Future VTOL Personal and Mass Air Transportation System

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

https://www.youtube.com/watch?v=6v5iMeRl5Qo&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

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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
- 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

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>STAKEHOLDER</th>
<th>OBJECTIVES</th>
</tr>
</thead>
</table>
| PUBLIC              | CONSUMER          | Min: travel time, expense  
                                Max: safety, mobility reach, comfort                                      |
|                     | SOCIETY           | Min: noise, emission  
                                Max: quality of life                                                        |
| CENTRAL GOVERNMENT  | REGULATOR         | Max: safety, security                                                       |
| LOCAL               | 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

<table>
<thead>
<tr>
<th>VTOL PERSONAL AND MASS AIR TRANSPORTATION SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>COSTS</td>
</tr>
<tr>
<td>ACQUISITION COST</td>
</tr>
<tr>
<td>OPERATION COST</td>
</tr>
<tr>
<td>NOISE</td>
</tr>
<tr>
<td>AIR TRAFFIC MANAGEMENT</td>
</tr>
<tr>
<td>INCREASING NUMBER OF AIR TRAFFIC</td>
</tr>
<tr>
<td>CRASH</td>
</tr>
<tr>
<td>PARKING</td>
</tr>
<tr>
<td>GREENHOUSE IMPACT</td>
</tr>
<tr>
<td>MAINTENANCE/INSURANCE COST</td>
</tr>
<tr>
<td>INFRASTRUCTURE COST</td>
</tr>
<tr>
<td>EMISSION ( ELECTRICAL ONES WILL NOT EMIT DIRECTLY )</td>
</tr>
</tbody>
</table>
The Methodology for the Case Study

The Aim of the Technology Assessment

User Service Providers Regulator

Interview Interview Interview

Interview Interview Interview

Questionary Questionary Questionary

Questionary Questionary Questionary

Questionary Questionary 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 an 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

Activity 1
Activity 2
Activity 3
Activity 4
Activity 5
Activity 6
Activity 7

Perception of the 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.

- Acceptable noise level (7)
- Flight safety and security (1), (4)
- Affordable operation cost
- Near on demand air transportation (3)
- Transportation mode integration (2)
- Traffic congestion relief (4), (5)
- Less door to door travel time (1), (6)
- Other, please define
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.

- Noise
- Safety (2)
- Security (3)
- Operation cost, affordability
- Emission
- Number of air vehicles in the airspace
- Air traffic management (1)
- Parking
- Land and infrastructure costs for vertiports
- 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.

- Technology maturity (4)
- Air Traffic Management (2)
- Regulation
- Social acceptability
- Flight safety and security (1)
- Parking and Land for vertiports in the cities (3)
- 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 organization or structured approach which is working on this emerging transportation option
THANK YOU

ANY QUESTION?
<table>
<thead>
<tr>
<th>IMPACT ANALYSIS</th>
<th>VTOL PERSONAL AND MASS AIR TRANSPORTATION SYSTEM</th>
<th>STAKEHOLDER IMPACT PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VEHICLE</td>
<td>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</td>
</tr>
<tr>
<td></td>
<td>INFRASTRUCTURE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ENROUTE</td>
<td></td>
</tr>
</tbody>
</table>

| 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, PARKING PORT 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                      | NOISE, EMISSION, WATER POLLUTION, CONGESTION, PARKING, LAND USE, ROAD FACILITIES |
|                 | MEDIA                                           |                               |

| ENVIRONMENT     | 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
- 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
# Suggested VTOL Air Vehicles and Vertiports

<table>
<thead>
<tr>
<th>Type</th>
<th>Where</th>
<th>Capacity</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>VTOL PAV</td>
<td>Urban</td>
<td>1 to 2 seats</td>
<td>Personal transportation</td>
</tr>
<tr>
<td>VTOL PAV</td>
<td>Regional</td>
<td>4 to 6 seats</td>
<td>Personal transportation, medical transportation, search and rescue</td>
</tr>
<tr>
<td>VTOL MAV</td>
<td>Urban</td>
<td>10+1 seats</td>
<td>Personal transportation</td>
</tr>
<tr>
<td>VTOL MAV</td>
<td>Regional</td>
<td>20+1 seats</td>
<td>Personal transportation</td>
</tr>
</tbody>
</table>

- With current modes; **min 2 hr by car**
- with VTOL Air Transportation; **max 00:30 hr**
Potential Benefit in Regional Transportation

- Point to point, on demand, high speed, VTOL regional air transportation
- Options to go my hometown

<table>
<thead>
<tr>
<th>No</th>
<th>Option</th>
<th>Travel time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>By car</td>
<td>12 hrs(min) Travel time + refresh time</td>
</tr>
<tr>
<td>2</td>
<td>By bus + by bus</td>
<td>16 hrs(min) Doorstep to port + waiting time + Travel time + port to destination time</td>
</tr>
<tr>
<td>3</td>
<td>By train + by bus</td>
<td>12 hrs(min) Doorstep to port + waiting time + Travel time + transfer time + port to destination time</td>
</tr>
<tr>
<td>4</td>
<td>By airline + by bus</td>
<td>10 hrs(min) Doorstep to port + waiting time + Travel time + transfer time + port to destination time</td>
</tr>
<tr>
<td>5</td>
<td>By high speed VTOL Air Transportation</td>
<td>2:30 hrs(max) Doorstep to port + waiting time + Travel time + port to destination time</td>
</tr>
</tbody>
</table>
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 Choice

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

Traveler`s Profile

- Household income
- Travel distance
- Number of travel party
- Scheduled or on-demand
- Travel origin and destination
- Need a pilot?
- Vehicle ownership
- Personal or Business trip
- Safety concerns
- Psychological effect
- Portal accessibility
- Amount of luggage
The Overall Goal

- Vertical and extremely short take off and landing,
- Operation at blockspeeds markedly faster than current combinations of land and air transportation,
- 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

https://youtu.be/1iyCgy1juHc