

# Development of a Web Based Application for the Implementation of an Integrated System Health Management (ISHM) Certification Process

Master Thesis Kick-off Presentation

MD. Mushfiqur Rahman

20.07.2015

Software Engineering für betriebliche Informationssysteme (sebis)

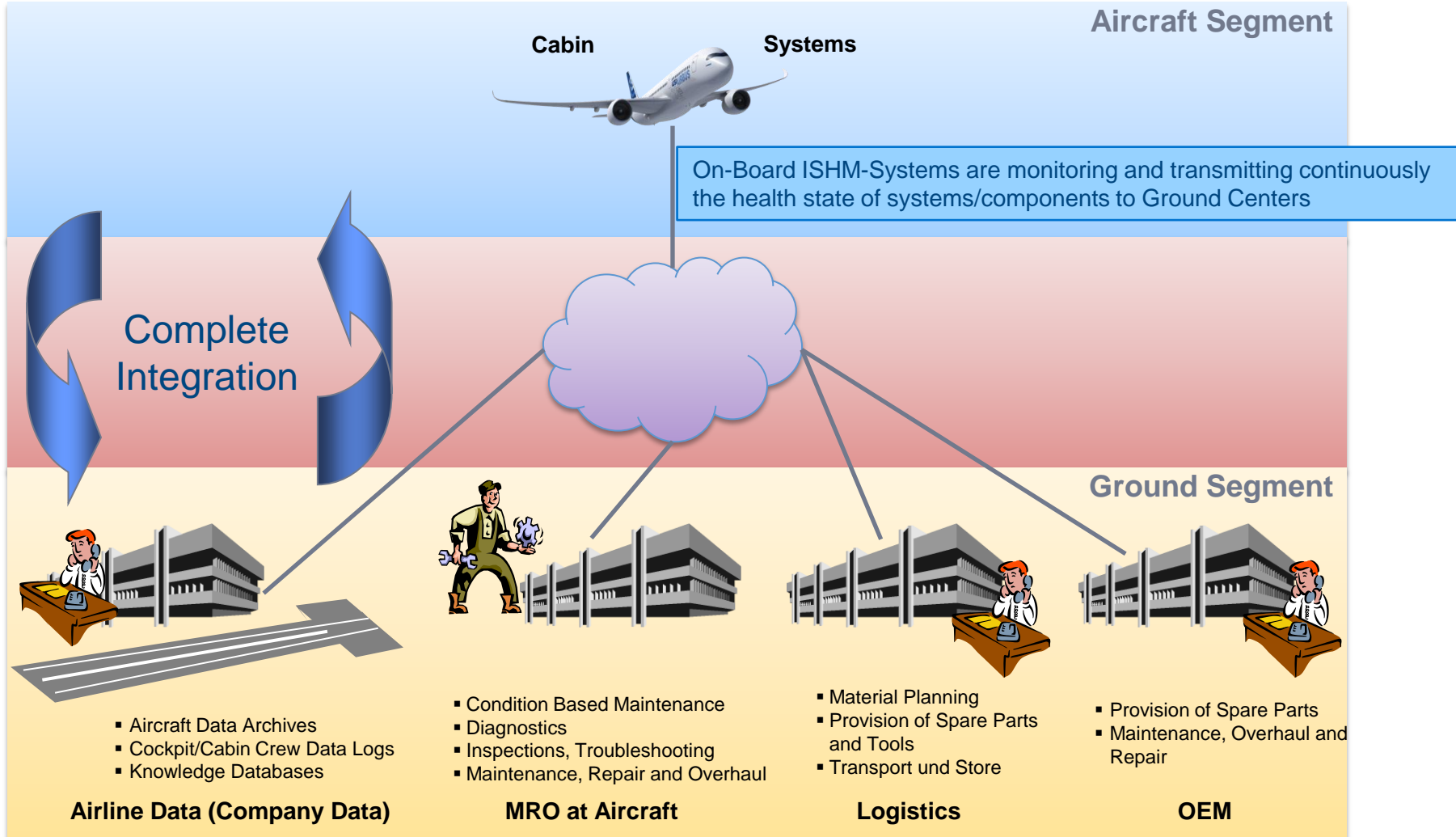
Fakultät für Informatik

Technische Universität München

[www.matthes.in.tum.de](http://www.matthes.in.tum.de)

- Motivation
- Objectives
- Preliminary requirements
- Problem Definition
- Proposed Solution
- Timeline

## ISHM - Integrated System Health Management



- Development of aircraft maintenance introducing ISHM-systems
- A Maintenance Credit is characterized by an approval to an ISHM-System, that adds to, replaces, or intervenes in industry accepted maintenance practices (like inspections) to improve them
- Introduced maintenance credits shall provide health monitoring and prediction capabilities to support advanced diagnostics and prognostics of aircraft systems/components

- Development of a process, called Mx Credit Process, for the certification of Maintenance Credits:
  - Provide a framework to get all necessary inputs from the respective stakeholders (A/C Design Dept, Safety Dept, Supplier...)
  - Provide required evidence to the certification authorities for the approval of ISHM-Systems and Maintenance Credits
  - Provide the involvement of the following processes:
    - A/C development process
    - Maintenance concept development
    - ISHM system development
    - Maintenance Credit certification

# Mx Credit Process - Common Approach

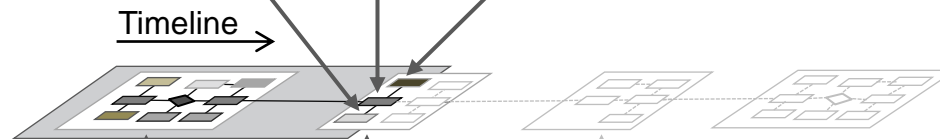
## Presentation - UI

Content Inputs/Outputs, Process View, Process Monitoring



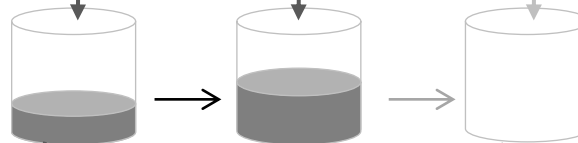
## Mx Credit Process View

Process Execution



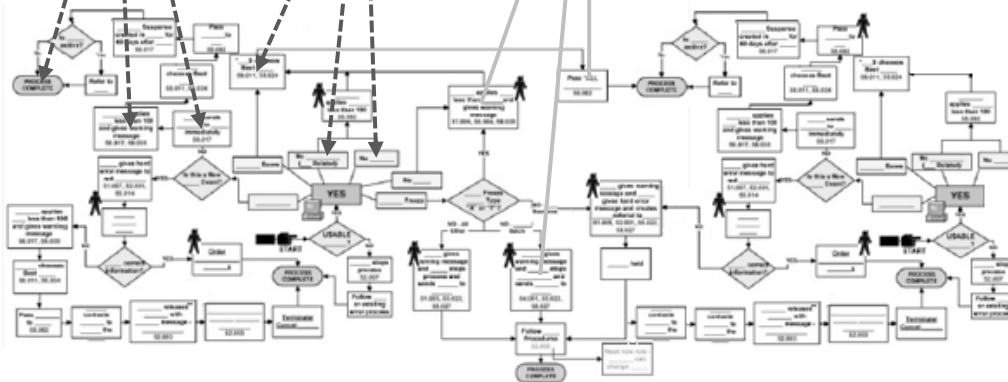
## Mx Credit Process Repository

Content Storage

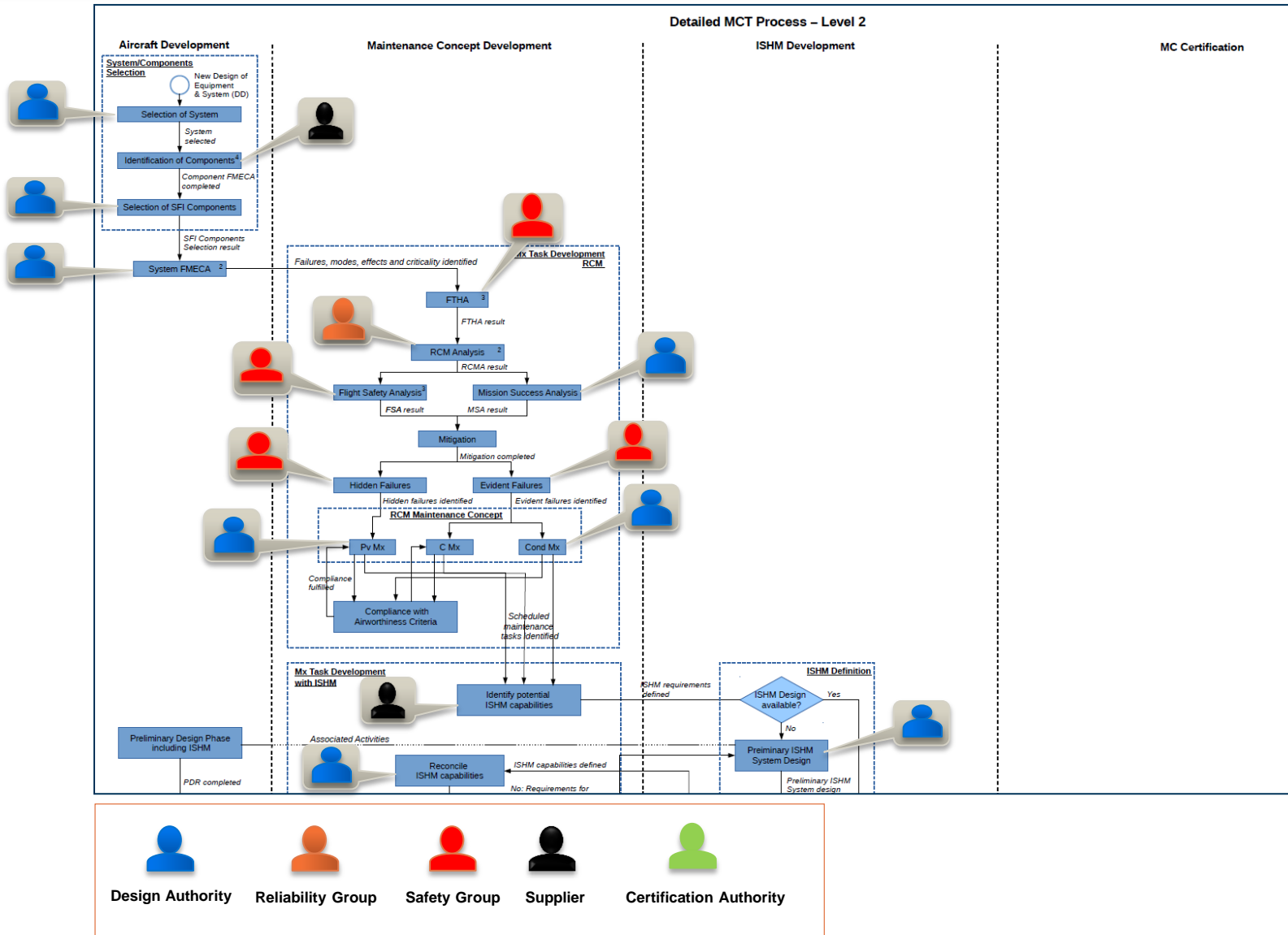


## Complex Process Environment

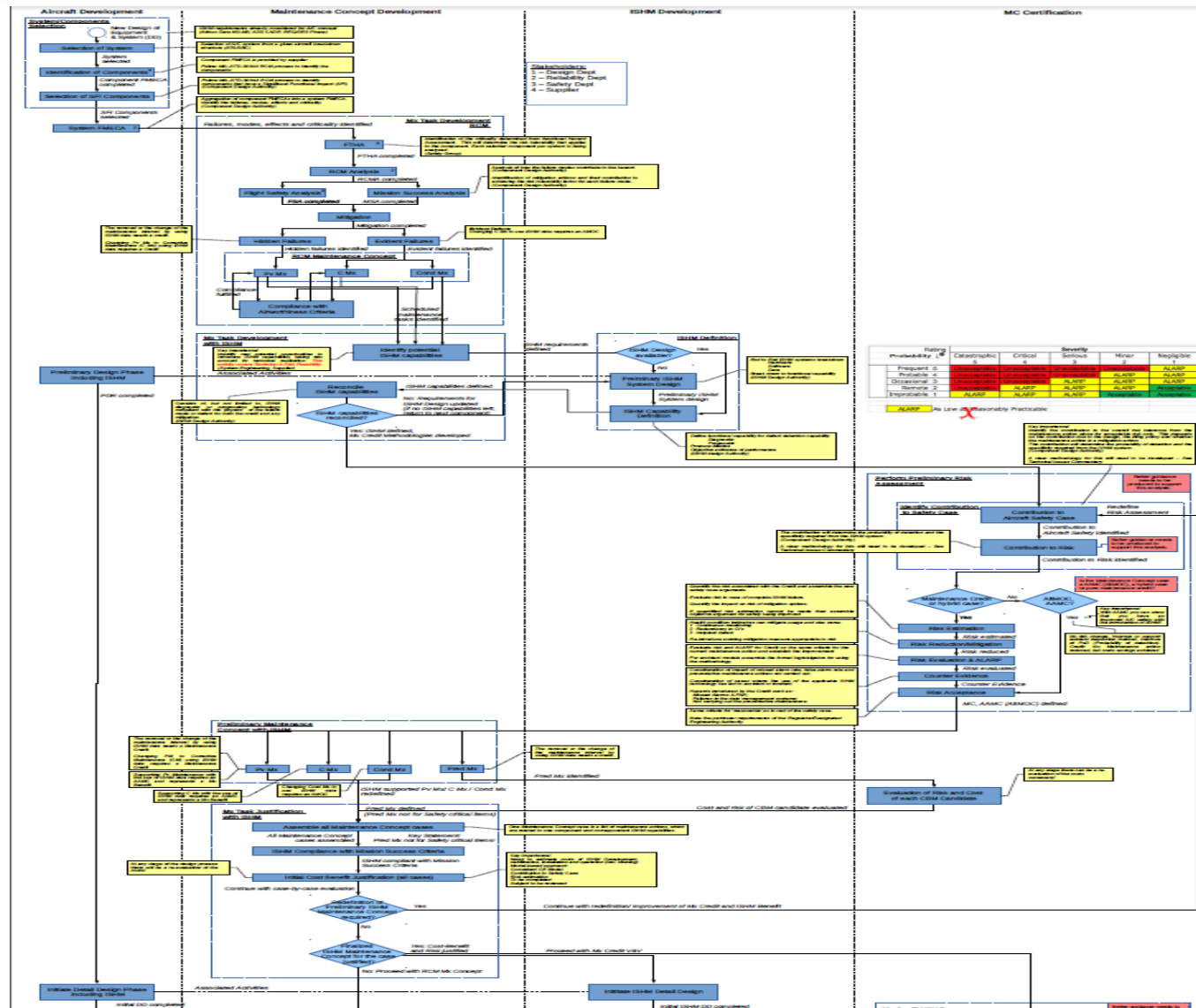
- Product Development
- Maintenance Concept Development
- ISHM Development
- Mx Credit Certification



# Detailed Maintenance Credit Process



# Detailed MCT Process



## Important Aspects of the Mx Process Framework

- **Accessing** the model of the Mx Process
- **Execution** of the Mx Process at runtime, respectively **rule-based** process execution
- **Adding** of content, annotations, data/documents links and results at runtime for each process step
- **Traceability** of executed process at each point of time
- **Reporting** of results for specific process steps or grouped activities
- **Mx Credit Process history**, including complete generated results per process step
- **Navigation** of modelled, executed or logged process
- No **modifications** to the existent complex process and the distributed data sources.

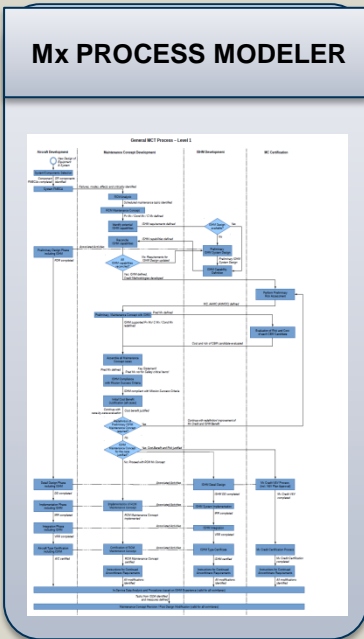
Process Modeling

Execution

- What is the state-of-the-art tools to model and execute process for modeling Mx process.
- What are the limitations of the current process execution environment for modeling the Mx process.
- How the MCT Web Framework looks like ?
- How the proposed Mx Web Framework improves the UX of the execution of the Mx process.

## Process modeling

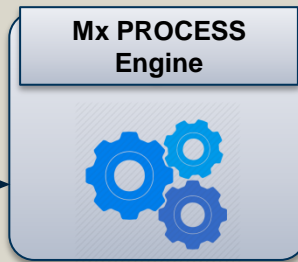
### Mx PROCESS MODELER



Export Processed Models

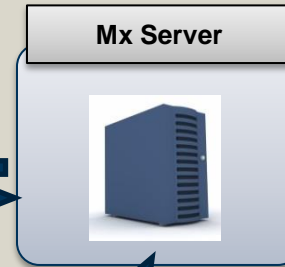
## Execution

### Mx PROCESS Engine

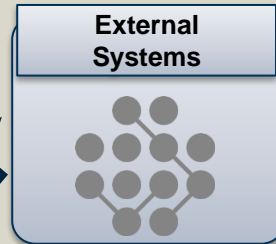


REST API

### Mx Server



### External Systems



### Data



### Mx Client



## Process modeling

There are many Business Process Model and Notation (BPMN) tool available in the market.



- A State-of-The Art study will come up with the potential process modelling solution taking into consideration the given requirements

## Execution

- Mx Credit Process service framework will communicate with the process execution engine with the RESTful API
- Mx Credit Process Framework will provide a form wizard to generate the web forms for the respective tasks
- It will also support the adding of content, annotations, data/documents links according to the users and groups.

Mx Credit Process

http://MxCreditProcess.de/CurrentTask

[Home](#) | [Settings](#) | [Help](#)

**System Components Selection** Peter Time: 14:32:30 - 20.07.2015

Tasks | Process | Manage

My Tasks | Queued | Open | Archived

+ New Component

Selection of A/C System

Name of the LRU/Component impacted

Supplier Details

FMECA Documentation

Models used

# Proposed solution IV – Mock up

Mx Credit Process

http://MxCreditProcess.de/ProcessView

Home | Settings | Help

System Component Peter Time: 14:32:30 - 20.07.2015

Tasks | **Process** | Manage

Graphical Process View | Tabular Process View

Select Task

- + Selection of System
- Identification of Components
- System FMECA
- + RCM with Mx Task
- FTHA
- Flight Safety Analysis
- Mission Success Analysis
- Mission Success Analysis
- Evident Failures
- Hidden Failures
- Preventive Maintenance
- On-condition Maintenance
- Corrective Maintenance
- Compliance with Continued

Add Delete

```
graph TD
    subgraph Aircraft_Development
        A1((Aircraft Development))
        A2[System Component Selector]
        A3[System FCMFA]
        A4[Detail Design Phase]
        A1 --> A2
        A2 --> A3
        A3 --> A4
    end

    subgraph Maintenance_Concept_Development
        M1[RCM Analysis]
        M2[RCM Maintenance Concept]
        M3{Design available?}
        M1 --> M2
        M2 --> M3
    end

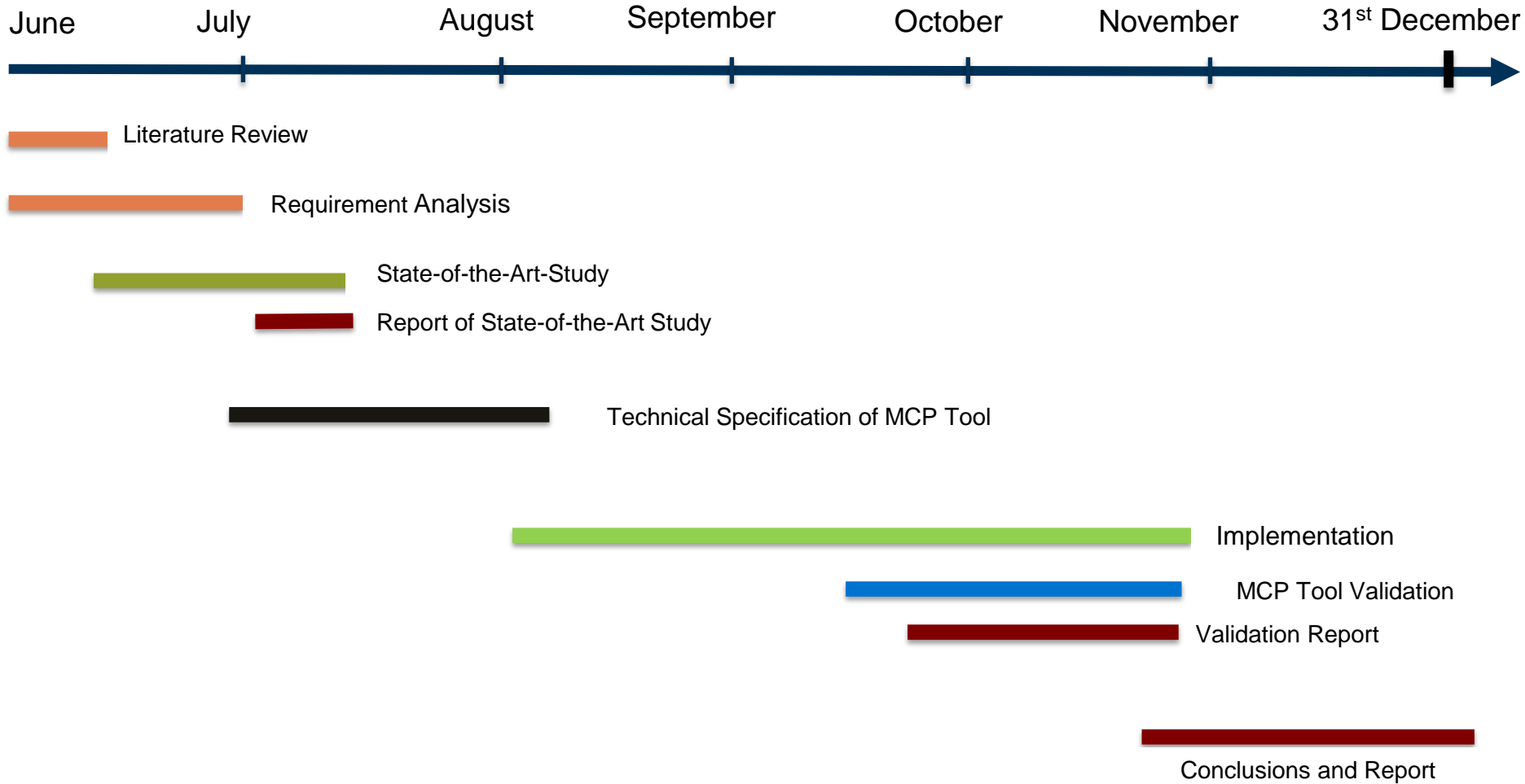
    subgraph RSHM_Development
        R1[Identify potential RSHM capabilities]
        R2[Identify potential RSHM capabilities]
        R3{Design available?}
        R4[Identify potential RSHM capabilities]
        M3 -- No --> R1
        M3 -- Yes --> R2
        R1 --> R3
        R2 --> R3
        R3 -- No --> R4
        R3 -- Yes --> R4
    end

    subgraph MC_Certification
        C1[Identify potential RSHM capabilities]
        C2[Identify potential RSHM capabilities]
        R4 --> C1
        C1 --> C2
    end
```

© Airbus Group Innovations

- Verification and Validation of Mx Credit Process will be realized by exemplary use cases containing:
  - Representative aircraft components
  - Results for each task, represented by text descriptions and linked documents
  - The evolution of the verification, validation and certification of correspondent Maintenance Credits for selected components
- Implemented use cases will be applied for the evaluation of the Mx Credit Process by the Certification authorities

# Timeline



**Thank you for your attention!**

# Questions ?

# Backup slides

Thesis Timespan : June 01,2015 – December 31,2015

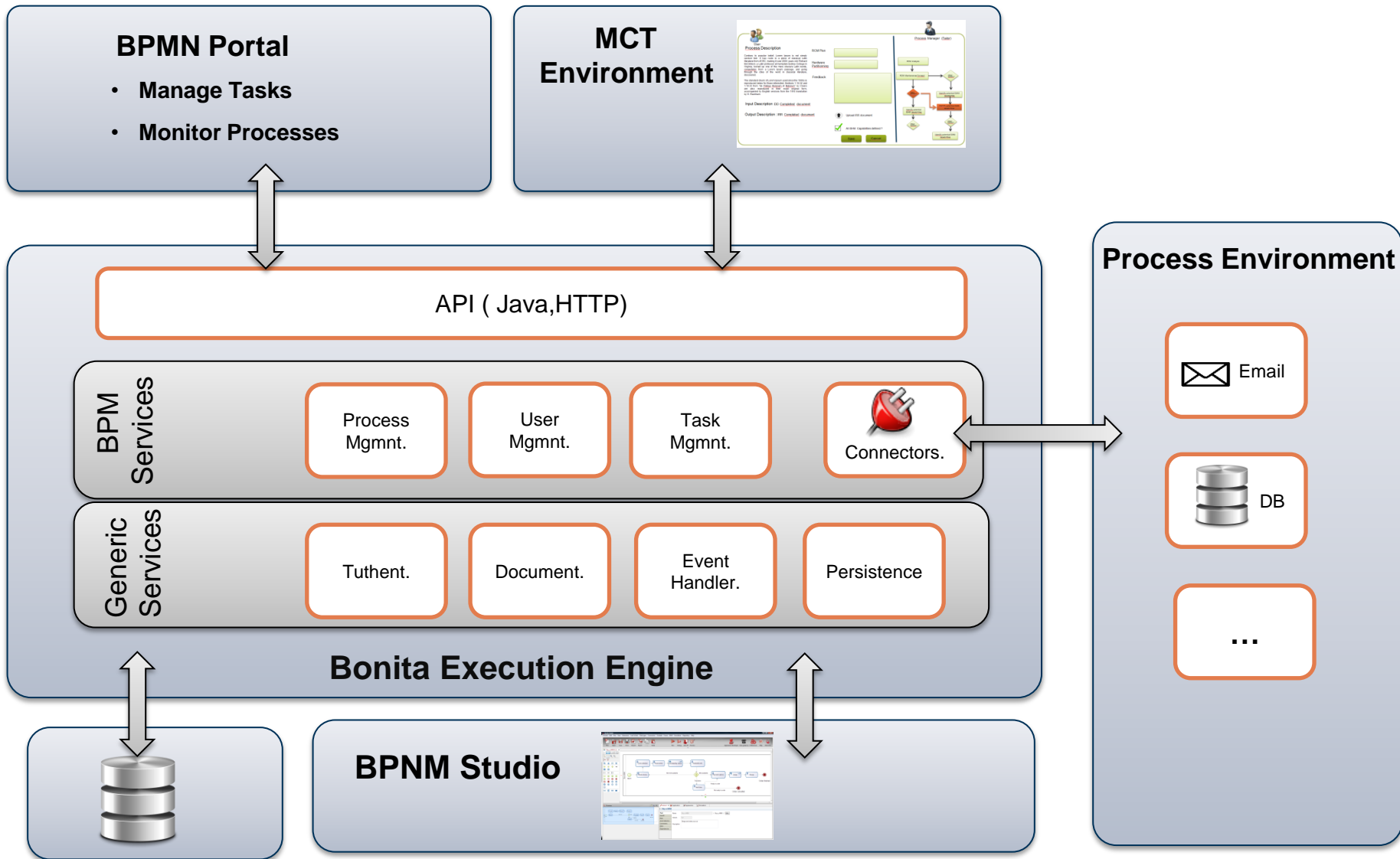
Supervisor :

**Prof. Dr. Florian Matthes**, sebis

Advisors:

- Adrian Hernandez-Mendez, sebis
- Milton Amador, Airbus Group Innovations

# Proposed Architecture



Integrated Systems Health Management (ISHM) provides the ability to maintain system health and performance over the life of a system. For safety-critical systems, ISHM must maintain safe operations while increasing availability by preserving functionality and minimizing downtime.

#### Certification Process :

The objective of the certification process is to document that the critical engineering requirements, health requirements, and safety requirements have been met for a space system that provides “maximum reasonable assurance” that the system's failure will not result in a crew or passenger fatality or permanent disability.

