# Anthropological studies of control rooms (and control situations)

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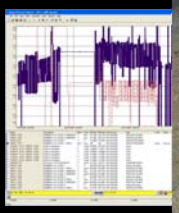
## My job: Studio Apertura, NTNU Social Research

- Interdisciplinary research institute owned by the Norwegian University of Science and Technology (NTNU)
- Studio Apertura: ~20 employees, sociology, anthropology, psychology, engineers.
- Organizational research:
  - Safety, ICT use, regulation, interdisciplinary collaboration etc.
  - Petroleum, Maritime, Infrastructures, Health, Aquaculture, Public agencies, Space operations.
- Extensive collaboration with NTNU and SINTEF.

# Me:

- Anthropologist and geological engineer
- PhD on subsurface professionals working for the Statfjord field.
- Prof 2 at NTNU Computer Science and Informatics.
  - Big data and algorithms in exploration.

- Some relevant projects:
  - IO center: modeling, simulation, sensor data interpretation.
  - Space research control rooms: ethnographic. studies, video/sound recordings, observation.
  - Ongoing project on emergency call centrals.



# Network for anthropology in control rooms - CTRLnet

- NTNU Samkul project
- "Lab" connected to the space research control room
- Course in anthropology of technology
- New assistant professor to be hired.

Lab, for experiments with control rooms, VR, AR etc

Ethnographic studies of space research control room

ESA projects: Moonwalk, Rover control, Mars habitats.

## Anthropology and control rooms, what do I mean?

- Anthropological studies in organizations
  - duration and depth, holistic, participation, personal, interpretative
  - rare, but there are ways to work ethnographically in shorter projects
  - a current methodological challenge/opportunity: participation in social interactions in "synthetic settings"

- Control rooms
  - "pure" control rooms become more networked
  - other settings become more like control rooms

## Understanding situated practice

The dearth of data on what people actually do—the skills, knowledge, and practices that comprise their routine work—leaves us with increasingly anachronistic theories and outdated images of work and how it is organized. (Barley & Kunda, 2001)

-Situated practice, the nitty gritty, always unique details of routine work. Not only the spectacular.
-Individual knowledge and informal and formal processes of sharing.
-Sociotechnical, the co-constitution of knowledge and technology/representations.

What this means: holistic orientation towards the social and sociotechnical environment.

## Study of Space research control room

- Presented in “Situated Practice and Safety as Objects of Management” (which I will draw on here)
- And more extensively in “What can possibly go wrong? Anticipatory work in space research operations.” (Johansen, Almklov & Mohammad, 2016)

- I will, as I do in the book chapter, supplement the discussion with examples from other cases.

## Space research operations

What can possible go wrong? (Johansen, Almklov & Mohammad, 2016)
Situated practice and safety as objects of management (Almklov, 2018)

- The case: Biological experiments at the ISS.
- Unique access to follow the research technicians.

- Extreme case, can we learn from it?
  - Focus on details, reliability, planning, trivial mistakes cost a lot.
  - Very limited access to the equipment.
  - Globally distributed network of partners (even a few in space).

## Space research operations

Arabidopsis thaliana in EMCS (Multigen)

Experiment containers

European Modular Cultivation System (ESA)

Express Rack 3 (NASA)

The International Space Station (ISS)

N-USOC (Trondheim)

Astronaut after successful procedure execution

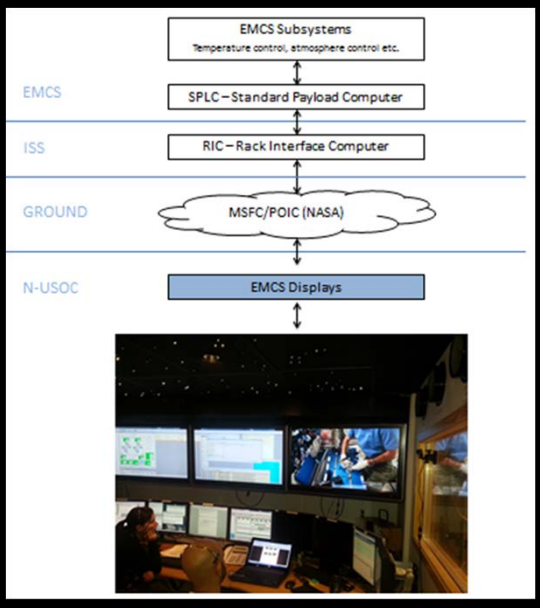
Huntsville Operations & Integration Center Huntsville, Alabama

# The experiment: From planning to operations.

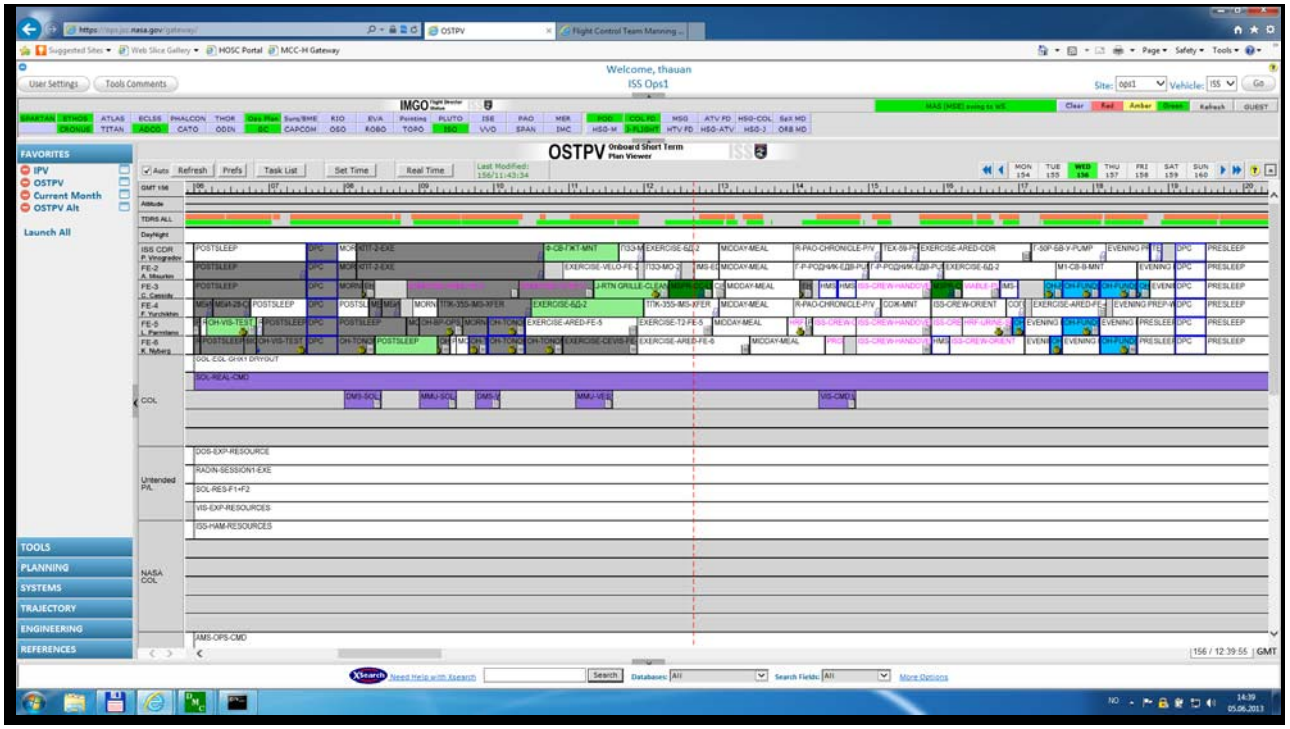
- Researcher proposes idea: Development of experiment containers, procedures, scripts, training, what if scenarios … etc.
- "Integration phase" lasts several years
- Extensive planning. Several layers of barriers, and redundancies.
- Distributed (Hutchins, 1995) nature of solutions:
  - Hardware → software → scripts → procedures → training.
- Real time phase (48 hours to a couple of weeks)
- Our project: Study of the planning process, training and control room situation.

Our example: How they solve a known issue

- Unstable telemetry.
- A problem they have encountered before and analyzed.
- Have several layers of "fixes".
- We discuss how the operators work to implement these.



- Challenges
  - Authorization to run fixes
  - Gain access to restart the RIC computer
  - Parallel activities, time windows, communication shadows
- Real-time solutions
  - Prospective scanning for potential opportunities and solutions
  - Real time planning
  - Listening to voice loop, time line tool
  - Authority by reference to pre-planned fixes
  - Effective language



# Findings

Don't plan to be ready—be ready to plan.

- No matter how pre-planned, they always need to improvise.
  Mainly regarding coordination.
- The importance of temporality:
  - Procedures are "timeless", work is not.
  - Procedures need to be aligned with other activities.
- Procedures are a part of the distributed cognition of the engineers.
  - They do not represent their anticipation, they are part of it.
  - A *relational* understanding of procedures.
  - Procedures are designed to support operational the professional practice, less for management or accountability purposes.

# Anticipatory work

.. in the planning phase.

- Extreme focus on finding all possible problems and preparing for them.
- Solutions are inscribed in hardware, software, scripts, procedures and training.

.. in the operational phase:

- Staying ahead of upcoming events. Listening to parallel activities.
- Looking for ways to implement pre-planned actions.
- Improvisation *with* procedures.
- Establishing the authority to get priority when necessary.

## Conclusions, procedures

- Procedures, rules and checklists can be an integrated part of a community of practice, a resource for improvisation, a means of remembering shared knowledge, and an inextricable part of the "distributed" knowledge of the workers.
- Other times, they primarily serve purposes of accountability and external control.

## Conclusions, Temporality

- The temporality of the work situation is an important factor in understanding the relationship between representations of work and situated practice.
- Representations of work tend to be detached from the evolving temporal trajectories of work as performed.
- Many of the insights recent years in safety science, e.g. in Resilience Engineering, on the importance on managing variability are mostly relevant in operational settings, within an operational temporality and with a certain amount of situational variability.
- Thus, for managers and workers seeking to improve safety, recognizing the difference in temporality of different settings is an important step in choosing strategies for safety management for each situation.
- One should not be trying to model one in the image of the other.

- Thanks!!
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- Read more here.


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ORIGINAL ARTICLE

**What can possibly go wrong? Anticipatory work in space operations**

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