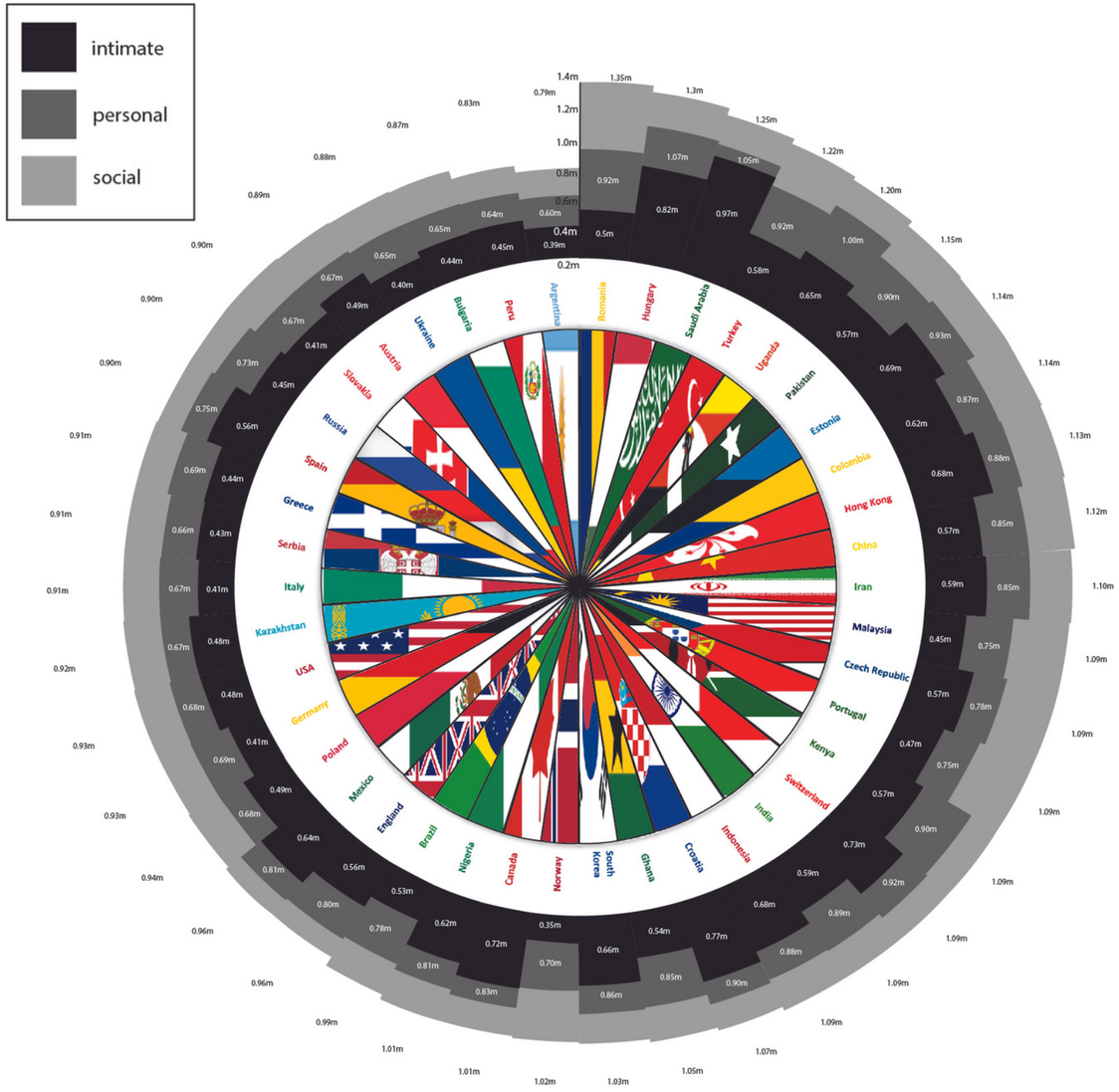
AND
MISSION
SUCCESS

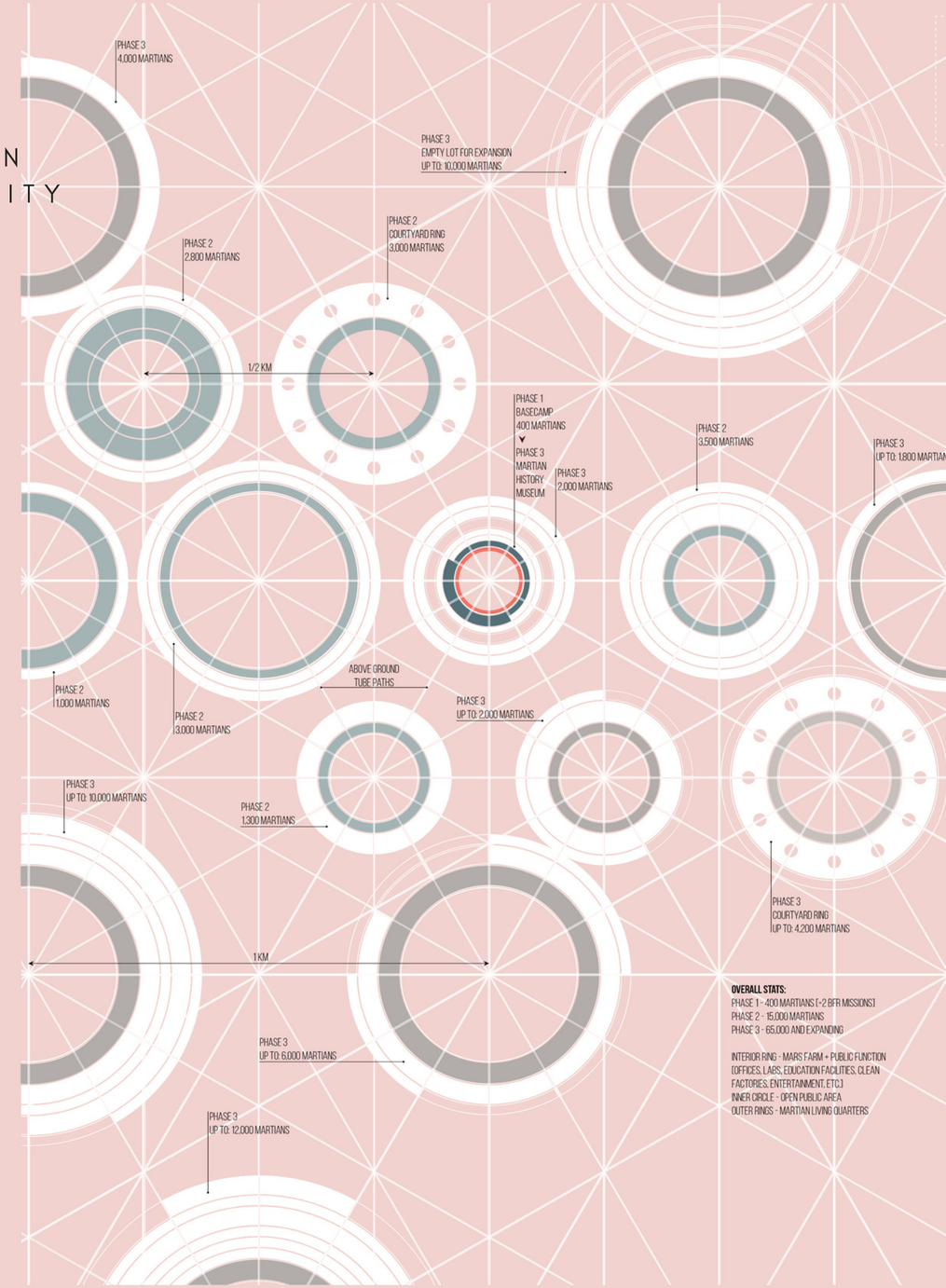


- "Contact Cultures" (South America, the Middle East, Southern Europe) and "Non-Contact Cultures" (Northern Europe, North America, Asia)
- women preferred more personal space from strangers than men, however cultural outweighed gender when influencing personal space perspectives



ZISO
Habitability
Research
(ongoing)

HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS



CONSEQUENTLY, THE MARTIAN PHYSICAL EVOLUTION WILL CONSIST OF STRONGER, MORE MUSCULAR AND FLEXIBLE LOWER BODY IN ADDITION TO LONGER AND BROADER TORSO FOR STORAGE OF MORE OXYGEN WHEN THERE IS LESS OF IT AROUND. MARTIAN MEN AND WOMEN WILL BECOME THE SAME SIZE DUE TO EQUAL SOCIAL ROLES AND PHYSICAL ACTIVITY. THE MARTIAN WILL WEAR A PROTECTIVE SKIN TIGHT SHIELD FROM THE RADIATION, DUST GOGGLES AND MOUTH AND NOSE COVER UNTIL COMPLETING THE EVOLUTION TRANSFORMATION.

PHASES OF COLONIZATION:

PHASE 1 - BASECAMP AS A SELF SUSTAINED ECOSYSTEM OF RINGS AND SHELLS WHICH FUNCTIONS AS LIVE-WORK-PLAY ENVIRONMENT, HOUSING 400 HUMANS ARRIVING BY TWO BFR FLIGHTS OVER A 4 YEAR SPAN. BASECAMP SIZE IS DICTATED BY DIMENSIONS AND WEIGHT LIMITS OF BFR PAYLOAD. IN ORDER TO PREVENT THE MARTIAN WORLD FROM USING 'FALCONS' AS DIMENSION STANDARD, BASECAMP WILL NOT BE CONTINUED TO NEXT PHASES.

PHASE 2 - SET ON A ½ KM CENTER GRID, CONSISTS OF LARGER RINGS MADE FROM LOCAL MARTIAN MATERIALS, MAINLY BY SYSTEM OF 3D PRINTING AND MELTING FOR RE-USE. EACH RING HAS DIFFERENT WORK-PLAY FUNCTIONS AT ITS CORE, ALONG WITH THE AEROPONIC MARS FARM.

PHASE 3 - SET ON 1KM CENTER GRID AND EXPANDING. EACH RING WILL REPRESENT A NEIGHBORHOOD AND EVENTUALLY A FULL CITY. FUTURE REMOVAL OF DOME AND OUTER ATMOSPHERE SHELL ACCORDING TO HUMAN ADAPTATION. TRANSFORMATION OF BASECAMP INTO A MARTIAN HISTORY MUSEUM BY ADDITION OF SURROUNDING RINGS.

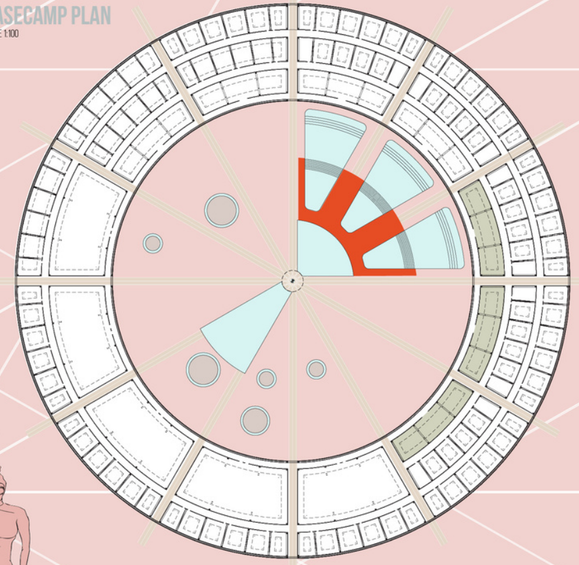
OVERALL STATS:

PHASE 1 - 400 MARTIANS (~2 BFR MISSIONS)
PHASE 2 - 15.000 MARTIANS
PHASE 3 - 65.000 AND EXPANDING

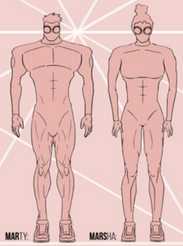
INTERIOR RING - MARS FARM + PUBLIC FUNCTION (OFFICES, LABS, EDUCATION FACILITIES, CLEAN FACTORIES, ENTERTAINMENT, ETC.)
INNER CIRCLE - OPEN PUBLIC AREA
OUTER RINGS - MARTIAN LIVING QUARTERS

BASECAMP PLAN

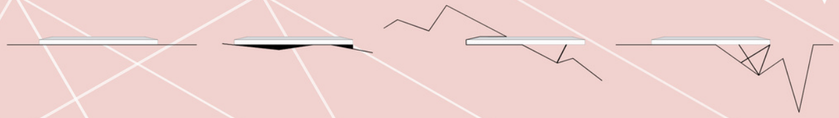
SCALE 1:100

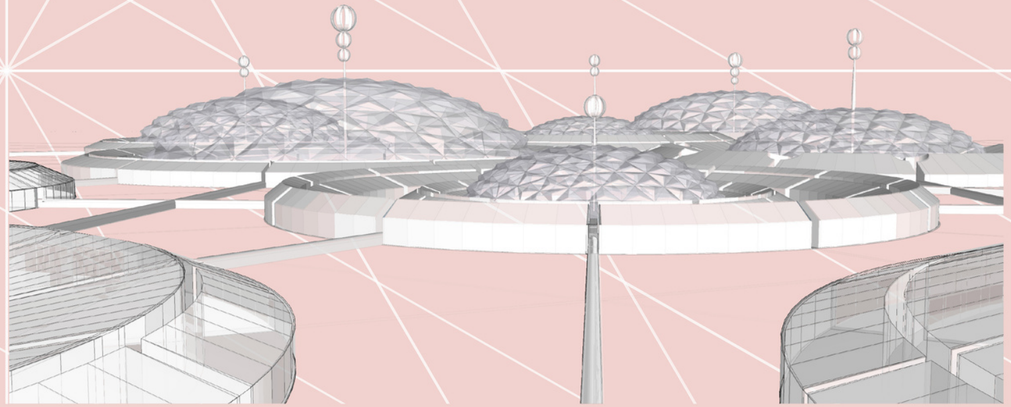


MEET THE MARTIANS



RING ON DIFFERENT TOPOGRAPHICAL SURFACES





Graphics by ZISO

HUMAN
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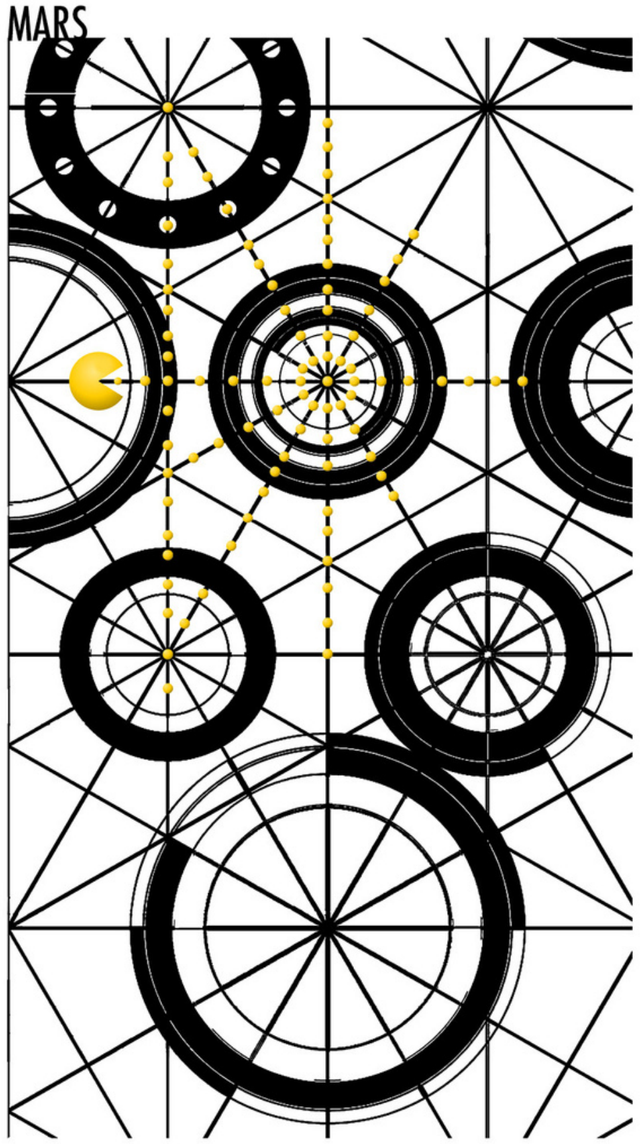
IMPACT ON
HABITABILITY
AND
MISSION
SUCCESS

safety



Graphics
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HUMAN
CENTERED
DESIGN
IMPACT ON
HABITABILITY
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SUCCESS

PREPARING FOR THE OF FUTURE SPACE TRAVEL

IS DESIGNING
FOR DIFFERENT
GENDERS, AGES,
BACKGROUNDS
AND ABILITIES

HUMAN
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DESIGN
IMPACT ON
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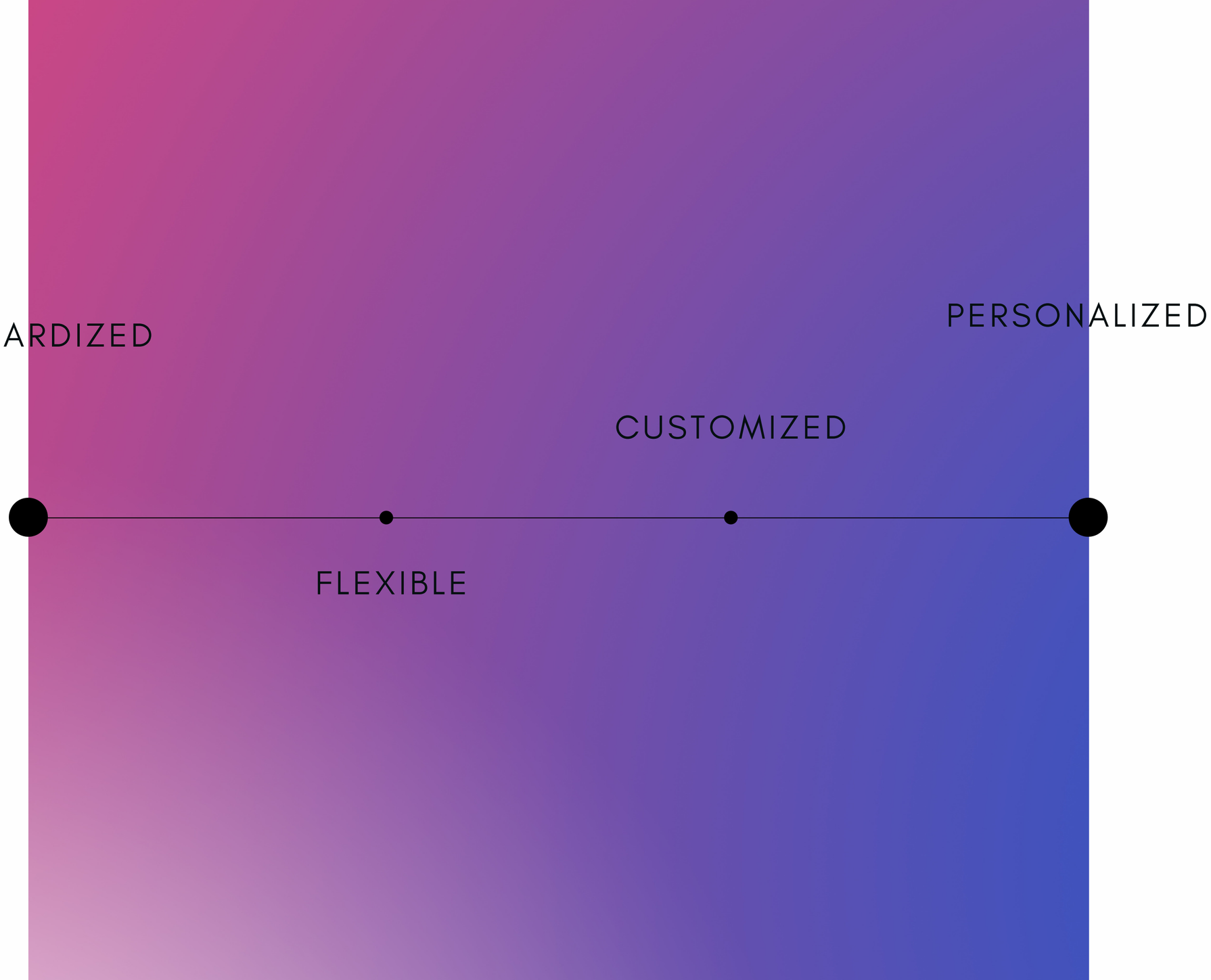
SUCCESS



HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS

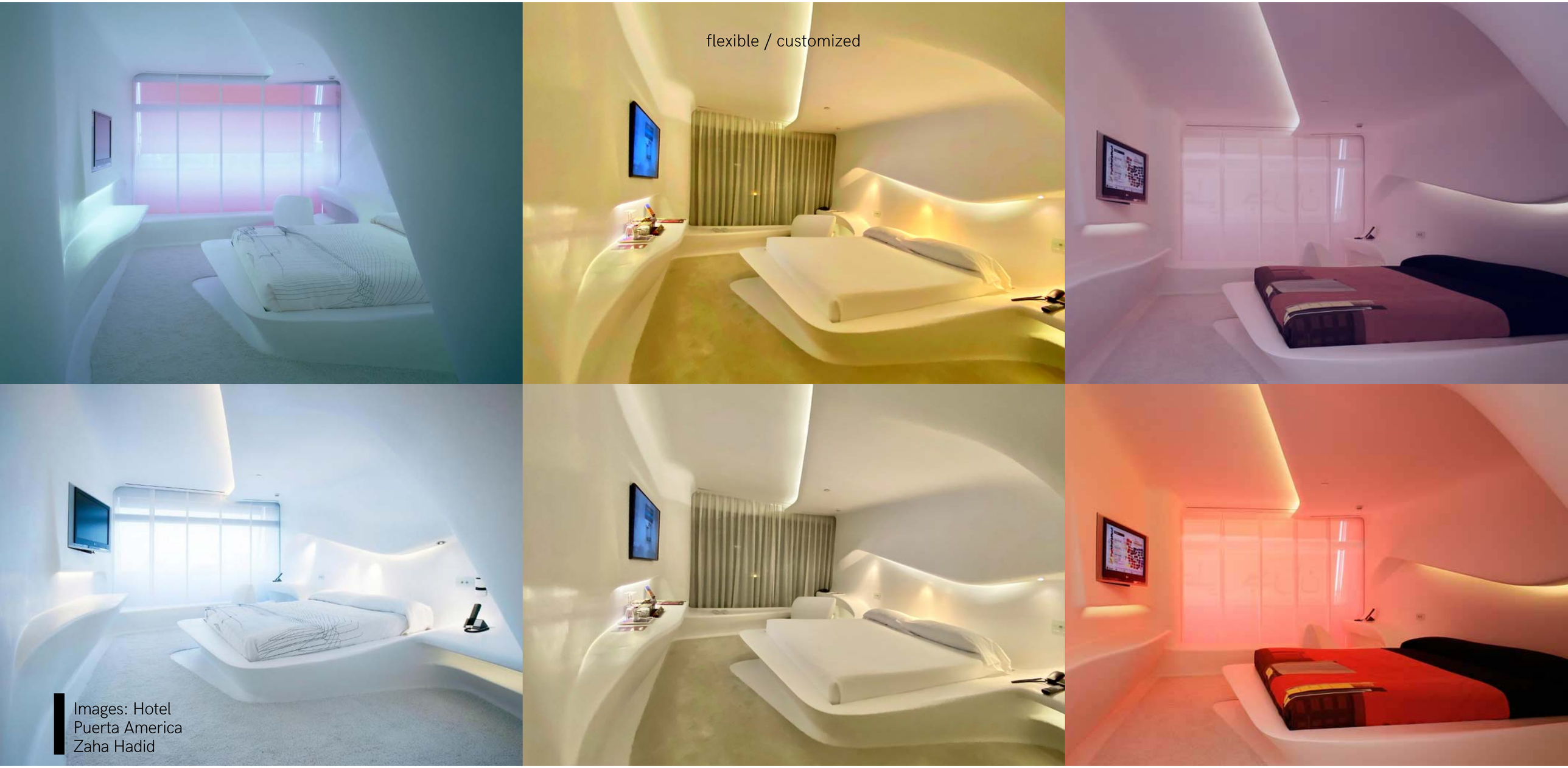
standardized

personalized

Photographs:
by NASA

SOYUZ
MS-15

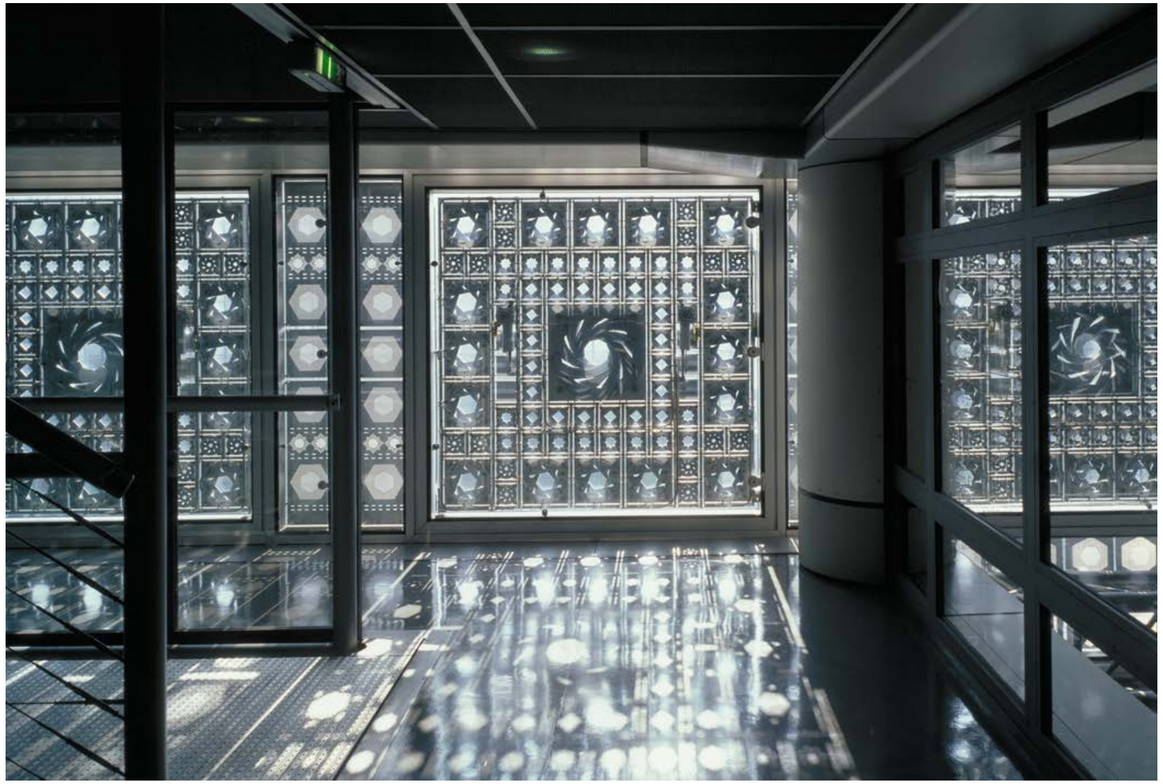
DRAGON
SpaceX Crew-1

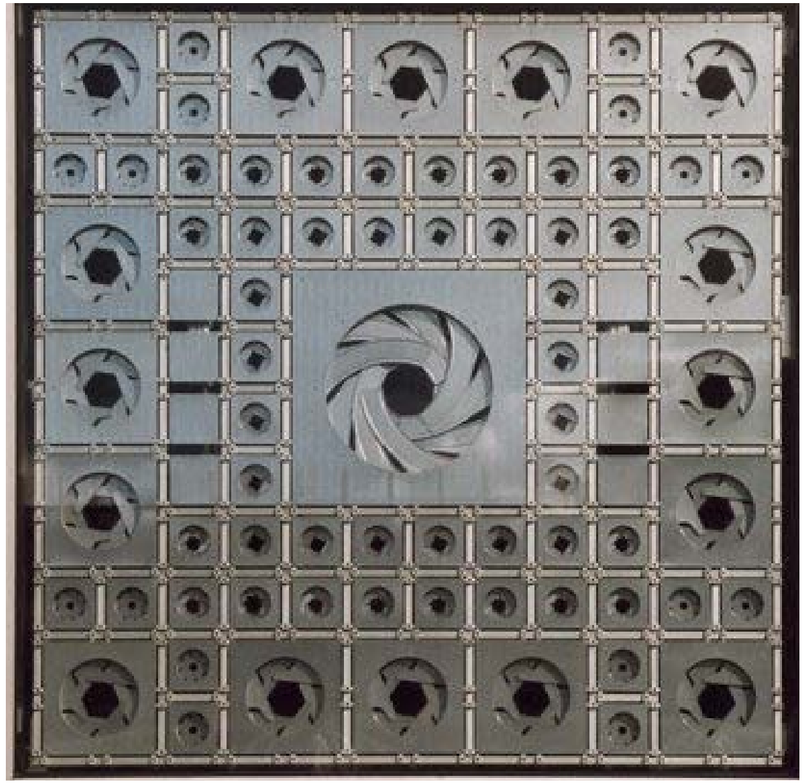


Images: Hotel
Puerta America
Zaha Hadid

HUMAN
CENTERED
DESIGN
IMPACT ON
HABITABILITY
AND
MISSION
SUCCESS

flexible / customized





Images: aperture shutters -
Institut du Monde Arabe,
Paris by Jean Nouvel (1987)

HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS

standardized

flexible/customized

BRAZIL CONTEMPORARY - CONTEMPORARY ART, ARCHITECTURE, VISUAL CULTURE AND DESIGN

'JUMP IN' INTERACTIVE ART INSTALLATION PHOTO VIA PEARLFISHER LONDON DESIGN STUDIO

Photographs (left): by NASA

CURRENT ISS SLEEP SOLUTIONS

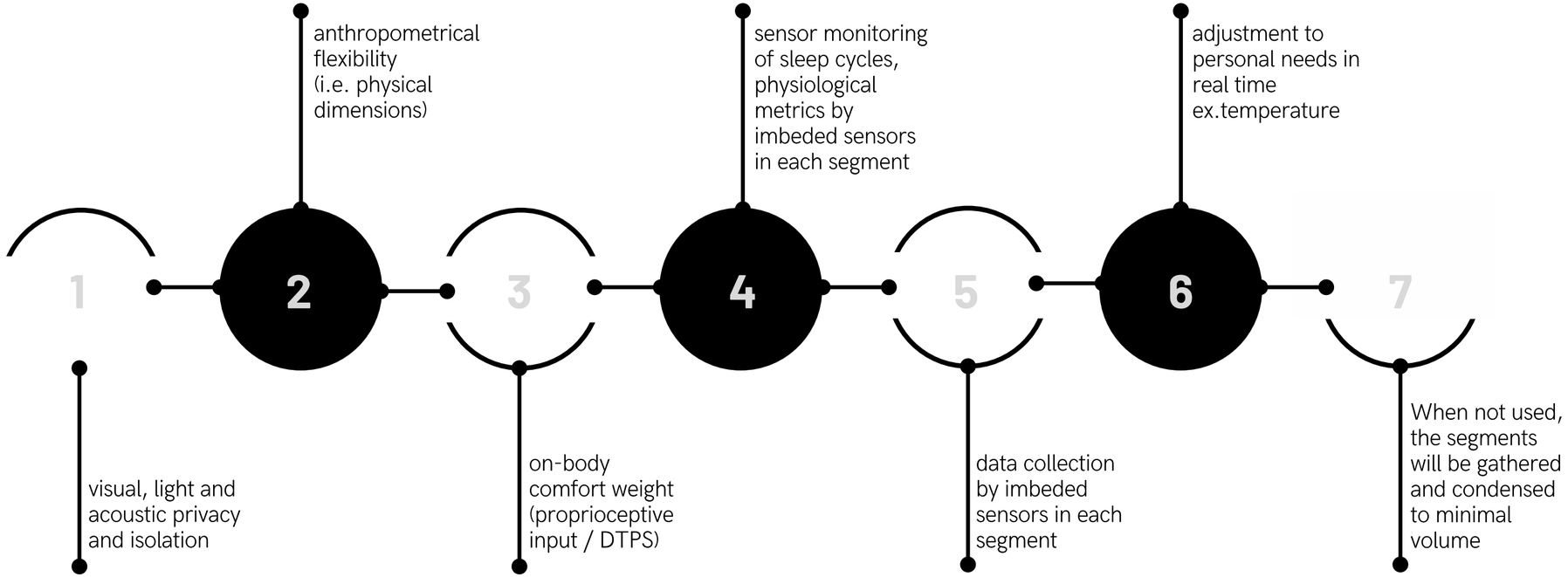
crew quarters / strapped sleeping bags

NEW POTENTIAL SOLUTIONS

feeling in volumes with segments

HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS

interdisciplinary approach for quality sleep in space
filling existing volumes with customized expandable segments that fit and mold around any body-type, providing:

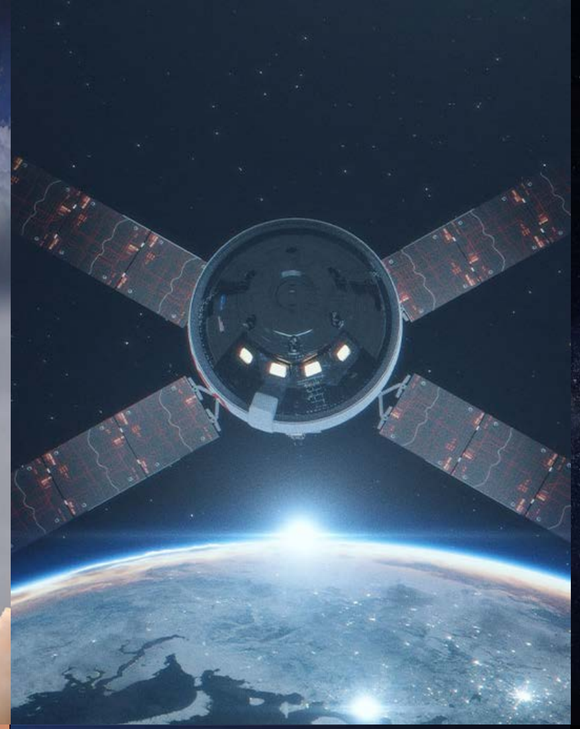
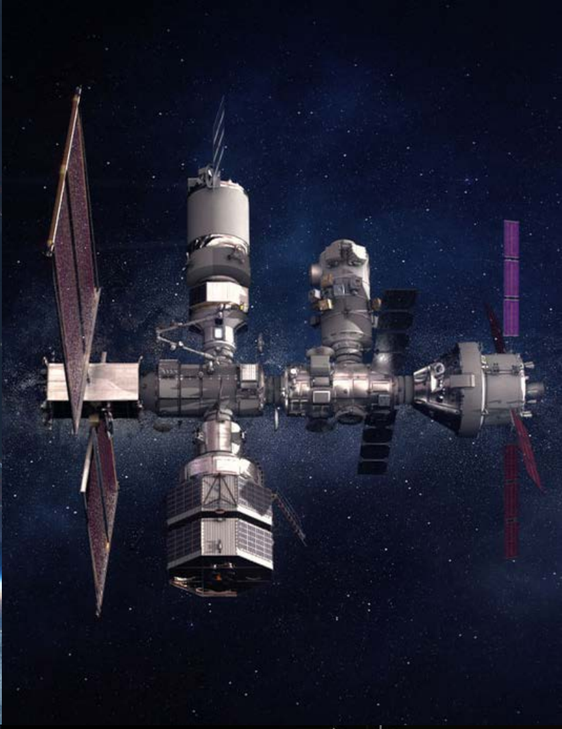


graph by ZISO

HUMAN CENTERED DESIGN IMPACT ON HABITABILITY AND MISSION SUCCESS

LONGER DURATIONS
MULTIPLE SPACE ENVIRONMENTS
DIVERSE CREW
NEW VEHICLES

NEW MISSION SUCCESS PARAMETERS
?


SLS, Orion Space craft, Gateway + HALO (Habitation and Logistics Outpost), Human Landing Systems, Artemis lunar base camp, Mars

Images:
By NASA

HUMAN CENTERED DESIGN CAN IMPACT
HABITABILITY AND MISSION SUCCESS

IT IS A PART OF THE HUMAN-ENVIRONMENT INTERACTION AND CAN BE MANIFESTED IN LOW TECH AND HIGH TECH SOLUTIONS

THE NEW ERA OF HUMAN SPACEFLIGHT IS A NEW OPPORTUNITY TO CREATE THE INTEGRATION IN THE PLANNING AND ENGINEERING PROCESS

AD
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