



Aerospace Operations

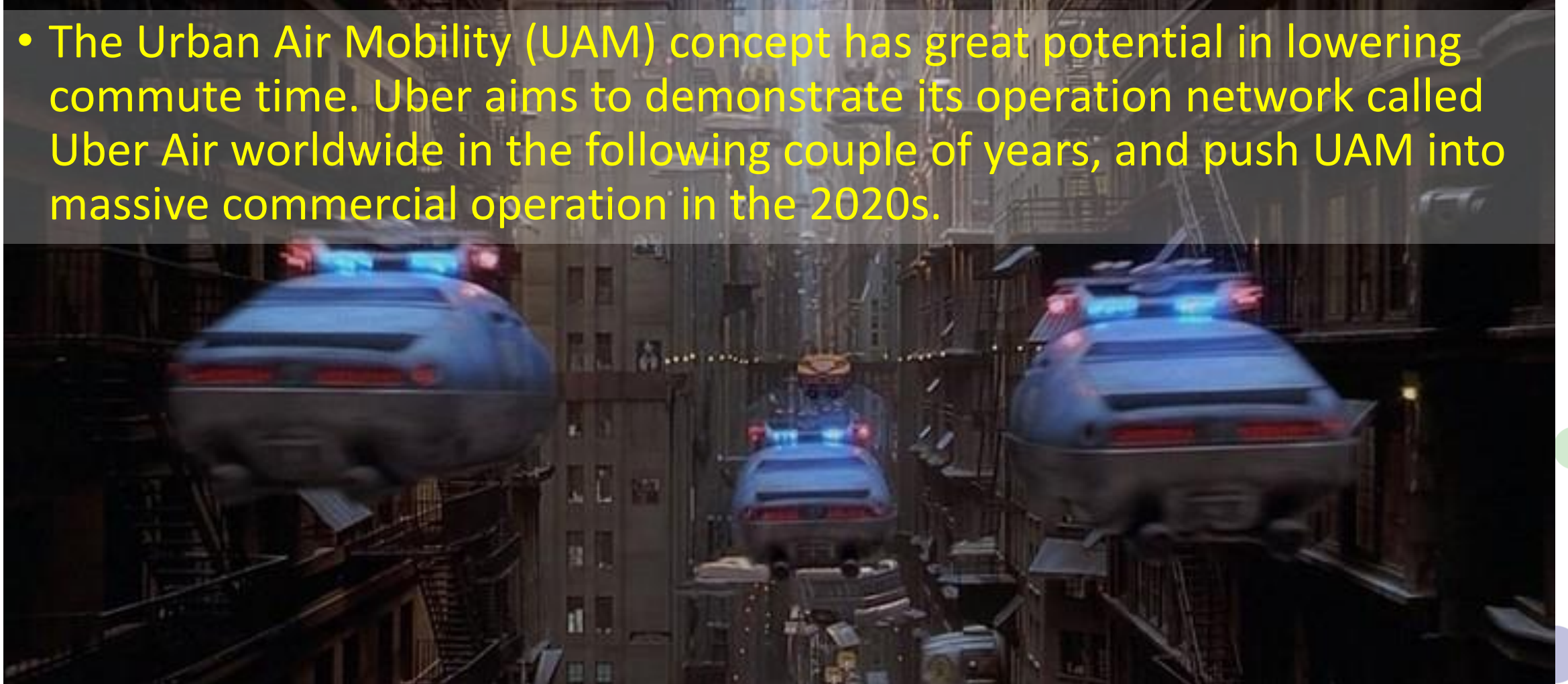
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**UAF Modelling of Urban Air
Mobility Operation**



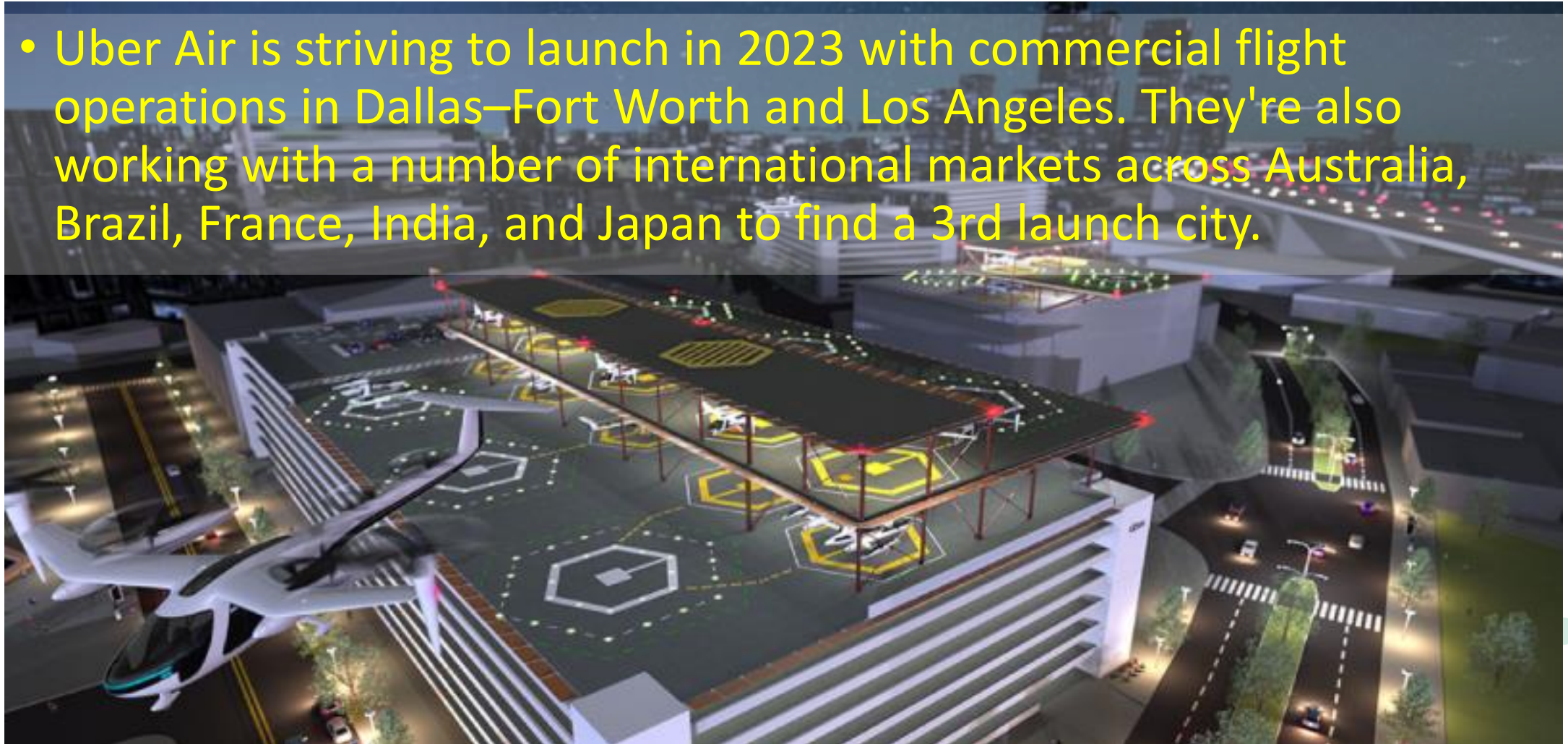
1-INTRODUCTION

- The Urban Air Mobility (UAM) concept has great potential in lowering commute time. Uber aims to demonstrate its operation network called Uber Air worldwide in the following couple of years, and push UAM into massive commercial operation in the 2020s.



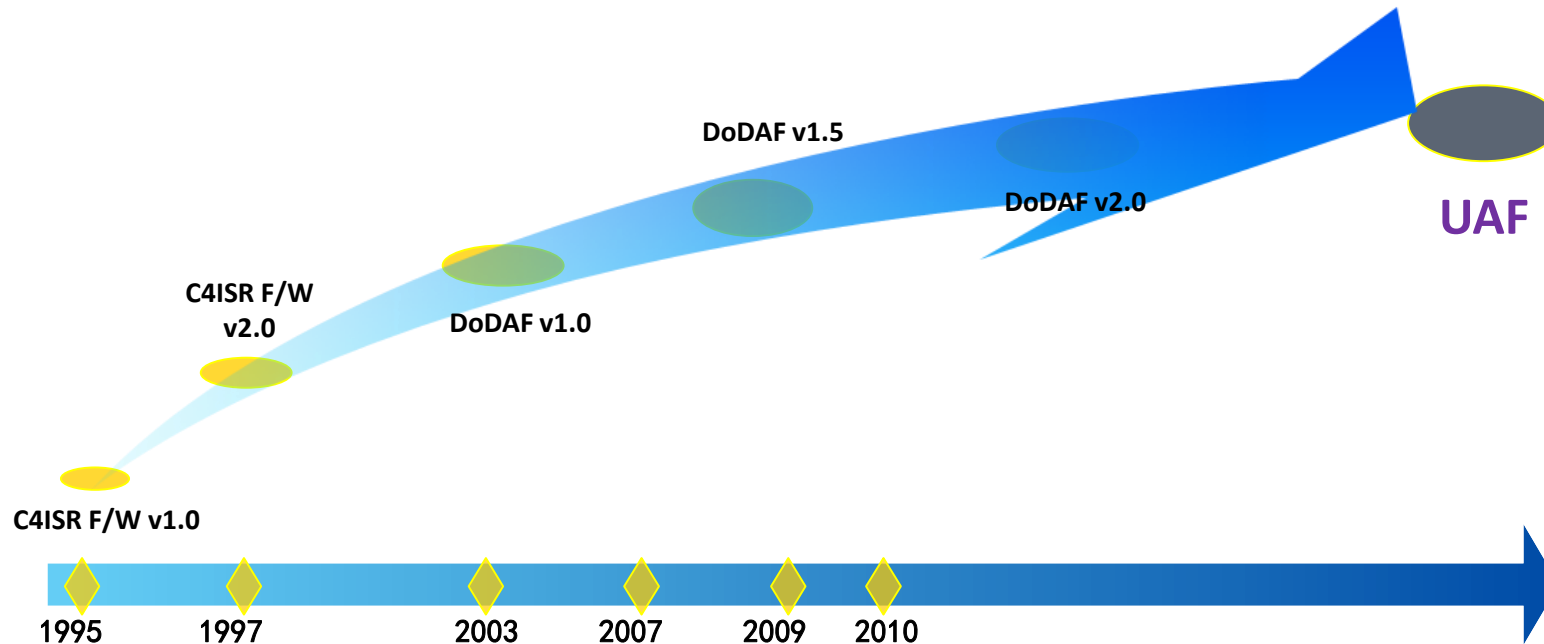
1-INTRODUCTION

- Uber Air is striving to launch in 2023 with commercial flight operations in Dallas–Fort Worth and Los Angeles. They're also working with a number of international markets across Australia, Brazil, France, India, and Japan to find a 3rd launch city.



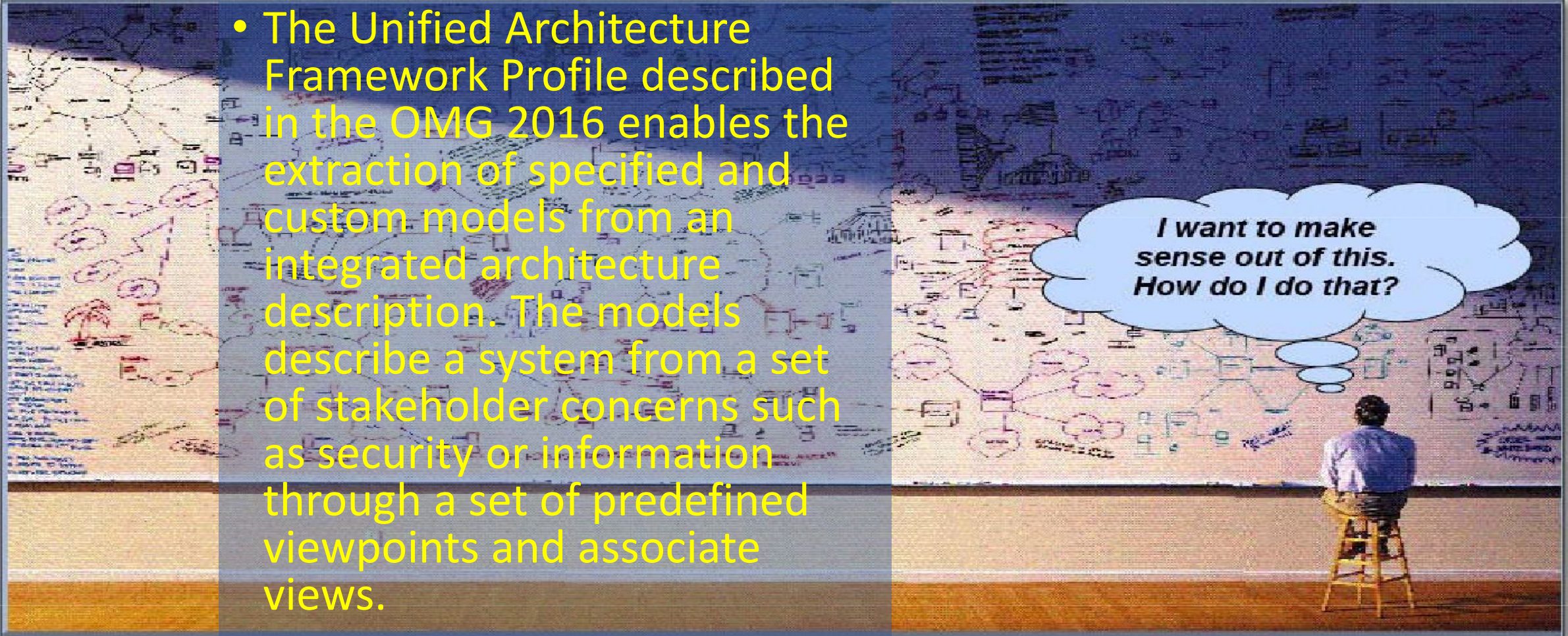
2-SoS ARCHITECTURE FRAMEWORK APPROACH

- SoS: System of system
- Architecture: elements within the SoS and relationship between them
- Framework: Baseline and standards of SoS architecture



2-SoS ARCHITECTURE FRAMEWORK APPROACH

- The Unified Architecture Framework Profile described in the OMG 2016 enables the extraction of specified and custom models from an integrated architecture description. The models describe a system from a set of stakeholder concerns such as security or information through a set of predefined viewpoints and associate views.



*I want to make sense out of this.
How do I do that?*

	Taxonomy Tx	Structure Sr	Connectivity Cn	Processes Pr	States St	Interaction Scenarios Is	Information It	Parameters Pm	Constraints Ct	Roadmap Rm	Traceability Tr
Metadata Md	Metadata Taxonomy Md-Tx	Architecture Viewpoints Md-Sr	Metadata Connectivity Md-Cn	Metadata Processes ^a Md-Pr	-	-	Conceptual Data Model,	Environment Pm-En	Metadata Constraints Md-Ct	-	Metadata Traceability Md-Tr
Strategic St	Strategic Taxonomy St-Tx	Strategic Structure St-Sr	Strategic Connectivity St-Cn	-	Strategic States St-St	-			Strategic Constraints St-Ct	Strategic Deployment, St-Rm Strategic Phasing St-Rm	Strategic Traceability St-Tr
Operational Op	Operational Taxonomy Op-Tx	Operational Structure Op-Sr	Operational Connectivity Op-Cn	Operational Processes Op-Pr	Operational States Op-St	Operational Interaction Scenarios Op-Is			Operational Constraints Op-Ct	-	Operational Traceability Op-Tr
Services Sv	Service Taxonomy Sv-Tx	Service Structure Sv-Sr	Service Connectivity Sv-Cn	Service Processes Sv-Pr	Service States Sv-St	Service Interaction Scenarios Sv-Is			Service Constraints Sv-Ct	Service Roadmap Sv-Rm	Service Traceability Sv-Tr
Personnel Pr	Personnel Taxonomy Pr-Tx	Personnel Structure Pr-Sr	Personnel Connectivity Pr-Cn	Personnel Processes Pr-Pr	Personnel States Pr-St	Personnel Interaction Scenarios Pr-Is	Logical Data Model,	Measurements Pm-Me	Competence, Drivers, Performance Pr-Ct	Personnel Availability, Personnel Evolution, Personnel Forecast Pr-Rm	Personnel Traceability Pr-Tr
Resources Rs	Resource Taxonomy Rs-Tx	Resource Structure Rs-Sr	Resource Connectivity Rs-Cn	Resource Processes Rs-Pr	Resource States Rs-St	Resource Interaction Scenarios Rs-Is	Physical schema, real world results		Resource Constraints Rs-Ct	Resource evolution, Resource forecast Rs-Rm	Resource Traceability Rs-Tr
Security Sc	Security Taxonomy Sc-Tx	Security Structure Sc-Sr	Security Connectivity Sc-Cn	Security Processes Sc-Pr	-	-	Security Constraints Sc-Ct		-	Security Traceability Sc-Tr	
Projects Pj	Project Taxonomy Pj-Tx	Project Structure Pj-Sr	Project Connectivity Pj-Cn	Project Process Pj-Pr	-	-	-		Project Roadmap Pj-Rm	Project Traceability Pj-Tr	
Standards Sd	Standard Taxonomy Sd-Tx	Standards Structure Sd-Sr	-	-	-	-	-	Standards Roadmap Sd-Rm	Standards Traceability Sd-Tr		
Actuals Resources Ar	-	Actual Resources Structure, Ar-Sr	Actual Resources Connectivity, Ar-Cn	Simulation			-	Parametric Execution/ Evaluation ^b	-	-	
Dictionary Dc											
Summary & Overview Sm-Ov											
Requirements Req											

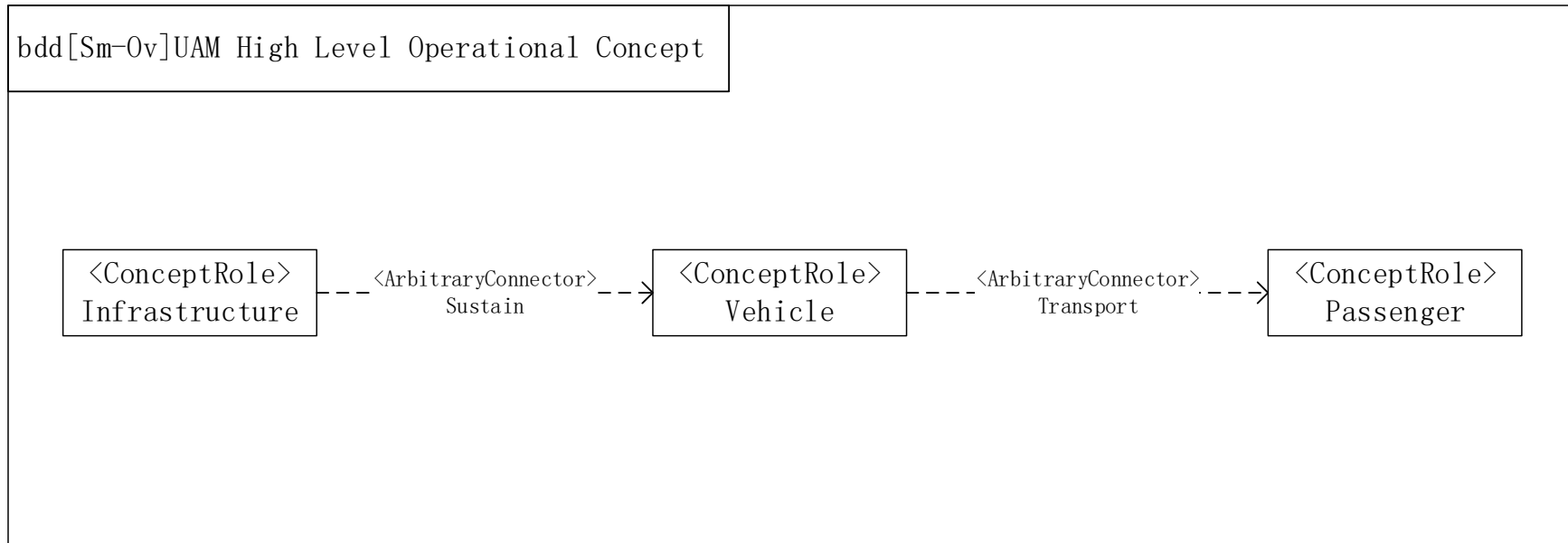
2.1 Architecture Framework Tailoring

- The purpose of this article is to focus on the operation of UAM, which will be substantially advisory for Civil Aviation Administration of China (CAAC) and other regarding authorities. Therefore, the **Op-Pr, Op-St, Op-Is, Op-Sr** views are required. To define these views, the operation concept of UAM must be established ahead, hence the **Sm-OV** is a must-do. And the **Pr-Tx** view is critical to functionalize each party of the UAM association, it should be modelled after the Sm-OV, and before the operational views.

2.2 Operation Concept

- The operation concept of UAM utilizes aerial vehicles to take passengers to their destinations between suburbs and cities. The vehicles are usually designed in the configuration of eVTOL to meet public requirements of lower noise level, safety and environmentally consciousness.
 - Customer calls for service through mobile apps. A vehicle will be allocated to the takeoff sites which is nearest to the customer, then piloted or autonomously directed to the nearest landing site of the input destination of the customer.

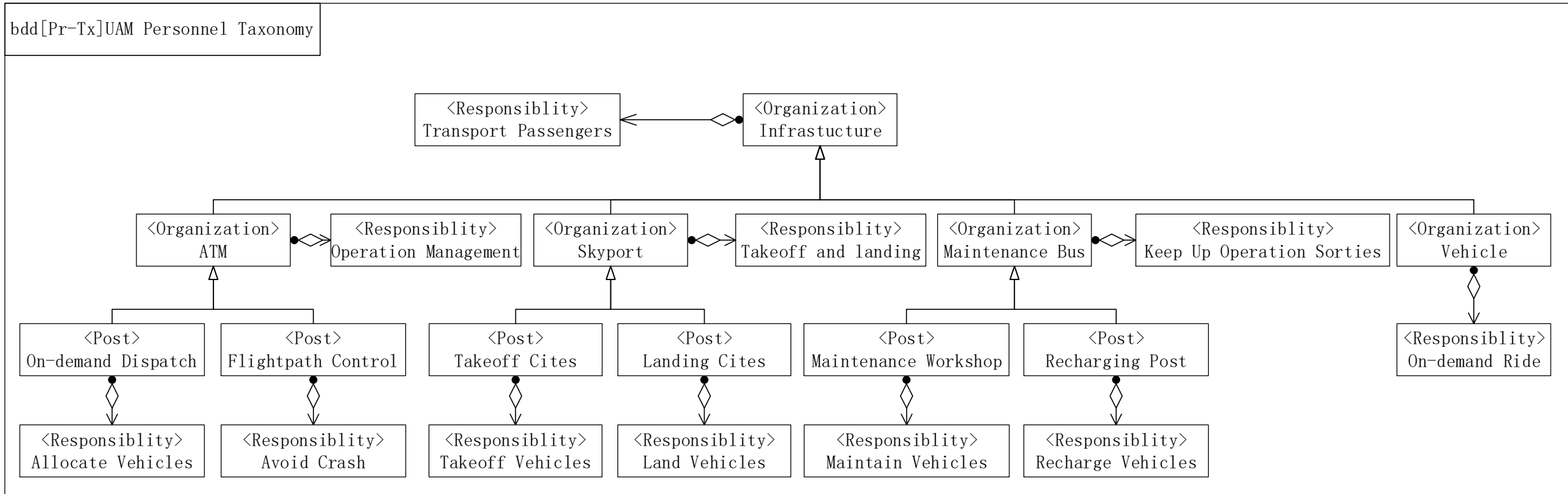
2.2 Operation Concept



2.2 Personnel Functions

- The UAM SoS contains systems of vehicles, air traffic management (ATM), takeoff/landing sites, vehicle maintenance hubs.
 - The vehicles are the vessel to transport passengers, whose aerial behaviors are conducted by the ATM system.
 - The ATM system directs the vehicles to takeoff and land on the skyports, and avoiding to crash into each other .
 - The maintenance is performed in the vehicle maintenance hubs, which could be either isolated or integrated into the skyports.

2.2 Personnel Functions



2.3 Operational Views

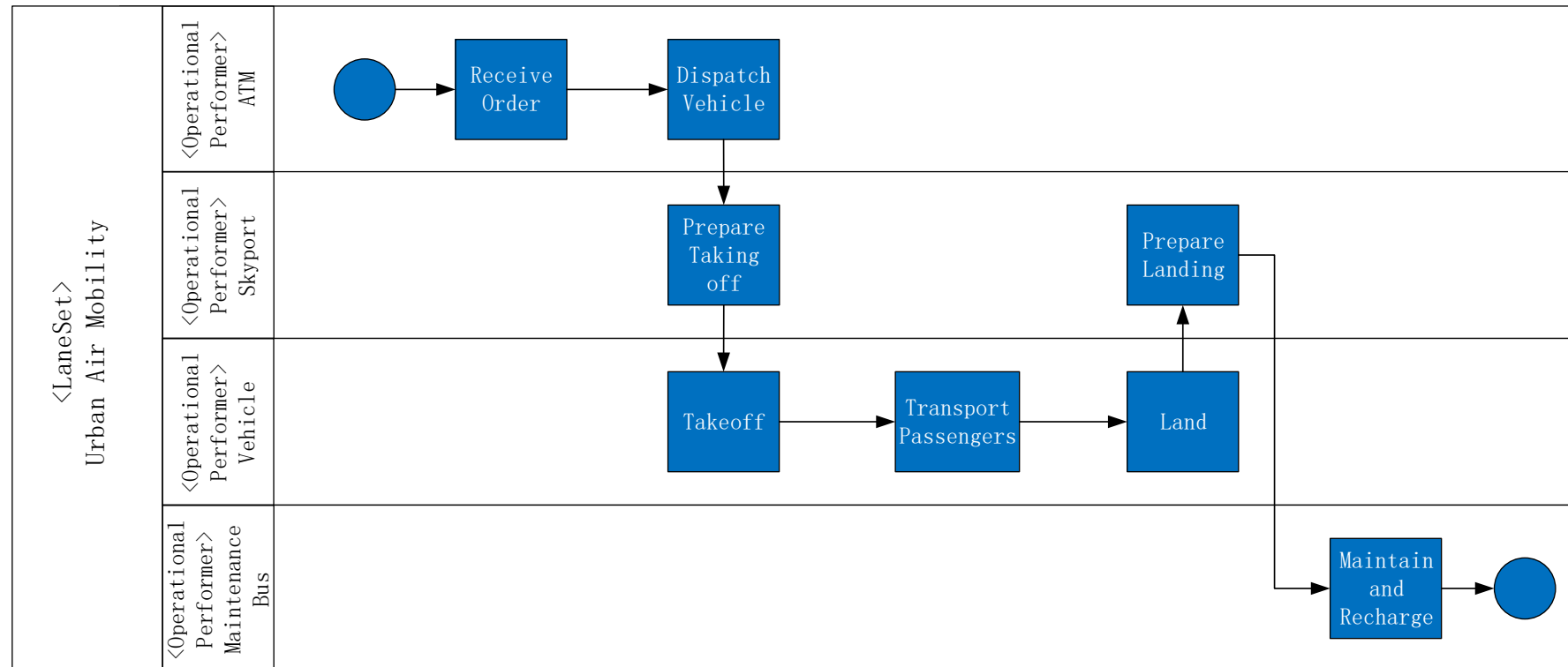
- The operational views illustrates the Logical Architecture of the enterprise.
- Describes the requirements, operational behavior, structure, and exchanges required to support (exhibit) capabilities.
- Defines all operational elements in an implementation/solution independent manner.

2.3.1 Operational Processes View

- The process of the operation starts when a passenger sends request for a trip through an mobile APP. A vehicle is then allocated to the skyport nearest to the passenger. After boarding, the vehicle takes off and fly to the destination via the flight path planned by the ATM. When arrives, the vehicle lands on the skyport and the passenger gets off to their destination. The vehicle should be checked for battery status. When ready, the vehicle waits for the next order to be taken.

2.3.1 Operational Processes View

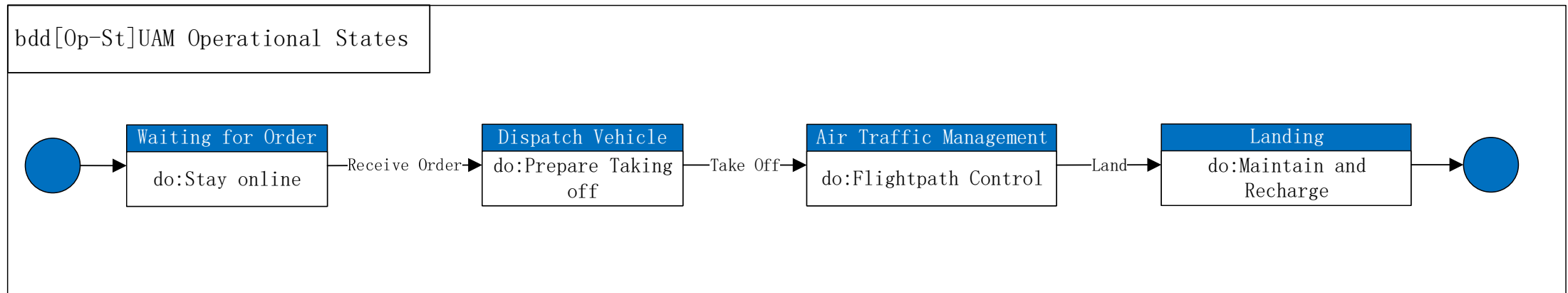
bdd[Op-Pr]UAM Operational Processes



2.3.2 Operational States View

- The operational states view captures state-based behavior of an element. It is a graphical representation of states of a structural element and how it responds to various events and actions.

2.3.2 Operational States View

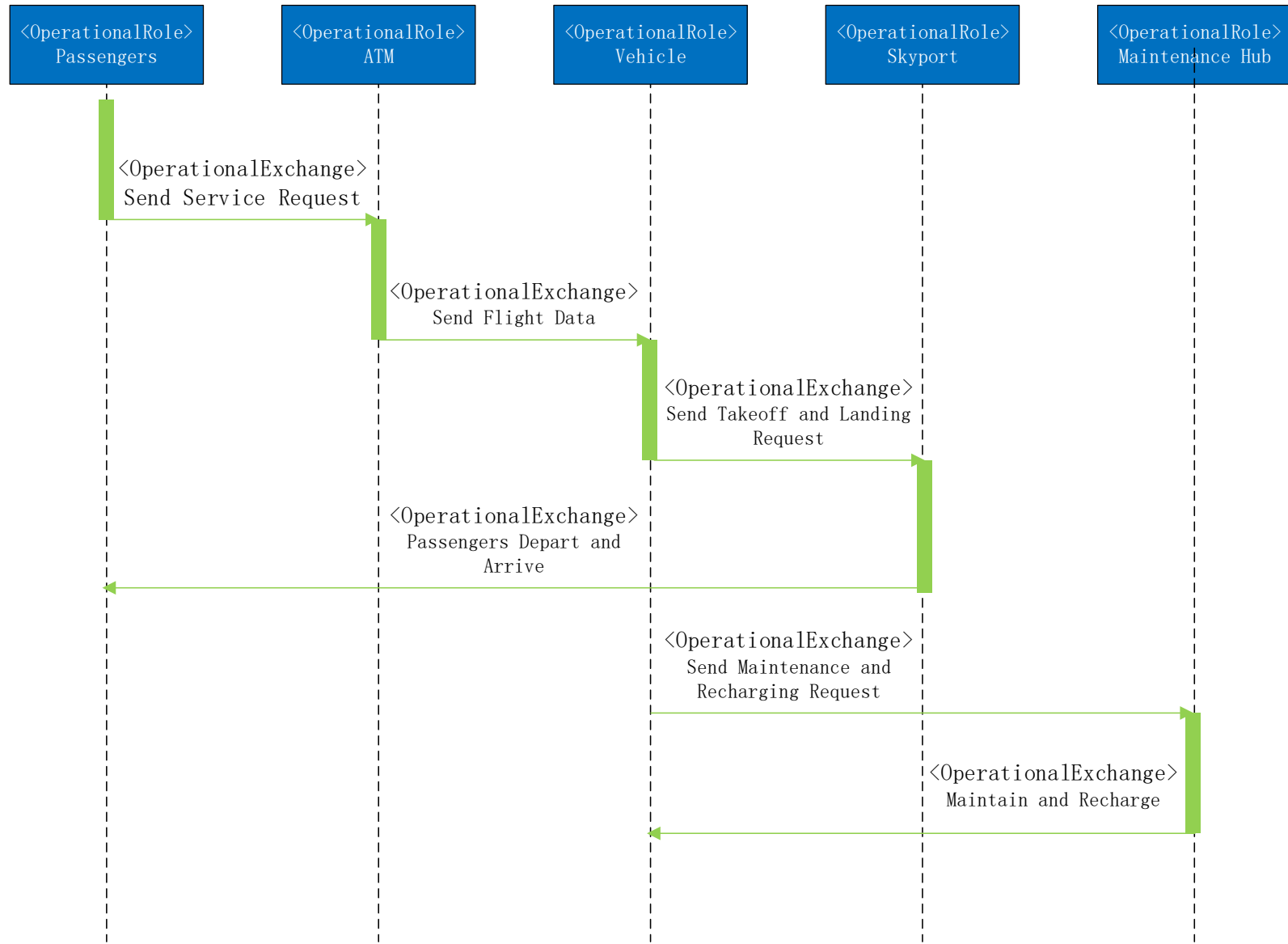


2.3.3 Operational Interaction Scenarios View

- The operational interaction scenarios view describes the interaction and data flow sequence between the operational roles such like passengers, the ATM, the vehicles, the skyports and the maintenance hubs. The view expresses a time ordered examination of the exchanges as a result of a particular scenario. Provides a time-ordered examination of the exchanges between participating elements as a result of a particular scenario.



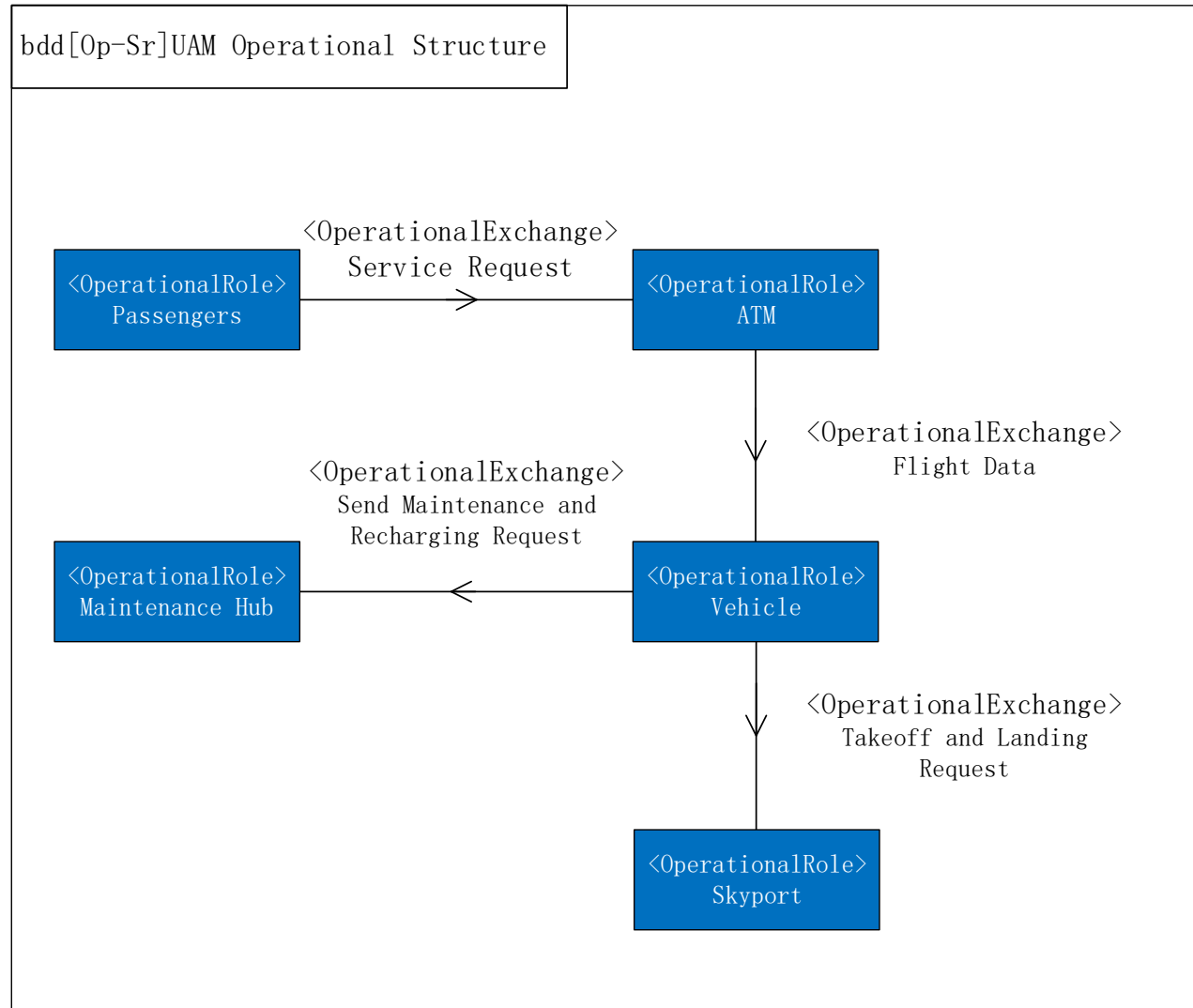
bdd[Op-Is]UAM Operational Interaction Scenarios



2.3.3 Operational Structure View

- The operational structure view describes the definitions of the dependencies, connections, and relationships between the different elements.

2.3.3 Operational Structure View



3-CONCLUSIONS

- The work described in the present paper has shown the first steps for the implementation of a Urban Air Mobility SoS, which has great potential in future commuting within city areas.
- The adoption of the architecture will allow system developers to generate fundamental operation concepts, hence to build the UAM SoS based on the concepts.
 - In particular it will be possible to form capabilities and operational descriptions, the data catalog, and a reference template, which will be available for the definition of new systems.
- According to UAF, the charts are essential to describe the workflow, personnel requirement, the operation standards and process of UAM, in sense of system of systems architecture.



APISAT 2019

Thank You!



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