



UX Design for NASA's Deep Space Network

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Once I thought I knew a lot.

Then I was sure I knew a little.

Now, I know that I know **nothing**.

-Private Dowding

Setting the scene

What is the DSN?

WHO is the DSN?

Change is coming

Designing for change: What didn't work

Designing for change: What worked

What we're planning

Setting the scene

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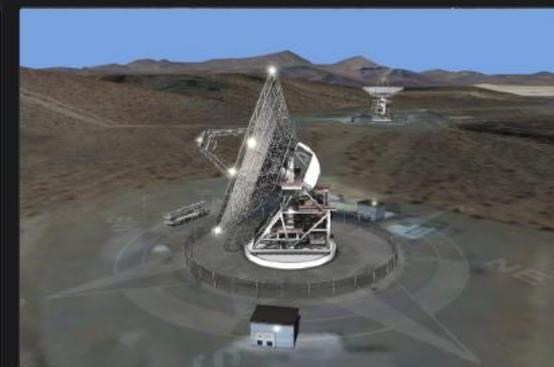
What we're planning



[DSN home](#)



OSIRIS-REX



[VIEW ANTENNA](#)

[VIEW SPACECRAFT](#)

[VIEW WORLD MAP](#)

ORX

SPACECRAFT

NAME

OSIRIS-REx

RANGE

-

ROUND-TRIP LIGHT TIME

-

ANTENNA

NAME

DSS 26

AZIMUTH

211.09 deg

ELEVATION

28.25 deg

WIND SPEED

22.84 km/hr

[+ more detail](#)

[credits](#) [contact us](#)

M01O MVN MSL
MEX

SOHO

MRO



63

65

54

55

STA

DAWN

ACE

DSN

ORX



14

15

24

25

26

NHPC

JNO

CAS

MMS4



43

34

35

36

MADRID

APR 7
6:47 PM

GOLDSTONE

APR 7
9:47 AM

CANBERRA

APR 8
2:47 AM

An intriguing design challenge

Old and new technologies combined

60 years of history

Designs need to last 20 years

40 years of human habit

Getting on with it

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Operator persona

Mostly male

Mostly older

Highly technical – but not IT people

Highly educated – 40 years ago

Operators in their habitat



Situational awareness



The good old days



Photo credit: Alexandra Holloway

Three cultures



Dramatic music

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Follow the Sun



Photo credit: USGS

Three links per operator

1 operator + 1 antenna + 1 spacecraft
= HARD

1 operator + 2 antenna + 2 spacecraft
= MUCH HARDER

1 operator + 3 antenna + 3 spacecraft
= **the wild, wild west**

Charge boldly forward

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How to incite revolution

Big changes with no user research

Drastic changes without good reason

Changes with good reason that are too drastic.

“User Acceptance Testing”

Embrace the “slow blink”

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Evolution, not revolution

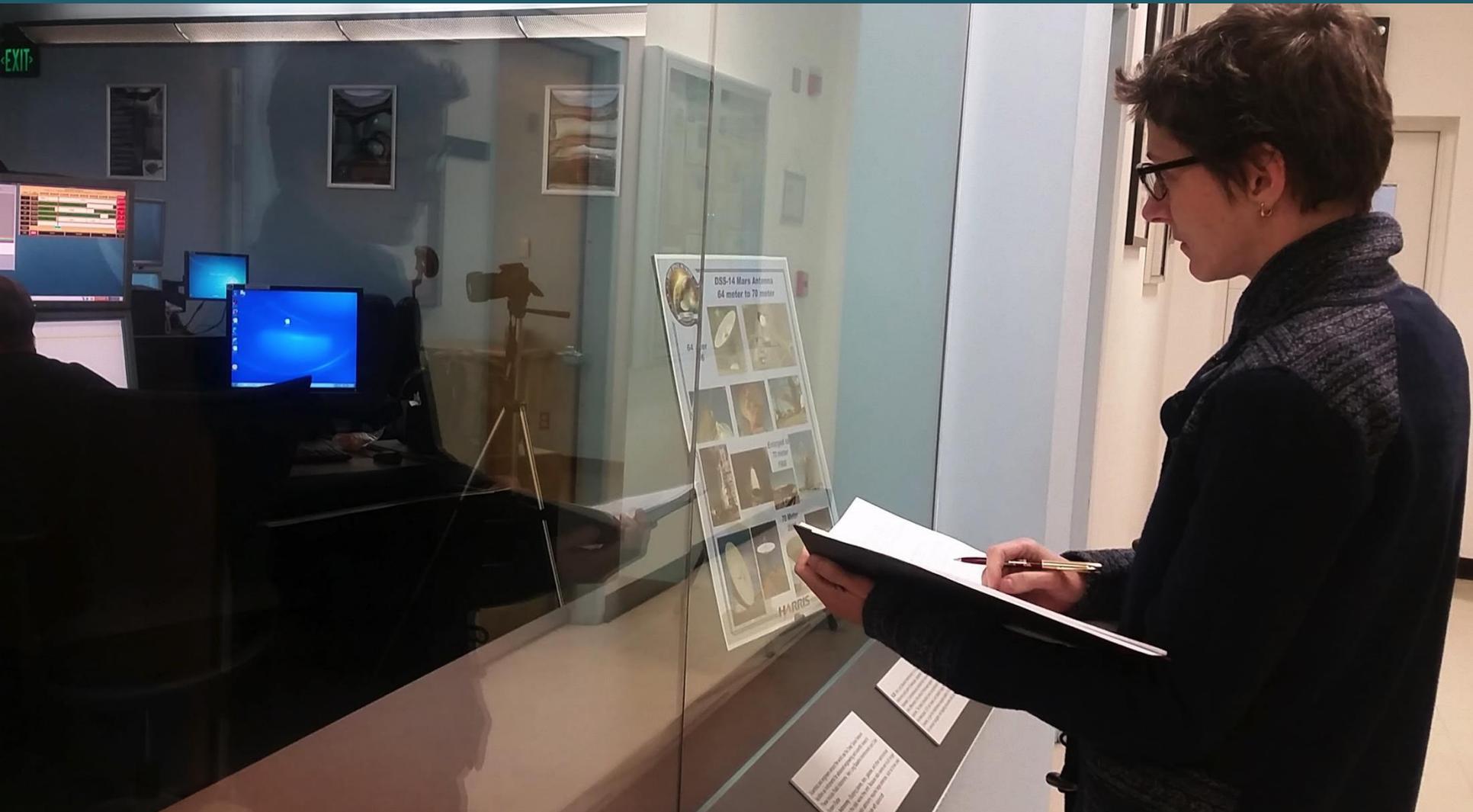
Involve early, involve often

Build trust

Iterations

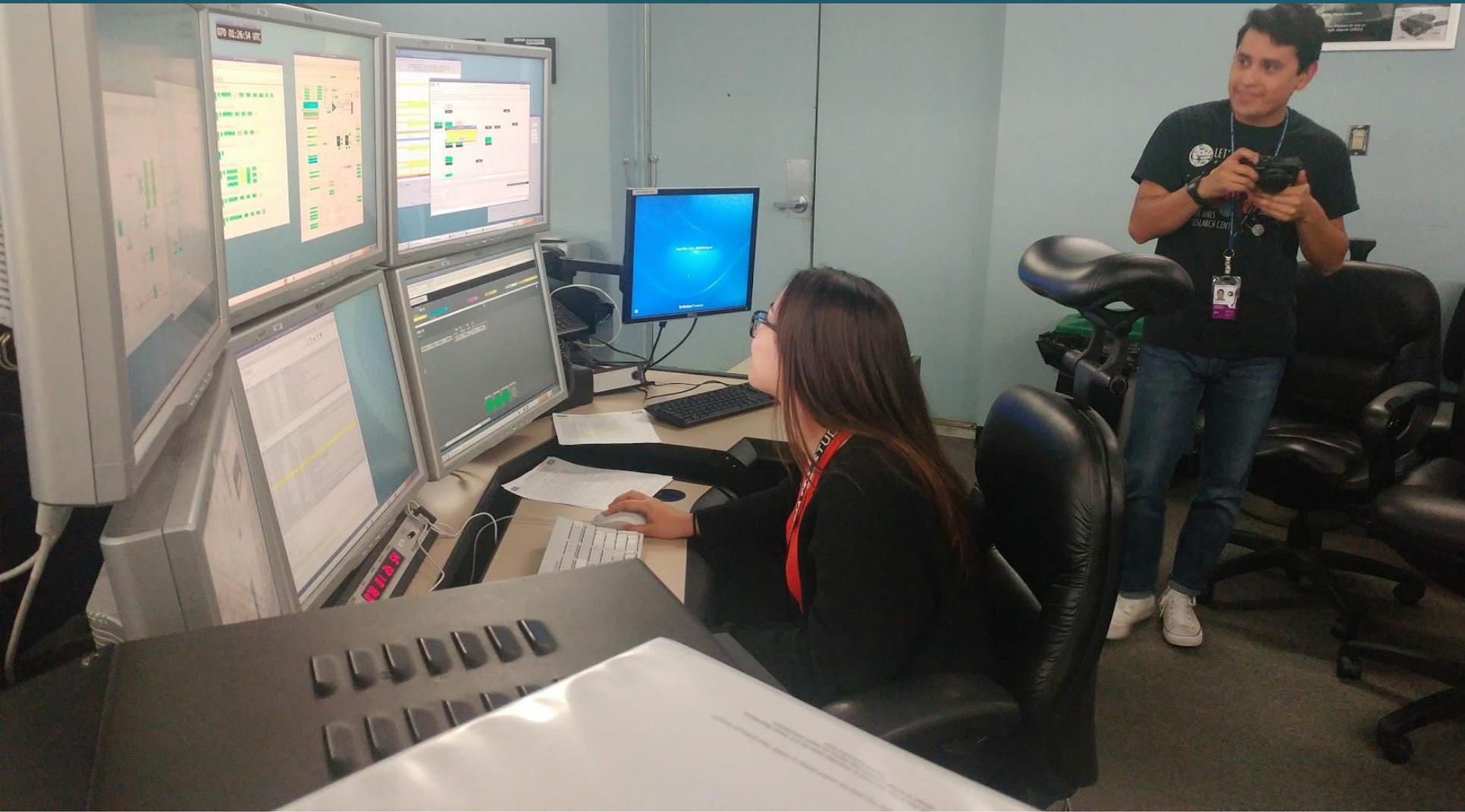
Slow and steady wins the race

Techniques



Observations

Techniques



Experiential Research

Techniques

DSS 14: (31) VGR1 - FJ_A

S/C (31) VGR1
IF DSS14X01C2
FC FJ_A

CARRIER IN LOCK

Conscan DC05
PC -169.613 dBm
Car residual 1 673.061 Hz
Predicts 1W 2W 3W
System noise temperature ENABLED
16.414 1 K
Carrier band X S Ka
AGC 1.704 1 V
Config Table 7031b160

SUBCARRIER IN LOCK

SYMBOL IN LOCK

Rate 319.960 94 sps
Predict rate 319.964 26 sps
Rate residual -0.003 32 sps
SNR 7.426 086 dB

TELEMETRY IN LOCK

RANGING OFF
STDL

TRX

Power
Predict p
Power residual
Band X S Ka
Drive ON

CMD CMG2
CMD MOD ON
Chk Creds BIND
SLE State UNBOUND
Prod State CONFIGURED
CLTU Received 0
CLTU Transmitted 0
CLTU Aborted 0

RNG IDLE
RNG MOD OFF
Activity IN SERVICE
Overall URA RESPOND
Rng Cal UNCALIBRATED
Countdown 0

ANTENNA TRACKING

Az EI
Actual 166.667 65.9887
Predict 166.708 66.0619
Residual -0.0095 -0.0006
Wrap CW

USC

UPL RCP LNA X2
DNL LCP

DC05 Data Outputs

CAR Data 1 082
TLM Data 156
RNG Data 0
DCD Pipe Backlog 8

WEATHER

Temp 67.8 F
Wind 7.3 MPH
11.7 kph
276 NW

Display

DSS - 4 3

RCP

FIXED PLRZR

LCP

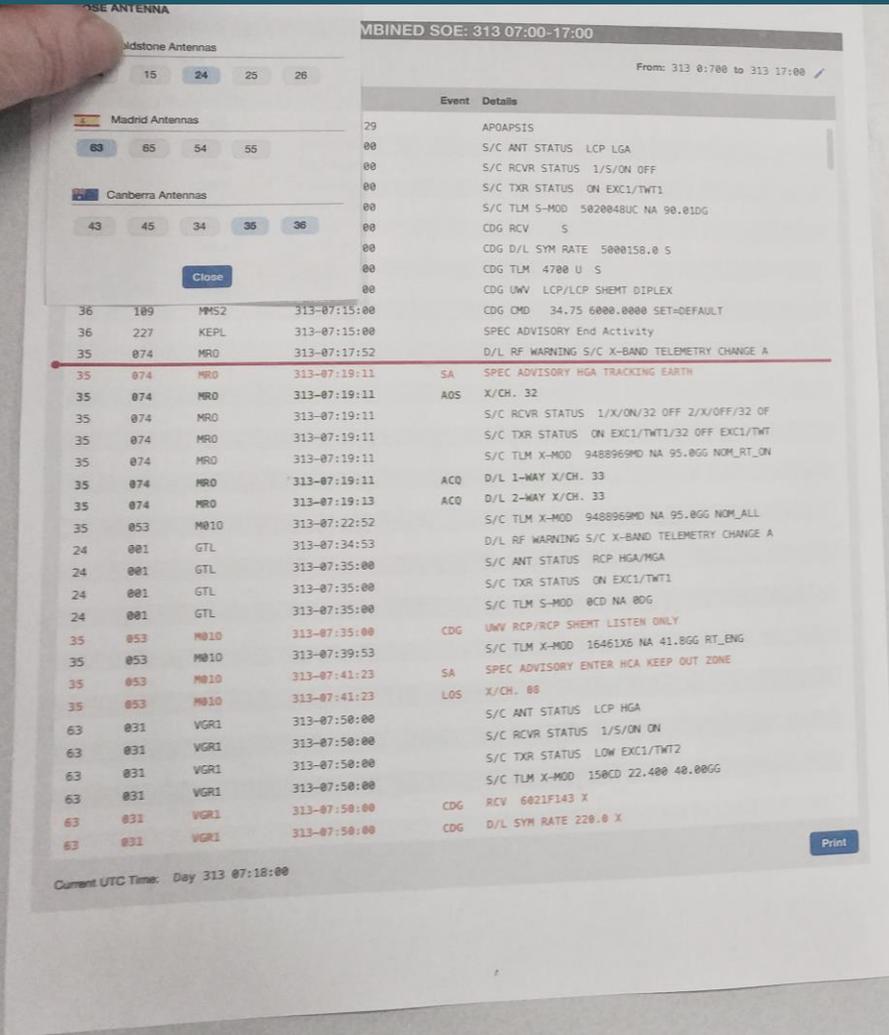
LOAD CTRL
=USE

LOAD

ANT

Paper Prototypes

Techniques



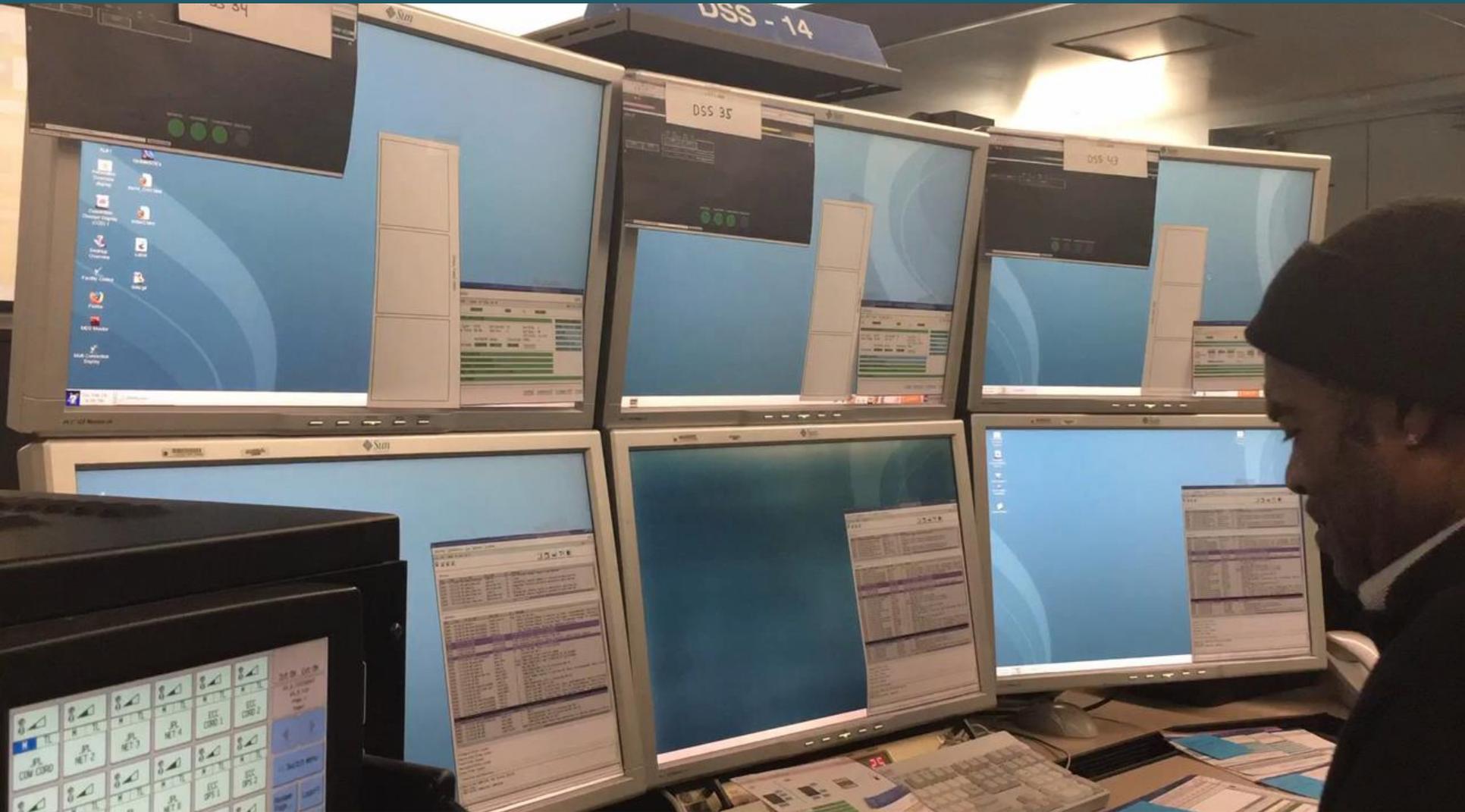
Paper Prototypes

Techniques



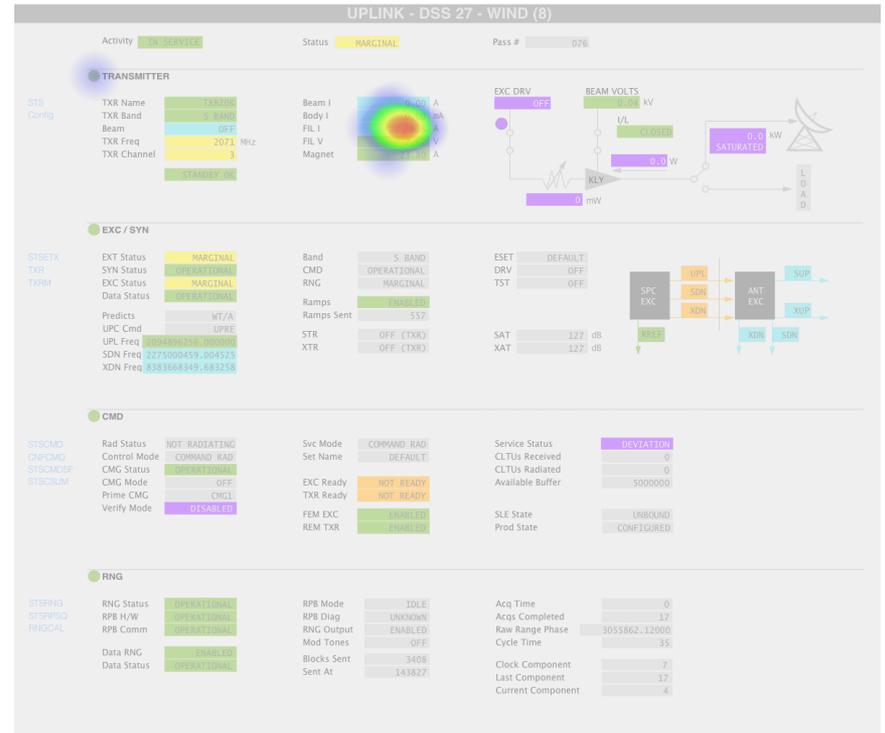
Participatory Design

Techniques



“Paper Dolls”

Techniques



“What Changed” tests

Techniques



Cultivating Ambassadors

Techniques



Banana bread

The future of Deep Space Operations

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What we're planning

How far can we evolve?

Modern technologies – but not too modern

Automation

PR and Goodwill

Training



Questions?



Thank you!

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