

AI-Based Persona Generation for the Development of a Post-Mission Analyzer Tool for Launch and Re-Entry Operations

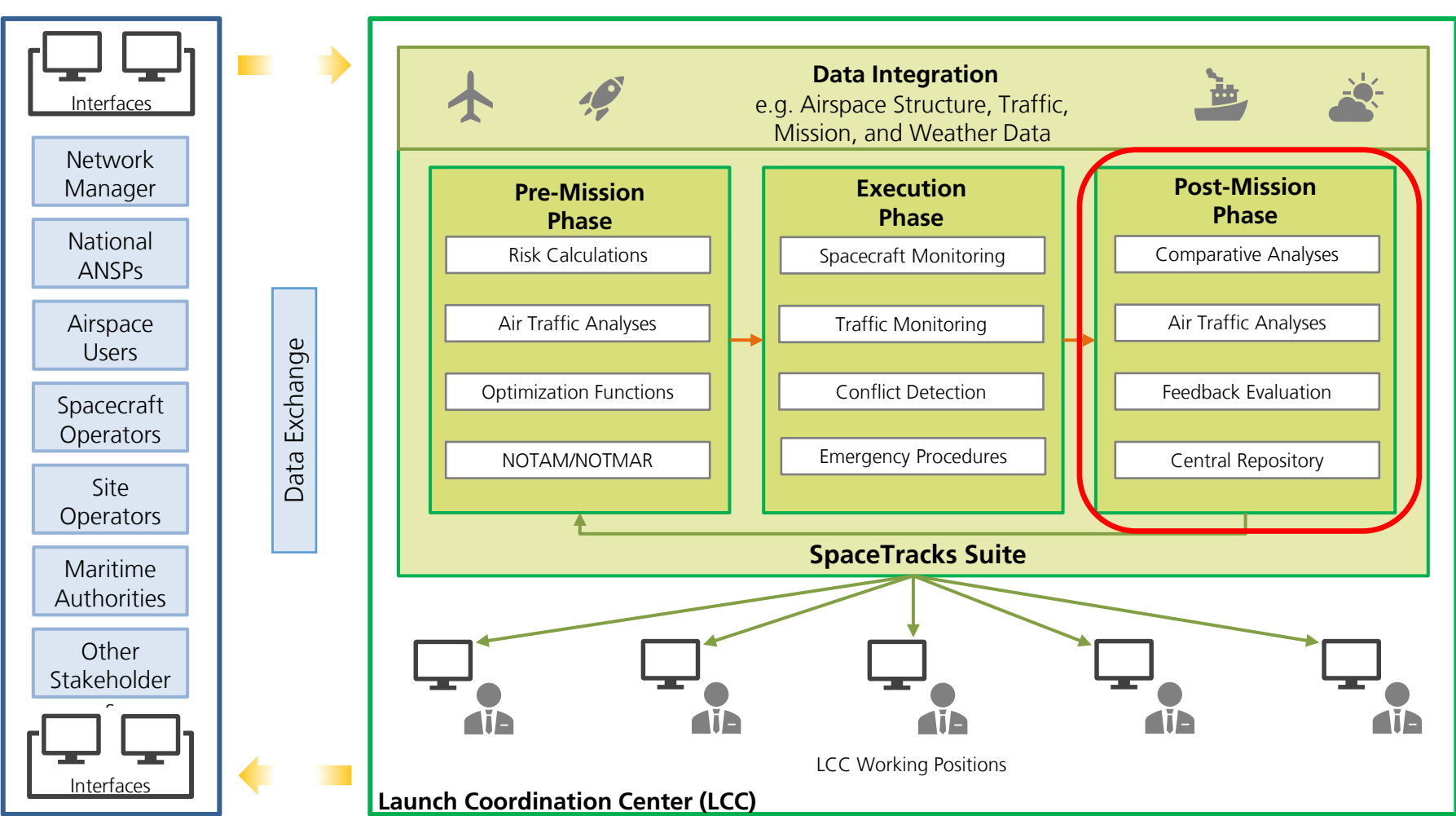
Artificial intelligence (AI) in the context of safe and efficient air traffic management ¹

Jens Hampe M.Sc.

German Aerospace Center (DLR), Institute of Flight Guidance, 38108 Braunschweig, jens.hampe@dlr.de

Motivation

- Increase in orbital launches and re-entries.
- Complexity in Air Traffic Management (ATM) integration.
- High demand for safe, efficient coordination across domains.
- Current challenge: Heterogeneous stakeholders + fragmented requirements.



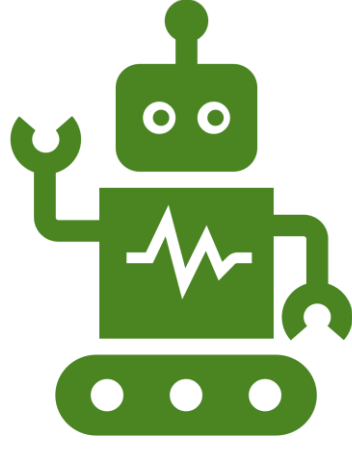
SpaceTracks Suite - DLR is developing a Launch and Re-entry Coordination Center ²

Evolution of Personas in Design

- Essential tools in Human-Computer Interaction (HCI) and User-Centered Design (UCD).
- They provide decision-makers with empathetic and memorable focus points.
- Generative Artificial Intelligence (GenAI), particularly Large Language Models (LLMs), offers breakthrough opportunities. ³

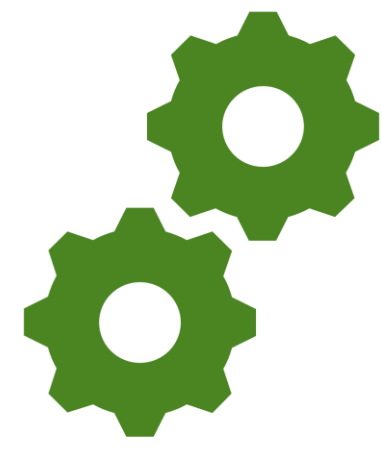
Objectives

Develop a systematic, Generative AI-driven approach to:



Assist and automate:
Enable User-Centered design of a Post Mission Analyzer (PMA)

Generate:
Generate realistic operational personas as interfaces between stakeholders and system design

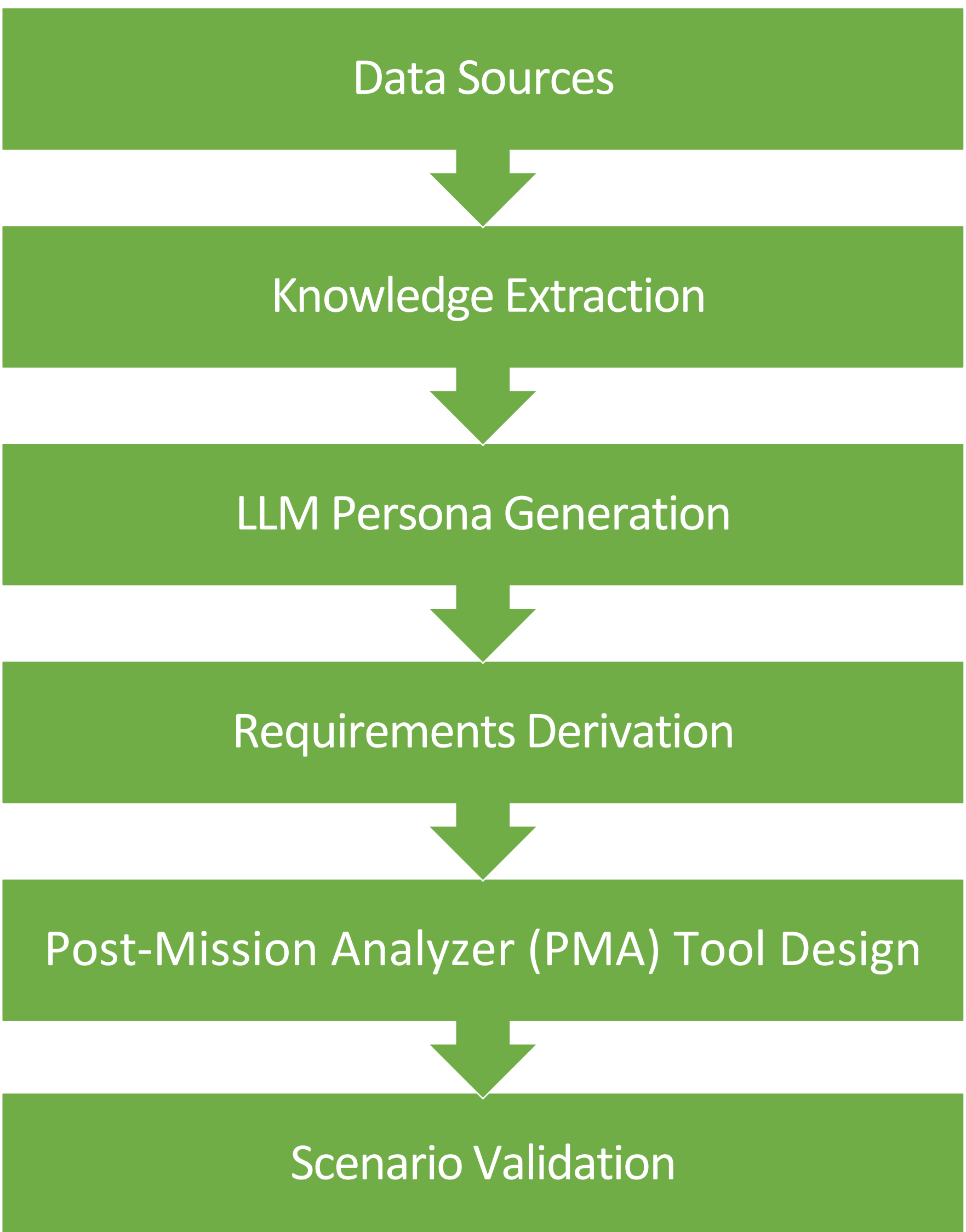




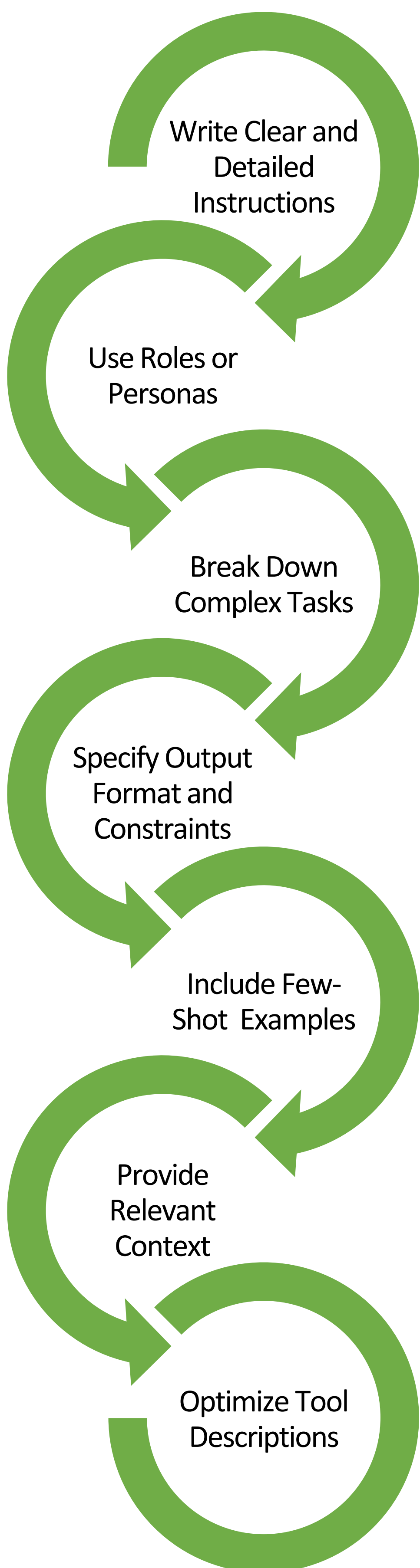
AI4SE:
AI supported requirements engineering for functional & non-functional requirements

Methodology

AI-Based Persona Generation Pipeline



Prompt Engineering / Refinement



Persona Coverages

1. Mission Trajectory & Safety Planner
2. Air Traffic Interface Coordinator
3. Post-Mission Review Lead / Process Optimizer
4. Regulatory & Compliance Auditor
5. Space Situational Awareness (SSA) & Debris Data Analyst



2. Air Traffic Interface Coordinator (ATC/ATFM Specialist)

Name: Marcus Vance, **Age:** 48, **Marital Status:** Divorced, two teenagers
Hobbies: Competitive road cycling, coaching youth soccer, restoring vintage radios
Education/Knowledge: M.Sc. in Air Traffic Management; certified ATC instructor; deep knowledge of ICAO Annex 11, TAR procedures, and EURACTRAC
Role: ATM Safety & Coordination Officer or Air Traffic Flow Manager working at a National Aviation Authority or CNS provider
Context: Manages temporary airspace closures, reroutes civil traffic during space operations, and ensures compliance with separation standards near hazard zones.
Goals with PMA: Quantify actual air traffic impact (flights diverted, delay minutes, airspace utilization changes) Verify Hazard Area boundaries against real-world execution and ATC implementation logs .Align time schedule deviations with operational disruption metrics
Key PMA Interactions: Impact summary generator, spatial-temporal hazard alignment viewer, stakeholder feedback input terminal, automated regulatory reporting export
Desires: One-click impact scoring, regulatory-ready summaries, direct feedback loops to refine future Temporary Airspace Reservations
Pain Points: Lack of standardized post-mission impact reports; reactive rather than predictive coordination; unclear accountability when plan vs. actual mismatches cause cascading delays
Computer Skills: Comfortable with SITA/EURACTRAC, MS Office, SharePoint, and web-based forms; limited experience with advanced visualization tools
Attitude Toward the Product: Pragmatic; will adopt if it cuts paperwork and speeds deconfliction cycles
Attitude Toward the Product's Technology: Favors rule-based validation over predictive AI; values stability, auditability, and seamless ATM system integration
Expectations: Mobile-friendly impact summaries; clear Hazard Area vs. actual flight path mapping; compliance-aligned report formats
Limitations: High operational tempo during peak flight seasons; budget/training constraints; zero tolerance for unstable betas in safety workflows

Key Insights

Critical success factors:

- Structured domain knowledge
- Expert-in-the-loop validation
- Controlled LLM prompting

Contribution

This work:

- Integrates AI into Systems Engineering methodologies
- Introduces a novel approach to persona generation in aerospace

Provides a foundation for:

- Advanced PMA tools
- Improved space–airspace integration

Conclusion & Future Work

- AI-driven personas enable excellent systems engineering for complex, multi-stakeholder space operations
- Use of Agentic AI

References

- (1) J. Hampe, Potential Methods and Applications of Artificial Intelligence (AI) in the Context of Safe and Efficient Air Traffic Management, Deutscher Luft- und Raumfahrtkongress 2023, Stuttgart, https://publikationen.dglr.de/?tx_dglrpublications_pi1%5bdocument_id%5d=610387
- (2) J. Hampe and A. Stahnke, "Improving air and space safety through enhanced coordination with the SpaceTracks Suite microservice architecture," 2024, <https://www.sciencedirect.com/science/article/pii/S2468896724000053>
- (3) D. Amin et al. How Is Generative AI Used for Persona Development?: A Systematic Review of 52 Research Articles (2025), <https://arxiv.org/pdf/2504.04927v1>

Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)
Institut für Flugführung
Lilienthalplatz 7, 38108
0531 295-2588 | jens.hampe@dlr.de
Braunschweig, Deutschland

