Session 2 :
Low Environmental Impact Transportation Systems

Chair:

YAMAGUCHI Eiichi, Professor, Doshisha University

Organizer:

NIWA Kunihiro, Senior Fellow, CRDS, JST

Panelist:

1. HAYASHI Koichi, Professor, Aoyama Gakuin University
2. TSUKAMOTO Hisashi, CEO/CTO, Quallion LLC
3. YAMAMOTO Iwao, President, Mitsubishi Chemical Science and Technology Research Center, Inc.
4. MORIKAWA Hiroyuki, Professor, University of Tokyo
5. WATANABE Hiroyuki, Senior Technical Executive, Toyota Motor Co.

Session Objective

We discuss the social and economic issues as well as technological issues to sketch the transportation systems 10 years from now.

In particular, we discuss the design and implementation of *Ba* (Interaction Field among key players).

Brain storming as a case study of Ba

Goal: Realize low environmental impact transportation systems that accounts for the largest proportion of world's CO_2 emissions.

Provocation: What is the car engine, which consumes oil and exhausts CO_2 and polluted gases ? Instead of thinking about Kaizen of the engine, think about paradigm disruptive innovation by "digging into science".

Key technology:

1. Liquid nitrogen (air) thermodynamic system
2. Electric motor system (rechargeable battery etc.)
3. paradigm disruptive ITS (wireless IT)

Mobility 2030 : Seven Goals

GIES2007

1. Reduction of conventional pollutants
2. Limit transport related GHG emissions to sustainable levels
3. Reduce the total number of road vehicle-related deaths and serious injuries
4. Reduce transport-related noise
5. Mitigate congestion
6. Narrow the “mobility opportunity divides”
7. Enhance mobility opportunities for the general population

GIES2008

Summary

Provocation by Yamaguchi

Large companies cannot descend from the “mountain”, once they ascend it. Are the current automobiles, which consume oils and exhaust pollutions and CO_2, really a right “mountain”?

Here, we set up a controversial Ba (field) to perform a provocative brain-storming, and dare to descend from the “mountain” toward what automobile should be for the future. We would then like to create the field of resonance to discover a vision of highly mobilized society 10 years from now on.

Summary

Presentation by Hayashi

Automobiles which never consume oil, completely different from the current automobile paradigm, are possible. Specifically, liquid nitrogen or liquid air cars are quite feasible.

Furthermore, we can make automobiles which even purify the atmosphere by hybridizing this liquid air car system with the electric car system. To realize this paradigm disruption, venture companies will carry an important role.

Compressed Air Vehicle: Present Status

MDI Inc. (Luxembourg) → Tata (India): nano(>$3,000)

a rear-wheel drive, all-aluminium, two-cylinder, 623cc, 33ps, multi-point fuel injection petrol engine

- **High pressure tank regulation**
- **Hybrid with gasoline engine**

http://www.tata.com/0_media/features/interviews/20080110_one_lakh_car.htm

Aoyama Gakuin University: 30-40 km/h efficiency

Summary

Presentation by Tsukamoto

The feasibility of the automobiles run by lithium ion batteries is quite enormous. To escape from the current oil-paradigm society, we have to accelerate the industrialization of the electric cars, specifically lithium ion battery cars. To encourage this activity, we need more entrepreneurs with enough vision/mind/talent to create new industries.

However, in Japan, creative engineers can hardly find the ba (field) on which he can exhibit their creativity. It is very important to maintain and encourage such Ba (fields), in order to realize the vision of new industry structures for the near future.

Safety Issue: Manageable

Fully Charge Crush Test

Quallion Helicopter Battery

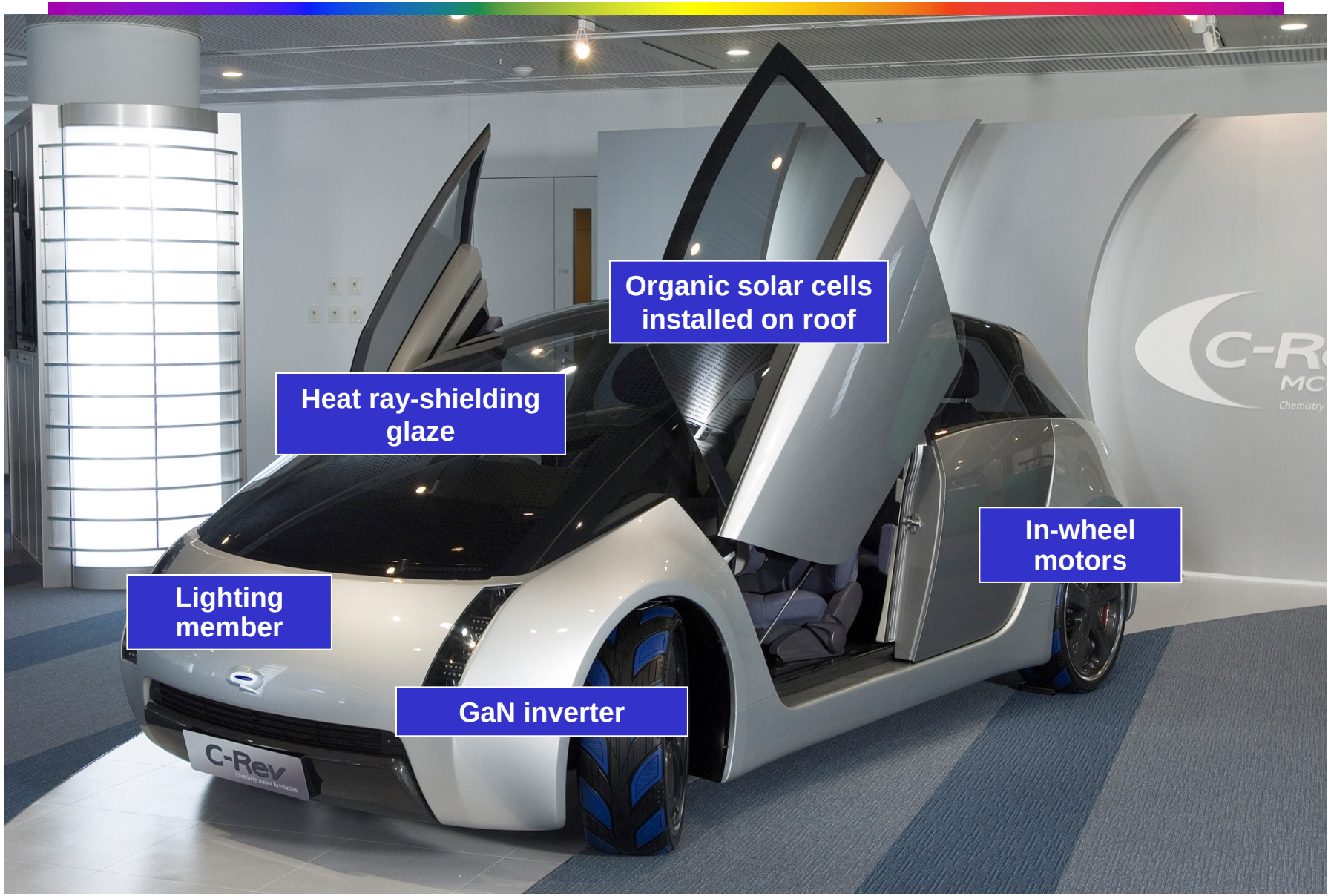
Summary

Presentation by Yamamoto

We are proceeding the technology innovation for enhancing the battery capacity. It is quite feasible to make electric cars which can run for 400 km by just one charge. We are now trying to reduce the weight of cars by 40 %. By this reduction, we will even make electric cars which can run for more than 500 km by one charge.

Furthermore, GaN is now being available for the materials for inverters and lighting systems. Thus, we can dramatically reduce the electric power consumption in the cars. Such dramatic innovation recently occurred in the field of materials will make it clear to design our future society.

Energy-saving Functions on Vehicle



Summary

Presentation by Morikawa

Vehicle-to-Vehicle Communication system is a key technology for realizing ubiquitous society with a wireless neural network system. With this system, we can realize autonomously-aided automobiles which can feel real spaces, take data for real world, connect each other, and, according to Watanabe-san, even come along anytime when we need mobility like “Kinto Un”.

In order to promote this technology globally, we need to share the total concept of mobility and standardize some protocol. First of all, we need some “Ba” to discuss the new concept.

取る・繋ぐ・貯める・使う

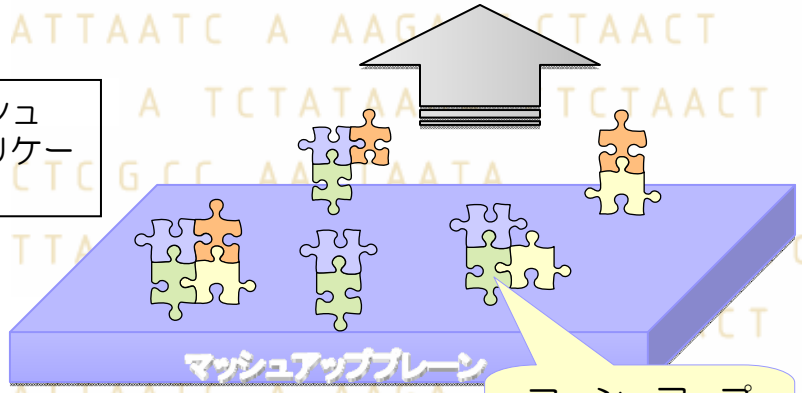
危険察知・共有サービス

コミュニティ支援サービス

メタボリック対策サービス

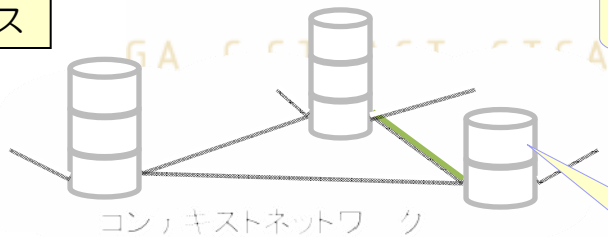
コンテキストアウェアアサービス群

コンテキストのマッシュアップを行い，アプリケーションに提供する



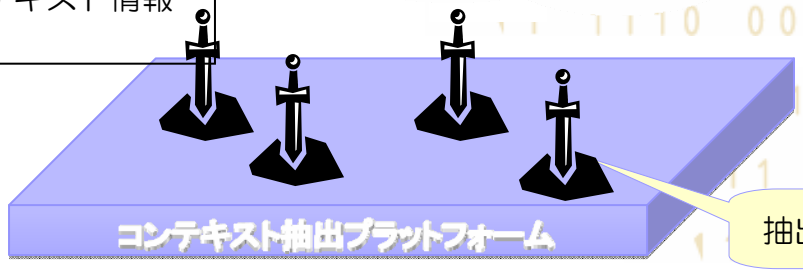
マッシュアップエンジン

様々なコンテキスト情報を蓄積する分散データベース



オープン分散データベース

センサ情報，サービス利用履歴，ユーザプロファイルなどからコンテキスト情報を抽出する



抽出プラグイン

Summary

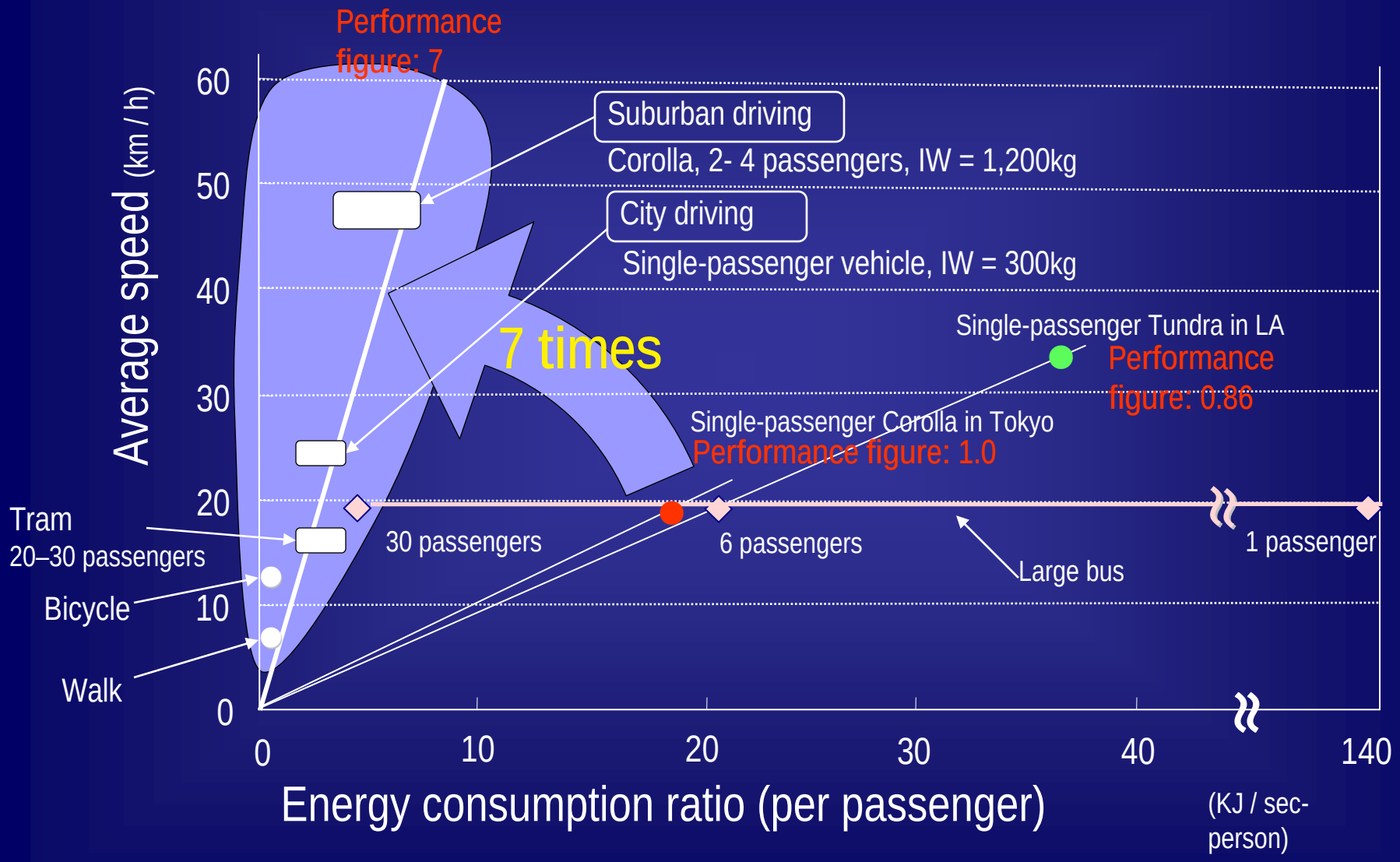
Presentation by Watanabe

We are strongly promoting R&D for plug-in hybrid, fuel cell hybrid and electric vehicles. This is to reduce CO_2 emission, to overcome excess dependence on oil/biomass, and to remove the air pollution.

Furthermore, we are strongly promoting new class of ITS. This is to minimize traffic accidents, to mitigate congestions and to narrow the mobility opportunity divide.

To realize well-mobilized society, we have simultaneously to encourage the urban design innovation in order to smooth the traffic flow as well as QOL of the residents. For this purpose, we should discuss a grand design for new transportation systems by organizing international alliances (as GIES Ba).

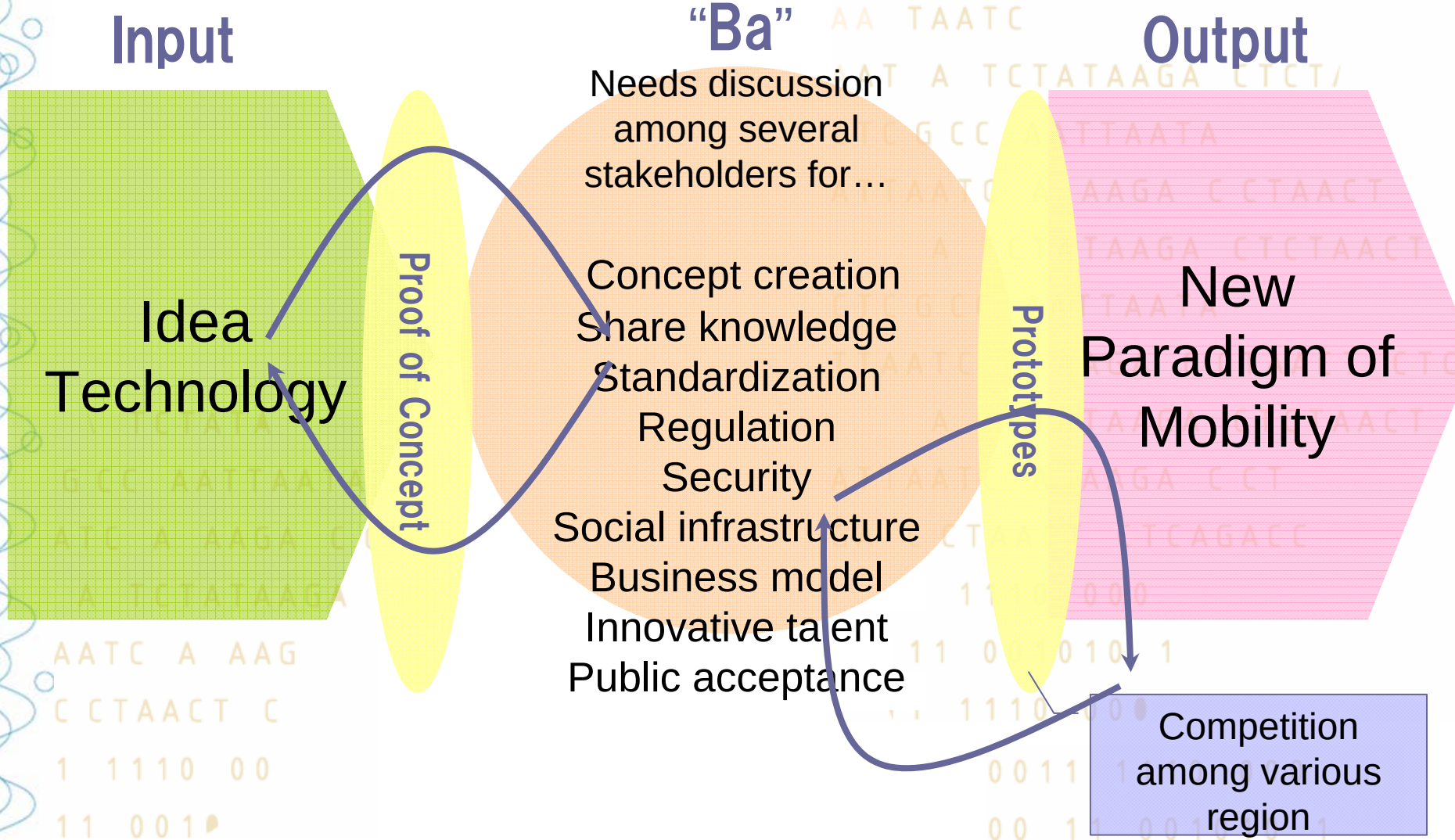
Mobility Performance: Improvement



Resolutions

- Needs for LEITS (Low Environmental Impact Transportation Systems)
  - CO_2 emission, Oil vanishing, BRICs' coming up etc.
- Elements of LEITS
  - Paradigm disruptive ideas：Liquid nitrogen (liquid air) car
  - Paradigm disruptive technologies (Li-ion batteries, new inverters, new lighting systems wireless power transfer）, High-speed wireless communications, Light materials for the body.
  - Handling information (Take, Connect, Store, Use)
- Challenges toward LEITS
  - Draw a grand design for the future after descending the "mountain"
  - Promote international collaboration for the open integral innovations
  - Integrate technologies into the total socio-economic systems
  - Business model which support promotion of LEITS system like V2G
  - Public acceptance
- International collaboration for…
  - Sharing environmental data,
  - Realizing "Ba" to discover various paradigm disruptive innovations and make ground design for the new transportation system

Innovation Eco-System for Low Environment Impact Transportation Systems



Time Schedule

- Step 1. Propose a draft of the grand design for new transportation systems that take it into account national and urban development plans by 2015.
- Step 2. Finalize the grand design that reflects the trial results at model systems by 2025.
- Step 3. Introduce the new transportation systems in special experimental zones around the world by 2030.
- Step 4. Achieve the world-wide adoption of the new transportation systems by 2050.