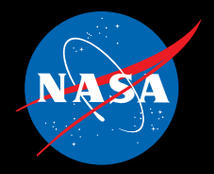
team

PYXIS *(pik·sis)*

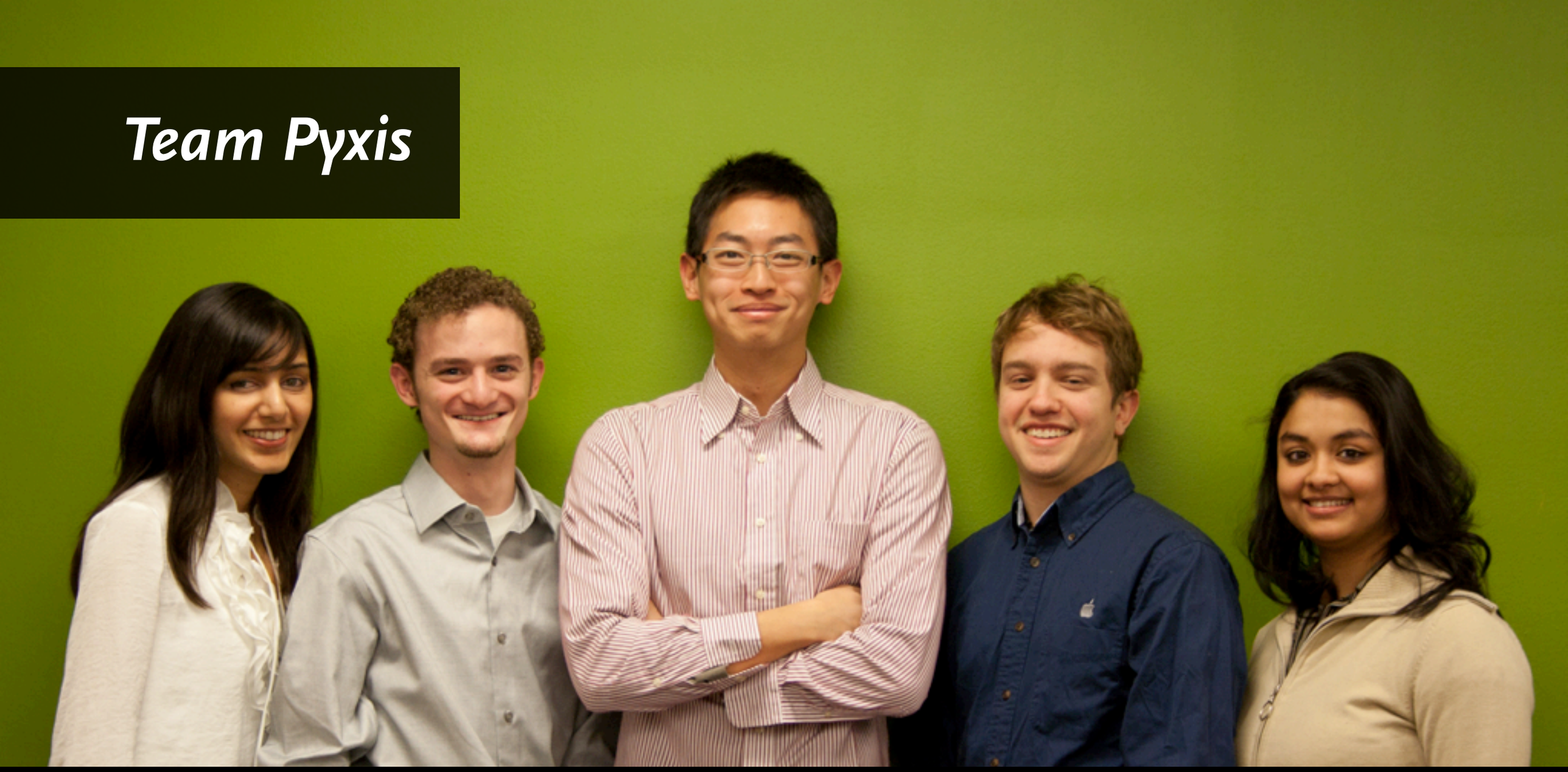
Final Presentation
August 2, 2011

Eric Dudiak
Nisha Kurani
Clifton Lin
Tony Poor
Sony Verma



Carnegie
Mellon
University

Team Pyxis



Nisha Kurani
Co-Project Manager

Clifton Lin
Co-Project Manager

Sony Verma
Research Lead

Tony Poor
Design Lead

Eric Dudiak
Technical Lead

About the HCII

Carnegie Mellon's Human-Computer Interaction Institute is dedicated to research and education in topics related to technology that supports human activity. The two-semester capstone project connects teams of masters students with industry sponsors.

Our NASA Colleagues

Final Presentation · NASA · Carnegie Mellon HCII · Team Pyxis

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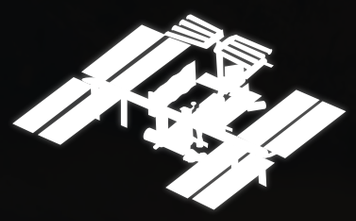
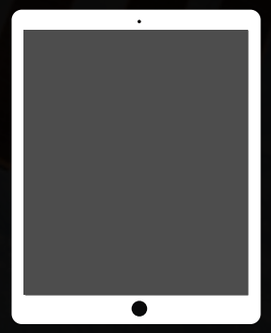
The *ISS Live!* Project

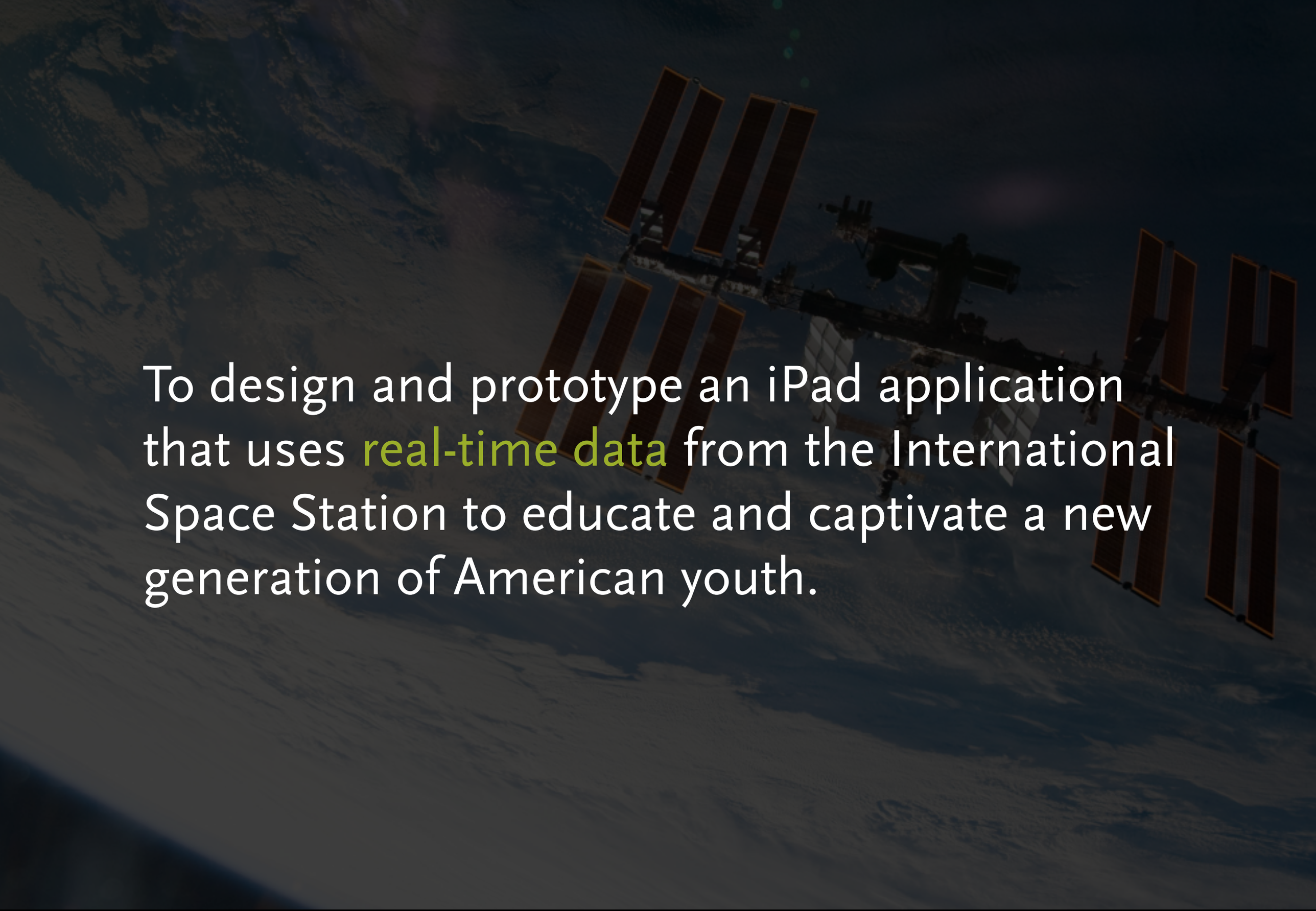


Schedule Data
Telemetry Data



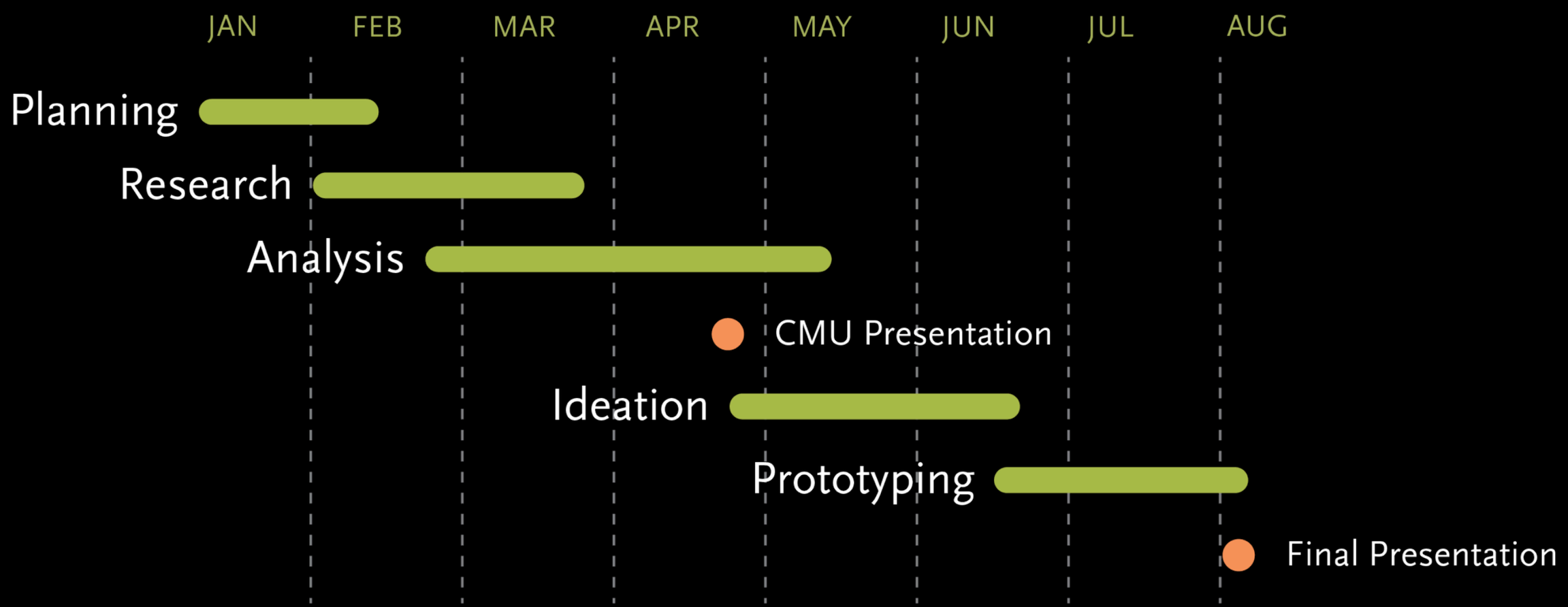
Emerging
Platforms

General Public



To design and prototype an iPad application that uses real-time data from the International Space Station to educate and captivate a new generation of American youth.

Overall Schedule



Today's Agenda

1. Research
2. Solution
3. Process
4. Conclusion

1

Research

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Field Research Demographics

Field Research Demographics

Students

What are their goals and desires?
What motivates them?

Field Research Demographics

NASA

What are their objectives?
What is interesting about the data?

Students

What are their goals and desires?
What motivates them?

Field Research Demographics

Educators

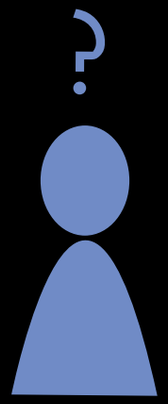
How do they craft content and communicate scientific material?

NASA

What are their objectives?
What is interesting about the data?

Students

What are their goals and desires?
What motivates them?



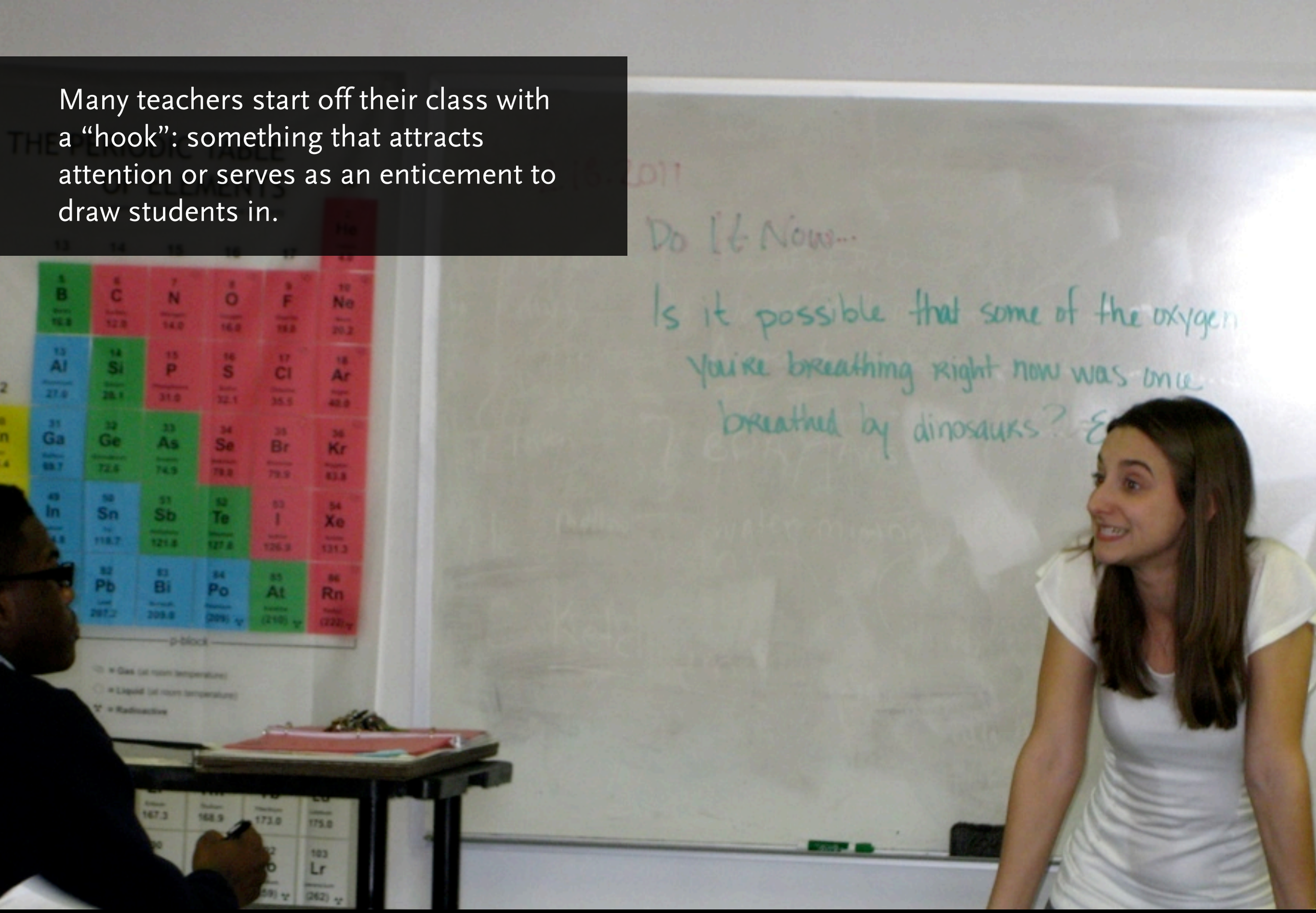
1
Captivate Students' Attention

2
Create a Visceral Experience

3
Relate it to their World

4
Manage Interruptions

Many teachers start off their class with a “hook”: something that attracts attention or serves as an enticement to draw students in.



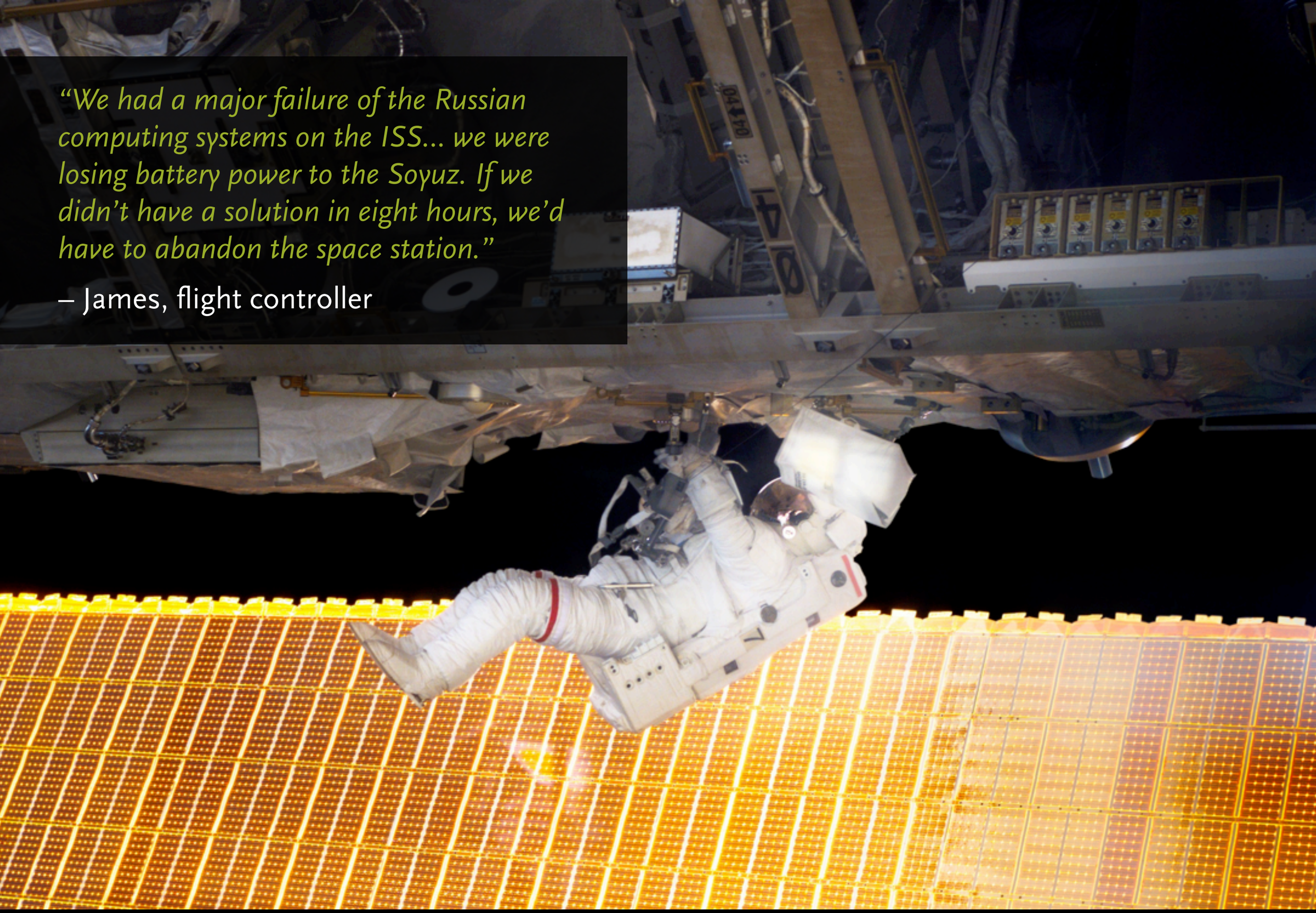
Captivate Students' Attention

Curiosity arises from familiar topics with a new twist.

Students have diverse interests.

Visuals universally attract attention.

Hierarchy of information facilitates browsing.



"We had a major failure of the Russian computing systems on the ISS... we were losing battery power to the Soyuz. If we didn't have a solution in eight hours, we'd have to abandon the space station."

– James, flight controller

Create a Visceral Experience

Hands-on presentation of information stands out.

Science experiments on the ISS is intriguing.

Technical details and experiential elements of life in space interest students.

Emotion increases excitement and memorability.

High risk activities are most interesting.

"You can go even deeper in physics and talk about what kind of bonds there are and what are the forces acting on the molecules, and everything is really connected."

– Isaac, 12th Grader

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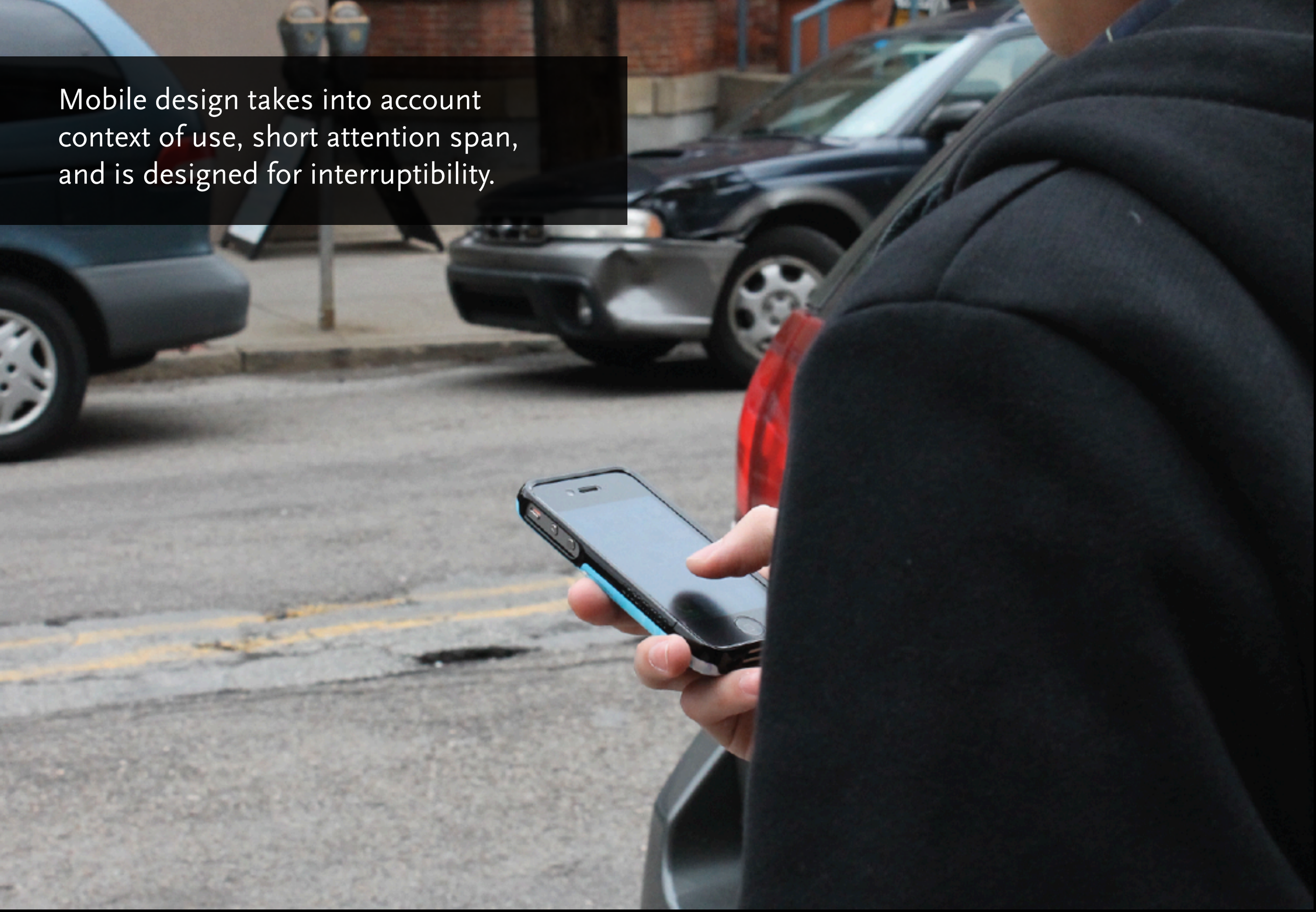
Relate It To Their World

Familiarity facilitates interest.

Students want to see value in what they learn.

Different perspectives enrich the story.

Camaraderie resonates with students and flight controllers.


Mobile design takes into account
context of use, short attention span,
and is designed for interruptibility.

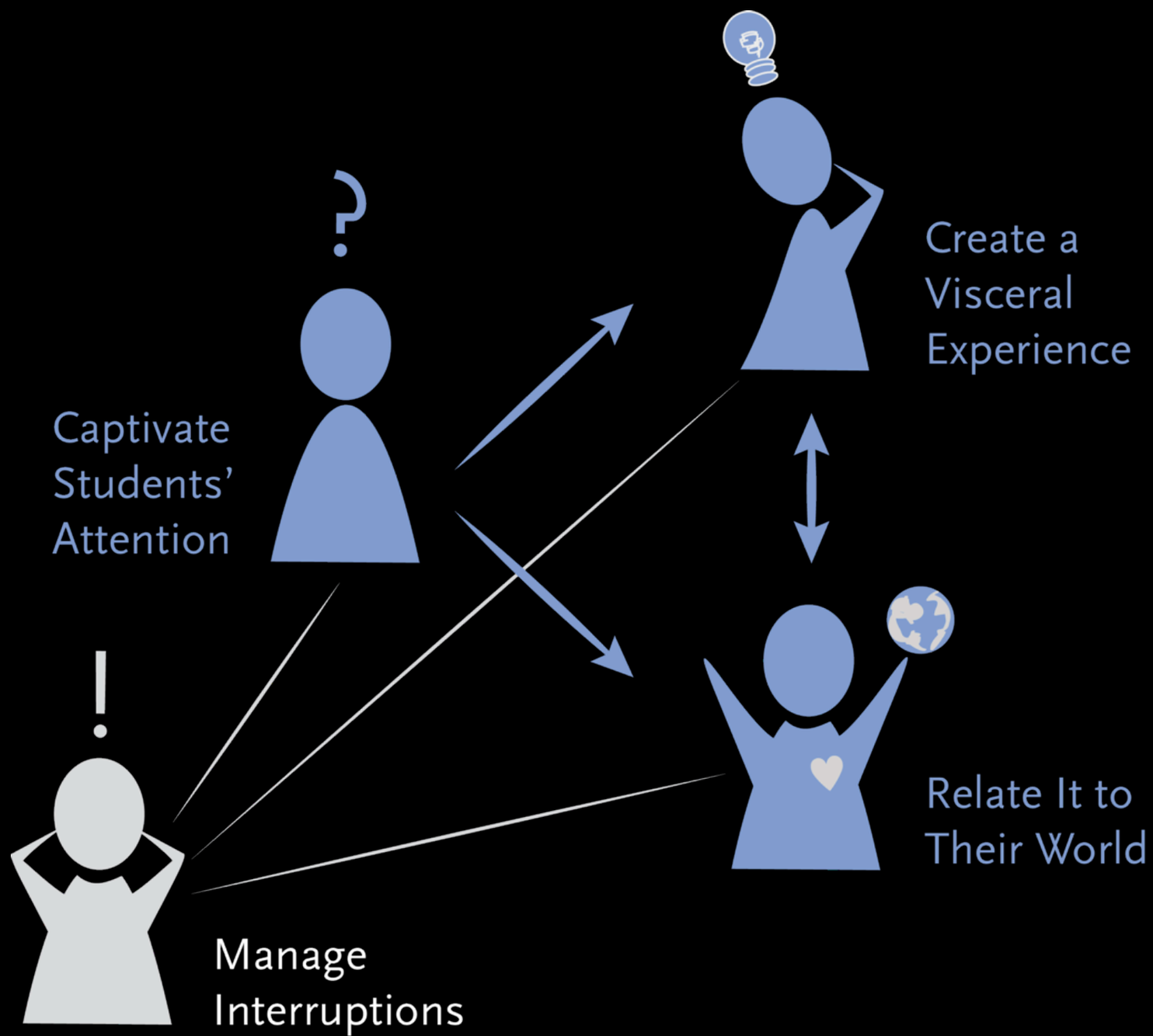
Manage Interruptions

Allow the users to flexibly enter and exit the application.

Minimize interruptions to workflow and user goals.

Put users in control in the process of interaction.

Theme Relationship



2

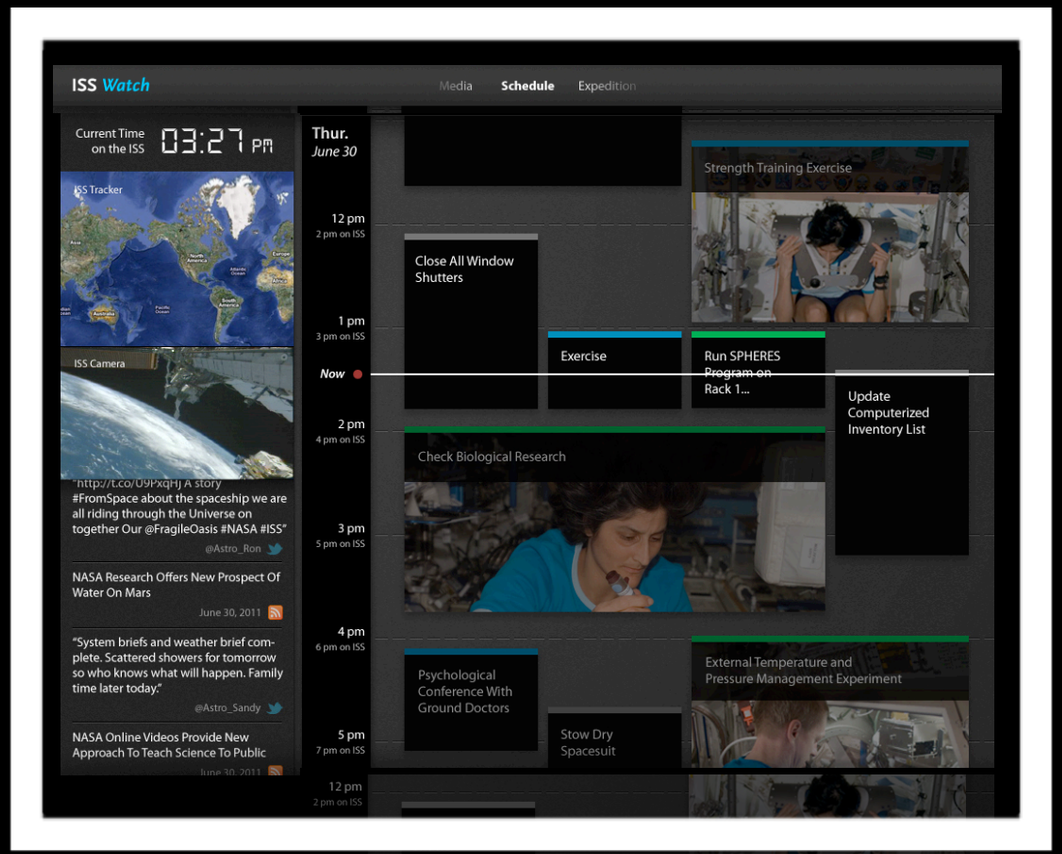
Solution

Introducing: **ISS** *Watch*

An iPad application that presents real-time station information to encourage high school students to explore and learn more.

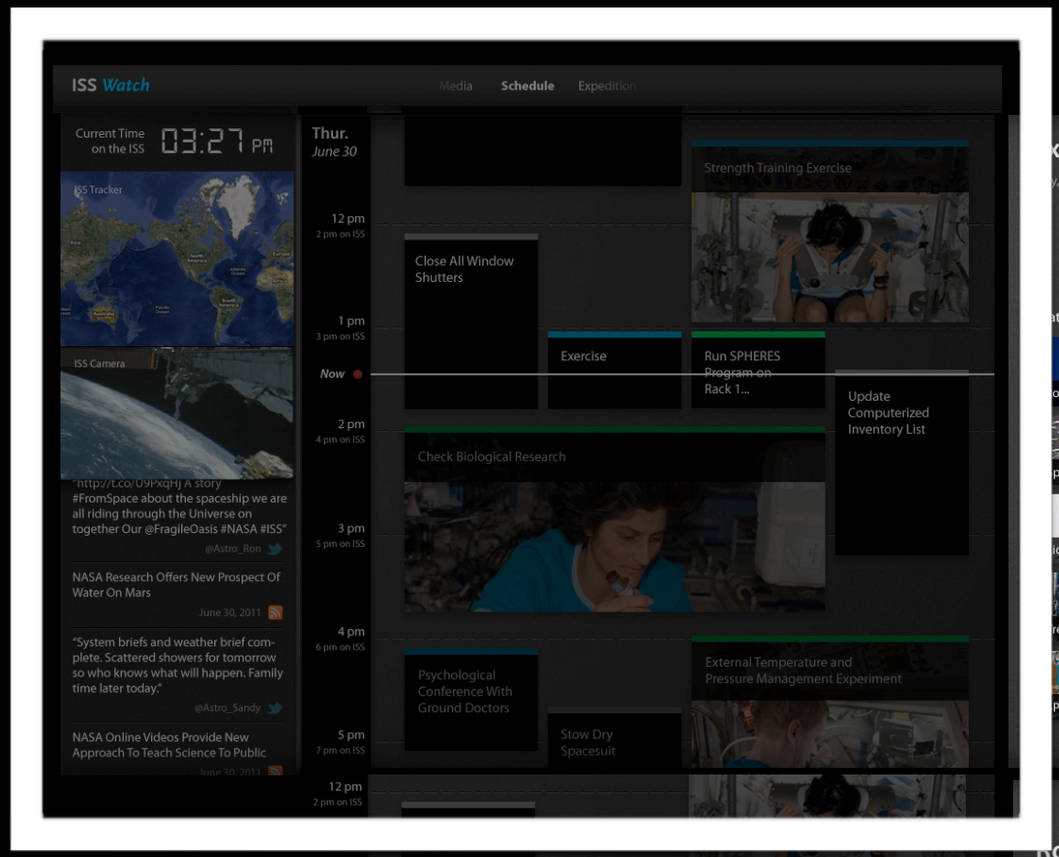
iPad
ISSWatch

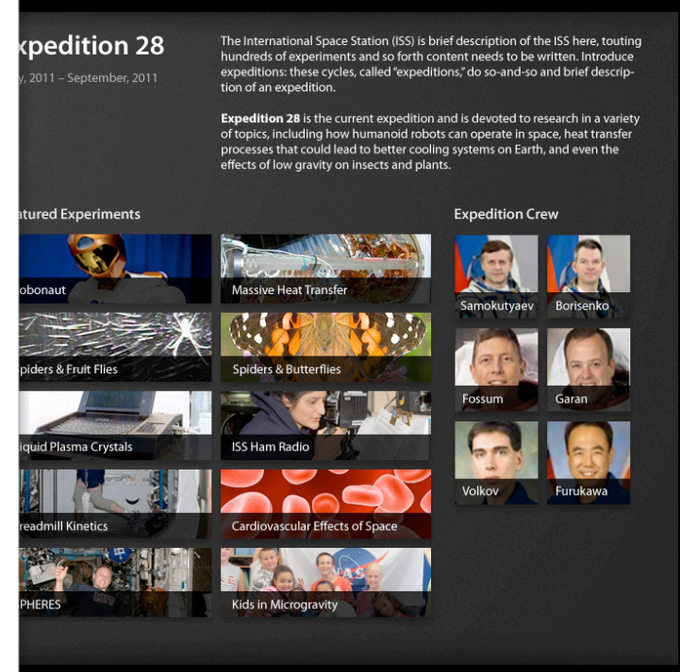
Schedule


ISS Watch
Media
Schedule
Expedition
Current Time on the ISS
03:27 PM
ISS Tracker
ISS Camera
"http://t.co/U9PxqHJ A story #FromSpace about the spaceship we are all riding through the Universe on together Our @FragileOasis #NASA #ISS"
@Astro_Ron
NASA Research Offers New Prospect Of Water On Mars
June 30, 2011
"System briefs and weather brief complete. Scattered showers for tomorrow so who knows what will happen. Family time later today."
@Astro_Sandy
NASA Online Videos Provide New Approach To Teach Science To Public
June 30, 2011
Thur.
June 30
12 pm
2 pm on ISS
1 pm
3 pm on ISS
Now
2 pm
4 pm on ISS
3 pm
5 pm on ISS
4 pm
6 pm on ISS
5 pm
7 pm on ISS
12 pm
2 pm on ISS
Close All Window Shutters
Strength Training Exercise
Exercise
Run SPHERES Program on Rack 1...
Update Computerized Inventory List
Check Biological Research
Psychological Conference With Ground Doctors
Stow Dry Spacesuit
External Temperature and Pressure Management Experiment

Schedule

Expedition

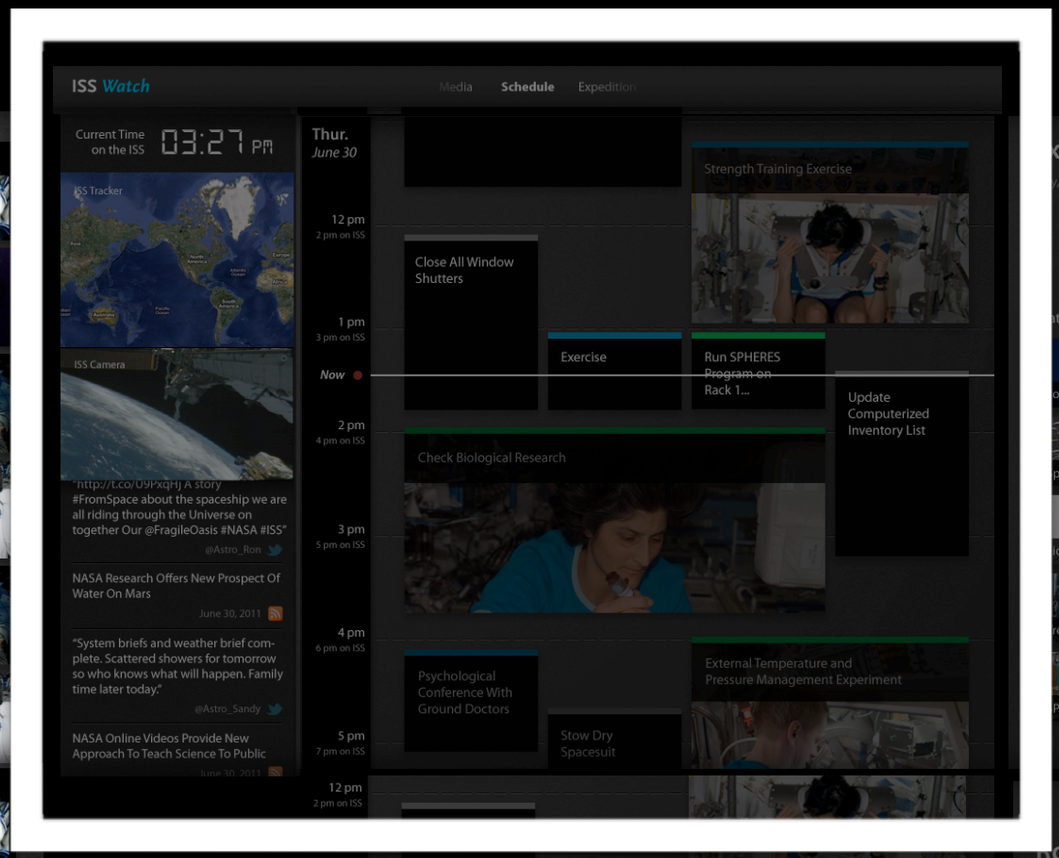


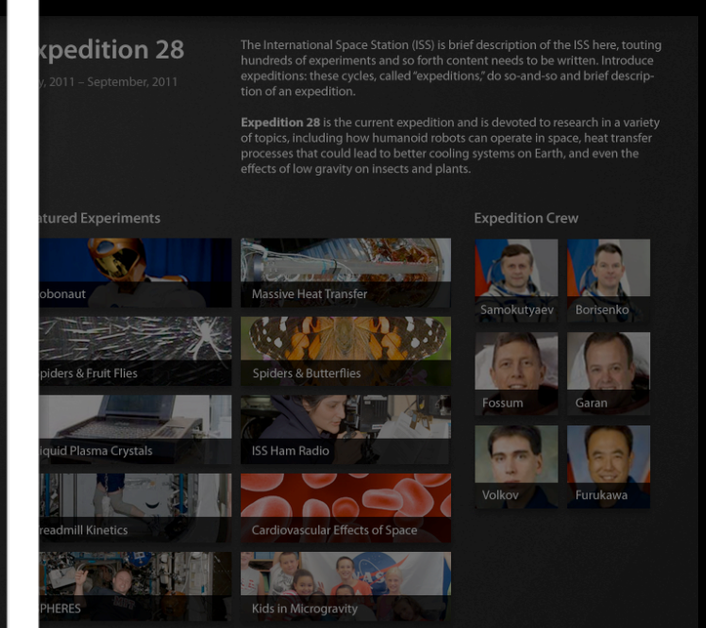


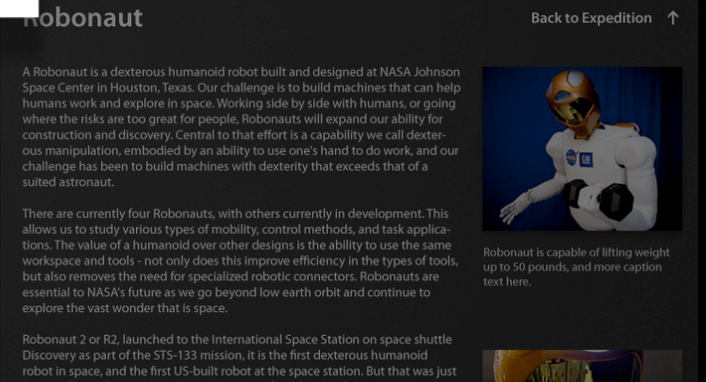
Media

Schedule

Expedition



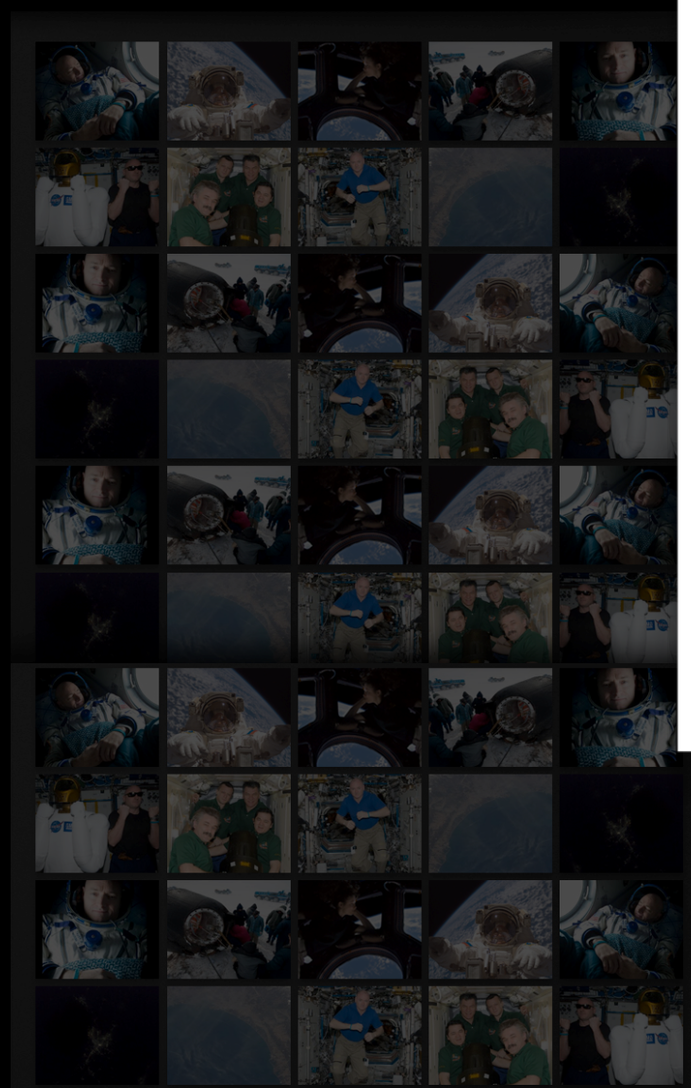


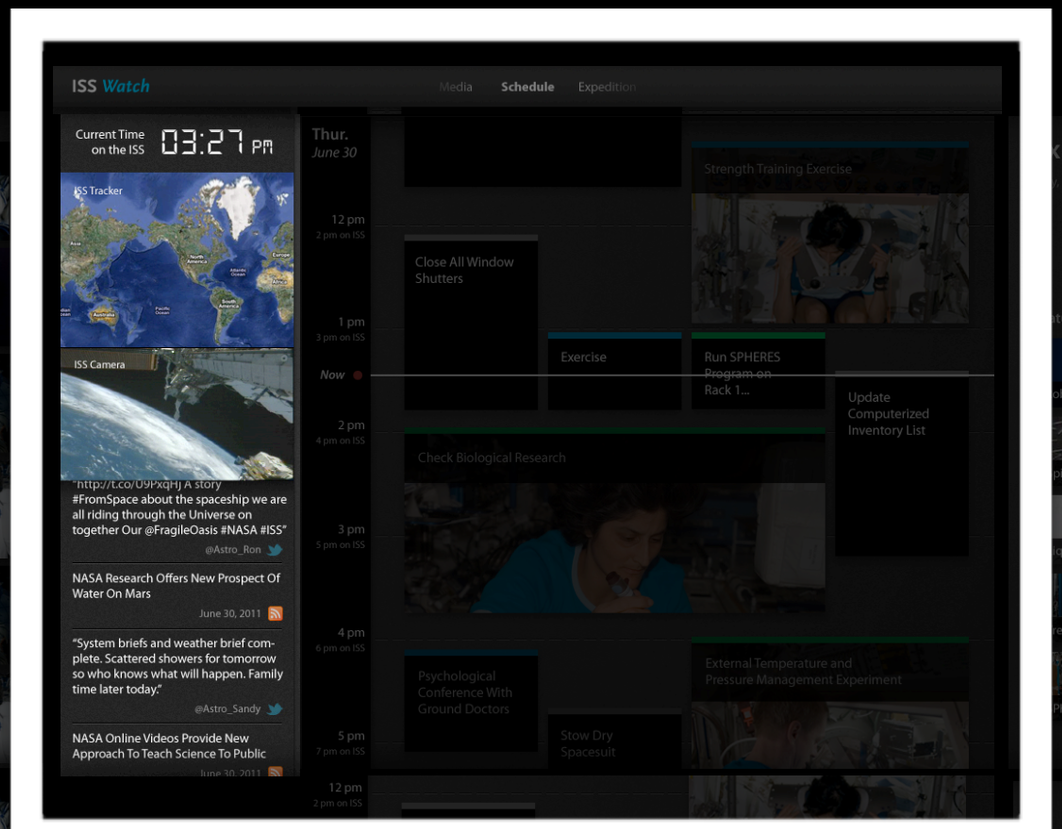


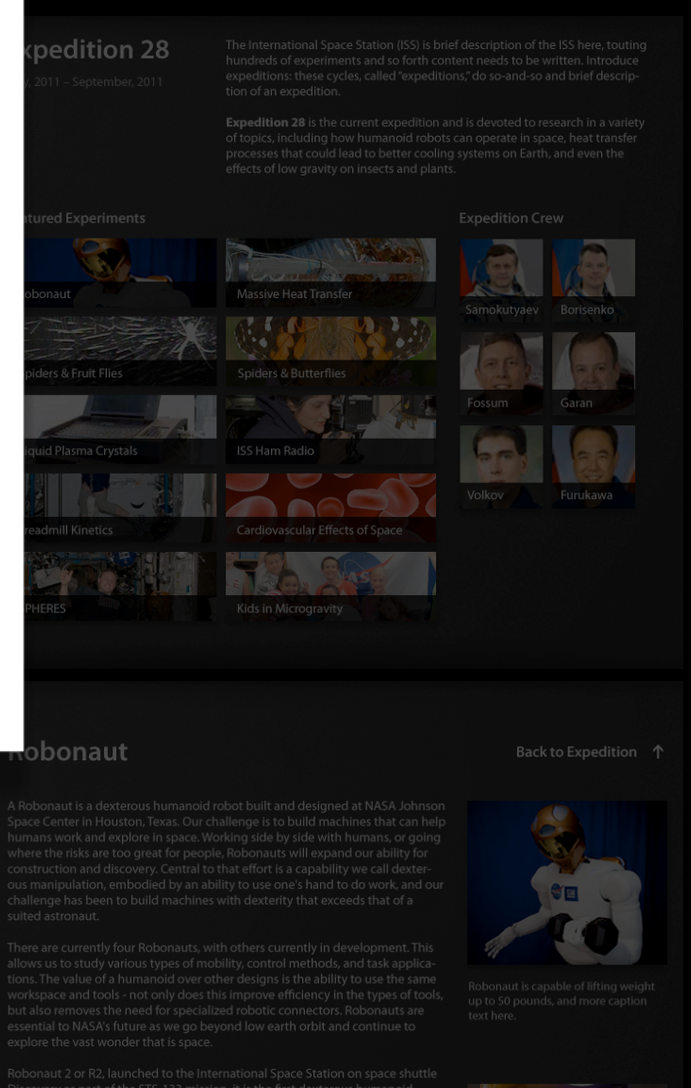
Media

Schedule

Expedition





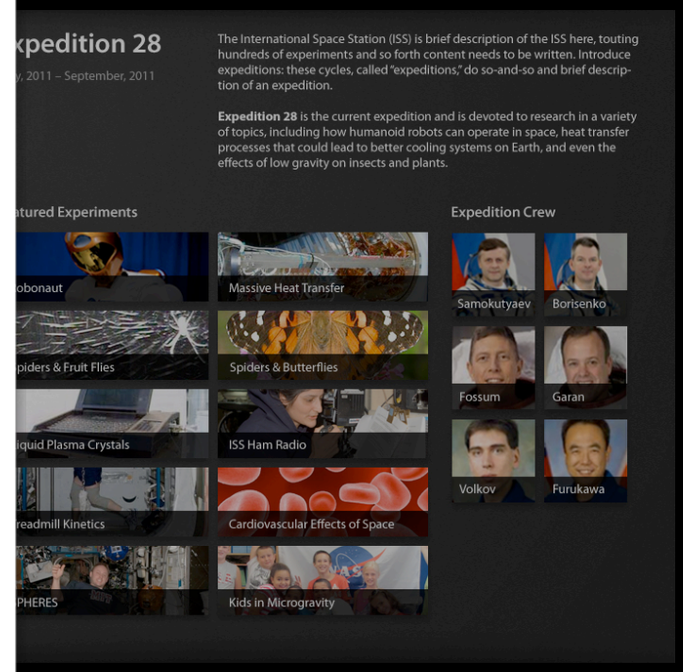


Vertical Scroll
navigates in depth of each
sections for further content

Media

Schedule

Expedition

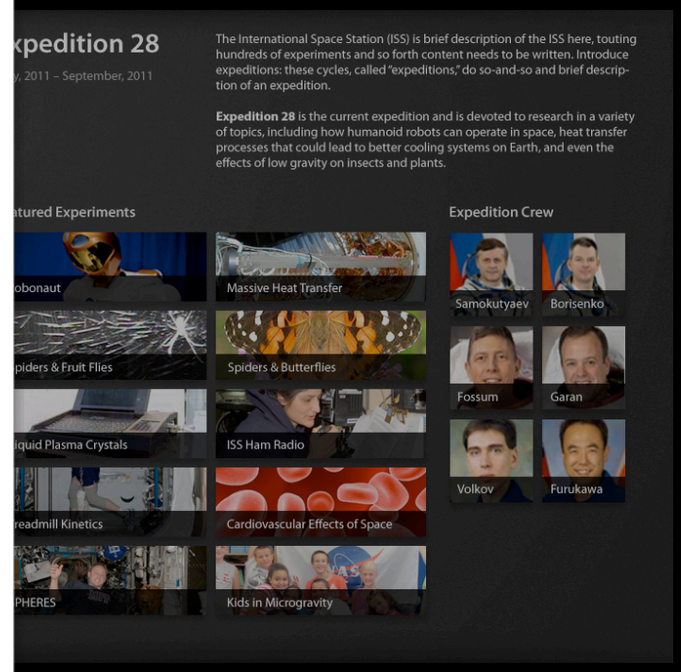


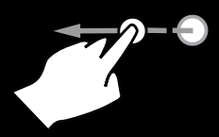
Vertical Scroll
navigates in depth of each
sections for further content

Media

Schedule

Expedition



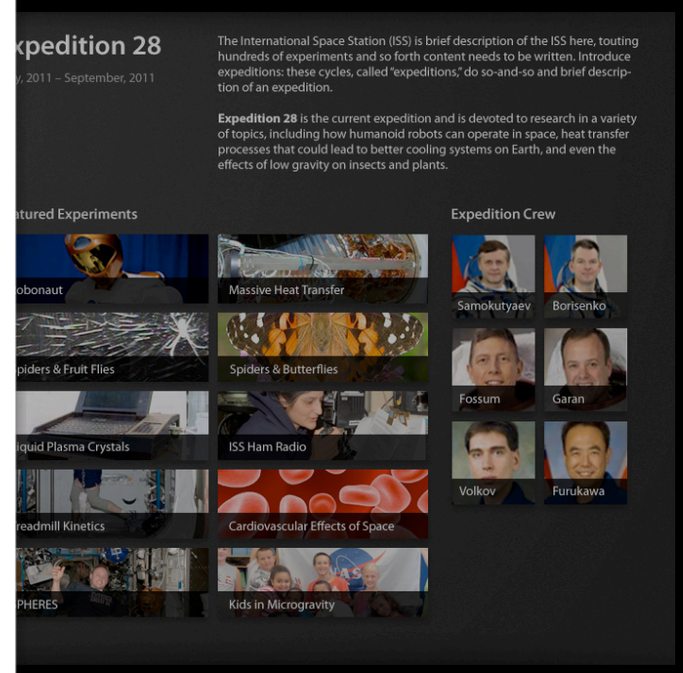


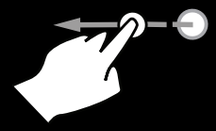
Horizontal Swipe
navigates between the 3 main sections of the application

Media

Schedule

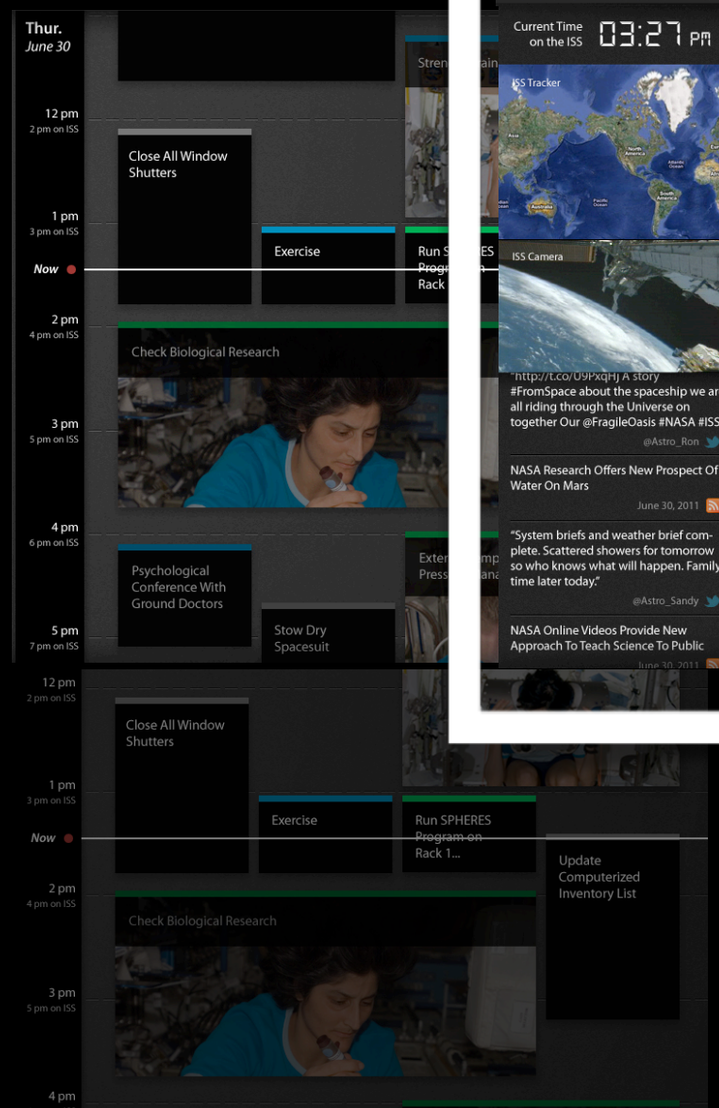
Expedition



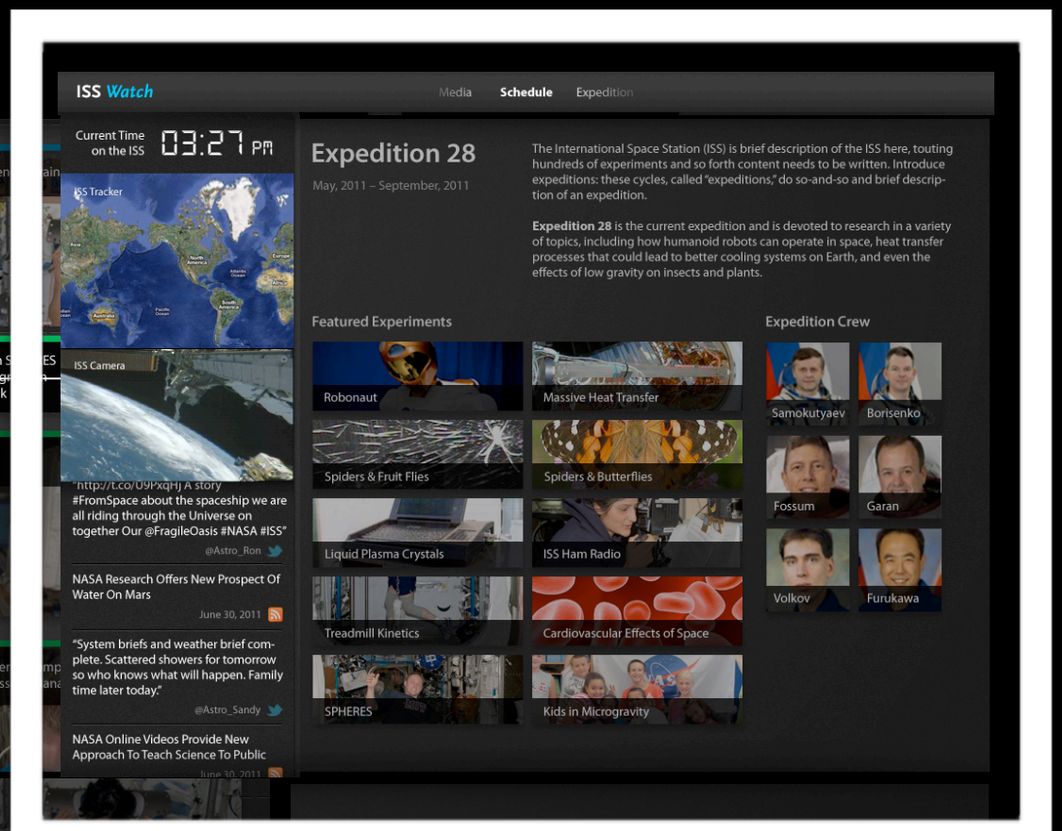


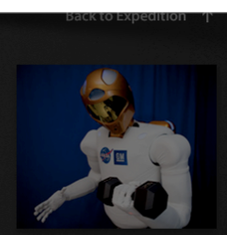
Horizontal Swipe
navigates between the 3 main sections of the application

Schedule



Expedition





Tap
Dive in depth into contents within each section

Expedition

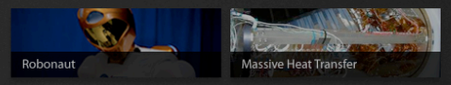
Expedition 28

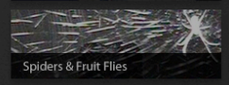
May, 2011 – September, 2011

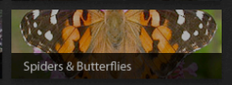
The International Space Station (ISS) is brief description of the ISS here, touting hundreds of experiments and so forth content needs to be written. Introduce expeditions: these cycles, called "expeditions," do so-and-so and brief description of an expedition.

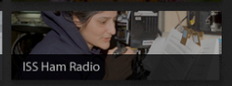
Expedition 28 is the current expedition and is devoted to research in a variety of topics, including how humanoid robots can operate in space, heat transfer processes that could lead to better cooling systems on Earth, and even the effects of low gravity on insects and plants.

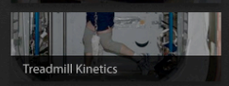
Featured Experiments

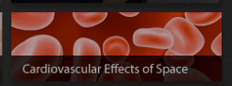


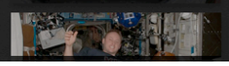


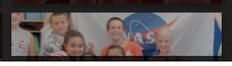












Expedition Crew

ISS *Watch*

Media **Schedule** Expedition

Current Time on the ISS 03:27 PM

"http://t.co/U9PxqHJ A story #FromSpace about the spaceship we are all riding through the Universe on together Our @FragileOasis #NASA #ISS"

@Astro_Ron

NASA Research Offers New Prospect Of Water On Mars

June 30, 2011

"System briefs and weather brief complete. Scattered showers for tomorrow so who knows what will happen. Family time later today."

@Astro_Sandy

NASA Online Videos Provide New Approach To Teach Science To Public

June 30, 2011

Robonaut

Back to Expedition

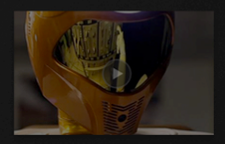
A Robonaut is a dexterous humanoid robot built and designed at NASA Johnson Space Center in Houston, Texas. Our challenge is to build machines that can help humans work and explore in space. Working side by side with humans, or going where the risks are too great for people, Robonauts will expand our ability for construction and discovery. Central to that effort is a capability we call dexterous manipulation, embodied by an ability to use one's hand to do work, and our challenge has been to build machines with dexterity that exceeds that of a suited astronaut.

There are currently four Robonauts, with others currently in development. This allows us to study various types of mobility, control methods, and task applications. The value of a humanoid over other designs is the ability to use the same workspace and tools - not only does this improve efficiency in the types of tools, but also removes the need for specialized robotic connectors. Robonauts are essential to NASA's future as we go beyond low earth orbit and continue to explore the vast wonder that is space.

Robonaut 2 or R2, launched to the International Space Station on space shuttle Discovery as part of the STS-133 mission, it is the first dexterous humanoid robot in space, and the first US-built robot at the space station. But that was just one small step for a robot and one giant leap for robot-kind.

Initially R2 will be deployed on a fixed pedestal inside the ISS. Next steps include a leg for climbing through the corridors of the Space Station, upgrades for R2 to go outside into the vacuum of space, and then future lower bodies like legs and wheels to propel the R2 across Lunar and Martian terrain. A four wheeled rover called Centaur 2 is being evaluated at the 2010 Desert Field Test in Arizona as an example of these future lower bodies for R2.

Robonaut is capable of lifting weight up to 50 pounds, and more caption text here.



Robonaut 2 practicing with its ISS taskboard.

With the Insights in Mind

Captivate Students' Attention

Create a Visceral Experience

Relate it to Their World

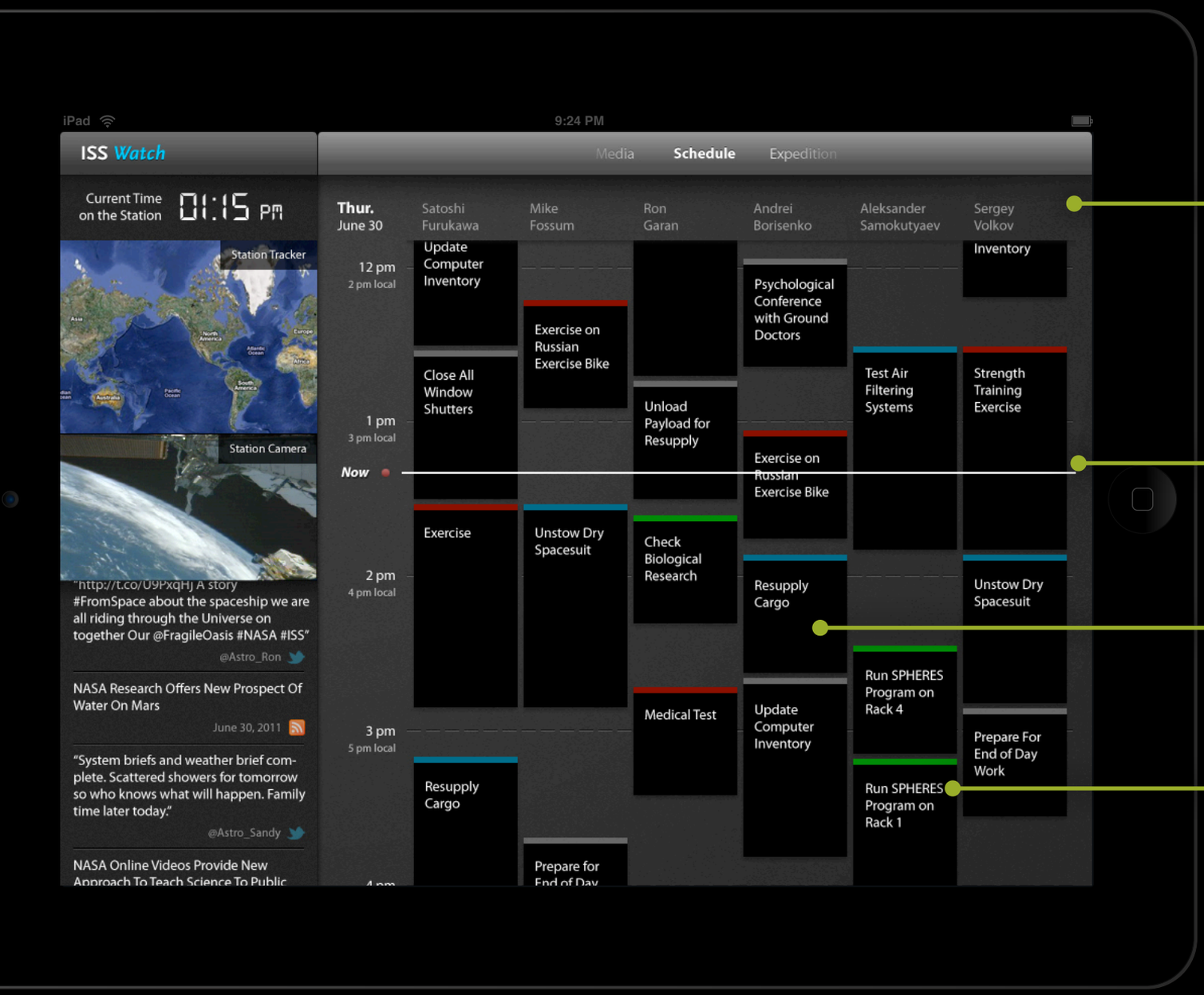
Manage Interruptions

Loading Screen

Simulation of synchronizing with the station

Provide quick fact to make the wait time meaningful

Schedule Screen



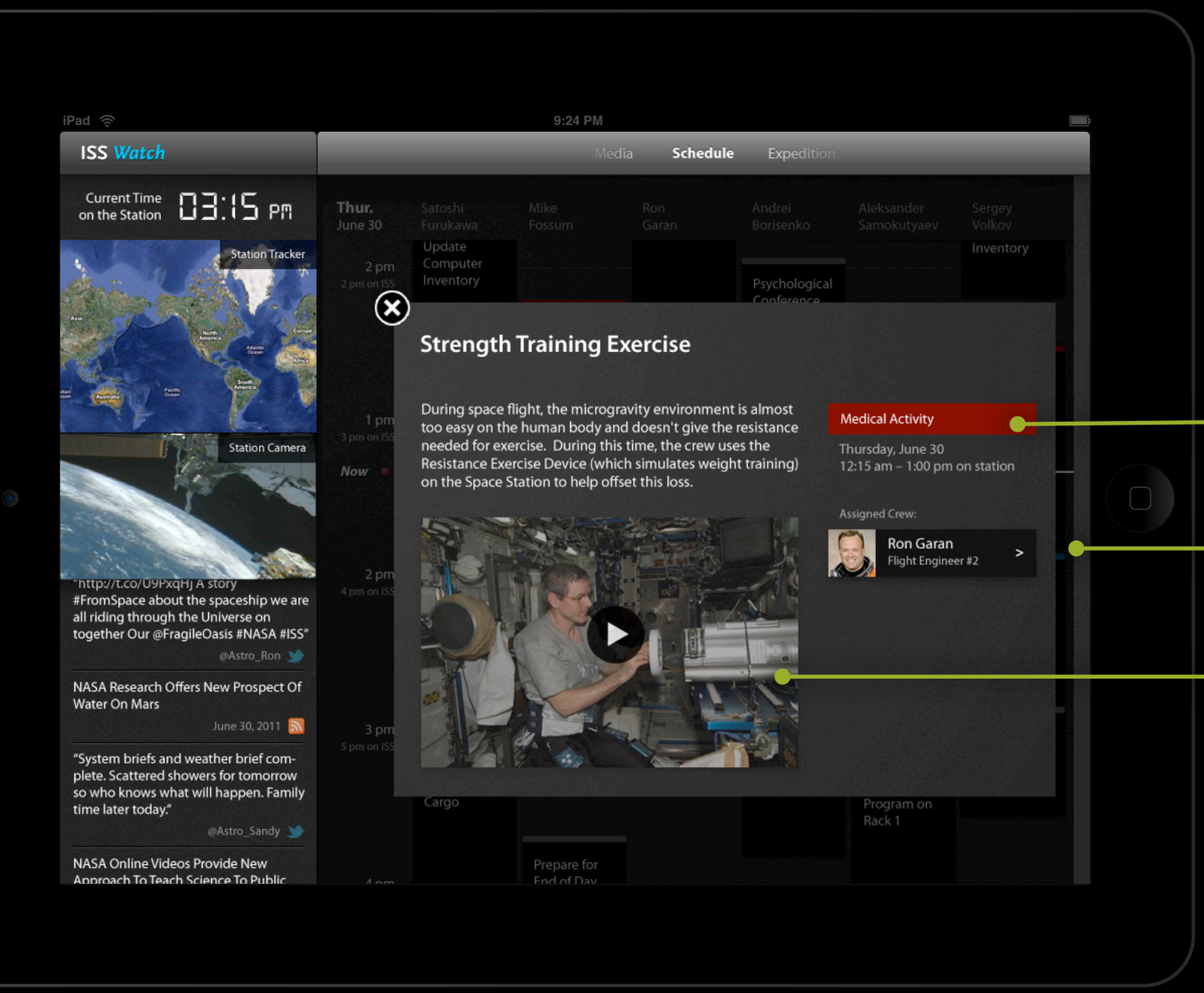
Scrollable timeline

Now line clearly indicates current activities

Tap-able timeline activity blocks brings out detail popover

Blocks are color-coded by category

Activity Detail Popover

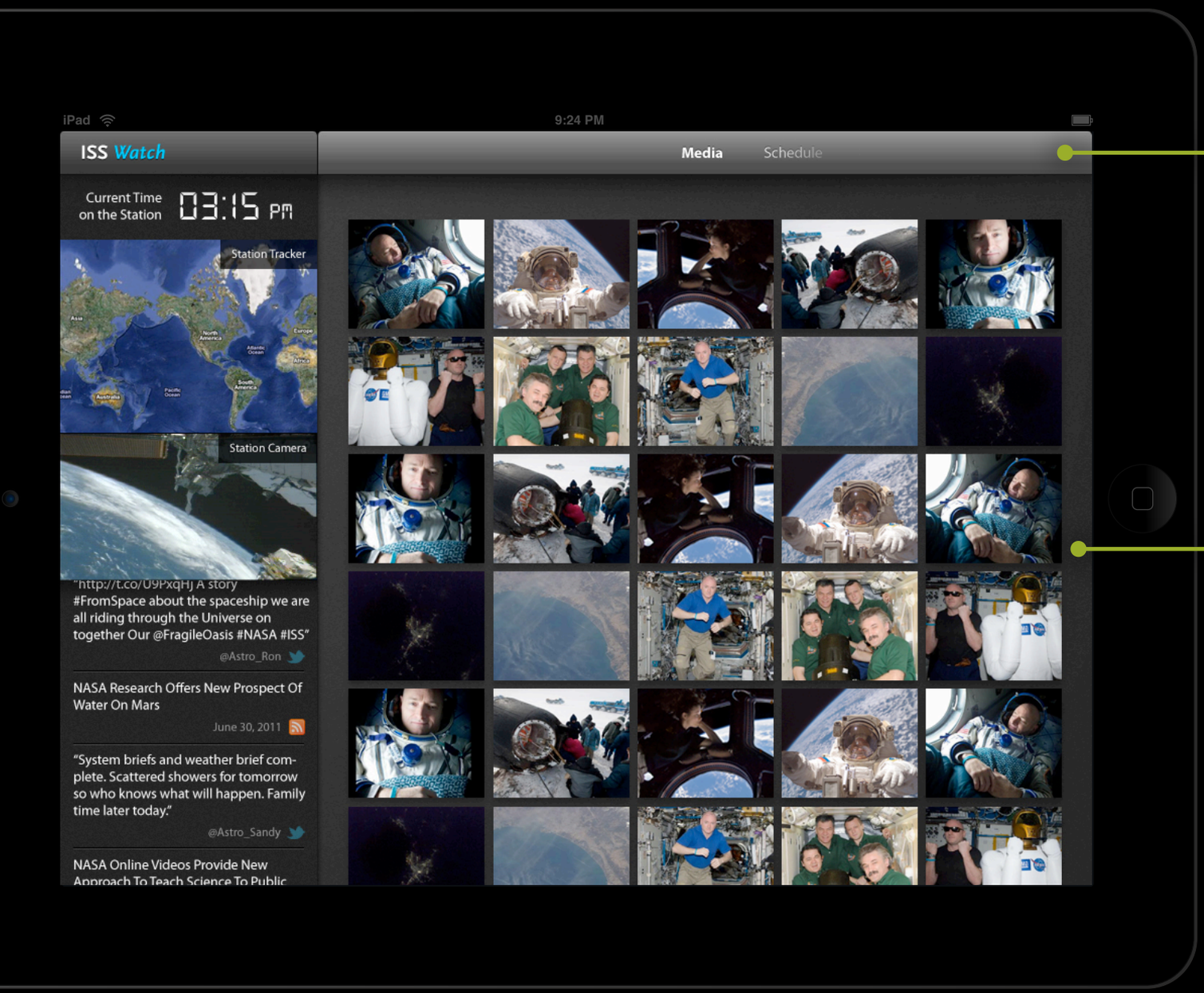


Category label

List of astronauts assigned

Description and media

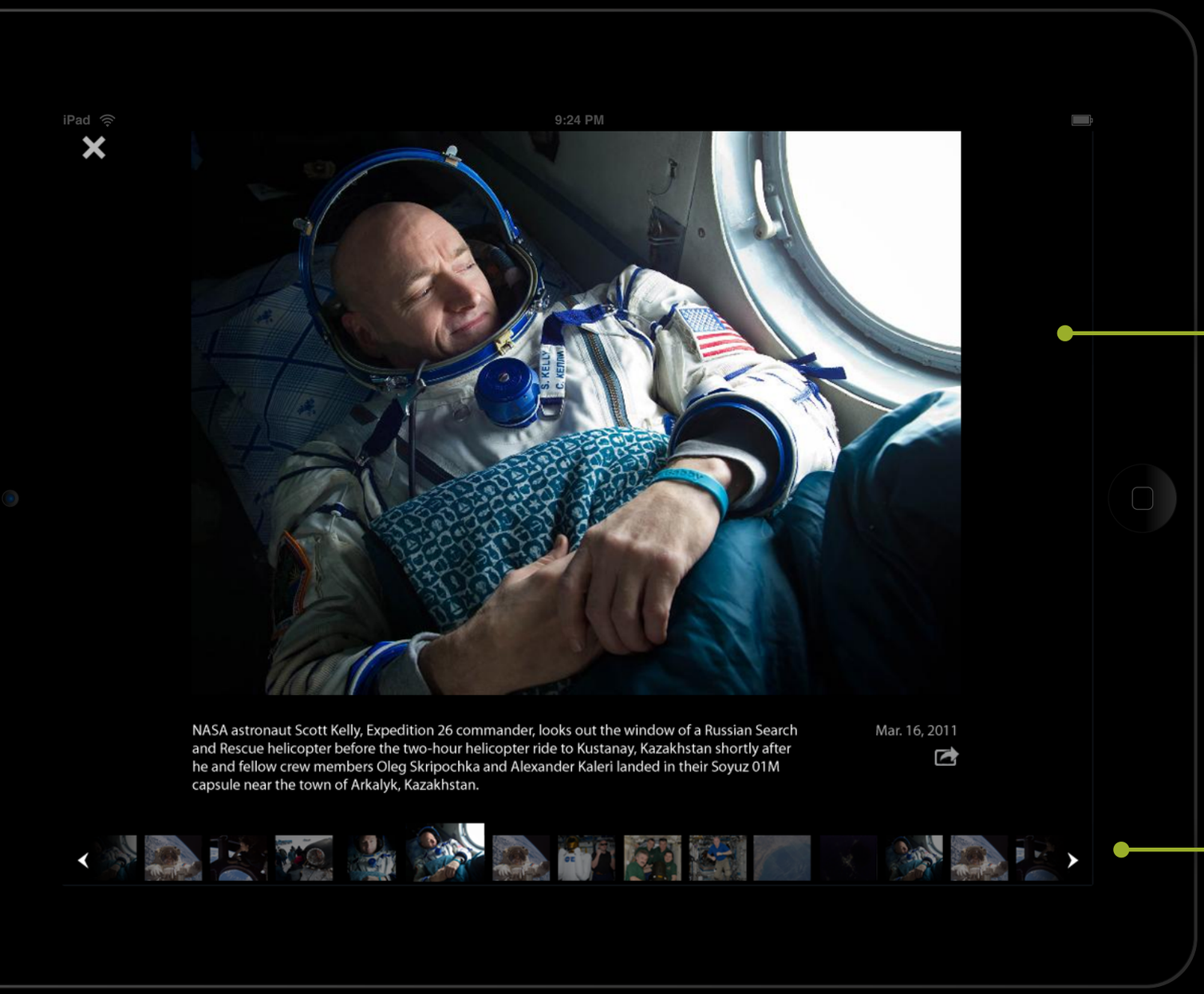
Media Gallery



Toggle switch between types of media

Scrollable collage of images and/or videos

Media Detail



Enlarged image with descriptions

Filmstrip supporting quick navigation through media

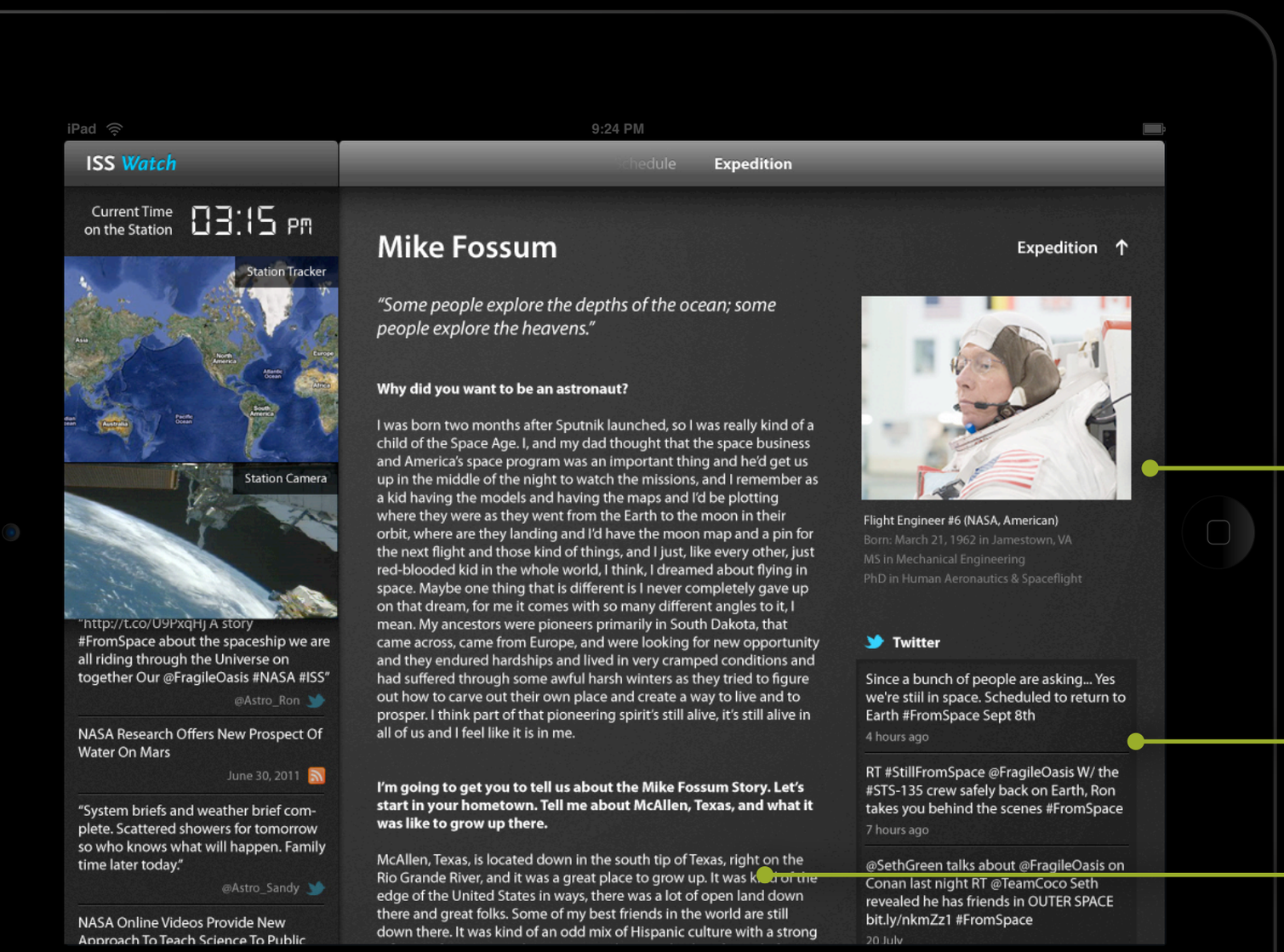
Expedition Screen

Overall description of the expedition/space station

Astronauts on board this expedition

Featured experiments

Astronaut Screen

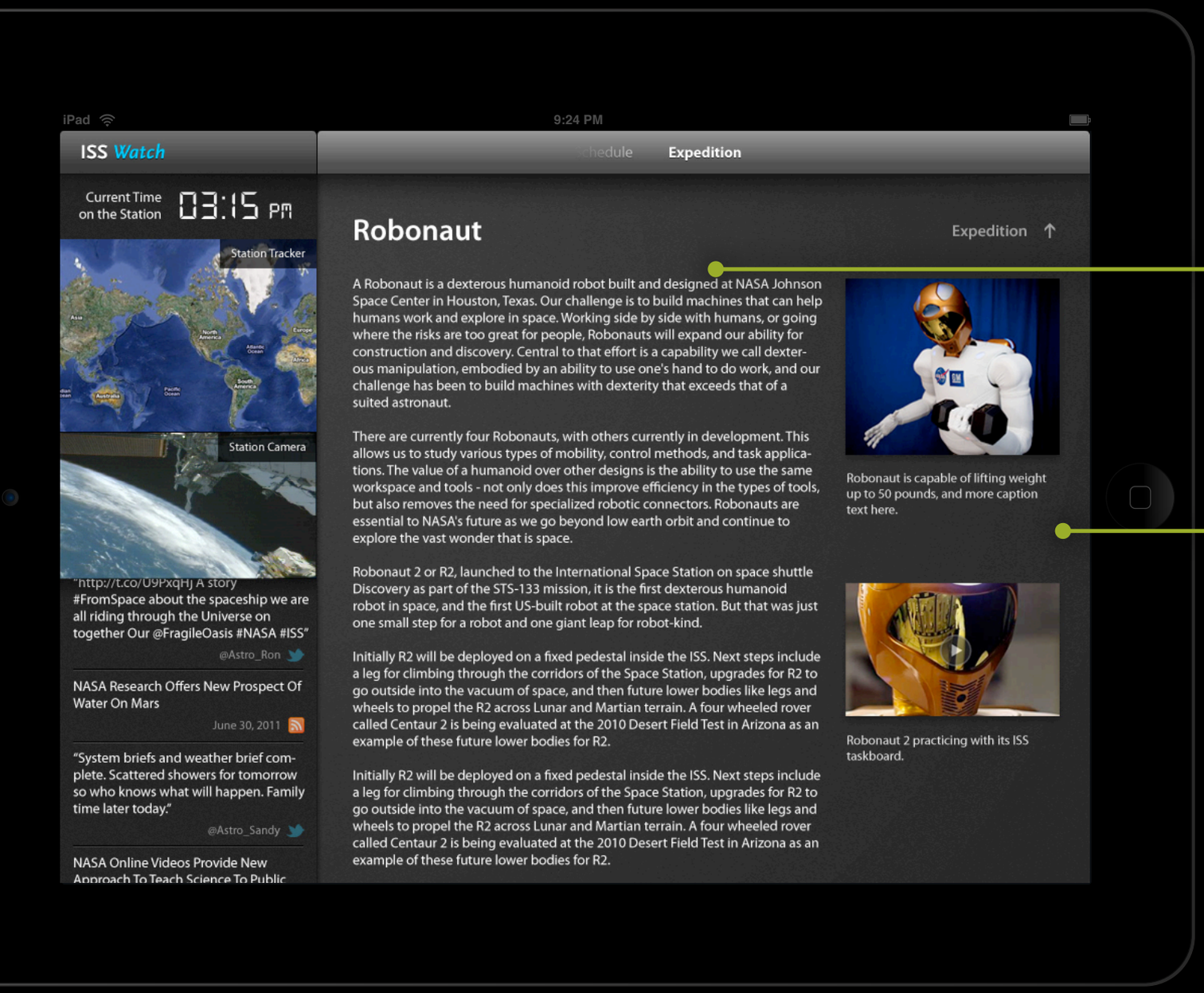


Picture and short astronaut biography

Tweets (when available)

Quote and preflight interview

Experiment Screen



Long description of the experiment

Related media (when available)

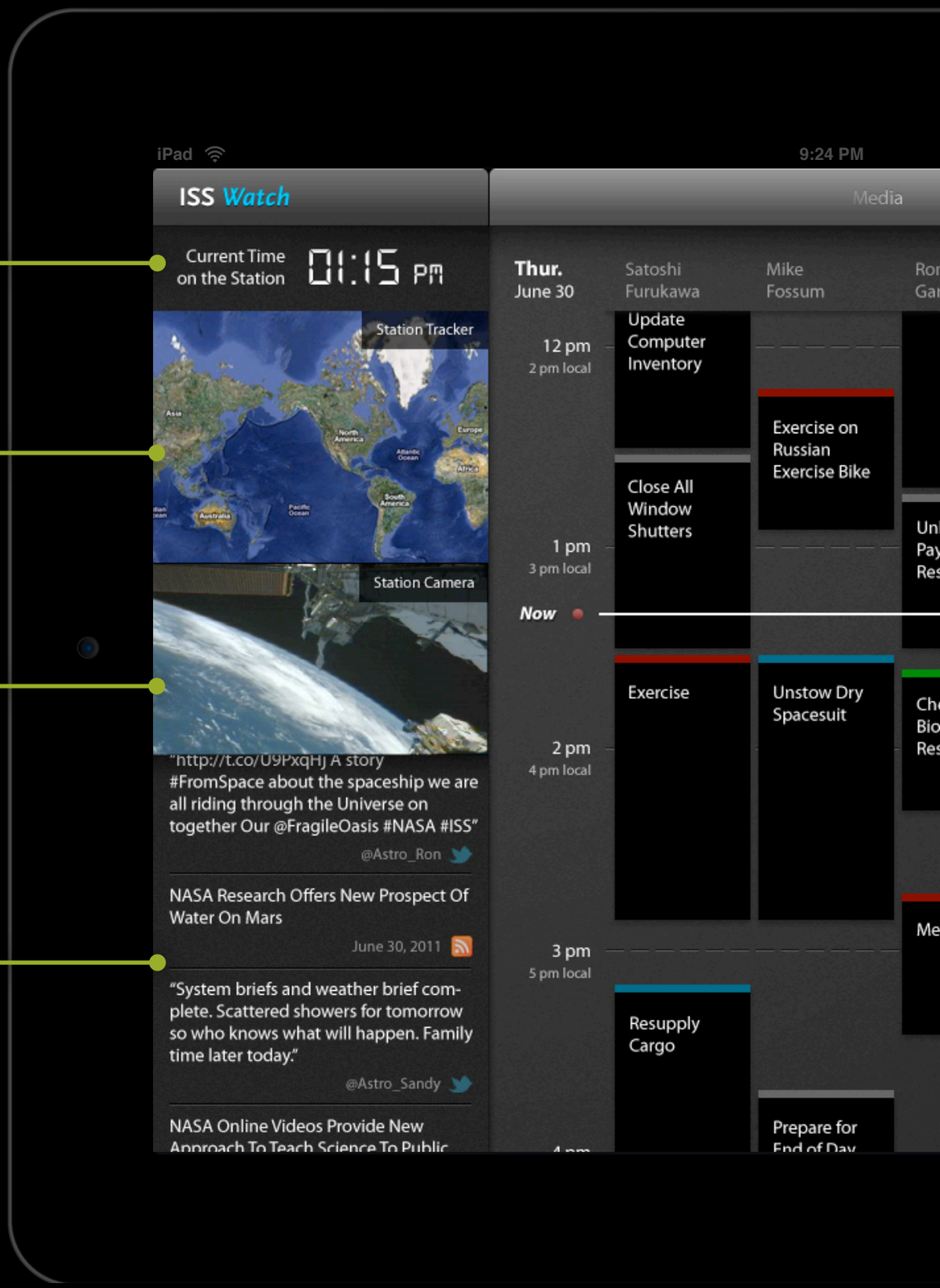
Real-time Panel

Station clock

Real-time station tracking

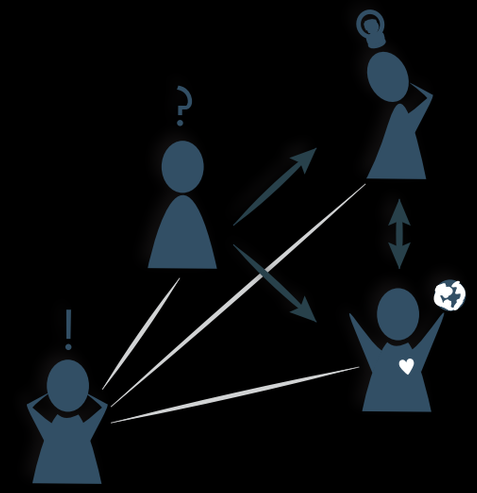
Live video from the station

Live stream of tweets and newsfeed



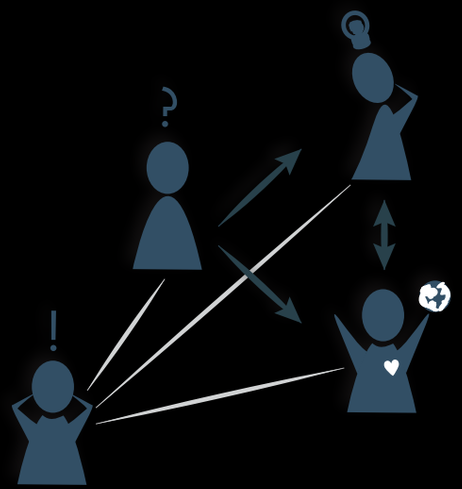
3

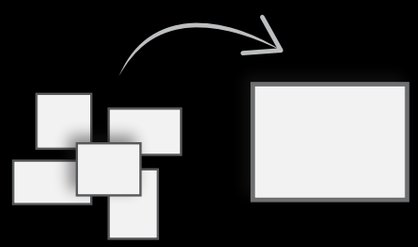
Process

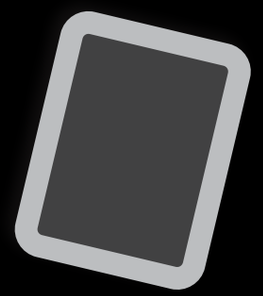


Research Insights

Solution





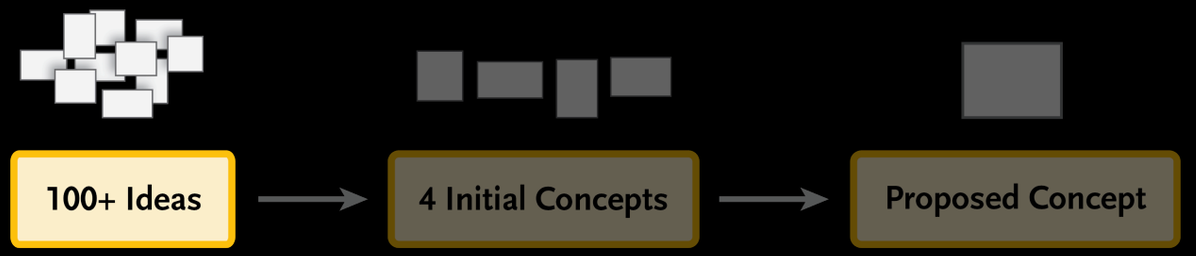


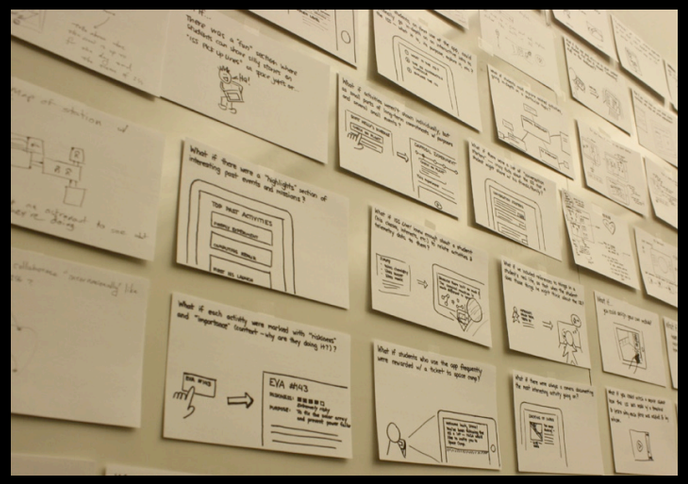
Research Insights → Ideation → Refinement → Solution

Idea Generation

100+ Ideas → 4 Initial Concepts → Proposed Concept

100+ Ideas





Rapid Brainstorming

Numerous rough ideas

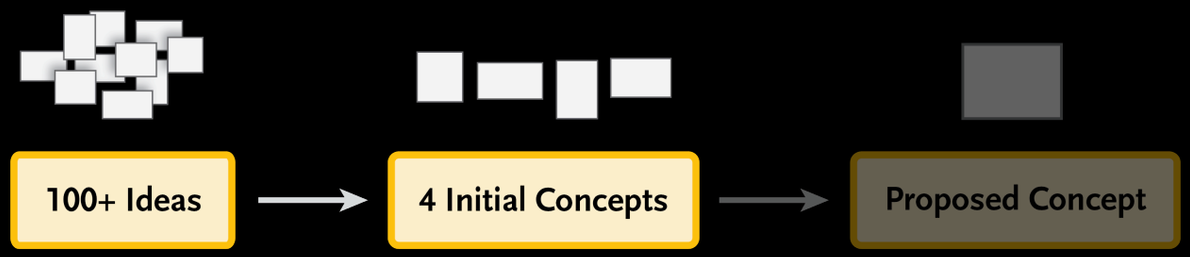
Persona-Based Design Studio

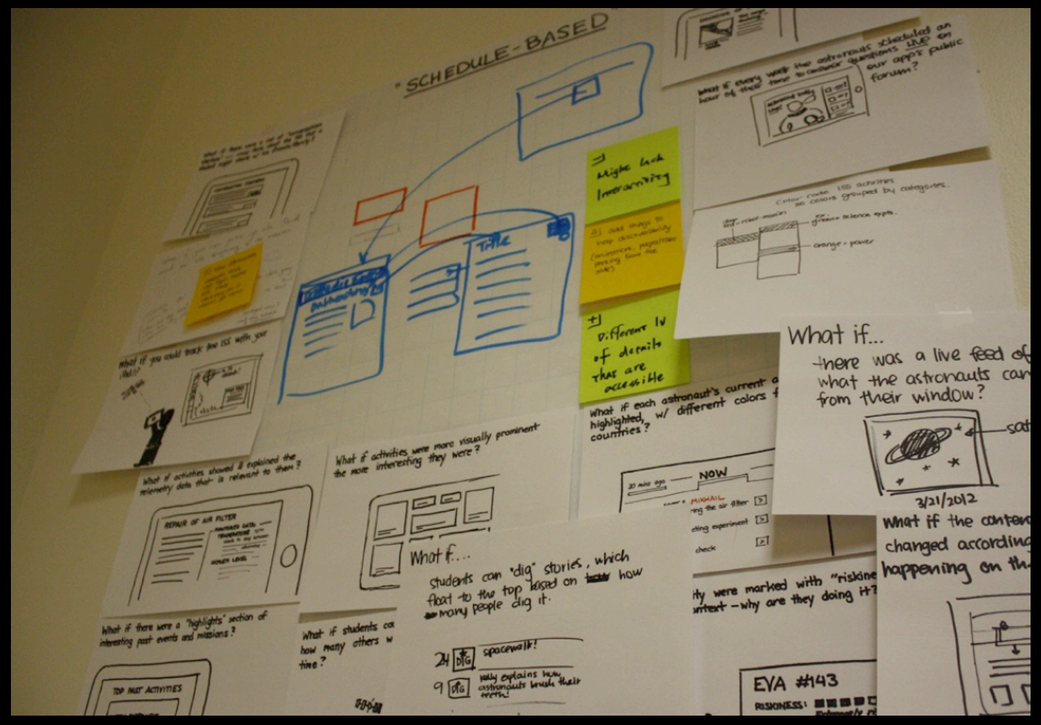
Persona-driven ideas

Brainwalking

Fleshed-out ideas

Analysis & Selection





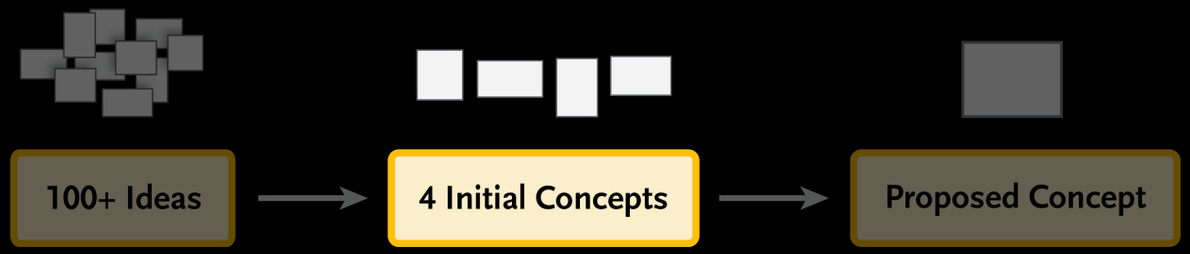
1. Idea Affinity

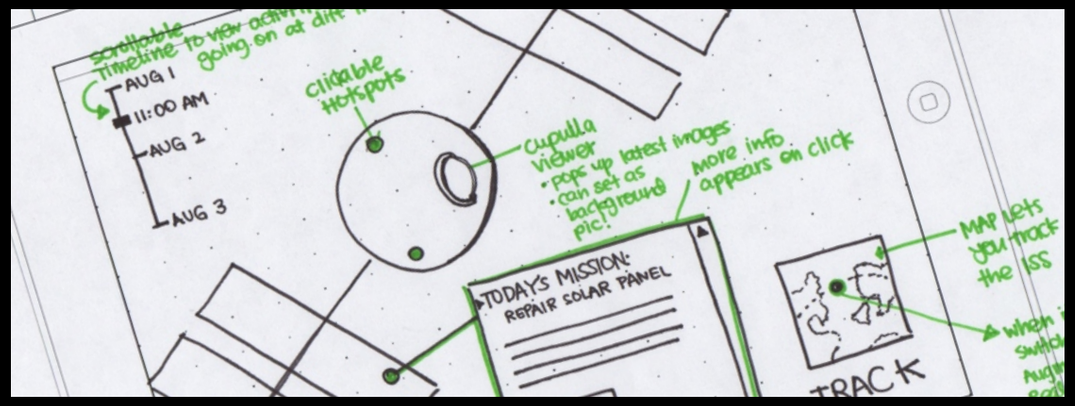
Group together similar ideas

2. Three Criterion Evaluation

"I Wish" / "I Like" / "Design Ideas"

Initial Concepts





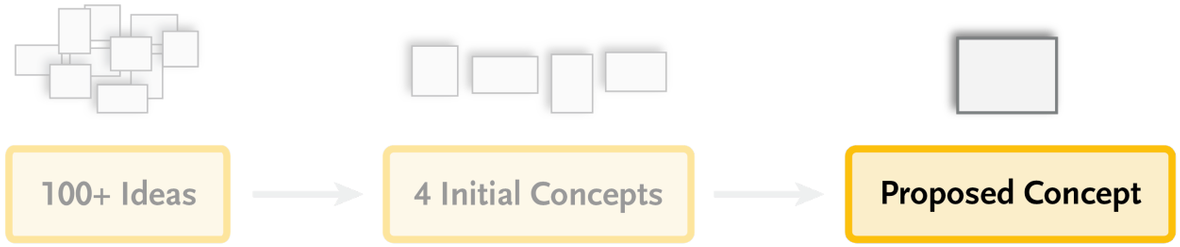
3D Model & Hotspots

Sensor Dashboard

Mission Control View

Activity Collage

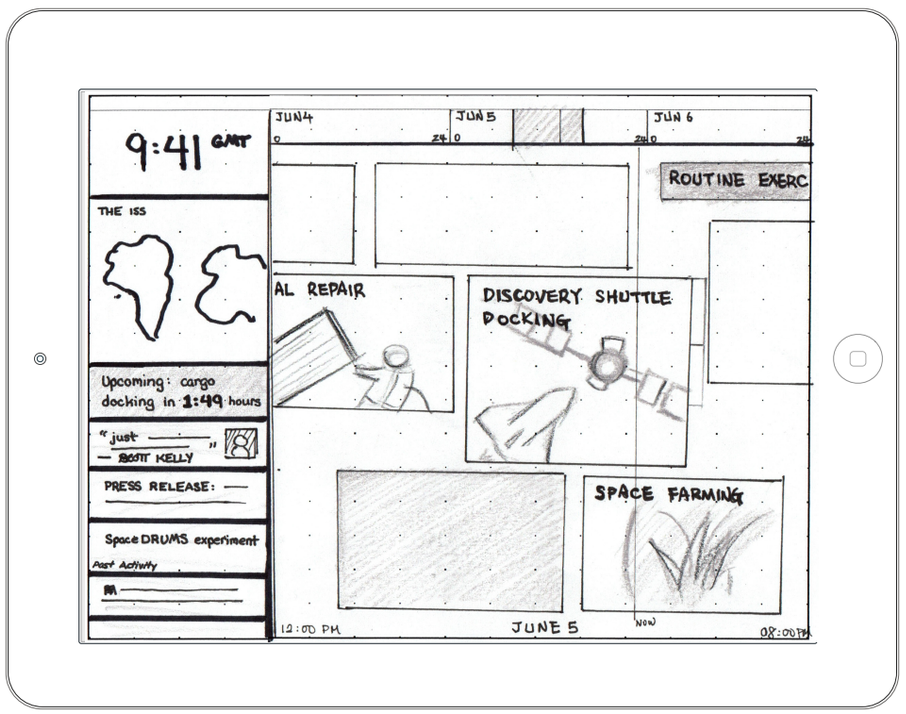
Proposed Concept

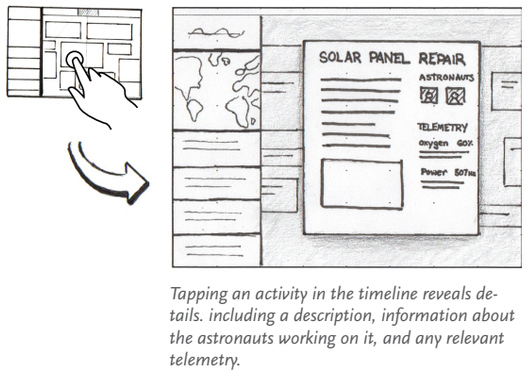


ISS Watch

Monitor the Station in Real-time

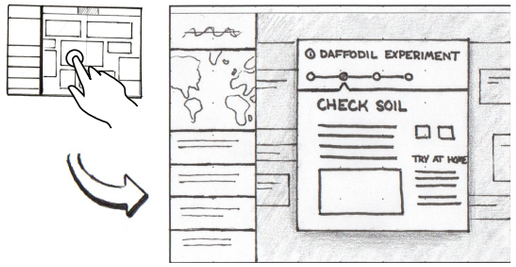
ISS Watch is an iPad application that provides real-time information about the ISS in a dynamic, scientific, and public-friendly way. It differs from other space-related educational resources because it focuses on the ISS and presents real data in the context of greater applications. The timeline visualizes scheduled activities, sizing them based on appeal. The left panel includes a live map tracking the station and a personalized feed that can present countdowns to significant events, press releases, ISS articles, and tweets from astronauts.





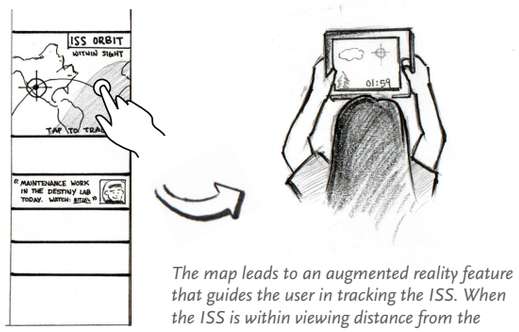
Tapping an activity in the timeline reveals details. including a description, information about the astronauts working on it, and any relevant telemetry.

Steve has always been interested in space, and he jumped at the chance to download *ISS Watch* because it would allow him to see what activities the astronauts are performing on the space station. He loves reading the real-time telemetry to learn more about how the values change and the impact it has on the station. This application helps him feel more in tune with the ISS. Furthermore, he also finds himself using the Event Countdown to keep track of the more exciting events coming up.



Activities that are parts of extended projects display information about the greater project. Additionally, science experiments include "Try At Home" versions that allow students to understand the greater purpose of activities.

Faith is always looking for new applications that would help her learn more about science. She stumbled upon *ISS Watch* and has been a fan ever since. It isn't as overwhelming as other educational applications because it enlarges the more popular activities that may be more interesting for her, and it explains the experiments in more detail.



The map leads to an augmented reality feature that guides the user in tracking the ISS. When the ISS is within viewing distance from the user's location, the tracking icon pulsates on the map.

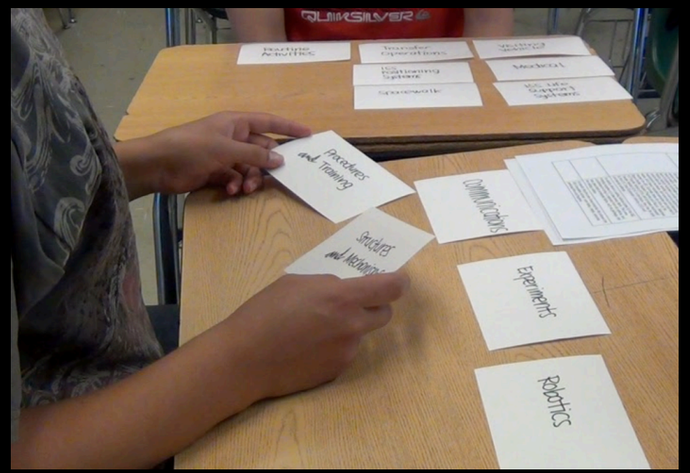
Taylor heard about *ISS Watch* through her friends at school. Her favorite part of the app is the left panel because she can read tweets from astronauts and news stories about their activities and missions in space. The ISS Tracker tool was particularly interesting for her because she never realized that she would be able to view the ISS from her home. She logs in periodically to see when the ISS will be in viewing distance.

team PYXIS — NASA — HCII — Carnegie Mellon University

Evaluation Methods

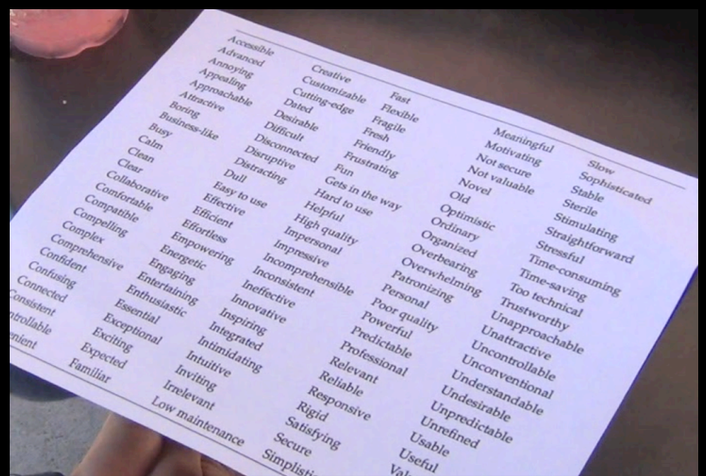
Usability

Think-Aloud w/ Probing
Paper Prototyping on iPad



Comprehension

Comprehension Questions
Card Sorting



Desirability

60-Second Commercial
Product Reaction Words

Five Iterations, Increasing Fidelity

Tracker | Astronauts | Experiments | Images

JUNE 13

6:00am | 8:00am | 10:00am | 12:00pm | 2:00pm

STATION ORBIT
WITHIN SIGHT

TAP TO TRACK

UPCOMING EVENT (3:00pm Tuesday)

Chat with NASA about implications of newly discovered black holes.

PRESS RELEASE

A Big Surprise from the Edge of the Solar System

PRESS RELEASE

Aquarius Launches to Survey Earth's Salty Sea

TWITTER (from astronaut Ronald Garan)

http://bit.ly/j1U9yf Come Aboard the #ISS! My 1st Video Blog Post #FromSpace Hope you enjoy!

PRESS RELEASE

ISS Finishes the Spharas experiment

Photo Space Biotechnology

Personal Time Before Going To Sleep

Personal Time Before Goi
Sleep

he Next Day's Work

Test Reaction

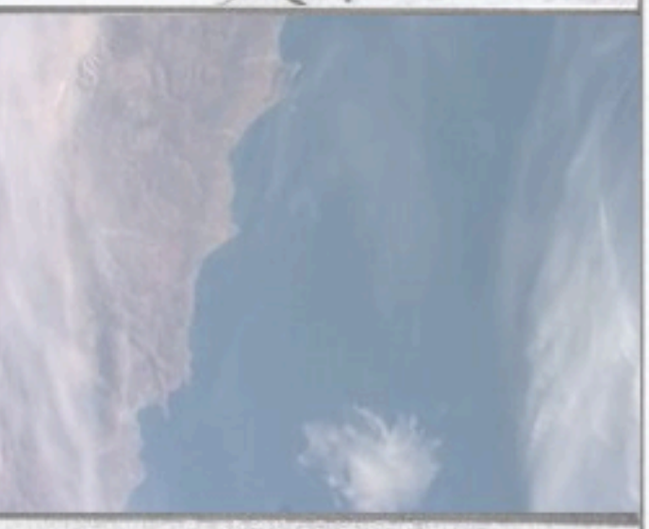
Check Biological Research

ry Spacesuit

Personal Time Before Going To Sleep

Personal Time B
Sleep

Five Iterations, Increasing Fidelity



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PRESS RELEASE
Aquarius Launches to Survey Earth's Salty Sea

Wed.
June 15

8:00am
3:00am PST

9:00am
4:00am PST

NOW

10:00am
5:00am PST

11:00am
6:00am PST

12:00pm
7:00am PST

Video Hour Setup
Laboratory Modu

Prepare For The Day's Work

Conference With Family And Friends

Environmental Health System

Exercise on Exercise Bike (US Version)

Robonaut System Unstow & Install

Strength Training Exercise

Psychology Conference With Ground Doctors

Transfer Computerized Inventory

Strength Training Exercise

Five Iterations, Increasing Fidelity

Schedule

Current Time on the ISS

ISS Time

ISS ORBIT

Quick Fact:

Over the next few years, there will be 260 spacewalks on the ISS. There have only been 138 in NASA history.

UPCOMING EVENT (3:00pm Tuesday)
Chat with NASA about implications of newly discovered black holes.

PRESS RELEASE
A Big Surprise from the Edge of the Solar System

TOP TWEET (from astronaut Ronald Garan)
http://bit.ly/j1U9yf Come Aboard the #ISS! 1st Video Blog Post

Thur.
June 30

12 pm

1 pm

Now

2 pm

3 pm

4 pm

5 pm

Close All Window Shutters

Exercise

Run SPHERES Program on Rack 1...

Strength Training Exercise

Update Computerized Inventory List

Check Biological Research

Psychological Conference With Ground Doctors

Stow Dry Spacesuit

External Temperature and Pressure Management Experiment

Five Iterations, Increasing Fidelity

ISS Watch

Media **Schedule** Expedition

Current Time on the ISS 03:27 pm

Thur. June 30

ISS Tracker

ISS Camera

"http://t.co/U9PxqHJ A story #FromSpace about the spaceship we are all riding through the Universe on together Our @FragileOasis #NASA #ISS"

@Astro_Ron

NASA Research Offers New Prospect Of Water On Mars

June 30, 2011

"System briefs and weather brief complete. Scattered showers for tomorrow so who knows what will happen. Family time later today."

@Astro_Sandy

NASA Online Videos Provide New Approach To Teach Science To Public

June 30, 2011

12 pm
2 pm on ISS

1 pm
3 pm on ISS

Now

2 pm
4 pm on ISS

3 pm
5 pm on ISS

4 pm
6 pm on ISS

5 pm
7 pm on ISS

Close All Window Shutters

Exercise

Run SPHERES ~~Program on~~ Rack 1...

Strength Training Exercise

Update Computerized Inventory List

Check Biological Research

Psychological Conference With Ground Doctors

Stow Dry Spacesuit

External Temperature and Pressure Management Experiment

Five Iterations, Increasing Fidelity

ISS Watch

Media **Schedule** Expedition

Current Time on the Station 01:15 pm

Station Tracker

Station Camera

"http://t.co/U9PxqHJ A story #FromSpace about the spaceship we are all riding through the Universe on together Our @FragileOasis #NASA #ISS"

@Astro_Ron

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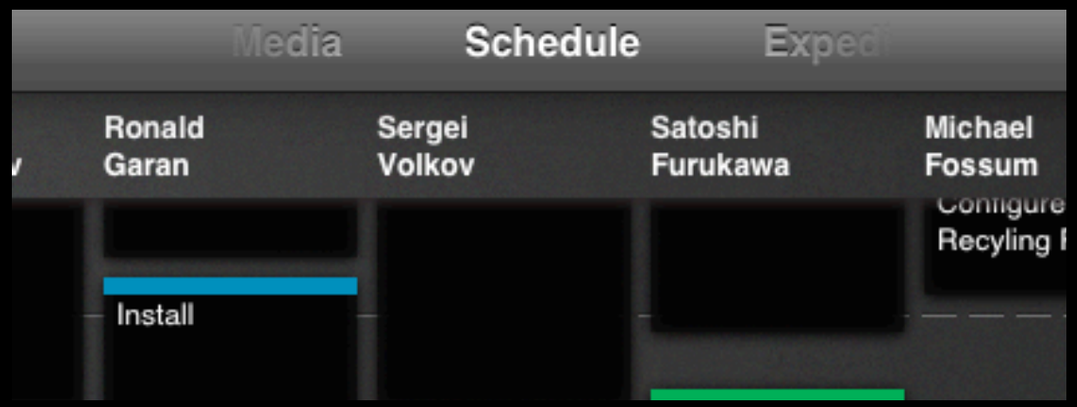
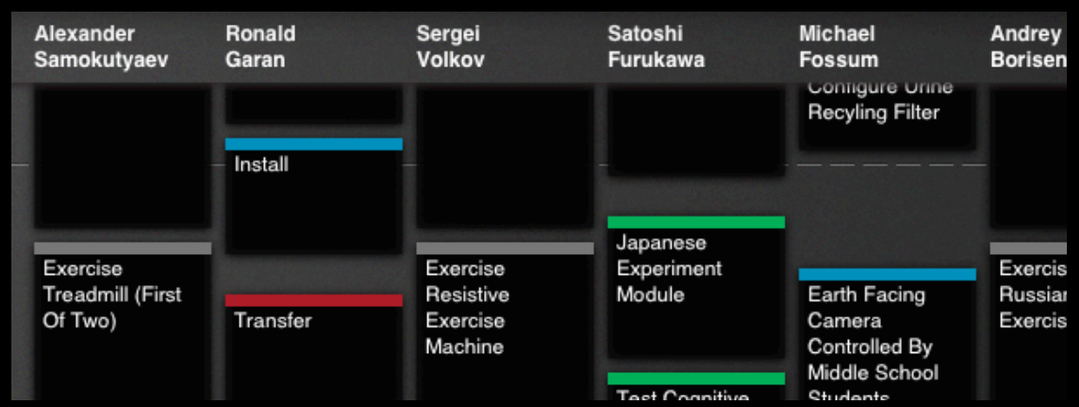
NASA Online Videos Provide New Approach To Teach Science To Public

	Thur.	Satoshi	Mike	Ron	Andrei Borisenko	Aleksander Samokutyaev	Sergey Volkov
12 pm 2 pm local	Update Computer Inventory				Psychological Conference with Ground Doctors		Inventory
	Close All Window Shutters	Exercise on Russian Exercise Bike		Unload Payload for Resupply		Test Air Filtering Systems	Strength Training Exercise
1 pm 3 pm local					Exercise on Russian Exercise Bike		
Now							
	Exercise	Unstow Dry Spacesuit	Check Biological Research		Resupply Cargo		Unstow Dry Spacesuit
2 pm 4 pm local				Medical Test		Run SPHERES Program on Rack 4	
	Resupply Cargo				Update Computer Inventory		Prepare For End of Day Work
3 pm 5 pm local		Prepare for End of Day Work				Run SPHERES Program on Rack 1	
4 pm							

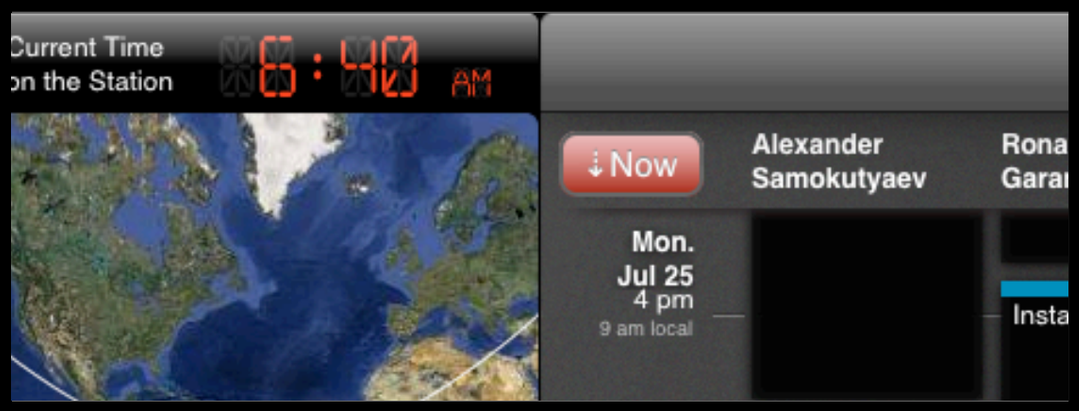
Selected Changes



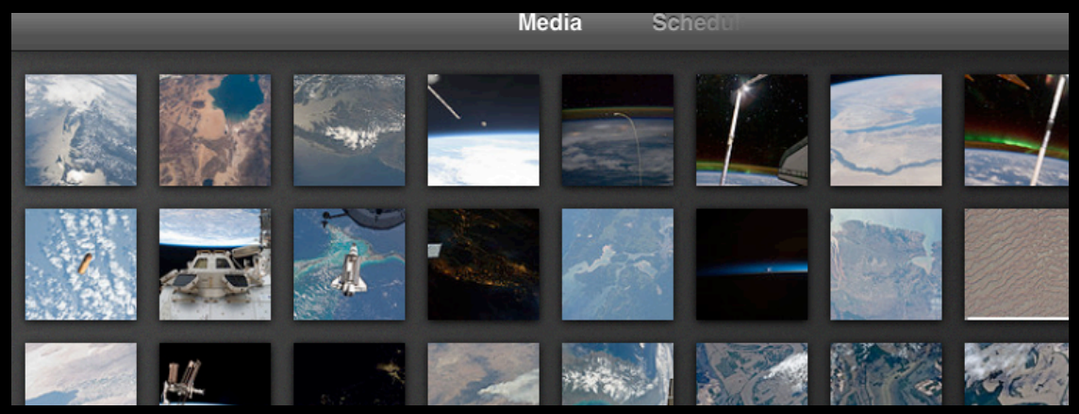
1. Engaging Navigation



2. Schedule Comprehension

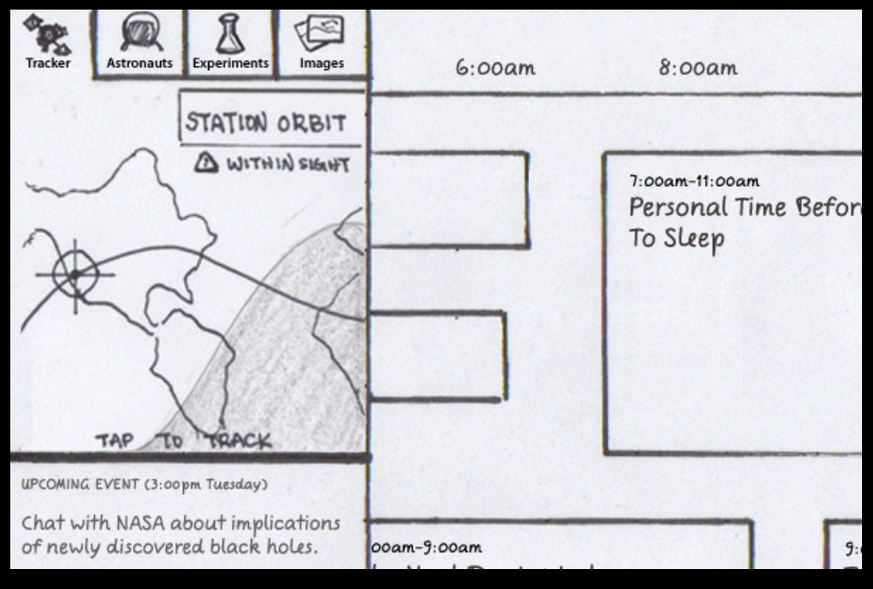


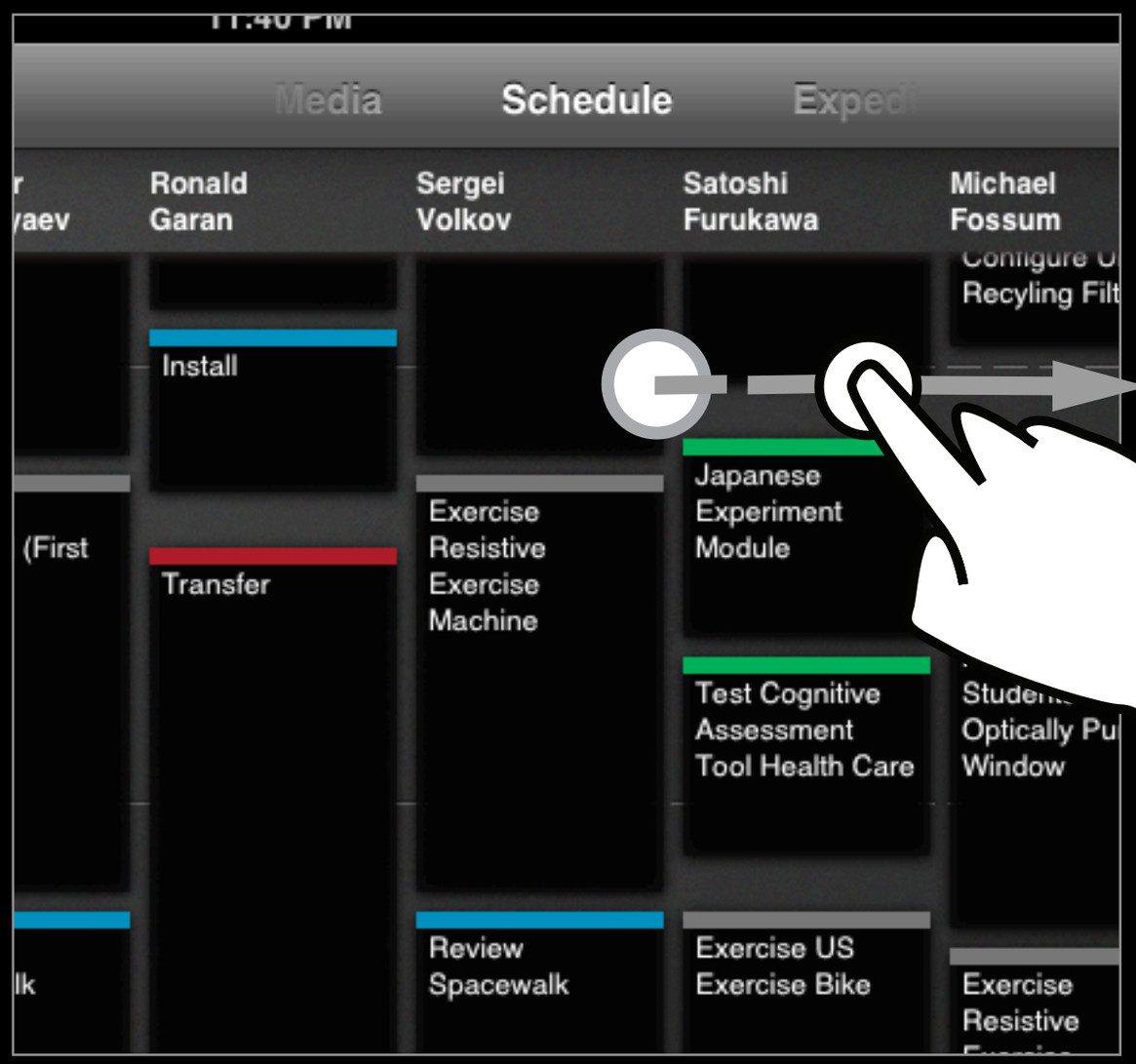
3. Real-Time Feeling



4. More Visuals

1. Improving Navigation





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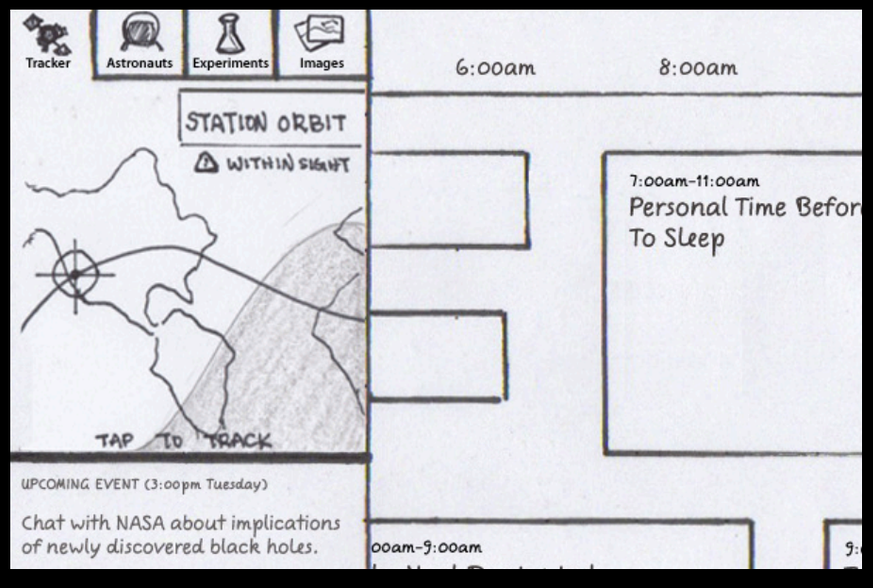
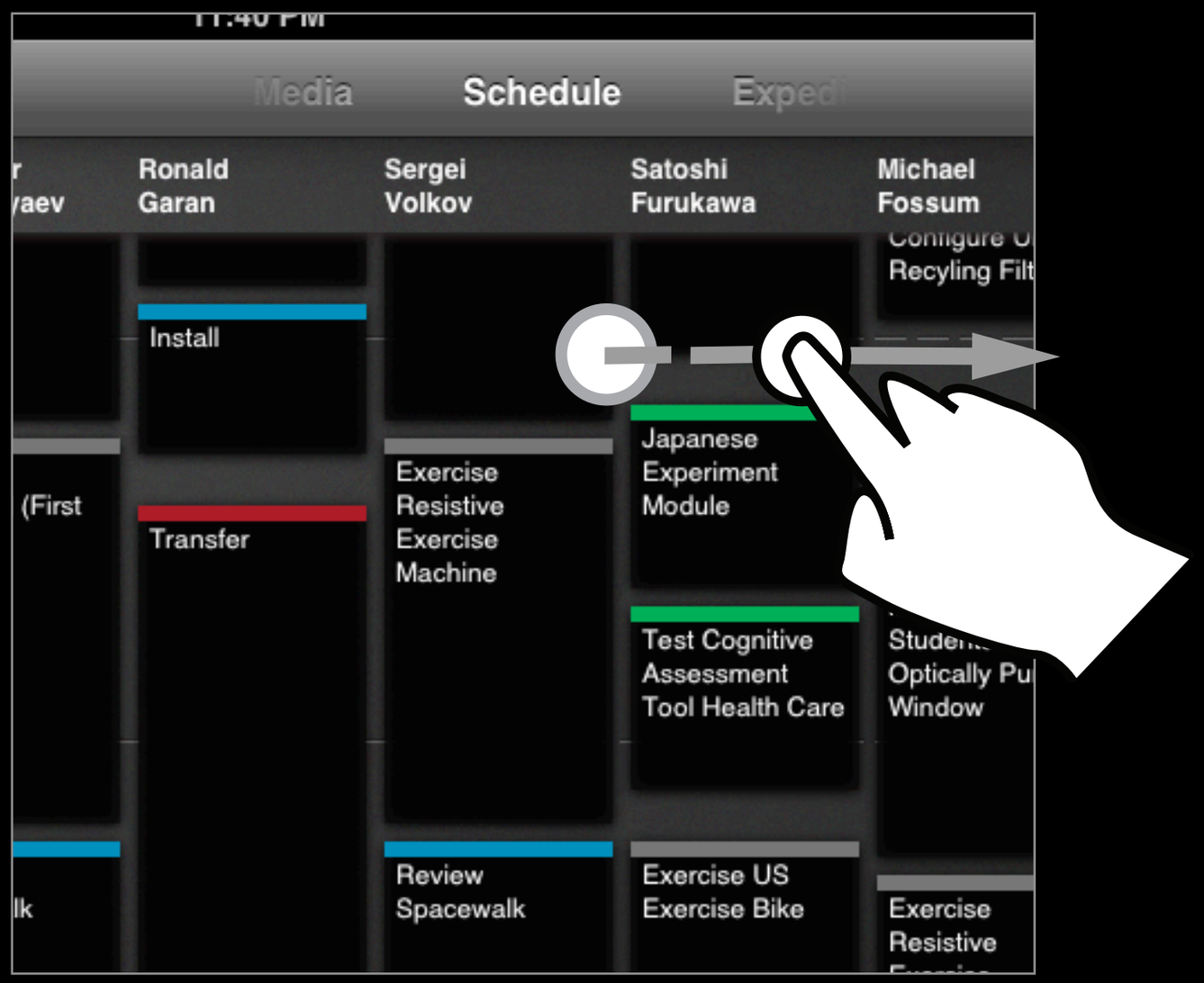
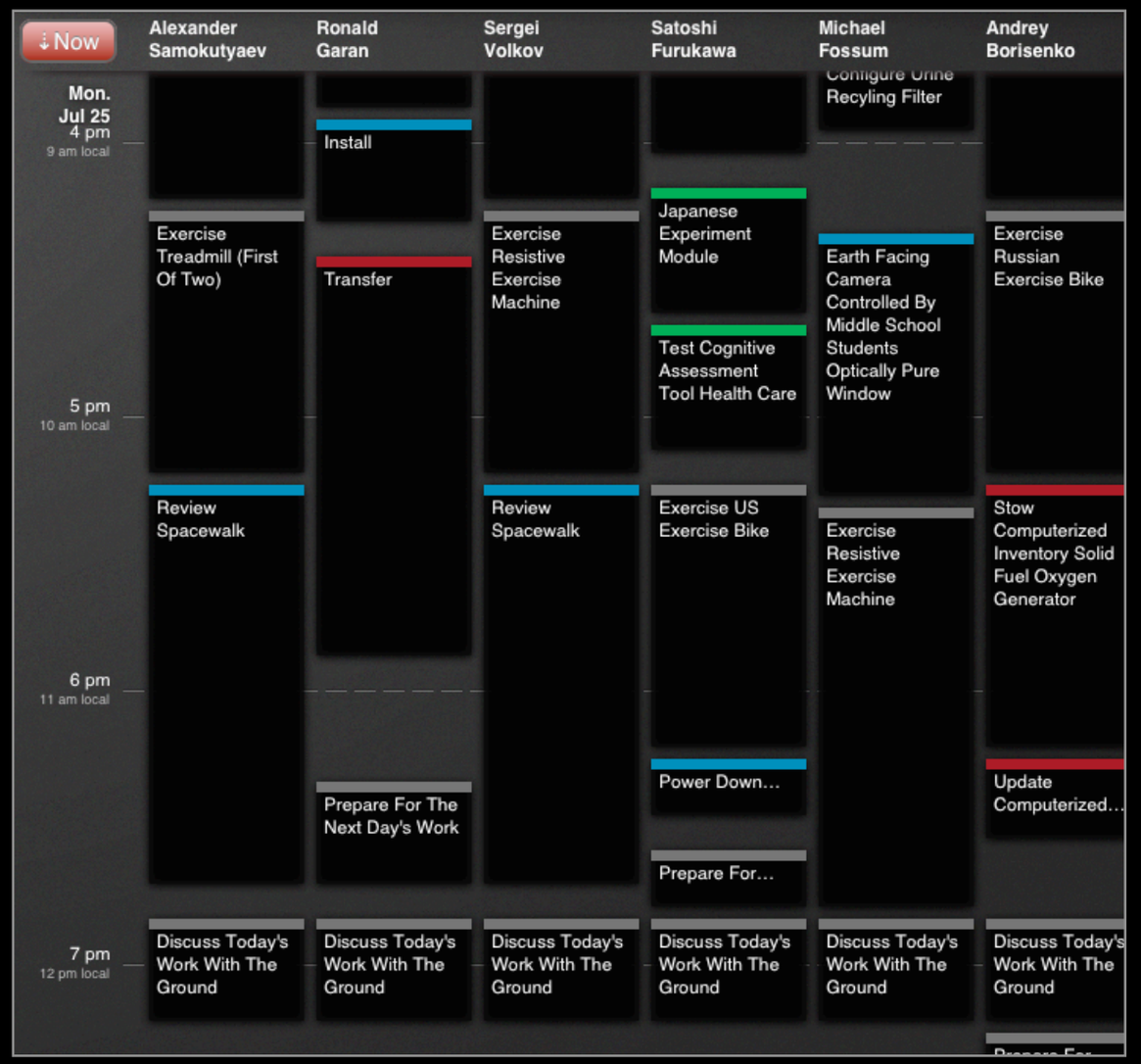




Possible Future Direction: the ability to zoom in and out of the timeline.

2. Improving Schedule Comprehension



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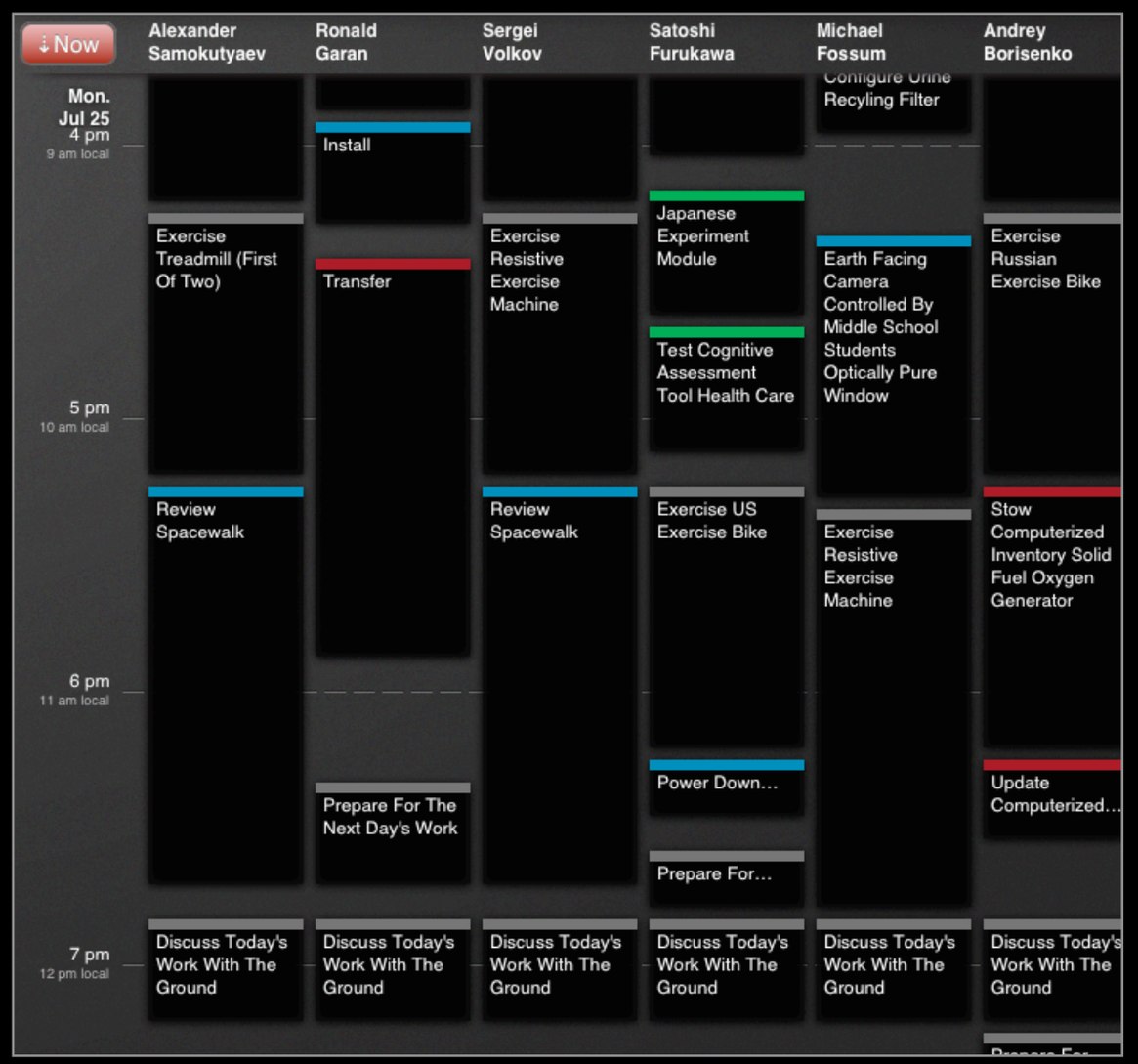
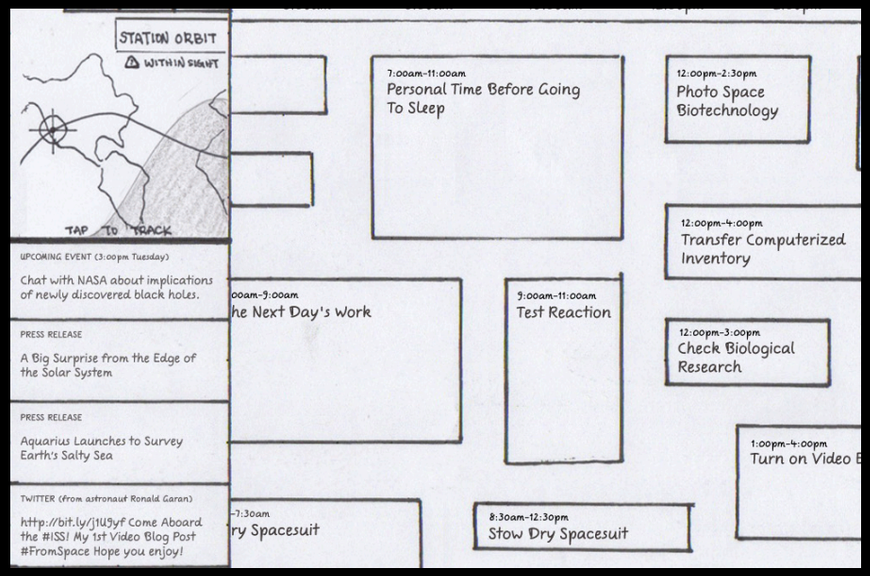
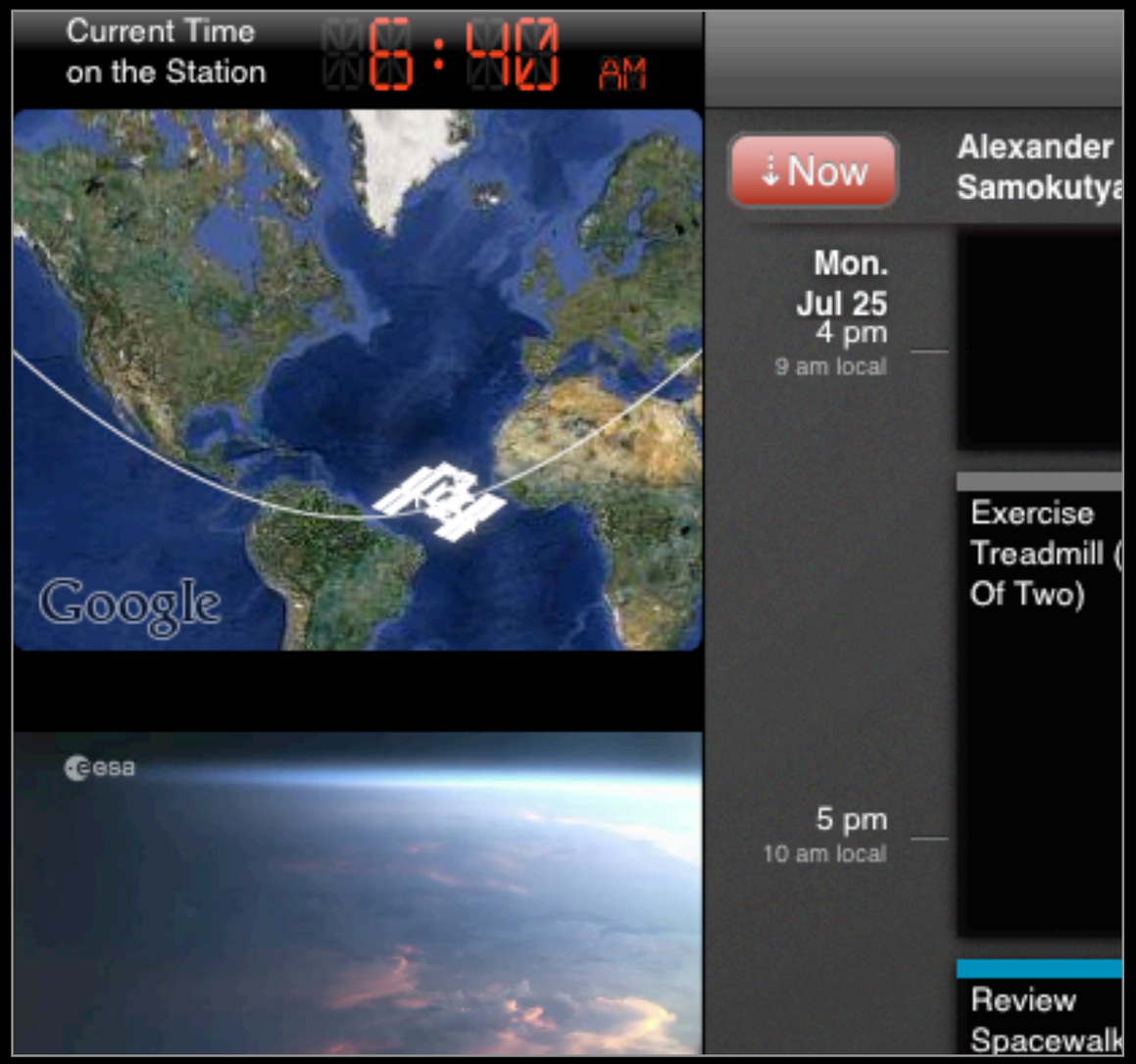


Possible Future Direction: truncate the sleep activity, improve category names.

3. Making It Feel More Real-Time





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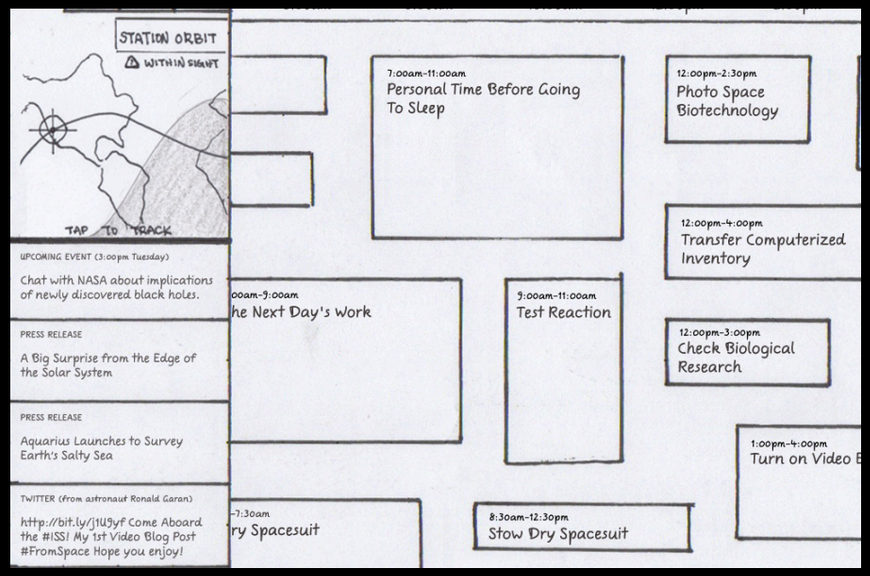
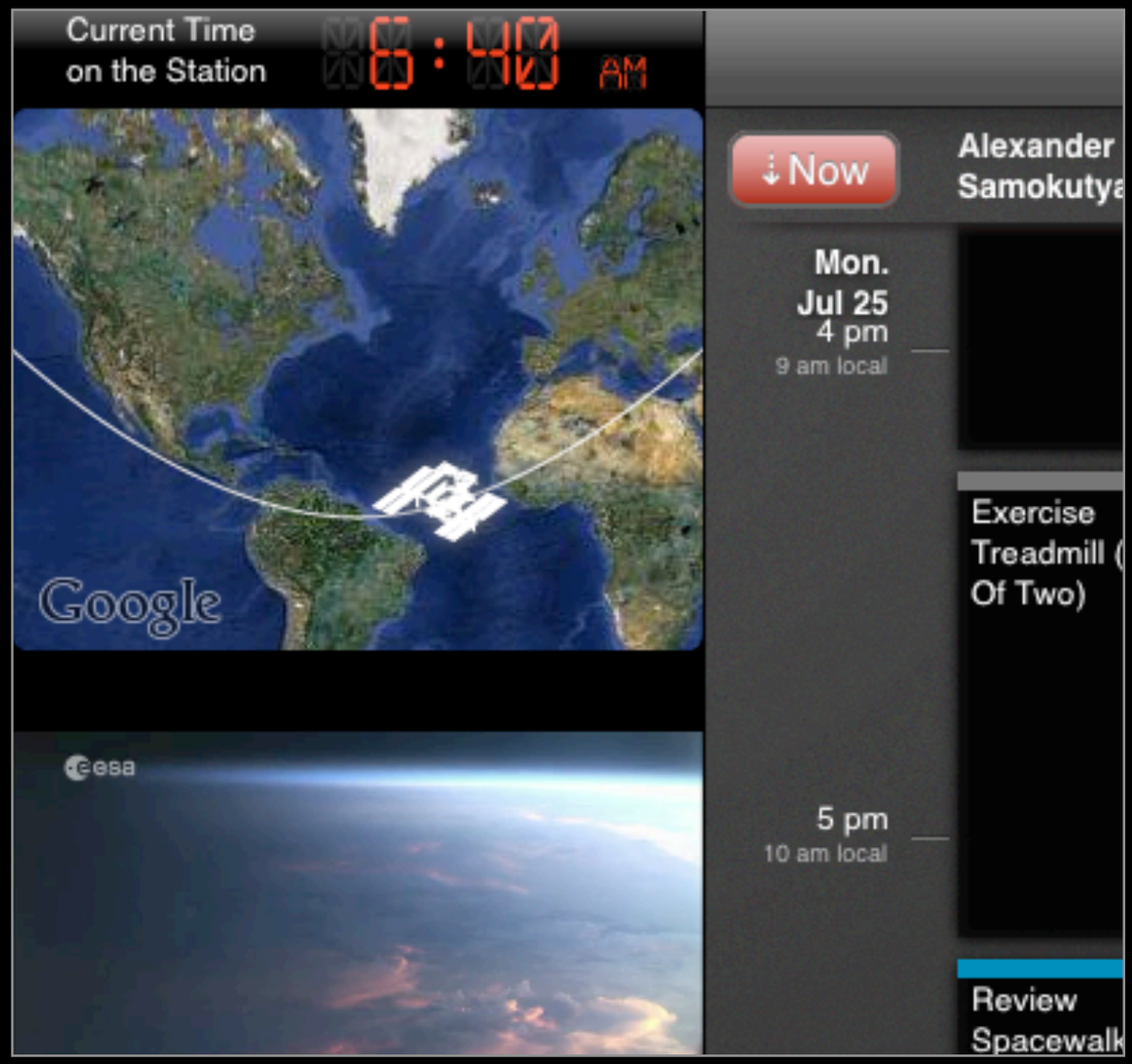




Possible Future Direction: augmented reality ISS tracker, telemetry integration.

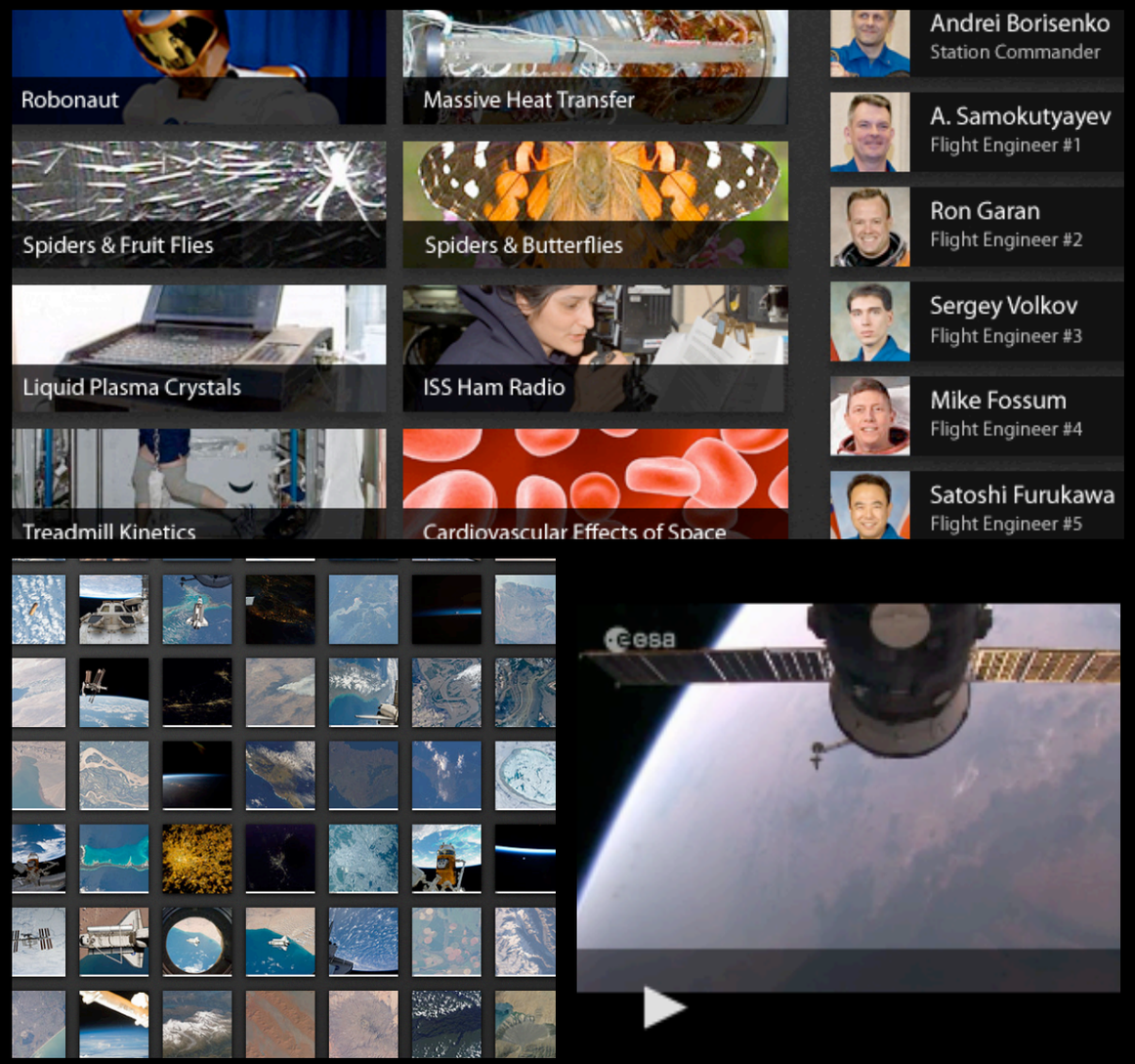
4. Improving Desirability Through Visuals

"Would you guys have photos of that too?... Yeah that would be cool. I think people would be interested in that."

– Jackie, high school student

"Maybe more pictures? Like if i clicked on the exercise on treadmill...maybe seeing a picture of that... or video?"

– Ashley, high school student



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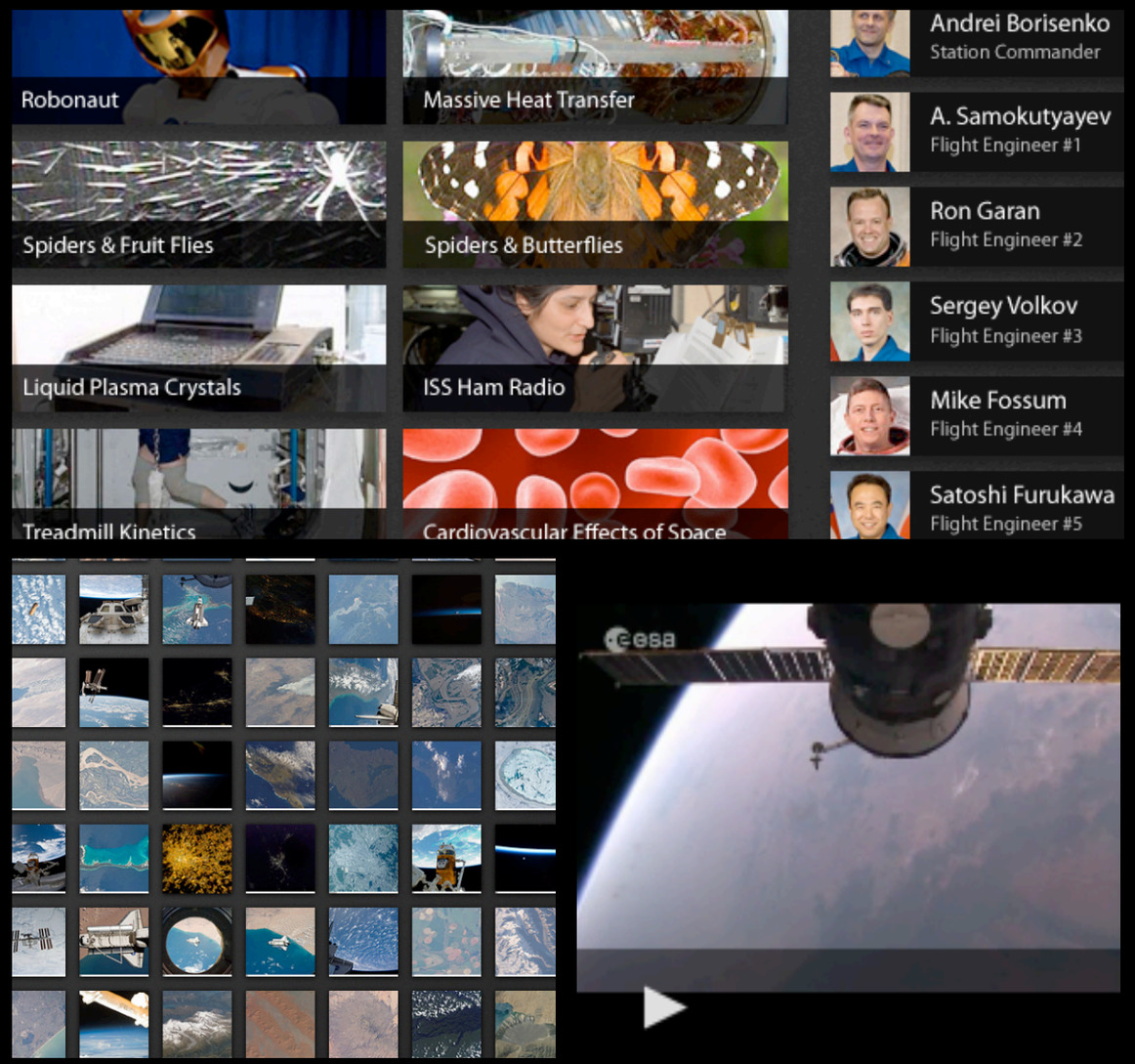


Possible Future Direction: more images for astronaut activities, have interesting media for each featured experiments.

4

Conclusion

Signals of Success

Signals of Success

Student feedback evolved from interface troubles
to curiosity and a desire for more.

Next Steps and Maintenance

1. Featured Experiments
2. Updated Astronaut Bios
3. Activity Descriptions
4. Publicizing

Future Research

Who is using the application?
What are they using the application for?
How can it improve?
How effective is the application?
Can we reach a broader audience?

Future Directions

1. Telemetry Integration
2. Past Expeditions Integration
3. Augmented Reality View for ISS Tracking
4. Do-It-At-Home Versions of Experiments
5. And more! (Check out our report)

Feedback Video

?

Q&A

?

Background Research

Spring Presentation · NASA · Carnegie Mellon HCII · Team Pyxis

Background Research

Literature Review

37 articles, talks, and books

Connect new knowledge to prior knowledge.

Better Integration of education and entertainment.

Competitive Analysis

5 space and science iPad apps

Cool interaction is key.

Immediate engagement is crucial.

?

Research Demographics

Spring Presentation · NASA · Carnegie Mellon HCII · Team Pyxis

Field Research Demographics

13 FLIGHT CONTROLLERS

NASA

23 STUDENTS

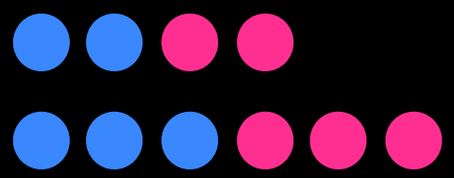
high school

college

10 EDUCATORS

teachers

NASA



7 SPACE ENTHUSIASTS

various

53

TOTAL

?

Research Methods

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Flight Controllers

Contextual Observation

observe the practice of flight controllers using scheduling systems.

Activity Affinity

understand which ISS activities happen most frequently and which are most exciting.

Interviews

uncover the reasons behind flight controllers' passions for space.

Educators

Classroom Observation

learn how teachers interact with the students to communicate technical information

Interview

further understanding of what methods worked

Students

Postcard Drawing Activity

discover what students know about space.

Background Interviews

learn how they use smartphones/schedules, and talk about their interest in space.

Card Activities

understand what's interesting to students about space and their daily activities/classes.

Contextual Thinkalouds

uncover how students discover new educational applications and evaluate their usefulness.

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Insights

Spring Presentation · NASA · Carnegie Mellon HCII · Team Pyxis

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Usage Scenario