

# Leveraging Design Thinking to Inform Water Resource Applications and the NASA PACE Mission

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## Abstract

The Plankton, Aerosol, Cloud, and Ocean Ecosystem (PACE) mission is NASA's next great investment in Earth Science, continuing NASA's legacy of over forty years of satellite ocean color measurements. PACE, expected to launch in 2023, will advance our Earth-observing and monitoring capabilities through hyperspectral imaging and multi-angle polarimetric observations of ocean, atmosphere, and land ecosystems. PACE will give us an unprecedented view of our home planet and will support user-driven environmental applications through research and applied science to address societal challenges and inform decision-making. An integral component of actionable applied science is Design Thinking - an iterative, problem-solving framework that integrates human perspectives, needs, and experiences at every step of process. In this session, we will present the design process, collaborative activities, and outcomes of the 2021 PACE Applications Water Quality community focus session. A Design Thinking methodology was used in event planning as well as during day-of ideation breakout sessions. To foster empathy and better illuminate the goals, concerns, and needs of the diverse PACE user community, eight draft user personas were created to represent a range of water industry users from research to government to the private sector. Attendees worked together to complete the various personas by identifying different user challenges and pain points, ideal data experiences, and realistic, tailored Earth Observation and PACE Mission specific solutions and opportunities to satisfy users' needs and goals. As a result, the eight archetype personas and co-production of knowledge will help ensure that PACE data are usable and accessible for a variety of possible users, thereby expanding the eventual reach and societal benefit of PACE. Lastly, we will highlight how Design Thinking will inform future stakeholder engagement efforts and actionable science via the PACE Mission.

# Leveraging Design Thinking to Inform Water Resource Applications and the NASA Plankton, Aerosol, Cloud, Ocean Ecosystem (PACE) Mission

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## Implementing the Design Thinking Process at NASA

**\*Design Thinking (DT):** human-centered approach to innovation focused on feasibility, viability, and desirability. Follows the process to the right.

**\*Human-Centered Design (HCD):** creative approach to problem solving starting with the end user/audience and ending with purpose-built solutions

For NASA Applications, DT and HCD can lead to [better services to the Earth science and water resource community](#) through the development, delivery, and application of [actionable, accessible, and usable](#) Earth Observation (EO) data! This includes partnership development, user & stakeholder engagement, data co-production and management, and training, communication, and outreach.

## Empathize: Targeting Partners & Understanding the PACE Community

### Outreach

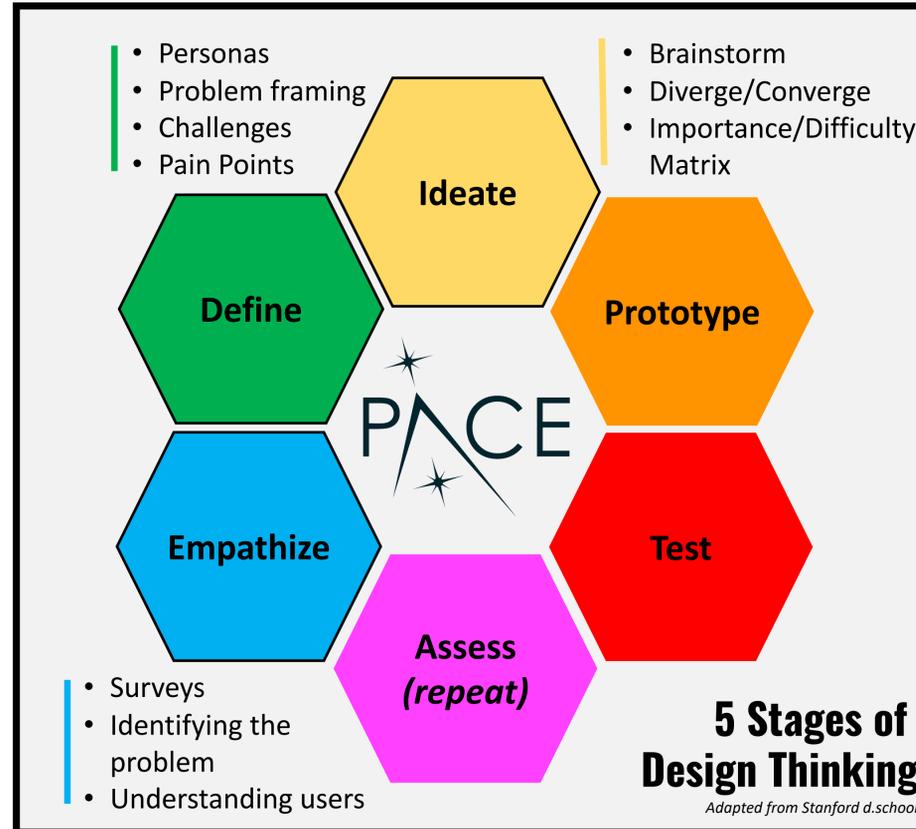
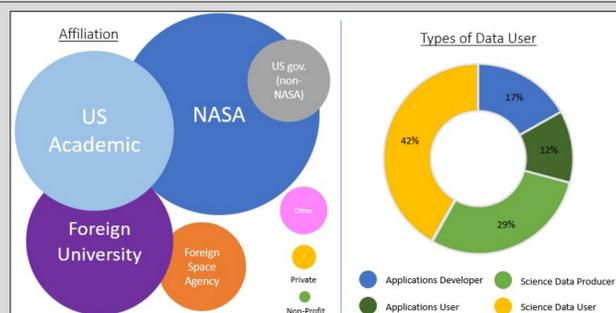
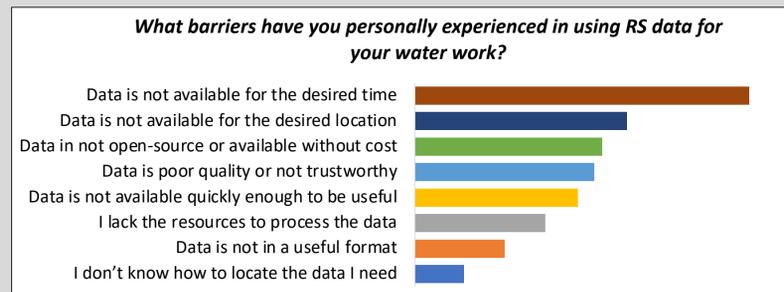
- Connecting with partner organizations, communities, or networks

### Community Surveys

- In addition to demographics, asking questions about applications and current work as well as priorities, challenges/barriers, gaps, and needs

### Registration Questions

- Asking questions during registration about sector, geographic location, familiarity with Earth observations, familiarity with PACE, user type, application focus area



## Define: Personas to Understand Types of PACE Water Users & What they Want

Personas help the PACE mission [understand the goals, concerns, and needs of the diverse water user community](#). Personas allow for designing products, trainings, communications to [satisfy users' needs and goals](#). Personas were created to represent a range of water industry users from research to government to the private sector. Community users helped identify challenges and pain points, as well as realistic, tailored EO and PACE-specific solutions and opportunities.

**This is Tom**  
Occupation: Water Gov. Bio/ Backstory: Tom has worked at Florida DEQ. He has a masters in the environment and recreates the environment and recreates focused on Gulf Coast water blooms, local culture, and so. Tom plans to retire in the next year.

**This is Julie**  
Occupation: Post-Doc Bio/ Backstory: Julie is a first-year post-doc research engineer. Her research is organic matter in a variety of ecosystems. She has a background in environmental engineering, and physics, yoga, and kayaking.

**This is Fe**  
Occupation: Science Bio/ Backstory: Fe is a Senior Scientist. She works in a variety of ecosystems. She has a background in environmental engineering, and physics, yoga, and kayaking.

**This is Astr**  
Occupation: Science Bio/ Backstory: Astr works as an engineer. She works in a variety of ecosystems. She has a background in environmental engineering, and physics, yoga, and kayaking.

**This is Jake**  
Occupation: Science Bio/ Backstory: Jake works in the Gulf of Mexico. He works in a variety of ecosystems. He has a background in environmental engineering, and physics, yoga, and kayaking.

**This is Claire**  
Occupation: Citizen Science Director Bio/ Backstory: Claire leads NASA's National Phytoplankton Monitoring Network (PNM) a community-based network of citizen-science volunteers monitoring marine phytoplankton and HABs. She trains groups through workshops and on-line webinars on how to collect field samples, identify group members, and report data to the NOAA HAB Monitoring and Reference Branch using an online database. In her free time, she enjoys spending time with her grandchildren and 3 dogs.

## Ideate: Using Co-Production to Target a Shared Vision for PACE

### Data Usability... For Whom? (brainstorming)

- Identify what usefulness means or looks like to different water user groups
- Share perspectives and gather feedback on user priorities and what would make PACE data valuable to them

### Turning Challenges into Solutions (brainstorming)

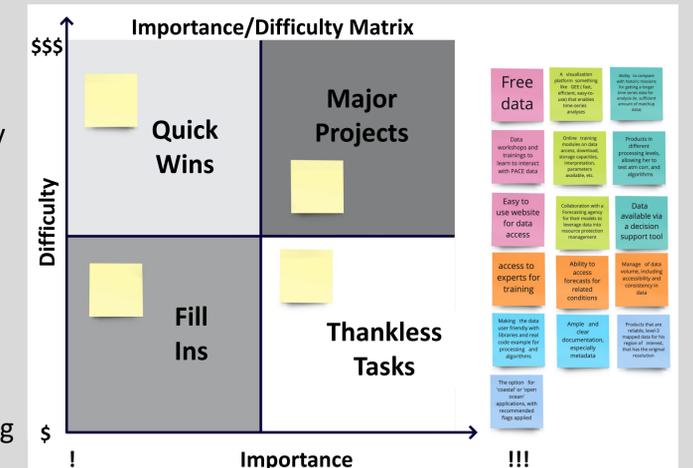
- Collect specific examples of how user communities think barriers can be addressed to ensure PACE data are accessible, usable, and actionable

Activity 2: Requirements / Must Haves  
Activity 3: Identifying PACE Solutions

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Activity 3: Identifying PACE Solutions

## Ideate: Prioritization Matrices to Inform PACE Data Solutions

- Can help prioritize PACE solutions quickly
- Can facilitate deliberation between data users/producers
- Can resolve/alleviate differing opinions



- Can help PACE develop a plan of action to [ensure PACE data are accessible, useable, and actionable](#)

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