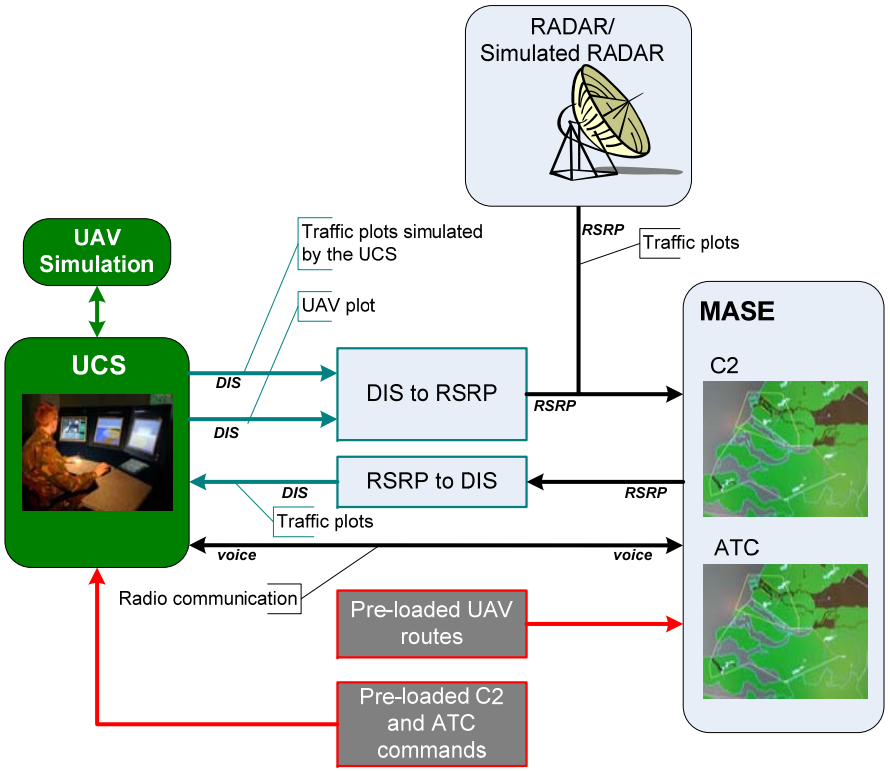
Ministry of Defence

6/24/2010

Applying NEC to UAS Operations Using an Evolutionary Approach



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Scope of this work

Connectivity does not automatically provide NEC…, but there is no NEC without connectivity.

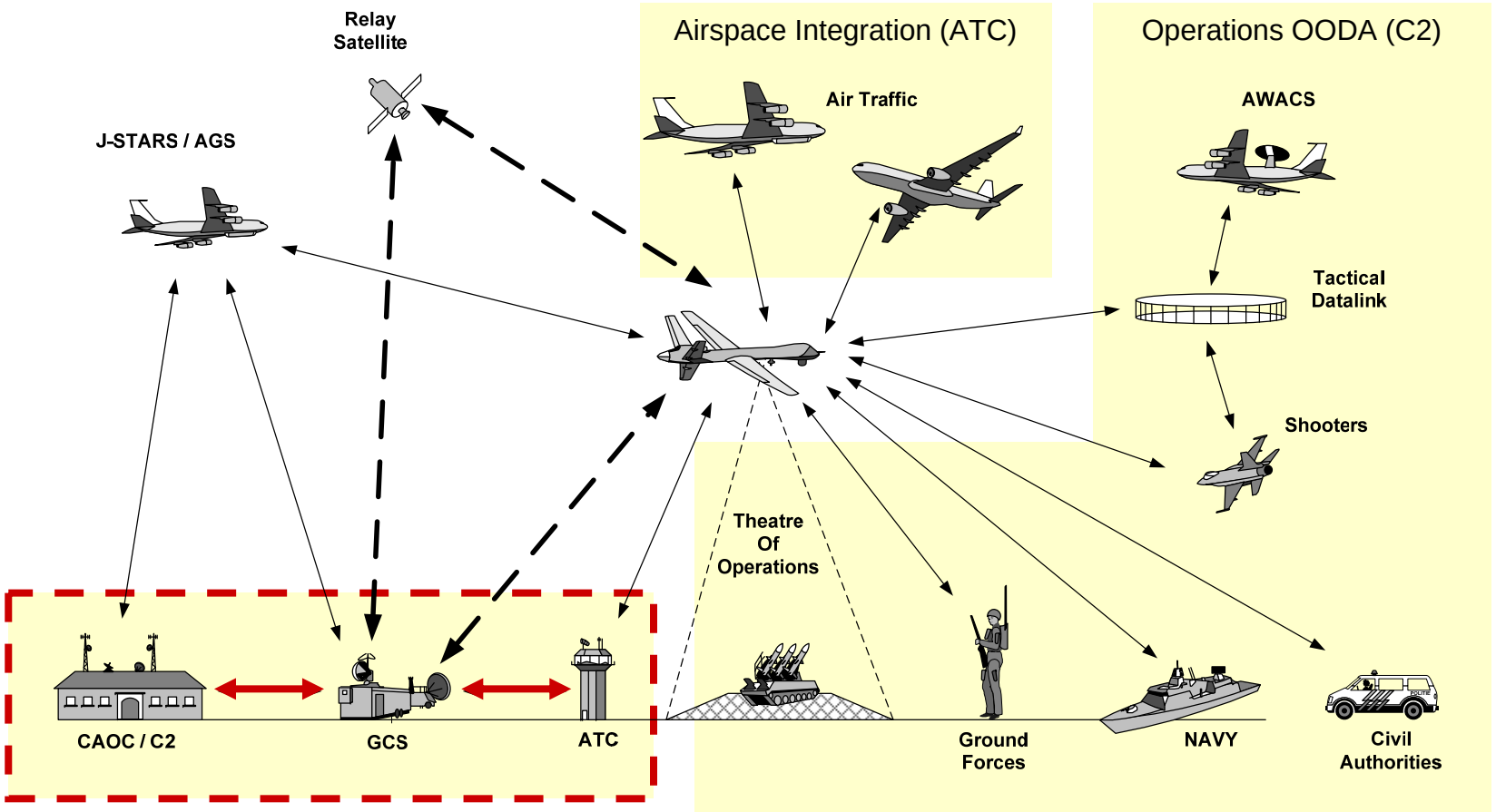
An evolutionary approach for the integration of a UCS with ATC and C2 systems is being pursued:

- exploiting the potential of existing technologies
- similarities in civil aviation (SWIM)

Waiting with the development and implementation of functions until the ‘promised’ NEC level becomes available, will unnecessarily delay the moment at which *significant operational gains* can be realized.

Introduction

- Coherent effects through the effective use of all observation and weapon capabilities
- Coordinated navigation of many entities and local synchronization



Connectivity Benefits

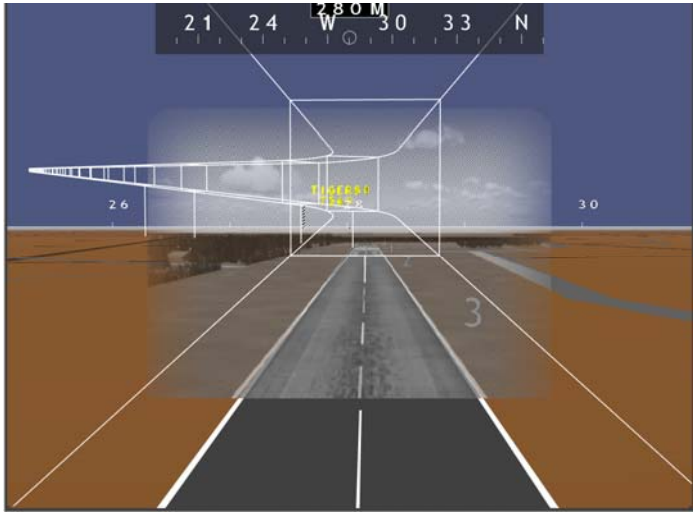
Enhancing default comms

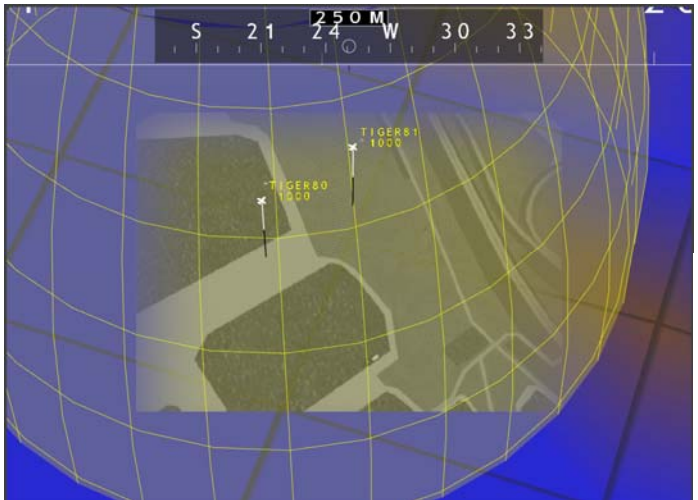
Exchanging planned state data:
- Enhanced conformance monitoring
- Conflict detection functions at ATC

ATC broadcasts of traffic

Datalinking of voice instructions:
- Tactical ATC commands
- Dynamic airspace boundaries
- Retasking events

Sharing new information:
- Detected threats
- Targets of opportunity





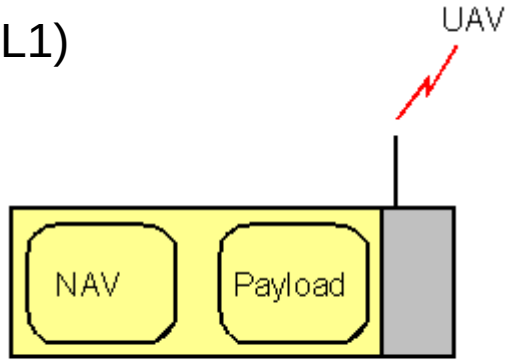
From Connectivity to NEC

NEC Levels:

1	Isolated	• Exchange of information through conventional means
2	De-conflicted	• Limited coordination, • No common picture of the situation
3	Coordination	• Coherent and efficient communication, • Information Sharing, • Common picture of the situation
4	Integration	• Integrated, coherent and consistent cooperation, • Efficient, interactive planning and execution
5	Coherent effects	• Effective use of all observation and weapon capabilities

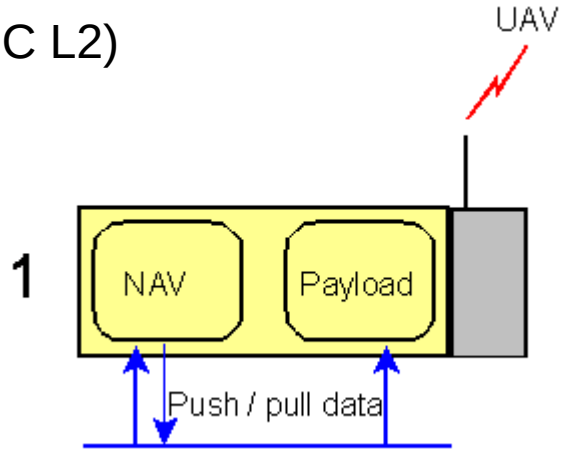
UCS Connectivity Options

IEC L1)



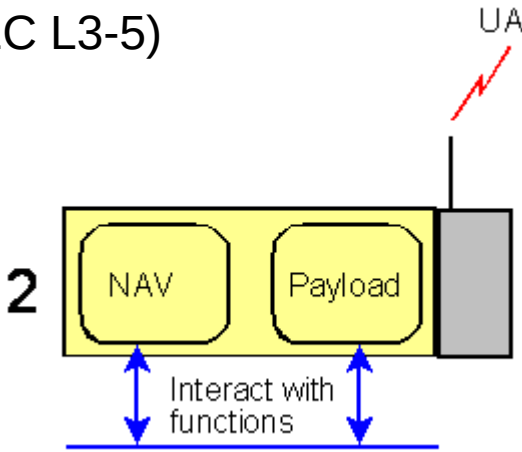
no connectivity

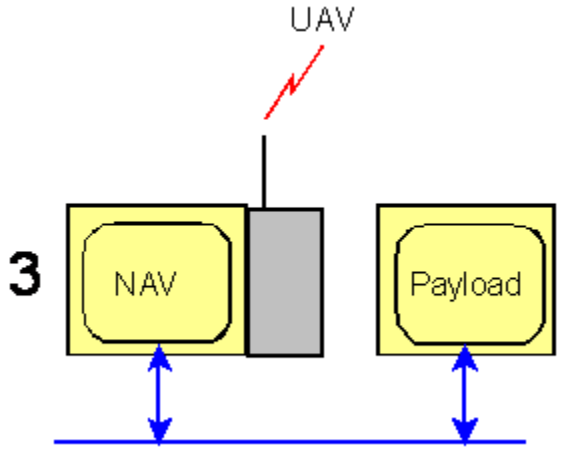
(NEC L2)



connectivity, but no interaction

IEC L3-5)





Development of NEC functions

esearch UCS – Baseline system (Config. 0):

real-time interaction with the route (definition / modification)

implementation of the selected route

Connectivity of the UCS with ATC

Airspace Integration

Graphics Engine

GUI [E1]

Interpreter

Route Visualization

Route Selection / Generation

Route Manager

UAV CTRL Uplink

UAV Downlink

Route Buffer

Ownship State

tion, robing

[A1]

terface Data

[A]

Network Interface for Route Exchange

[E]

Network Interface for Ownship State

[B]

Network

Connectivity of the UCS with C2

Faster OODA loop

Graphics Engine

GUI [F1]

Interpreter

Route / Area Visualization

Route Selection / Generation

Route Manager

UAV CTRL Uplink

UAV Downlink

Route / Area Buffer

Ownship State

terface
l Data

[C]

Network Interface for Tactical Data Exchange

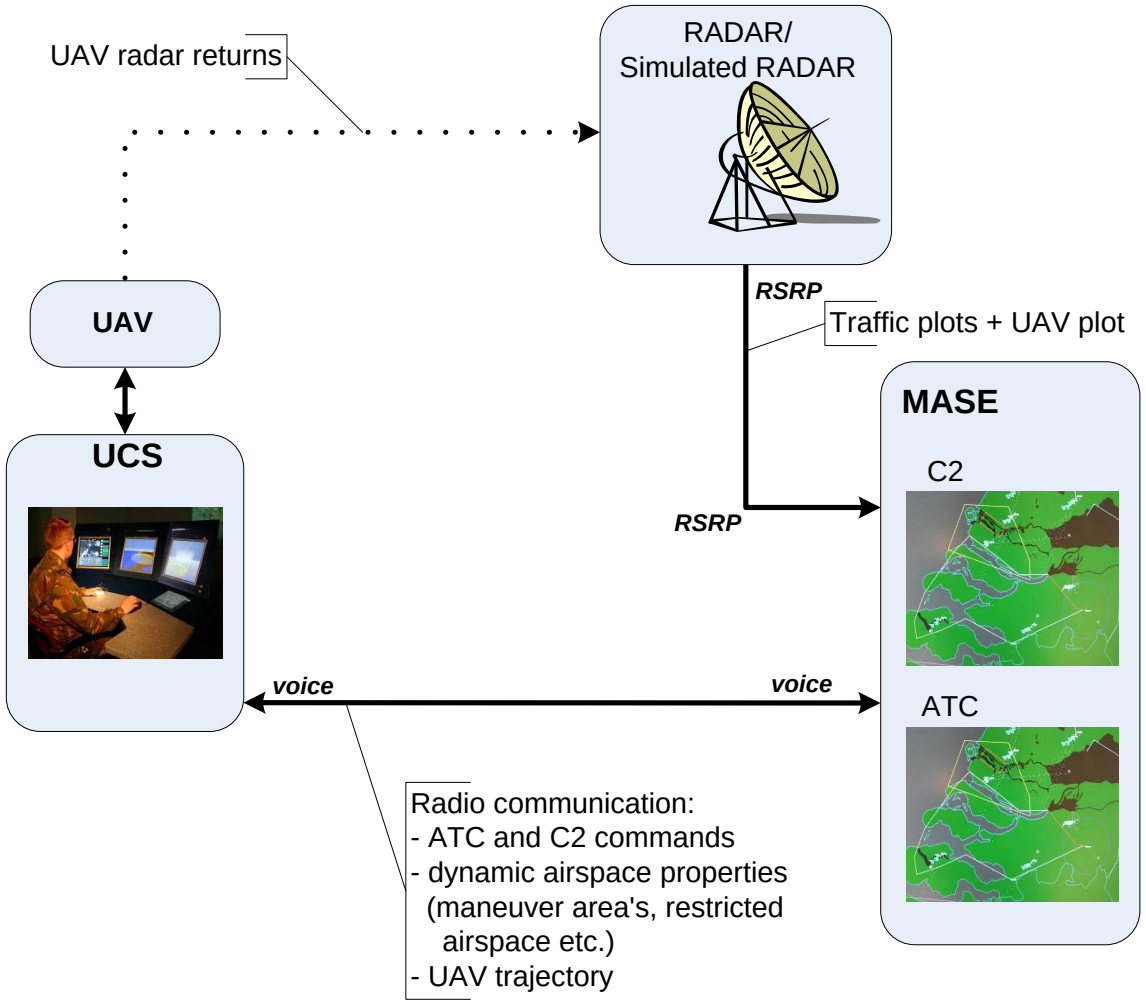
[F]

Network Interface for Ownship State

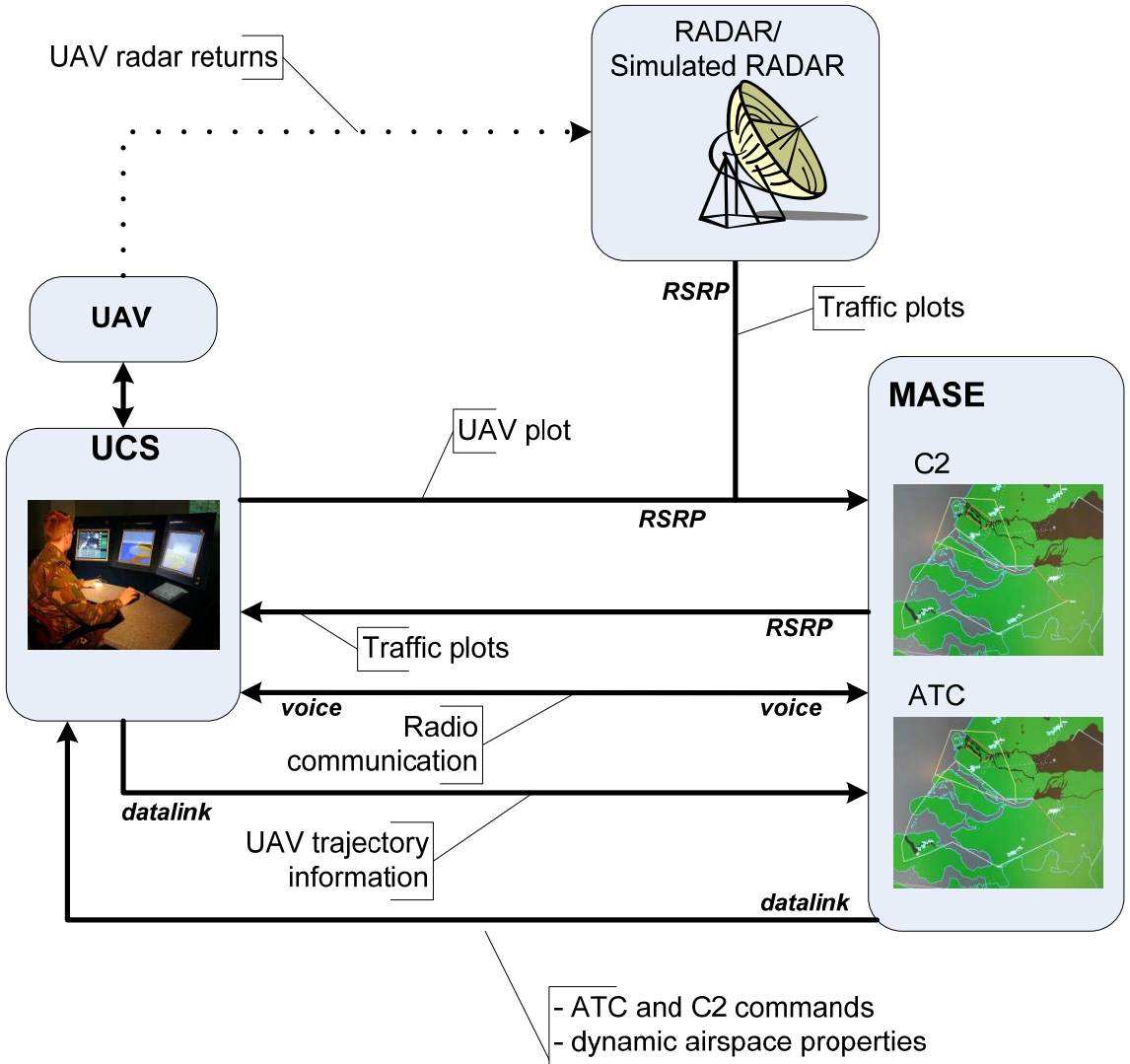
[B]

Network

Situation without Datalink



Desired Connectivity



How to get there?

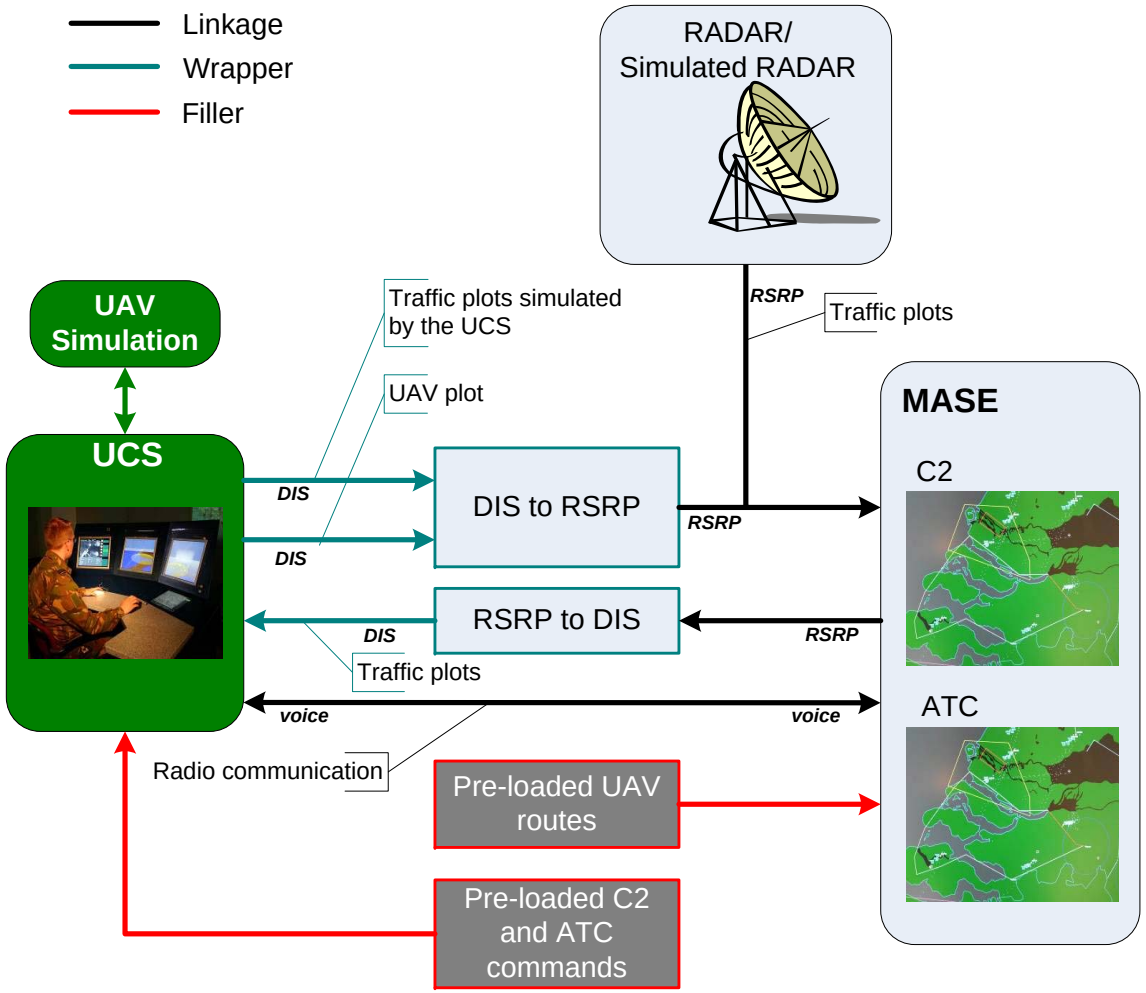
In the near term we must live with the separate systems we have today. But we can take steps, using modeling and simulation, to test and tune future integration'

The results of such an approach contribute to:

- the definition of a roadmap for the functions that will benefit from an increase in connectivity (e.g. in terms of bandwidth, security, availability, integrity);
- refine the requirements for the final SWIM environment.

In this way, an evolutionary, spiral-based approach to NEC can be achieved.

Simulation Environment

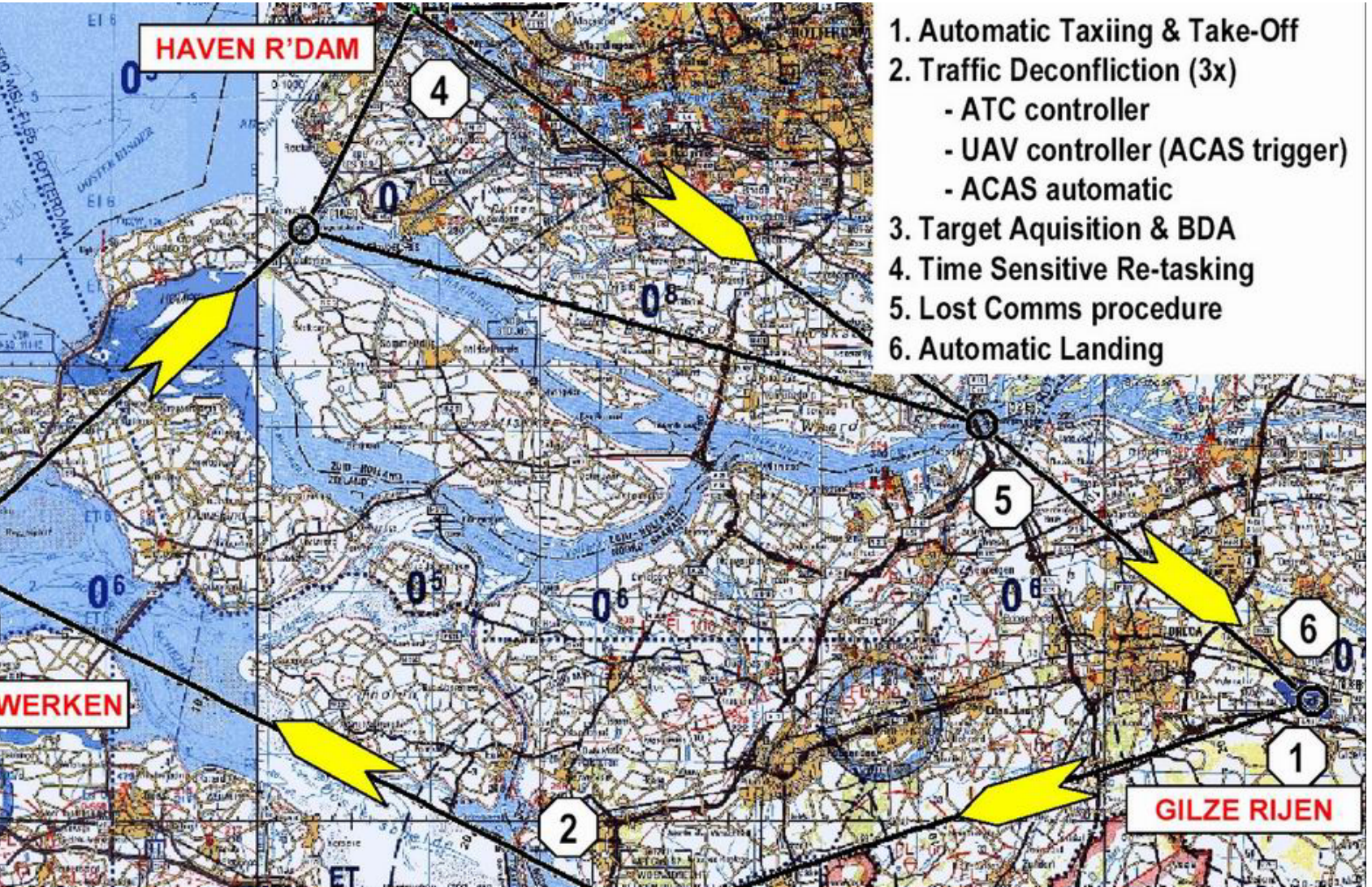


Simulation Studies & Demonstrations

- Airspace integration;
- ISTAR & BDA;
- Time-sensitive re-tasking.

- Chief of Royal Netherlands
- Air Force Command
- Military Air Traffic Control Centre
- Defense Materiel Organization
- C2 Knowledge Centre (Army, Navy, Air Force)
- Defense Research & Development

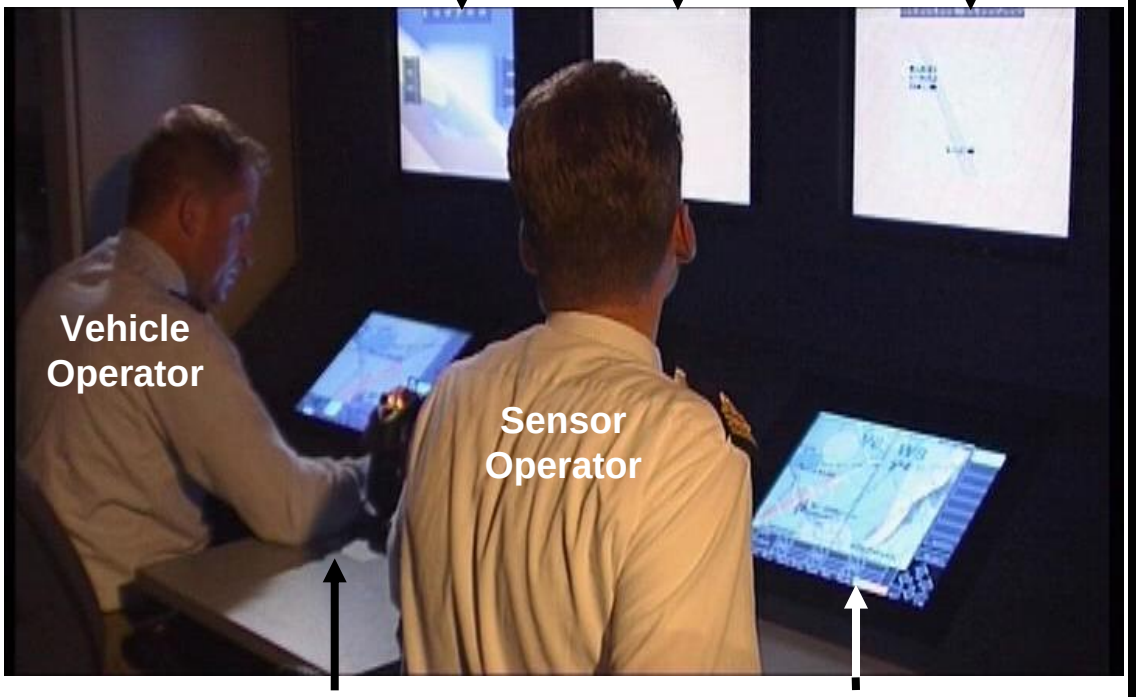
Simulation Studies & Demonstrations



Simulation Studies & Demonstrations

- Vehicle-Payload Interaction
- Distributed Control
- Geographically Separated Users

Synthetic Vision Technology



Discussion

Standards for the protocols needed to realize the envisioned NEC CONOPS do not yet exist. Also, the current generation C2 systems still has proprietary interfaces.

The increased adherence to standards will reduce the amount of wrappers needed to integrate different, non-standard systems into a common network.

Information sharing in itself will only allow NEC L3 to be reached. L4: integrated and coherent cooperation, requires the development of concepts defining how multiple users interact with the data.

Achieving NEC L5 goes beyond the integration of a UCS with C2 and ATC and requires a consideration of the overall system of which all these elements are part.

Clearly, these capabilities will not just ‘happen’. Focused research is needed to identify possibilities and explore them.

Summary & Conclusions

Connectivity does not automatically provide NEC…, but there is no NEC without connectivity.

An evolutionary approach for the integration of a UCS with ATC and C2 systems is being pursued:

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The results of such an approach contribute to:

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- refine the requirements for the final SWIM environment.

Summary & Conclusions

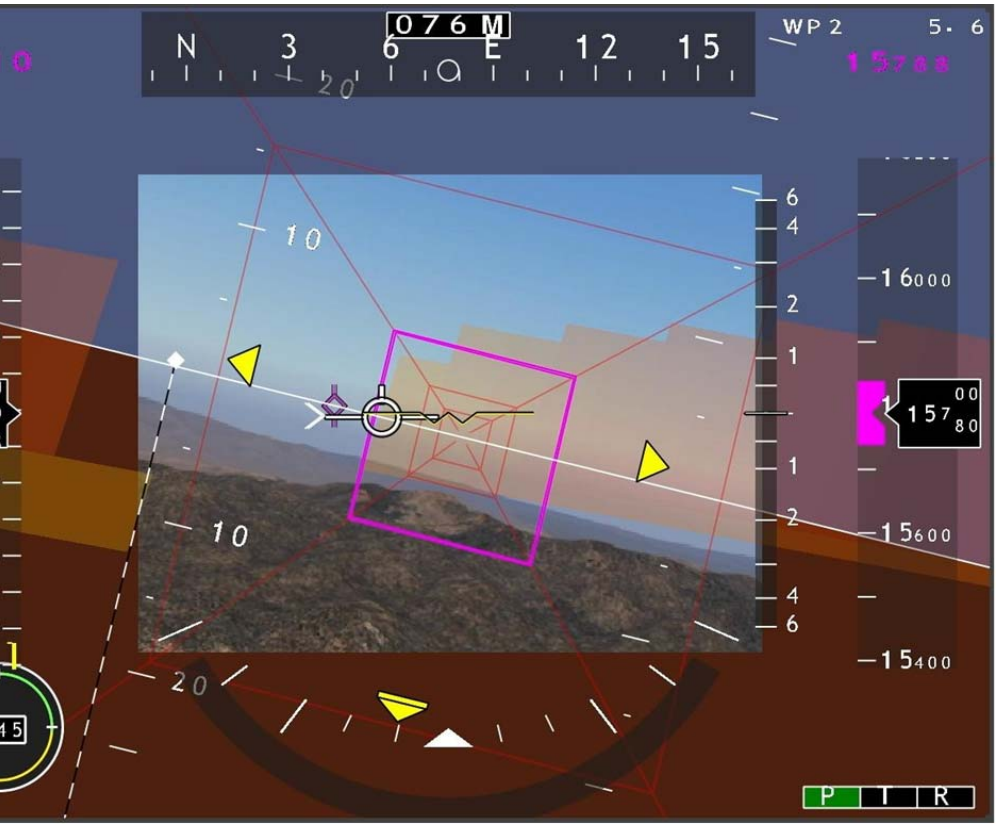
The concepts discussed in this work are not new, but the implementation of the integrated simulation environment and the subsequent use to explore these concepts is still quite rare.

It has been demonstrated how to enable NEC without having to do a "big bang" development where the entire network is realized in one spiral, development cycle, or acquisition.

The more implementations, scenarios, and domains that embrace this approach, the more likely it is that we'll see more NECs available on the shelf, to everyone's benefit.

Waiting with the development and implementation of functions until the 'promised' NEC level becomes available, will unnecessarily delay the moment at which *significant operational gains* can be realized.

Thank You



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