DESIGN OF AUTONOMOUS MEDICAL RESPONSE AGENT (AMRA) AGGREGATE INFORMATION DASHBOARD (AID)

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This work is supported by the Translational Research Institute through NASA Cooperative Agreement NNX16AO69A
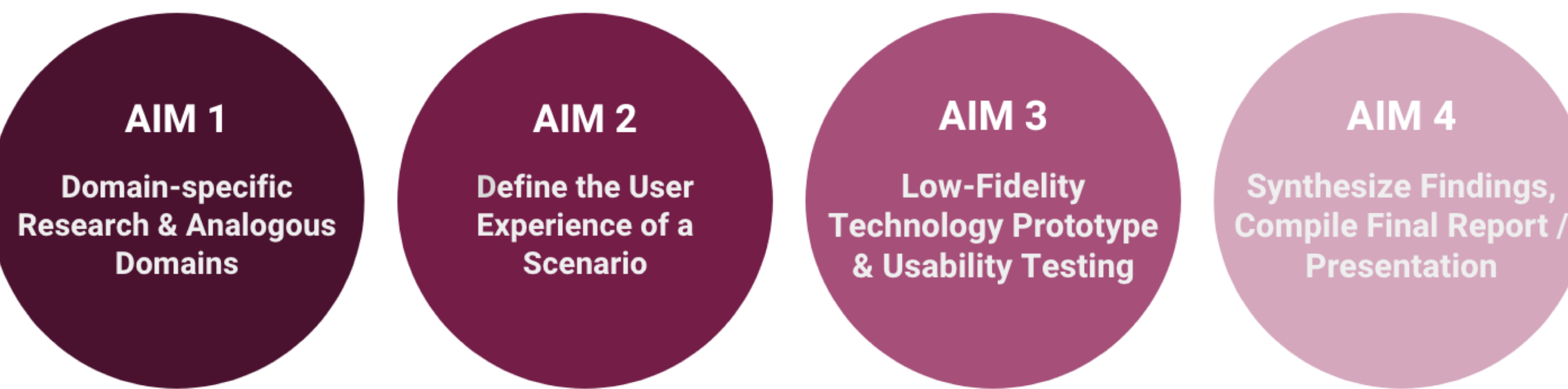
PROJECT DESCRIPTION

Nahlia's autonomous medical response assistant (AMRA) is envisioned to help astronauts interpret their symptoms and guide self-treatment until healthy is restored. Major challenges for astronauts in deep space missions will be that crewmembers are not expected to be medical professionals, may be under high workload, high stress, are facing physiological challenges caused by spaceflight, and have limited voice communications with Earth. This proposal focuses on the creation of a prototype that:

1) provides an optimal work flow of actionable recommendations for self-care of the crew while, 2) building trust between Mission Control Center (MCC) flight surgeons and astronauts on long-duration exploration missions (LDEM) with limited voice communication.
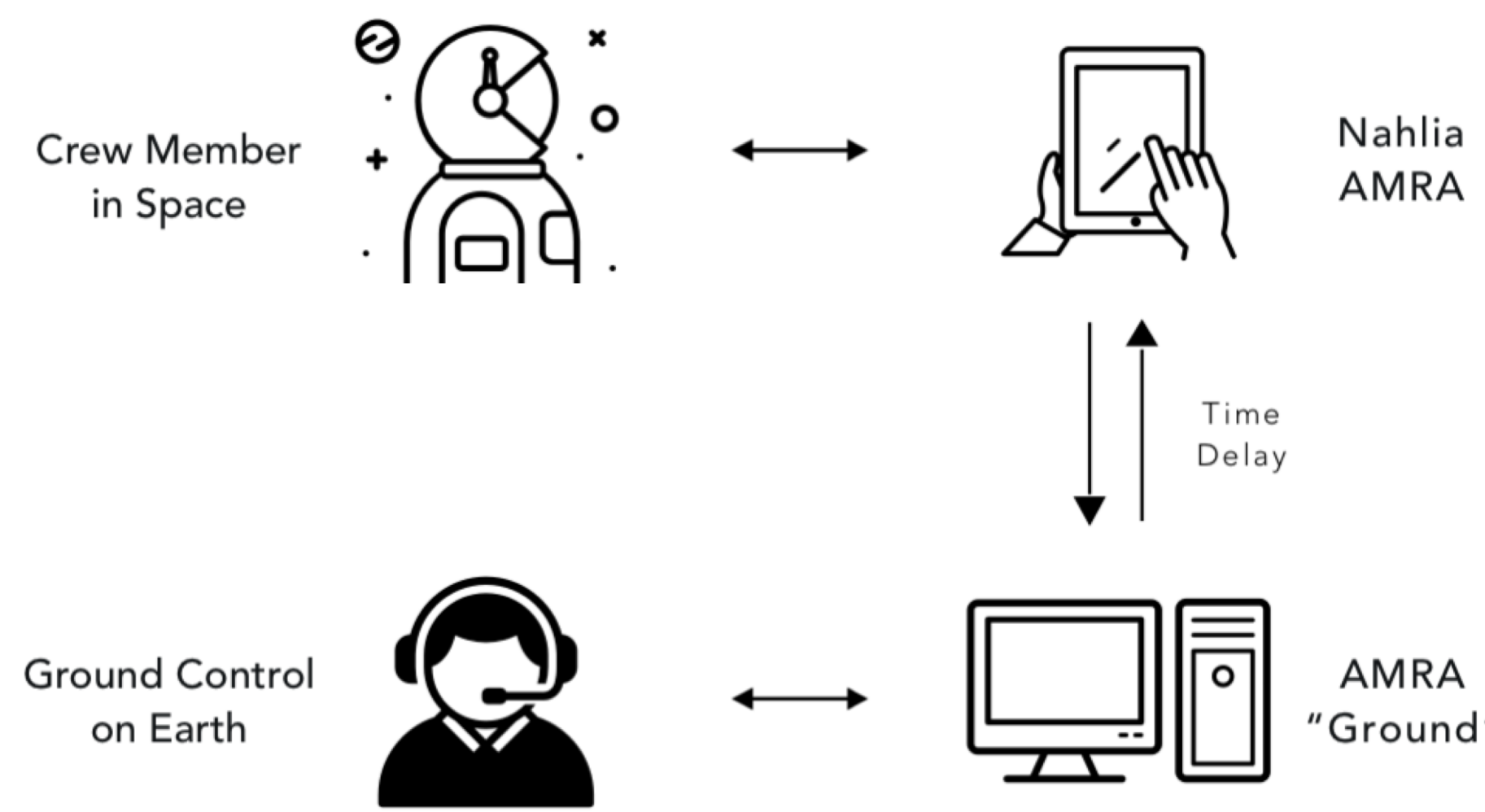
Nahlia's autonomous medical response agent (AMRA) is envisioned as a technology interface to capture and record information from planned and unplanned medical incidents in future long-duration exploration missions while making actionable recommendations to crew when real-time communication with ground would not be possible. AMRA's algorithm develops a differential diagnosis for high-risk medical conditions and based on the perceived risk makes recommendations to the crew and/or guides the crew through appropriate testing and treatment protocols. Through AMRA AID, the flight surgeon also has the opportunity to comment and respond to medical incidents.

PROJECT AIMS

AIM 1 Domain-specific Research & Analogous Domains

AIM 2 Define the User Experience of a Scenario

AIM 3 Low-Fidelity Technology Prototype & Usability Testing

AIM 4 Synthesize Findings, Compile Final Report / Presentation

PERSONAS

In our research we have identified three key stakeholders and defined the user needs, pain points, and design requirements for each. To validate our assumptions, we have interviewed and received feedback on our design approach with: 5 Former NASA Flight Surgeons, 2 Current Flight Surgeons, 2 Emergency medicine specialists, and 2 Former Astronauts.

Crew Member with Limited Medical Expertise

Crew Medical Officer

Fight Surgeon on Ground

Future crewmembers on long-duration exploration missions may or may not have emergency medical training. The AMRA interface must therefore be designed for use by both medical specialists and non-specialists alike. AMRA will integrate protocols relevant to the development of a differential diagnosis through a touch-screen and a conversational user interface.
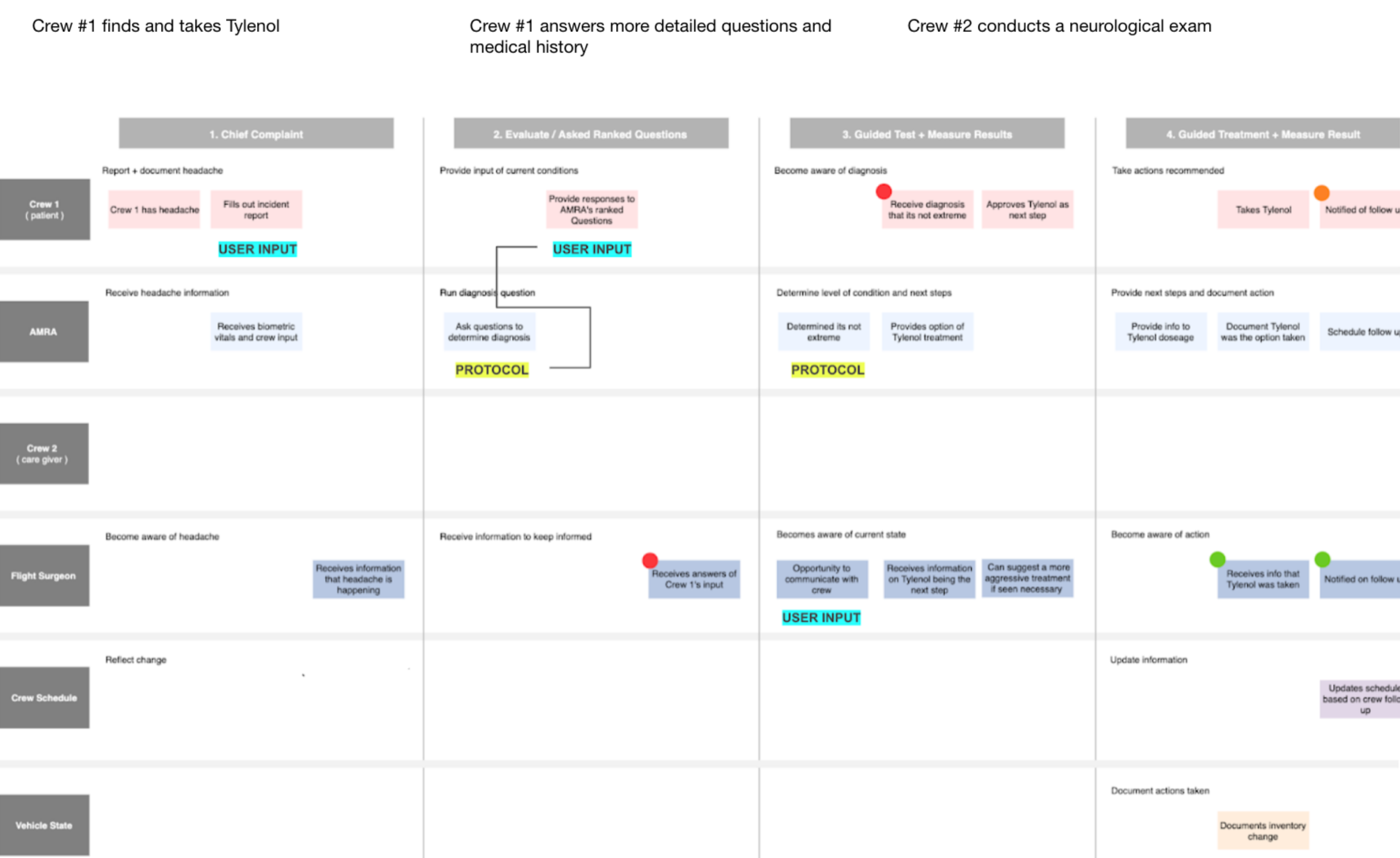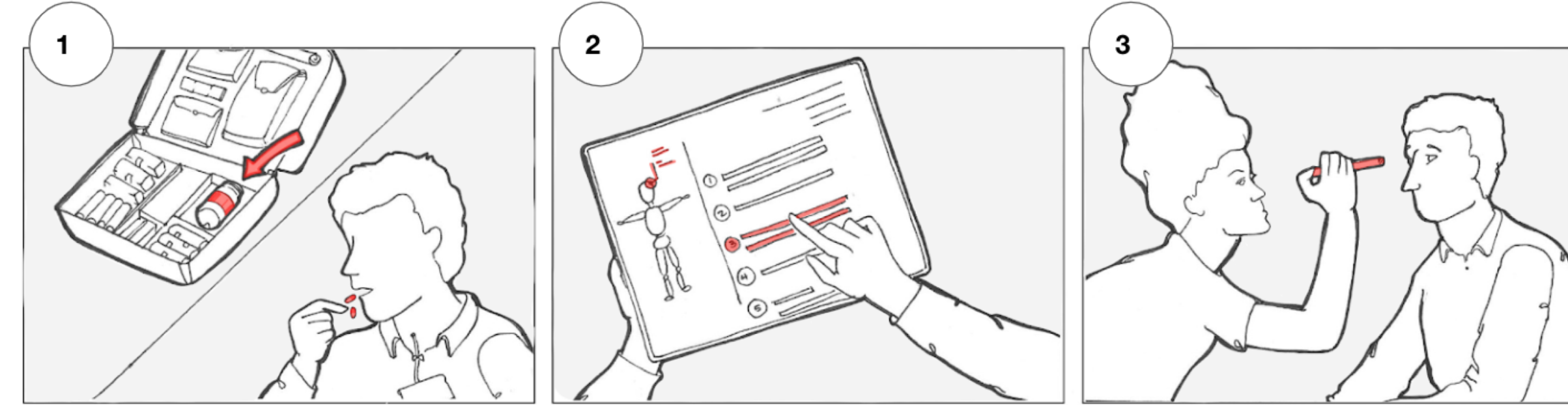
The CMO will have received specialized training specific from other crewmembers. AMRA will typically prioritize the CMO's participation when scheduling diagnostic tests and treatments with other crewmembers. The CMO will require quick & straightforward access to emergency procedure protocols, reference materials and possibly training.

The flight surgeon will require the capability to comment, respond, and make additional recommendations to the crew and in response to AMRA's diagnosis & treatment course following planned & unplanned incidents. The flight surgeon will require data relevant to routine and unplanned medical incidents to be captured and sent to ground routinely.
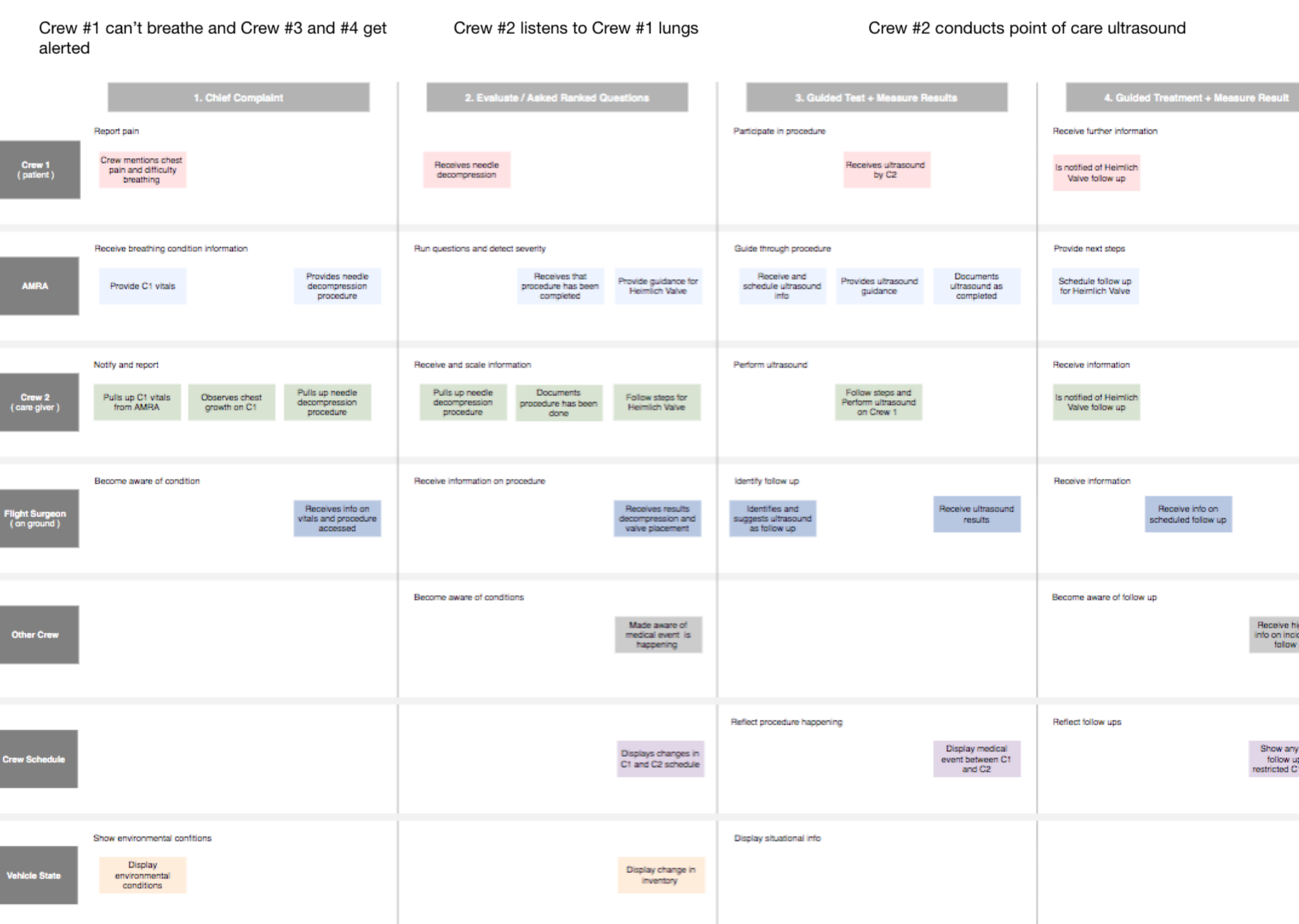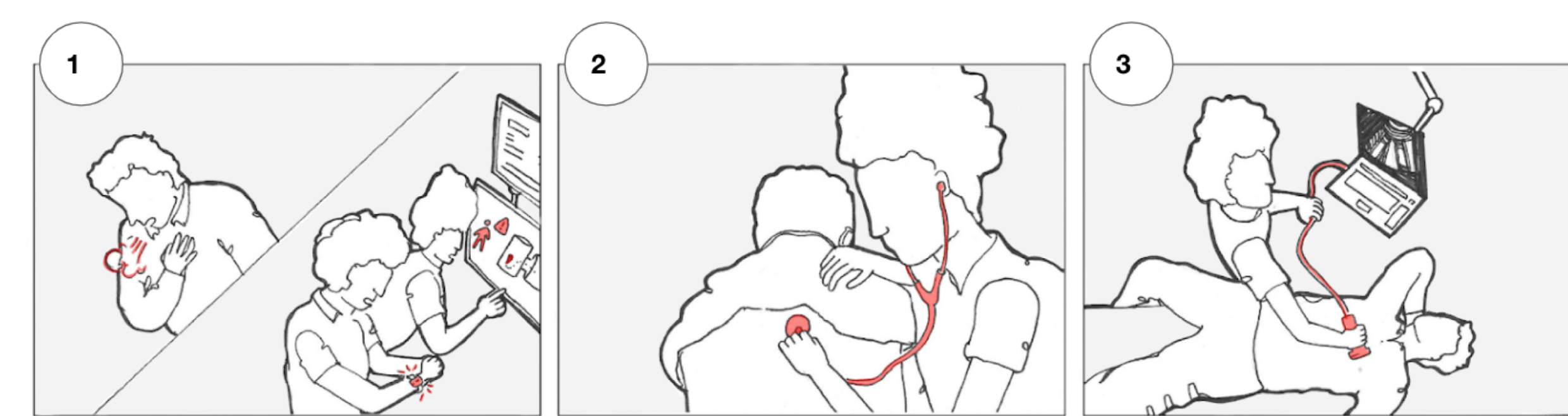
USER SCENARIOS

Two user scenarios have been conceived to demonstrate the efficacy of AMRA AID in the event of 1) a routine and/or chronic medical incident, and 2) an emergency or unplanned medical incident. The interactions and communication requirements for all stakeholders have been considered within the context of a future long-duration exploration mission, where time delays and limited bandwidth would prevent real-time communications between the crew and ground.

SCENARIO 1: HEADACHE

Crew #1 finds and takes Tylenol

Crew #1 answers more detailed questions and medical history

Crew #2 conducts a neurological exam

SCENARIO 2: DIFFICULTY BREATHING /PNEUMOTHORAX

Crew #1 can't breathe and Crew #3 and #4 get alerted

Crew #2 listens to Crew #1 lungs

Crew #2 conducts point of care ultrasound

PROCESS DESCRIPTION

The sequence flows are used to derive "static states" for the user interface, which show how mission-critical information can be interrelated without assuming a causal relationship. The comprehensive view enables efficient information access for both crew & ground support, and enables ground support to make critical analytical decisions based on crew and vehicle health.
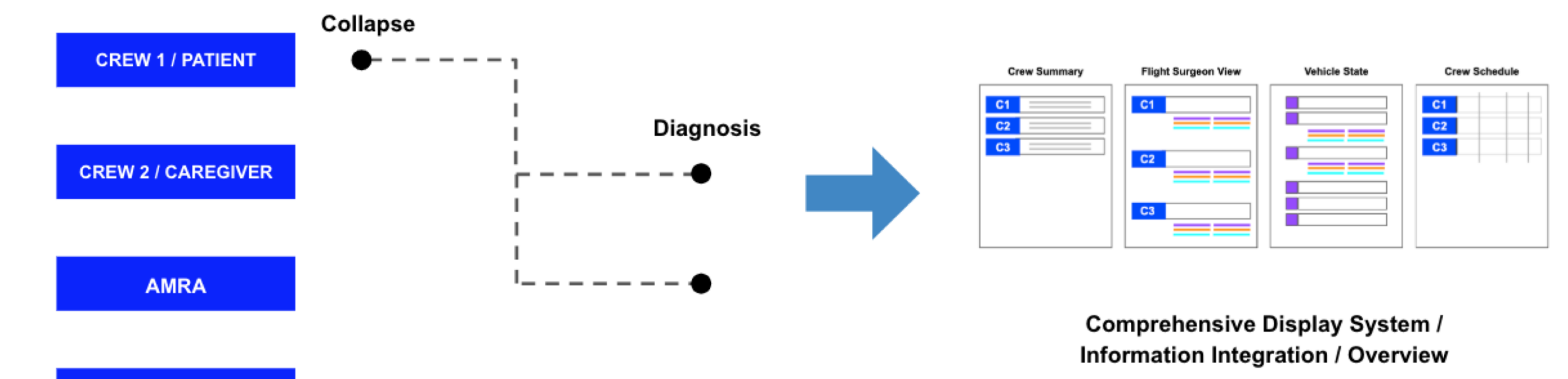

CURRENT PROTOTYPE

The current prototype is comprised of 5 screens. While the Flight Surgeon interface is specifically intended for ground, the remaining screens capture the information captured and communicated between the crew, AMRA, and the flight surgeon in the event of a planned and/or unplanned medical incident.
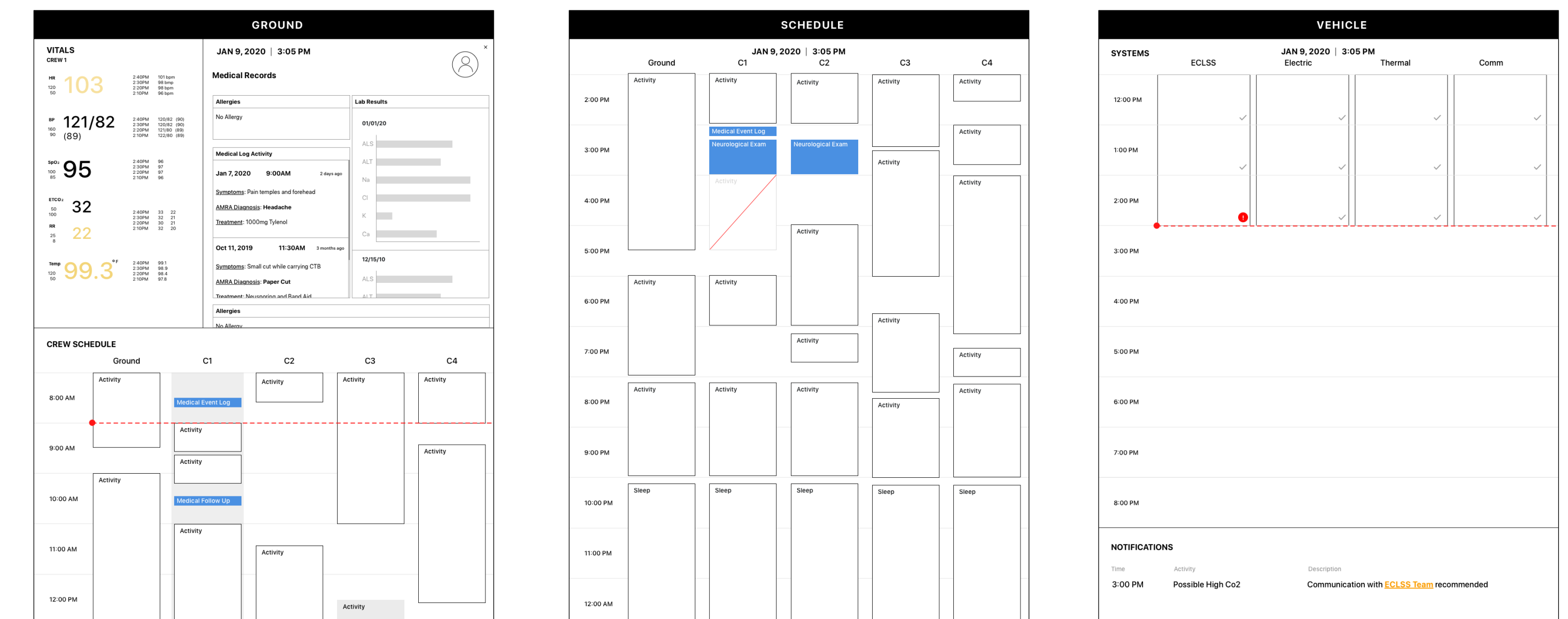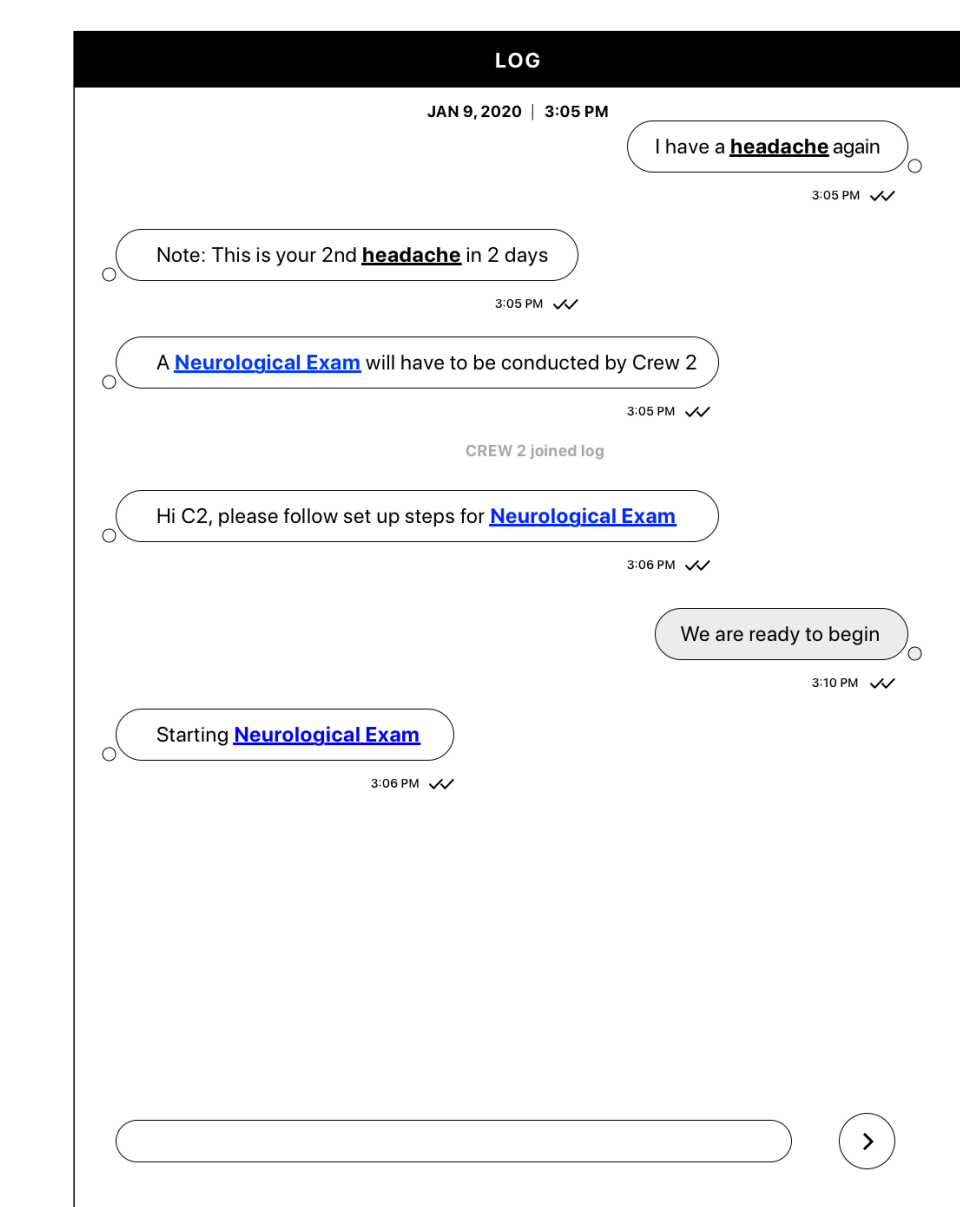

Flight Surgeon Interface

Crew Schedule

Vehicle Health / Information
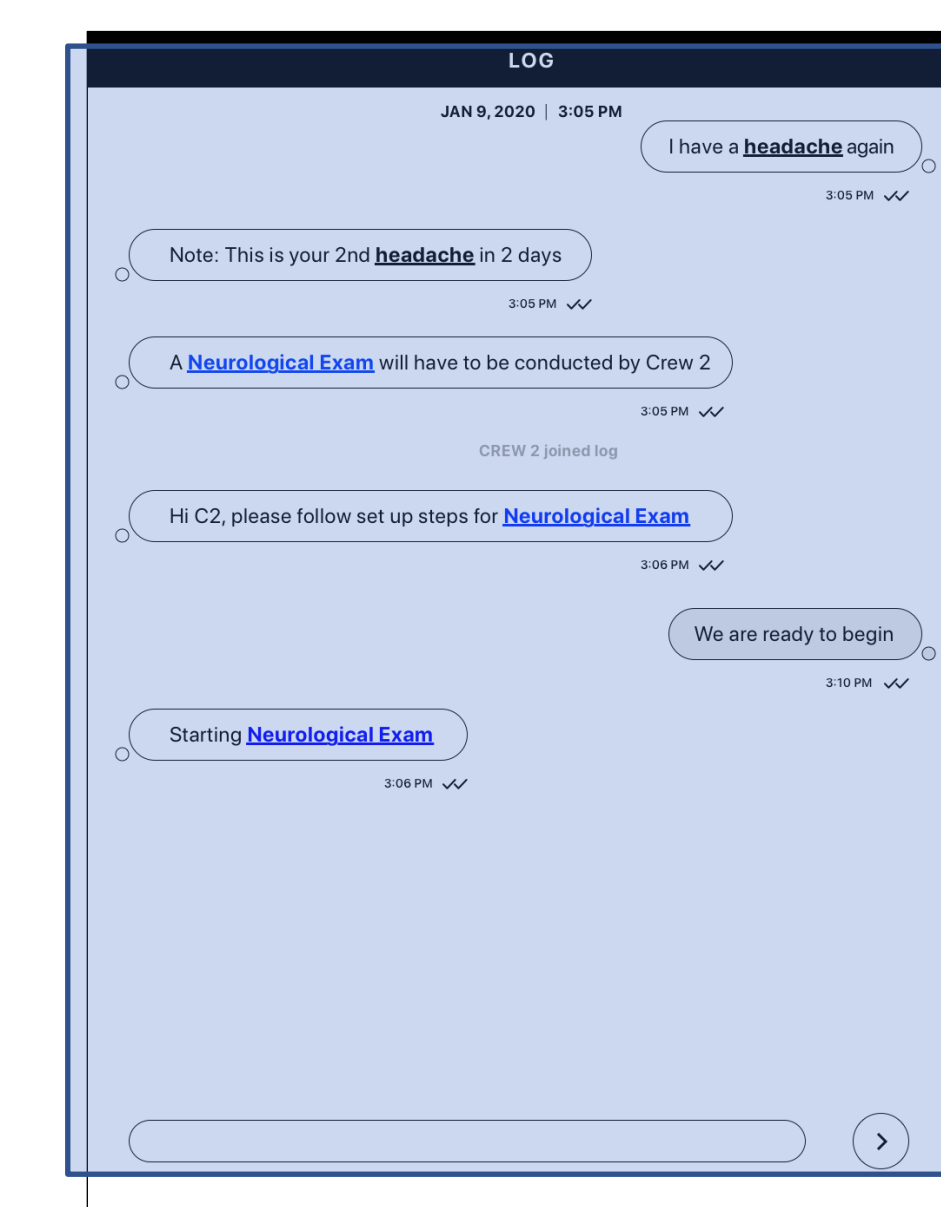
On-board Crew Medical Information

AMRA Log

NEXT STEPS

- Our next prototype is anticipated for completion in late February and we will continue performing user tests with flight surgeons, astronauts, emergency medical experts and other subject matter experts.

CHALLENGES

- We are not at a stage in the project where we can represent the functioning algorithm within the interface
- Simulating a true mission context for user testing the described scenarios has been a distinct challenge for the project. We have therefore focused on validating all information and data elements required in the event of a planned or unplanned medical incident.