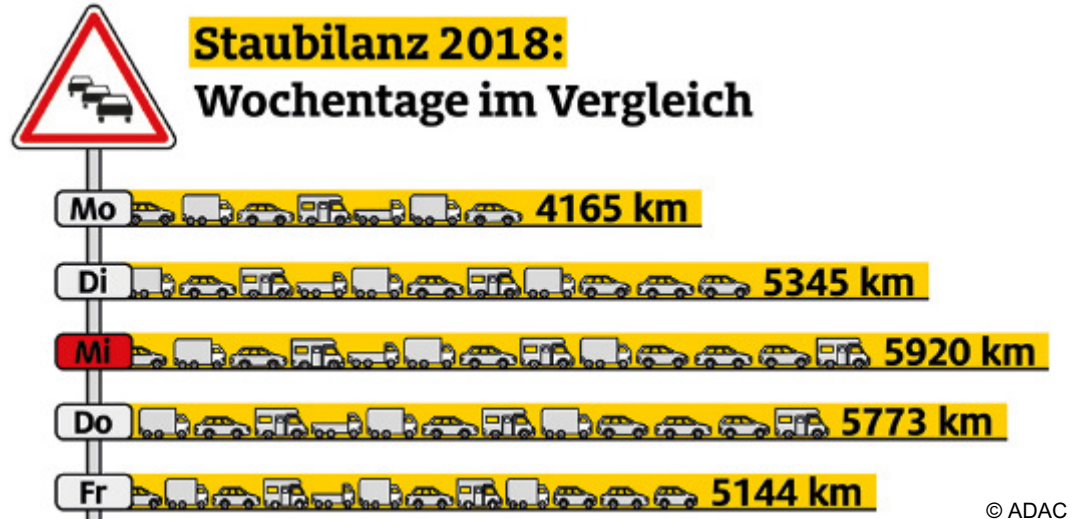




eSat The Silent Air Taxi Project – Advanced Aircraft Concepts for General Aviation

Eike Stumpf, RWTH Aachen

Traffic jams, delays, connection failures – traditional transport modes are increasingly encountering limits



0745	FR	2178	DUS Weeze	A	Verspätet	10:2
0755	4U	2014	Stuttgart	D	Verspätet	10:0
0755	FR	5492	Frankf Hahn	A	Verspätet	10:0
0800	FR	5903	Bremen	A	Verspätet	10:2
0800	4U	012	Köln Bonn	D	Verspätet	10:1
0810	FR	9703	Stockholm	A	Verspätet	10:2
0835	SX	4011	Bern	D	Verspätet	09:1
0850	EZS1591		Genf		Verspätet	10:2
0850	LY	351	Tel Aviv		Gelandet	
0855	EZY4371		Lyon		Verspätet	10:2

Ziel Destination	Gleis Platform/Voie	Status	Abfahrt Departure / Départ	Über Via
Kassel-Wilhelmsh.	Hamburg-Altona	verspätet +++ unbest.	08:41	ICE 973
Kassel-Wilhelmsh.	Frankfurt(M)Hbf	Achten Sie die angezeig.	08:41	S6
Berlin-Spandau - Berlin Hbf	Hamburg-Altona	spätet +++ unbestimm	08:45	IC 2434
Hamm - Dortmund - Essen	München Hbf	fällt aus! +++ Zug	08:48	RE30
Wuppertal - Köln Hbf	Bln-Gesundbrunnen	+++ Zug fällt aus	08:48	RE10
arburg - Hamburg Hbf	Düsseldorf	fällt aus! +++ Wg 27-21	08:51	RB38
Leipzig - Halle - Leipzig Hbf	Bonn-Bad Godesb	+++ Zug fällt aus	08:55	RE60
	Hamburg-Altona	+++ Zug fällt aus		
	Dresden	Achte beachten Sie die		

New transport modes due to a more intermodal aviation

First concepts, new players & totally different approaches



Change in aviation

- Focus on environment-friendly properties for new aircrafts, especially within General Aviation
- Enhanced intermodality between different transport modes to realize individual air mobility

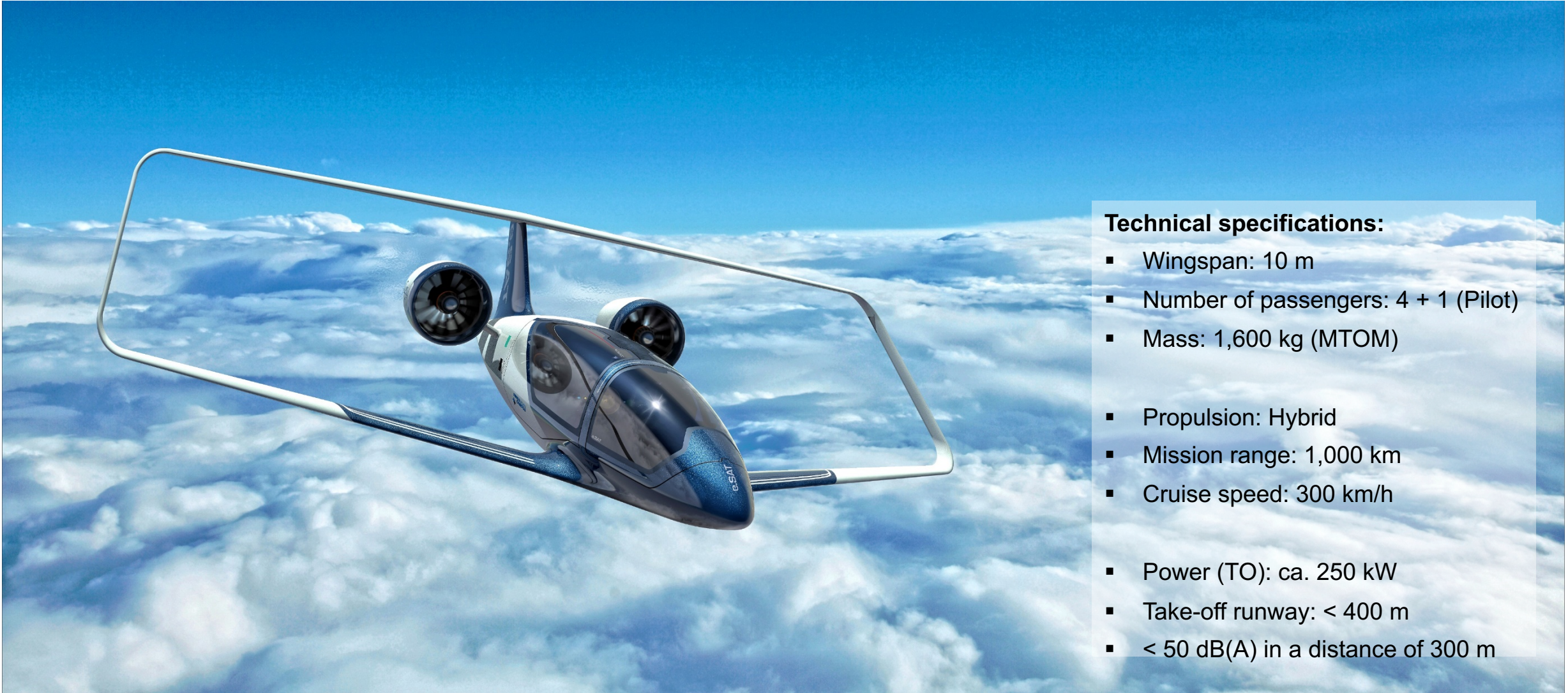
Urban & Regional Air Mobility

- Volocopter, Lilium, Airbus and a multitude of further companies develop fully electric & low-noise aircrafts for inner-city mobility
- Fully electric and hybrid concepts for regional travel distances close the gap between urban and (inter-) national mobility



- New technical possibilities as well as increased demands in terms of travel time allow the development & commercialization of innovative air transport concepts
- A multitude of enterprises follow various concepts that aim on different business fields

The Silent Air Taxi closes the transportation gap for mission ranges for up to 1,000 km – quiet, comfortable & affordable



Technical specifications:

- Wingspan: 10 m
- Number of passengers: 4 + 1 (Pilot)
- Mass: 1,600 kg (MTOM)

- Propulsion: Hybrid
- Mission range: 1,000 km
- Cruise speed: 300 km/h

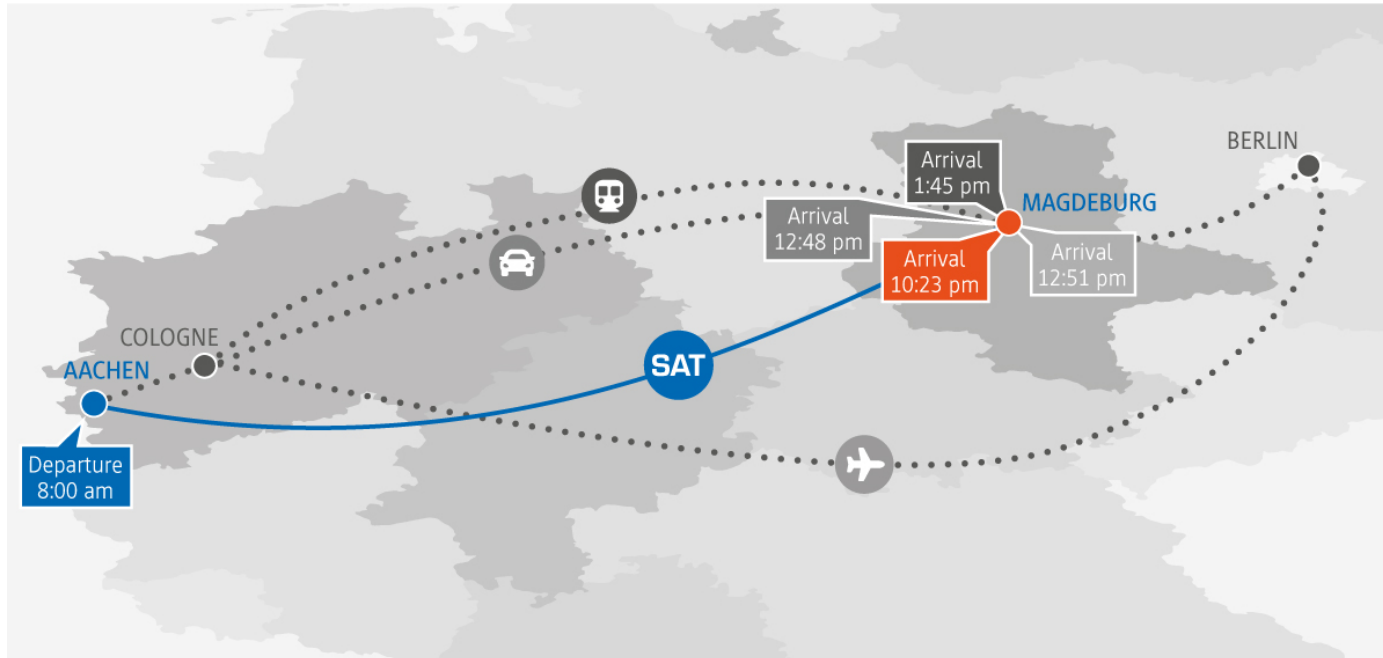
- Power (TO): ca. 250 kW
- Take-off runway: < 400 m
- < 50 dB(A) in a distance of 300 m

A fast, flexible and affordable transport between Aachen und Magdeburg?

The SAT provides the solution...

Route, travel time and costs for one person by means of transportation

One-Way-connection Fraunhofer IPT (Aachen) to Fraunhofer IFF (Magdeburg)



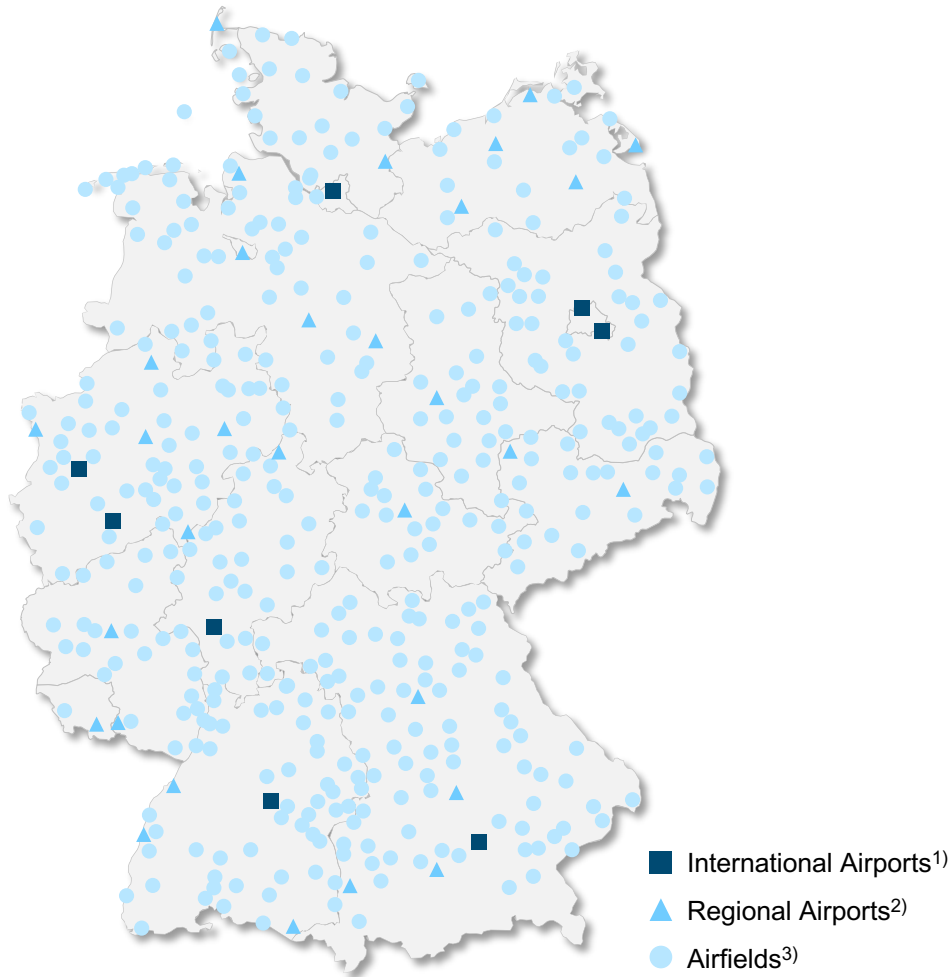
- The Silent Air Taxi opens up the potential to provide significantly quicker intermodal transport
- For trips apart from connections between major cities, travel time can be cut in half
- Trip cost (cab + SAT) can compete with other means of transportation
- With opportunity costs taken into account the SAT is the cheapest and quickest option available

SAT Silent Air Taxi (SAT)
 CS-25 scheduled flight
 Rental car
 Railway transportation

Transport vehicle	Travel time	Travel cost	Opportunity cost ⁵⁾	Total cost
CS-25 Scheduled flight ¹⁾	04:51 h	366,64 €	727,50 €	1094,14 €
Long distance rail ²⁾	05:45 h	201,60 €	862,50 €	1064,10 €
Rental car ³⁾	04:48 h	145,51 €	720,00 €	862,51 €
Silent Air Taxi ⁴⁾	02:23 h	259,25 €	357,50 €	616,75 €

¹⁾ Flight Eurowings ²⁾ 1. class train ticket (2x change of trains) + cab Aachen & Magdeburg; ³⁾ Europcar: VW Passat from Aachen incl. fuel expenses;
⁴⁾ Cap costs IPT → Merzbrück and airfield Magdeburg (EDBM) → IFF based on taximeter, SAT-cost presumed 0.5 €/km ⁵⁾ internal charge rate of 150 €/h presumed

A dense network of airports and especially airfields covers Germany and is ready for use



1) More than 10 Mil. passengers/ year 2) incl. Int. Airports < 10 Mil passengers 3) Both regular and special airfields

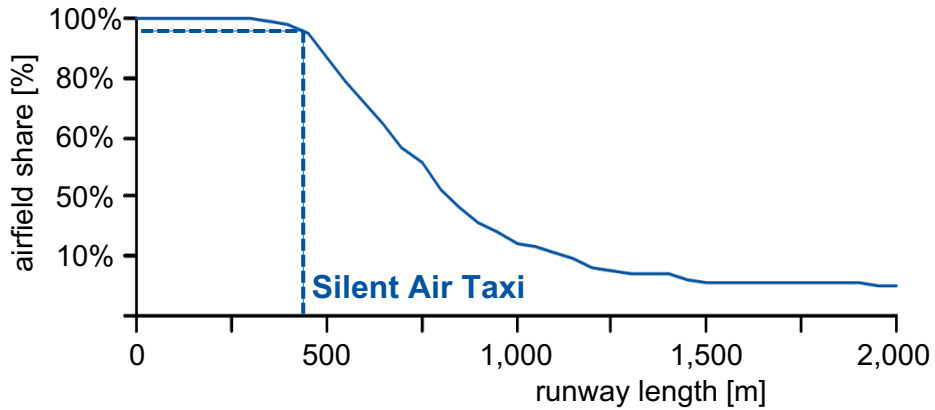
Airports & airfields in Germany

- About 400 airports and airfields are operated in Germany as of 2018
- Less than 40 airports can handle large aircrafts and significant amounts of passengers
- More than 350 airfields allow short point-to-point journeys and though a significant reduction of travel time

Impact for Urban & Regional Air Mobility

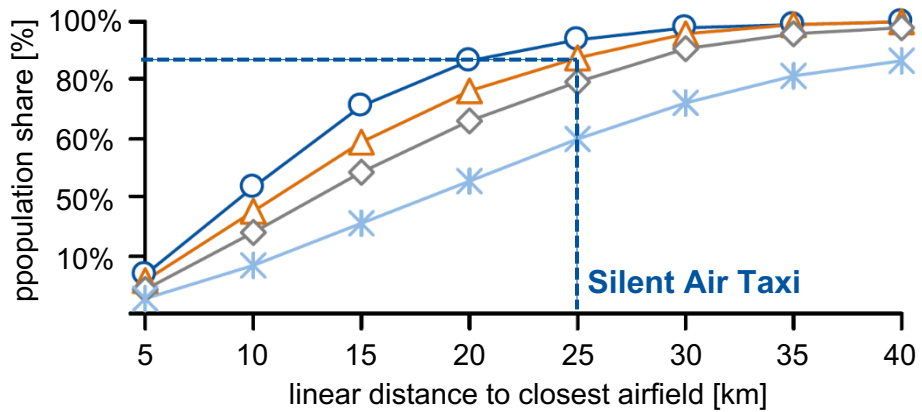
- Besides intra-city air transport, Urban Air Mobility will connect city centers with their nearest airfield to ensure short turn-over times
- Regional Air Mobility services relying on already existing infrastructure will drastically increase the accessibility of regions not covered by international airports

The Silent Air Taxi is able to fly from most German airports and therefore can reach a large share of population

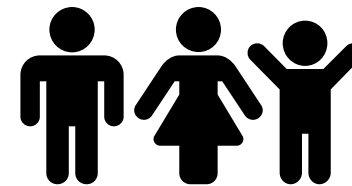


Situation in Germany

- Over 95 % of airports and airfield in Germany can be utilized by the SAT based on its short take-off and landing (STOL) ability
- More than 80% of the population live in a distance of 25 km or less to the closest airfield
- Therefore a superb infrastructure is already in place, which provides access to a majority of the citizens as potential customers



- all airfields (incl. CS-25)
- all airfields
- airfields ≥ 600m
- airfields ≥ 800m



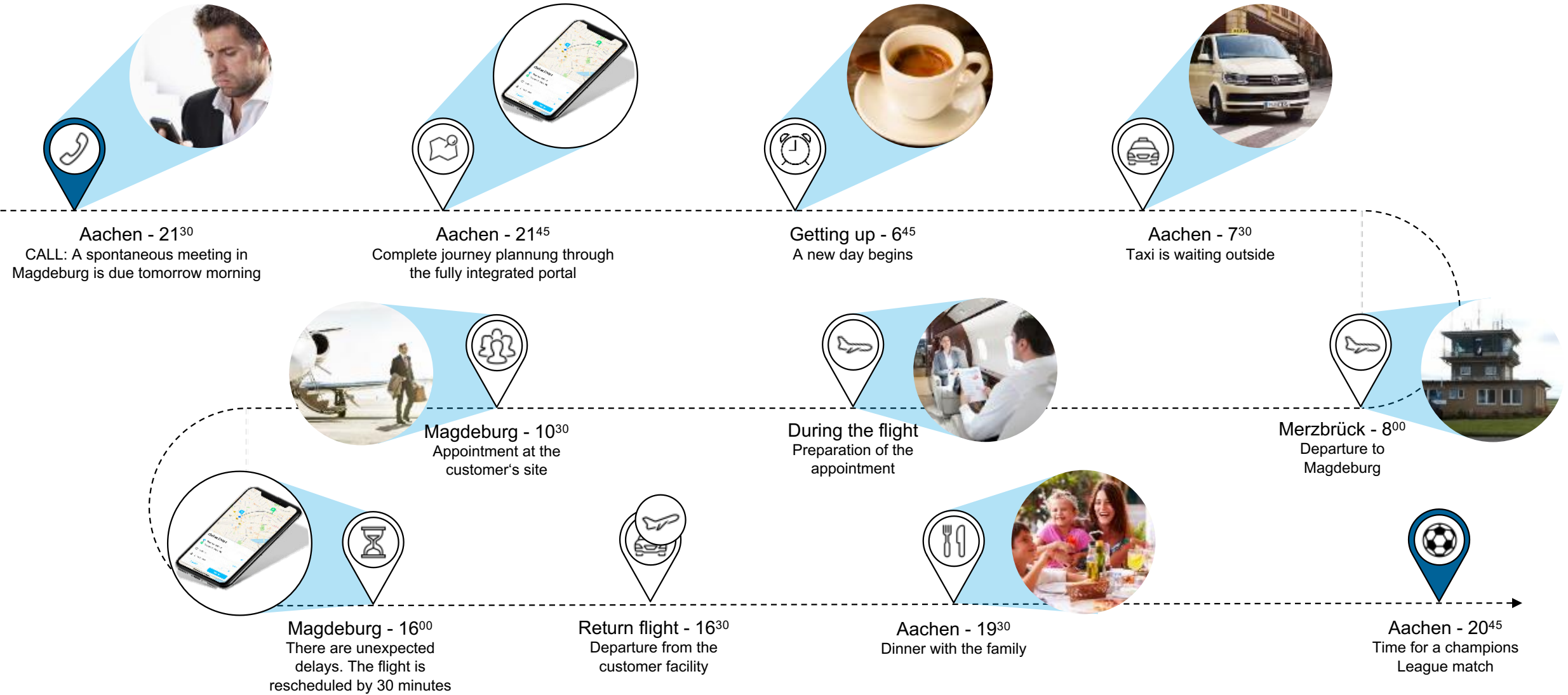
> 80 %



> 95 %

Vision of the »Silent Air Taxi«

New standard in terms of efficient & flexible travel time



SAT development is guided by a clear vision – based on the 10 core aspects of commercial air transports

The Silent Air Taxi – quiet, comfortable & affordable – for air taxi services & general aviation

Noise

- “Overflight indistinguishable from everyday background noise” – focused on airfield neighbor-hoods & interior noise levels

TCO¹

- Capital costs
- Energy requirement
- Maintenance costs
- Availability

Comfort

- Pleasant travel experience
- Large choice of available airfields
- On-Demand operations

Green

- Hybrid propulsion
- Aerodynamic efficiency



Requirements of commercial air transport services guide the development of the Silent Air Taxi and lead to a high product value for general aviation customers

1) Total Cost of Ownership

Competences at the Aachen location

About 50 experts are already working on the Silent Air Taxi today

Aircraft Design

Prof. Stumpf
Prof. Janser



Research & Development

Markus Wellensiek



Structural Design

Prof. Schröder
Prof. Gries



Product Development

Prof. Schuh



Product & Production Concept

Prof. Schuh



Prototyping & Production

Prof. Janser
Prof. Jeschke



Power Train

Prof. Jeschke
Prof. Hameyer



Flight Operation

Flugplatz Aachen-Merzbrück



System Optimization

Prof. Mathar
Prof. Abel



Human-Machine-Interface

Prof. Nitsch



Road to market for the Silent Air Taxi

Significant milestones up to entry into service

- Detailed design of the Silent Air Taxi
- Public kick-off in June 2019 as a major milestone for the marketing campaign
- Acquisition of research funds & risk capital to finance and expand development activities
- First flight of the Silent Air Taxi until 2022
- Entry into Service starting 2024
- Development of SAT-family (Cargo, all-electric, autonomous)
- Planned sales of > 1,000 units p.a.

