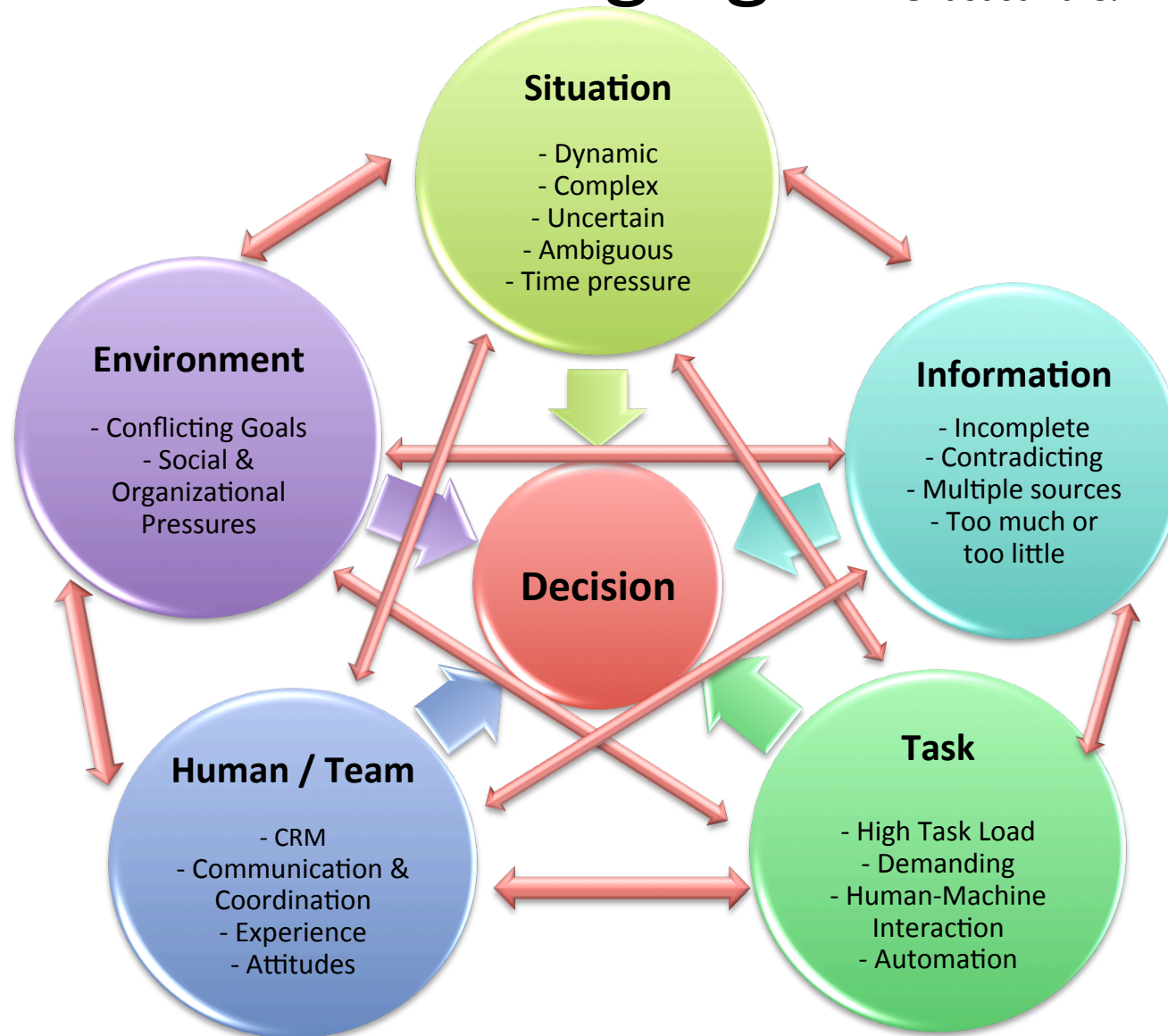# Decision Making in High Risk Systems

Dr. Nadine Bienefeld

Why is DM in High Risk Systems so challenging ?

(Bienefeld, 2012; Orasasanu & Martin, 1998)

Situation

- Dynamic
- Complex
- Uncertain
- Ambiguous
- Time pressure

Environment

- Conflicting Goals
- Social & Organizational Pressures

Information

- Incomplete
- Contradicting
- Multiple sources
- Too much or too little

Decision

Human / Team

- CRM
- Communication & Coordination
- Experience
- Attitudes

Task

- High Task Load
- Demanding
- Human-Machine Interaction
- Automation

Hidden Traps: Cognitive Biases

Perception

- Framing
- Filtering
- Filling in the gaps

When choosing Hypotheses

- Fixation
- Confirmation Bias
- Frequency gambling

When choosing Action

- Plan continuation
- Habit capture
- Goal seduction / Press-on-itis

Naturalistic DM (Klein et al. 1993)

- Experts can make fast decisions based on:
  - intuitive recognition of situation
  - intuitive situation assessment
  - mental simulation of options & consequences
  - intuitive pattern matching for best option

- ≈ 90% of decisions made in high-risk systems
- Does NOT always lead to best decision!

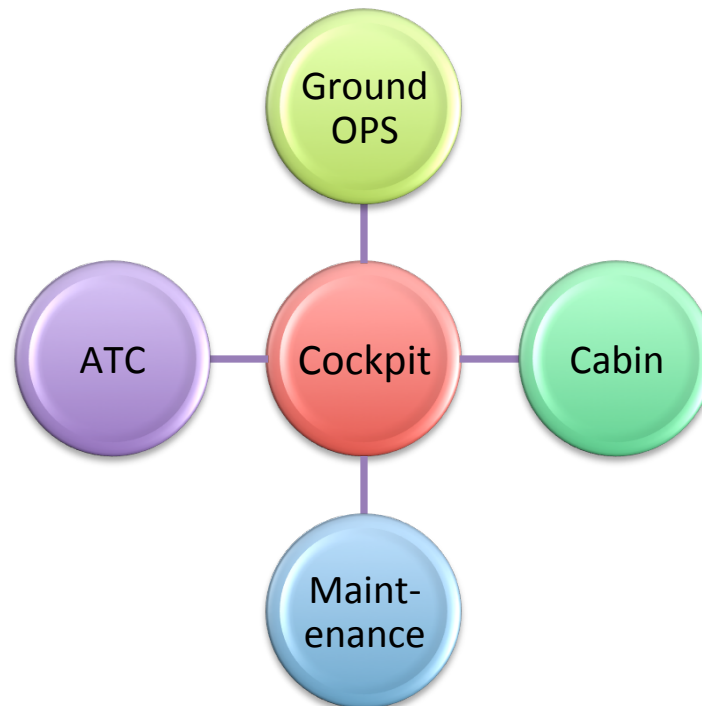# Decision Making in Multiteam Systems
Bienefeld, 2012

Study:
- *Multiple* teams involved in decision making (esp. in high risk systems)
- 504 pilots and CCMs / 85'000 behavioral events during live observation in simulator

Result:
- Decision quality and performance depend not on team but on *inter-* team collaboration

How to Improve DM in High-Risk Systems

Design

- System Interdependence, Salient Cues & Prognoses (Degani, Barshi, Shafto, 2013)
- Flight Manuals & Checklists
- DM tools e.g., FORDEC (Hörmann, 1997); PAVE, CARE (FAA, 2011)

4 Ps
(Degani & Weiner, 1999)

- Philosophy
- Policy
- Procedures
- Practices

Philosophy
Policy
Procedures
Practices

Training

- Decision Making Skills – Mental Models & Metacognition
- Scenario Based Training under Stress (Teams & MTS)
- Task Management

CRM

- Crew and MTS communication → Shared Mental Model
- Leadership → Information Management, Resource Management
- Speaking up
- Debriefing and self-reflection (also during normal ops)
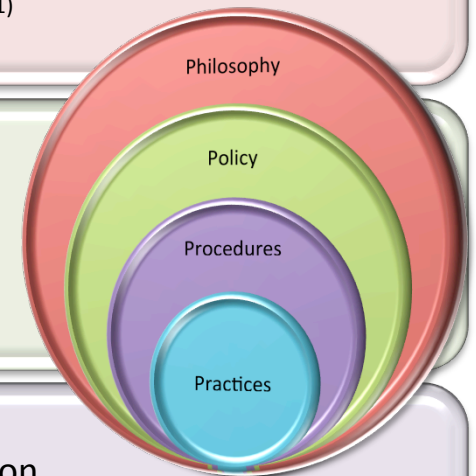
*"When there aren't any smart decisions,
I suppose you just have to pick the
stupid decision you like best."*

Orson Scott Card

*Dr. Nadine Bienefeld
High Risk Teams: Assessment – Consulting –
Training*
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