Vision or Illusion?

Future Air Transportation System

TECHNOLOGY ASSESSMENT OF EMERGING AVIATION TECHNOLOGIES

The Case Of VTOL Personal And Mass Hybrid Air Vehicles For Urban And Regional Air Transportation Systems

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- **INTRODUCTION**
  - **Why did I Select this Topic?**
  - **Background**
  - **Statement of the Problem**
- **RESEARCH QUESTIONS**
- **THE AIM AND THE CONTRIBUTION OF THE THESIS**
- **LITERATURE REVIEW**
- **METHODOLOGY**

INTRODUCTION

Abbreviations

- PAV : Personal Air Vehicle
- MAV : Mass Air Vehicle
- VTOL: Vertical Take off and Landing
- PPAT : Personal and Public Air Transportation System

Why did I Select this Topic?

- My personal motivation is **to examine technology assessment process and to practice in a real current issue** from the point of process, research methods and policy on which I think that I can contribute with my professional background.
- I intended **to provide a vision** to contribute to the public and policy opinion forming on the potential consequences of emerging air transportation technology **since** it is
  - **an answer to the existing issues and**
  - **the next logical step** in the natural progression.

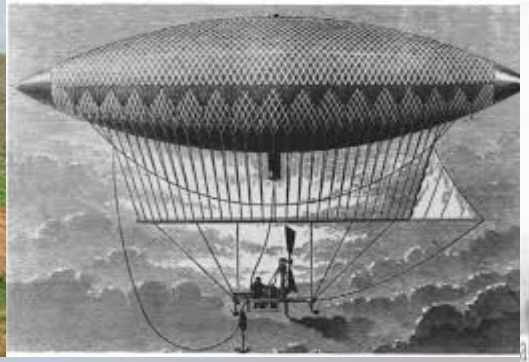
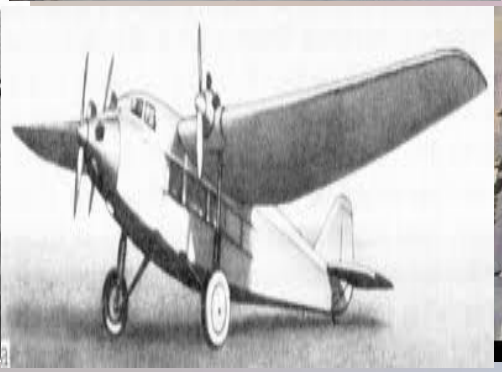
Background









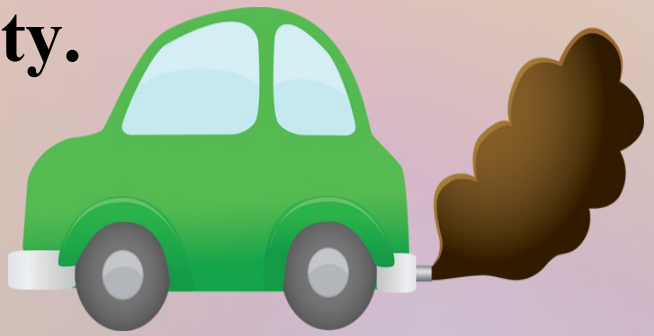




Background

- The **ability to travel** is one of the most basic human needs.The more travel made possible, the greater the **socio economic opportunities** available.
- The developed nations entered **the 1900s** with a transportation system for people centred upon the horse, the rail road and the steamship with associated **travel times the order of hours to days and weeks,** depending on distance.
- Now, **Travel times have shrunk to minutes and hours. The automobile** has long supplanted the horse and **the fix-wing aircraft** has nearly driven the rail road and steamship**.**

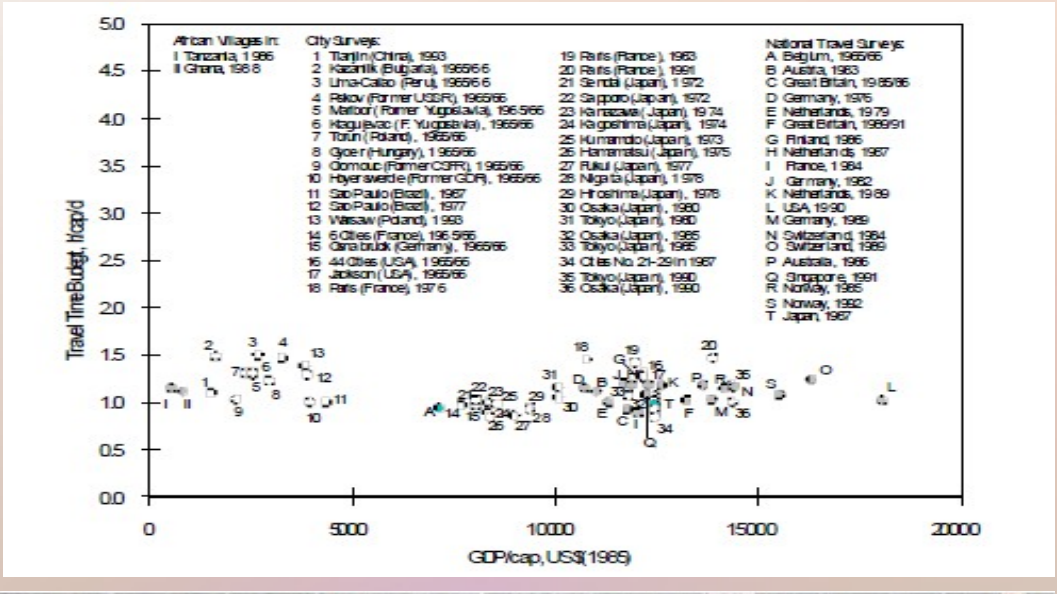
Background

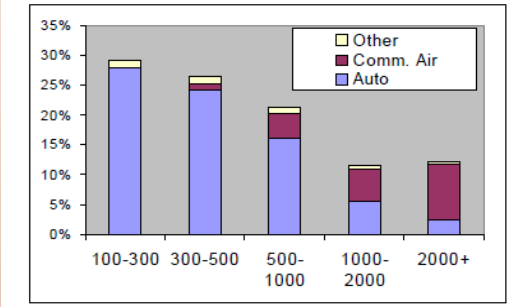
- The **daily radius of action** has improved from about **3 miles** per day **in 1900** to about **25 miles** per day **in 2000** for intra urban travel. However, the **2000 data also shows the first decreases** for ground mobility speed.
- Urbans face **congestions** as well as **increasing emissions and noise** and, thus **reduced accesibility.**

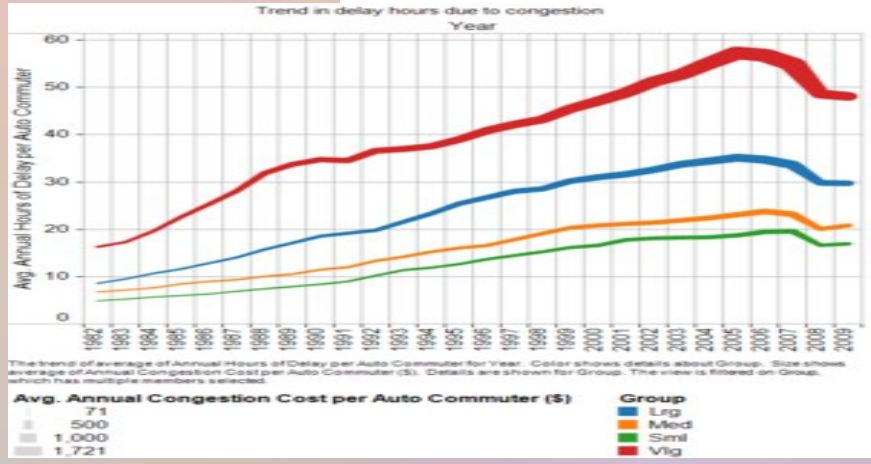


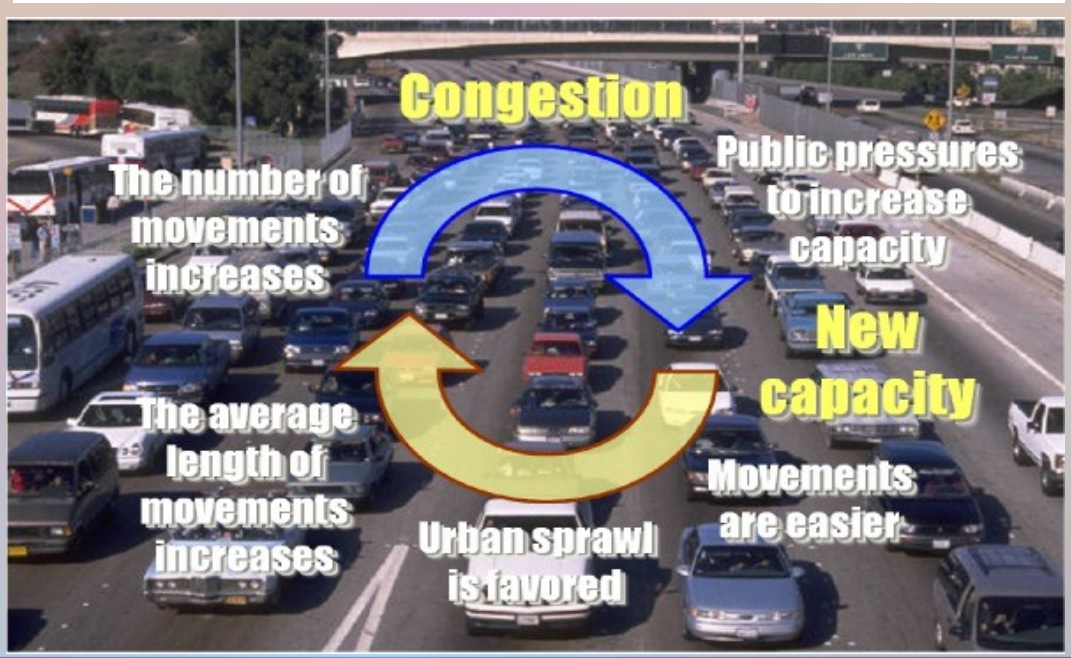
- In USA, 5.7 billion gallons of **fuel wasted** in traffic yearly due to seven fold increase in traffic delays over the 30 years. **In Europe, approximately 100 billion Euros are lost every year** as a result of congestion. **In Istanbul, 2 billion Euros yearly.**

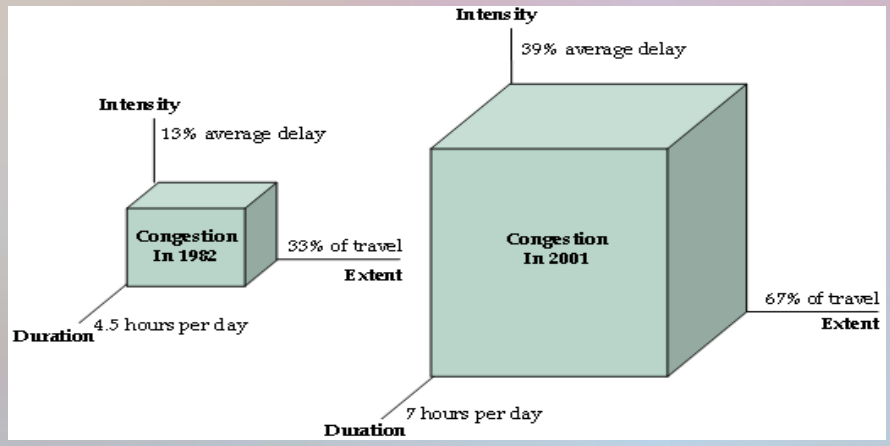
Background


African Villages in:
I Tanzania, 1966
II Ghana, 1968
City Surveys:
1 Tianjin (China), 1993
2 Kazanlik (Bulgaria), 1965/66
3 Lima-Callao (Peru), 1965/66
4 Rekov (Former USSR), 1965/66
5 Maribor (Former Yugoslavia), 1965/66
6 Kragujevac (F. Yugoslavia), 1965/66
7 Torun (Poland), 1965/66
8 Gyoer (Hungary), 1965/66
9 Olomouc (Former CSFR), 1965/66
10 Hoyerswerda (Former GDR), 1965/66
11 Sao Paulo (Brazil), 1967
12 Sao Paulo (Brazil), 1977
13 Warsaw (Poland), 1968
14 6 Cities (France), 1965/66
15 Osnabrück (Germany), 1965/66
16 44 Cities (USA), 1965/66
17 Jackson (USA), 1965/66
18 Paris (France), 1976
19 Paris (France), 1963
20 Paris (France), 1991
21 Sendai (Japan), 1972
22 Sapporo (Japan), 1972
23 Kanazawa (Japan), 1974
24 Kagoshima (Japan), 1974
25 Kumamoto (Japan), 1973
26 Hamamatsu (Japan), 1975
27 Fukui (Japan), 1977
28 Niigata (Japan), 1978
29 Hiroshima (Japan), 1976
30 Osaka (Japan), 1980
31 Tokyo (Japan), 1980
32 Osaka (Japan), 1985
33 Tokyo (Japan), 1985
34 Cities No. 21-29 in 1987
35 Tokyo (Japan), 1990
36 Osaka (Japan), 1990
National Travel Surveys:
A Belgium, 1966/66
B Austria, 1983
C Great Britain, 1985/86
D Germany, 1976
E Netherlands, 1979
F Great Britain, 1988/91
G Finland, 1986
H Netherlands, 1987
I France, 1984
J Germany, 1982
K Netherlands, 1989
L USA, 1990
M Germany, 1989
N Switzerland, 1984
O Switzerland, 1989
P Australia, 1988
Q Singapore, 1991
R Norway, 1985
S Norway, 1992
T Japan, 1987
Travel TimeBudget, h/cap/d
GDP/cap, US$(1985)

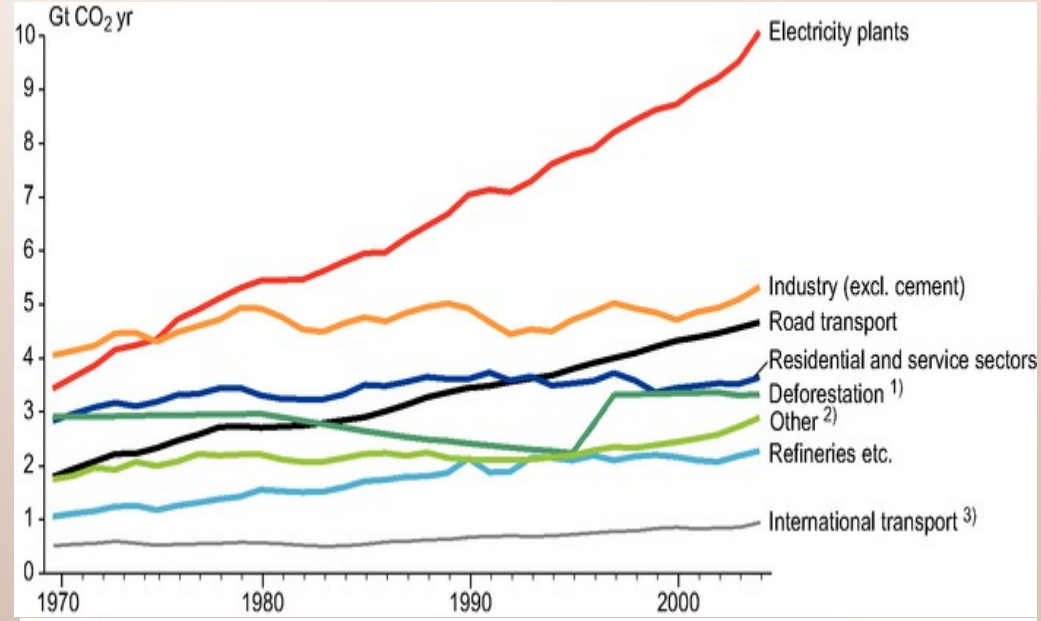

Other
Comm. Air
Auto
100-300
300-500
500-1000
1000-2000
2000+

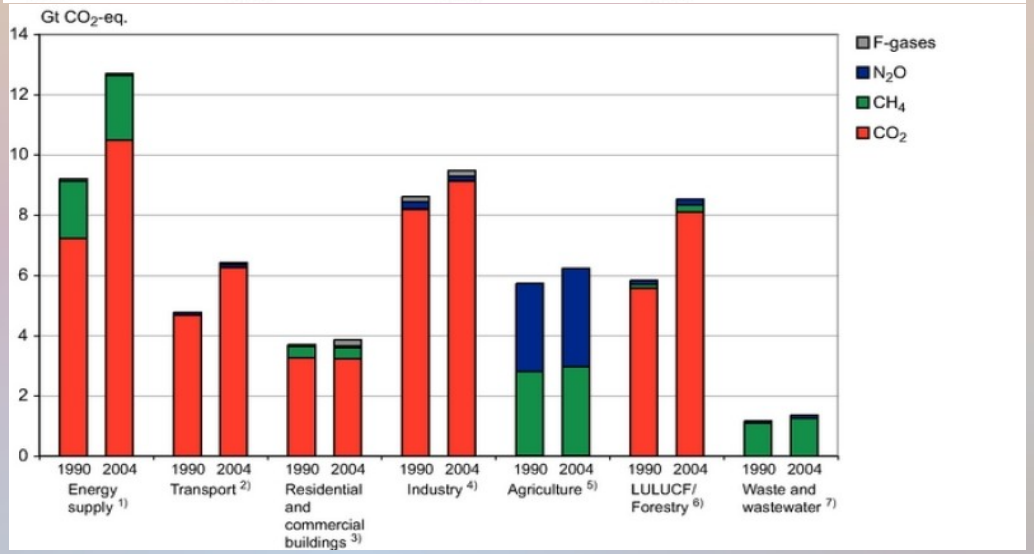

Trend in delay hours due to congestion
Year
Avg Annual Hours of Delay per Auto Commuter
Avg. Annual Congestion Cost per Auto Commuter ($)
71
500
1,000
1,721
Group
Lrg
Med
Sml
Vlg


Congestion
Public pressures to increase capacity
New capacity
Movements are easier
Urban sprawl is favored
The average length of movements increases
The number of movements increases

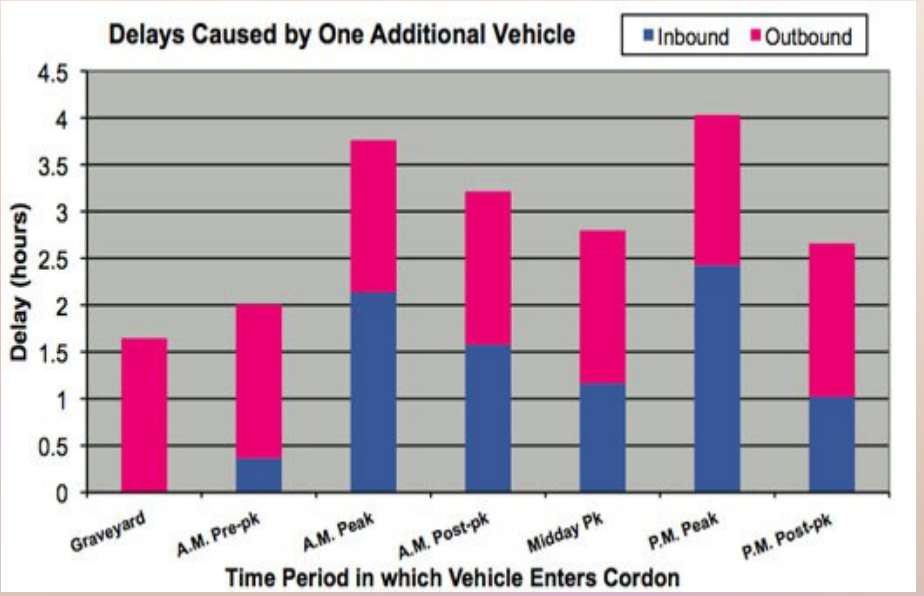

Intensity
39% average delay
Intensity
13% average delay
Congestion In 1982
33% of travel
Extent
Duration
4.5 hours per day
Congestion In 2001
67% of travel
Extent
7 hours per day
Duration

Background

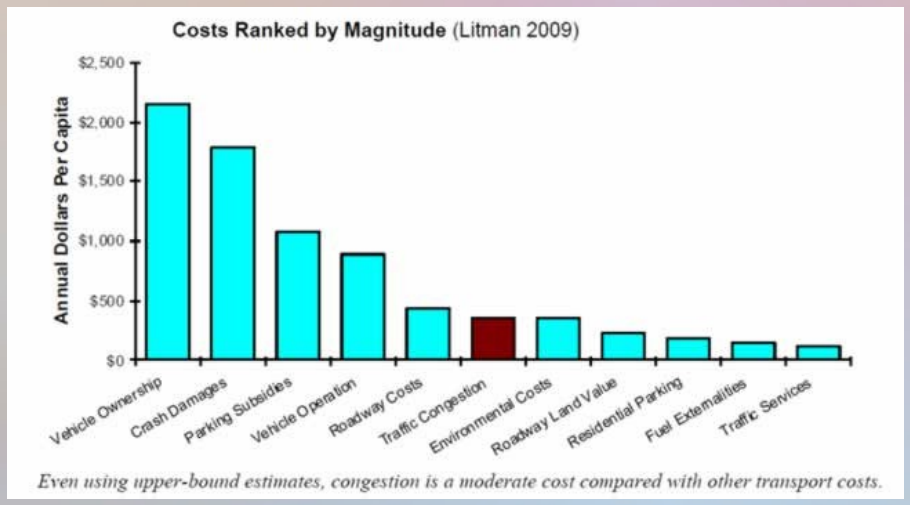




Change, I. (2012). IPCC Fourth Assessment Report, Working Group III http://www.camelclimatechange.org/view/article/153705 -

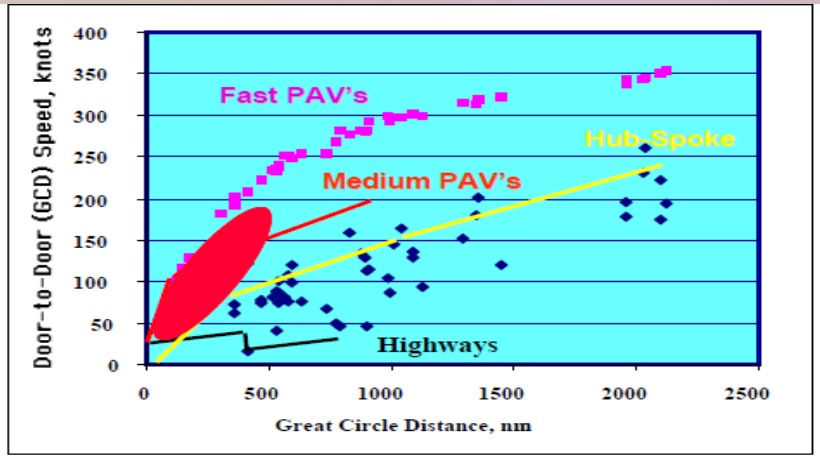


An analysis using the Balanced Transportation Analyzer shows how much time individual drivers steal from fellow drivers by choosing to drive into the New York City CBD



Background

- On the other hand, there has been a long belief that **aviation** would one day be capable of reaching on everyday impact in people`s daily lives.
- As the auto improved quality of life and standards of living, PPATS are envisioned to do likewise in this century. **Considering door to door block time, PPATS** have the potential to achieve **another five to ten fold daily mobility reach increase over the auto today.** While not solution to all travel, PPATS would provide **a new better choice up to 500-600 miles where airlines and automobiles provide poor blockspeed service.**



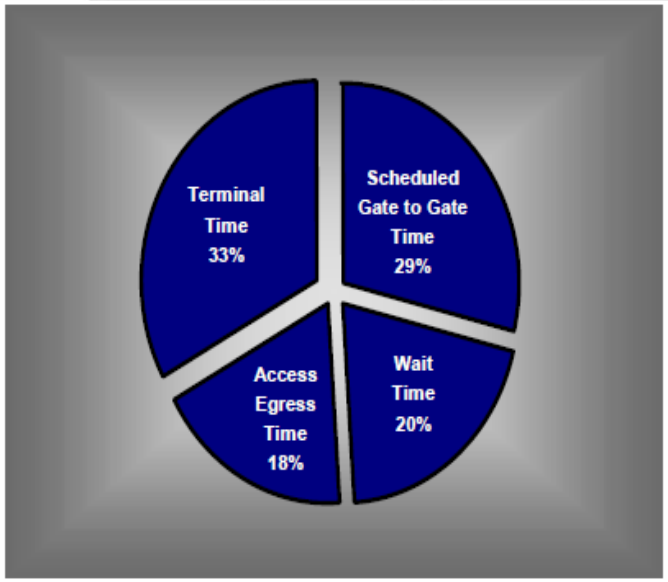
Door to Door Travel Time by Mode

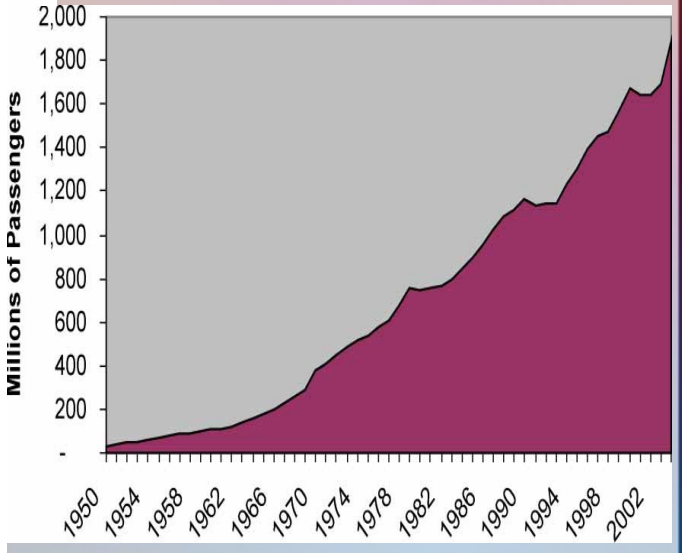
Background

- As a result, **the needs** in transporation systems are **rapidly increasing**. The high speed railway and intelligent highway concept are not only the solution of future transportation. **The answer** to the issue might be **in the air as a radical solution.**
- Therefore NASA has initiated **Small Aircraft Transporation System** (SATS) project, Darpa has iniated **DARPA X-Plane** project, and EU has supported some projects like European Personal Air Transport System (**EPATS**), **Pplane** and **myCopter**

MAIN IDEA
To shift part of long distance trips from cars to small aircrafts

Statement of the Problem





Statement of the Problem

- Commercial Airlines Delays

Year	On time Arrivals	On time (%)	Arrival Delays	Delayed (%)	Flights Cancelled	Cancelled (%)	Diverted	Flight Operations
1997	4,218,165	77.94%	1,083,834	20.03%	97,763	1.81%	12,081	5,411,843
1998	4,156,980	77.20%	1,070,071	19.87%	144,509	2.68%	13,161	5,384,721
1999	4,207,293	76.11%	1,152,725	20.85%	154,311	2.79%	13,555	5,527,884
2000	4,125,263	72.59%	1,356,040	23.86%	187,490	3.30%	14,254	5,683,047
2001	4,619,234	77.40%	1,104,439	18.51%	231,198	3.87%	12,909	5,967,780
2002	4,329,635	82.14%	868,225	16.47%	65,143	1.24%	8,356	5,271,359
2003	5,317,886	81.96%	1,057,804	16.30%	101,469	1.56%	11,381	6,488,540
2004	5,566,323	78.08%	1,421,406	19.94%	127,757	1.79%	13,784	7,129,270

Note: For purposes of this report, a flight is considered delayed if it arrived at (or departed) the gate 15 minutes or more after the scheduled arrival (departure) time as reflected in the Computerized Reservation System.

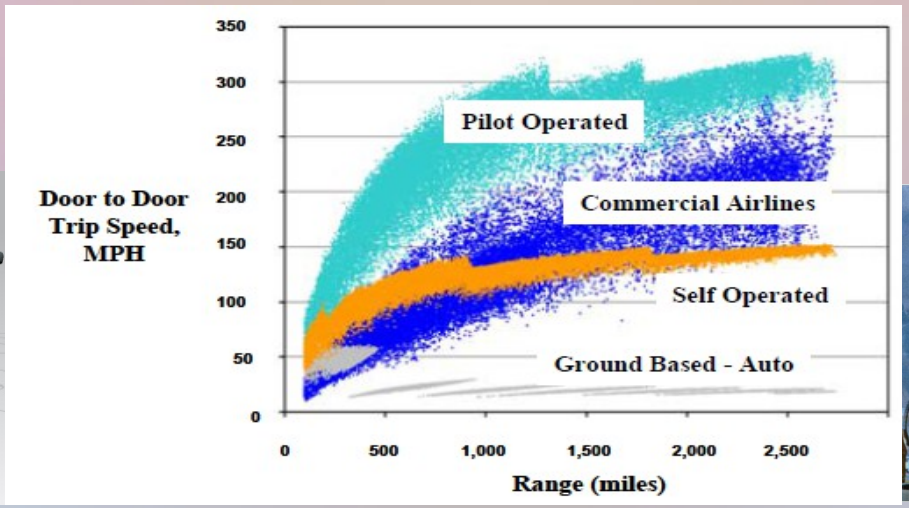
Statement of the Problem

1) Limitations of the current ground and airline transportation systems,
2) Increasing congestions,
3) poor block speed,
4) expanding population and
5) demand for affordable mobility

- will drive the development of **future transportation technology and policy**.
- **The third wave of the aeronautics** could bring about great new capabilities for society and be relevant in most people`s daily lives.

Statement of the Problem

- **So, What Is Taking PPATS So Long!**



RESEARCH QUESTIONS

- Is the **potential benefit** of VTOL PPATS **enough to develop?**
- Can the **anticipated technological progress** be expected to be **strong enough to enable VTOL PPATS?** What are the **technologies in which considerable progress will have to take place** to enable? Are these efforts another **revisiting or** has the time **arrived**?
- What are the **success factors for social acceptability**?
- What are the **main challenges** including technology, regulation, operation, social and environment aspects?

THE AIMS AND THE CONTRIBUTION OF THE THESIS

- **to provide a vision** to serve as a decision aid to developers, policy makers and users**,**
- to contribute to **the public and policy opinion forming**
- **to offer a** technology assessment **framework** through a **multicriteria analysis.**

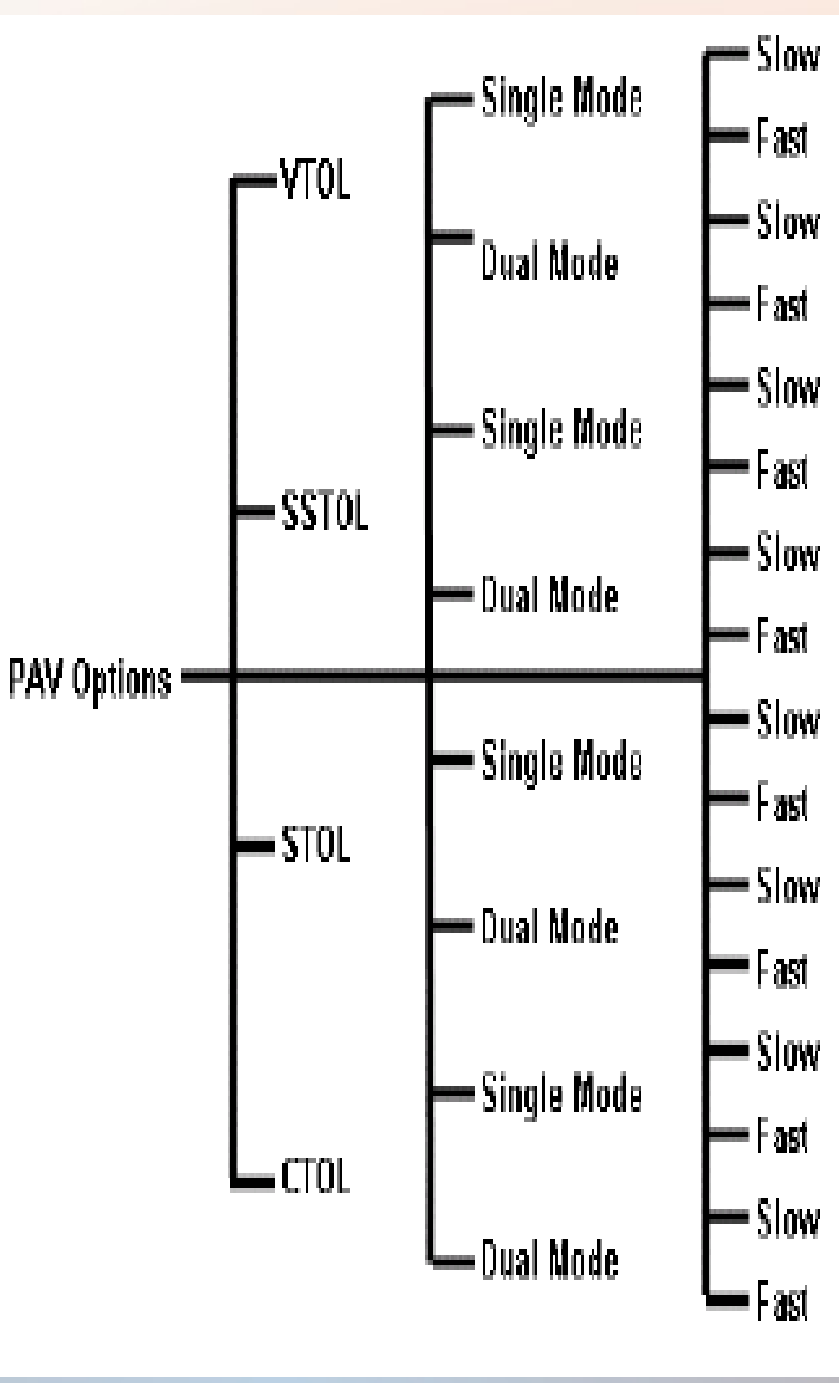
The Contributions of the Thesis :

- The existing literature offers several relevant insights, but also **has shortcomings within the context of technology asssessment of an emerging socio-technological system of systems**.
- There are few papers considering the technology assessment of emerging VTOL Personal and Mass Air Vehicle concepts. This thesis **aims to offer technology assessment of VTOL PPATS through a multicriteria analysis.**

LITERATURE REVIEW

What is Meant by Personal Air Vehicle (PAV) and Mass Air Vehicle (MAV)?

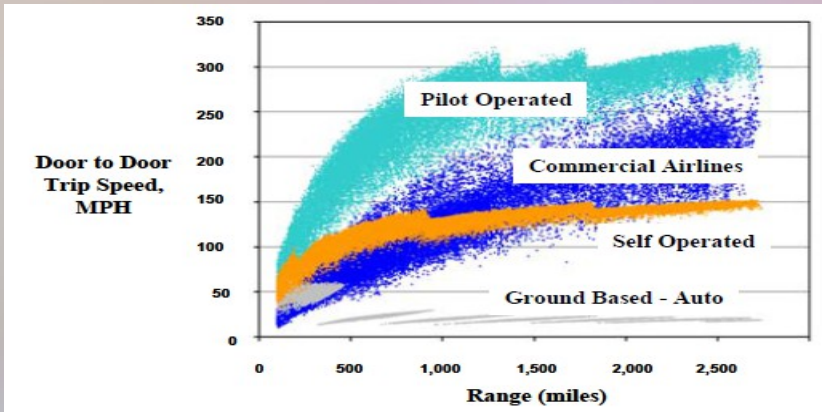
- PAVs and MAVs are not today`s General Aviation Aircraft, nor are they “Jetsons” like imaginations. They are envisioned as **safe, all weather, easy to use vehicles of the future (20 years)for general population** to **improve on demand individual mobility within the longer transportation environment.**
- **PAVs** aim to provide 2 to 5 seats, safe, easy to use, all weather, on demand air mobility .
- **MAVs** aim to provide single pilot monitored, 10 to 25 seats, safe, all weather, point to point air mobility.


PAV Options
VTOL
SSTOL
STOL
CTOL
Single Mode
Dual Mode
Single Mode
Dual Mode
Single Mode
Dual Mode
Single Mode
Dual Mode
Slow
Fast
Slow
Fast
Slow
Fast
Slow
Fast
Slow
Fast
Slow
Fast
Slow
Fast
Slow
Fast

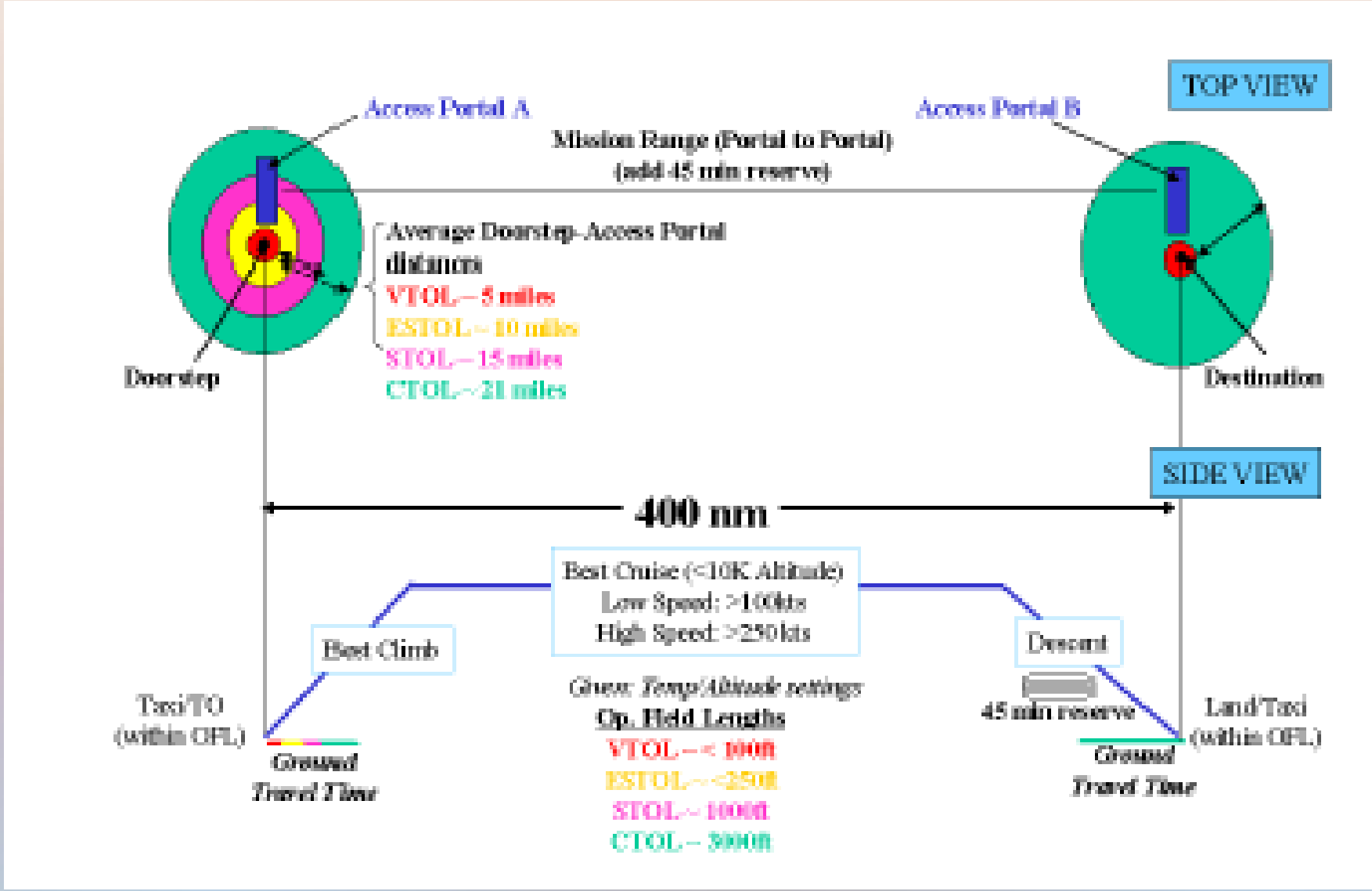

PH-PALV
PH-PALV

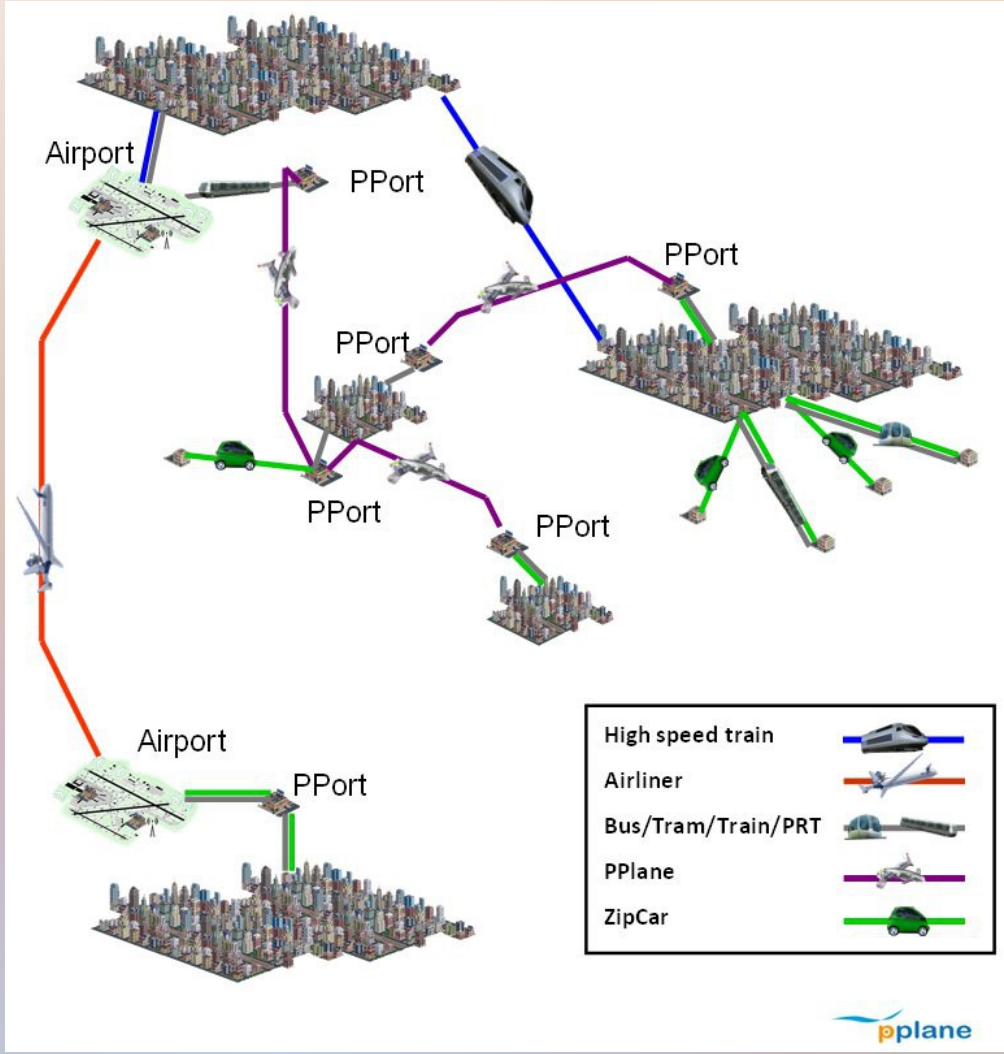
Attractiveness of VTOL PAVs and MAVs

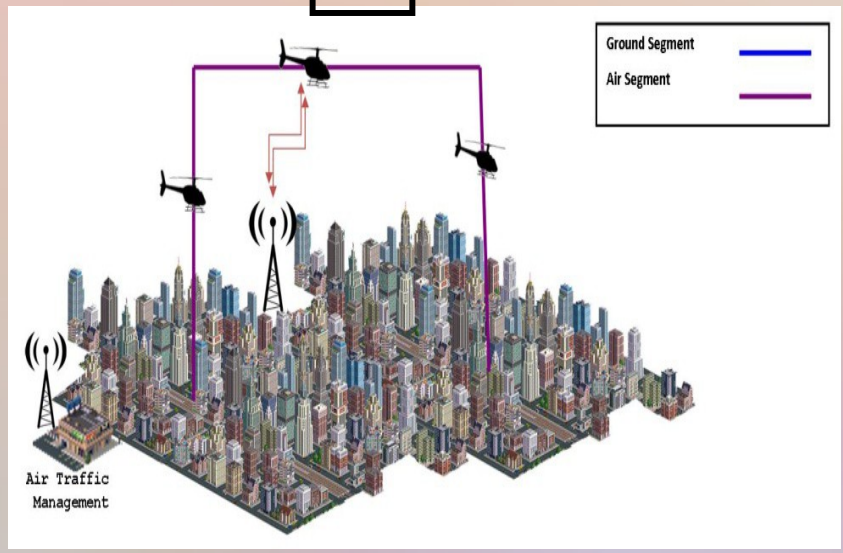
- Desired travel time, on demand travel
- Travel time savings, efficient blockspeed
- Extending daily radius of the action five to ten times further
- Increasing trips per day
- Less distances from doorstep to portals
- Operable from anywhere, point to point travel
- Expand transportation choice
- Comfort
- Relieve road traffic congestion



A Typical Regional Transportation Scenario

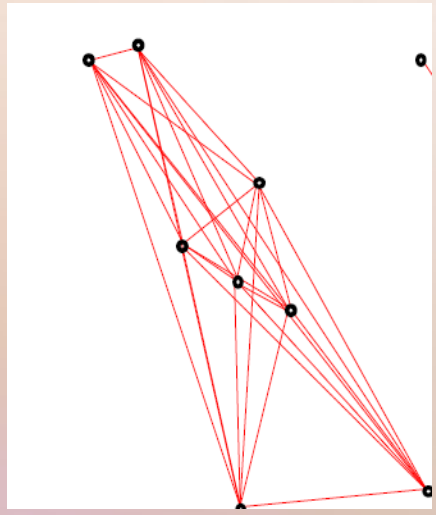



Airport
PPort
PPort
PPort
PPort
PPort
Airport
PPort
High speed train
Airliner
Bus/Tram/Train/PRT
PPlane
ZipCar
pplane

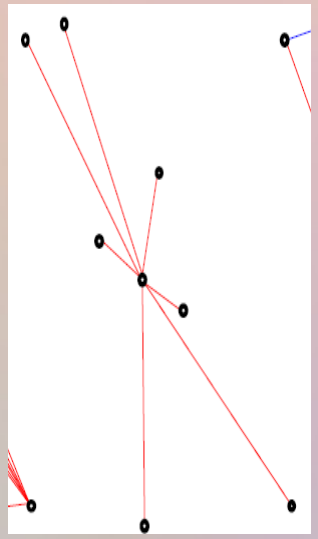

Ground Segment
Air Segment
Air Traffic
Management

Basic Operation Concepts

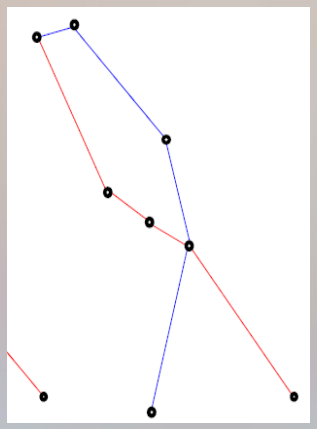
- Point to point transportation



- Hub and spoke transportation



- Ring transporation



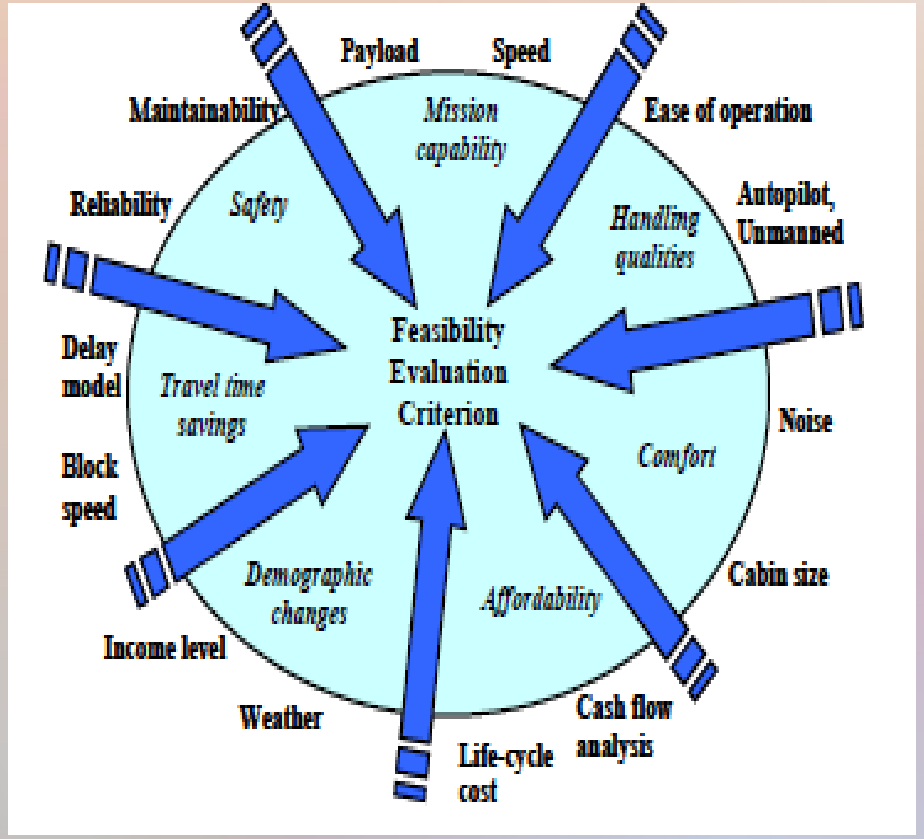
Basic Mission Concepts

- Personal Transportation
- Mass Transportation

- Air Taxi
- Air Ambulance
- Air Cargo Transportation
- Fire Vehicle

Feasibility Evaluation Criteria

- Travel time savings: **blockspeed**
- **Safety**: reliability, maintainability, all weather, avoidance
- **Ease of operation:** autopilot
- Comfort: **noise, riding quality**
- Affordability: **life cycle cost,** cash flow analyse
- **Mission capability**:speed, range, payload



The Overall Goals

- Implies integrating overall technology areas with practical everyday transportation requirements to design a class of vehicle by constraint,
  - **Vertical** and extremely short **take off and landing**
  - Operation at **blockspeeds markedly faster than current combinations of land and air transporation** and **increasing daily radius of action**
  - **Unit cost comparable** to current luxury **cars** and small **general aviation aircraft**
  - **Reliability**
  - **Safety comparable with airlines**
  - Ability **to integrate with existing land and air transportation system**

VTOL Air Vehicle`s Advantages Over Helicopters

- **Higher cruise speed**, up to 300-400 knots
- Lower **noise**
- Lower **vibration**
- **Superior economics**

VTOL Air Vehicle`s Advantages Over Fix-Wing Aircraft

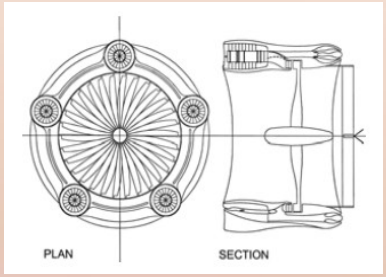
- More convenient **downtown service**
- Increased **operational flexibility** due to VTOL ability: point to point transportation, etc.
- More **competitive economics**
- Increased **mission flexibility** due to VTOL ability
- Access **to small cities and remote rural** communities
- **No need long runways**

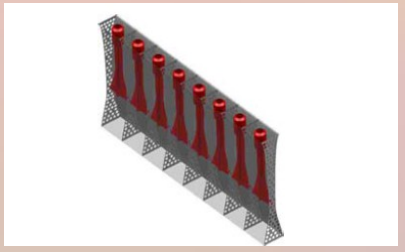
Key Factors for Transportation Mode Choice

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

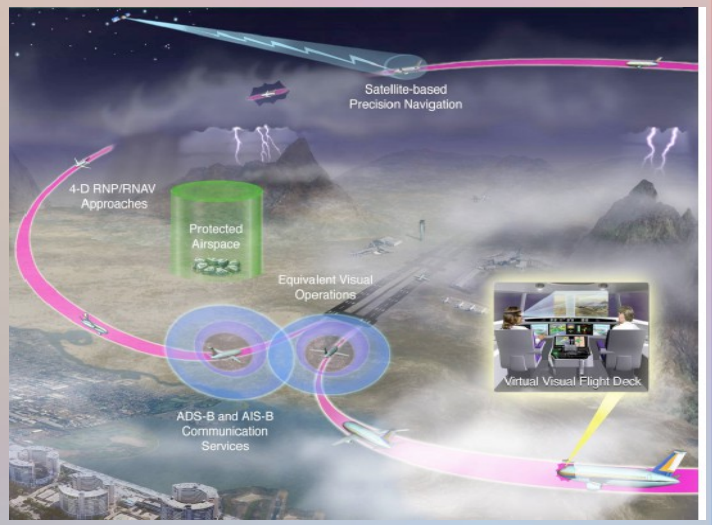
Key Technologies To Enable

- **Propulsion**
  - VTOL
  - Safety
  - Noise
  - Operating cost
  - Emission
  - Performance: speed, range, capacity





- **Automation**
  - All weather take off and landing
  - Emergency recovery
  - Navigation
  - Crash avoidance and seperation
  - Safety

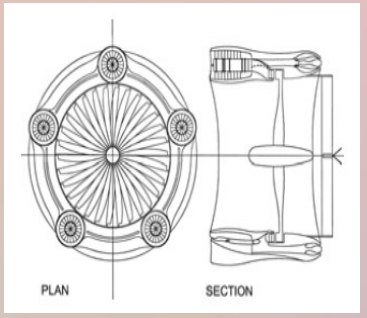


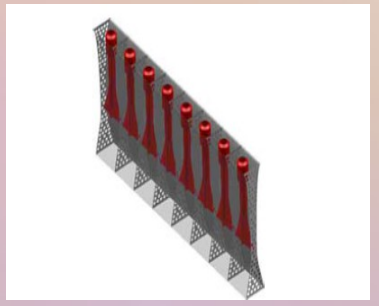
Automation

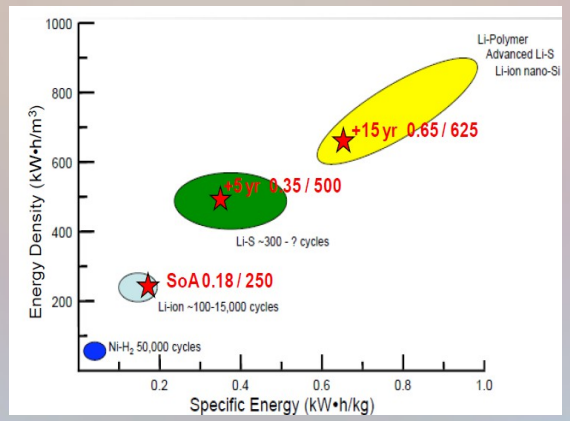
- Autonomous technology, in the air and on the ground, is certain to be required if aviation is to break out of its niche and become a ubiquitous mode of transporation.
- Whether it is easy to fly personal air vehicles, optionally piloted air taxis or single pilot monitored mass commuter transports, aviation **will have to go beyond automation to enable wider public use of aircraft**. At least automatic:
  - **All weather take off and landing**
  - **Emergency recovery**
  - **Navigation**
  - **Crash avoidance**
- **Computer monitored by pilot authority** should be a possible automation level to enable all requirements

Propulsion

- VTOL Flying is an **energy intensive** transportation mode.
- One of the **technological challenges** to be improved to expect requirements
  - **Safety**
  - **Noise**
  - **Operating cost**
  - **Emission**
  - **Performance**







Aviation Safety

- Aircraft accidents, especially by air carriers are often high profile events, affecting the public`s overall perceptions of aviation safety.
- Governments and industry, recognizing that even small degradiations can cause a loss of public confidence in flying, have gone to great lengths to ensure safety.
  - **Daily operation in all weather**
  - **Automatic integration with airspace control, automatic separation and crash avoidance**
  - **Emergency recovery, safe landing**
  - **Reliability and maintainability**

Environmental Compatibility

- Environmental issues constrain growth in the aviation sector. Aircraft
  - **Noise**
  - **Emission** major concerns.
- The perception of flying over houses should also be taken into consideration for social acceptability.

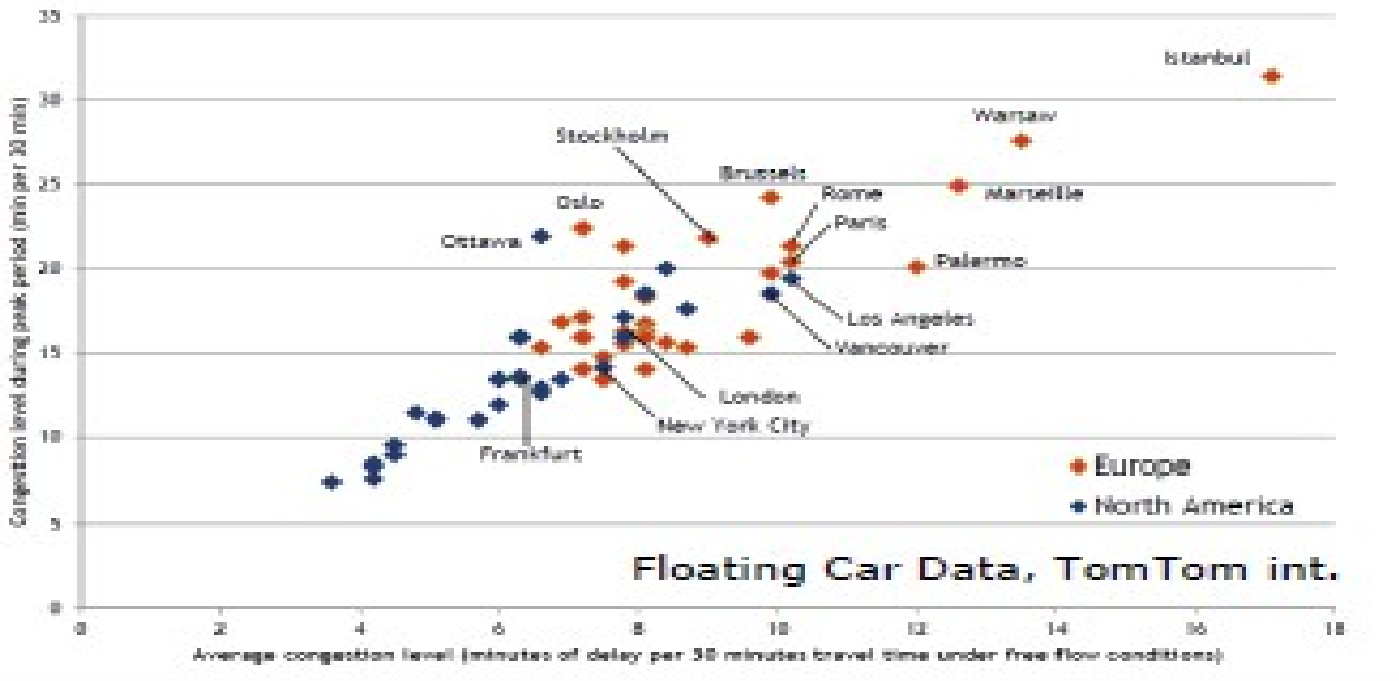
Major Challenges

- There are technological, regulatory and societal challenges to the vision that we have to overcome to enable:
  - **Ease of use**
  - **Safety**
  - **Airspace control**
  - **Noise**
  - **Daily operations in all weather**

Why Did I Select Istanbul as a Case Study for Urban Transportation?

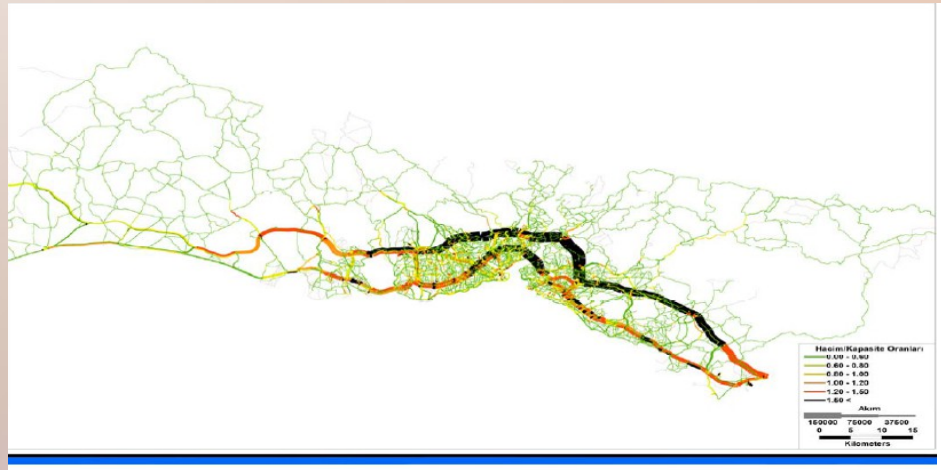
Why Did I Select Istanbul as a Case Study for Urban Transportation?

- The **demand would be expected to grow** in the future with both population and income as well as in response to **incresing congestion**
- Approximately more than **2 billion Euros are lost every year as a result of congestion.**

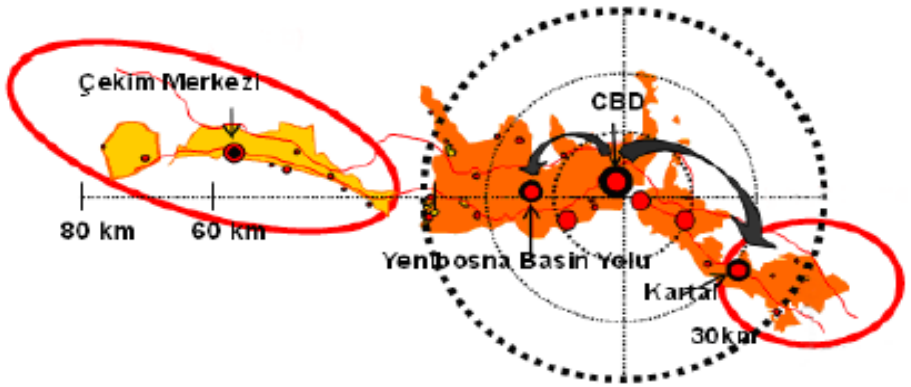


Why Did I Select Istanbul as a Case Study for Urban Transportation?

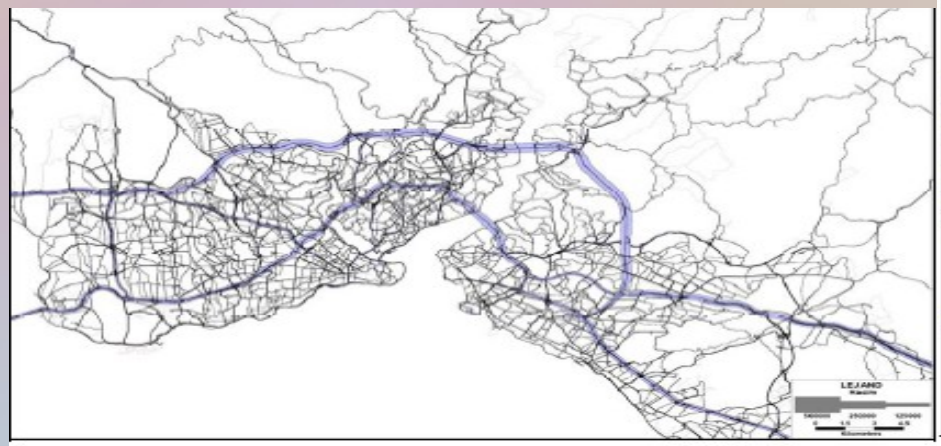
- Downtown centers and Daily road volumes



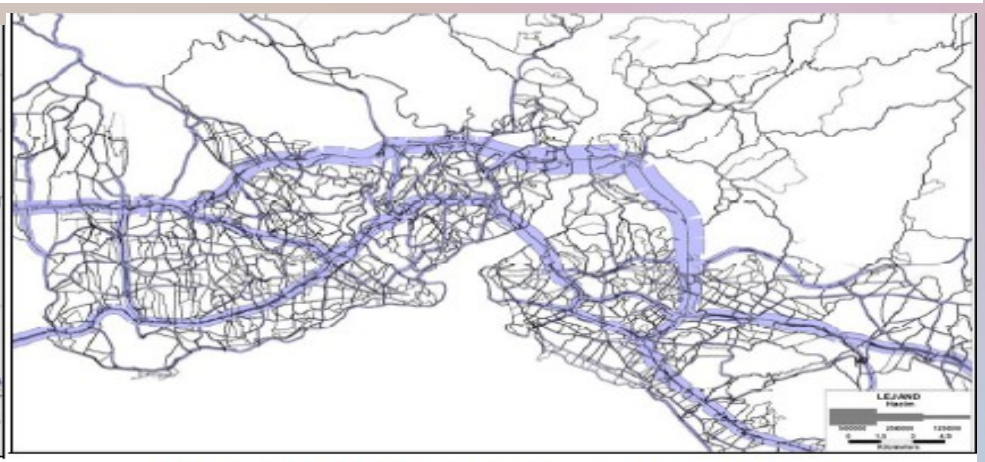
Şekil 3.2.1 2009 Yılı Karayolu Kapasite Kullanım Oranları (V/C)
Kaynak: İUAP Proje Ekibi, 2009



Şekil 8.3.4 Çok Merkezli Şehirsel Gelişme



Şekil 10.1.14 Mevcut Duruma ait Günlük Hacim Değerleri



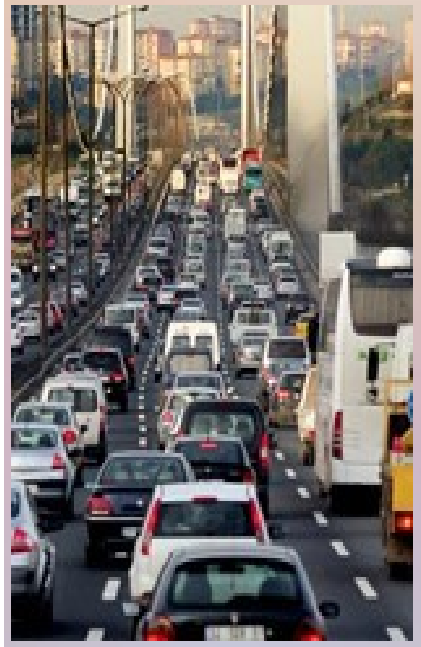
Şekil 10.1.15 2023 Temel Durum Günlük Hacim Değerleri

Why Did I Select Istanbul as a Case Study for Urban Transportation?

- Over capacity bridges

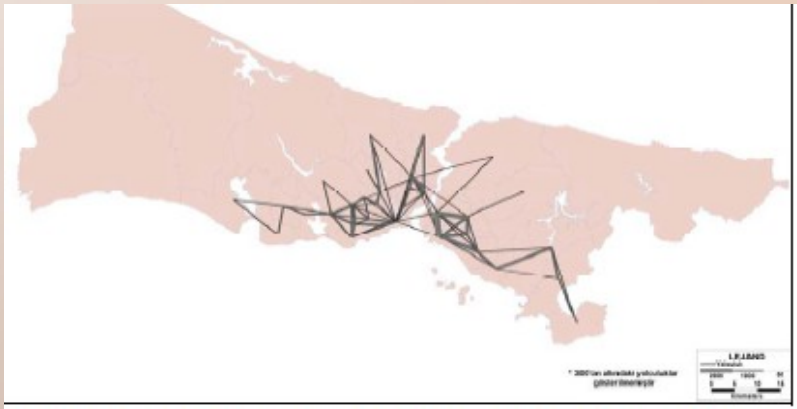
Şekil 12.6.4 Boğaziçi Köprüsünden Geçen Günlük Araçların Mevcut Durumda ve Maksimum Tasarım Kapasitesindeki Hizmet Düzeyi Değerleri

kil 12.6.5 FSM Köprüsünden Geçen Günlük Araçların Mevcut Durumda ve Maksimum Tasarım Kapasitesindeki Hizmet Düzeyi Değerleri

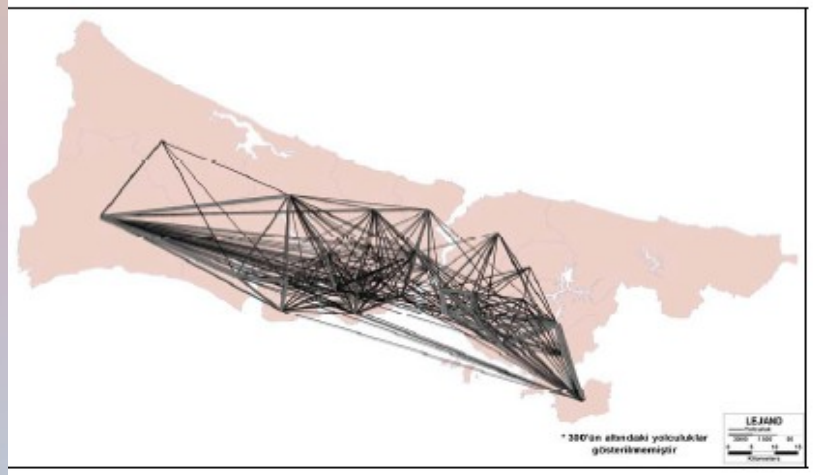


Why Did I Select Istanbul as a Case Study for Urban Transportation?

- Cars

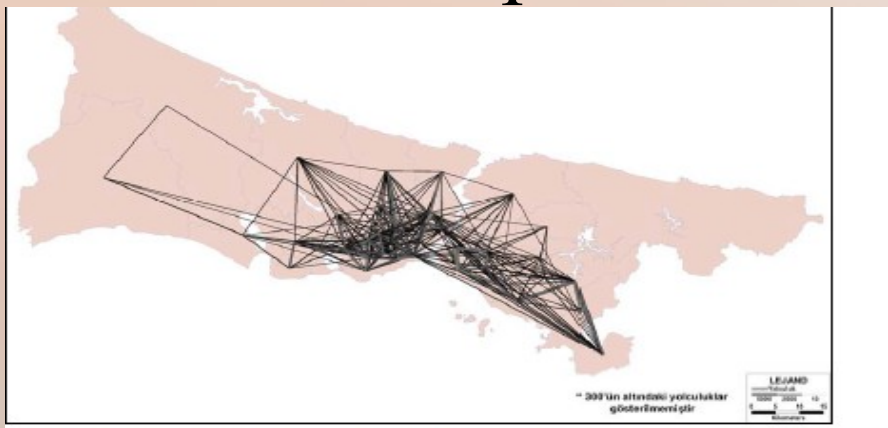


kil 10.1.10 Mevcut Durum için Tüm Amaçlara Göre Zirve Saat Otomobil Yolculukları

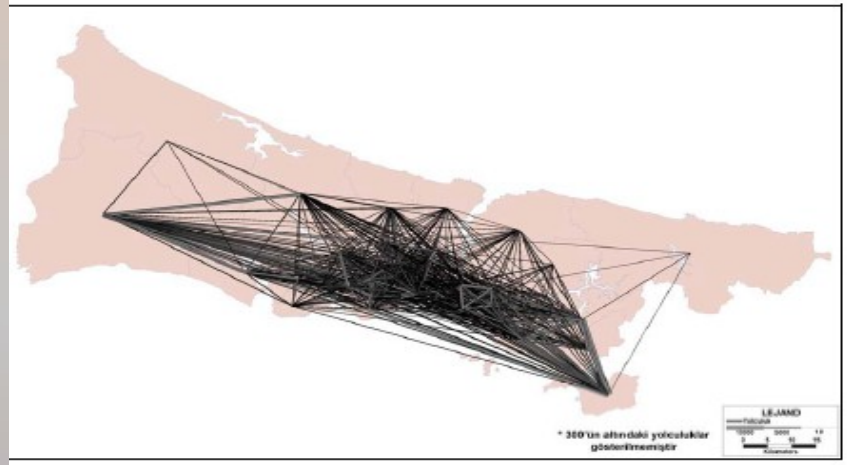


10.1.11 2023 Temel Durum için Tüm Amaçlara Göre Zirve Saat Otomobil Yolculukları

Public Transportation



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



l 10.1.13 2023 Temel Durum için Tüm Amaçlara Göre Zirve Saat Toplu Taşıma Yolculukları

Why Did I Select Istanbul as a Case Study for Urban Transportation?

- Socio economic data

	2006	2009	2023	2023/2006
Population	12.009.000	13.393.665	17.217.056	1.43
PCGDP ($)	4.955	9.783	20.884	4.21
Travel Number	20.924.133	24.271.995	35.027.482	1.67
Number of car	1.351.782	1.841.446	4.335.882	3.21
Mobility	1.74	1.81	2.03	1.17

Tablo 21.2.1 2009-2023 Ulaşım Sektörü Yatırım Planı (Milyar $)

Yatırım Sektör Sektör	Kısa	Orta	Uzun	Toplam (Milyar $)
Yol&Kopru	0,6	1,3	2,9	4,8
Raylı Sistem	3,7	7,1	6,6	17,4
Bakım&onarım	0,8	1,0	1,5	3,3
Diğer Alt Sektörler	3,0	4,2	3,5	10,7
Kamulaştırma Min	0,9	1,0	1,5	3,4
Kamulaştırma Max	2,5	3,1	2,7	8,3
*Toplam (Milyar $)	8,9	13,6	14,5	36,9

*Kamulaştırma dahil değildir.

A Case Study For Regional Transportation

- Point to point on demand regional air transportation

METHODOLOGY

Research Design

- Factors affecting research design
  - Long term emerging aviation technology
  - A socio technological system of systems
  - In transportation area
  - Stakeholders: government, local municipalities, users, industry, research institutions, service providers, interest groups
  - Purpose of the thesis: description, prediction
  - Approach: both qualitative and quantative
  - Methods of analysis: cost benefit analysis, life cycle analysis, scenarios, sensitivity analysis, decision analysis, case study, subjective judgement, roadmap, interview, impact analysis
  - Time and place of data collection: 2000-06.2017; USA, Europe, Turkey
  - Tools: benefit visualization tool, GOTChA chart, interviews, depth interviews, documentary analysis, attending conferances and brifings

Research Procedure

- First step
  - Document readings
  - Interviews
- Second step
  - Description
  - Classification
  - Depth interview
  - If I need, Questionaries
- Third step
  - Data analysis
  - Follow up interviews

Research Method Approach

- **Is the potential benefit of VTOL PPATS enough to develop?**
  - Document readings
  - Cost and Benefit Analysis, Benefit Visualization Tool
  - Interviews
  - Case scenario
- **Can the anticipated technological progres be expected to be strong enough to enable VTOL PPATS?**
  - Document readings
  - Roadmap
  - Technology GOTChA Chart
  - Interviews
- **What are the success factors for social acceptability?**
  - Document readings
  - Interviews
  - Impact analysis
  - Subjective judgement

Benefit Visualization Tool

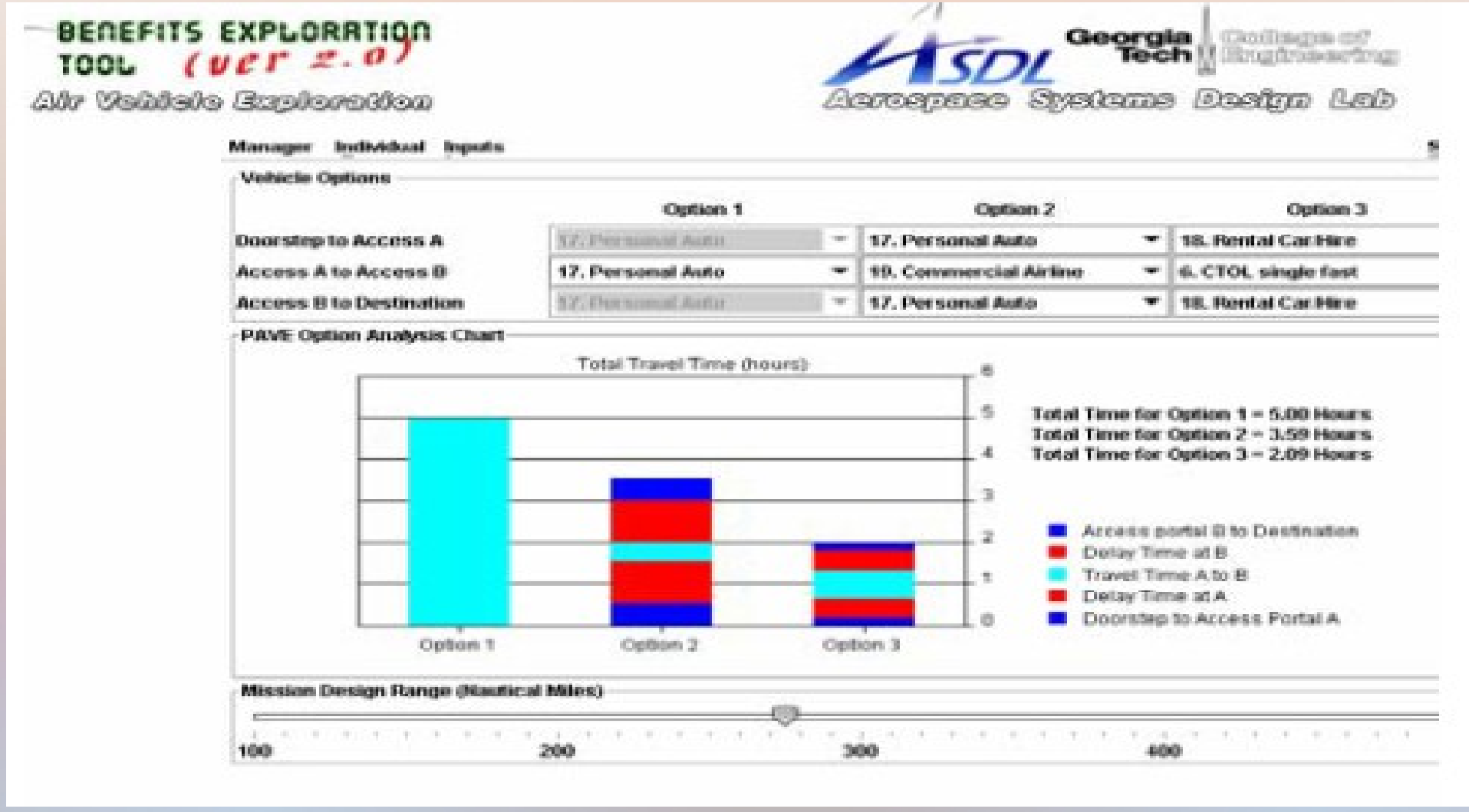
- A framework that integrates
  - Economic benefit metrics
  - Mission sensitivity analysis
  - Vehicle sizing capabilities
- It is a microscopic model of an individual traveler`s trip from doorstep to destination, and serves as a requirement generator in the development of an ideal PAV or MAV

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

Benefit Exploration Tool



Cost Benefit Analysis

Equation 1: D-D Time Computations

$$\text{D - D Time} = \alpha + \beta + \delta + \varepsilon + \varphi$$

where

$$\alpha = \text{Travel Time}_{\text{Doorstep to Portal A}} = \frac{\text{Ground Distance}}{\text{Avg. Ground Vehicle Speed}}$$

$$\beta = \text{Travel Time}_{\text{Wait Time at Portal A}} = \text{Vehicle Specific}$$

$$\delta = \text{Travel Time}_{\text{Portal A to Portal B}} = \frac{\text{Travel Distance}}{\text{Avg. Vehicle Air Speed}}$$

$$\varepsilon = \text{Travel Time}_{\text{Wait Time at Portal B}} = \text{Vehicle Specific}$$

$$\varphi = \text{Travel Time}_{\text{Portal B to Destination}} = \frac{\text{Ground Distance}}{\text{Avg. Ground Vehicle Speed}}$$

Equation 2: Real Interest Rate Computation

$$r_o = \frac{r - f}{1 + f}$$

where r_o = real interest rate

r = nominal interest rate

f = inflation rate

Equation 3: Adjusted Cumulative Cash Flow Computation

Adjusted Cumulative Cash Flow, ACF

= PAV Option Cum. Cash Flow - Baseline Cum. Cash Flow

where ACF can have negative OR positive values

Equation 4: Value of Time Computation

$$\text{Value of Time (in units of dollars per hour)} = \frac{\text{Annual Income}}{\text{2080 working hours per year}}$$

Equation 5: Vehicle Time Saving Index (VTSI) Computation

$$\text{VTSI} = \frac{\text{D - D Time}_{\text{Baseline}} - \text{D - D Time}_{\text{PAV Option}}}{\text{D - D Time}_{\text{PAV Option}}}$$

Equation 6: Value of Time Saved Computation

Value of Time Saved (in dollars)

= VTSI * Hours of Utilization * Hourly Value of Time

Equation 7: Cash Flow Computation

Cumulative Cash flow = Cumulative Profits - Cumulative Costs

= [VTSY + Cumulated Profits] - [TCPY + Cumulated Costs]

where:

VTSY = Value of Time Saved per Year for current year

$$= \left(\frac{\text{Value of Time}}{\text{1 hour}}\right) * \left(\frac{\text{Hours Saved by using PAV per year}}{\text{1 year}}\right)$$

$$= \left(\frac{\text{Income Fluctuation Rate} * \text{Annual Income}}{\text{2080 working hours per year}}\right)$$

$$* \left(\text{Hours Saved per day} * \frac{\text{260 working days}}{\text{1 year}}\right)$$

TCPY = Total Cost Per Year

= Annual Capital Payment + Adjusted Annual Direct Operating Cost (DOC)

= (Annual Interest Payment + Annual Installment) + Adjusted Annual DOC

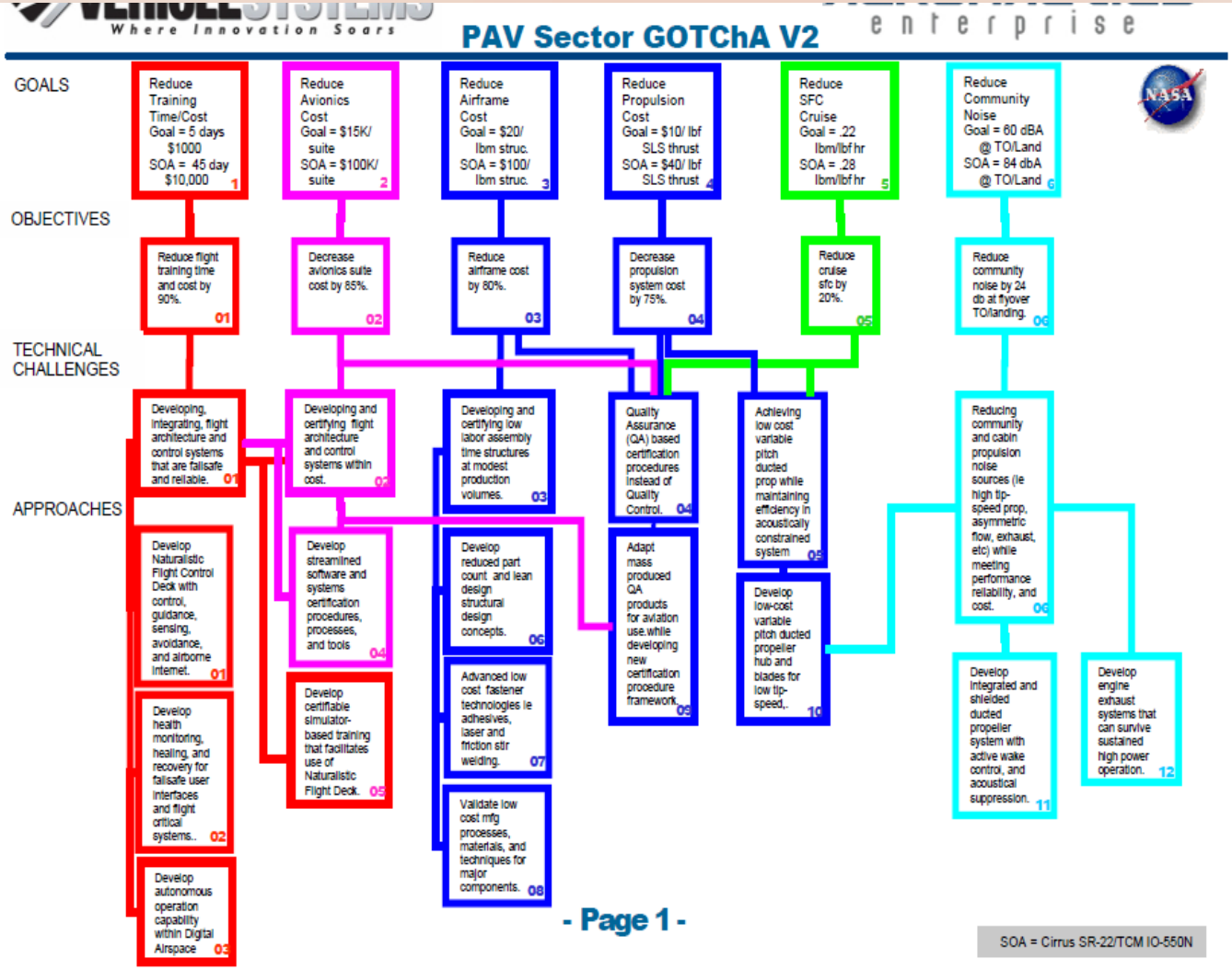
$$= \left[(\text{Loan Interest Rate} * \text{Loan Balance}) + \frac{\text{Post Downpayment Balance}}{\text{Loan Period, n}} \text{ for n years}\right]$$

$$+ \left[\text{Real Interest Rate} * \frac{\text{DOC}}{\text{1 hour}} * \frac{\text{Hours}}{\text{1 Trip}} * \frac{\text{Number of Trips}}{\text{1 week}} * \frac{\text{52 weeks}}{\text{1 year}}\right]$$

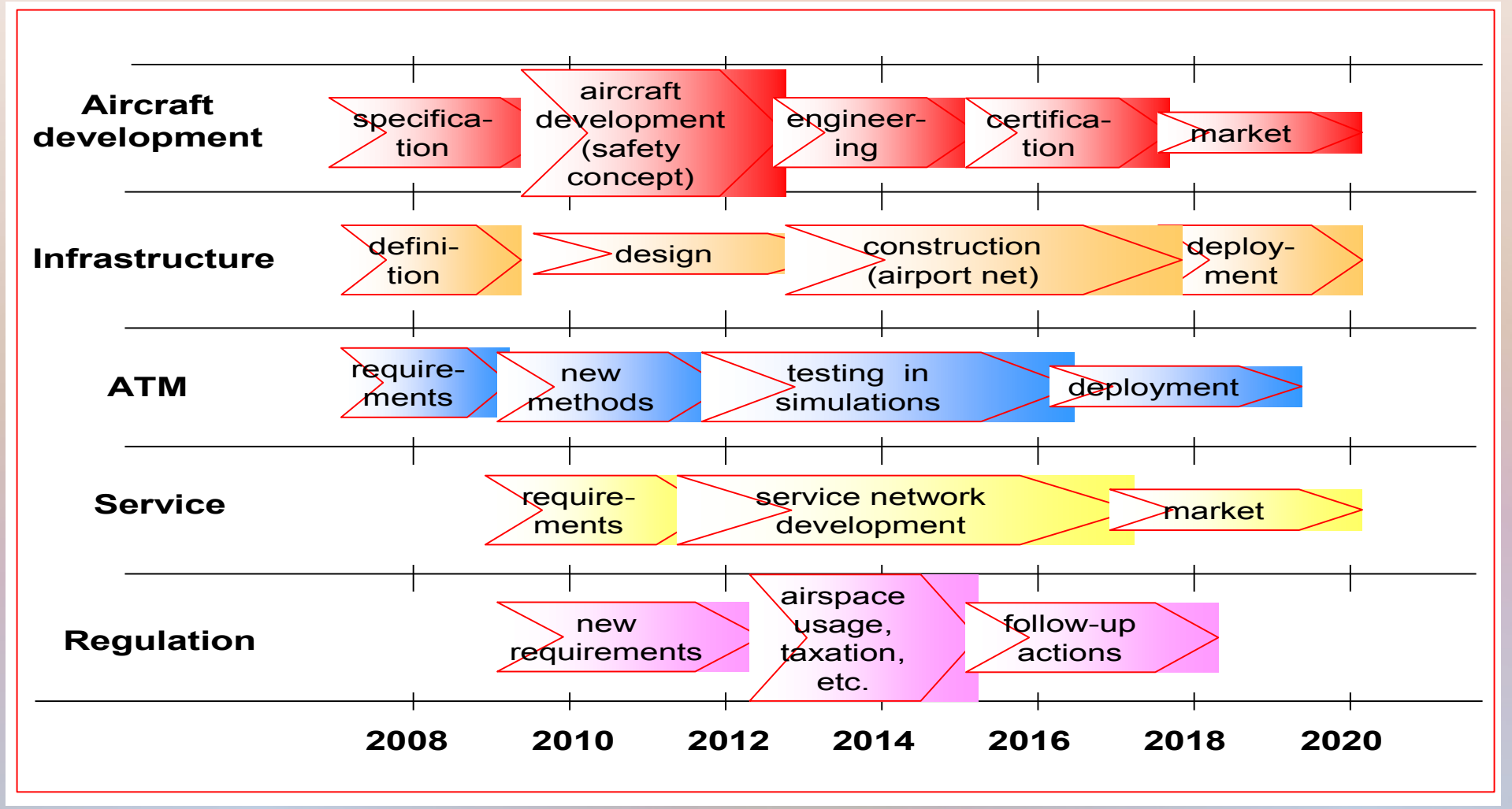
Source: http://www.asdl.gatech.edu

AIAA 2002-5620

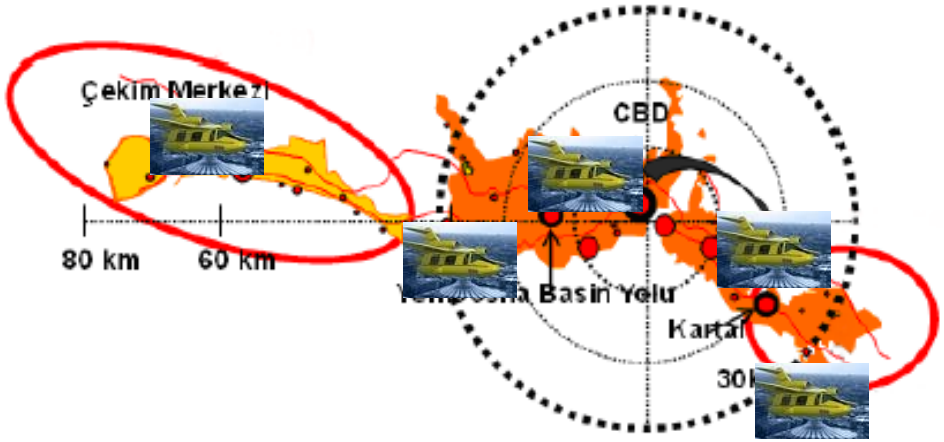
Technology GOTChA Chart



Roadmap


Aircraft development
specifica-tion
aircraft development (safety concept)
engineer-ing
certifica-tion
market
Infrastructure
defini-tion
design
construction (airport net)
deploy-ment
ATM
require-ments
new methods
testing in simulations
deployment
Service
require-ments
service network development
market
Regulation
new requirements
airspace usage, taxation, etc.
follow-up actions
2008
2010
2012
2014
2016
2018
2020

Case Study Scenario



Şekil 8.3.4 Çok Merkezli Şehirsel Gelişme

- Point to point, and hub and spoke transportation from portals
- Personal and public air transportation, air taxi and air ambulance
- Blockspeed
- 5, 10, 25 seats
- Number of pessangers travelling

THANK YOU

ANY QUESTION?

- The developed nations entered **the 1900s** with a transportation system for people centred upon the horse, the rail road and the steamship with associated **travel times the order of hours to days and weeks,** depending on distance. Now, **Travel times have shrunk to minutes and hours. T**he **automobile** has long supplanted the horse and **the fix-wing aircraft** has nearly driven the rail road and steamship**. The daily radius of action has improved from about 3 miles** per day **in 1900 to about 25 miles** per day **in 2000 for intra urban travel.**

- **However, the 2000 data also shows the first decreases for ground mobility speed.** Urbans face **congestions** as well as **increasing emissions and noise** and, thus **reduced accesibility.**

As we know that, the **ability to travel** is one of the most basic human needs.The more travel made possible, the greater the **socio economic opportunities** available. However,

- Limitations of the current ground and airline transportation systems,
- Increasing congestions and the waste of time and resources
- poor block speed,
- expanding population and
- demand for affordable mobility

will drive the development of **future transportation technology and policy**.

At this point, The high speed railway and intelligent highway concept are not only the solution of future transportation. **T**he **answer** to the issue might be **in the air as a radical solution. The third wave of the aeronautics** could bring about great new capabilities for society and be relevant in most people`s daily lives.