U.S. Navy

Rethinking the Traditional Kneeboard

Big Nerd Ranch

Challenge

- Navy F/A-18 fighter pilots need access to vital information quickly - traditionally this information is a literal stack of documents on their kneeboards.

- The physical kneeboard presented several challenges from the ergonomics of the kneeboard to the inefficient nature of accessing possibly outdated data.

- The Navy is currently experimenting with electronic kneeboards but haven't yet found a single application that does all they need.

- The need for a digital solution that lightens the physical and mental load that comes with the traditional kneeboard.

Big Nerd Ranch Solution

- We changed the conditions of the cockpit for the pilot to increase efficiency and physical limitations.

- Conducted Industrial Design and UX Research into the human factor challenges of digitizing a paper kneeboard.

- Collaborated with a military contractor (SoarTech) to create a proof-of-concept demo.

Outcomes

- iOS app and native iOS design & development expertise.

- User-experience-centered design.

- Providing an interface for SoarTech's existing AI.

- Created the story for a stakeholder demo to focus our scope and effort.

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Business Challenge

Piloting one of the most technologically advanced fighter jets in the world requires a lot – both physically and mentally. Pilots have to manage a significant amount of data, including flight paths, weather patterns, and mission-critical information. They then have to make vital decisions that could potentially impact their mission.

In the past, pilots have used a physical kneeboard, or Flight Bag, to store the stack of reference materials they need during flight. In the already tight space of the F/A-18 cockpit, the kneeboard takes up valuable space and requires a significant time investment whenever the pilot needs information. That's assuming the information is up-to-date as there is an inherent amount of latency in the data.

The Navy is currently experimenting with electronic flight bags and digitized kneeboard applications to lighten both the physical and mental load of dealing with a paper-based kneeboard. While there are many applications in the market that address a singular aspect of a kneeboard, they tend to only focus on the technical aspects of digitizing the kneeboard.

Few approach the challenge from a holistic nature and none consider the physical limitations and ergonomics that a pilot faces in trying to access the information in a variety of environments.

As we looked to provide a more comprehensive solution, we asked ourselves the following questions.

- How do we elegantly consolidate the multiple functions of a pilot kneeboard into one digital product?

- How can we create a product that best suits the pilot's physical space in regards to ergonomics?

- How can we help Navy fighter pilots anticipate problems while in the air and quickly find a solution?

- How can we use AI to assist in the pilot's decision-making?
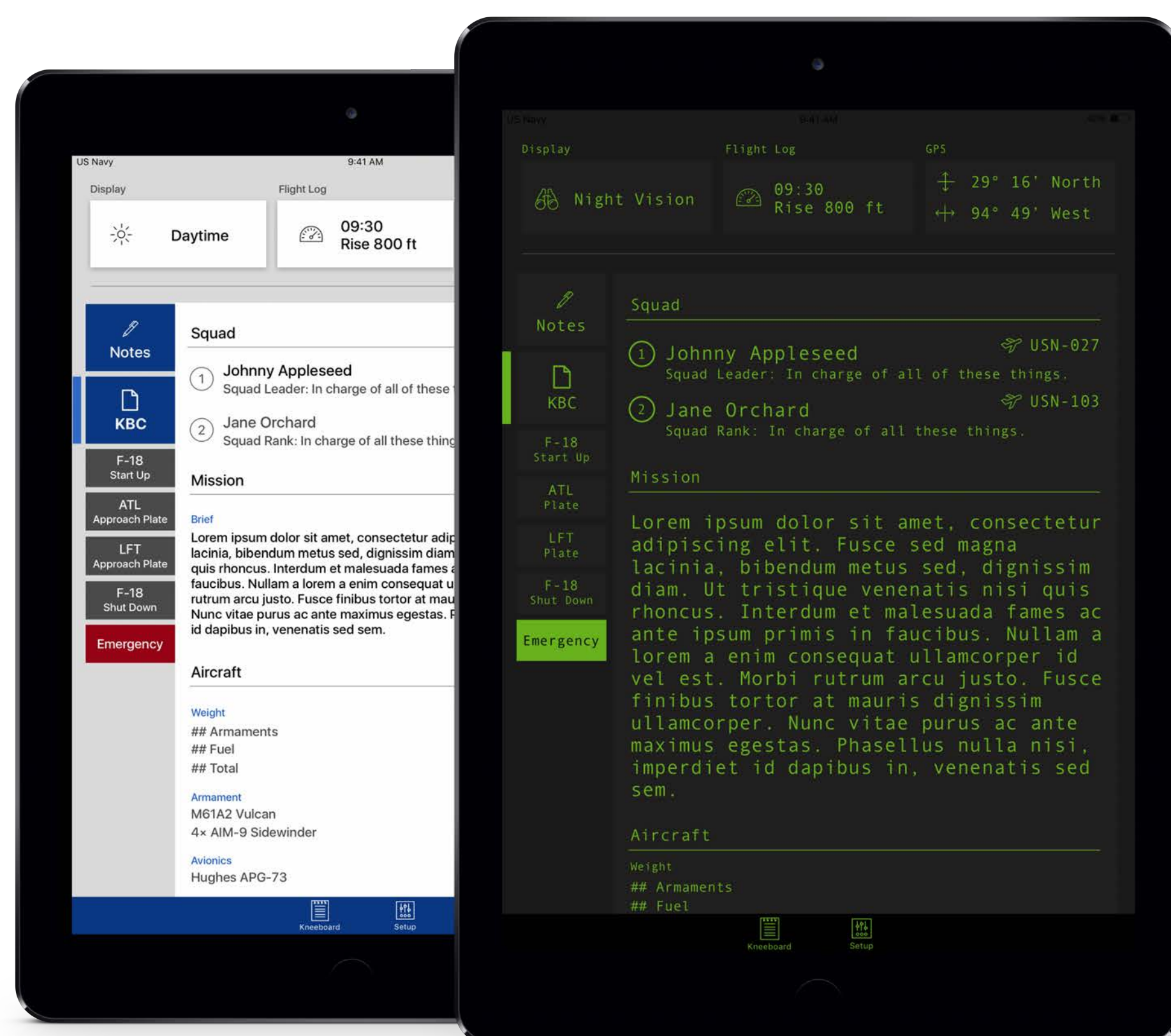
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Solution

We approached our solution by considering a host of factors–from the physical space to the UI/UX of the kneeboard to the technical requirements that a digital solution requires.

LISTEN AND LEARN

We began the process by having one of our designers conduct Industrial Design & UX Research into the challenges of digitizing a paper kneeboard specific to the human factor. This research largely took the form of user interviews with those most knowledgeable of the limitations and challenges of the kneeboard–Navy fighter pilots. From that research, our designer better understood the unique operating environment of a jet cockpit and the constraints a pilot faces and incorporated those findings to create low-fidelity prototypes for an iOS kneeboard app.

In the prototype we were sure to address specific usability challenges such as:

• Viewability: Can we ensure readability in both the glare of daylight and through the use of night vision goggles at night?

• Ergonomics: How does the pilot's sitting position affect the orientation and placement of a digital scratchpad?

• Environment: Changing gravity means everything must be strapped down (stylus too!).

• Software: Flight data must be up-to-date and in real time.

In phase two we worked with SoarTech, a military contractor, to take the findings and prototype designs and put them into practice. This resulted in a fully-coded proof-of-concept demo and iOS application. For the purpose of the demo, a Unity flight simulator was created that mimics the conditions inside the cockpit and sends mocked environmental and aircraft data to the application. Throughout the process we've had Navy pilots work within the demo and provide us with feedback.

A large part of working with SoarTech was the inclusion of an AI-drive user interface system into the kneepad while also working to prioritize the features that were essential to the demo story. This meant that our designers and developers had to work collaboratively to ensure coordinated efforts between development of the iOS application, the AI system, and the flight simulator.

As a result, a tight focus was placed on features that either affected or were affected by the AI system. As one of the more detailed elements, the interface has the ability to understand the vital information such as location, phase of flight, aircraft conditions, and weather in order to better facilitate decision-making. This data includes providing the pilot with up-to-date flight path changes, emergency procedures, or changes to overall mission goals. This information is quickly related to the pilot in a useable manner allowing the pilot to factor the date into their decision-making process. In addition, the application has a minimal design with splitview tabbed navigation, easing the cognitive workload for the pilot.
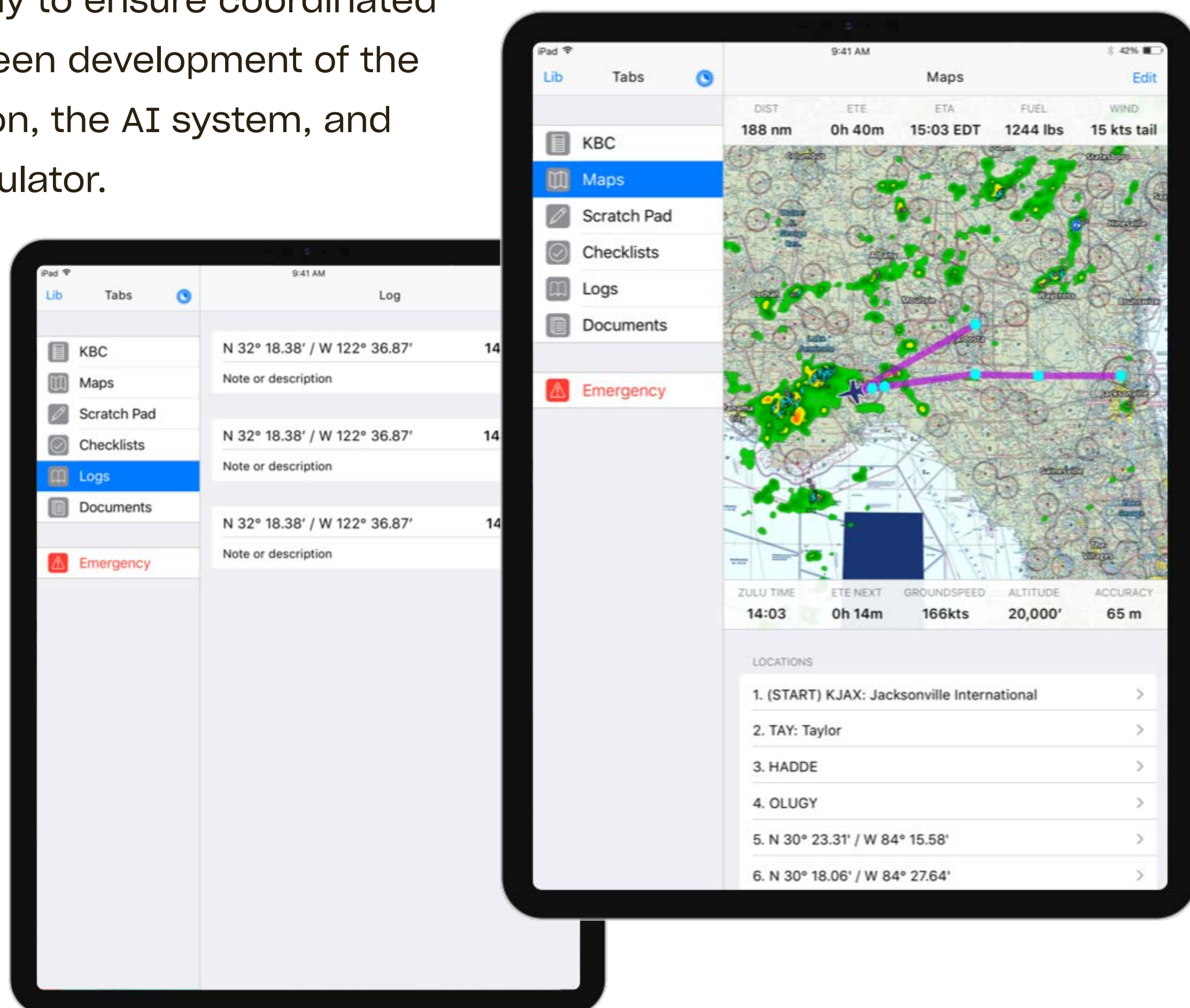
![Big Nerd Ranch logo]

Approach

Even before the discovery phase of the process the Navy saw that they had a functional issue with the kneeboard but they weren't sure how to best proceed. They also didn't have a traditional team in place, so we took the lead in both development and design and filled in the existing gaps.

Our designers and developers used the partnership to mentor the client in iOS development since they are researchers, not iOS developers.

Throughout the project, Big Nerd Ranch:

- Interviewed former and current Navy pilots about their experiences.

- Pivoted to evolving client goals.

- Mid-way Discovery helped ensure deliveries prioritized the demo

- Modular code and good architecture allowed us to easily rearrange the building blocks of the app.

- We were able to remain Agile™ while allowing the client time to figure things out on their end.

- AI-driven design became Design-driven AI.

- Working around blockers: We designed and built the iOS architecture/app first without having proper backend dependencies from the client.

- Remained flexible despite a difference in development processes

- Gave an R&D (research and development) company a taste of Agile™ without forcing our style upon them.

- Had frequent check-ins to make sure our own deliveries met the expectations of SoarTech and Navy and that SoarTech was able to deliver on their end as well.

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Client Value

Focus

Created the story for a stakeholder demo to focus our scope and effort.

User-Centered Design

Designed the user experience to help the pilots complete their tasks.

iOS Expertise

Expert app development and AI integration for the iPad.

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Big Nerd Ranch's development
processes are pretty awesome!

SOARTECH

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