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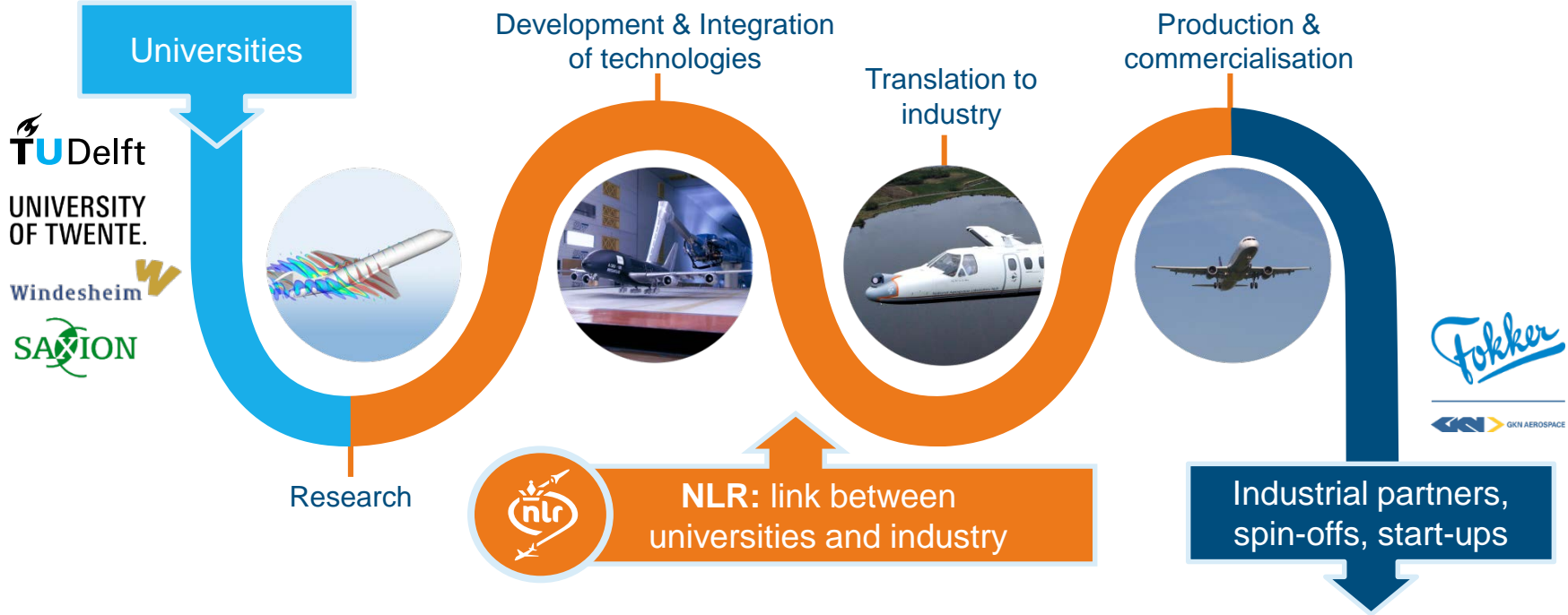
LVC for Joint and Combined Air Power

Arjan Lemmers
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Development & Integration of technologies

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Research

NLR: link between universities and industry

Industrial partners, spin-offs, start-ups

Fokker

GKN AEROSPACE

Background – Air LVC

RNLAF is transitioning to 5th gen air force

- Modern weapon and sensor systems
- Networked approach to operations
- Information-driven
- Performance based training

Requires new training approaches and new training environments

Problem statement

The RNLAF faces several challenges regarding:

- Training area size
- Availability of live platforms and threats
- Environmental restrictions
- Exposure to external world
- Training joint and combined (in the future)

Solution – Integrated LVC environment for Joint Air operations:

- Flexibility, scalability, data-centric
- Fit-for-purpose, all domain, effective
- Sustainable, Concept Development & Experimentation (CD&E) opportunities

What is LVC?

An LVC environment integrates Live entities with simulated entities (Virtual and Constructive) to facilitate training and CD&E

- Live – a real-world player operates a real-world platform

- Virtual – a real-world player operates a simulated platform

- Constructive – a simulated player operates a simulated platform

Central challenge is to inject the Live (legacy) environment with Virtual and Constructive inputs/simulations

Potential for training

LVC has the potential to:

- **Enhance live flying** training outcomes

- **Enable scenario generation** to exercise fifth-generation capabilities

- **Augment existing training ranges** to provide electronic and cyber warfare effects

- **Support the large footprints** of modern sensors, networks, and weapons

- **Allowing exercise in a secure environment** so as not to reveal their capability

Air LVC program

Goal – Develop knowledge and test beds for future LVC-technology development, integration, and exploitation.

Duration – 2021 – 2025

Focus areas
- Training concepts
- Architecture
- Technology
- Operation
- CD&E opportunities

LVC Training Research

Innovative LVC Concepts for Training:

- Scalable in geographic areas, air space, number of entities
- Training tasks for individual, team and collective training
- Flexibility in scenarios

The challenge lies in a good trade-off between live and virtual training

LVC Architecture and Technology Research

- Data exchange protocols
  - Combination of simulation and operational solutions for data exchange
- Data Link
  - Existing datalink protocols like Link-16
  - Specific LVC training waveform
- Interoperability with mission systems
  - Modifications to operational software
- Location of computer generated forces and weapon fly-outs
  - On-board
  - On the ground

Operational Approach

A complex joint combined training scenario as a use case to frame the research

- Identify interactions

- Evaluate training value

- Assess the available/required technology

- Develop experimental test beds

- Design operational set-up and procedures
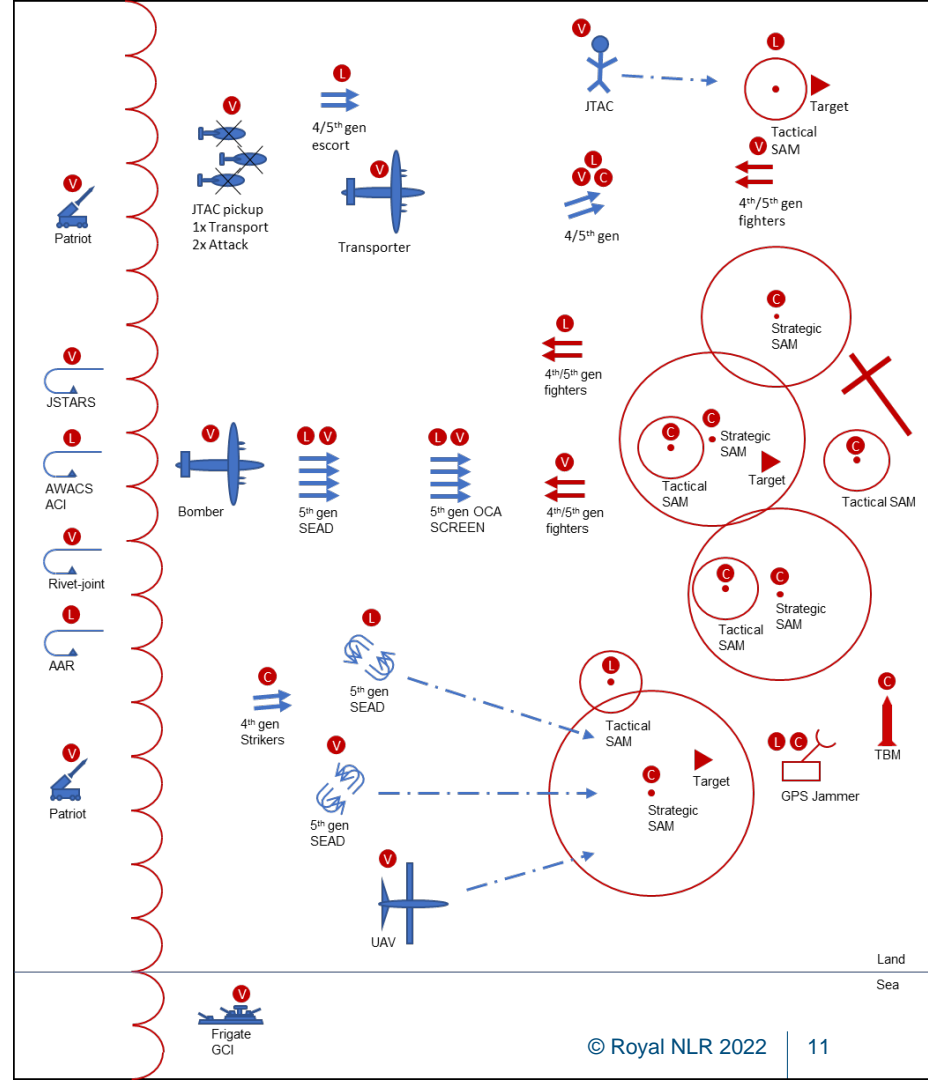
Minimal Viable Exercise

Scenario with:

- 2x Live 5th gen fighters
    - F-35

- 1x Virtual 4th gen bomber
    - Desktop simulator
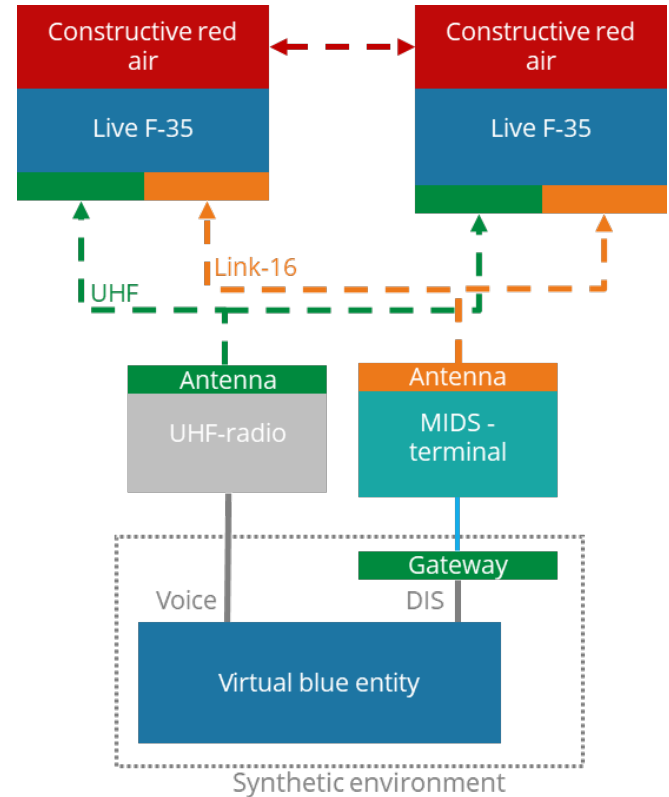
- 2x Constructive red air
    - ET-module
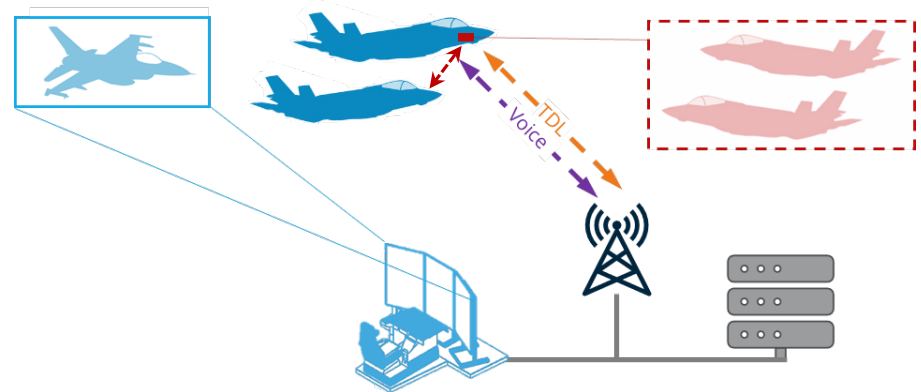
**Focus on adding training value for Live
entities with minimal effort**

Minimal Viable Exercise

Experiment to:

- Quick win using existing technology

- Test the possibilities and limitations of operational datalinks.

- Gain experience with linking synthetic to live environment.

- Testbed for future experiments

Outlook

Output

- Coherent vision on how to integrate LVC in RNLAF
- Testbeds / demonstrators for RNLAF
- Spin-off in technology development

Next steps

- Extend on results of the test and continue research
- Participate in large live exercise in 2024

Call for international cooperation

- Integrate LVC environment in combined training environment
- Standardization of technology and LVC training solutions

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