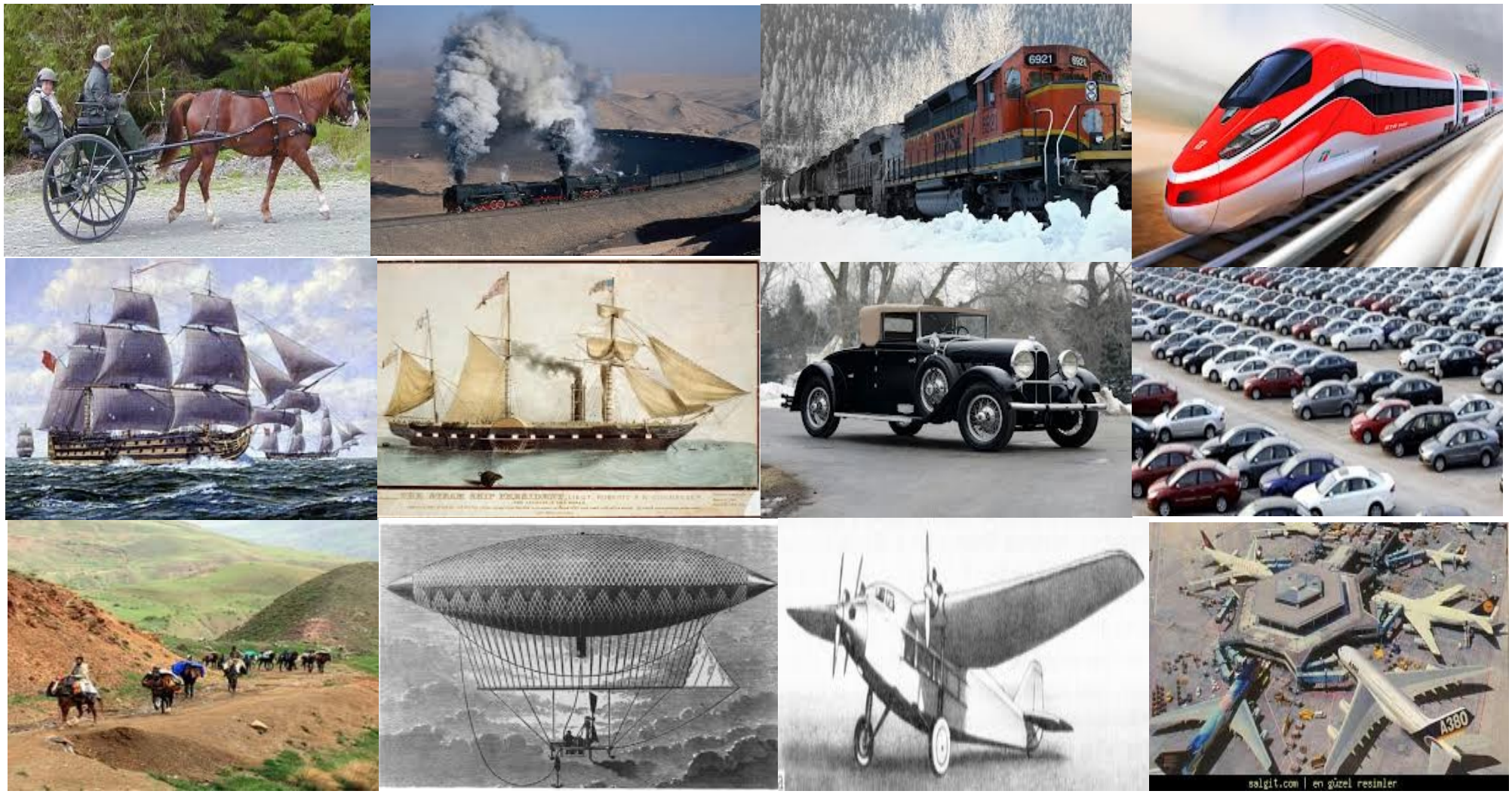
Future VTOL Personal and Mass Air Transportation System

https://www.youtube.com/watch?v=wHJTZ7k0BXU&feature=youtu.be

Technology Assessment of VTOL Personal and Mass Air Transportation System



Technology Assessment of VTOL Personal and Mass Air Transportation System

- **Setting a framework for the thesis**
- **The methodology for the case study**
- **Responses from service providers**

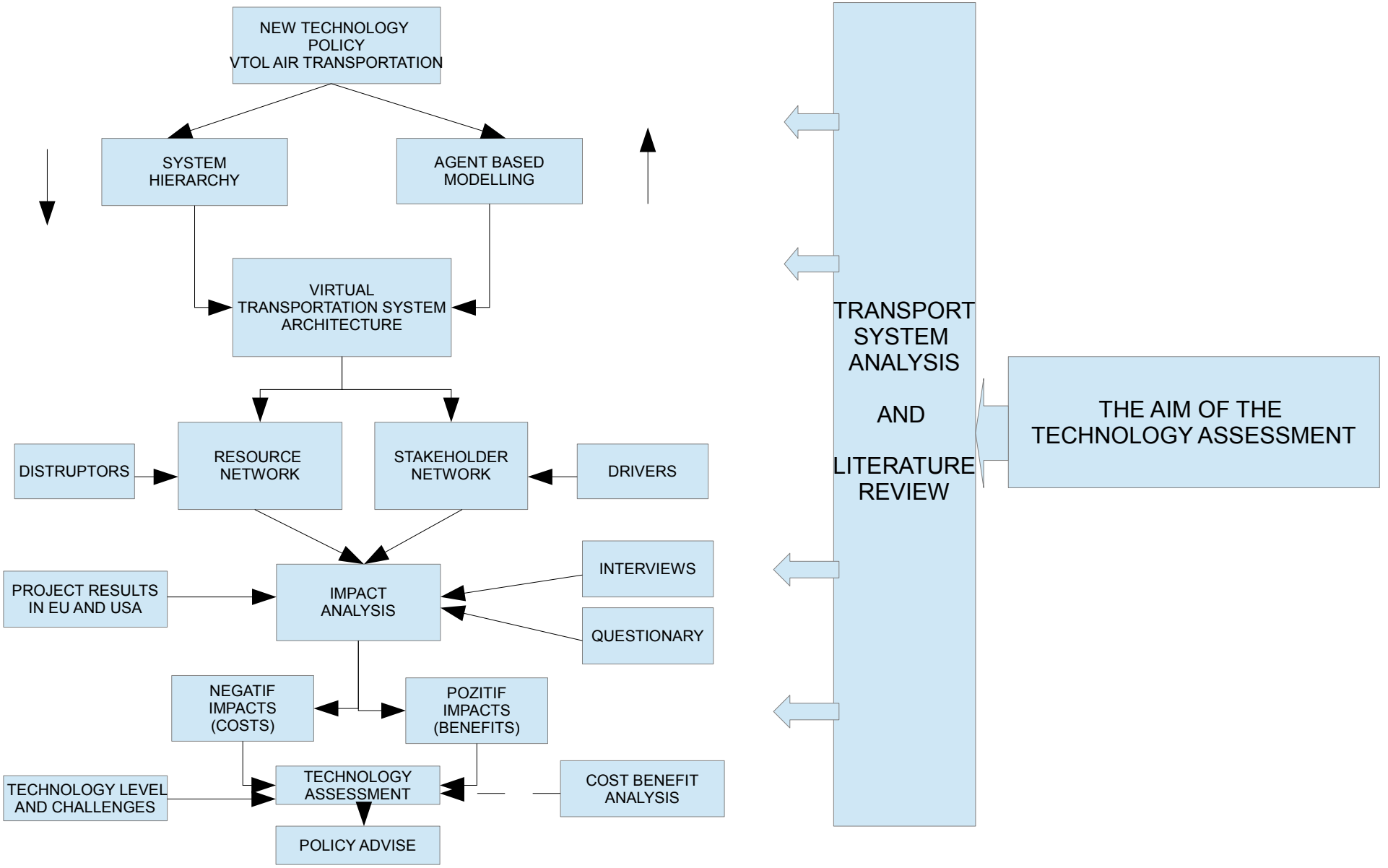
A. Mete Yazan

PhD. Program on Technology Assessment

Supervisors: Prof. Antonio Muniz,

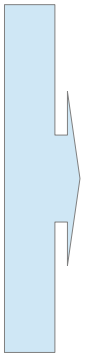
Prof. Michael Decker

The Framework for the Technology Assessment of VTOL Personal and Mass Air Transportation System



The Framework for the Technology Assessment of VTOL Personal and Mass Air Transportation System

- **Defining the aim of the technology assessment**
- **Understanding the big picture and getting familiar with the socio-technological system and basic terminology, in our case, VTOL Air Transportation System analysis**
- **Creating virtual VTOL Air Transportation Architecture in the light of transportation system analysis and technology assessment**
  - **Entity Centric Abstraction guides the construction of a virtual VTOL Air Transportation System coached in the form of an Agent Based Modelling**
    - **Stakeholder network**
    - **Resource network**
    - **Drivers**
    - **Distruptors**
    - **Environment**

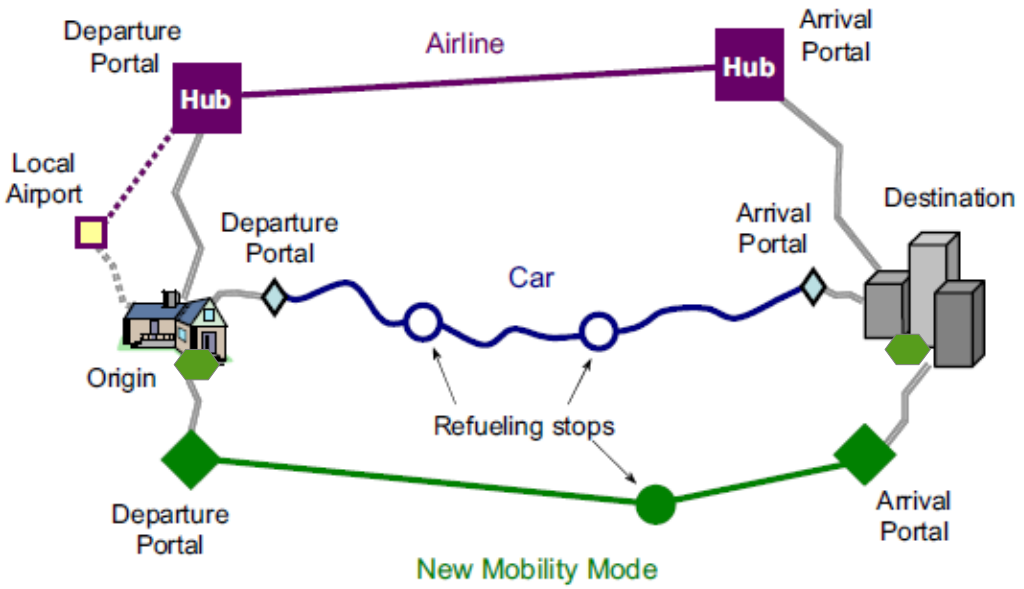


Transportation architecture

- **Impact analysis**
- **Policy advise**

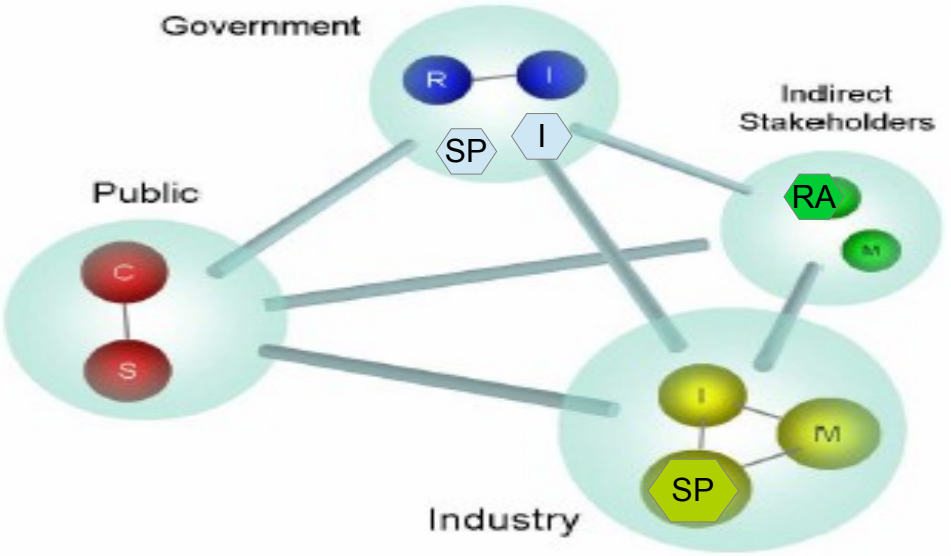
The Framework for the Technology Assessment of VTOL Personal and Mass Air Transportation System

- **RESOURCE NETWORK:**
  - **VTOL personal and mass air vehicle,**
  - **Vertiport,**
  - **Air traffic and airspace management,**



The Framework for the Technology Assessment of VTOL Personal and Mass Air Transportation System

- **STAKEHOLDER NETWORK:**
  - **Public:** Consumer (C) and Society (S)
  - **Government:**
    - **Central Government:** Regulator (R) and Infrastructure provider (I)
    - **Local Government:** Service Provider (SP)and Infrastructure provider (I)
  - **Industry:** Manufacturer (M), Service Provider (SP), and Insurance (I)
  - **Indirect Stakeholders:** Research Agency (RA) and Media (M)

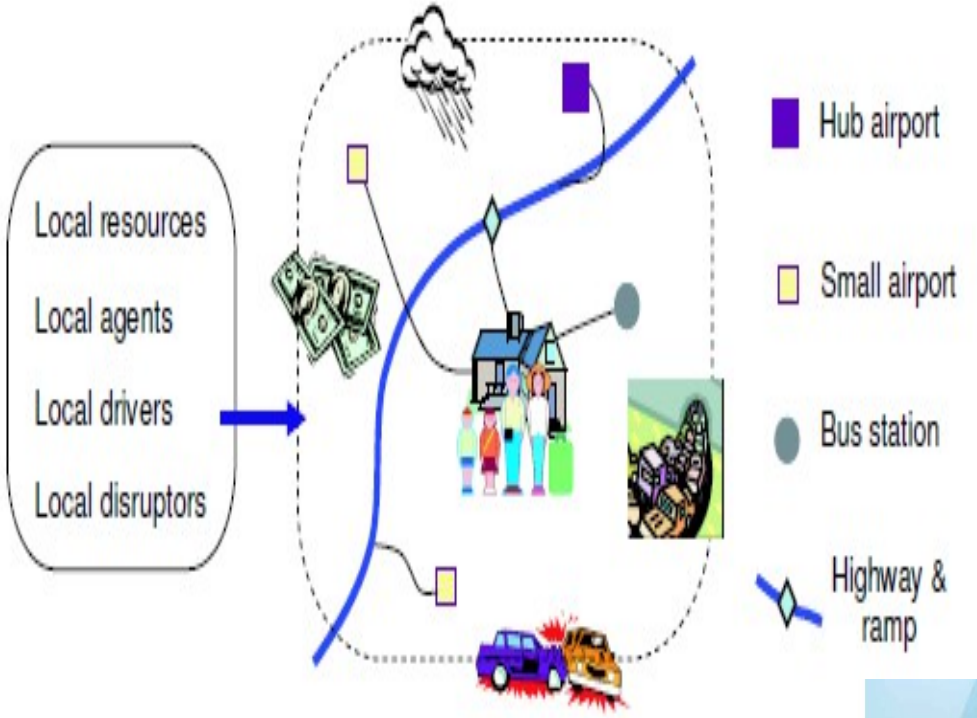


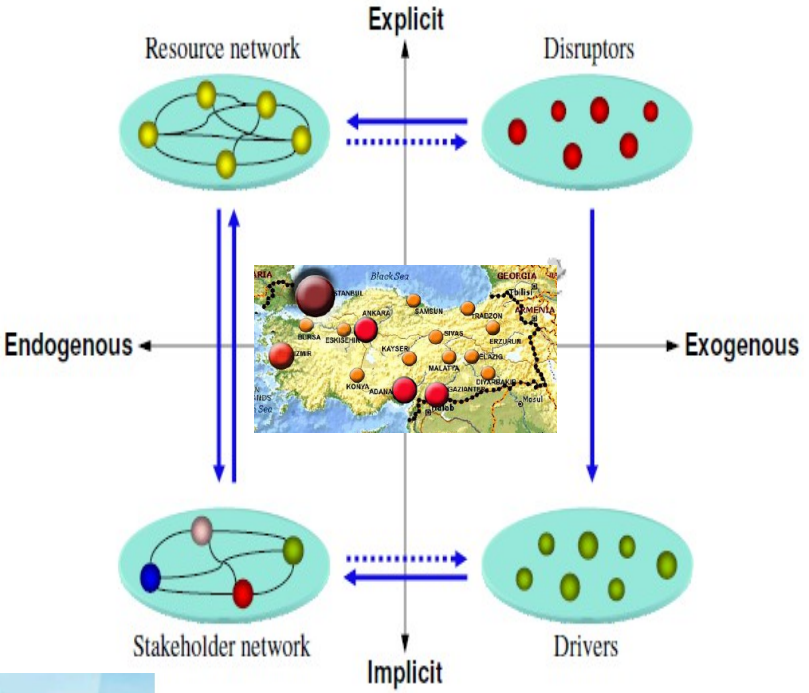
Transportation System Stakeholders

CATEGORY	STAKEHOLDER	OBJECTIVES
PUBLIC	**CONSUMER**	Min: travel time,expense Max:safety, mobility reach, comfort
	SOCIETY	Min: noise, emission Max:quality of life
CENTRAL GOVERNMENT LOCAL	**REGULATOR**	Max: safety, security
	INFRASTRUCTURE PROVIDER	Min: budget, delay Max: capacity
	SERVICE PROVIDER	Max: travel time saving, sustainability, consumer satisfaction
	INFRASTRUCTURE PROVIDER	Min: budget, delay Max: capacity
INDUSTRY	**MANUFACTURER**	Max: profit, market share, service provider satisfaction
	SERVICE PROVIDER	Max: profit, market share, customer satisfaction
	INSURANCE	Max: profit, market share, customer satisfaction
INDIRECT	RESEARCH AGENCIES	
	MEDIA	

The Framework for the Technology Assessment of VTOL Personal and Mass Air Transportation System

- **VIRTUAL TRANSPORTATION SYSTEM ARCHITECTURE**





Main Costs and Benefits

VTOL PERSONAL AND MASS AIR TRANSPORTATION SYSTEM		
COSTS		**BENEFITS**
ACQUISIATION COST	USER	**TRAVEL TIME SAVING**
OPERATION COST		DAILY MOBILITY REACH
NOISE		**DOOR TO DOOR BLOCK SPEED**
AIR TRAFFIC MANAGEMENT	SOCIETY	AVERAGE DELAY REDUCTION
INCREASING NUMBER OF AIR TRAFFIC		**REDUCE CONGESTION**
CRASH		**NEAR ON DEMAND**
PARKING		REDUCE INFRASTRUCTURE COST
GREENHOUSE IMPACT		DISASTER RELIEF
MAINTENANCE/INSURANCE COST	ENVIRONMENT	RELIABILITY
INFRASTRUCTURE COST		ANYWHERE
EMISSION (ELECTRICAL ONES WILL NOT EMIT DIRECTLY)		

The Methodology for the Case Study

THE AIM OF THE TECHNOLOGY ASSESSMENT

INDUSTRY

QUESTIONARY

USER

QUESTIONARY

SERVICE PROVIDERS

ISTANBUL

INTERVIEW

QUESTIONARY

IZMIR

INTERVIEW

QUESTIONARY

REGULATOR

SESAR

INTERVIEW

QUESTIONARY

SHGM

INTERVIEW

QUESTIONARY

DHMI

INTERVIEW

QUESTIONARY

COMPUTING THE VALUE OF TRAVEL TIME SAVING AND THE REDUCE OF TRAVEL COST

VISUALIZING THE POTENTIAL BENEFIT FOR REGIONAL TRANSPORTATION

QUALITATIVE TECHNOLOGY ASSESSMENT AND QUANTITATIVE SAMPLES

The Methodology for the Case Study

- **The perception, expectation and concern of the service providers, regulator and (user)**
  - **Interviews**
    - **Service providers**
      - **Two department managers of transportation planning departments in Istanbul, Izmir Municipality**
    - **Regulators**
      - **Four department managers at Civil Aviation Agency and State Airports Agency**
  - **Questionary**
    - **Service providers**
      - **30 Transportation planning department staffs at Istanbul and Izmir Municipality**
    - **Regulator**
      - **Staffs at Civil Aviation Agency and State Airports Agency**
- **Computing the value of travel time saving and the reduce of travel cost in Istanbul**
  - **Based on Istanbul transportation master plan, basic travel facts, cost benefit methods**
- **Visualizing benefit for regional transportation**

Personal and Mass Air Transportation System Survey Questionnaire for Service Provider

4. Perception of the System

Please rate your personal perspectives on the following activities using the scale below.

1 – Strongly Disagree, 2 – Somewhat disagree, 3 – Neither Agree nor Disagree,

4 – Somewhat Agree, 5 – Strongly Agree

I would be comfortable with flying in a self piloting personal air vehicle ……..... 1 2 3 4 5

I would be comfortable with flying in an aircraft flown by a fully autonomous pilot..……..... 1 2 3 4 5

I would prefer on demand air transportation rather than a scheduled airline..……....1 2 3 4 5

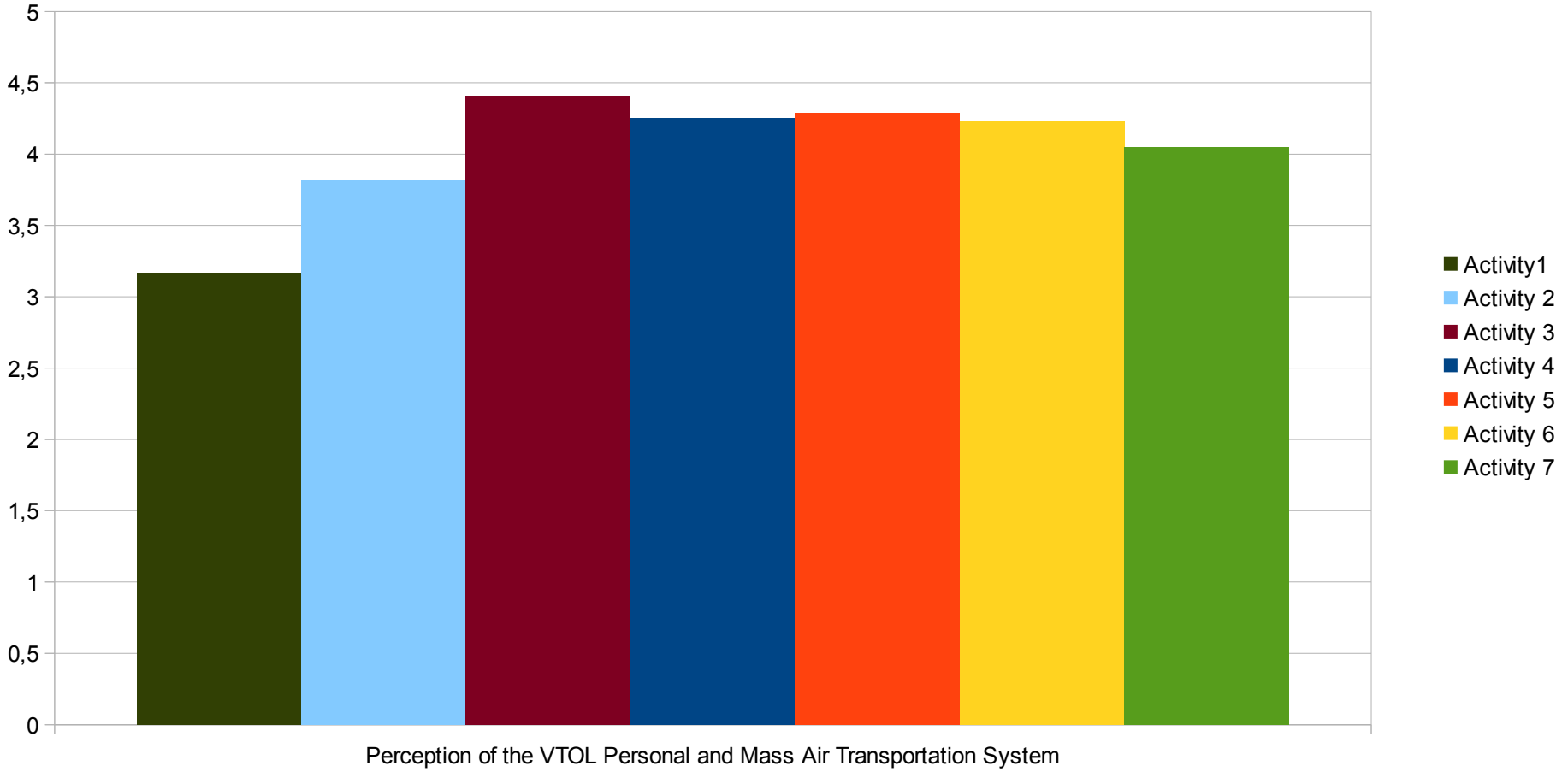
I would be comfortable with flying in air taxi.....……..……....1 2 3 4 5

I would be comfortable with flying in a single pilot monitored mass air vehicle…….....…....1 2 3 4 5

Using personal air vehicle for transportation is likely to help relief urban congestion..... 1 2 3 4 5

VTOL personal and mass air transportation system for urban and regional transportation can contribute business profit, traffic congestion relief, and daily life quality ….....1 2 3 4 5

Perception of VTOL Personal and Mass Air Transportation System



Personal and Mass Air Transportation System Survey Questionnaire for Service Provider

5. Please rate your highest priority expectations from highest 1 to 7 in case of implementing VTOL Personal and Mass Transportation System for urban and regional transportation.

o Acceptable noise level (7)

o Flight safety and security (1), (4)

o Affordable operation cost

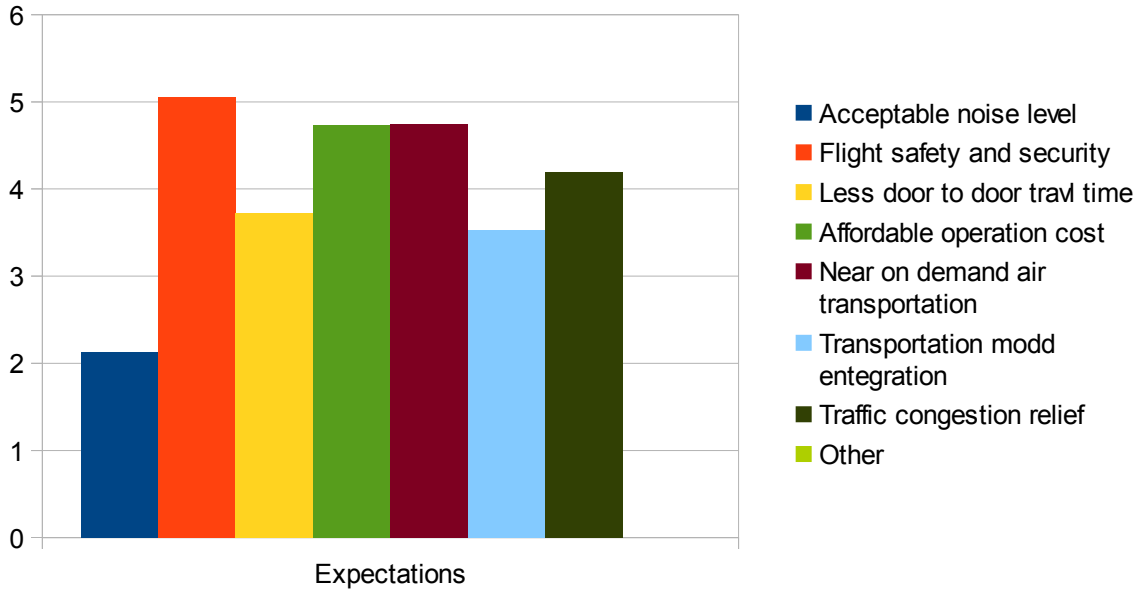
o Near on demand air transportation (3)

o Transportation mode entegration (2)

o Traffic congestion relief (4), (5)

o Less door to door travel time (1), (6)

o Other, please define



Personal and Mass Air Transportation System Survey Questionnaire for Service Provider

6. Please rate your highest priority concerns from highest 1 to 9 in case of implementing VTOL Personal and Mass Transportation System for urban and regional.

o Noise

o Safety (2)

o Security (3)

o Operation cost, affordability

o Emission

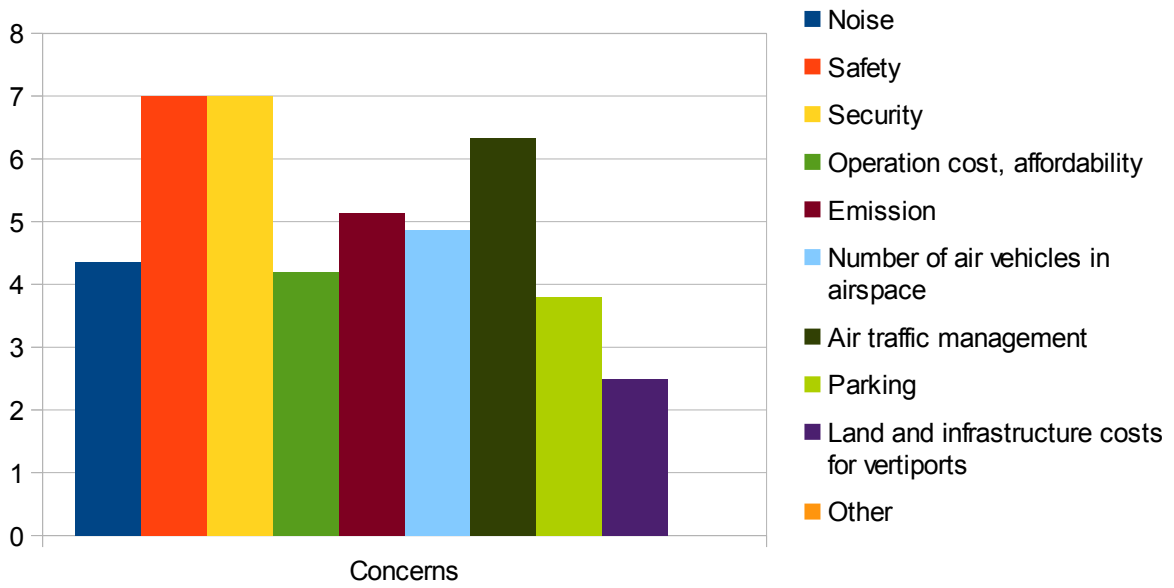
o Number of air vehicles in the airspace

o Air traffic management (1)

o Parking

o Land and infrastructure costs for vertiports

o Other, please define



Personal and Mass Air Transportation System Survey Questionnaire for Service Provider

11. Please rate main challenges to enable VTOL Personal and Mass Air Transportation System for urban and regional transportation, from highest 1 to 6.

o Technology maturity (4)

o Air Traffic Management (2)

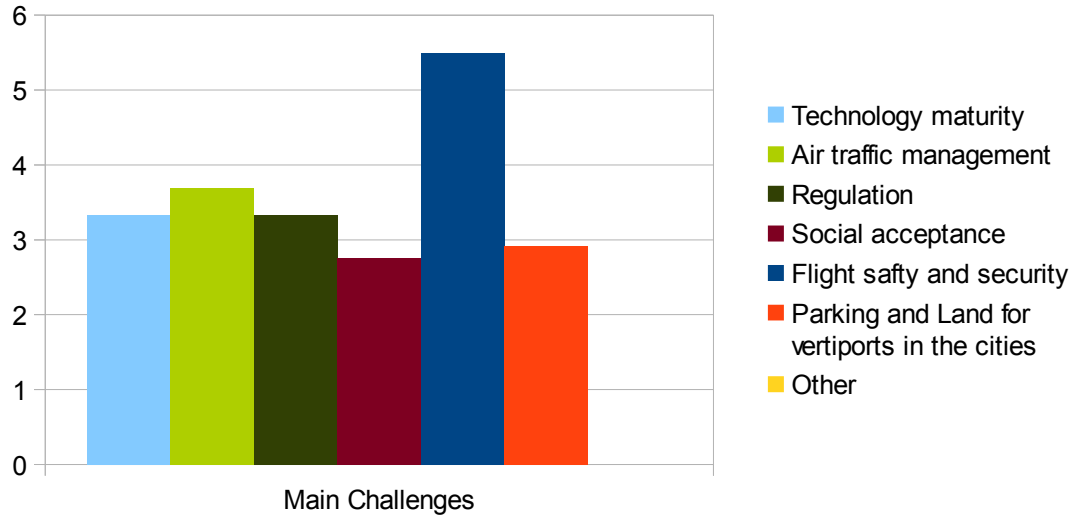
o Regulation

o Social acceptability

o Flight safety and security (1)

o Parking and Land for vertiports in the cities (3)

o Other, please define



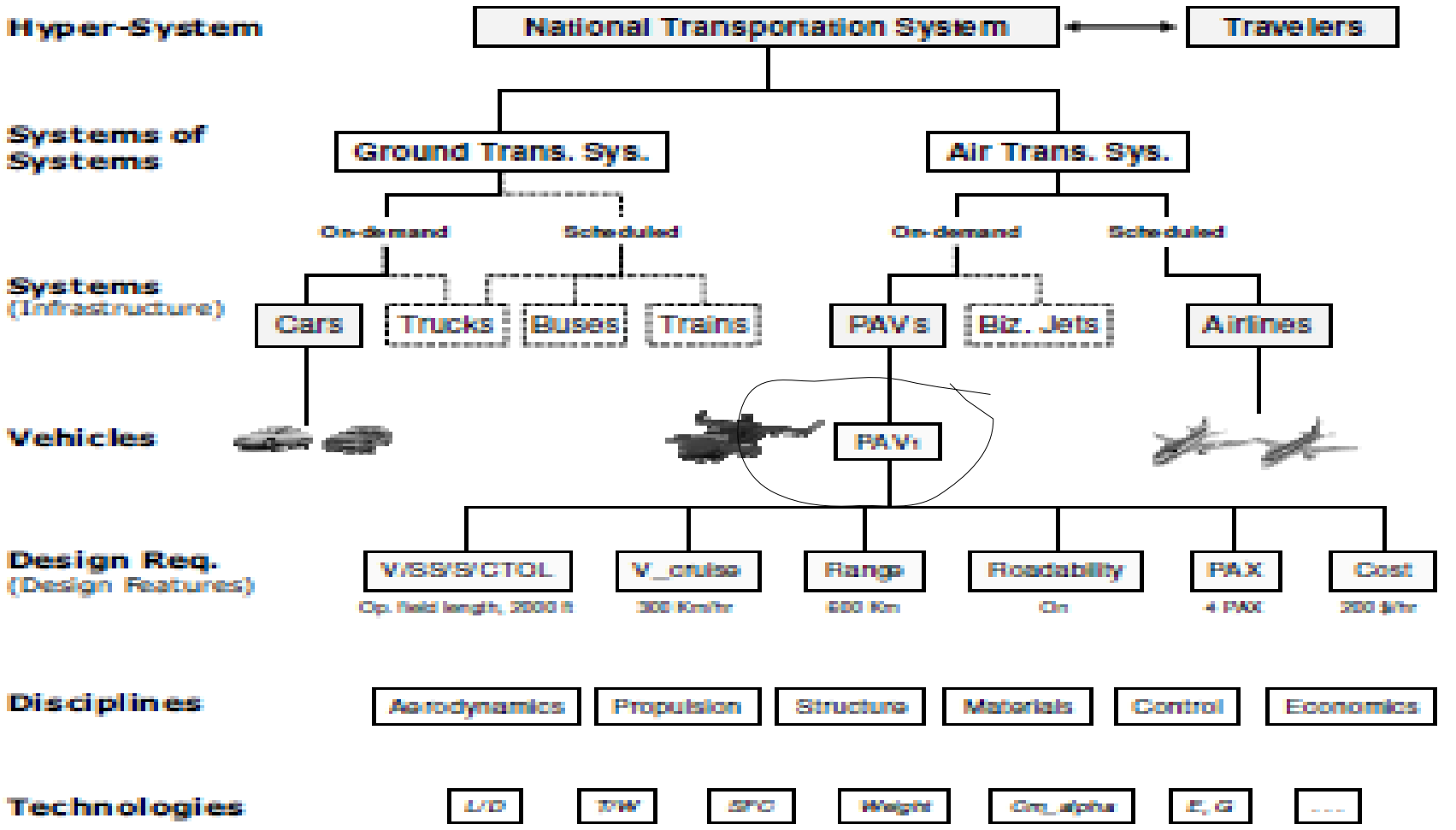
Personal and Mass Air Transportation System Survey Questionnaire for Service Provider

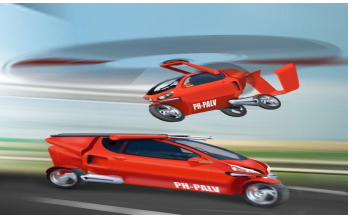
- Results:
  - Findings seem parallel with the papers`
  - The perception of the system is positive
  - Flight safety and security is the main concern, expectation and challenge
  - At the moment, the VTOL Personal and Mass Air Transportation System is beyond the scope of their projects
  - There is not any institutional organizationor structured approach which is working on this emerging transportation option

THANK YOU

ANY QUESTION?

Transportation System Hierarchy

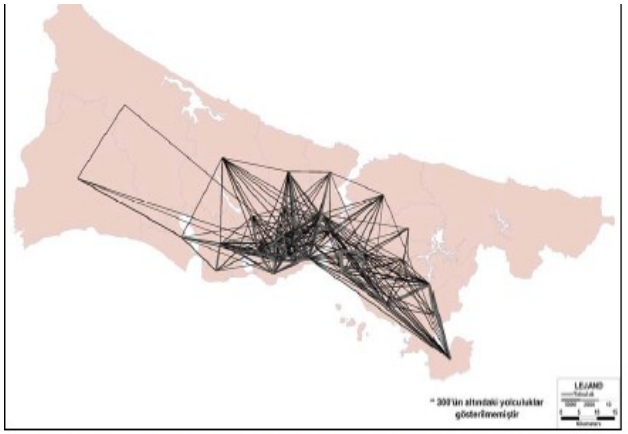




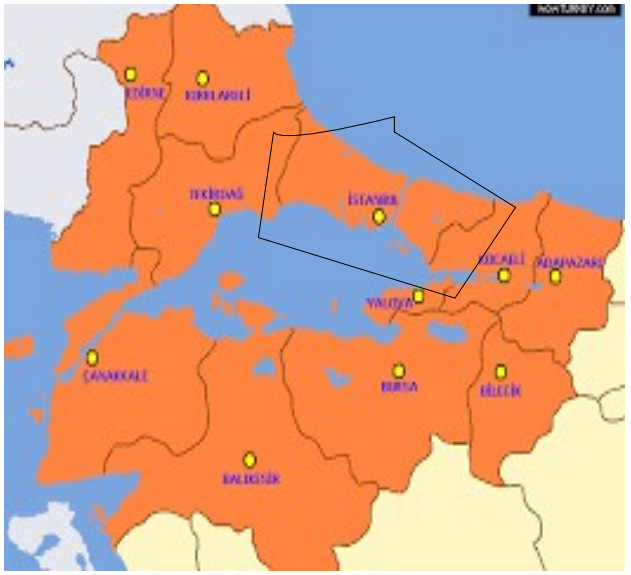
IMPACT ANALYSIS			VTOL PERSONAL AND MASS AIR TRANSPORTATION SYSTEM			STAKEHOLDER IMPACT PARAMETERS
			VEHICLE	INFRASTRUCTURE	ENROUTE	
STAKEHOLDERS	PUBLIC	USERS				OWNERSHIP COST, OPERATION COST, TRAVEL TIME, CONGESTION, DAILY MOBILITY REACH, SAFETY, CRASH, EASY TO FLY TECHNOLOGY, ROADABILITY, CRUISE SPEED, CAPACITY, RANGE, DAILY MOBILITY REACH, DOOR TO DOOR BLOCK SPEED, TRAVEL TIME SAVING, DELAY REDUCTION, PARKING, TAKE OFF AND LANDING PORTS, NOIS, WAITING TIME, TRANSFER TIME, ENTEGRATION OF MODES, INSURANCE/MAINTENANCE COST, OPERATION TYPE; PRICE/FEE SCHEDULE, ON DEMAND, NEAR ALL WEATHER, LICENCE REQUIREMENT
		SOCIETY				NOISE, EMISSION, SECURITY, CRASH, RESOURCES, LAND USE AND VALUE, CONGESTION ,DELAY, WASTE OF TIME AND FUEL, CRASH, WATER, ROAD FACILITIES,INCREASING NUMBER OF AIR VEHICLE, TRAFFIC SERVICES, PORTAL ACCESSIBILITY
	GOVERNMENT	REGULATORY AGENCY				SAFETY, SECURITY, AIRSPACE, AIR TRAFFIC MANAGEMENT, NUMBER OF AIR VEHICLES, PORT MANAGEMENT, OPERATION, SEARCH AND RESCUE, MEDICAL TRANSPORTATION, LICENSE REQUIREMENT, CRUISE SPEED, RANGE, CAPACITY, TYPES OF PORTALS
		INFRASTRUCTURE PROVIDER				TYPES OF PORTALS, PORT CAPACITY, VEHICLE ROADABILITY, LAND USE AND VALUE, MAINTENANCE COST, PARKINGPORT FACILITIES AND SERVICES, ENTEGRATION OF SECONDARY MODES
	INDUSTRY	SERVICE PROVIDER				ACQUISITION COST, OPERATION COST, INSURANCE COST , MAINTENANCE COST, OPERATION, PRICE/FEE, RELIABILITY, CAPACITY, RANGE, TRAVEL TIME SAVING, PORT FACILITIES, ENTEGRATION OF SECONDARY MODES, REDUCING CONGESTION, DAILY MOBILITY REACH, WEATHER RESISTANCE, LICENSE REQUIREMENT, SAFETY AND SECURITY, PORTAL ACCESSIBILITY,
		MANUFACTURER				
		INSURANCE				
	INDIRECT	RESEARCH AGENCIES				
		MEDIA				
ENVIRONMENT						NOISE, EMISSION, WATER POLUTION, CONGESTION, PARKING, LAND USE, ROAD FACILITIES
			AUTOPILOT, ROADABILITY, CRUISE SPEED, RANGE, CAPACITY, VTOL, NOISE, EMISSION, NEAR ALL WEATHER	TYPES OF PORTS; POCKET AIRPORT, VERTIPORT, LAND USE, PARKING, ENTEGRATION OF MODES, SECURITY	AIRSPACE AND AIR TRAFFIC MANAGEMENT, INCREASING AIR TRAFFIC, SAFETY, HIGHWAY IN THE SKY	

Can Increase Daily Radius of Reach

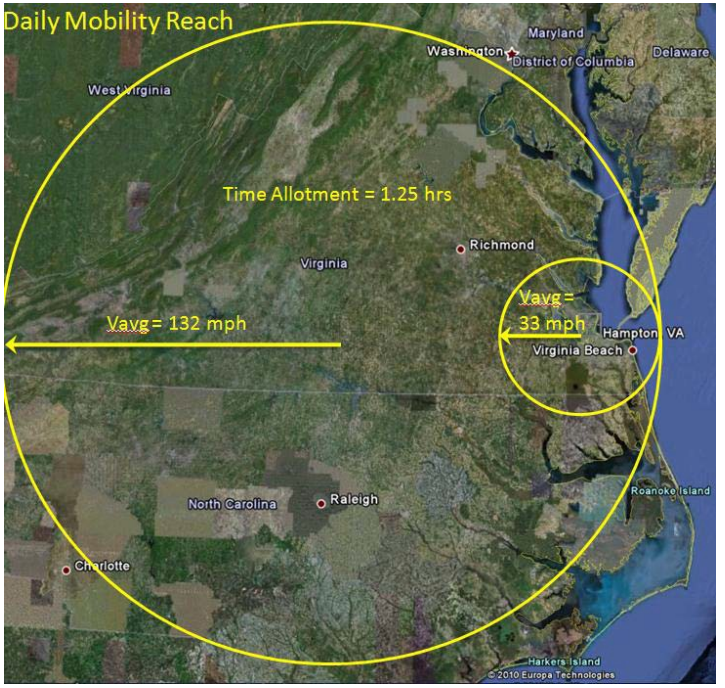
- Current and expected daily radius of reach in Istanbul



kil 10.1.12 Mevcut Durum için Tüm Amaçlara Göre Zirve Saat Toplu Taşıma Yolculukları

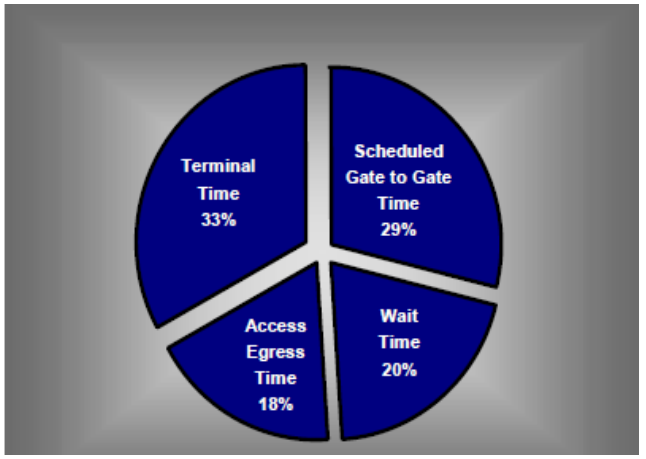


- Increasing daily radius of reach with high speed VTOL Air Vehicle

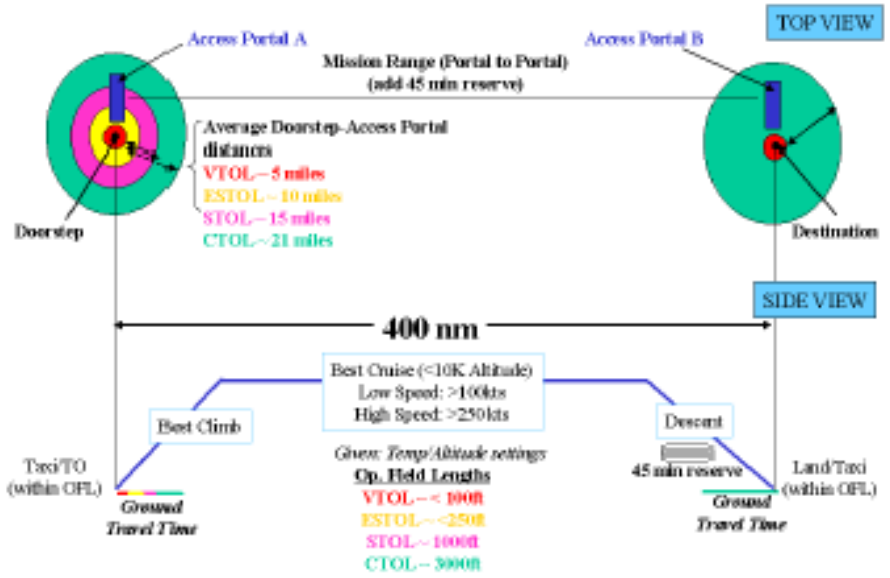


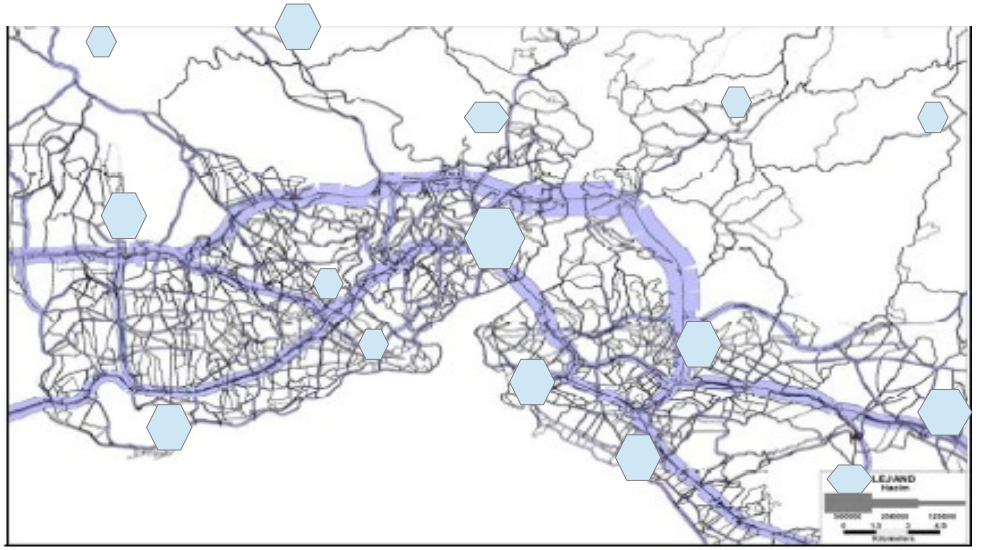
Can Save Travel Time and No Need Runway

- Can increase door to door block speed and save travel time



- Almost from anywhere to anywhere, no need runway
- Near on demand

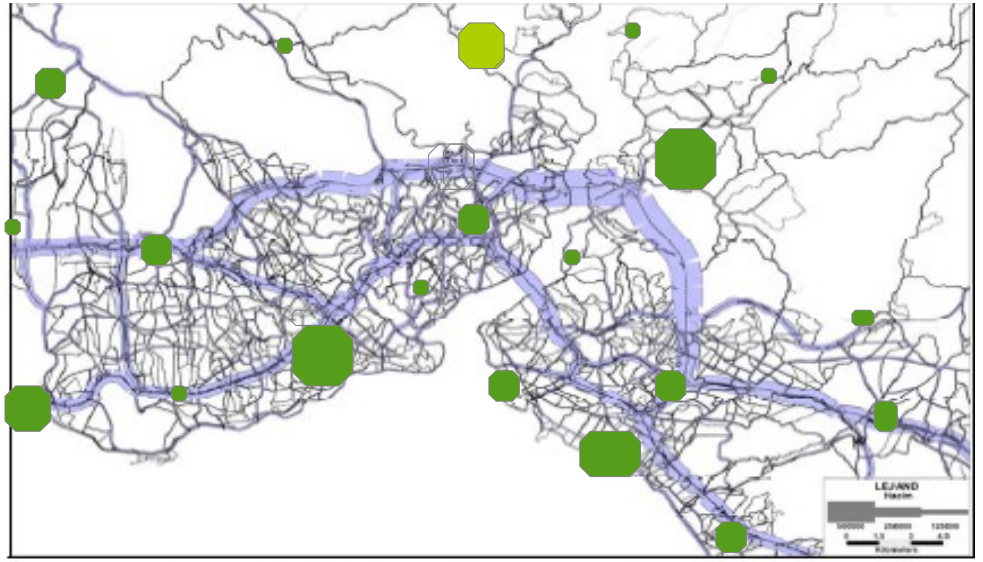




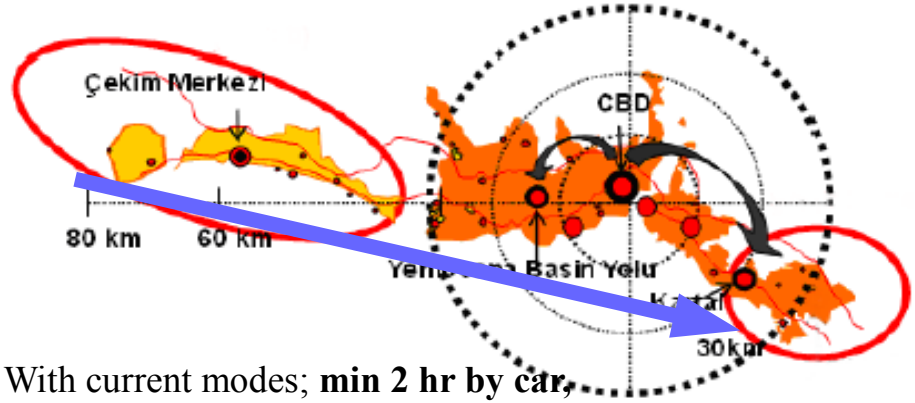
Şekil 10.1.15 2023 Temel Durum Günlük Hacim Değerleri

Suggested VTOL Air Vehicles and Vertiports

Type	Where	Capacity	Purpose
VTOL PAV	Urban	1 to 2 seats	Personal transportation
VTOL PAV	Regional	4 to 6 seats	Personal transportation, medical transportation, search and rescue
	Urban		Air taxi, medical transportation, search and rescue
VTOL MAV	Urban	10+1 seats	Personal transportation
	Regional		
VTOL MAV	Urban	20+1 seats	Personal transportation
	Regional		



Şekil 10.1.15 2023 Temel Durum Günlük Hacim Değerleri



- With current modes; **min 2 hr by car,**
- with VTOL Air Transportation; **max 00:30 hr**

Şekil 8.3.4 Çok Merkezli Şehirsel Gelişme

Potential Benefit in Regional Transportation

- Point to point, on demand, high speed, VTOL regional air transportation

- Options to go my hometown

No	Option	Travel time	
1	By car	**12** hrs(min)	Travel time+ refresh time
2	By bus+by bus	**16** hrs(min)	Doorstep to port+waiting time+Travel time+ port to destination time
3	By train+by bus	**12** hrs(min)	Doorstep to port+waiting time+Travel time+transfer time+ port to destination time
4	By airline+ by bus	**10** hrs(min)	Doorstep to port+waiting time+Travel time+transfer time+ port to destination time
5	By high speed VTOL Air Transportation	**2:30** hrs(max)	Doorstep to port+waiting time+Travel time+ port to destination time

Benefit Visualization Tool

- Requirement parameters
  - Mission requirements
    - Mission range
    - Wait time at portal
  - Vehicle requirements
    - Vehicle air speed
    - Acquisition cost
    - Operating cost
  - User requirement
    - Personal income
    - Utilisation

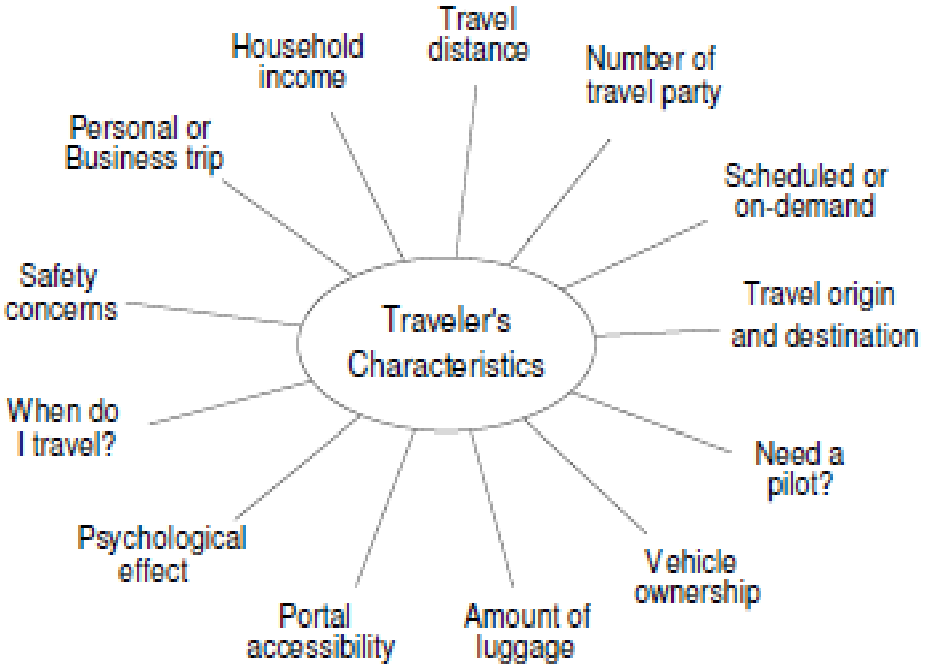
Source: http://www.asdl.gatech.edu

Key Factors for Transportation Mode

Key Factors for Transportation Mode Choice

- Availability
- Cost
- Time saving, door to door travel time
- Reliability
- Subjective factors
  - Comfort
  - Privacy
  - Prestige

Traveler`s Profile



The Overall Goal

- Vertical and extremely short take off and landing,
- Operation at blockspeeds markedly faster than current combinations of land and air transporation,
- Increasing daily radius of action,
- Unit cost comparable to current luxury cars and small general aviation aircraft,
- Excellent reliability,
- Minimum environmental cost,
- Excellent safety comparable with airlines,
- Ability to integrate with existing land and air transportation system,
- **In short**, the vision has been to enable people and goods everywhere to have the convenience of on-demand point-to-point travel, anywhere, anytime in less travel time, through a network of pocket airports and vertiports.

New VTOL Projects