



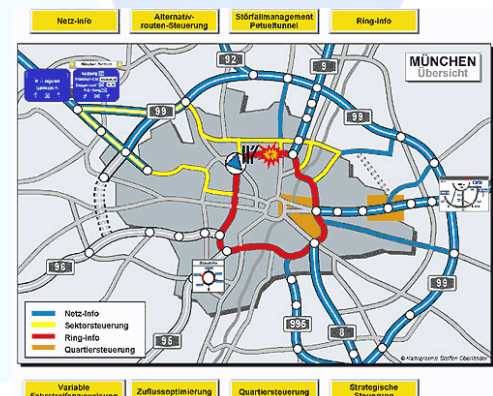
# Mensch-Maschine-Interaktion in hybriden Systemen

Prof. Dr. Johannes Weyer  
Universität Dortmund

FSP Ambient Intelligence  
Kaiserslautern, 10. Nov. 2006

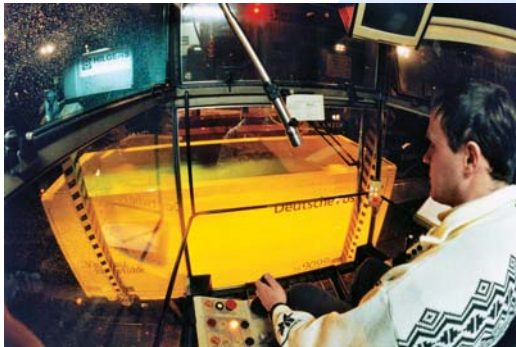
## Introduction

- **management of complex systems**
  - if autonomous technology is part of the game
- **micro-level: changes of interaction**
- **meso level: regime change**
  - new governance mode





## Autonomous technology?



- new type of technology
- autonomous activity, interactivity (Rammert)
- hybrid systems



## Aktivitätsniveaus von Technik

1. passiv
  2. aktiv
  3. reaktiv
  4. interaktiv
  5. transaktiv
- konventionelle Technik (instrumentell)
- avancierte Technik (interaktiv)



## Content

1. Introduction ✓
2. Micro level: interaction
3. Meso level: governance
4. Case study aviation
5. Conclusion: Future paths



## Micro level

- distributed agency
- re-distribution of responsibility
  - cockpit: assistance by *autonomous* technology
  - aviation/ATC: *autonomous* navigation



## Interaktions-Konstellationen

### Interaktion von Menschen mit ...

	Menschen	konventioneller Technik	avancierter Technik
Berechenbarkeit	regelmäßiges Verhalten	vollständig berechenbar	undurchschaubar, irregulär
Zuschreibung von Handlungsfähigkeit	ja	nein	teils/teils
Handlungstypus	a) strategisch b) kommunikativ	a) instrumentell (Konstrukteur) b) strategisch (Nutzer)	a) instrumentell (Konstrukteur) b) adaptiv (Nutzer)

Hybride Systeme

## Content

1. Introduction ✓
2. Micro level: interaction ✓
3. Meso level: governance
4. Case study aviation
5. Conclusion: Future paths

Hybride Systeme



## Meso level

- **new uncertainties and risks**
  - do they cooperate?
  - system out of control?
- **governance**
  - management of complex systems
  - new modes of control?



## Paradigm-shift(s) in governance theory

1. Hierarchical, centralized control (1950/60s)
2. decentralized self-organization (1980/90s)
3. Re-centralization?  
(central control of decentralized systems)

source: Rochlin 1998





## Content

1. Introduction ✓
2. Micro level: interaction ✓
3. Meso level: governance ✓
4. Case study aviation
5. Conclusion: Future paths



## Case study aviation

- 1920/30s: loosely coupled, manually operated, local *autonomy*
- 1940s-60s: international standardisation
- 1960/70s: *centralisation*, increasing complexity (ATC)
- 1980s-2000: semi-automated system, *decentralisation* (TCAS)
- 2000s: global ATC system (Free-flight)

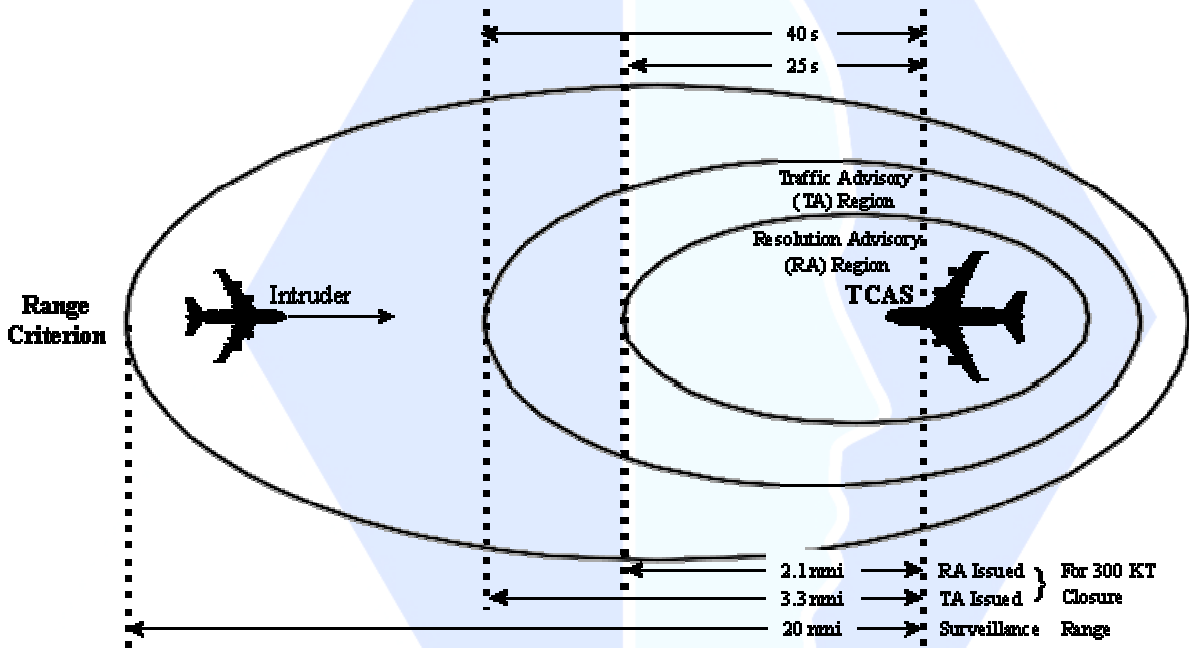
source: Deuten 2003 (modified)





# TCAS – operational logic

Hybride Systeme

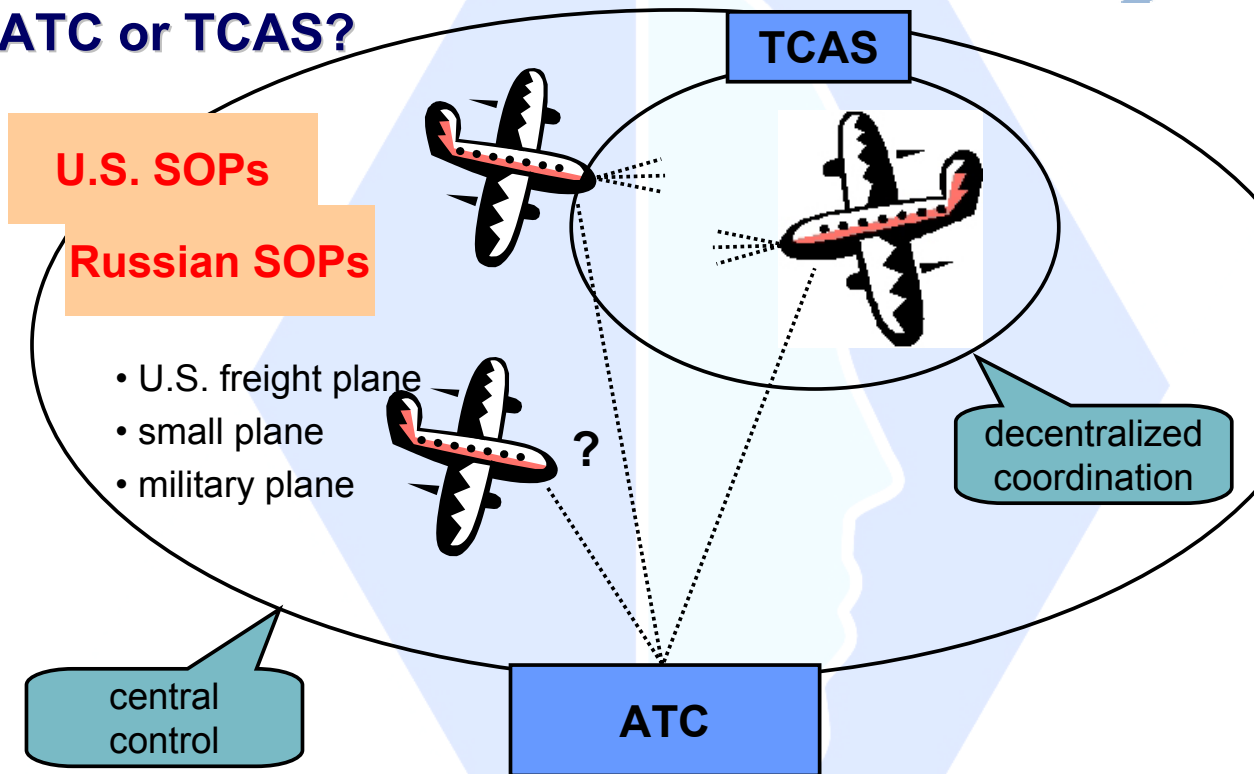


[www.rannoch.com/tcasf.html](http://www.rannoch.com/tcasf.html) (01.09.2004)



# ATC or TCAS?

Hybride Systeme



# Midair collision in Brazil Sept. 29, 2006

Hybride Systeme



Boeing 737-800



Absturz der Boeing 737-800 der Fluggesellschaft GOL auf dem Flug von Manaus nach Brasília

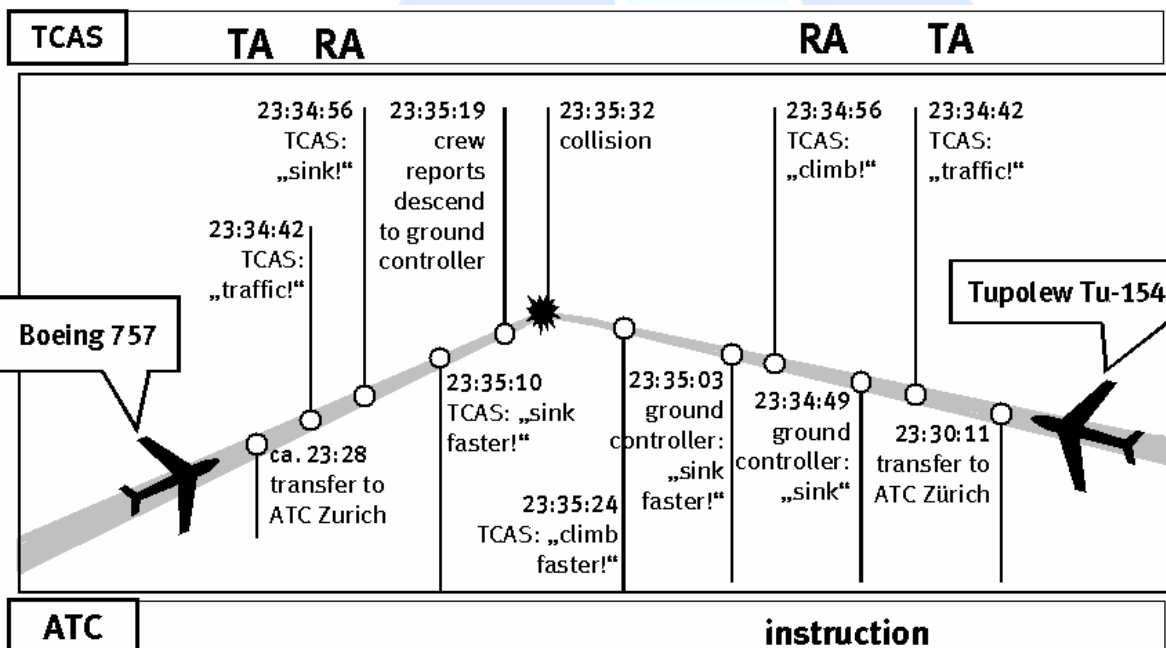
Embraer Legacy



source: www.faz.net

# The Mid-Air Collision at Ueberlingen in 2002

Hybride Systeme



FAZ 20.07.2002: 7





## The Mid-Air Collision at Ueberlingen in 2002

- pitfalls of automation
- organizational failure
- insufficient training
- divergent safety cultures
- unresolvable conflict



## Conclusion

- regime change
  - deconstruction of the old regime
  - construction of a new regime
- transition period
- different options

Habsheim 1988





## Content

1. Introduction ✓
2. Micro level: interaction ✓
3. Meso level: governance ✓
4. Case study aviation ✓
5. Conclusion: Future paths



## Governance mode (1)

### Decentralized self-coordination

- local optimization
- decentralized negotiations

### Risks

- emergent effects
- guarantee of safety?





## Governance mode (2)

### Central control

- global optimization
- top-down, loss of autonomy

### Risks

- totalitarian control
- loss of learning capabilities?



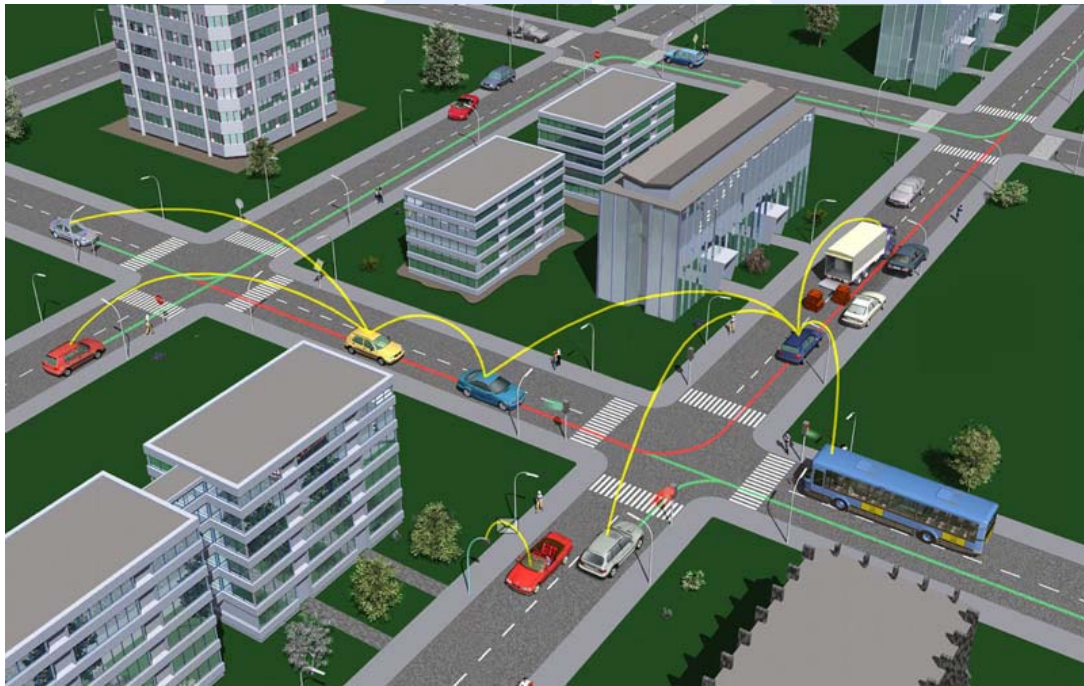
## eSafety report of the EU Commission (2005)

- new technologies:
  - ESP
  - systems with Intelligent Speed Adaptation (ISA) ..., which work in a **forcing and intervening** manner and could reduce the number of accidents by 35% (item 39)
    - 10 000 accidents per year
  - alcolocks
  - eCall (emergency call); mandatory for new vehicles from 2009



# Car2Car Communication

Hybride Systeme

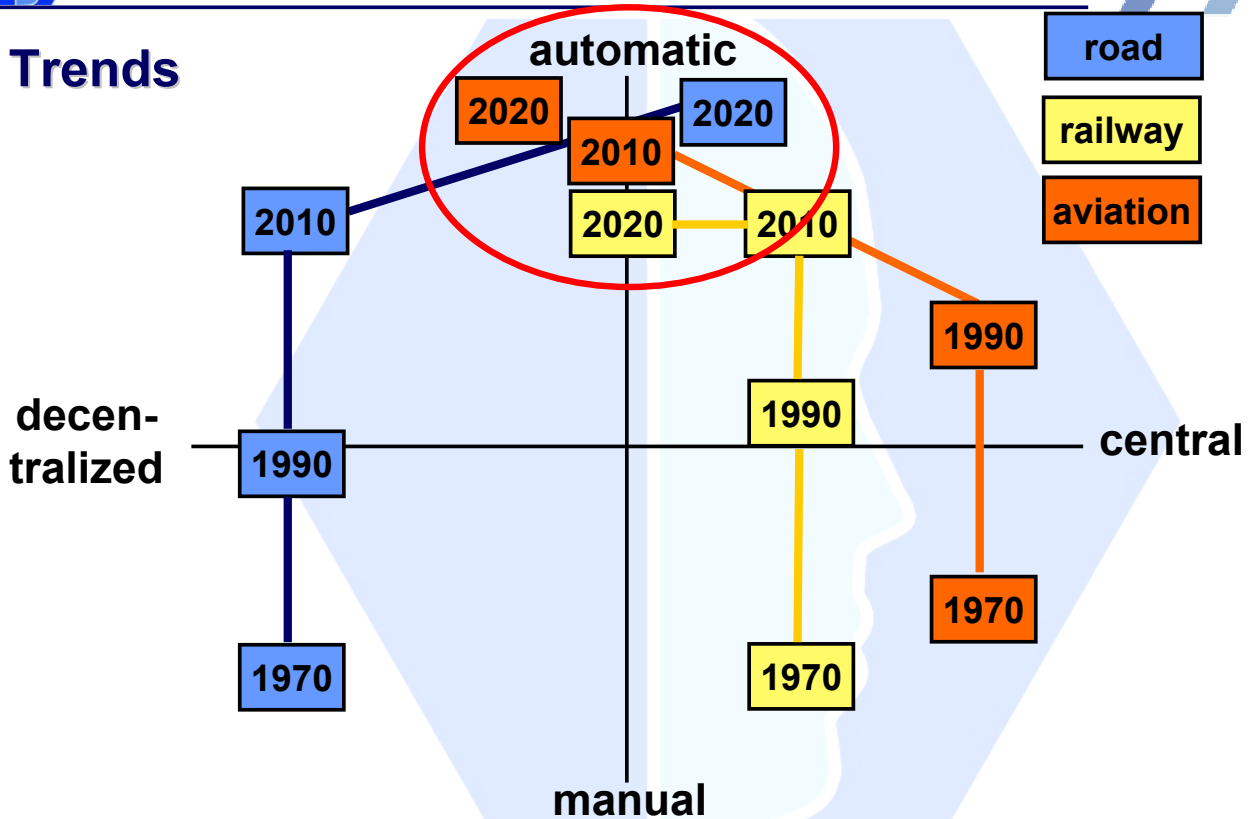


<http://www.car-2-car.org/index.php?id=131>



# Trends

Hybride Systeme





**Thanks for your attention!**