INTRODUCTION

SKA Dish

The Square Kilometre Array (SKA) project is responsible for developing the SKA Observatory, the world's largest radio telescope ever built: eventually two arrays of radio antennas - SKA-1Mid and SKA-1Low - will be installed in the South Africa's Karoo region and Western Australia's Murchison Shire, each covering a different range of radio frequencies. In particular SKA-1Mid array will comprise 133 15m diameter dish antennas observing in the 350 MHz-14 GHz range, each locally managed by a Local Monitoring and Control (LMC) system and remotely orchestrated by the SKA Telescope Manager (TM) system.

Figure 1 SKA Dish antenna overview

Dish sub-elements

Four sub-elements can be identified in the SKA-1Mid dish element:

- Dish Structure (DS): antenna structure and optics, feed indexers, servo systems, power distribution and safety systems
- Single Pixel Feed (SPF): feed packages (OMTs, LNAs), helium cooling and vacuum system and relative controllers
- Receiver (SPFR): RF, digitizer and relative controllers
- Local Monitoring and Control (LMC): sub-system for each dish antenna that deals with the management, monitoring and control of the operation as orchestrated by the Telescope Manager (TM)

Dish User Interfaces

Two user interface types are assumed from the element side:

- Engineering interfaces used by DSH sub-elements engineers (test, diagnostic, maintenance (Figure 2) Navigation interface used by control room operators for operations purposes)
- User interfaces 

Figure 2 Dish Engineering Interfaces

Figure 3 Sketch of DISH LMC engineering UI

METHODS

Usability and Accessibility

The ISO 9241 standard Ergonomics of Human-System Interaction (ISO, 2008) defines usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use". Specifying:

- Effectiveness: the accuracy and completeness with which users achieve specified goals.
- Efficiency: the resources expended in relation to the accuracy and completeness of the achieved goals.
- Satisfaction: the comfort and acceptability of use.

Accessibility is the degree to which a product, device, service or environment is available to as many people as possible (often focused on people with disabilities or special needs).

USAGE-CENTERED DESIGN

A usage-centered design (UCD) approach for interactive software applications is based on the early involvement of users of the application from its conception. In practical terms, it means that feedback offered by users is considered in analysis phases, as well as iterative design, prototype and evaluation based on usability criteria. Several techniques can be applied to establish such a kind of process: structured interviews, contextual enquiries, sketching, storyboarding, user testing, writing scenarios and personas, among others.1,4,5

Interactive sketches and storyboards may be used as throw-away mockup UI prototypes (Figure 3) and discussion documents for brainstorming with the aim of eliciting opinions of stakeholders and users.

Figure 4 IFML conceptual model of DISH LMC UI

CONCLUSIONS

The Dish engineering UIs and control activities can mitigate product risks (i.e., those concerning with what will be developed and whether it will be the right solution), elicit new requirements through users and tasks analysis, design and validate appropriate UIs. Prototyping is a key tool to be used in exploratory usability investigations and for the evaluation of technologies against SKA TM requirements.

REFERENCES