The 3rd ENRI International Workshop on ATM/CNS

A STUDY ON OPERATION CONCEPT FOR NEXT GENERATION AIR VEHICLES IN KOREA

February 20, 2013

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THE KOREA TRANSPORT INSTITUTE

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1. INTRODUCTION

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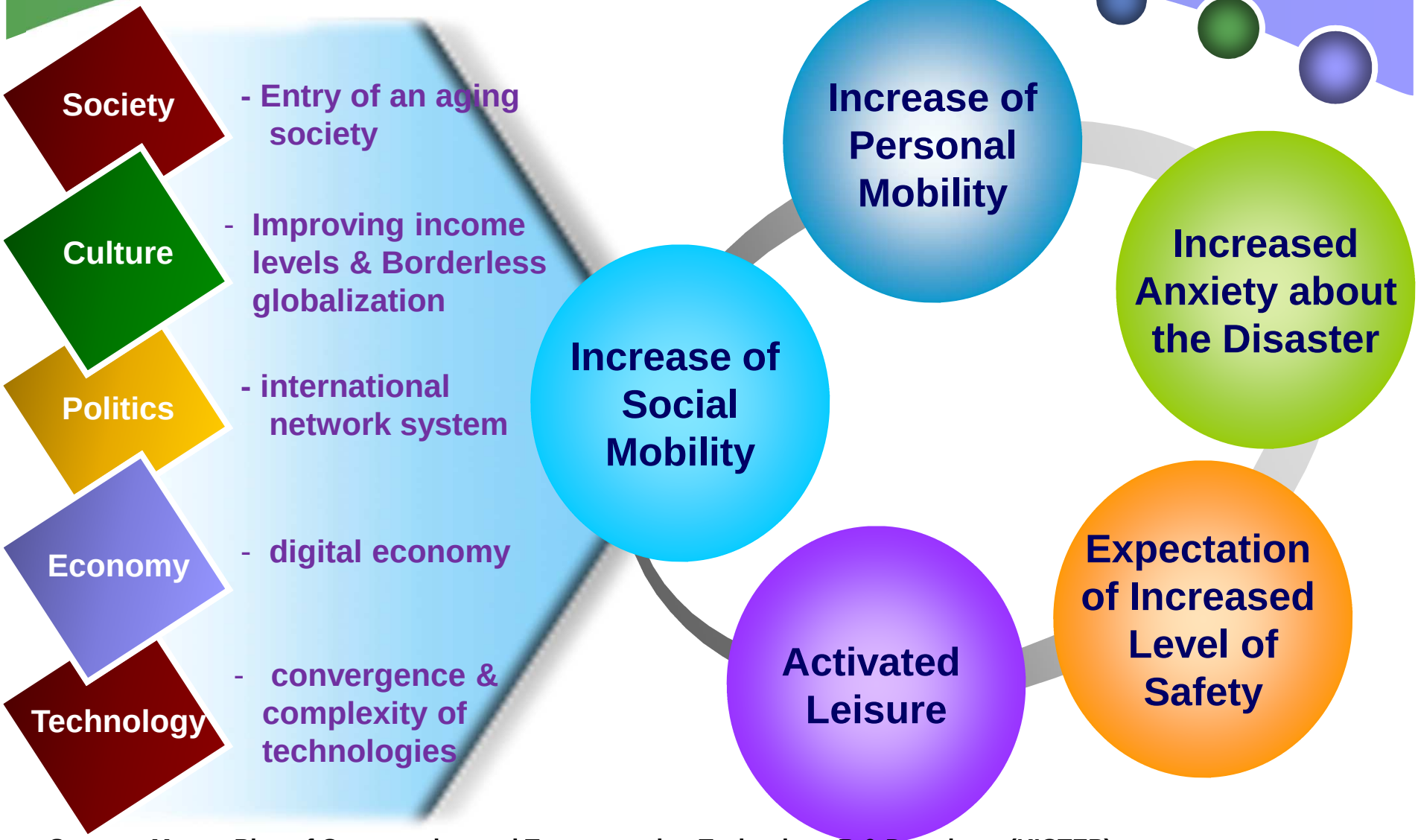


Source : Master Plan of Construction and Transportation Technology R & D projects (KICTEP)

1. INTRODUCTION

Air traffic growth
average annual rate : + 7.3%

Air traffic delays
Operational efficiency and aviation safety

Problems due to traffic congestion

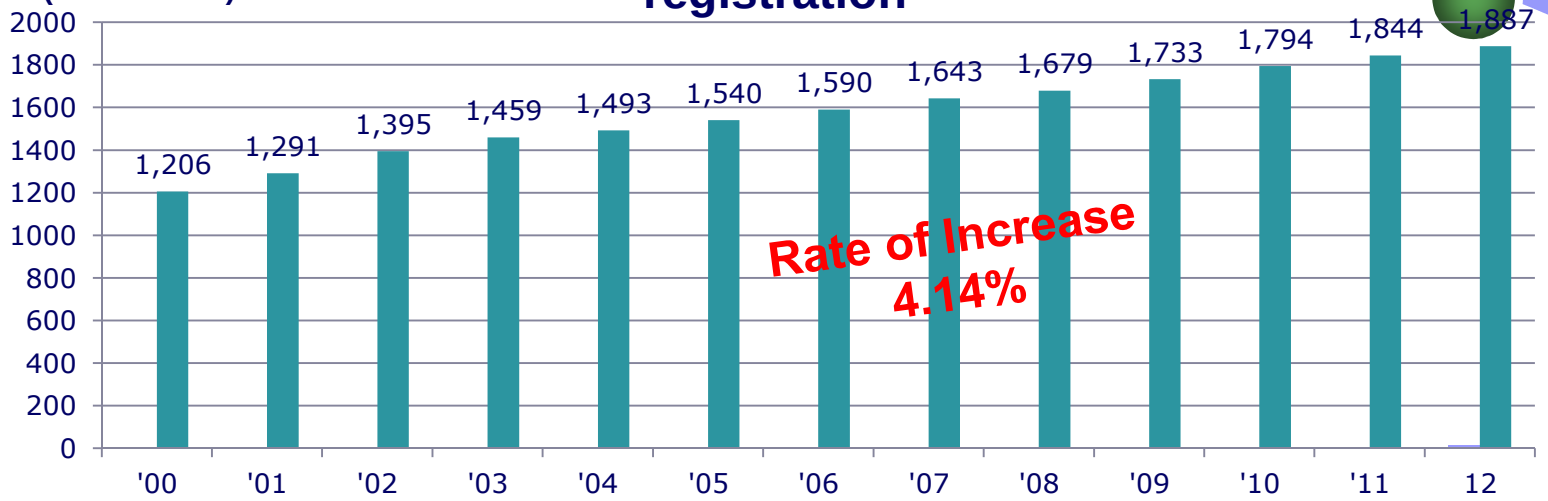
overland traffic congestion
Emergence of PAV

Transport efficiency
Increased traffic congestion costs

- Limited road conditions, traffic congestion → Moving speed lower/ fuel consumption increased
  - ✓ Cost of road traffic congestion : ~ $ 24 billion (2008 in Korea)
  - ✓ Total population : 48.5 m (2008)
  - ✓ Annual Traffic congestion cost : 50 $/person
  - ✓ No. of Vehicle Registration : 16.4 m (2008)
  - ✓ **Annual Traffic congestion cost :** 150 $ /vehicle

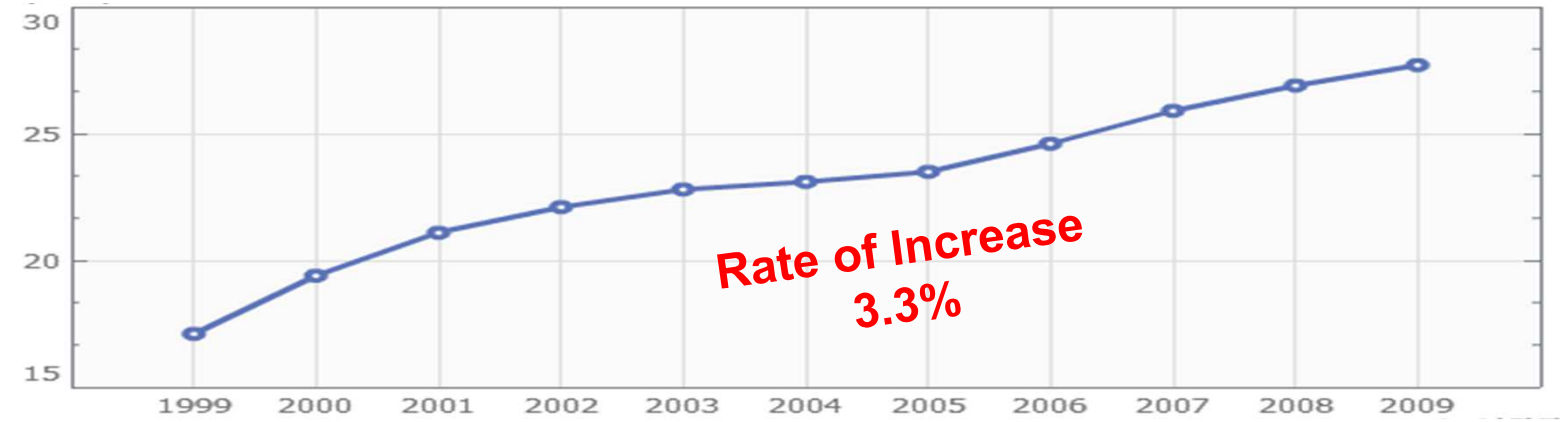
1. INTRODUCTION

Number of vehicles registration



Source : The ROK Ministry of Land Transport and Maritime Affairs

Annual Traffic Congestion Cost



Source : The ROK Ministry of Land Transport and Maritime Affairs

1. INTRODUCTION

2. TRENDS OF PAV DEVELOPMENT

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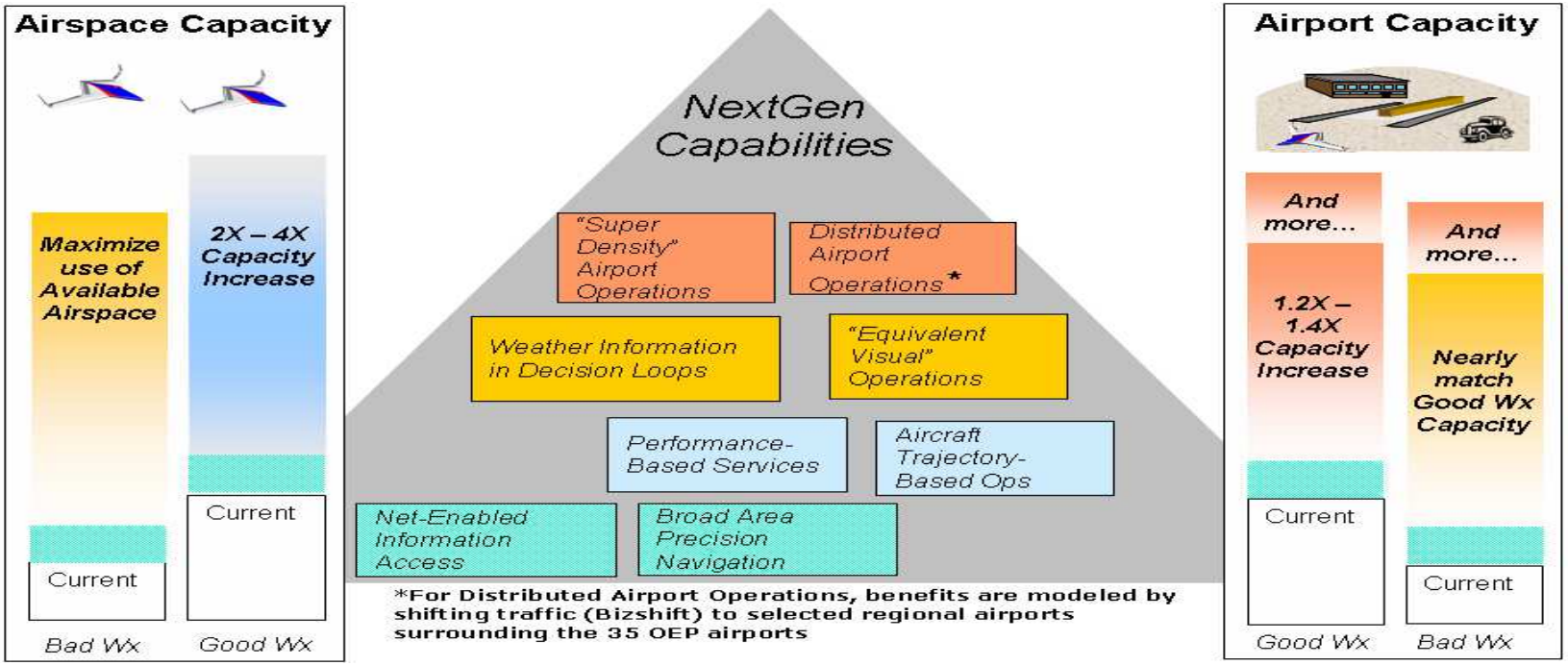
International Trend

- NASA Concept of PAV
  - ✓ In the 2005 Centennial Challenge initiative in conjunction with the CAFE Foundation, NASA has proposed the definition of a PAV as follows;
    - Seats 2 to 6 passengers, 240–320 km/h cruising speed
    - Quiet, comfortable and reliable
    - Able to be flown by anyone with a driver's license
    - As affordable as travel by car or airliner.
    - Near all-weather capability enabled by synthetic vision systems
    - Highly fuel efficient (able to use alternative fuels).
    - 1,300 km range.
    - Provide "door-to-door" travel capabilities
- AGATE/PAVE/SATS programs
  - ✓ AGATE and PAVE programs performed by NASA for developing the core technologies of small aircrafts to provide safer, more convenient and comfortable air transport
  - ✓ SATS Program performed by FAA applying free flight concept for point to point air transport

2. TRENDS OF PAV DEVELOPMENT

International Trend

- NextGen
  - ✓ JPDO(Joint Planning and Development Office) set-up in 2005
  - ✓ To cope the air traffic demand of 2-3 times increase up to 2025
  - ✓ Air traffic infrastructure implementation plan
  - ✓ To improve safety and capacity of Airspace and Airport



Source : FAA NextGen

2. TRENDS OF PAV DEVELOPMENT

International Trend

- SESAR (Europe)
- Key Performance Targets in 2020
  - ✓ To enable 3times increase in capacity
  - ✓ To improve safety 10 times
  - ✓ To reduce by 10% environmental impact per flight
  - ✓ To cut ATM cost by 50%

Source : SESAR In Brief, General Overview , 2009

- CARATS (Japan)

SESAR, an ambitious phased programme

→ The SESAR Definition Phase (2005-2008) delivered the SESAR ATM Master Plan. It was developed by a representative group of ATM stakeholders. The plan, based on future aviation requirements, identified the actions, from research to implementation, needed to achieve SESAR goals.

→ The SESAR Development Phase (2008-2013) will produce the required new generation of technological systems, components and operational procedures as defined in the SESAR ATM Master Plan and Work Programme.

→ The SESAR Deployment Phase (2014-2020) will see the large-scale production and implementation of the new air traffic management infrastructure, composed of fully harmonised and interoperable components guaranteeing high-performance air transport activities in Europe.

2. TRENDS OF PAV DEVELOPMENT

ROK Trend

- KOREA AEROSPACE RESEARCH INSTITUTE(2010)
  - ✓Preliminary study on PAV has been performed under the program of the ROK Ministry of Knowledge Economy (MKE).
  - ✓Roadmap for the development of PAV has been set up to 2030 focused on the development of air vehicles.

- THE KOREA TRANSPORT INSTITUTE (2011)
  - ✓Master plan study on the infrastructure for the PAV operation has been performed under the program of the ROK Ministry of Land Transport and Maritimes Affairs.
  - ✓Operating type of PAVs has been classified into 2 modes.
  - ✓Operation concept for the near-term, the mid-term and the long-term has been developed in the frame of the development stage of PAVs.

3. OPERATION CONCEPT FOR NEXT GENERATION AIR VEHICLES

3.1 Scenario for PAV Operation
3.2 Phase 1 operation concept
3.3 Phase 2 operation concept

3.1 Scenario for PAV Operation

Conventional take-off and landing PAV

- Mainly flying , possible to drive
- Operated environment friendly/ economically
- Relatively long-haul flight

Short/Vertical take-off and landing PAV

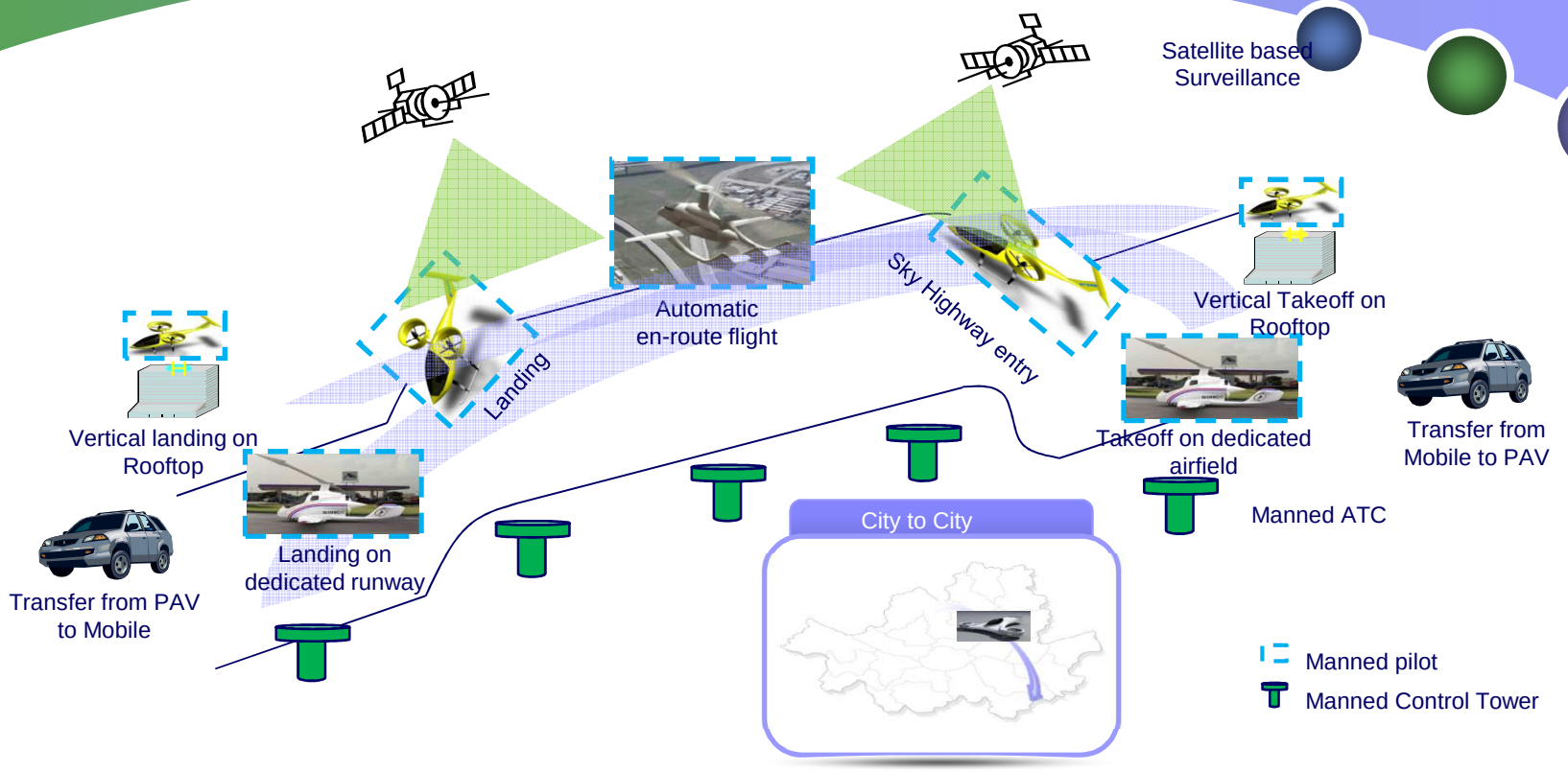
- High space –utilization
- Operated simply
- More expensive than CTOL

Image source s: Terrafugia Transition, Paul Moller′s skycar etc.

3.1 Scenario for PAV Operation

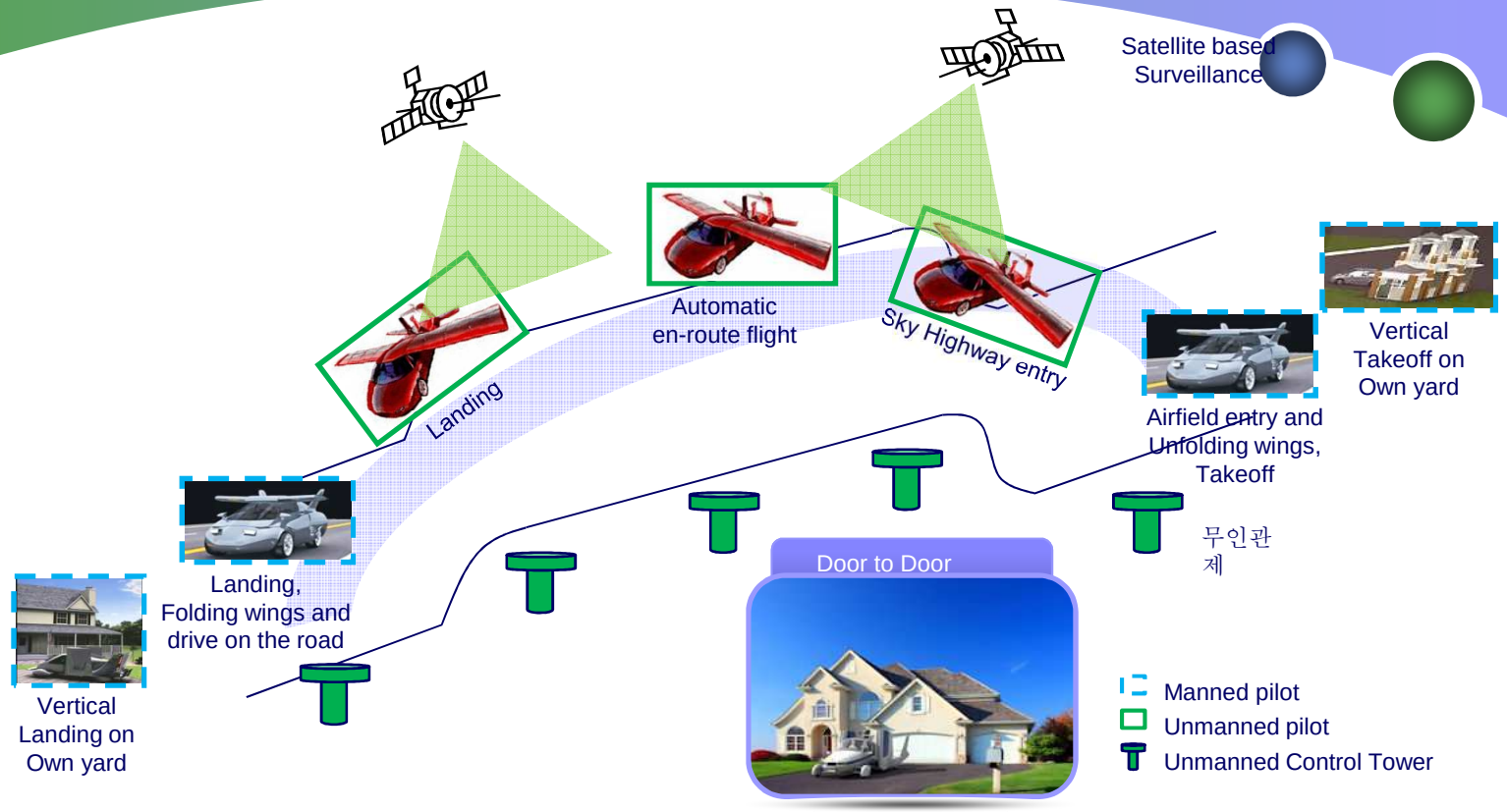
		Phase 1	Early Phase 2	Late Phase 2
Type of PAV		CTOL	STOL+VTOL	STOL+VTOL
Operation Mode		Single Mode	Single Mode	Dual Mode
Accessibility		City to City	Zone to Zone	Door to Door
Air-field	Size	PAV airfield with runway	Vertical take-off and landing airfields (reduced in size), building rooftops, etc.	Private residential yards, building rooftops, etc.
	ATS	Manned	Unmanned	Unmanned
Pilot		Manned	Manned	Manned (Road)/ Automated (Sky)

3.2 Phase 1 operation concept



- "See and Avoid" Operational Concept
  - ✓ Similar to the operation for the light aircraft and ultra-light aircraft.
  - ✓ Visual flight rules and air traffic services with current air traffic control procedures.
  - ✓ Conventional infrastructure : aerodromes, taking-off and landing facilities, designated airspace for light and ultra-light aircrafts in Korea

3.3 Phase 2 operation concept



- "Detect, Sense and Avoid "Operational Concept
  - ✓ Ultimately, based on the concept and technologies for free flight.
  - ✓ Concept of highway in the sky with automatic air traffic service
  - ✓ Operated in vertical taking-off and landing mode and both on the ground and in the air.

4. CONCLUSION

4. CONCLUSION

- Emergence of New means of transportation
  - ✓Traffic congestion, New technologies, Convergence of vehicle + aircraft
  - ✓Types of PAV operation
    - Single mode(flying only)
    - Dual mode(flying and driving)

- Operation Concept
  - ✓Operation concept for PAVs
    - Phase I (short term) : “see and avoid” under controller’s ATS
    - Phase 2 (long term) : “detect, sense and avoid” under automatic ATS
  - ✓Accessibility to Destination improved (door to door).

Thank You !

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