# Swedish industry efforts to increase UAV usability by progressing traffic insertion of UAVs

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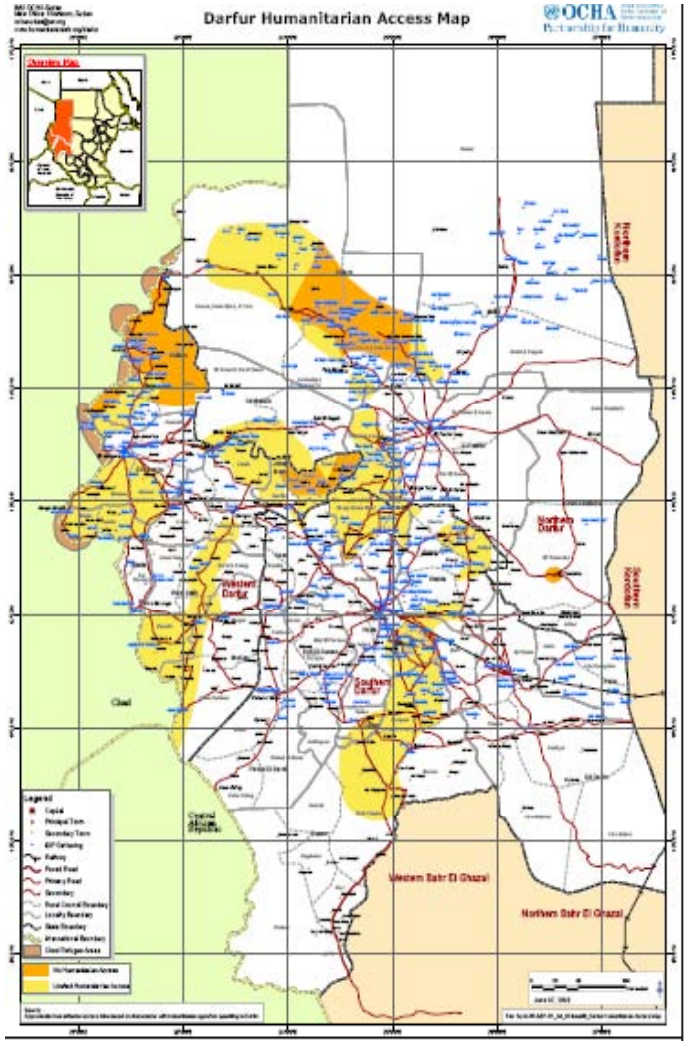
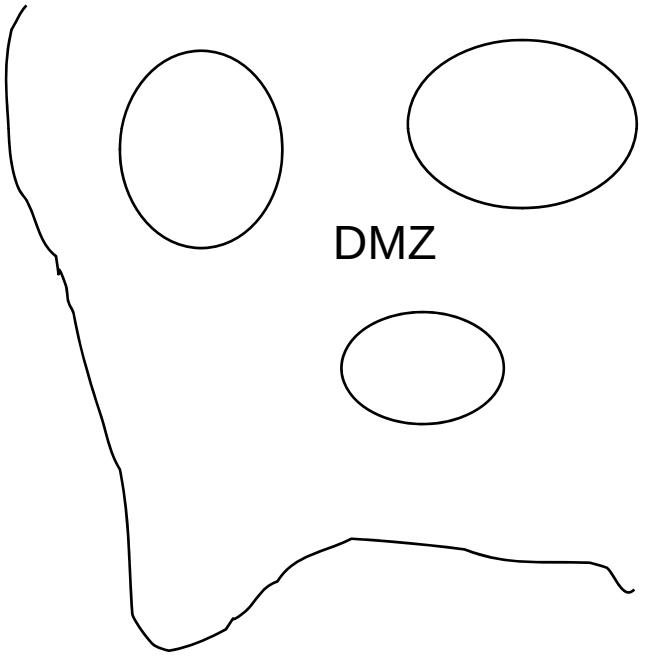
24 September, 2007

# Importance of UAV traffic Insertion for UAV usability

# International Operations, The Darfur example



# Nordic countries, Local surveillance areas and tasks

Fishing

Oil

Border protection

Environmental,
Traffic monitoring
SAR support,
Disaster relief
…

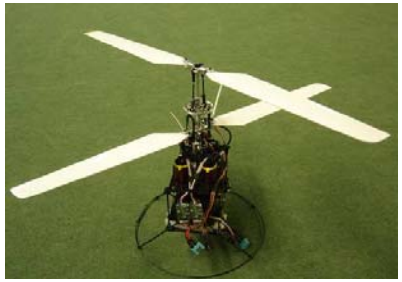
# Saab in the UAV segment- Time for the market

New configurations

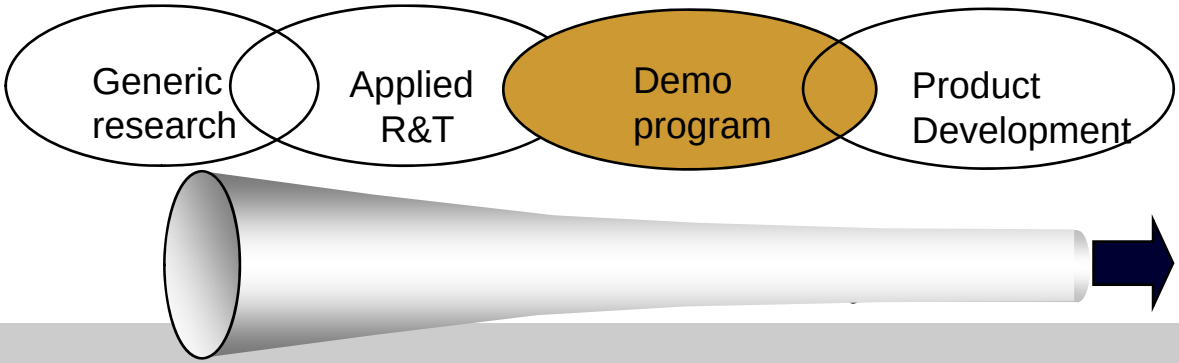
L.O. Materials

Neuron UCAV Demo

Fully autonomous operations



Co-operating systems




Skeldar- Saab's first UAV product

# UAV Major Civil/Security Applications

**Security:**

- Border surveillance / reconnaissance
- All types of borders, movements
- Police / Terrorist action surveillance
- Maritime surveillance
- Survey and inspection of pipelines & power lines
- Tracking / Photography

**Services:**

- Cartography and mapping
- Search and rescue
- Fire fighting monitoring and management
- Disaster Relief

- Environmental surveillance:
  - Oil spill / pipeline inspection
  - Fishing restrictions
  - Mineral exploration
  - Imaging spectrometry
  - Agricultural spraying
  - Aerial photography
- Atmospheric / scientific / oceanographic / geophysical research
- Telecommunications re

**UAVS are potentially more cost-effective and will most probably have technology spin off for Commercial Air Transport Systems (e.g. single pilot/pilot free operation and safety)**

**Reduce the risk to humans in hazardous areas**



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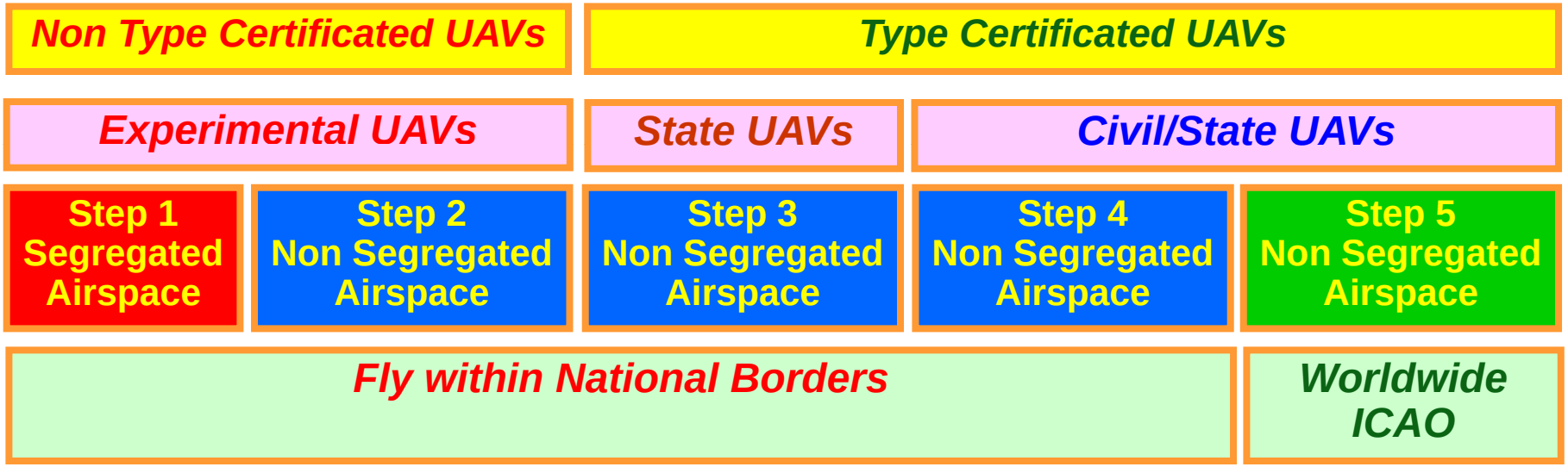
# Regulatory aspects

# ASD UAV Certification & Qualification

## A Five Step Approach to UAV Operations in Controlled Airspace



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# Activities Towards UAV Traffic Insertion

| Non Type Certificated UAVs | | Type Certificated UAVs | | |
|---|---|---|---|---|
| Experimental UAVs | | State UAVs | Civil/State UAVs | |
| Step 1 Segregated Airspace | Step 2 Non Segregated Airspace | Step 3 Non Segregated Airspace | Step 4 Non Segregated Airspace | Step 5 Non Segregated Airspace |
| Fly within National Borders | | | | Worldwide ICAO |


Sharc

European single sky

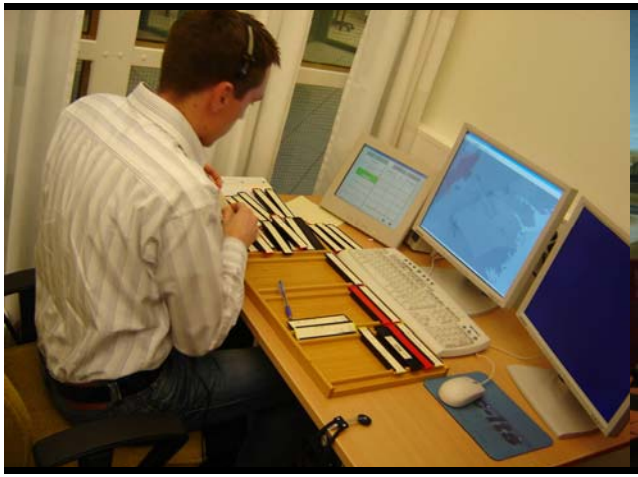
Sturup Demo

Manned S&A

UAV S&A

2006 2008 2010 2015

# Sturup Demo



APP Radar Controller

ESSL Tower Controler

UAV Operator

**Analysis Centre**

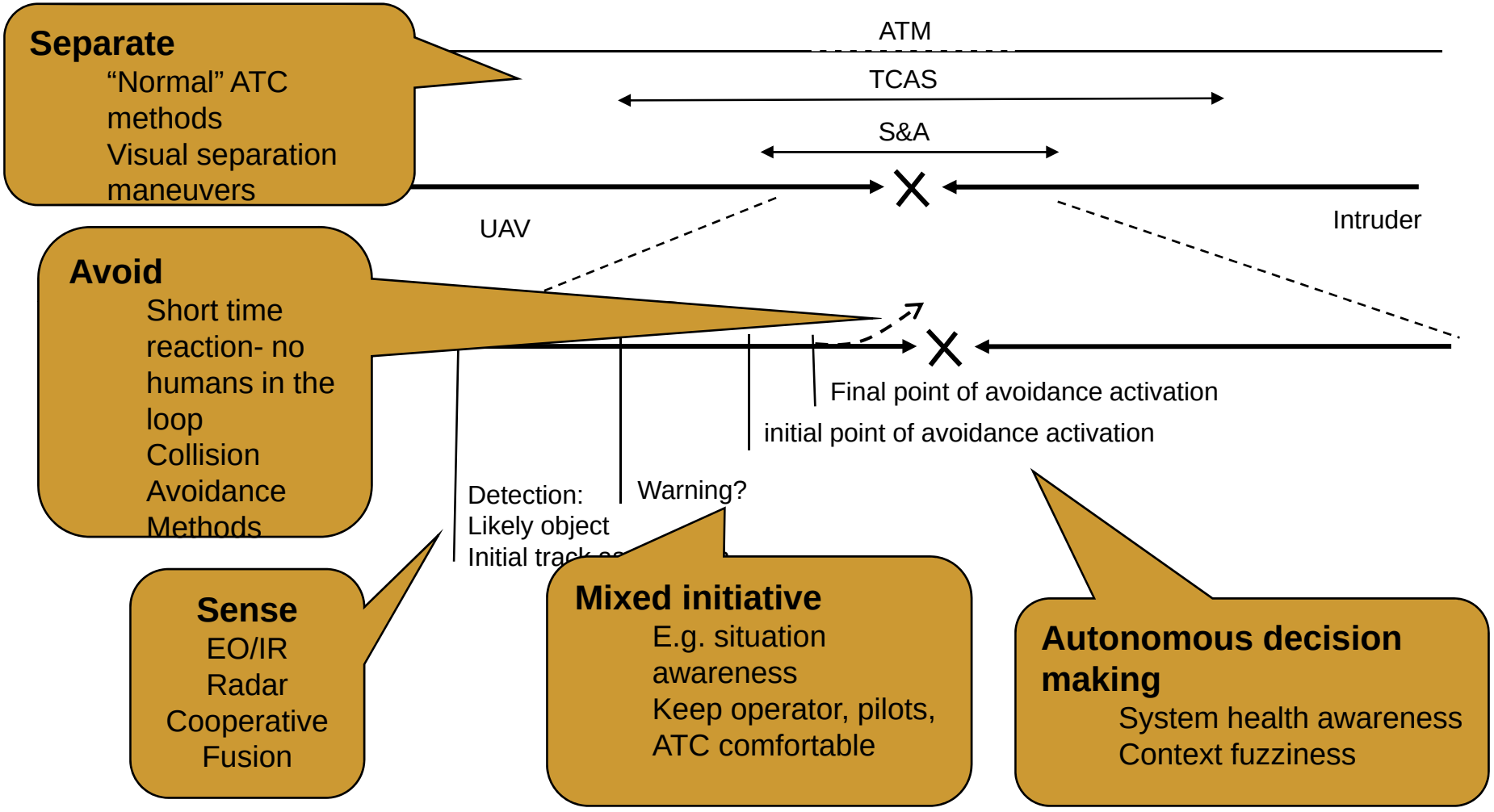
# SESAR

- Initiative to achieve a Single European Sky in three steps
  - Definition -2008
  - Development 2008-2013
  - Deployment 2014-2020
- Aims for cohesive decision making and synchronized commitment in Europe
- Objectives include
  - Improve and reinforce safety
  - Restructure to accommodate air traffic flow
  - Create additional Capacity
  - Increase overall ATM efficiency
- Supported by state-of-the-art and innovative technologies

- The ATM system is developing
  - Is a moving target
  - important to assure that UAV's are considered as part of the ATM system

# Technology

# Basic case- heads on collision avoidance



Technology example:

# Collision Avoidance Methods

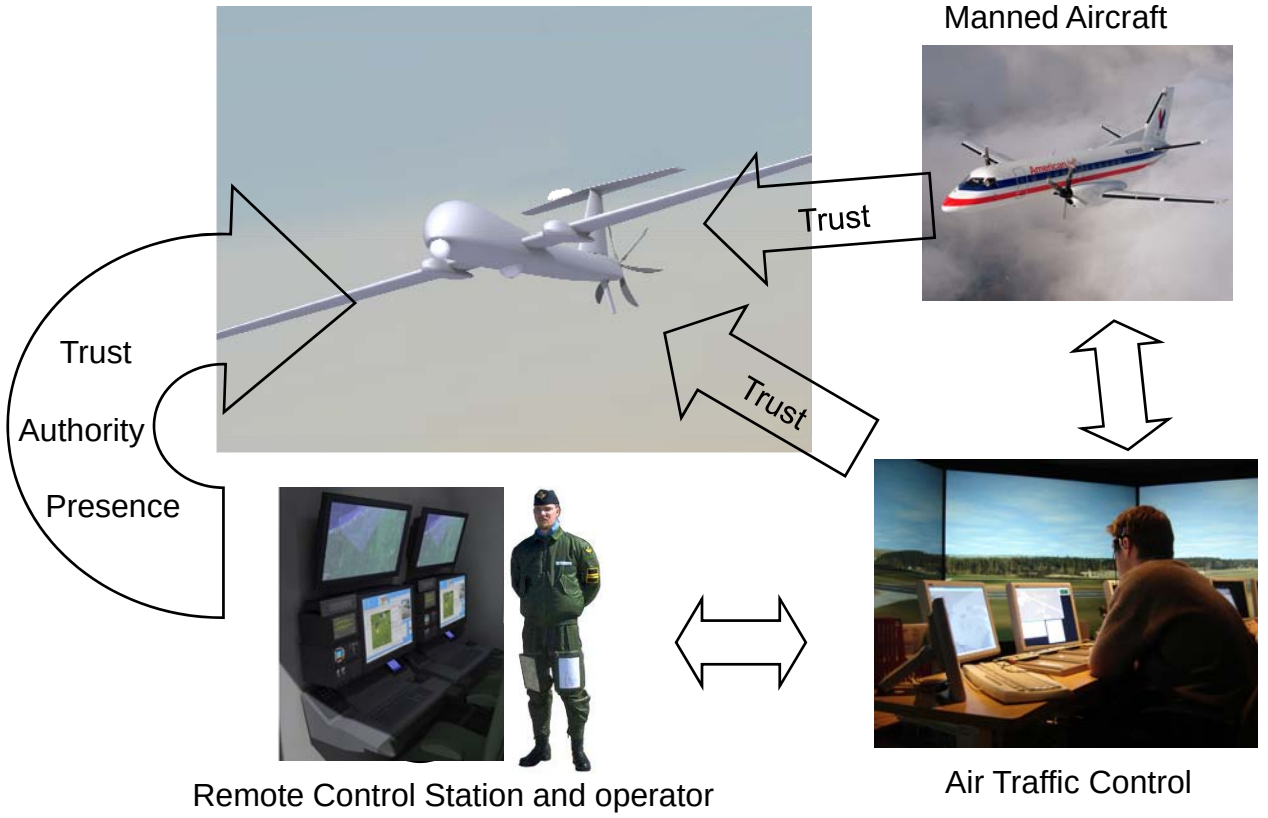
- **UAV traffic insertion purpose:** To achieve avoidance capability
  - Ensure existence of non collision path (Claim space method)
  - Capability to handle dense traffic
  - Minimize unnecessary activation of the system
  - Do not create new dangerous situations

- **Demonstration of technologies in Auto ACAS:** to allow aircraft to operate in close vicinity without risk of collisions
  - Three Overall Requirements
    - Ensure avoid capability
    - Minimize unnecessary activation of the system, nuisance free operation
    - Do not create new dangerous situations
  - General principles
    - Aircraft in vicinity exchanges info on state vector and intentions
    - Collision avoidance methods ensures that at least one collision free path exists
    - The system overrides the pilot when needed to assure collision free path

Technology Example:

# Mixed Initiative from the Pilot, the Operator, the ATC and the System

- The operator needs to understand the behavior and intentions of the UAV e.g. to avoid creation of dangerous situations, stress, fatigue or reduced capacity due to UAV's in the air space
- Coordination and command authority particular important for abnormal situation

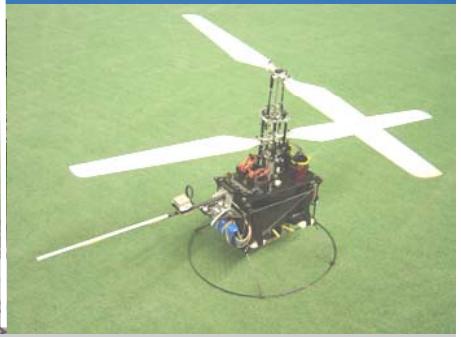


# University Research relating to traffic insertion: Linklab

- Goal is to have research that contributes with possible technologies in the traffic insertion complex.

- Has demonstrator driven research with Linköpings University that focuses on technologies relevant for UAV's in complex interacting application environments (e.g. TI). Current scenarios of civil security character, e.g.
  - Tsunami situation
  - Gas leak from railway accident

- Research areas include
  - High level autonomy and decision support
  - Cooperative Systems and networks
  - Sensor Fusion
  - Planning
  - Mixed Initiative



# Discussion and Conclusions

- Traffic Insertion of UAV's
  - Increases the flexibility of UAV usage
  - Necessary for the civil UAV market to reach volume
  - Builds technology foundation that could contribute to more efficient use of air space
- Achieving Traffic Insertion
  - Regulatory, Technical, and Acceptance issues need to be addressed in an integrated manner
  - Activities that involves all stakeholders are important
  - A stepwise approach is needed
  - Could benefit from development of ATM methods
  - Should we compare with the pilot?
    - Probably possible to achieve at least equivalent level of safety as the pilot in collision scenario
  - Public acceptance
- SE Industry
  - Prepared for the next step- to demonstrate in flight
  - Is considering national and international solutions (preferred)
  - Has good dialogue with authorities as well as access to air space suitable for experimentation

END

# A stepwise approach is needed- a number of options

- Increasing complexity in types of UAV flights, e.g. national to international
- Complexity of airspace, e.g. class (IFR-IFR first) and density of traffic
- Degree of separation, possible additional separation initially
- Priority of traffic, i.e. UAV's to have less priority initially, and have to stay away from manned A/C
- Take off and landing not included in initial traffic insertion
- ……