

# Modelling normal performance variability with FRAM

## And: Risk analysis with FRAM

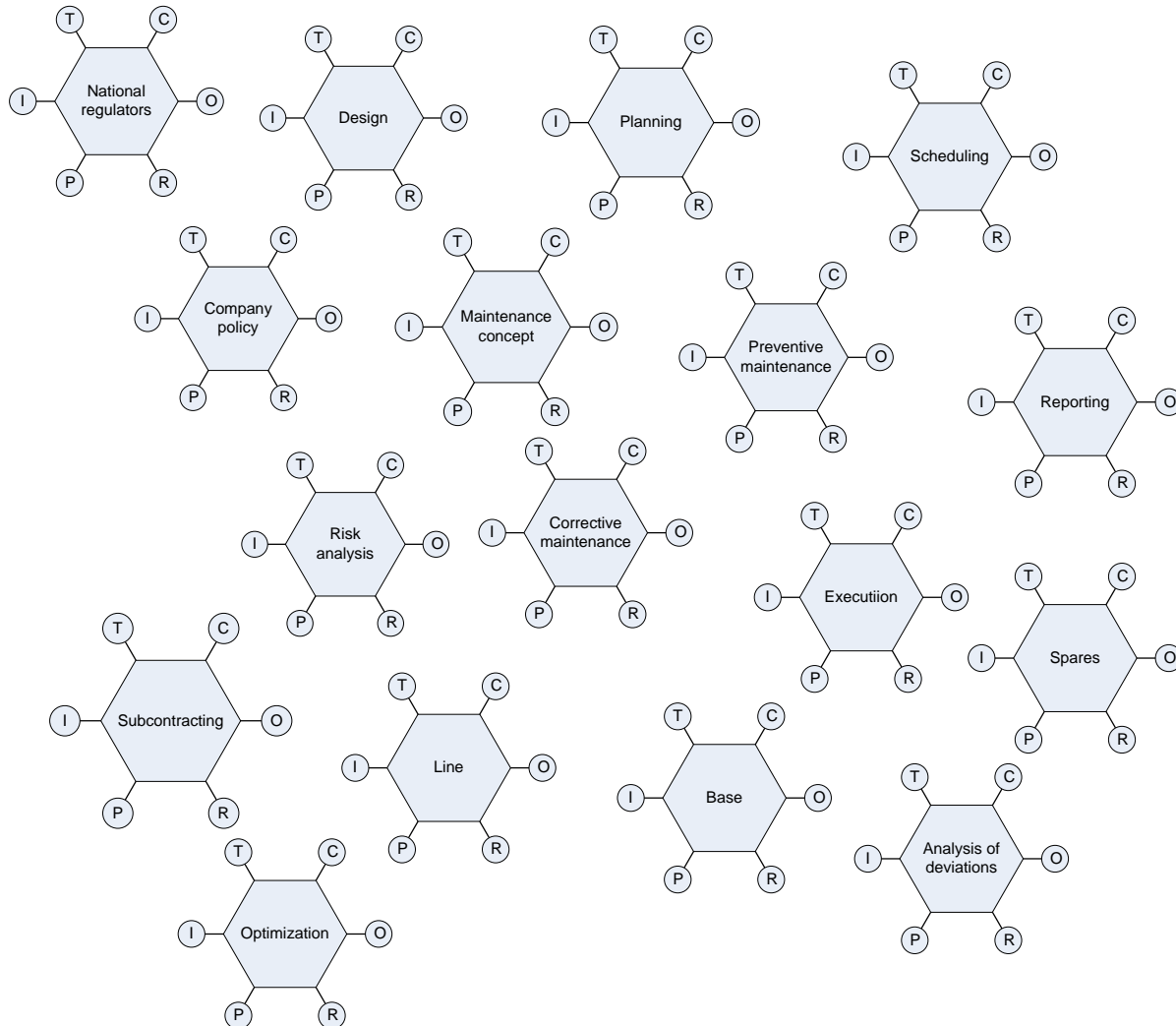
Aviation & Petroleum Industry  
An initial discussion

Ivonne A. Herrera, Camilla K. Tveiten  
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# Background and objective

- It is required to address a situation where there could be a conflict between production and safety in a socio-technical system
- How we capture normal variability both POSITIVE and negative characteristics without looking only for errors?

# Aviation – maintenance context



# Petroleum industry context

## Production optimizing

- Short- and long-term control and optimization of oil and gas flow in a value chain from reservoir, via offshore facilities to export from installations.
- Major communities involved:
  - reservoir engineers
    - Responsible for updates of the subsurface model when production change the properties of the reservoir
  - production engineers
    - Responsible from reservoir, meaning to maximize the production from the existing wells to the separators (separate oil-gas-water) on the platform
  - process engineers
    - Responsible for modeling the flow from the separation facilities on the platform onwards.
  - (Offshore) operators
    - Handle daily process control and optimization. Monitor safety (emergency and shut-down alarms), technical systems and equipment, minute to minute production Many additional tasks related to CCR
  - Various contractors that are involved at various points.....
- Surroundings: Drilling and well control, maintenance, company, authorities...

# Prior to the analysis

- Collection of information (documents+interviews)
  - Work process descriptions
  - Qualitative observations
  - Do we need description of incidents/accidents or this will affect the analysis in a negative way?
  - Success history telling?

## ***Questions - comments***

- Normal operations involve several work processes. How to handle the complexity?
- Do we need “industry experts” to carry out an analysis?

# 0 Describe the target situation or scenario

- Criteria for scenario selection
  - Regular, irregular, unexampled events
  - Critical
  - Normal+normal=critical
  - Always underspecified

## ***Questions - comments***

- What is a target situation of normal work
- Target situation – successful operation – what does this mean?
- What is a good enough scenario description?
  - Use a time sequence?
  - Describe both what is normal and what actually happened

# 1 Identify essential system functions

## Criteria for "essential"

- Just the functions that makes system work...
- Guessing this is very critical to get right 😊
- Interviews to capture "the work as planned and as performed"

## Questions

- Level of analysis
  - On what level should functions be described in order to obtain a good analysis?
- How do we describe time and it's impact short term – long term?
- When to stop the description?
  - Breakdown of the system into functions until each of them defines an acceptable process( one you can reasonably validate in the context of the action)

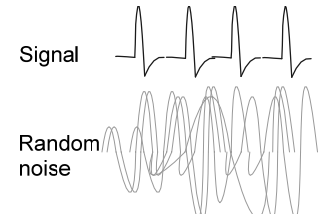
# 2 Potential for variability

- Variability could be endless
- How we identify normal and abnormal variability?
- Need for another way to visualize variability?

## *Questions*

- We have a check list but it limits the "things to look for"
  - How do we capture other "CPCs" that are important

# 3 Functional resonance



Use FRAM network in a multidisciplinary work environment

## *Questions - comments*

- How you identify “resonance” that is essential to the system
- Resonance between two normal processes

# 4 Identify “barriers” for variability and...

- ” (1) *Physical barrier* systems block the movement or transportation of mass, energy, or information. Examples include fuel tanks, safety belts, and filters.
- (2) *Functional barrier* systems set up pre-conditions that need to be met before an action (by human and/or machine) can be undertaken. Examples include locks, passwords, and sprinklers.
- (3) *Symbolic barrier* systems are indications of constraints on action that are physically present. Examples include signs, checklists, alarms, and clearances. Potential functions encompass preventing, regulating, and authorizing actions.
- (4) *Incorporeal barrier* systems are indications of constraints on action that are not physically present. Examples include ethical norms, group pressure, rules, and laws. “

## Questions

- How you go from resonance to “damping factors” identification
- How do we select essential “damping factors”
- Which kind of “damping factors” support flexibility, early warnings, creativity and improvisation\*

# 4 ...Performance monitoring

- Barriers
- CPCs
- Early warnings....
- ....+ reactive information....monitoring everything and having focus on what's important
- Drifting towards failure and sudden disruptions??

## ***Questions***

- What to look for? What do we do from a risk perspective?
  - Performance monitoring is an important factor when FRAM is used in risk analysis and for risk prevention.