

# Cockpit Thermal Comfort Assessment using FMI Models for Co-Simulations

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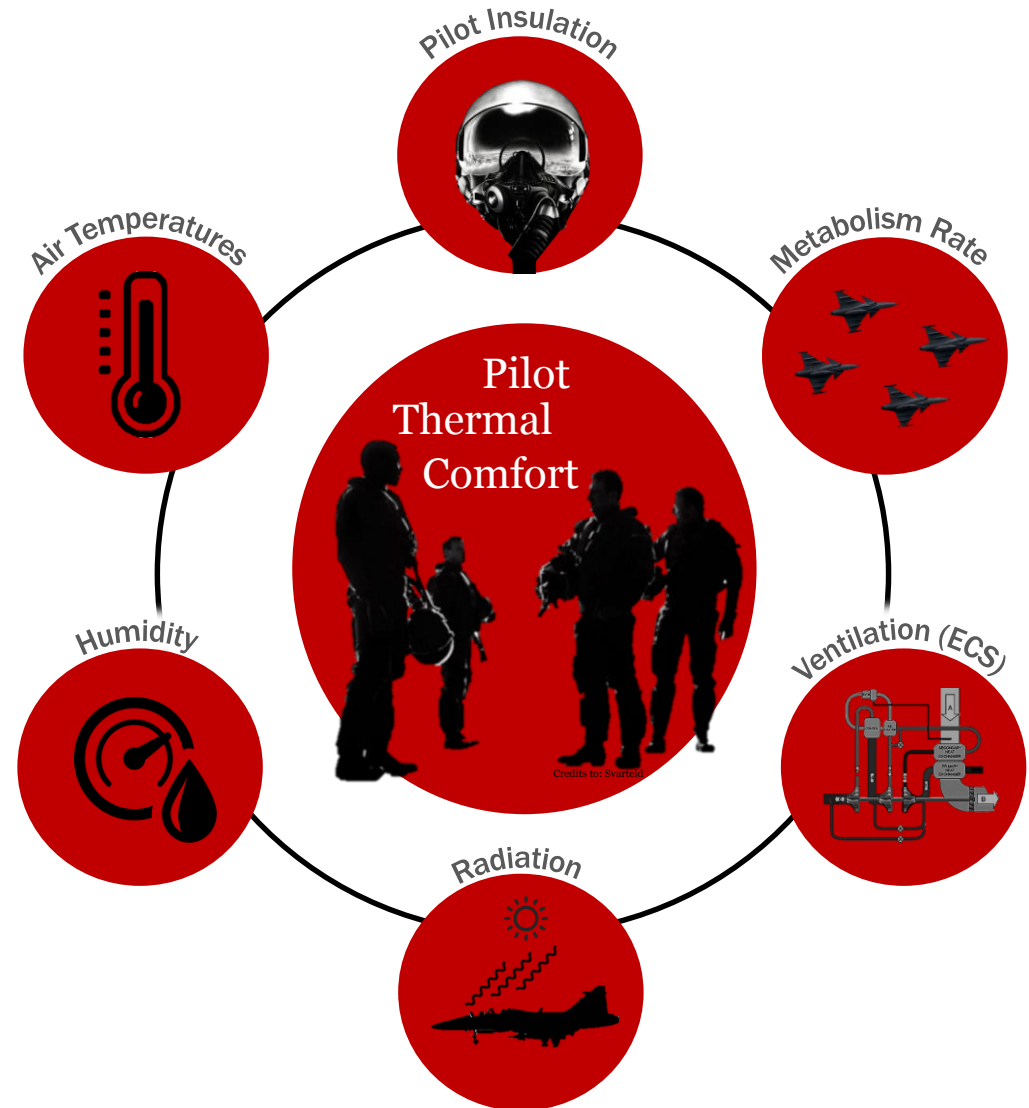
Saab AB, Aeronautics

# Outline

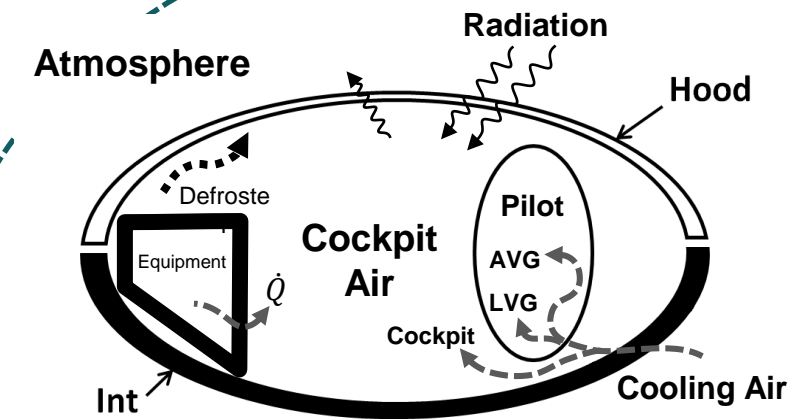
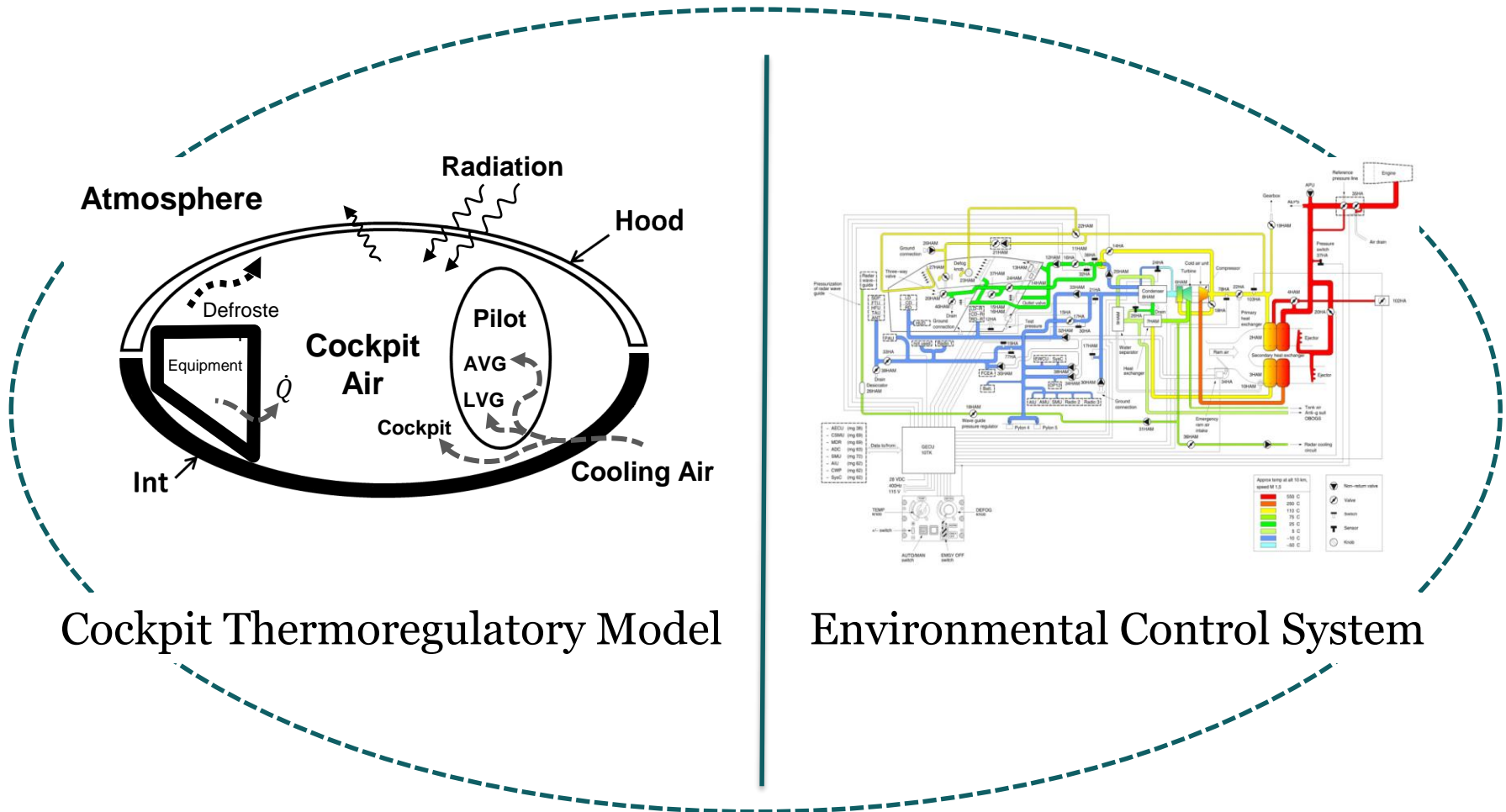
- Background and Aim
- Approach
- Validation
- Results
- Application
- Future Work

# Background

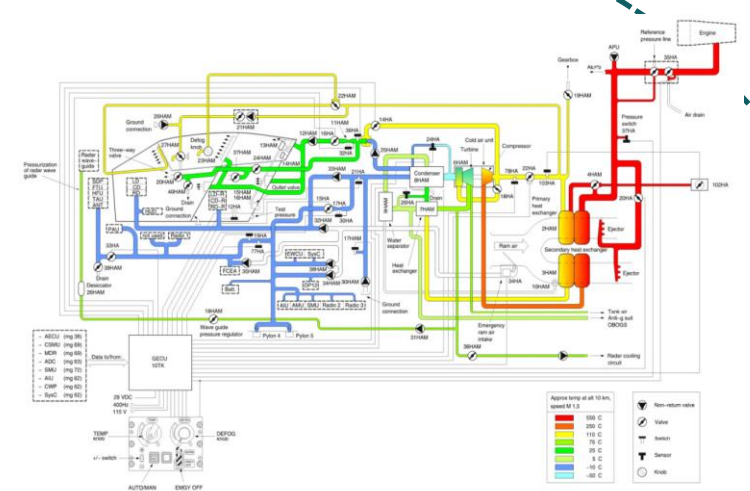
- many fighter aircrafts operate today globally and are therefore often exposed to a wide range of different thermal conditions
- if thermal comfort is not ensured the pilot can suffer from significant heat or cold stress decreasing its physiological and mental performance



# Background and Aim

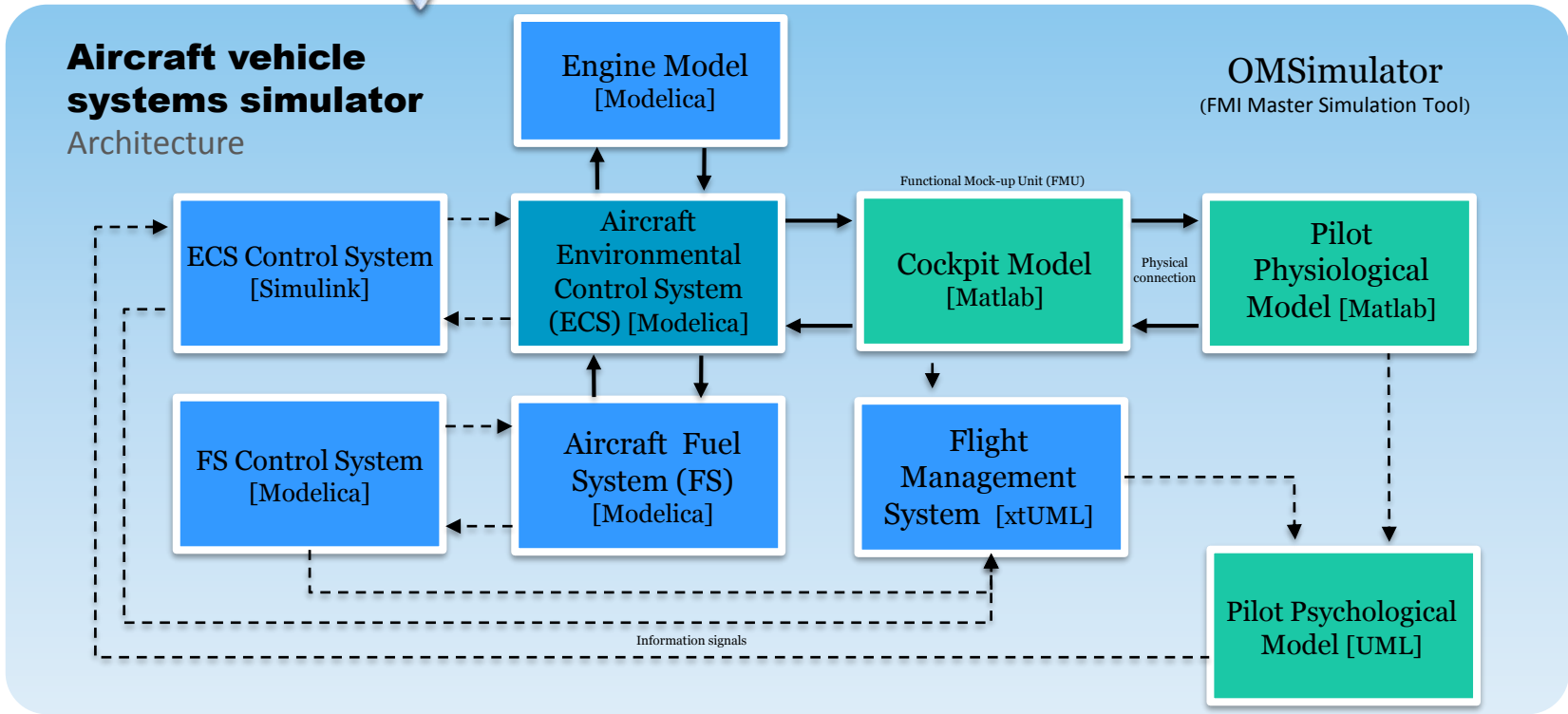


Cockpit Thermoregulatory Model



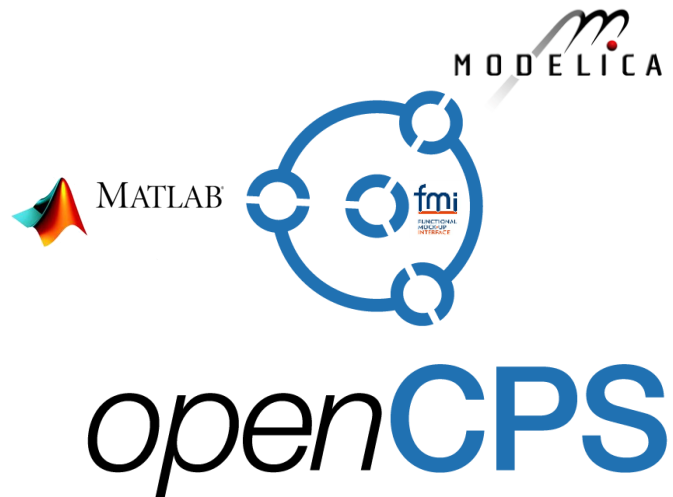
Environmental Control System

# Model Overview



# Approach

*Co-Simulation*

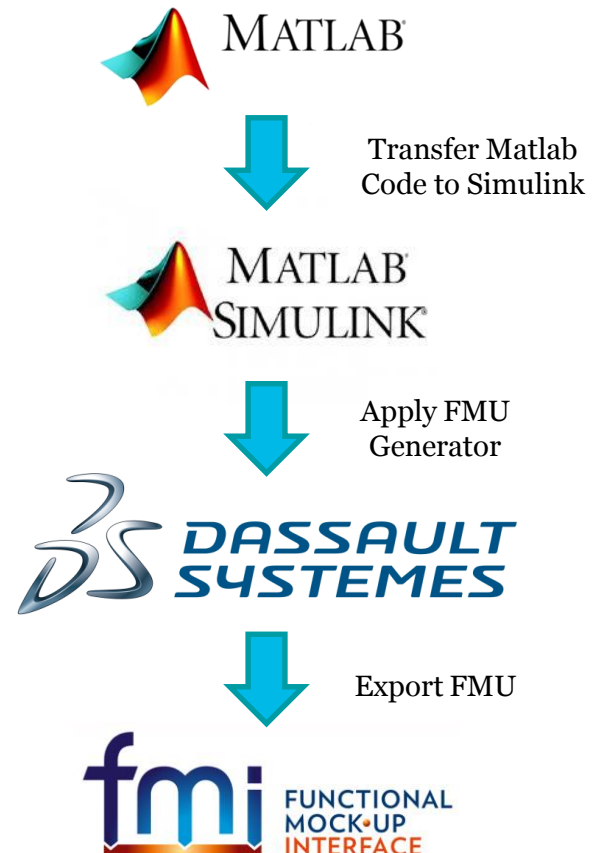


- **Past:** thermal comfort was assessed by measurements, stand-alone models or models including partial and simplified subsystem models with manual result/data exchange to other external models
- **Now:** assessment of thermal comfort using co-simulation facilitate faster and more comprehensive simulations as well as optimizations including a direct data exchange with all relevant aircraft subsystems

# Approach

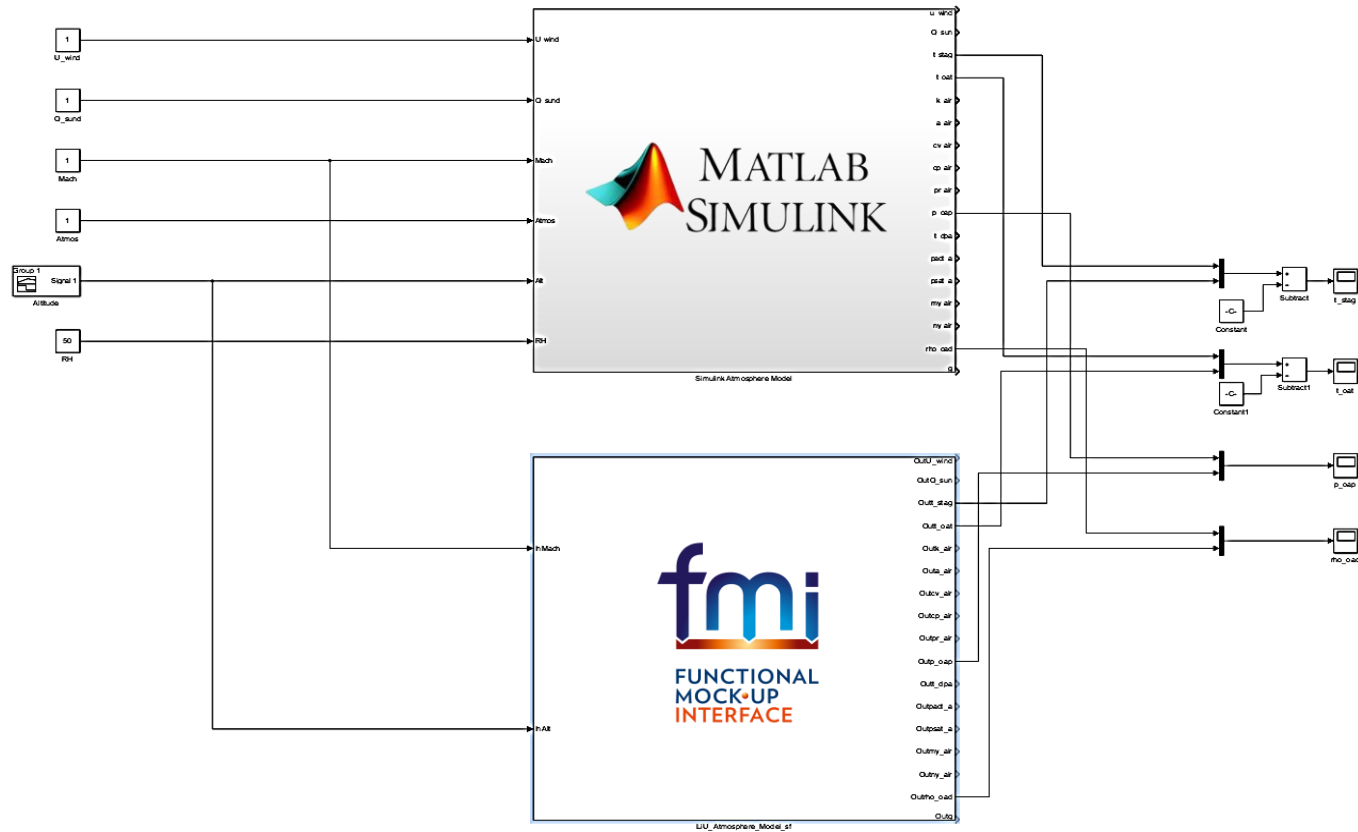
*Transfer*

- Matlab code can't be directly exported as executable FMU
- FMI for Matlab Simulink is supported via Dassault's FMI Kit for Simulink toolbox



# Approach

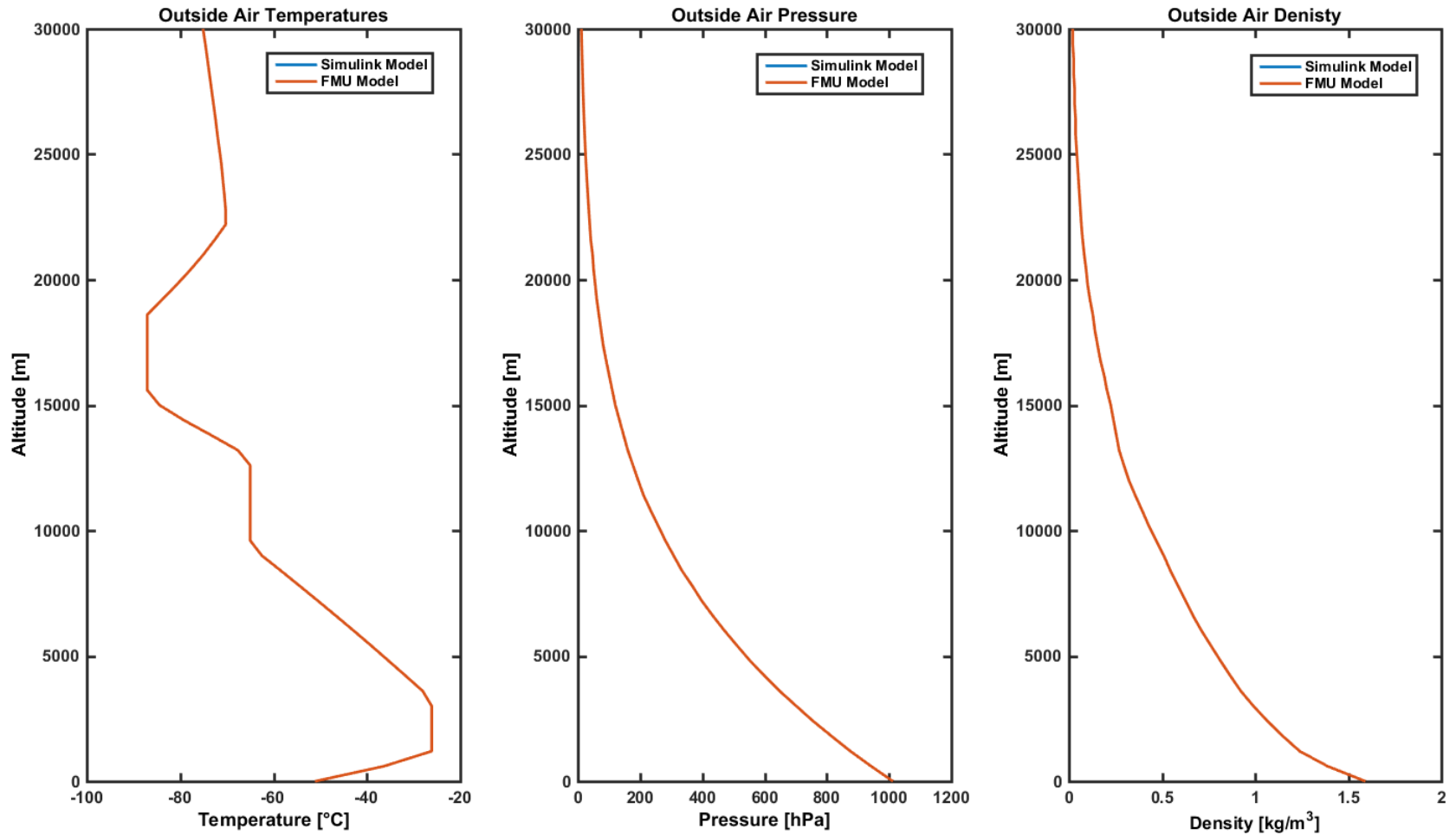
*Validation*



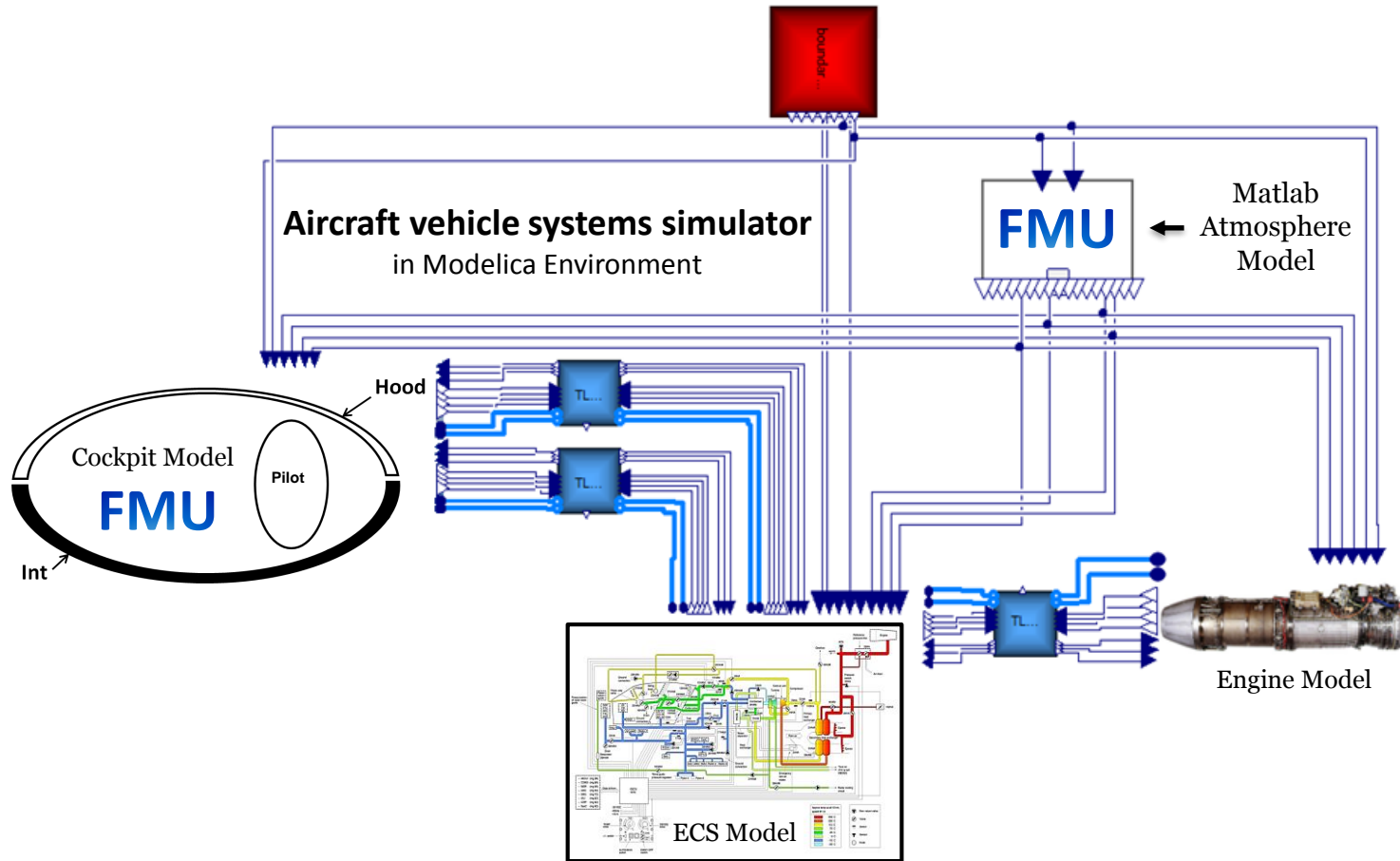


# Results

MIL STD-210A Cold Atmosphere Data vs Altitude

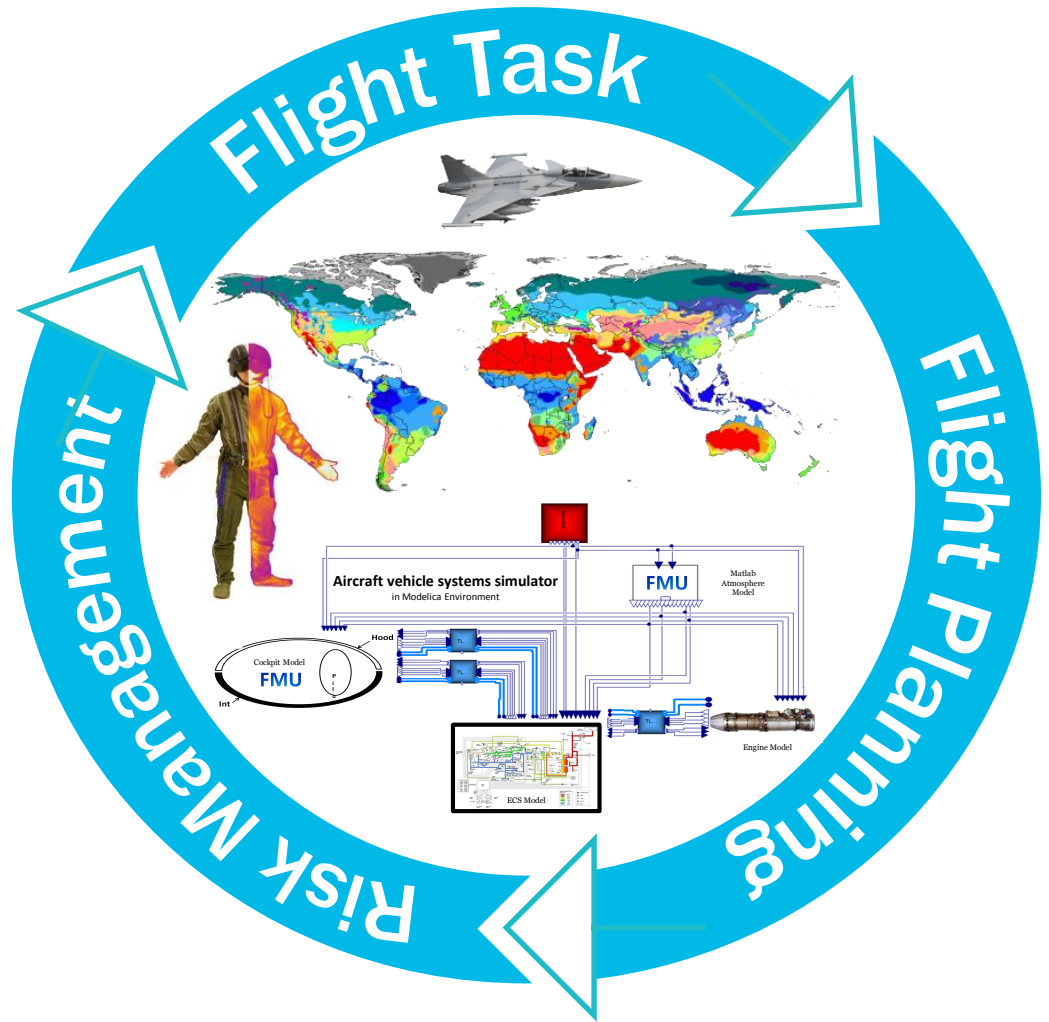
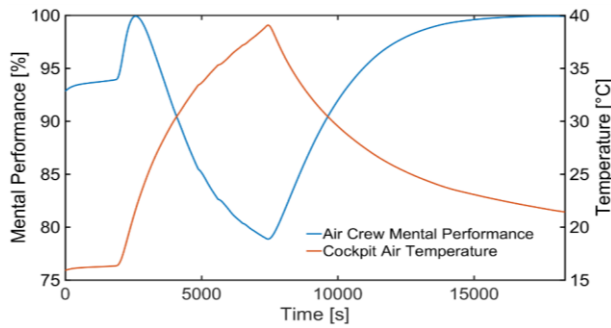
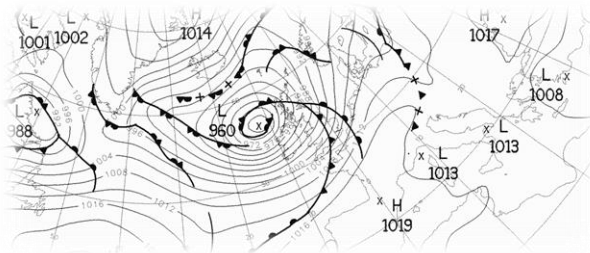


# Application



# Application

Example



# Future Work

- generation and validation of the Cockpit-FMU as well as integration in the presented aircraft vehicle systems simulator
- transfer existing Matlab code based Pilot-model into a FMU for thermal comfort and physiological performance assessment using the co-simulation benefits of the aircraft vehicle systems simulator



Thanks for your attention!

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