# SPACETALK

DESIGN SPECIFICATION


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**SPONSORS**

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MHCI+D

# Introduction

National Aeronautics and Space Administration (NASA) spacecraft missions require scientists and engineers across the country to share complex mission data with each other. Yet, data such as scientific instrument schedules, spacecraft orientation, and orbital trajectory are difficult to convey with static presentations, texts and charts. Remotely located scientists and engineers need a quick and easy means of discussing complex mission-centric data in order to make decisions, or to gain a holistic understanding of the mission.

To solve this issue, we've designed *SpaceTalk*: a collaborative mobile virtual reality (VR) application that creates an interactive and immersive simulation of NASA spacecraft missions. With *SpaceTalk*, users can easily view past, present and project states of missions either individually or collaboratively as if they were in orbit beside the spacecraft.

Those with the *SpaceTalk* app installed on their mobile device can request a VR talk with other users and discuss complex mission information in context. We believe that the accessibility and immersion of mobile VR will enable scientists and engineers to collaborate with each more efficiently and effectively than ever before, saving NASA precious time and resources in missions.

This *Design Specification* is meant to describe the *SpaceTalk* application in full to create as little friction as possible during the development process. It is composed of an architecture, system flow, interaction model and visual system to create a holistic definition of the application.

# Contents

# 01

# Architecture

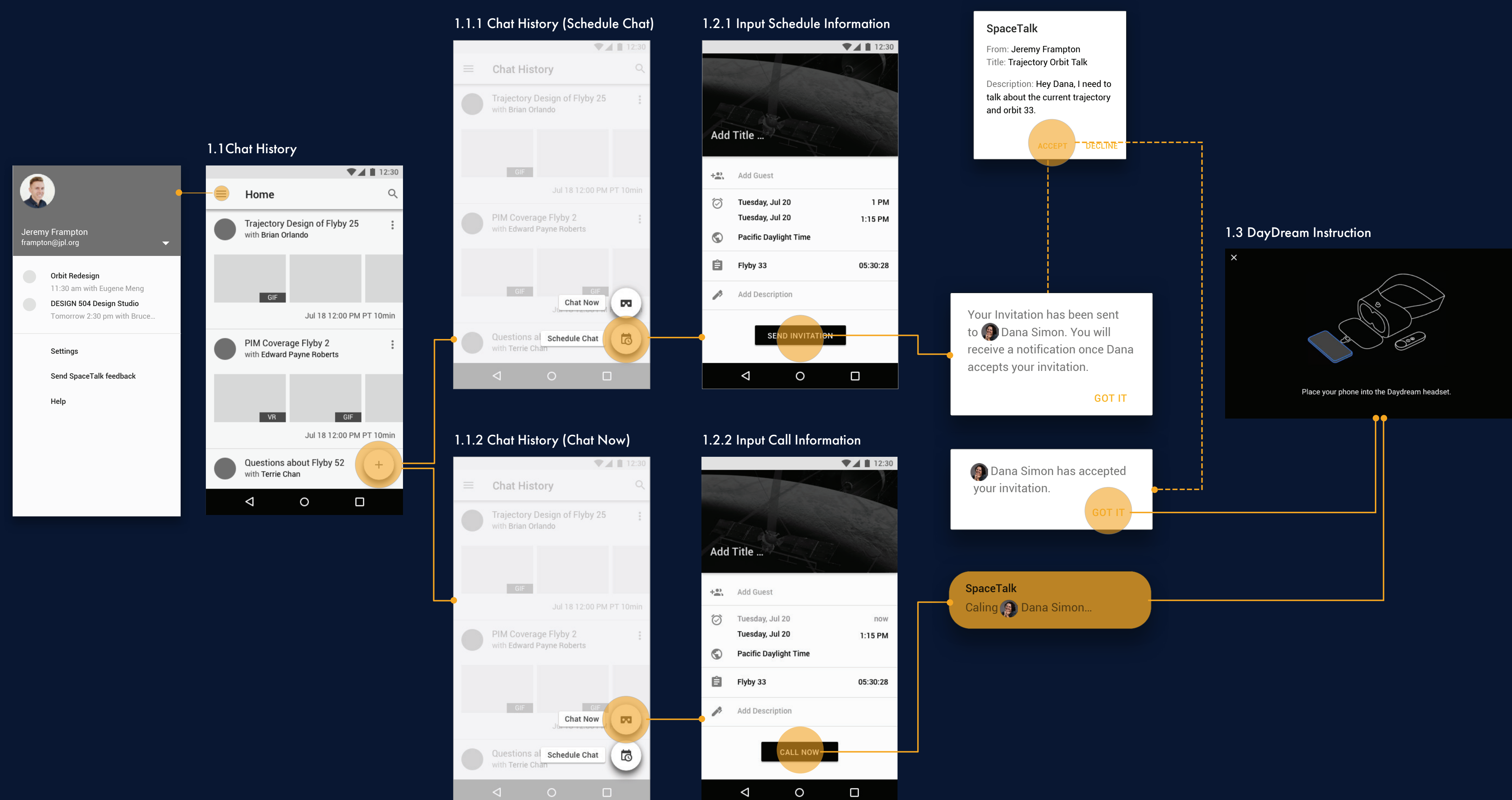
The Architecture describes how content in the application is composed in terms of information hierarchy to facilitate intuitive interactions.

# Mobile Site Map

*SpaceTalk* leverages the power of existing smartphones to create a convenient and collaborative VR experience.

Users of the mobile application can start a talk or schedule a future talk with other users with a specific mission, orbit, and time in mind.

During a *SpaceTalk*, screen captures in the form of screenshots, GIFs, and full VR scenes will be autosaved in a user's profile, which can be accessed on the phone and shared externally with other mission personnel via the mobile application.



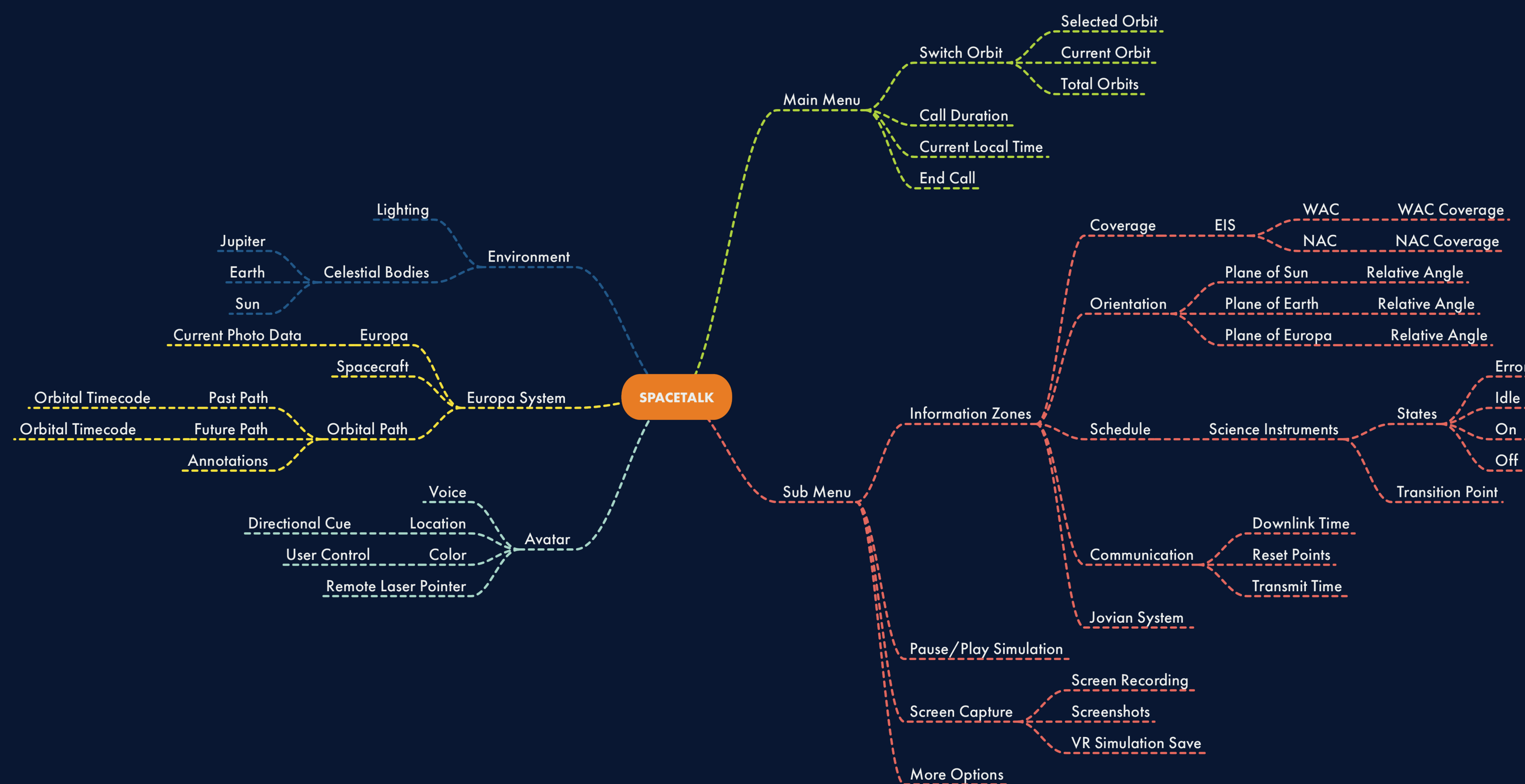
# VR Information Architecture

*SpaceTalk* simulates a space view of the Europa Clipper mission by visualizing the physical environment and relevant mission datasets in 5 information zones designated by distance, each featuring specific sets of data.

The match of information zones with particular a data visualization takes into consideration the contextual need of data analysis in order to optimize the viewing conditions for specific scientific tasks.

Additionally, SpaceTalk accommodates the social aspect of collaboration by allowing people to see the presence of their collaborators in the form of avatars. Visual cues like color and motion are also used to augment the collaborative experience.

Although *SpaceTalk* is designed for the Europa Clipper mission, it can be easily adapted for other spacecraft missions as well.



# 02

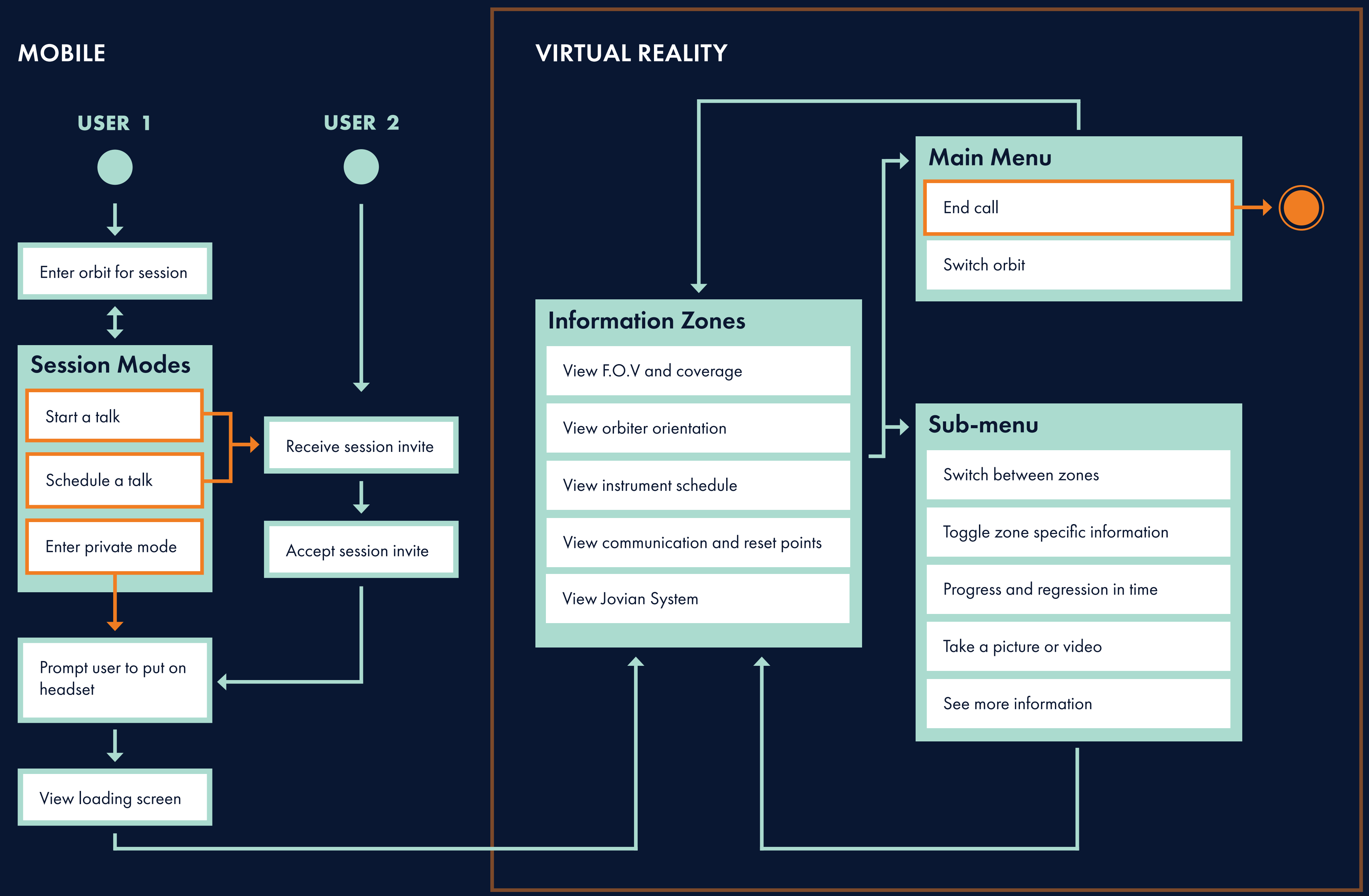
## System Flows

System flows describe the main interactions in the application and provide a systematic view of how it fits into current mission processes.

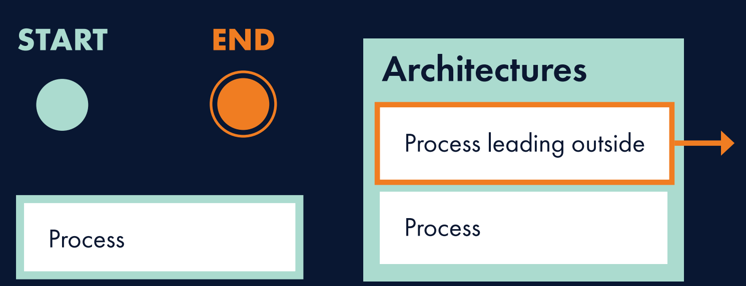
# Interaction Flow

With SpaceTalk, mission personnel will be able to initiate or schedule a talk with another *SpaceTalk* user regardless of their location. Once they arrive in a desired orbit in the VR experience, they will be able to explore 5 different information zones with different types of mission data.

Additionally, they will be able to progress or regress through time to explore how the mission has changed, or how it will change over time.



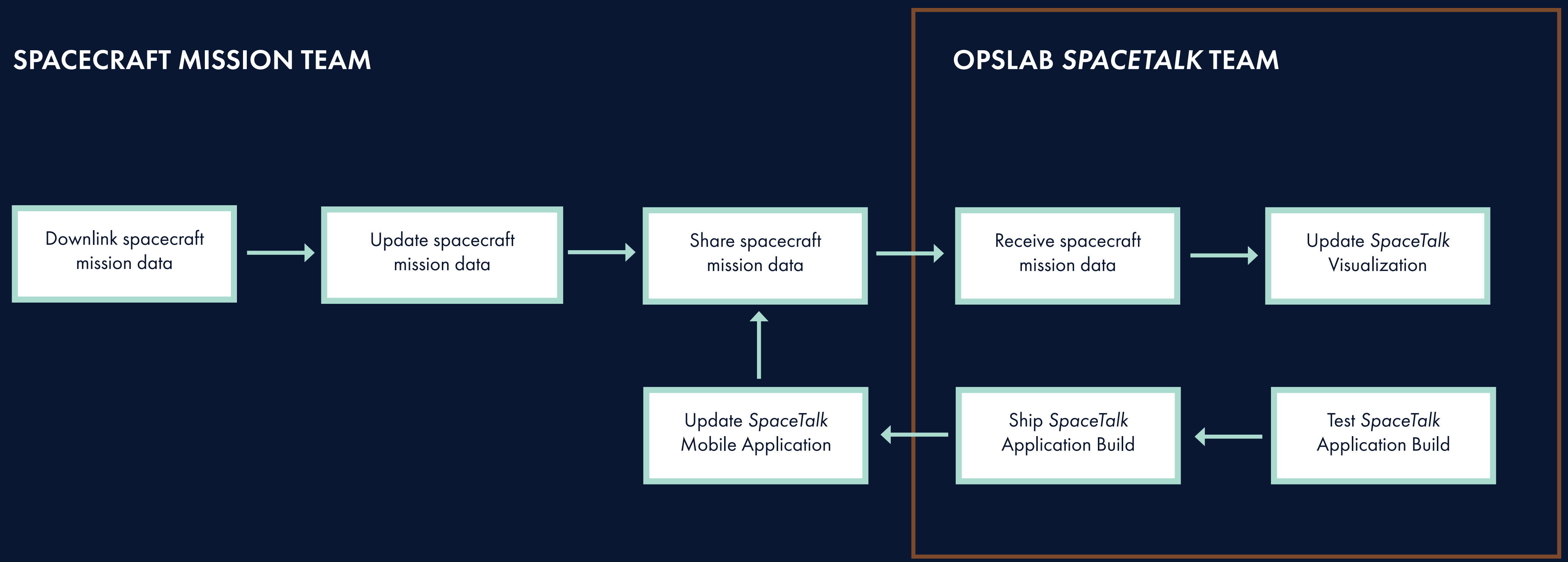

## LEGEND



# System Diagram

In order to maintain the SpaceTalk system, a Spacecraft Mission Team must share spacecraft mission data with the OpsLab SpaceTalk Team. In doing so, the SpaceTalk Team can receive the latest mission data to update, test, and ship a new build of the application.

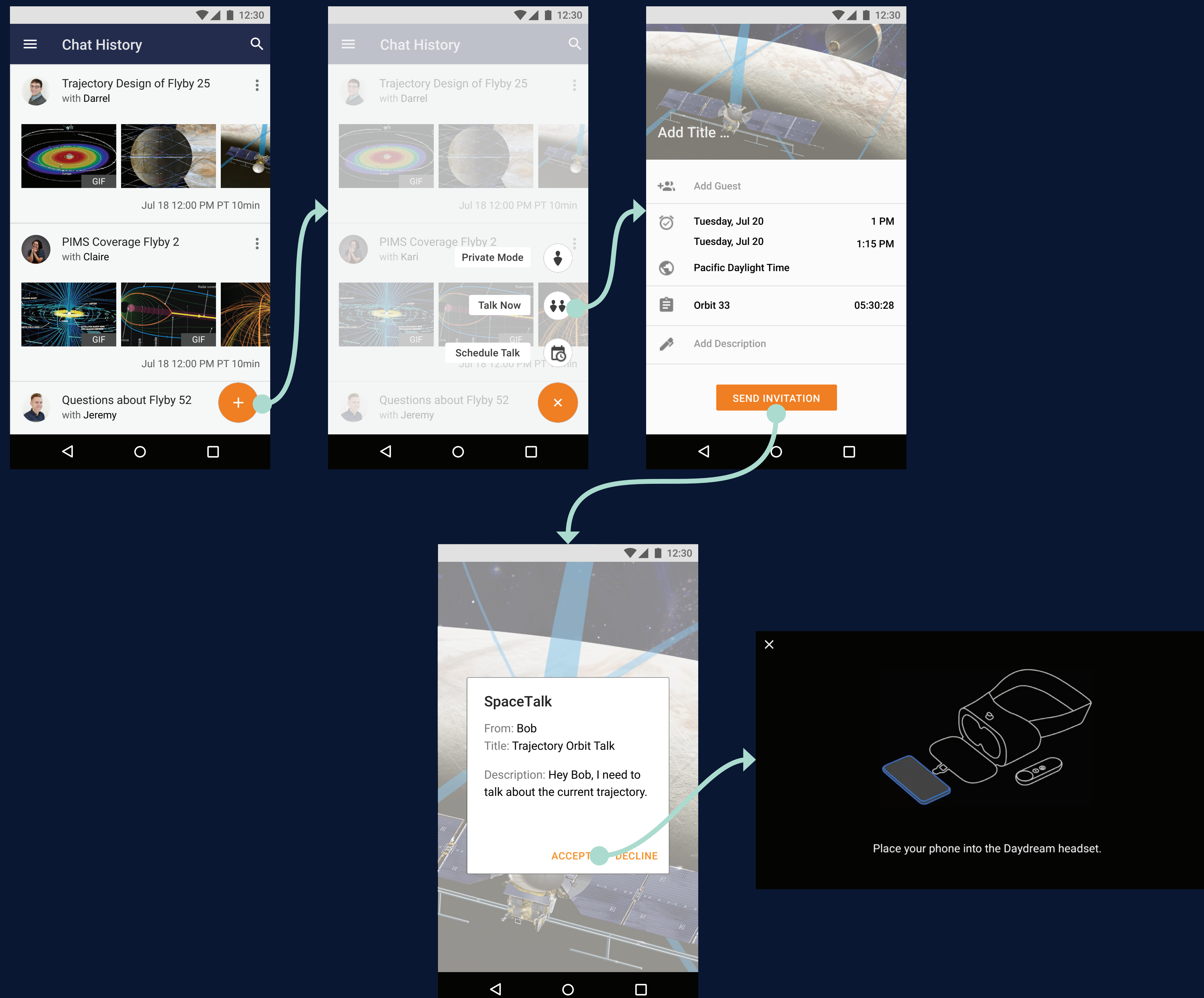
Because this is a government application and confidential mission data may exist, automatic updates via a traditional application store will most likely not be possible. If this is the case, SpaceTalk users will be prompted to update the application to the latest build in order to use it. If no confidential information exists and NASA Jet Propulsion Lab (JPL) does not mind public usage of the application, we recommend using the Google Play Store and Apple App Store.



# Flow 01

## START A TALK

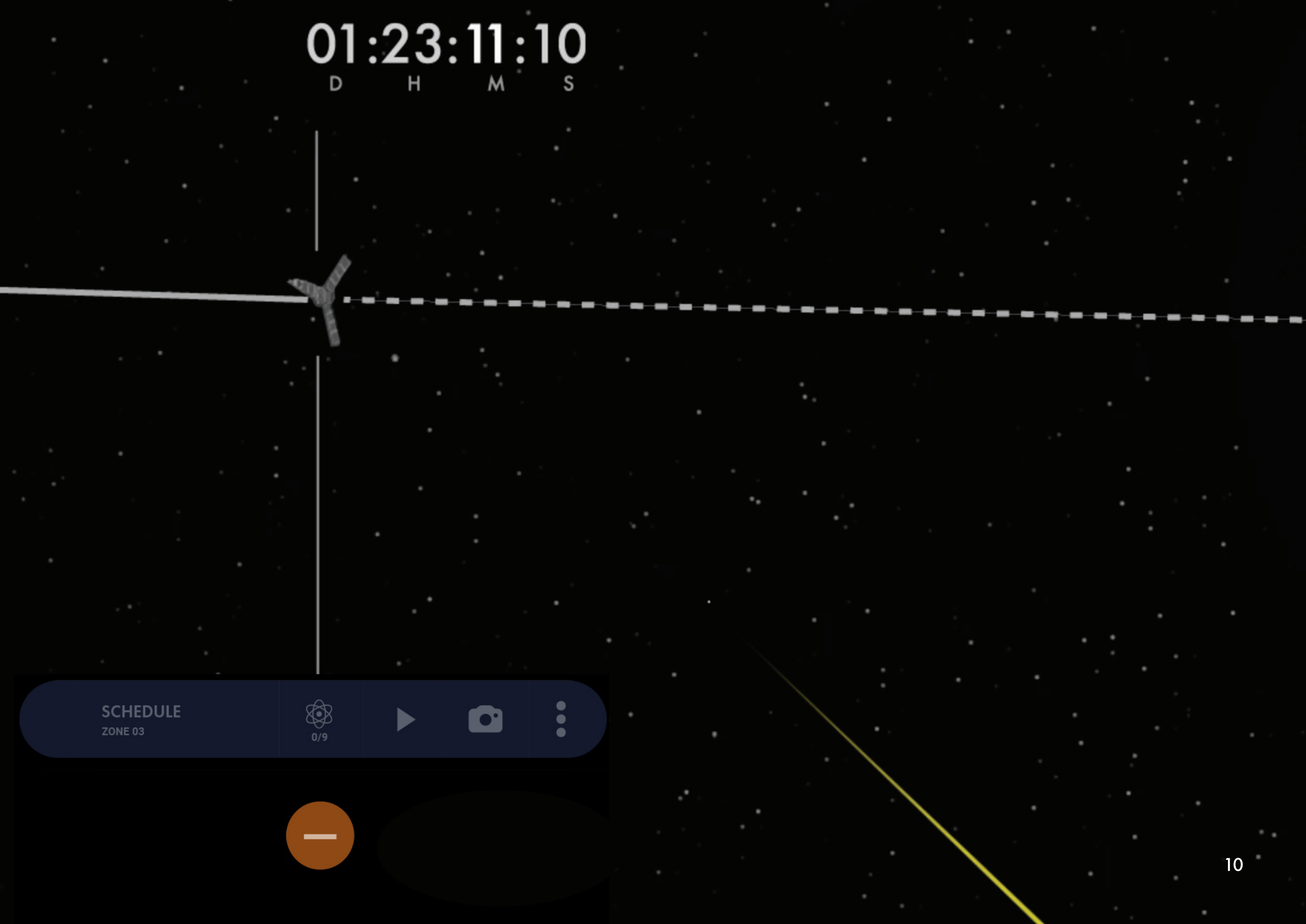
The following flow demonstrates how a user would initiate a Talk with another *SpaceTalk* user.



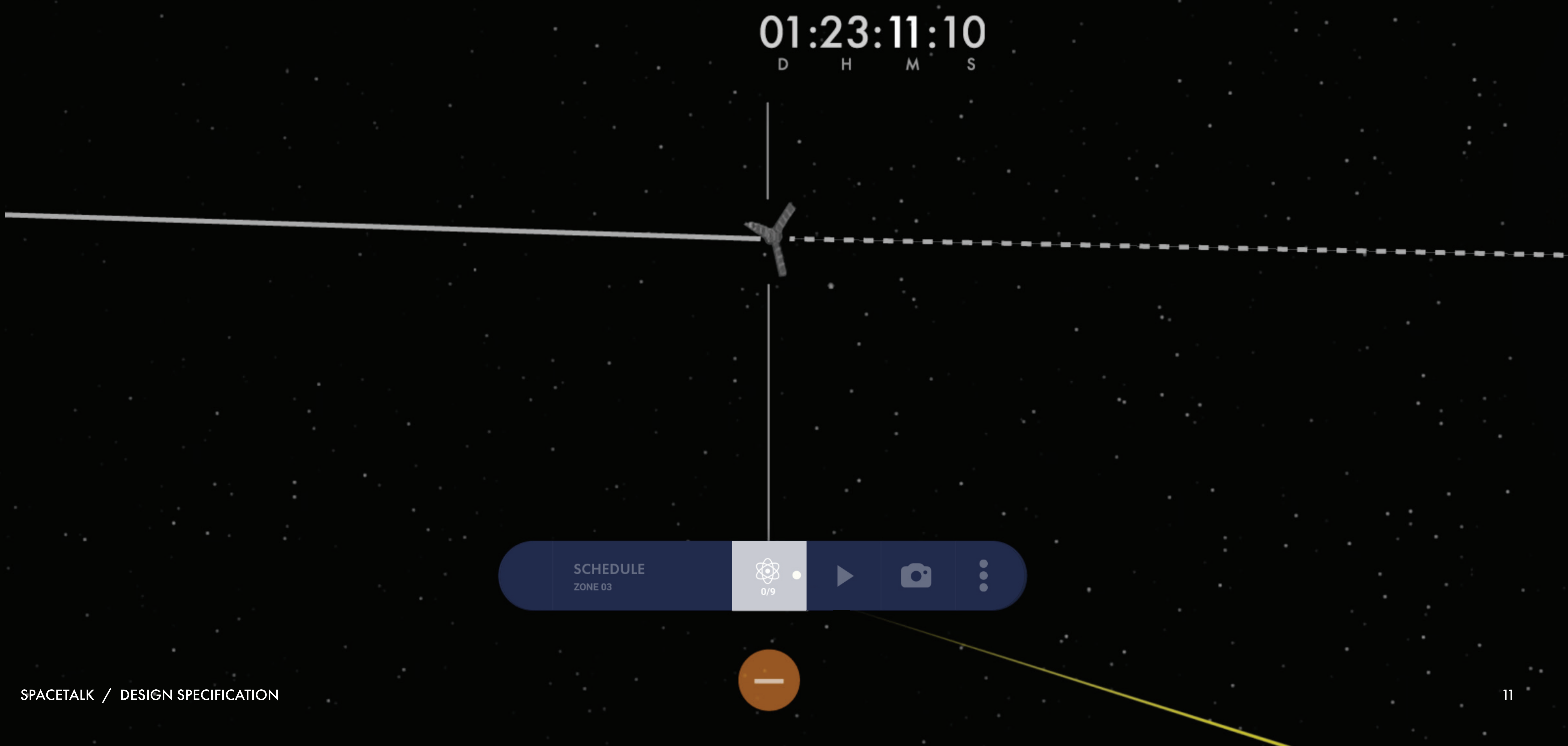
# Flow 02

## TOGGLE INSTRUMENT SCHEDULE DATA

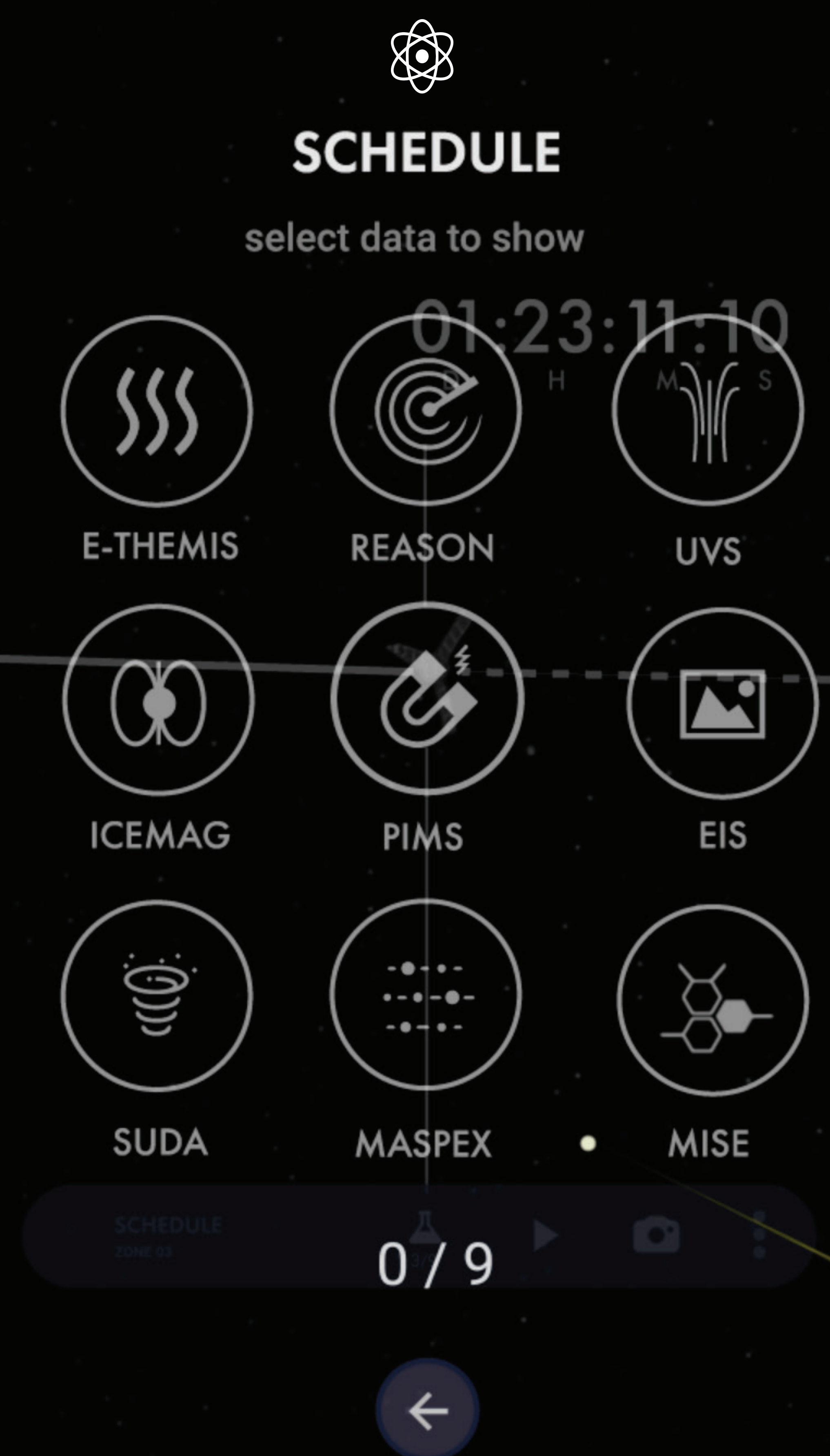
The following flow demonstrates how a user would go about toggling data in a zone, specifically science instrument data.



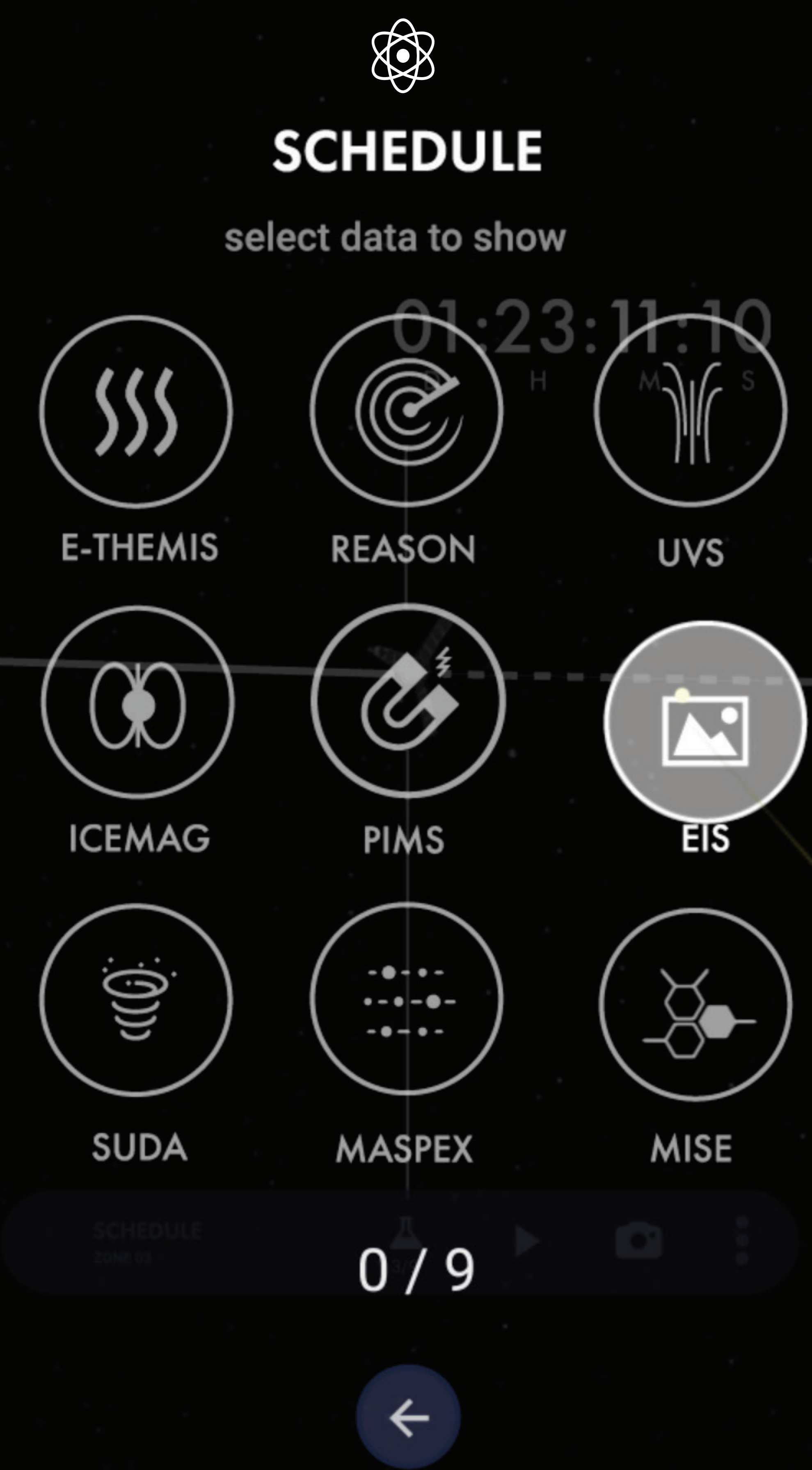
# Flow 02



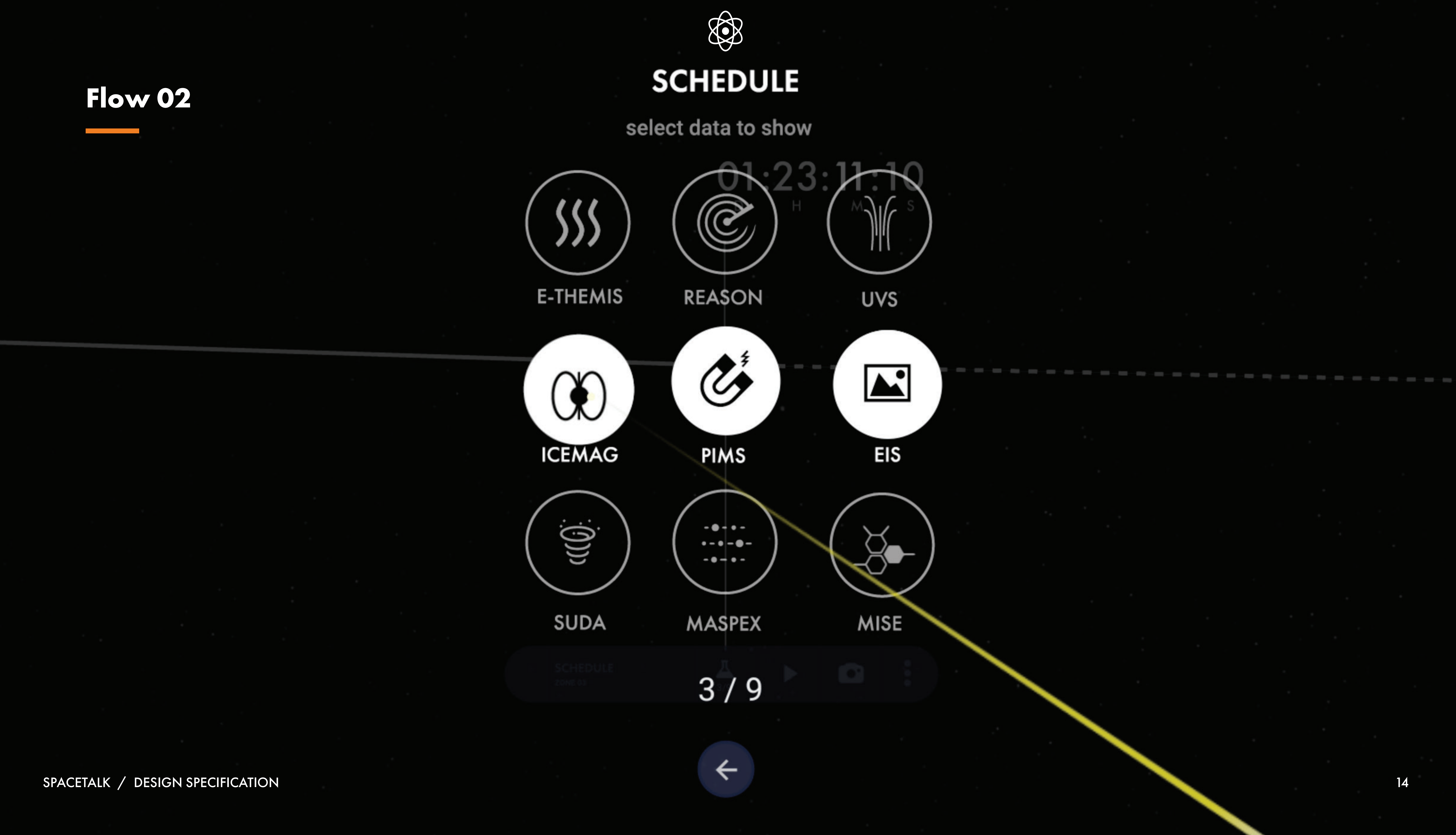
# Flow 02


SCHEDULE
select data to show
01:23:11:10
E-THEMIS
REASON
UVS
ICEMAG
PIMS
EIS
SUDA
MASPEX
MISE
0 / 9

## Flow 02


SCHEDULE
select data to show
01:23:11:10
E-THEMIS
REASON
UVS
ICEMAG
PIMS
EIS
SUDA
MASPEX
MISE
0 / 9

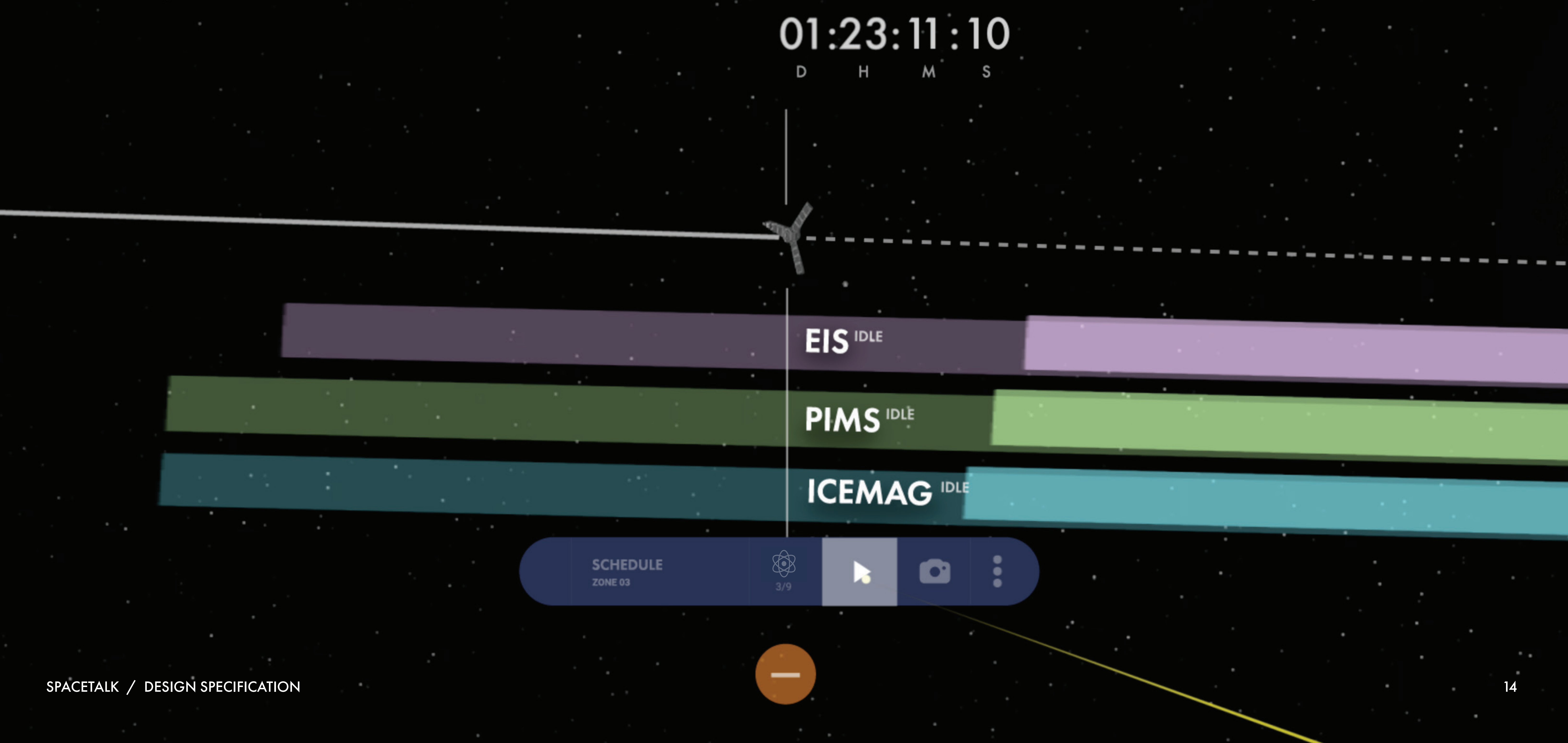
## Flow 02


SCHEDULE
select data to show
01:23:11:10
E-THEMIS
REASON
UVS
ICEMAG
PIMS
EIS
SUDA
MASPEX
MISE
3 / 9

# Flow 02


SCHEDULE
select data to show
01:23:11:10
E-THEMIS
REASON
UVS
ICEMAG
PIMS
EIS
SUDA
MASPEX
MISE
3 / 9

# Flow 02


01:23:11:10
D H M S
EIS IDLE
PIMS IDLE
ICEMAG IDLE
SCHEDULE
ZONE 03
3/9

# 03

# Interaction Model

The Interaction Model illustrates how to properly use the application and how users would go about interacting with the virtual environment.

# Mobile VR

SpaceTalk uses mobile VR technology, specifically Google Daydream. The Google Daydream headset is a smartphone-enabled VR device. It is completely untethered and only requires the user to place their Daydream-ready smartphone into the headset in order to be immersed in virtual reality.

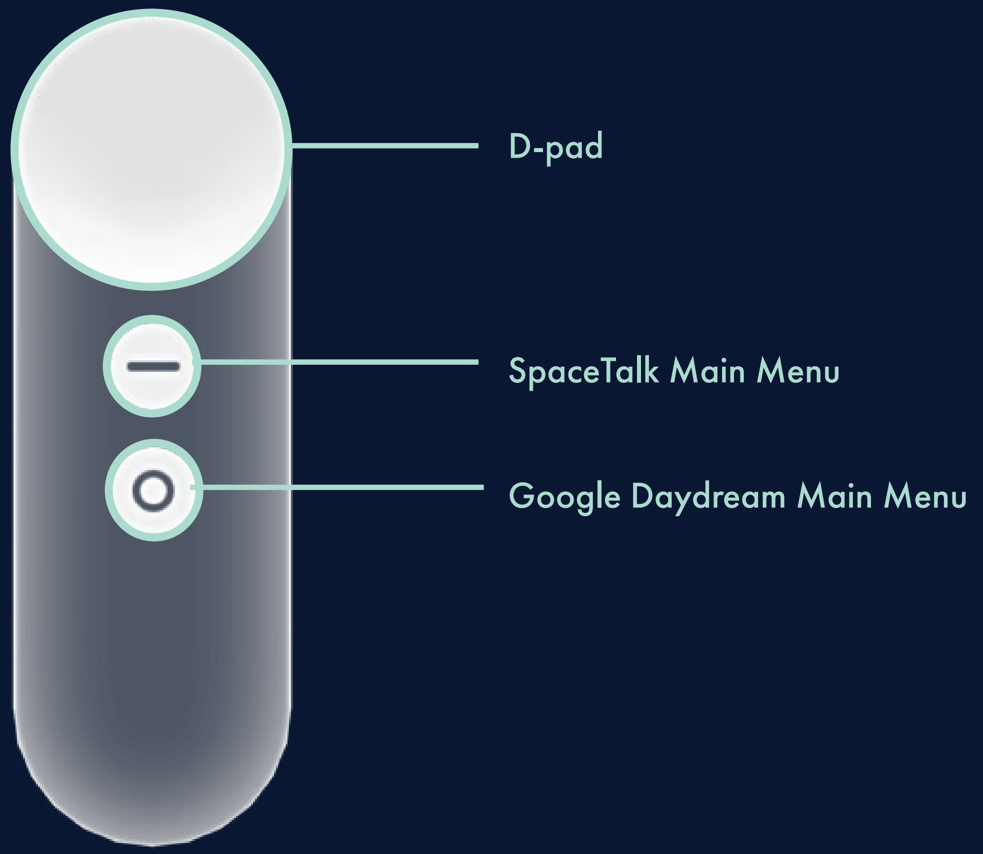
The device also comes with one remote to help users navigate in VR environments with more accuracy. To get the best possible collaborative experience in *SpaceTalk*, users should plug in headphones to hear their collaborator's voice and directional audio cues.

We expect mobile VR to become widely available on more devices, including the iPhone, in the near future. Therefore, we expect that these methods of interaction should carry over to future devices as well.

# REMOTE CONTROL

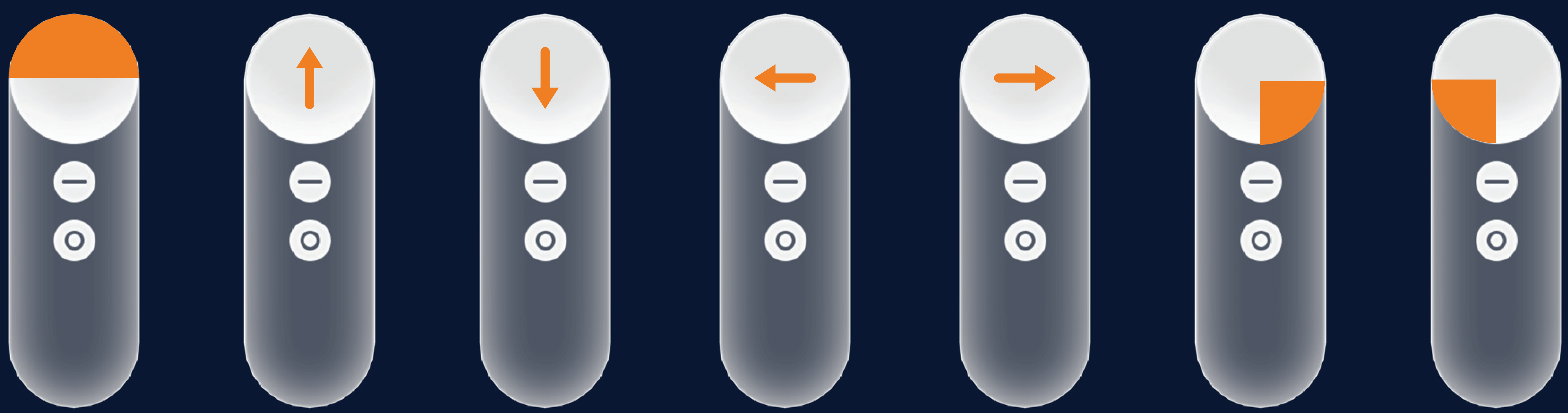
## MAIN INPUTS

The Google Daydream offers a large D-pad that is capable of receiving swipe and click input. Just below the d-pad are 2 smaller buttons - when clicked, the top one brings the user to SpaceTalk's main menu and the bottom to Google Daydream's main menu.



# REMOTE CONTROL

## APPLICATION NAVIGATION



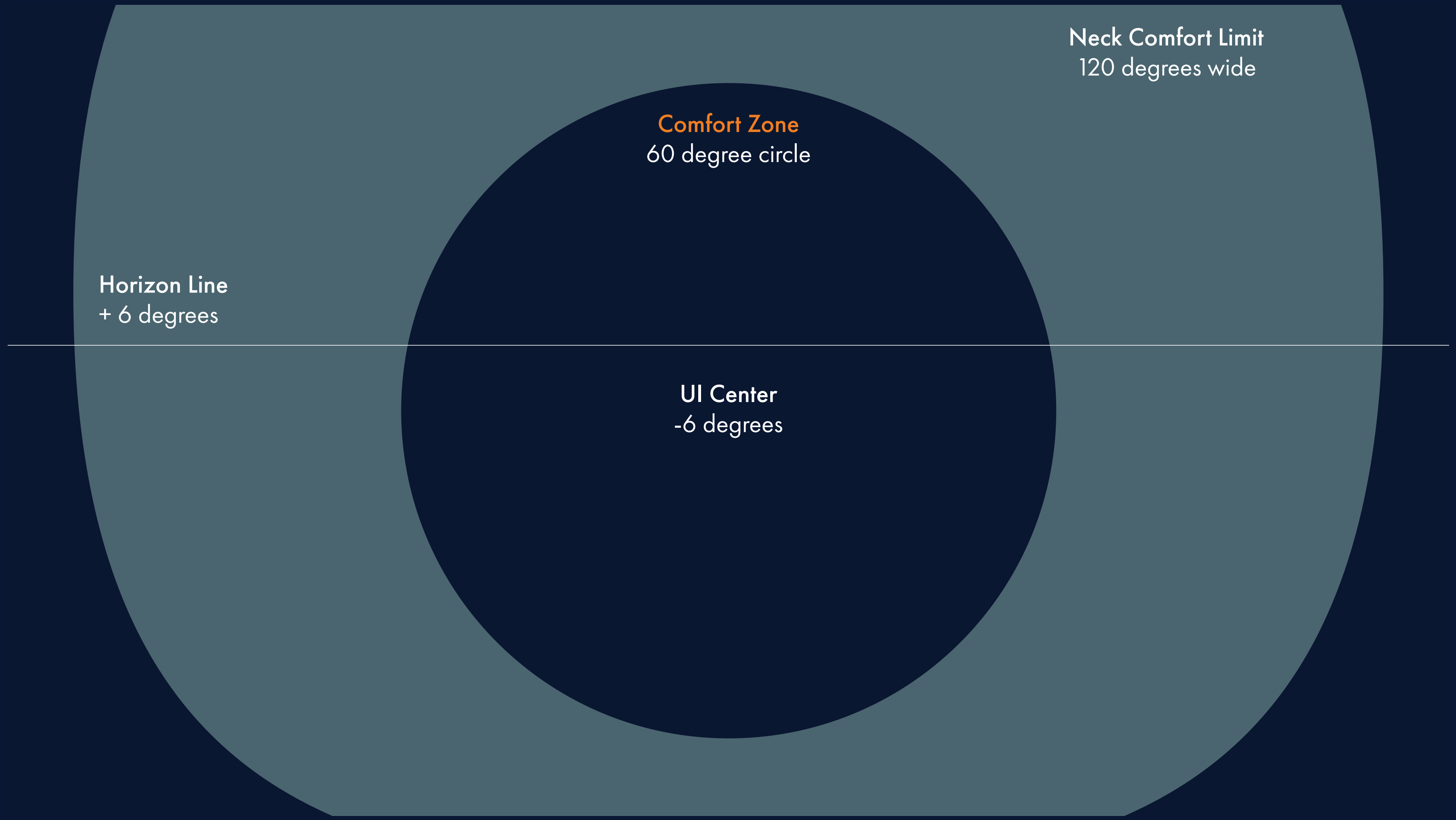
DIRECT SELECTION | MOVE ABOVE | MOVE UNDER | MOVE LEFT | MOVE RIGHT | ZOOM IN | ZOOM OUT

# ENVIRONMENT

## FIELD OF VIEW

Applying Google Daydream's design conventions, *SpaceTalk's* core content will render in the "Comfort Zone" of one's field of view.

Note:
*Humans naturally tilt their heads slightly downwards. In order to make reading content ergonomic, the "center" of the environment should be rendered 6 degrees lower than the Horizon Line.*



# ENVIRONMENT

## UI DISTANCE

In order to ensure legibility, visual comfort, and motor comfort, the Sub Menu is placed 2.5m away from the user. In addition, to respect information hierarchy, the main menu is placed at 2m. Other secondary overlay menus will also be placed 2m away from the user to respect content hierarchy.

# INFORMATION ZONES

The *SpaceTalk* experience is divided into 5 Information Zones. Each zone presents the user with a unique set of information that can be viewed at an optimal distance.

To travel between zones, users have the following 2 options:

*1. Click the Zone Navigation Button on the Sub Menu to open the Zone Navigation Map.*

*2. Zoom into or out of zones to be given a prompt to go to the next zone.*

Note:

*It is important to note that users can only explore within one zone at any given time. When one user travels to another zone, the other will follow. This is to support users' need for effective and timely collaboration.*

# INFORMATION ZONES

## ZONE 01 / COVERAGE

The Coverage zone allows the user to view from the perspective of the spacecraft as if they were looking through its camera. This feature is currently implemented specifically for the EIS, NAC, and WAC instruments on for the Europa Clipper mission.

# INFORMATION ZONES

## ZONE 02 / ORIENTATION

The Orientation zone allows the user to understand the orientation of the orbiter in relation to other celestial bodies.

# INFORMATION ZONES

## ZONE 03 / SCHEDULE

The Schedule zone allows the user to view the science instrument schedule in context alongside the spacecraft's orbital path and Europa. Each instrument will show its 4 states: on, off, idle, and error.

The user can toggle instruments on and off to see information that is relevant to their needs.

# INFORMATION ZONES

## ZONE 04 / COMMUNICATION

The Communication zone shows information that is relevant to the spacecraft's communication with Earth as well as the spacecraft's reset points. The information can be shown in past, present, and future states of its orbital path.

# INFORMATION ZONES

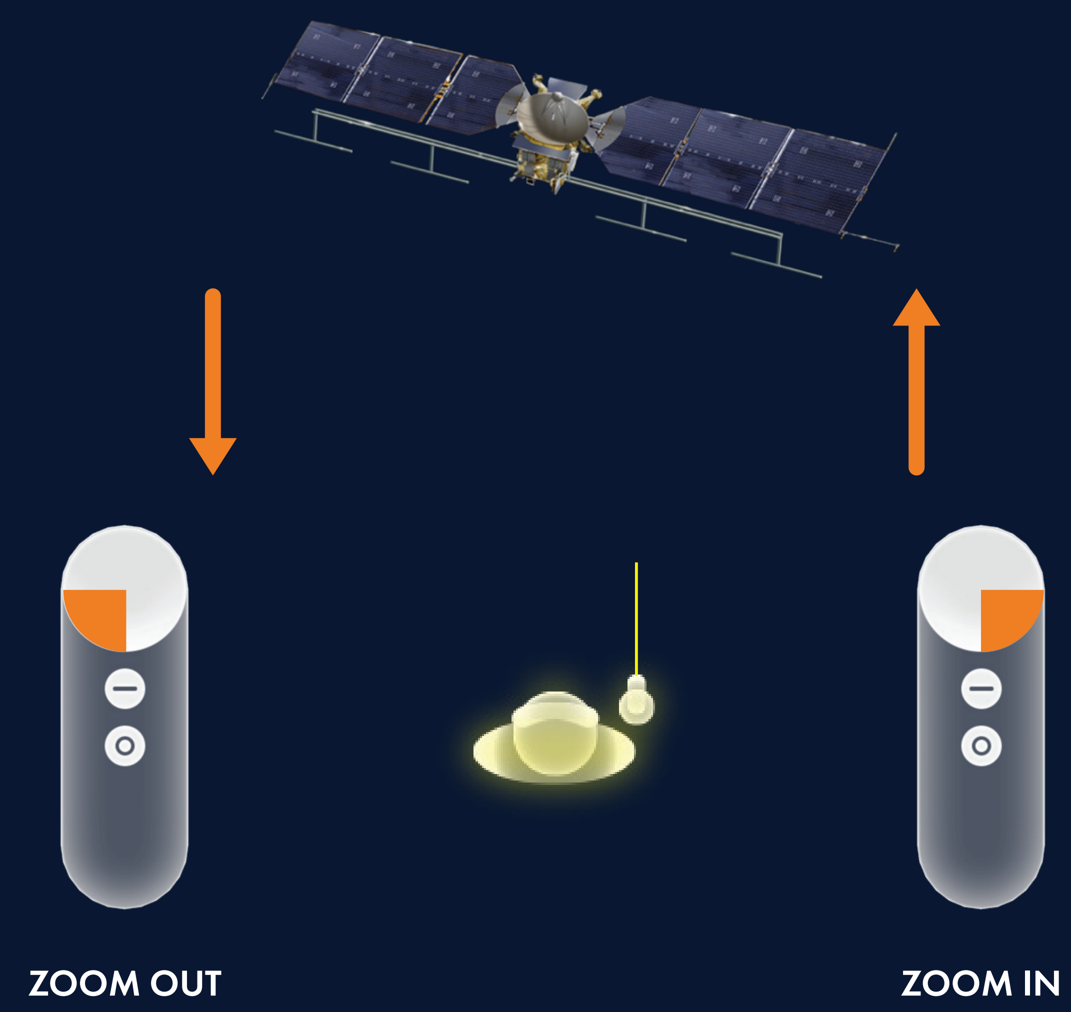
## ZONE 05 / JOVIAN SYSTEM

The furthest zone allows the user to see the Jovian System from a bird's eye view to get a bigger picture of the system. This currently doesn't have information to toggle, but should in the future following further application testing.

# MOVEMENT

## ZOOMING

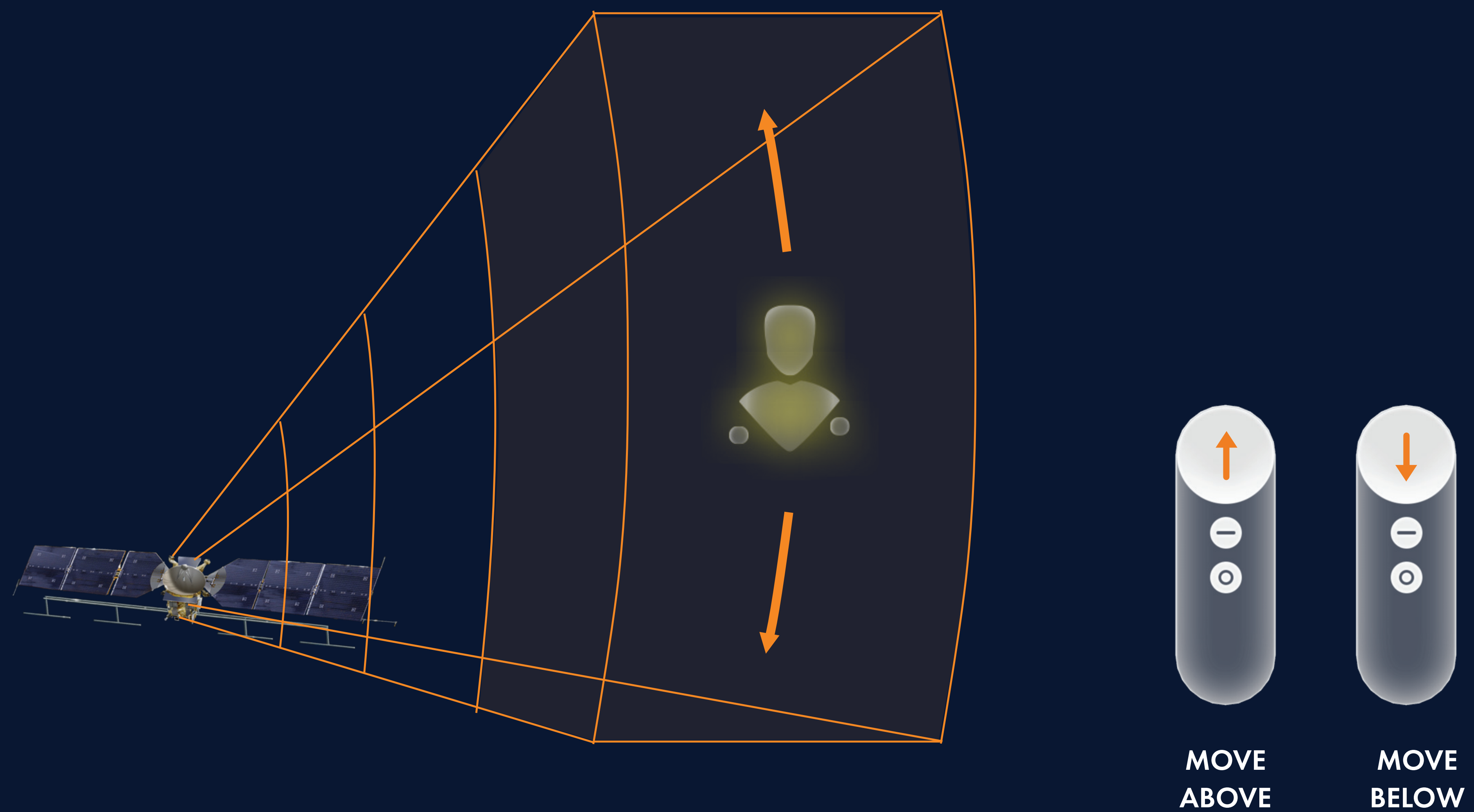
In order to ensure quick and seamless movements in space, the user is always anchored to the orbiter. Imagine there is a railway track that extends from the center of the spacecraft to the user. Users pivot around the spacecraft which you will see in the next page. By clicking or long pressing on the bottom quadrant of the controller, the user can zoom-in and out from the orbiter. Movement velocity should always remain consistent.



# MOVEMENT

## ABOVE AND BELOW

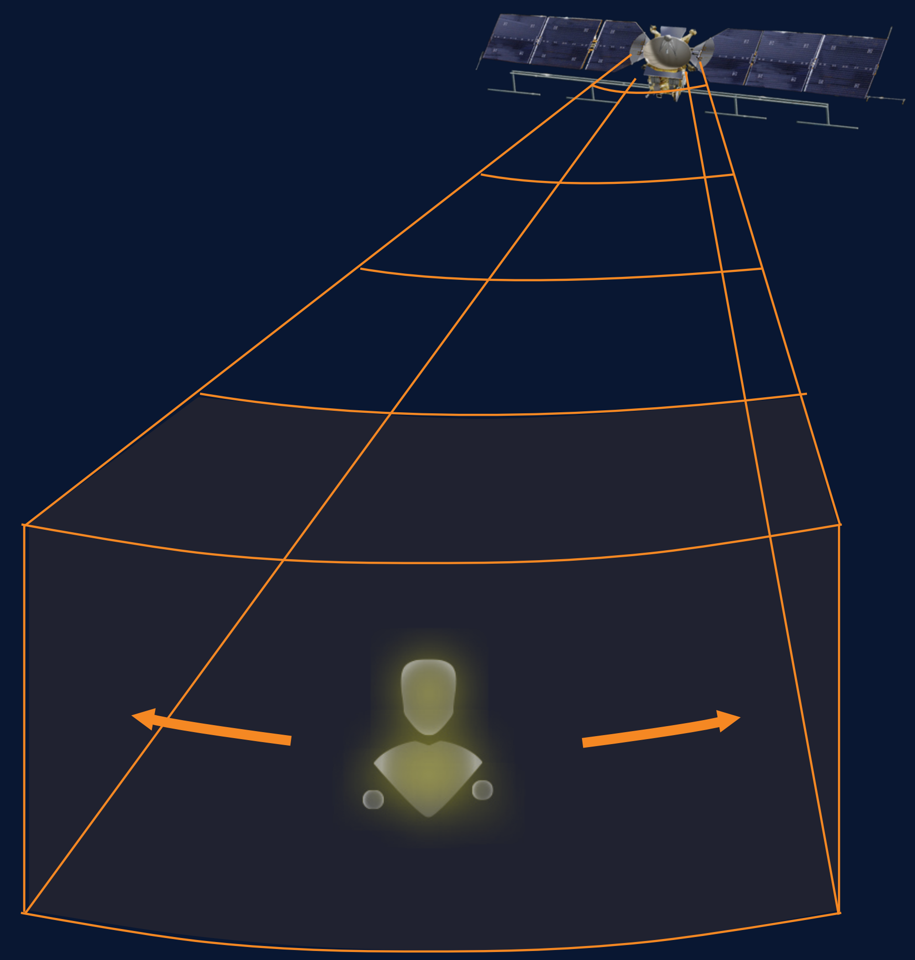
Anchored to the orbiter, the user can move above or below the spacecraft by swiping up or down on the Trackpad. The user can only move within one zone at a time.

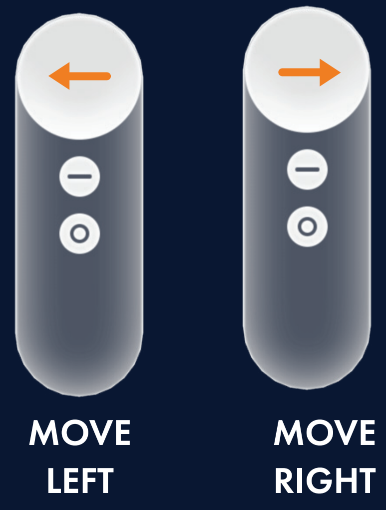


# MOVEMENT

### LEFT AND RIGHT

Anchored to the spacecraft, the user can move left or right by swiping left or right on the Trackpad. The user can only move within one zone at a time.





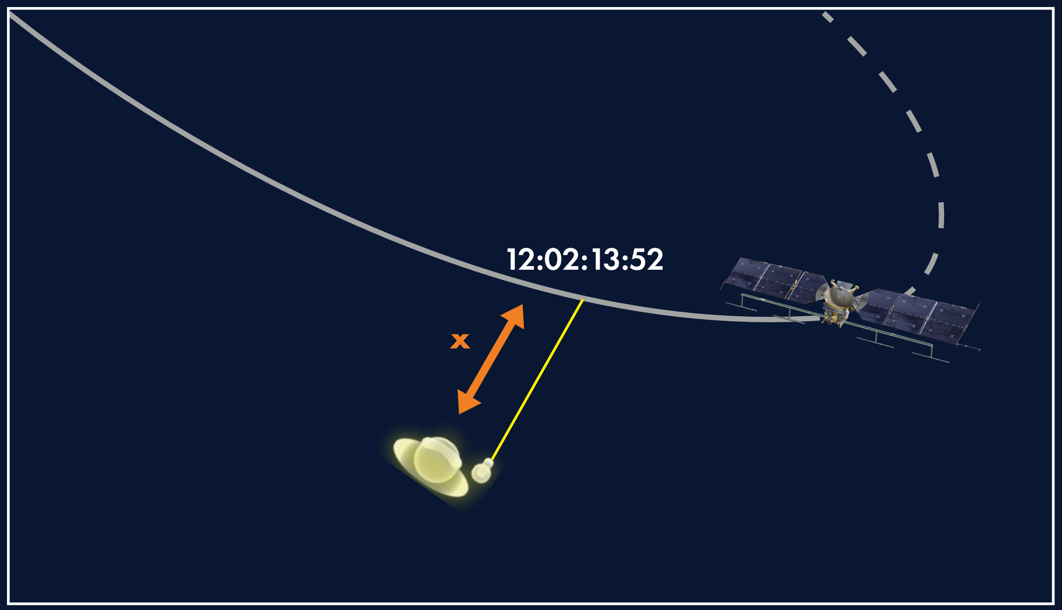
# MOVEMENT

## TELEPORT ALONG ORBITAL PATH

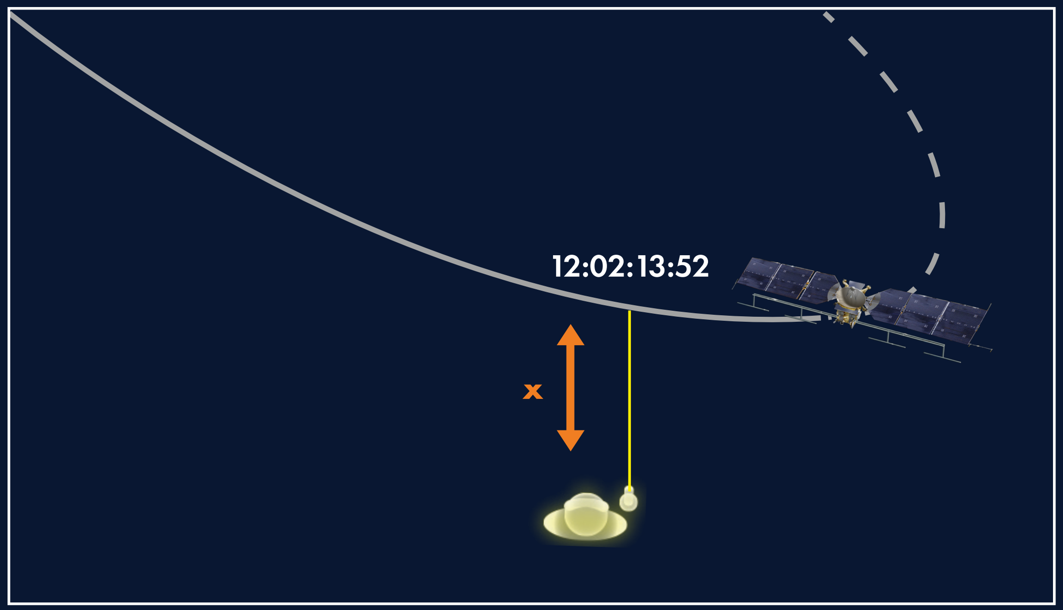
Users can teleport to different points of the orbital path by selecting and clicking it. A timecode will pop up to aid users in choosing a more precise time. After being teleported to the new point in time, *SpaceTalk* will re-center the user's point of view to look directly at the point in which the user has selected.

The distance between the user and the object(s) immediately in front of them will not change from their starting point to their end point. This ensures the user's ability to understand where they are in relation to his or her surroundings.

Due to the small hit box of the orbital path line, the user's laser will magnetically be placed on it when in close proximity. This can be seen in the visual system.




1 Select the point on the orbital path to teleport



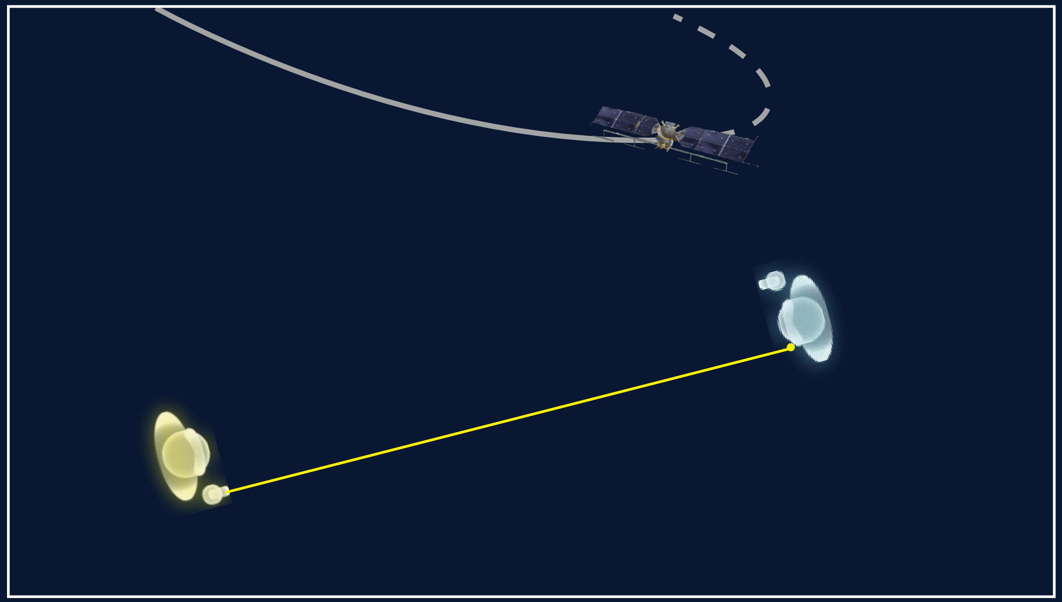

2 Re-center user's view and maintain the same distance as before

# MOVEMENT

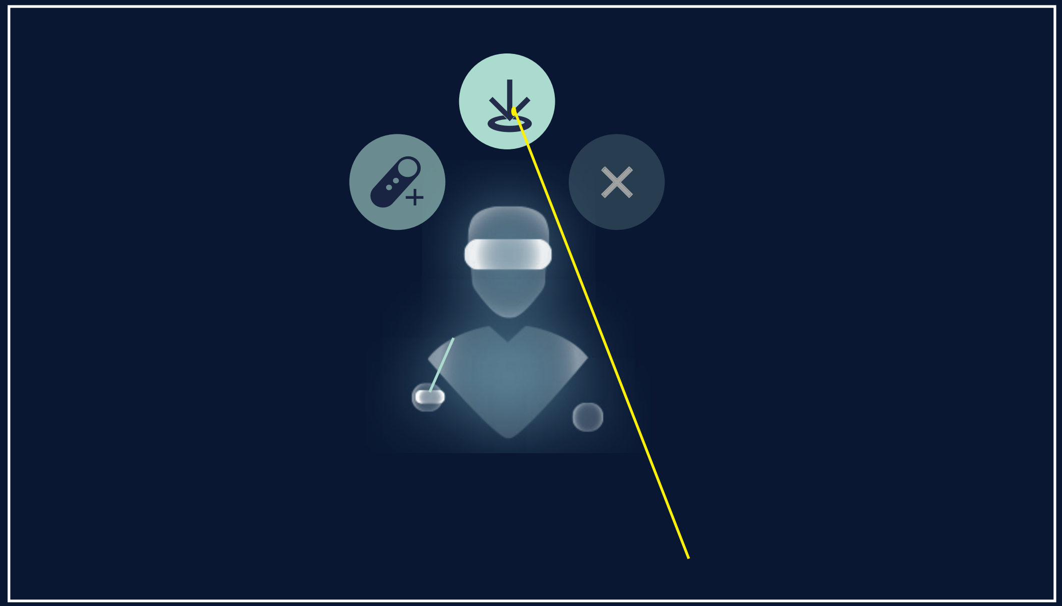
## TELEPORT TO AN AVATAR

While individually exploring in space, users may want to quickly stand next to their collaborator in order to share a similar point of view. To do so, the user simply points and clicks on their colleague's avatar and selects the teleport button. They will then be teleported next to their colleague, facing the same direction as when they clicked the teleport button.

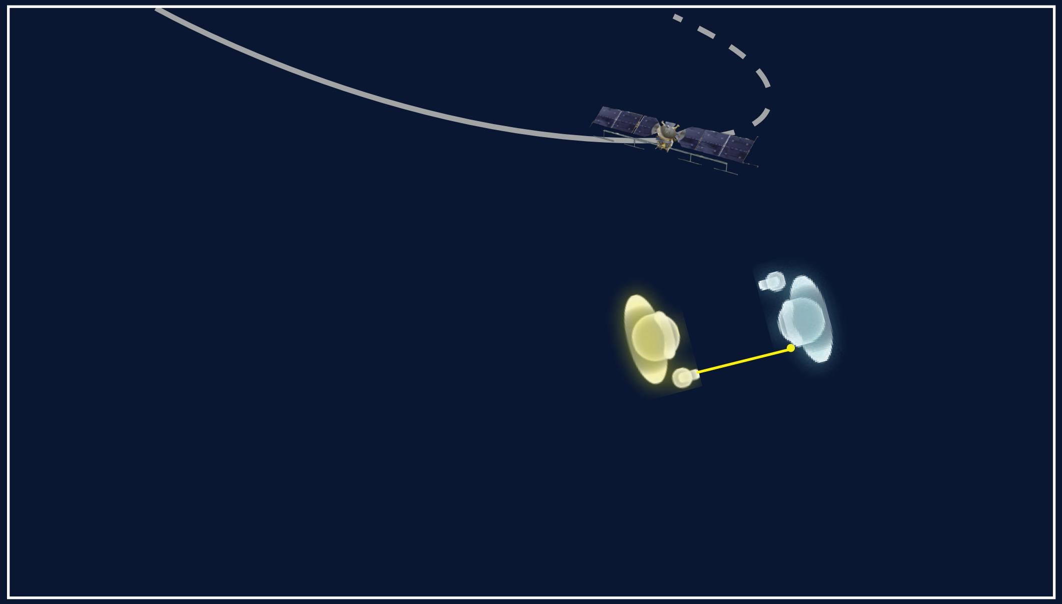
Because the other avatar could be too far away for the remote laser to reach, whenever the user's laser is in the direction of an avatar, it will magnetically be placed on it.



1 Click on the other avatar



2 Select the Teleport button



1 User will be teleported next to the avatar in the same point of view

# USER CONTROL

## PERMISSIONS

To help facilitate *SpaceTalk's* quick and easy collaboration, each user plays a different role. One user, colored in yellow, will act as the 'Guide' and the other, colored in blue or magenta, as the 'Participant'. The Guide can navigate into different information zones, toggle data, and change the orbital time. The Participant, in response, will automatically enter the new information zone, teleport, or be in another orbital time automatically. However, the Participant will not be able to change these parameters unless they were given the control (see next page).

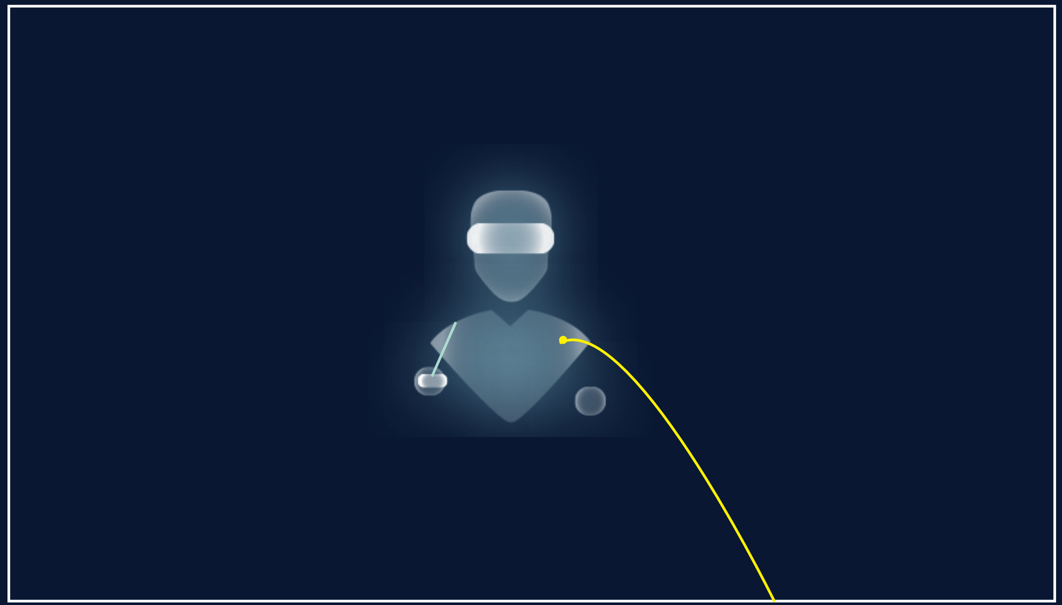
**USER CONTROLS**

| | GUIDE | PARTICIPANT |
|---|---|---|
| **MOVEMENT** | | |
| Move between zones | X | |
| Move within zone | X | X |
| Teleport on trajectory | X | |
| Teleport to Avatar | X | X |
| **SYSTEM SETTINGS** | | |
| Set orbital time | X | |
| Take a screenshot | X | |
| Video recording | X | |
| **COMMUNICATIONS** | | |
| Highlight | X | X |
| Annotate | X | X |

# USER CONTROL

## SWITCHING CONTROL

The role of the 'Guide' can be transferred to the 'Participant' by simply selecting the Participant and clicking on the Give Control button.



1 Select and click on the Participant user

2 Choose the Given Control button

# DEPTH CUES

## AERIAL PERSPECTIVE

In the real world, “the farther away an object, the more air particles we have to look through, making objects that are father away look less sharp and bluer than close objects.” (E. Bruce Goldstein, 2013) This is called “aerial perspective”.

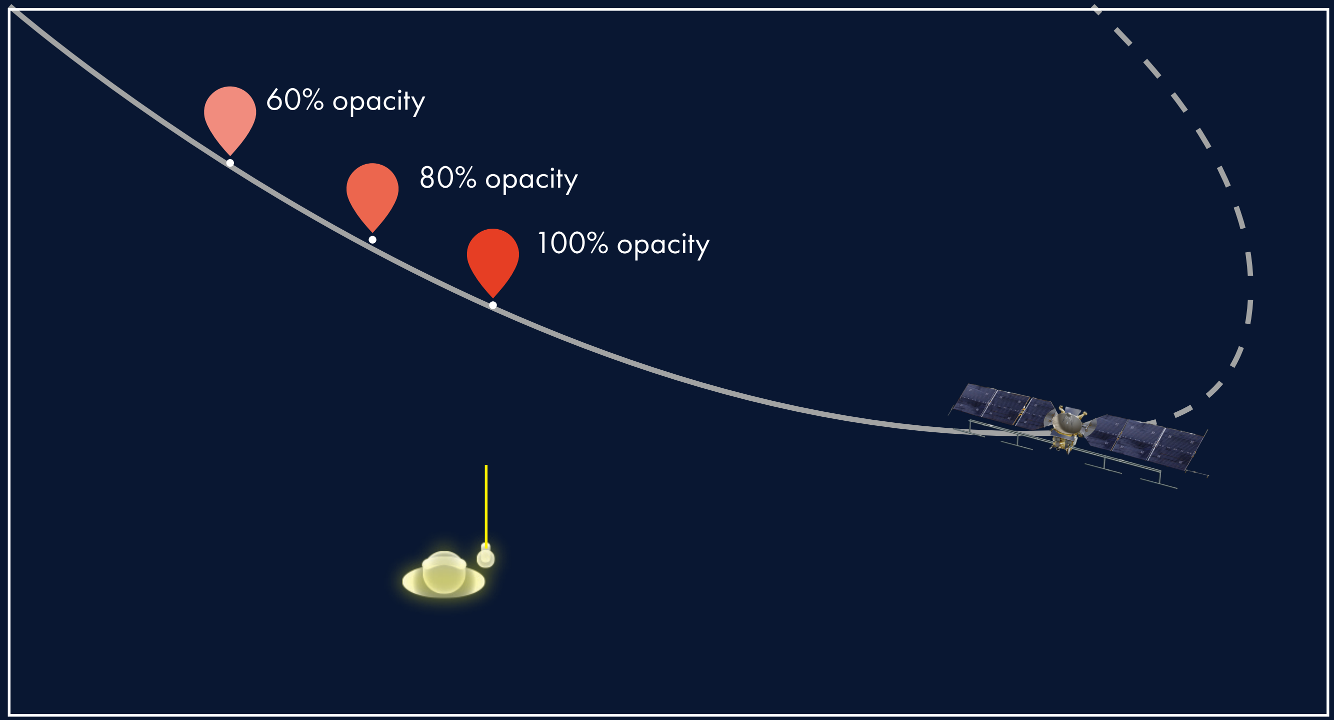
In VR, there is only one physical distance between the user’s eyes to the display. In order to simulate depth, objects that are further away should render in lower opacity.

Note:

*Currently this is only applied to the Reset Point Marks and Annotations that are close together. In order to understand the precision of aerial perspective and know how to apply on what objects, usability testing will need to be conducted.*

Exceptions:

*Note that the Main Menu, Sub Menu, and Avatars are exceptions. They will change in scale, but not in opacity.*



04

# Visual System

The visual system represents the relationship between color, type, interface components and system interaction.

# Color

Color in *SpaceTalk* should only be used to communicate interaction states in interface components, or to understand data types within the application. Using color for decoration or emotional appeal could potentially lead users to falsely interpret application data, which could have dire consequences in spacecraft missions.

## PRIMARY COLORS


## SECONDARY COLORS

# Typography

## MOBILE TYPOGRAPHY

The SpaceTalk mobile application interface on Android devices will use Roboto, Google's standard Material Design typeface.

When an iOS version of mobile VR is released with a remote input device, use the San Francisco font and refer Apple's Human Interface Guidelines.

| | | | | |
|---|---|---|---|---|
| T1 | Title | 20pt | Roboto Medium | 100% |
| T1 | Title | 20pt | Roboto Medium | 87% |
| T2 | Subheader | 16pt | Roboto Regular | 87% |
| T3 | Body 1 | 14pt | Roboto Regular | 87% |
| T4 | Body 2 / Menu | 14pt | Roboto Medium | 87% |
| T5 | Input | 14pt | Roboto Medium | 56% |

# Typography

## VR TYPOGRAPHY

When in virtual reality, the main typeface will be Futura PT. As opposed to static two-dimensional interfaces with a fixed distance, typography in virtual reality will be entirely based on a user's viewing distance from the type, in which it will be scaled appropriately for a comfortable reading experience. We recommend using the **dmm unit** (distance-independent millimeter) to describe the size of type. This can be found in the latest 2017 Google I/O talks.

## VR FONT

Futura PT

## VR TEXT SIZES

| | |
|---|---|
| Headline | Medium 48dmm |
| Title | DEMI 36dmm |
| SubHeading 1 | MEDIUM 24dmm |
| SubHeading 2 | Medium 24dmm |
| Body | Book 21dmm |
| BUTTON | DEMI 16dmm |
| Caption 1 | Medium 12dmm |
| Caption 2 | Futura Medium 18 |

# Iconography

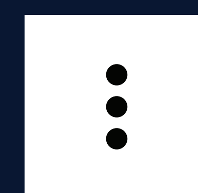
## MOBILE ICONOGRAPHY

The iconography for the SpaceTalk mobile application follows the principles laid out in Google's Material Design guidelines. Several of the symbols to the right can be acquired directly from Google's icon library.

When an iOS version of mobile VR is released with a remote input device, use Apple's Human Interface Guidelines for iconography.

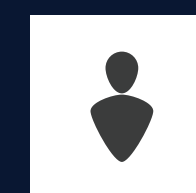
**S1**
color: #ffffff
opacity: 100%

**S2**
color: #ffffff
opacity: 100%



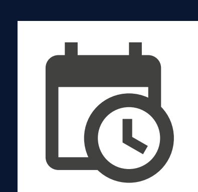
**S3**
color: #000000
opacity: 100%

**S4**
color: #ffffff
opacity: 100%

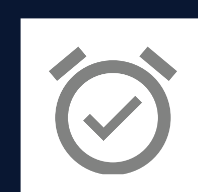


**S5**
color: #000000
opacity: 76%

**S6**
color: #000000
opacity: 76%



**S7**
color: #000000
opacity: 76%

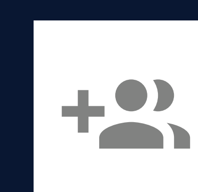


**S8**
color: #000000
opacity: 50%

**S9**
color: #000000
opacity: 50%

**S10**
color: #000000
opacity: 50%

**S11**
color: #000000
opacity: 50%



**S12**
color: #000000
opacity: 50%

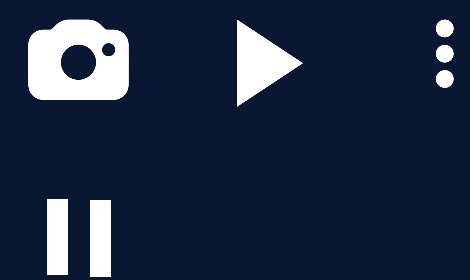
# Iconography

## VR ICONOGRAPHY

Iconography in *SpaceTalk's VR experience* should be simple and as self-evident as possible in order to provide users with a pleasant long term experience with the interface, and a low learning curve. Universal iconography such as the back button that currently exist in the modern computing interfaces should be used whenever relevant to create a sense of familiarity with the interface.

Additionally, we encourage the use of scalable vector graphic (SVG) iconography to accommodate distance and scaling in virtual reality. Because there are multiple viewing distances that require images to be scaled for comfortable viewing, SVGs would make for easier development and upkeep.

### SUB MENU ACTIONS



### TOGGLE SUB MENU

### FLOWER MENU

### SCIENCE INSTRUMENTS

### INFORMATION ZONES

### CAMERA ACTIONS

### MAIN MENU

**Sub Menu Actions, Toggle Sub Menu Science Instruments, Information Zones, Camera Actions**
color: #ffffff
opacity: 100% (hover) / 30%

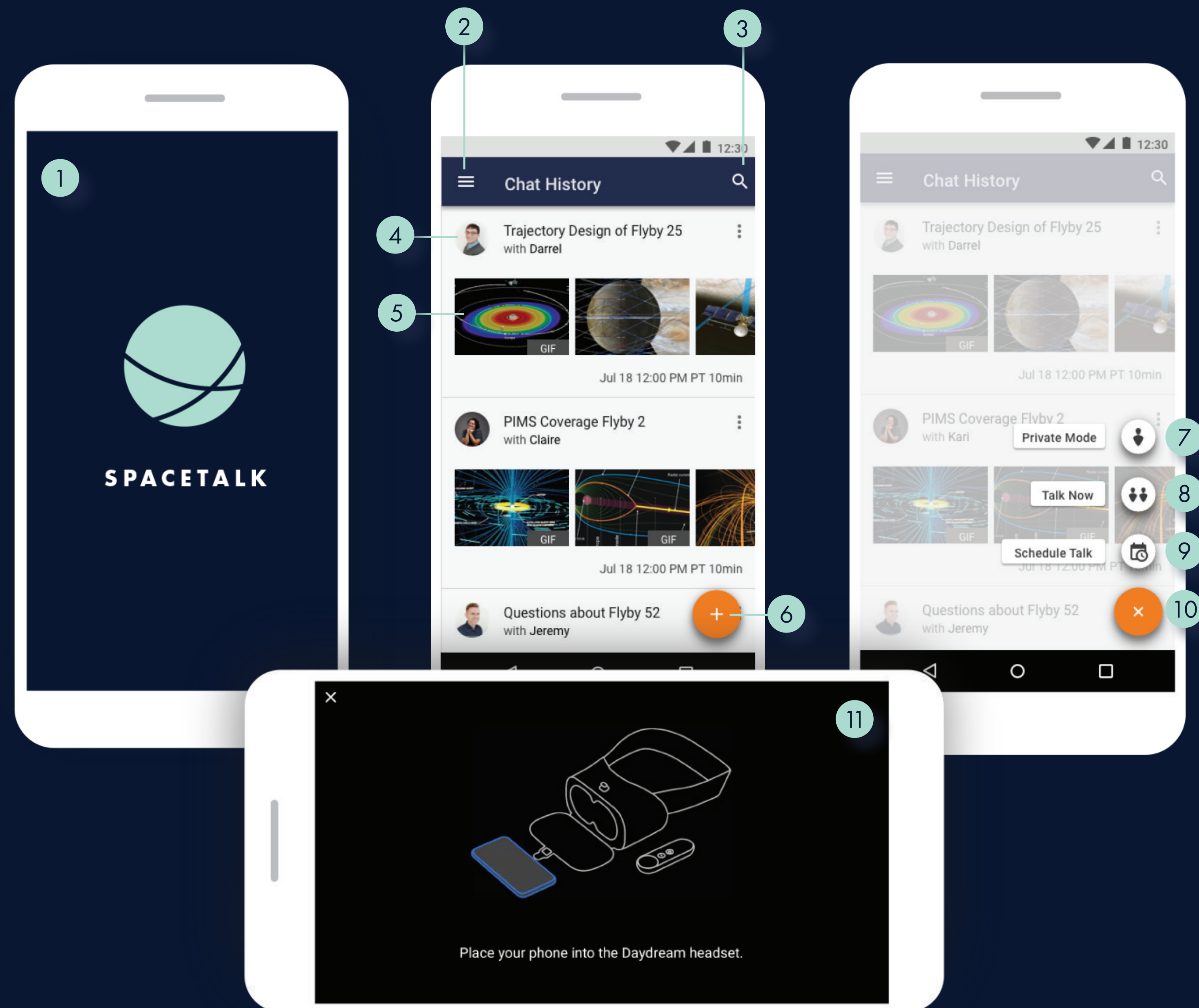
**Flower Menu, Main Menu**
color: #252d4d
opacity: 100% (hover) / 30%

1 **Exceptions: Close Icon, End Call Icon**
color: #ffffff
opacity: 100% (on hover) / 30%

# UI Components

## MOBILE APPLICATION INTERFACE

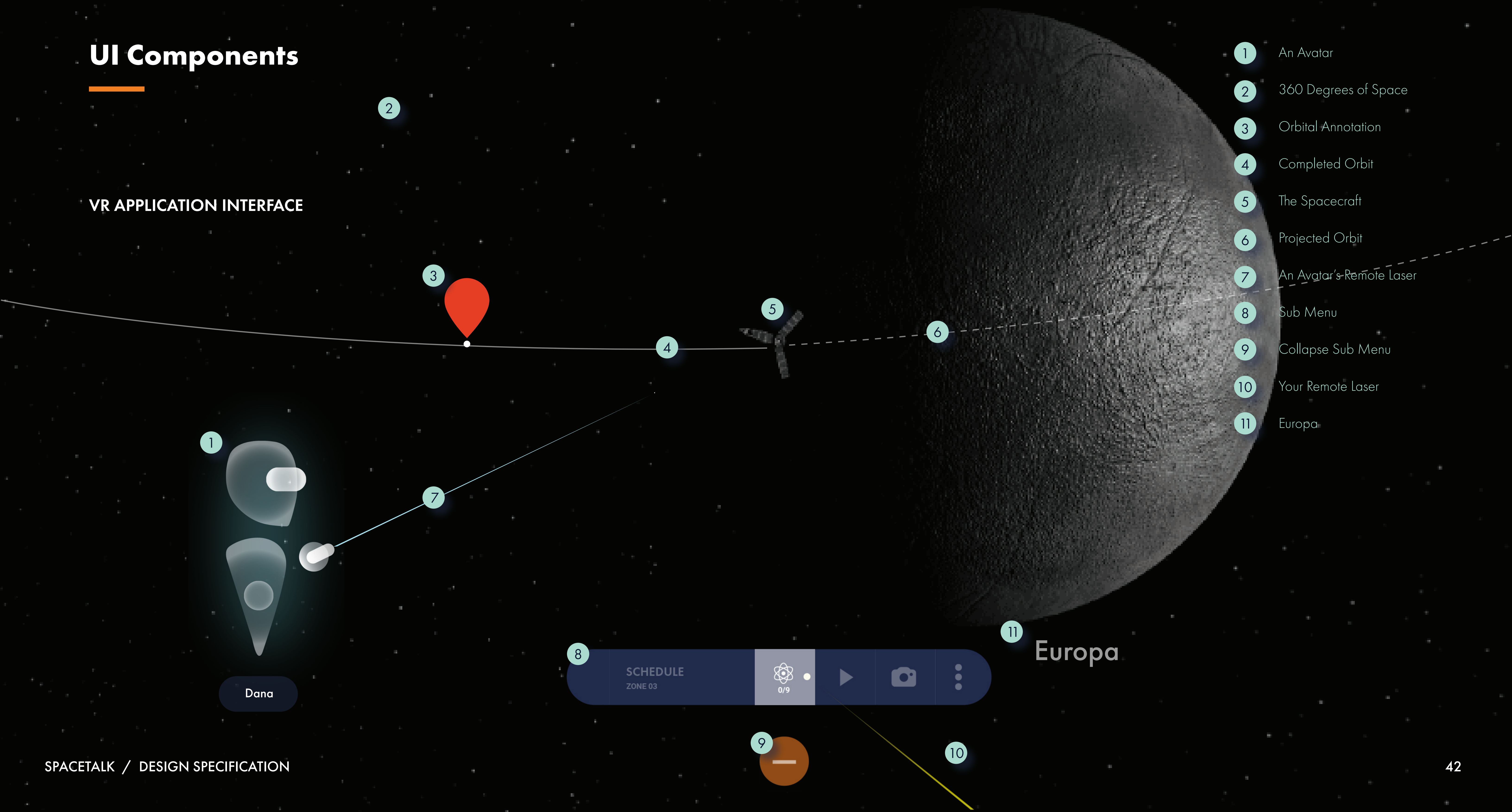
UI Components in the mobile application interface should reflect the interface guidelines of the operating system of the smartphone. For Android phones, Material Design should utilized. For iOS devices, Apple's Human Interface Guidelines should be used. These are universal mobile design standards that create a sense of familiarity with an otherwise novel interface.




1. Splash Screen
2. Main Menu
3. Search for Captures
4. User Profile
5. Screen Capture
6. Actions Menu
7. Enter Private Simulation
8. Have a *SpaceTalk*
9. Schedule a *SpaceTalk*
10. Collapse Actions Menu
11. Enter SpaceTalk Screen

# UI Components

## VR APPLICATION INTERFACE




1. An Avatar
2. 360 Degrees of Space
3. Orbital Annotation
4. Completed Orbit
5. The Spacecraft
6. Projected Orbit
7. An Avatar's Remote Laser
8. Sub Menu
9. Collapse Sub Menu
10. Your Remote Laser
11. Europa

# UI Components

## VR INTERFACE GUIDELINES

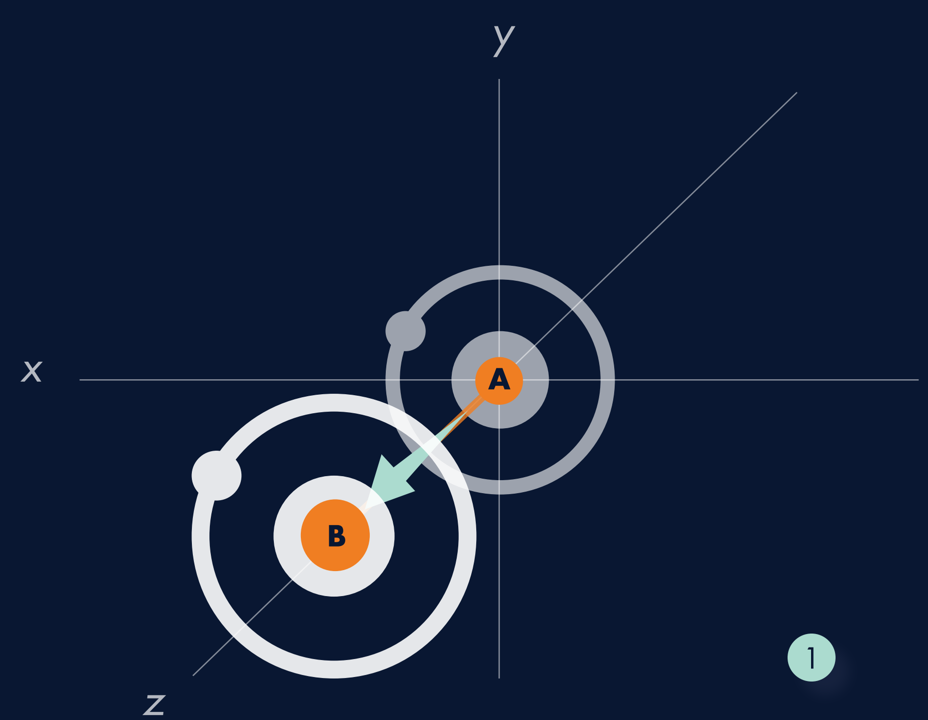
UI Components in *SpaceTalk*'s VR experience should only make use three-dimensional space for the purposes of more efficient and understandable interactions than traditional two-dimensional components.

Although we encourage leveraging the power of three-dimensional space in VR for inherently three-dimensional objects such as spacecraft, planets, and moons, traditional two-dimensional interfaces and forms such as menus, icons, and text overlay provide a sense of familiarity for new users, especially with a technology this novel. It's been proven through the Most Advanced Yet Acceptable (MAYA) design principle that introducing novel design conventions takes time, and should not implemented all at once. Doing so could stifle technology adoption.

In light of this, we suggest leveraging proven two-dimensional components for now, but doing so in a way that leverages some degree of depth and perspective, or the z-coordinate. Therefore, to create a balance between two-dimensional and three-dimensional UI components, we suggest that menus and icons slightly move towards the user along the z axis on hover. As shown in our Interaction Model, we also suggest using different UI distances with the z-axis in order to create clear content hierarchy. For now, this is a good balance between familiarity and novelty which leverages some degree of three-dimensionality.

In the future, as more efficient and understandable three-dimensional UI conventions arise, we encourage their implementation in *SpaceTalk*.

1 UI components such as buttons, menus and icons make use of the z-axis as shown in this figure. Notice A's movement to B: both opacity and distance to the user change to clearly show interface states.



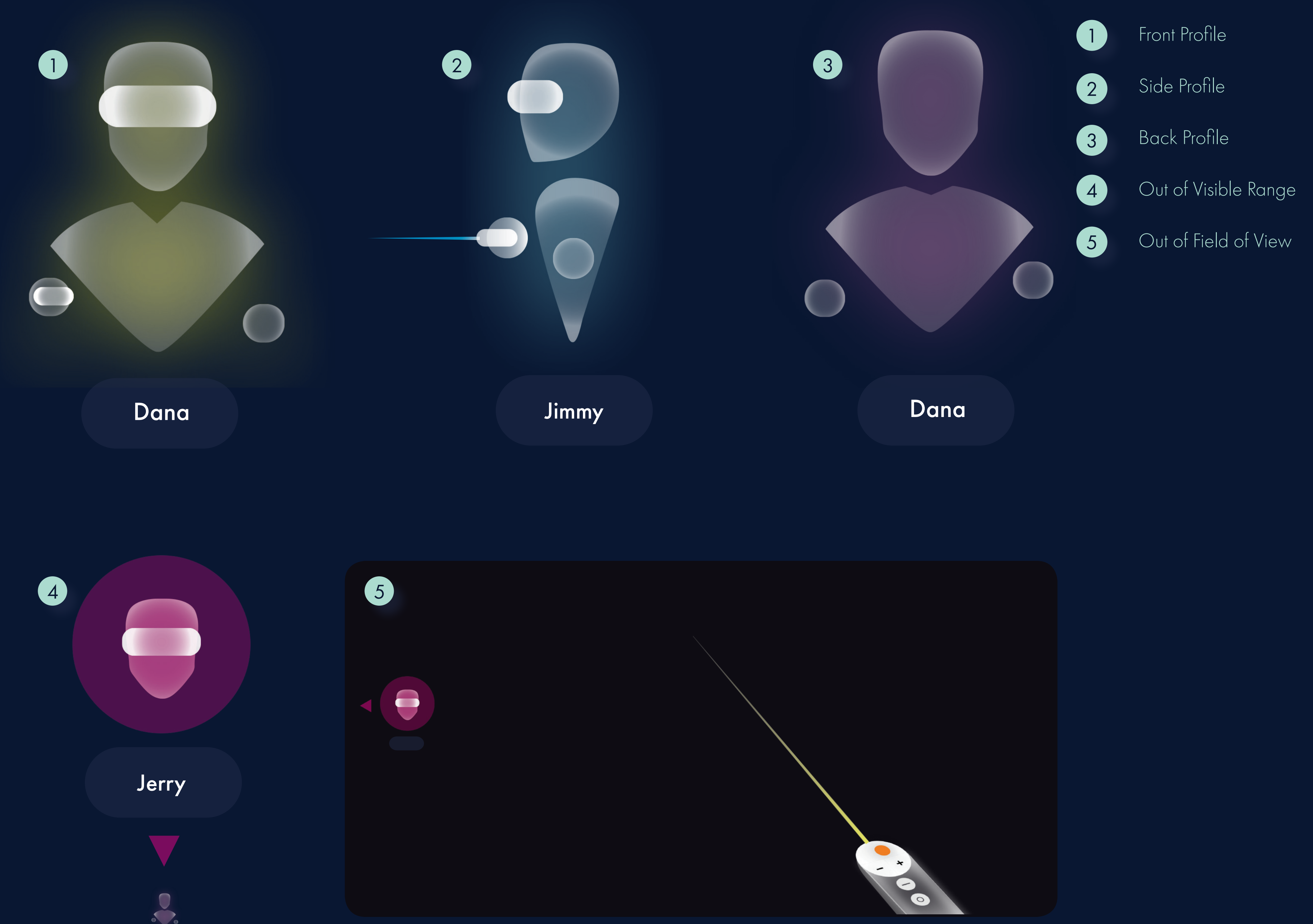
# UI Components

## AVATARS

Avatars in *SpaceTalk* are representative of gender neutral human-like forms with two primary modes of user input: remote input and head rotation. Unless additional input modalities such as movement tracking are added to *SpaceTalk*, these forms should remain the same to create the right affordances for users.

Avatars are also distinguished by color and username to enable easy user identification to facilitate better collaboration in a virtual environment. Avatar color also represents a user's level of control.

If another avatar is out of visible range, a circular icon of the avatar will appear to enable seamless interaction. If an avatar is outside of a user's field of view, an arrow and circular icon will enable easy way-finding of other collaborators.

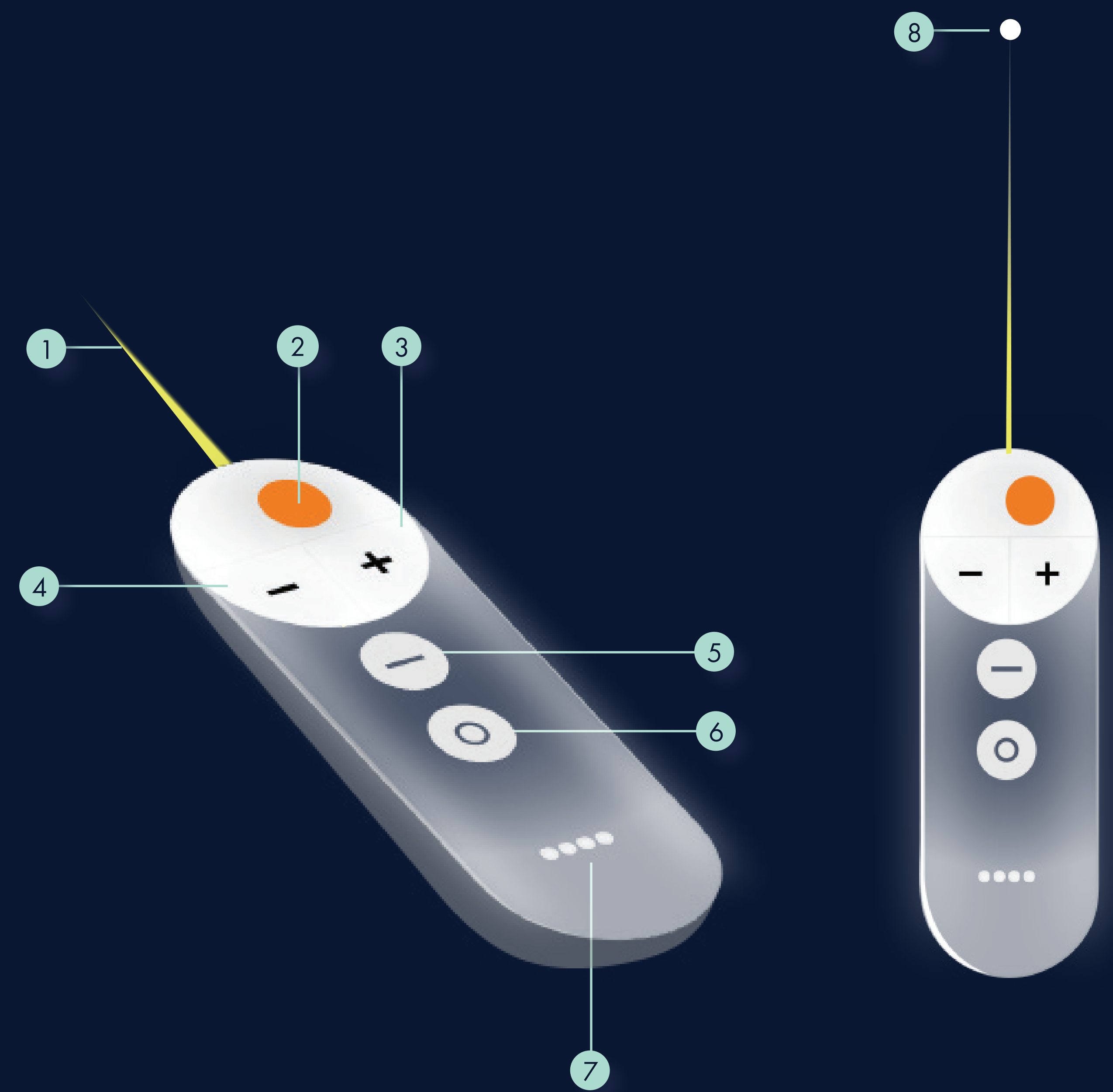


# UI Components

## VIRTUAL REMOTE

The primary user input method in *SpaceTalk's* virtual reality experience will be a virtual remote. Users will be able to see their touch inputs on the remote just as they would in real life without a headset on covering their vision.

To point or interact to areas of interest in SpaceTalk's immersive environment, a virtual pointer will emit from the top of the remote. Similar to a mouse cursor on traditional computers, it will allow users to see their area of focus and share it with others. This pointer will increase and decrease in size depending on the object in focus.




1 Laser Pointer

2 Touch Feedback

3 Zoom In

4 Zoom Out

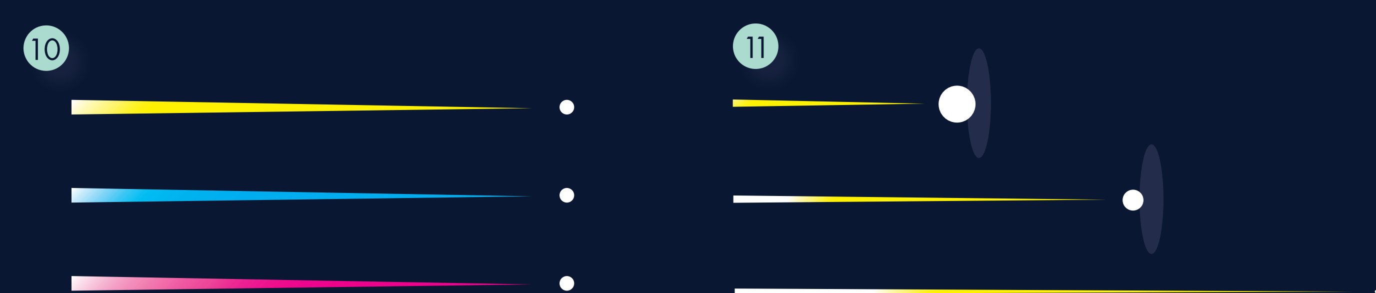
5 Main Menu

6 Daydream Menu

7 Remote Battery Indicator

8 Laser Pointer Cursor

9 Expand Menu On Hover




10 *SpaceTalk* users are each assigned a laser color when they enter a Talk. Those with the yellow laser pointer have full control over the simulation.

11 Distance will determine the size of the laser pointer cursor.

# UI Components

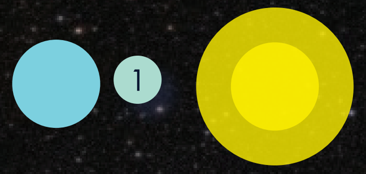
## SPACE OBJECTS

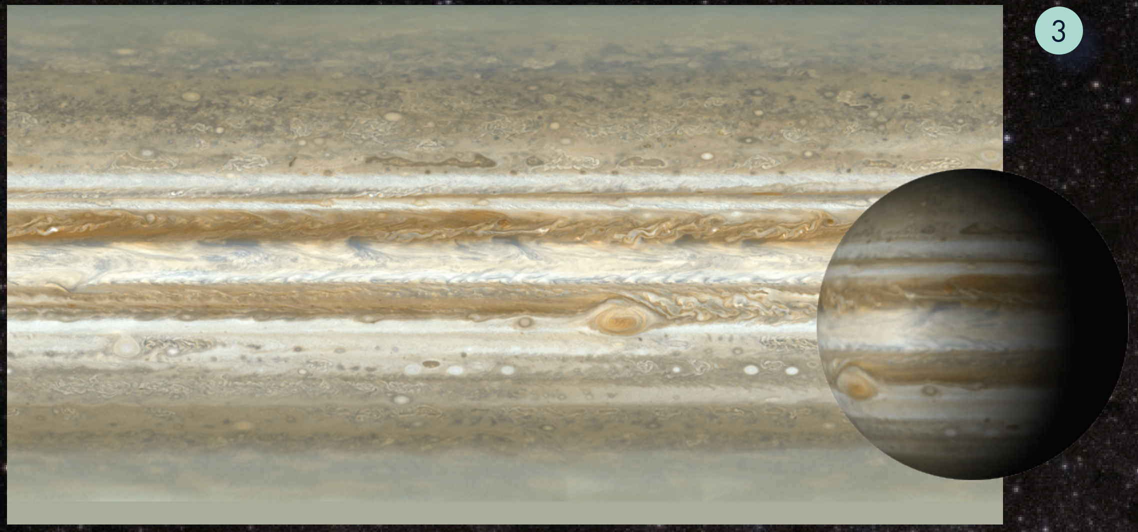
Space Objects including the spacecraft and pertinent celestial bodies in *SpaceTalk* should be accurately portrayed when in visible range to make the simulation as useful as possible to mission personnel.

Mission-specific space objects such as the body being orbited and the spacecraft should be updated regularly with accurate mission data.

Although the Sun and Earth's position should be accurate, their form should be an abstraction unless they are mission-specific.

The spacecraft should be to scale when a user is within viewing distance. If a user is too far away to see the orbiter, an abstraction will take its place.


1 2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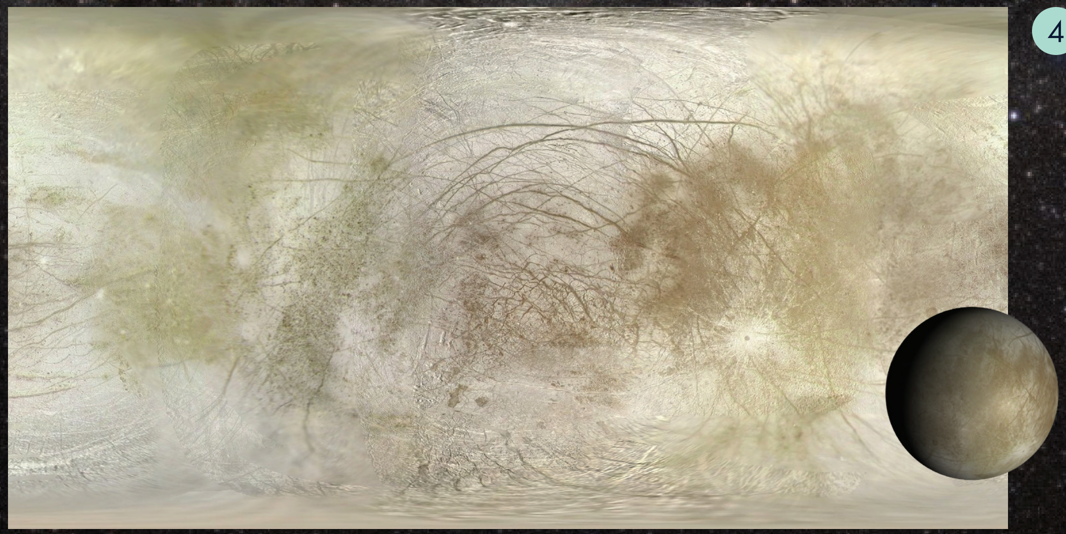
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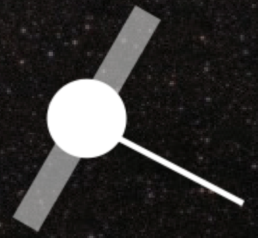
5


6

1. Earth Abstraction
2. Sun Abstraction
3. Jupiter
4. Europa
5. Spacecraft
6. Abstraction of Spacecraft

# UI Components

## ORBITAL PATH

The orbital path represents the temporal position of the orbiter and shows the past, present and future states of the spacecraft. When clicking on the orbital path, users can add colored annotations and teleport to a future spacecraft position.

Because selecting a thin entity such as an orbital path would be difficult using the remote laser pointer, users' laser pointer cursor will magnetically latch on to the path when in close proximity.


1. Spacecraft Future Position
2. Spacecraft Past Position
3. Add Annotations
4. Orbit Timecode
5. Spacecraft Current Position
6. Magnetic Laser Pointer

# UI Components

## FLOWER MENU

The Flower Menu allows users to interact with other users and the environment without being taken out of context as an overlay menu would do.

Users need only to click on an interactive entity such as an avatar or orbital path to trigger the menu. After clicking on the entity, the Flower Menu will be triggered and users need only move their wrist in the direction of a desired action. For example, if a collaborator wanted to teleport to another user's location, they'd hover over their avatar and click. This would lock their camera position on the other collaboration so that they can move their wrist to the top most button, teleport. An additional click when the teleport button is in focus would take them to the other collaborator's location.

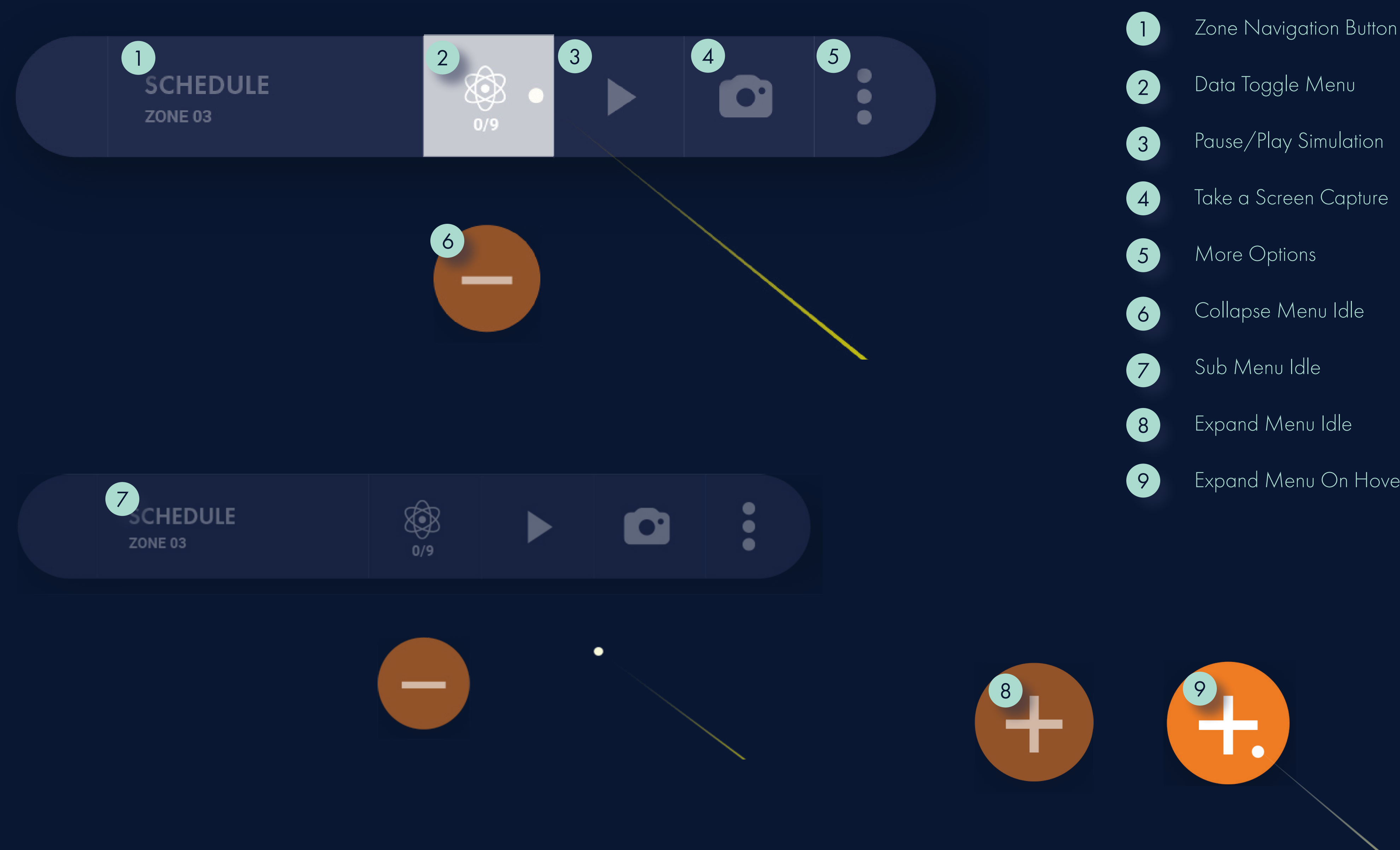

1. Hand Over Control
2. Teleport to Users Location
3. Close Out Flower Menu
4. Add Annotation
5. Teleport to This Location
6. User clicks on an interactive entity like an orbital path.
7. The click toggles the flower menu. The user need only to move their remote in the direction of a desired button.

# UI Components

## SUB MENU

The Sub Menu is the primary means interaction in *SpaceTalk* and consists of the most important interactions in virtual reality. For this reason, it is always present in the lower third of a users field of view. To enable a more immersive experience, we've also made it expandable and collapsible, and lowered the default opacity when not in use.

In the Sub Menu, *SpaceTalk* users to navigate to different zones, toggle useful zone-specific data, capture key moments to share with others, and pause and play the immersive mission simulation.



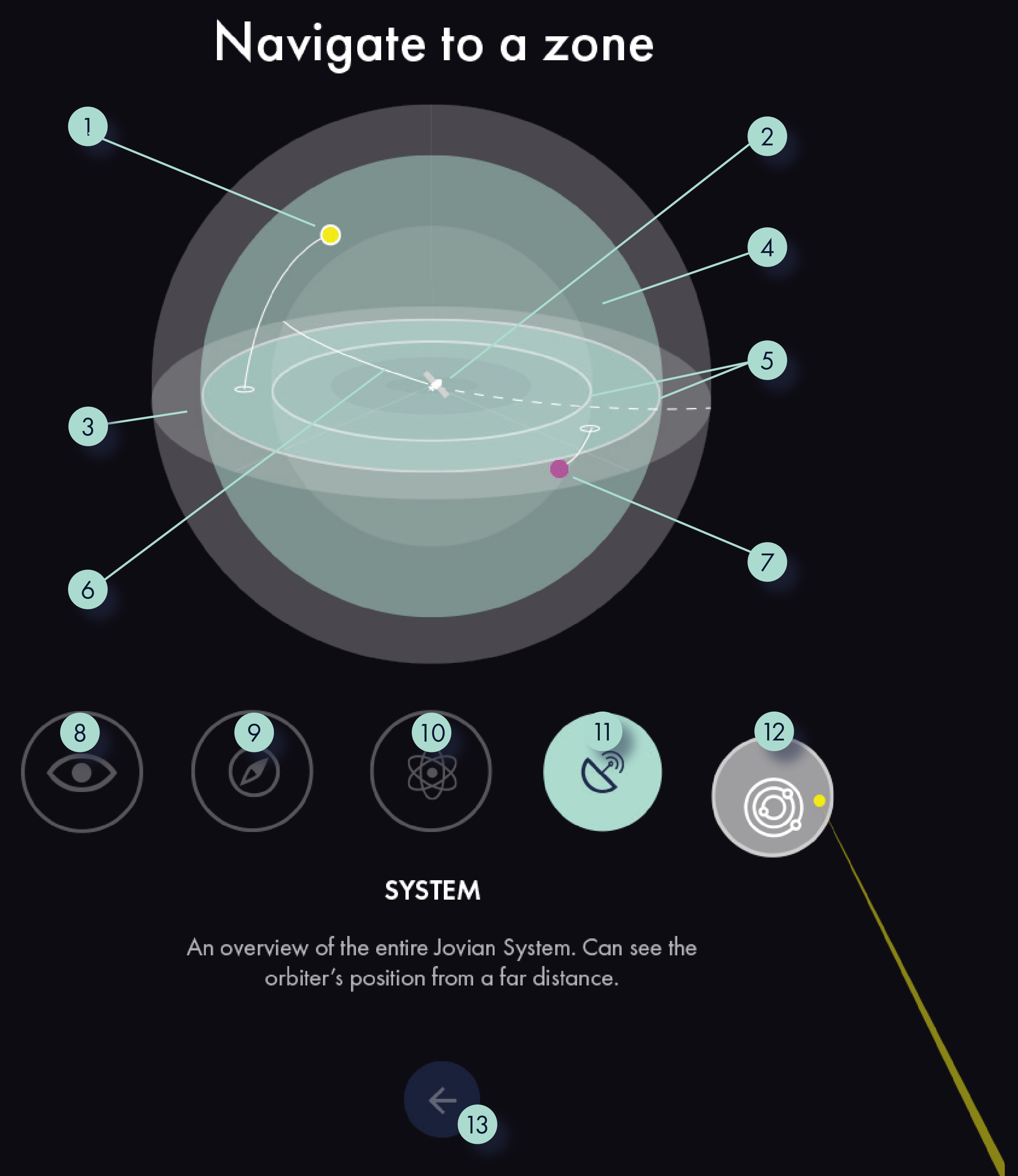
# UI Components

## ZONE NAVIGATION MAP

The Zone Navigation Map, which is accessed via the Sub Menu, allows users to navigate between different orbiter viewing points, or "information zones". Each of these zones is optimized to view a specific type of mission data.

In addition to allowing users to select a zone to enter, it also shows a visual representation of each of the zones, both users' current zone, and each user's current location within said zone.

Users can also hover over a zone to be given a brief synopsis of the data in the zone.




1. User Location 1
2. Orbiter Location
3. Information Zone on Hover
4. Selected Information Zone
5. Information Zone Boundary
6. Orbital Path
7. User Location 2
8. Coverage Zone Button
9. Orientation Zone Button
10. Schedule Zone Button
11. Comm. Zone Button
12. Jovian System Zone Button
13. Back to Sub Menu

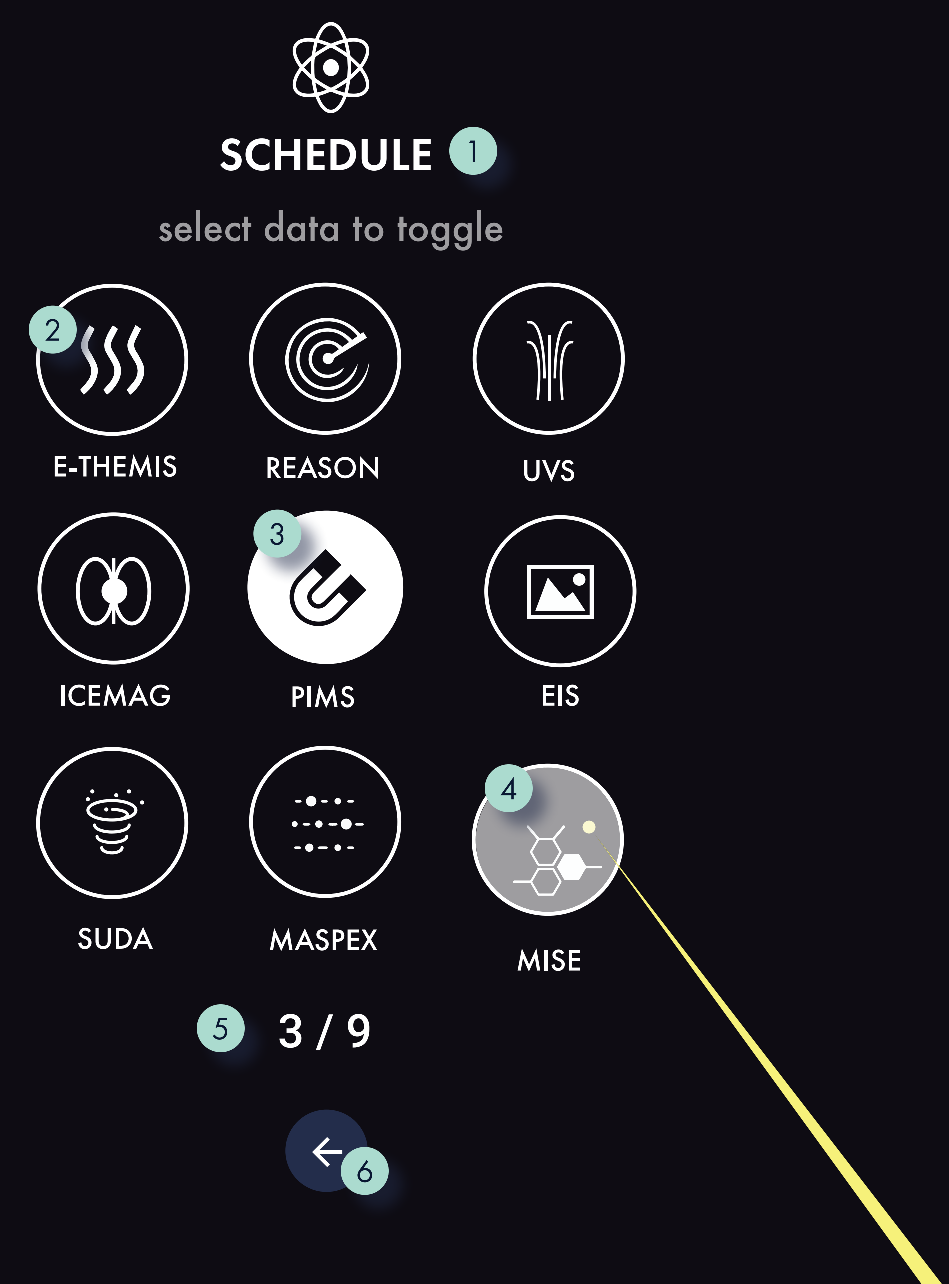
# UI Components

### DATA TOGGLE MENU

The Secondary Menu is a menu system with the most hierarchy in the virtual reality application that manifests after a user presses the application button on the remote.

Similar to the Sub Menu, it creates a dark overlay onto the users field of view to disable other interactions.

In the Secondary Menu, *SpaceTalk* users can end the virtual reality call, navigate to another orbit in a spacecraft mission, or go back to their current activities.



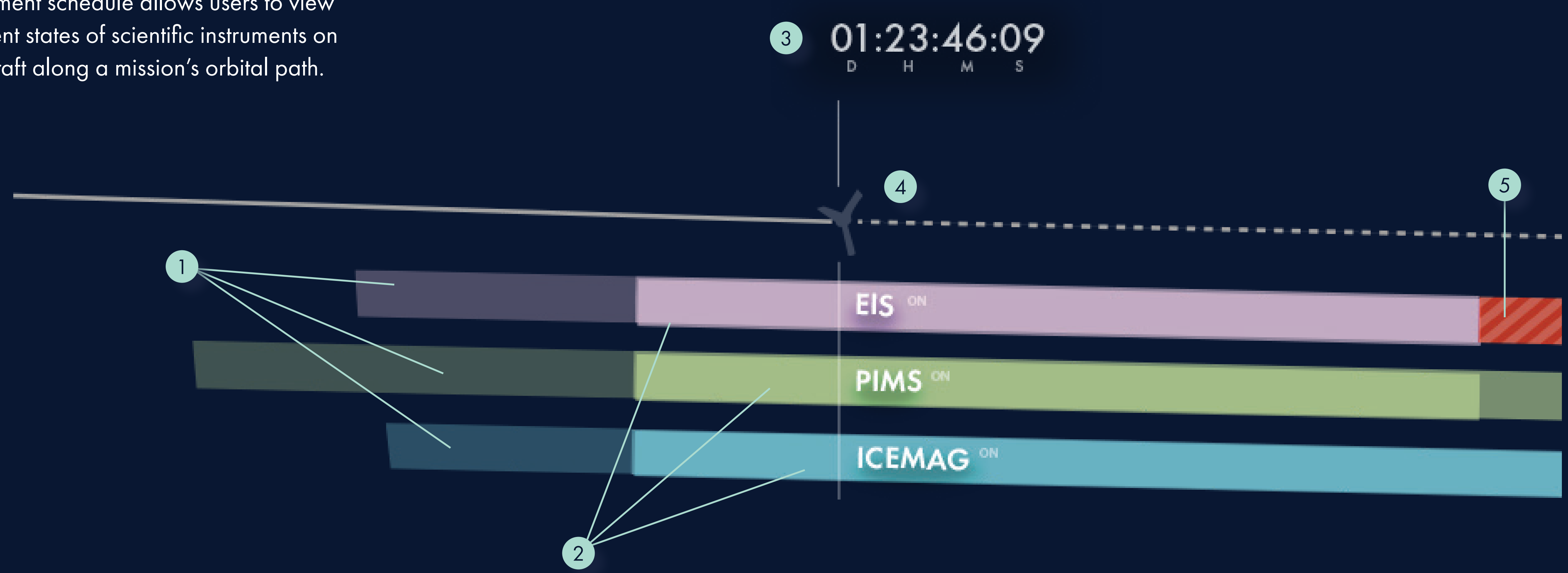

1. Zone Location
2. Data Toggle Button
3. Data Selected
4. Data Toggle On Hover
5. Data Selected
6. Go Back to Menu

# UI Components

1. Science Instrument Idle
2. Science Instrument On
3. Orbit Timecode
4. Spacecraft
5. Science Instrument Error

## SCIENCE INSTRUMENT SCHEDULE

The instrument schedule allows users to view the different states of scientific instruments on a spacecraft along a mission’s orbital path.



# UI Components

## SCIENCE INSTRUMENT COVERAGE

The Science Instrument Coverage feature allows *SpaceTalk* users to view imaging instrument coverage from the spacecraft's point of view.


1. Past Imaging Coverage
2. Current Imaging Coverage
3. Future Imaging Coverage
4. Orbit Timecode
5. Back to Sub Menu
6. Selected Science Instrument
7. Pause/Play Simulation
8. More Options

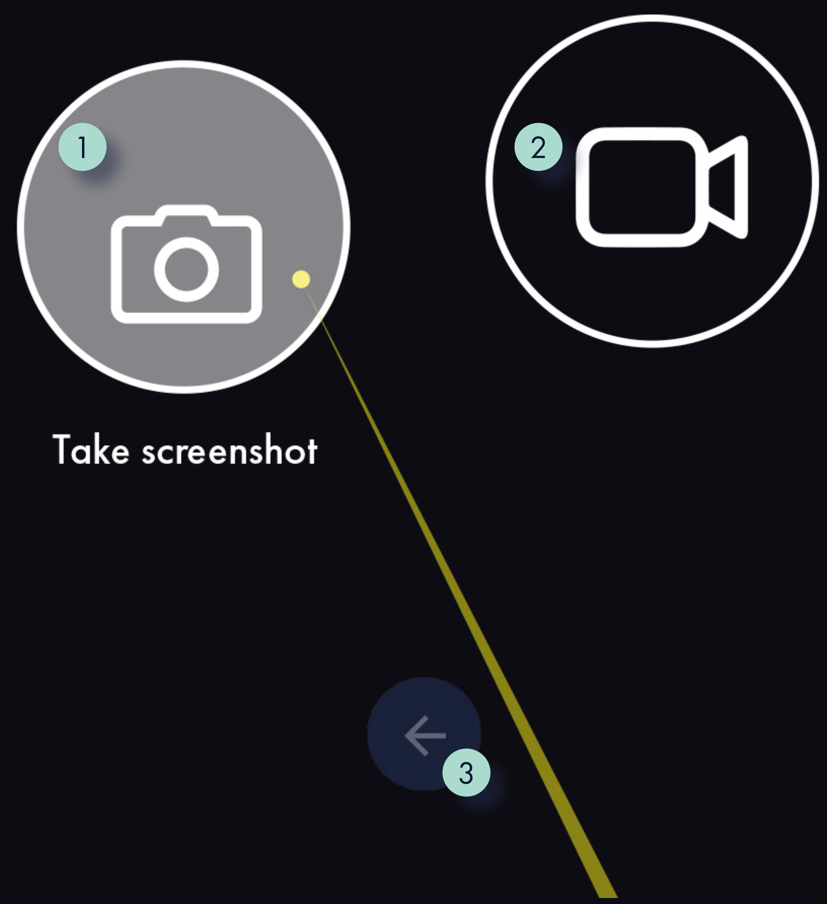
# UI Components

1. Take Screenshot On Hover
2. Take Video Recording
3. Go Back to Sub Menu

## SECONDARY OPTIONS MENU

The Secondary Options Menu in *SpaceTalk* serves as a catch-all menu system for users to dive into additional levels of detail.

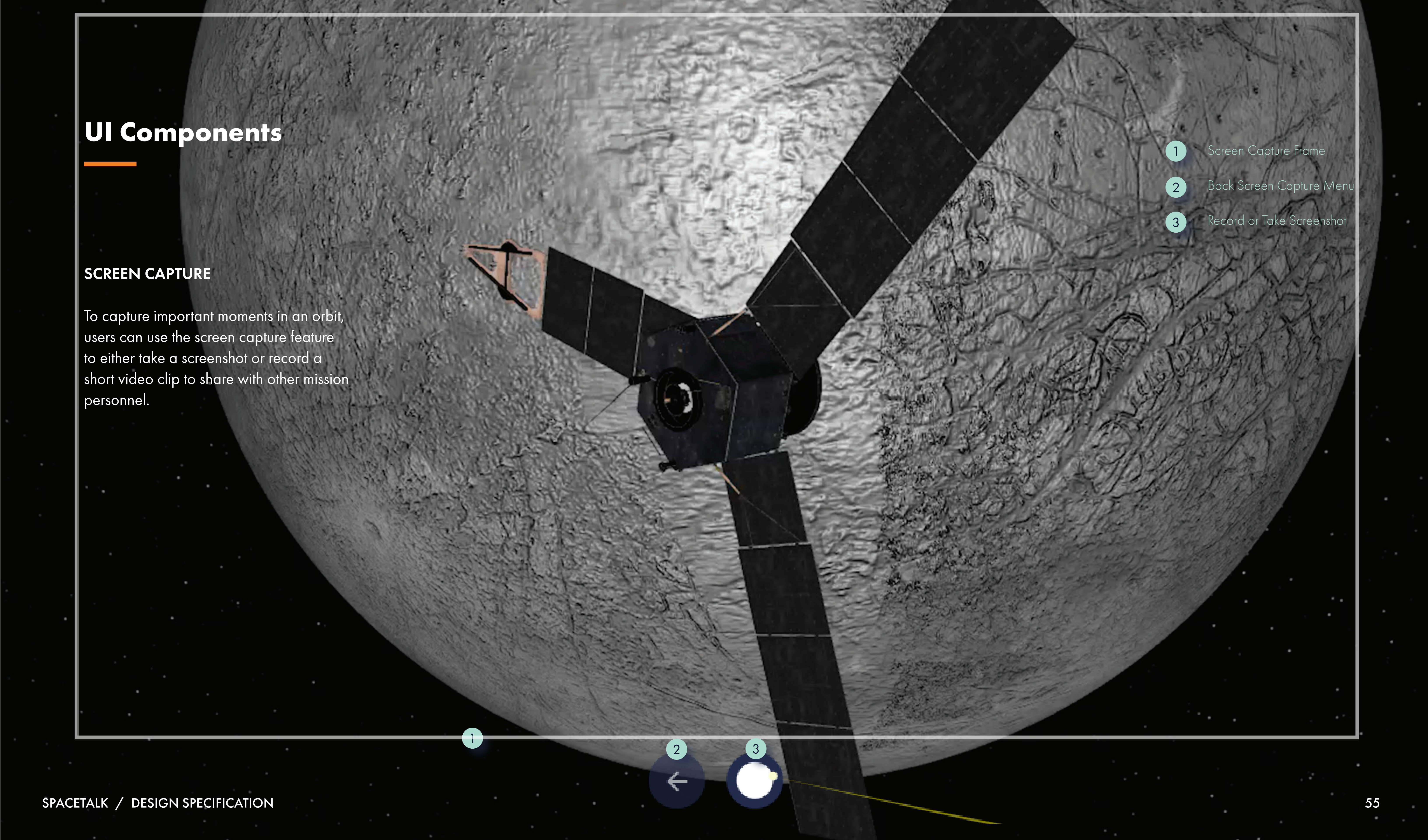
The screen capture selection interface is an example of this menu in use as seen to the right.



# UI Components

## SCREEN CAPTURE

To capture important moments in an orbit, users can use the screen capture feature to either take a screenshot or record a short video clip to share with other mission personnel.

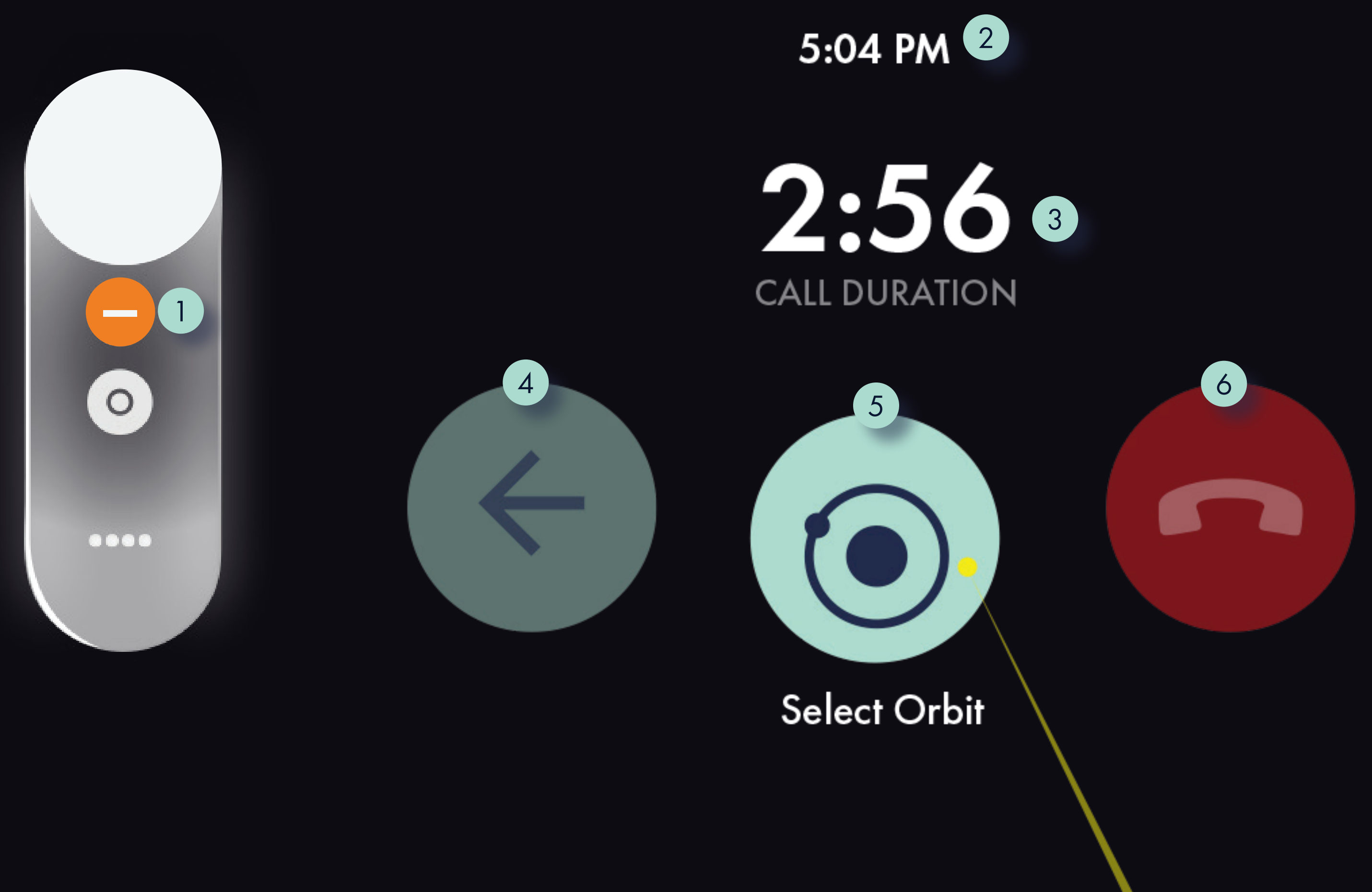


# UI Components

## MAIN MENU

The Main Menu, which can be access video the application button on the remote, is the primary means of allowing *SpaceTalk* users to navigate to different orbits or end a *SpaceTalk* call.

When pressed, it will be overlayed on top of the SpaceTalk interface with a high opacity black background to represent its highest level of hierarchy.



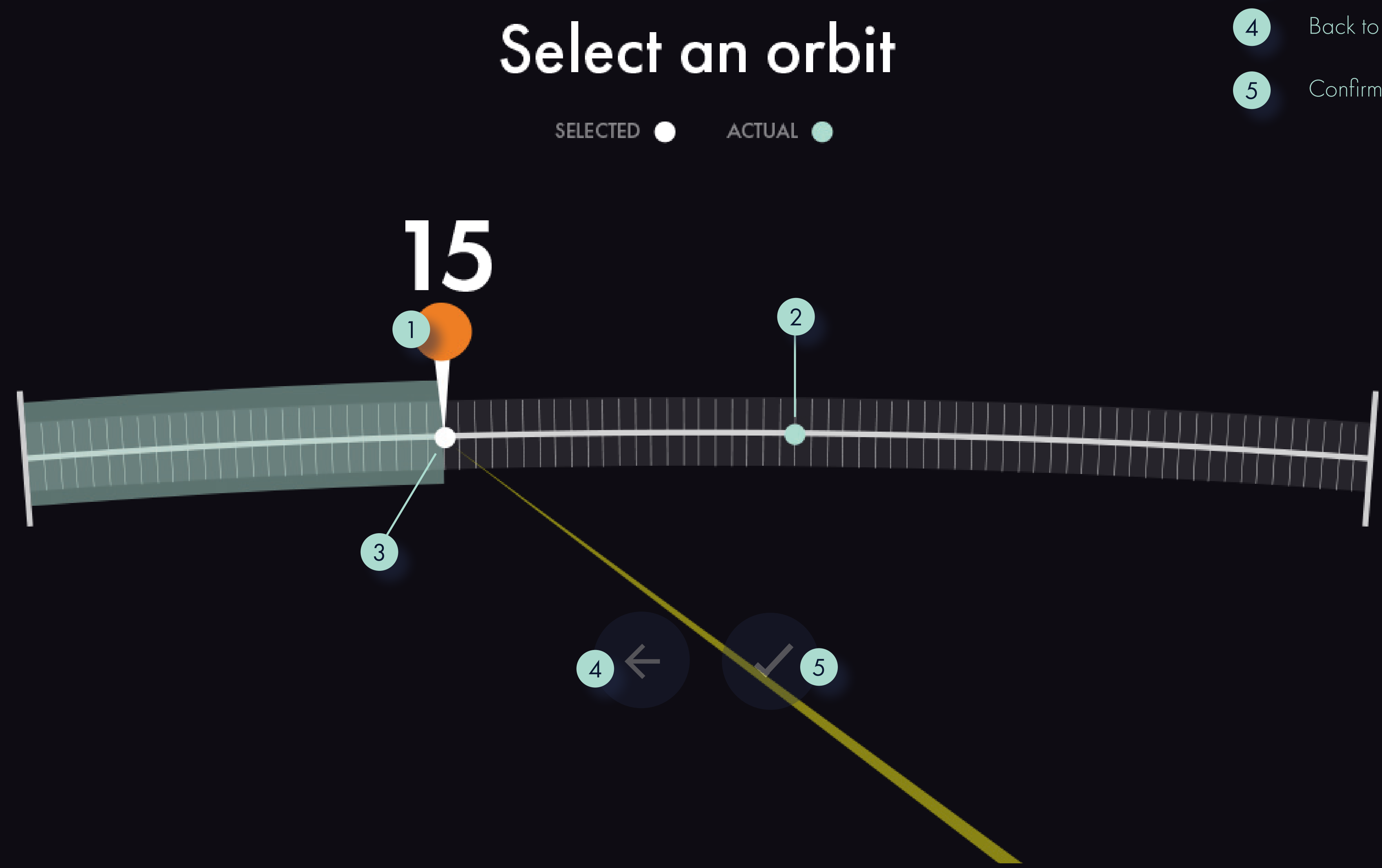

1. Access Main Menu
2. Local Standard Time
3. Call Duration
4. Back to Sub Menu
5. Select An Orbit
6. End SpaceTalk

# UI Components

## ORBITAL TIMELINE

The Orbital Timeline can be accessed via the Main Menu and is the primary means of allowing users to travel to a desired orbit within a spacecraft mission.

Users simply select their current orbit with their pointer and drag to a desired orbit. Once a desired orbit is selected, users click the confirmation check button underneath the timeline to transport themselves and collaborators to the new orbit.



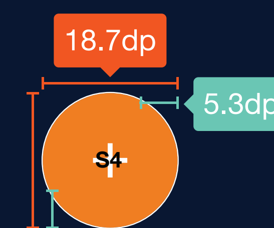

1. Orbit Hover Selector
2. Actual Spacecraft Orbit
3. Orbit You Are Current In
4. Back to Main Menu
5. Confirm Orbit Selection

# MOBILE REDLINES

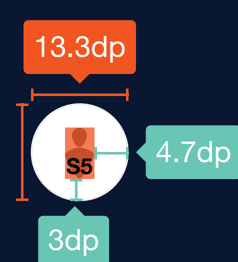
## BUTTONS

Please refer to pages 37 and 39 for the redline references.

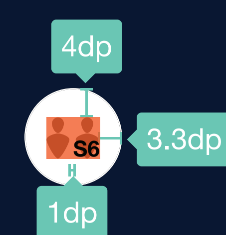

**B1**
background color: #252d4d
opacity: 100%



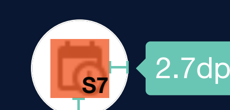

**B2**
background color: #ef7d22
opacity: 100%




**B3**
background color: #ffffff
opacity: 100%




**B4**
background color: #ffffff
opacity: 100%



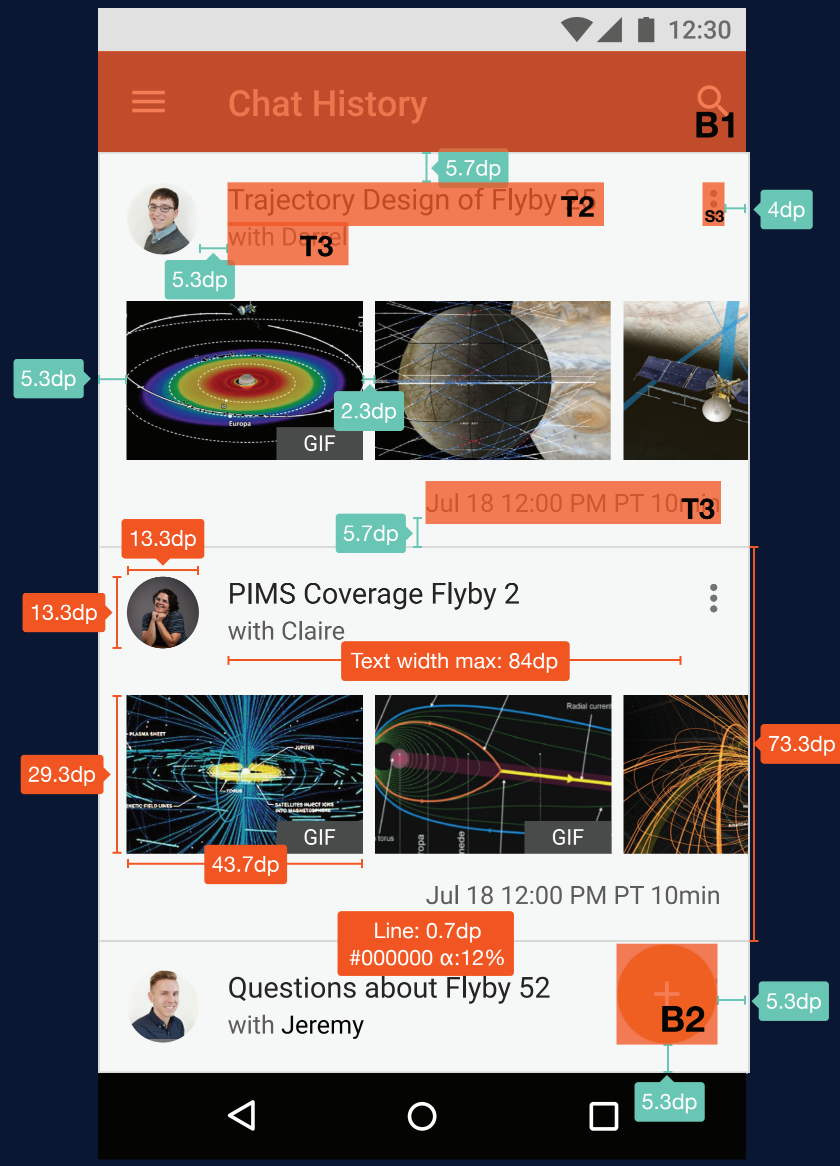

**B5**
background color: #ffffff
opacity: 100%

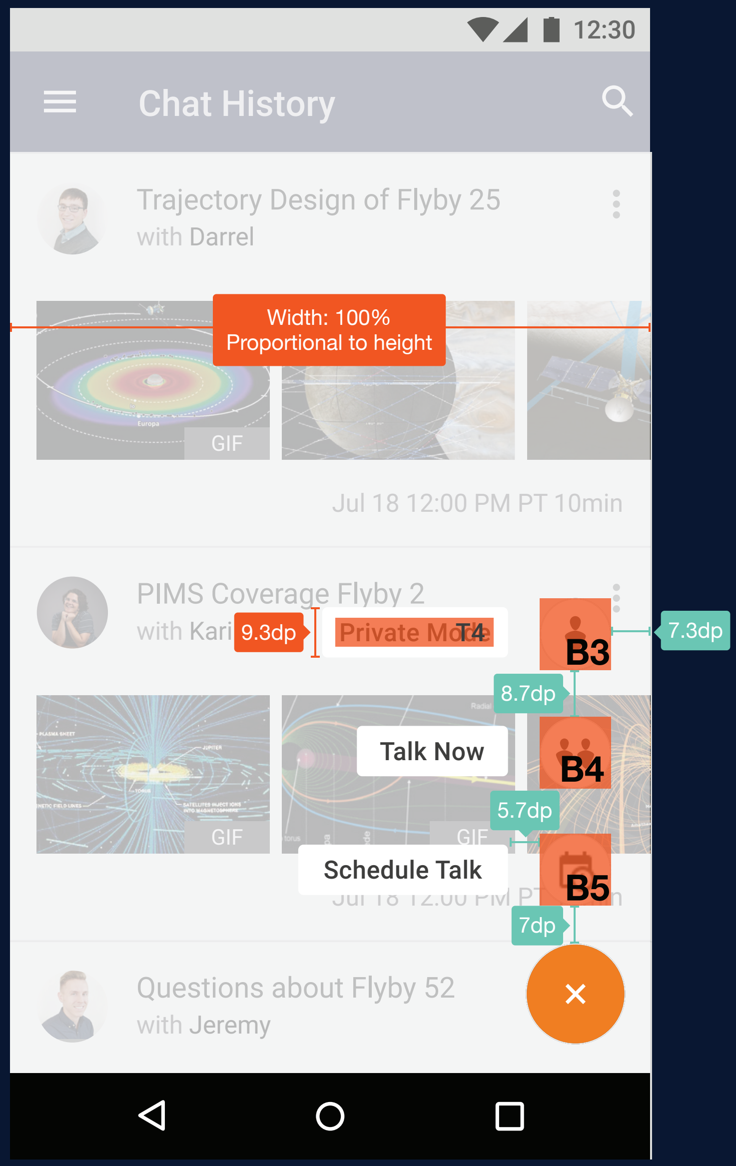

**B6**
background color: #ef7d22
opacity: 100%

# MOBILE REDLINES

## UI REDLINES

Please refer to pages 37 and 39 for the redline references.



# MOBILE REDLINES