Final Report on an Automated Truck Platoon within Energy ITS Project

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Outline

- Introduction of “Energy ITS” Project
- Automated Truck Platoon
  - Technologies
  - Effectiveness of platooning on energy saving and CO_2 emission reduction
- Demonstrations
- Conclusions

Outline of "Energy ITS" Project

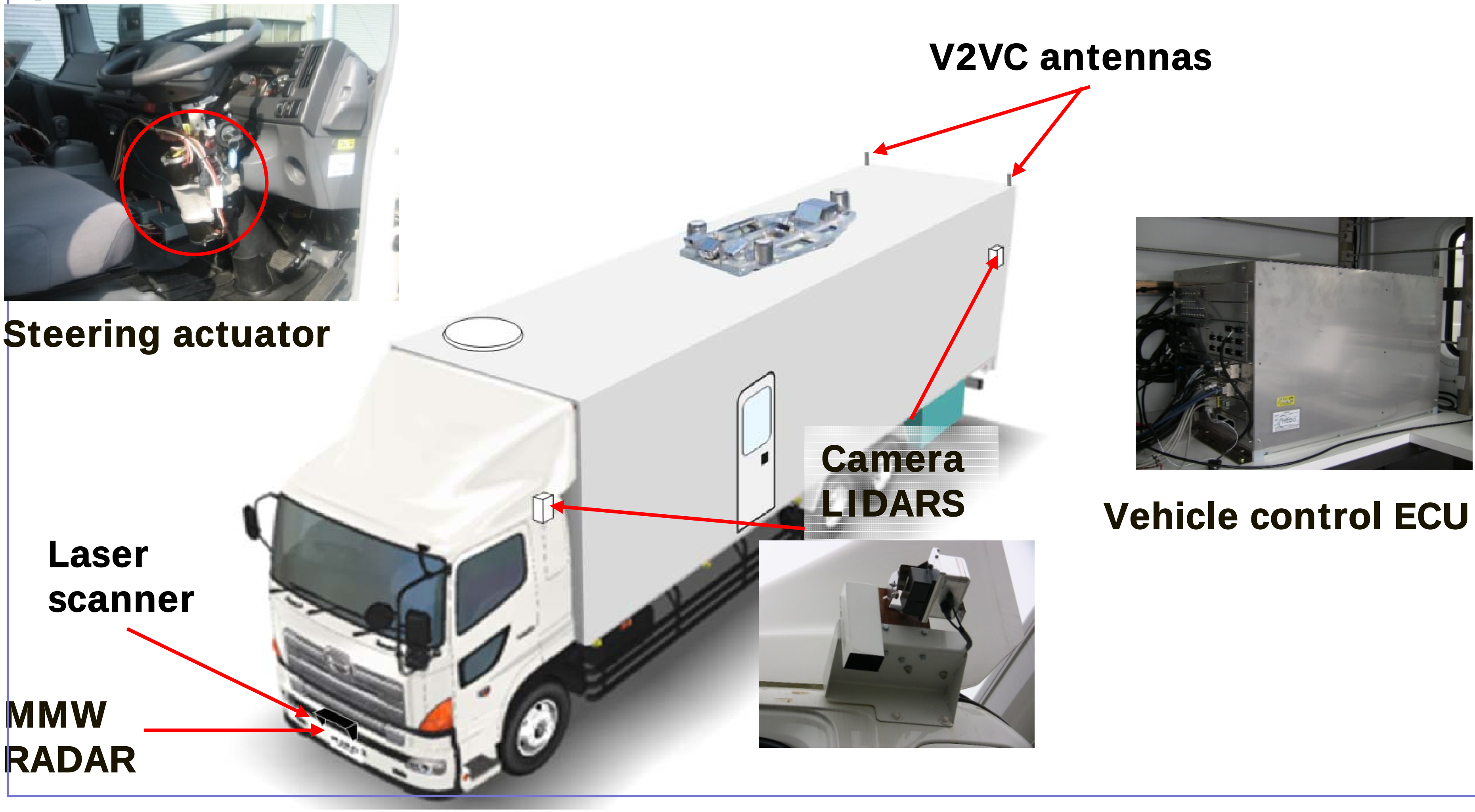
- Objectives: energy saving and CO_2 emission reduction in road transportation
- Period: 2008FY – 2012FY
- Funding: METI* & NEDO**, about 4.4 billion yen in 5 years
- Themes
  - Automated truck platoon (3.9 B yen)
  - Evaluation method of effectiveness of ITS on CO_2 emission reduction (0.5 B yen)

*METI: Ministry of Economy, Trade and Industry
**NEDO: New Energy and Industrial Technology Development Organization

Automated Truck Platoon

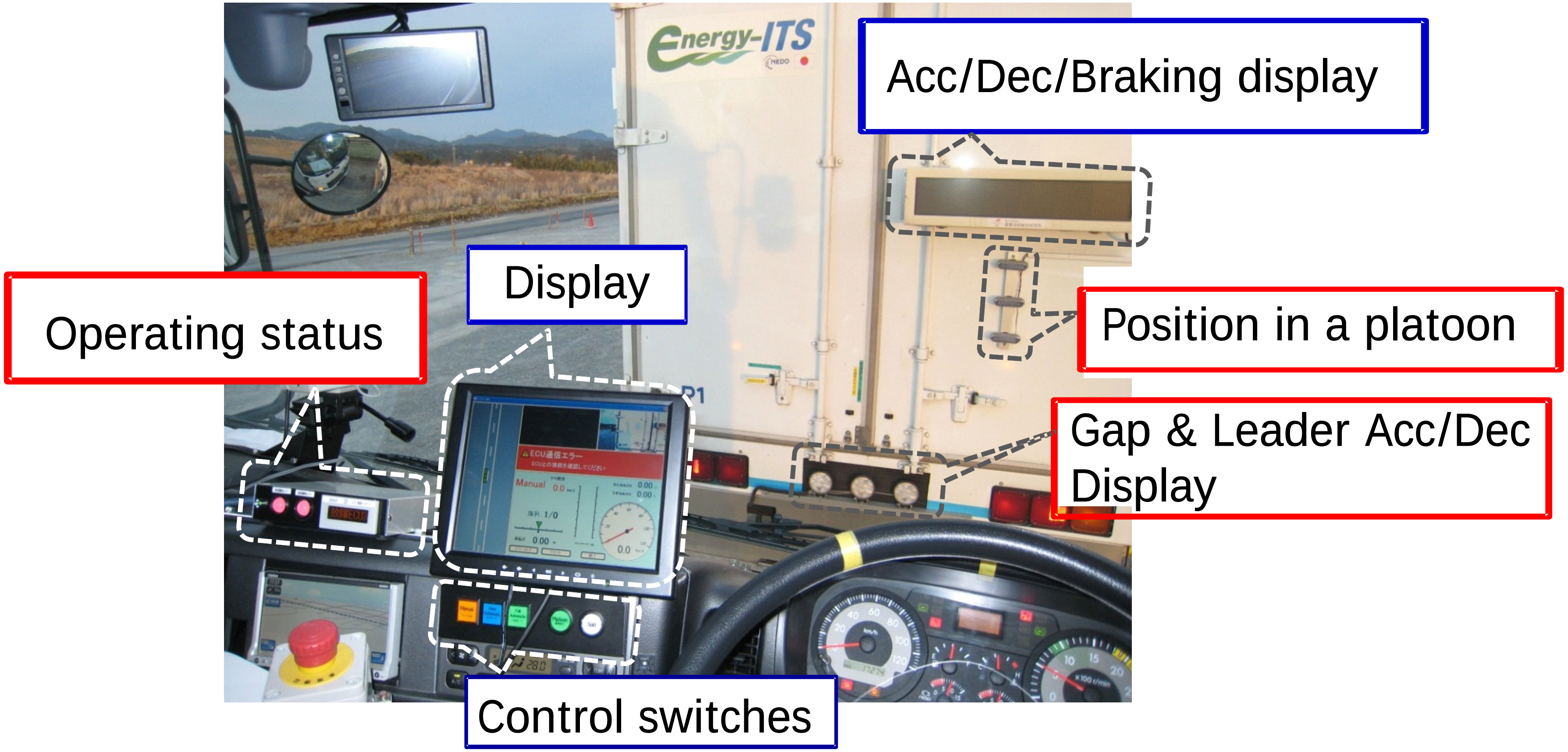
- Objectives
  - Energy saving and CO_2 emission reduction by reduction of aerodynamic drag by platooning
- Technologies
  - Passive and active computer vision for lane marker detection for lateral control
  - Radar, laser scanner, and Inter-vehicle communications for gap measurement for longitudinal control
- Feature of the technologies: high reliability
- Goals
  - Fully automated truck platoon: 3 heavy automated trucks and 1 light automated truck at 80 km/h with 4 m gap
  - Cooperative ACC: 4 heavy trucks at 80 km/h with 30 m gap

Configuration of the Vehicles



HMI for Drivers on the Followers

- Information to drivers on the dashboard and on the back of the leader



Passive Safety Device

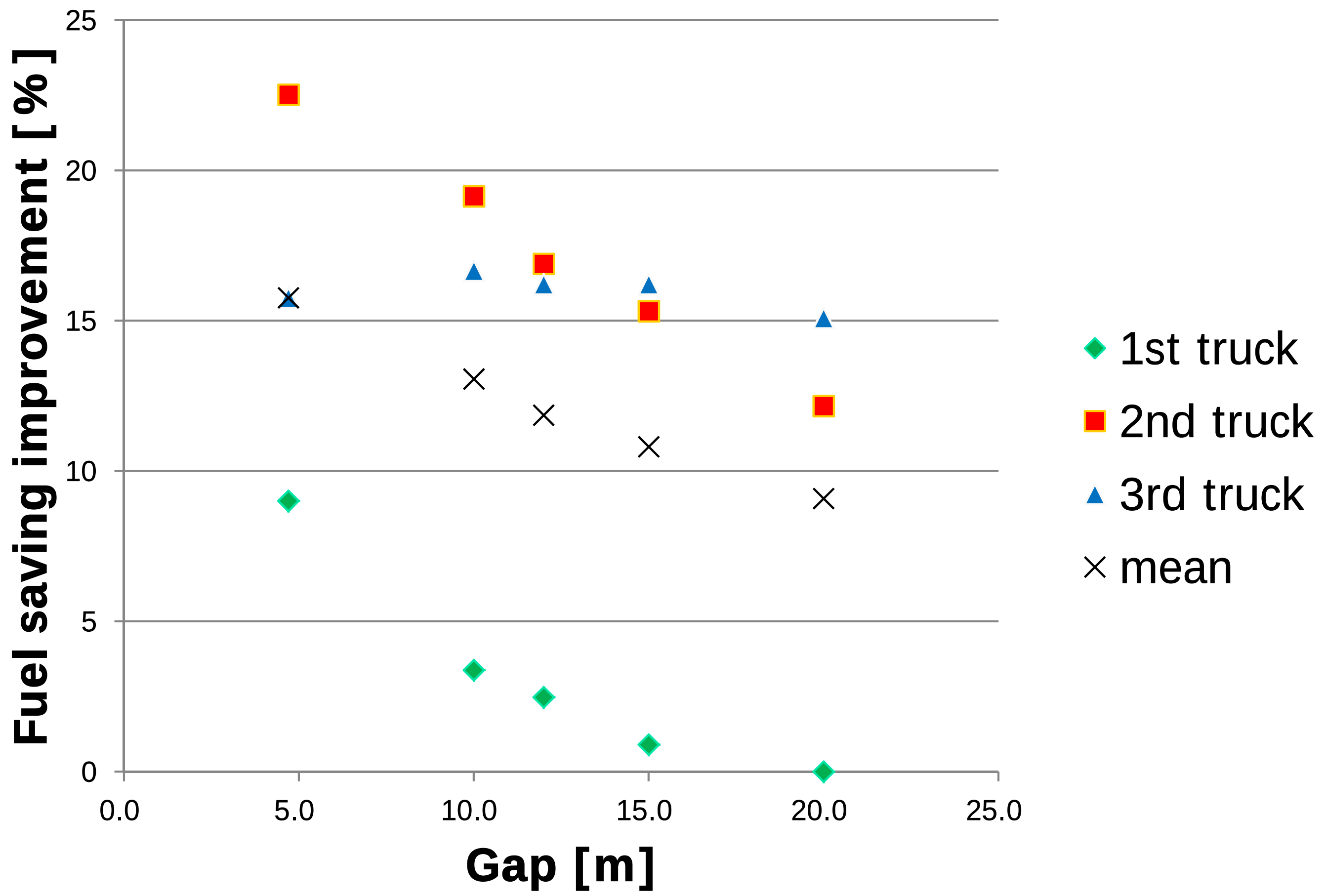
- Shock absorber for 4 m platooning

(left) trial device, (right) experiment

Fuel Saving by Platooning

3 truck platoon, empty-loaded, 80 km/h

3 truck platoon, empty-loaded
80 km/h



Performance of Platooning

Items		Goal	Experiments
Lateral control	Along straight line	±15 cm@80 km/h	±10 cm以下
	Along a curved line (1000R)	±20 cm@80 km/h	±20 cm以下
Longitudinal control	Steady state	±0.5 m@80 km/h	±0.5 m以下
	Decelerating state	-1.5 m@0.2 G	-1.0 m以下
		-3.0 m@0.5 G	-2.0 m以下
Fuel consumption reduction (3 trucks, flat road, empty-loaded)	Gap=10 m	13 %	13.7 %
	Gap=4.7 m	18 %	15.9 %

Effectiveness of Platooning on CO2 Emission Reduction

- Estimate of CO2 emission reduction by simulation
  - Roadway: Tomei expressway, Tokyo area, about 100 km
  - Traffic flow: light vehicles 69 %, heavy vehicles 31 %
  - Platoon rate: 40 % of heavy trucks

Speed	**Gap**	**Micro effect (less aero drag)**	**Macro effect (capacity Increase)**	**Total**
80 km/h	10 m	2.0 %	0.1 %	2.1 %
	4 m	3.5 %	1.3 %	4.8 %

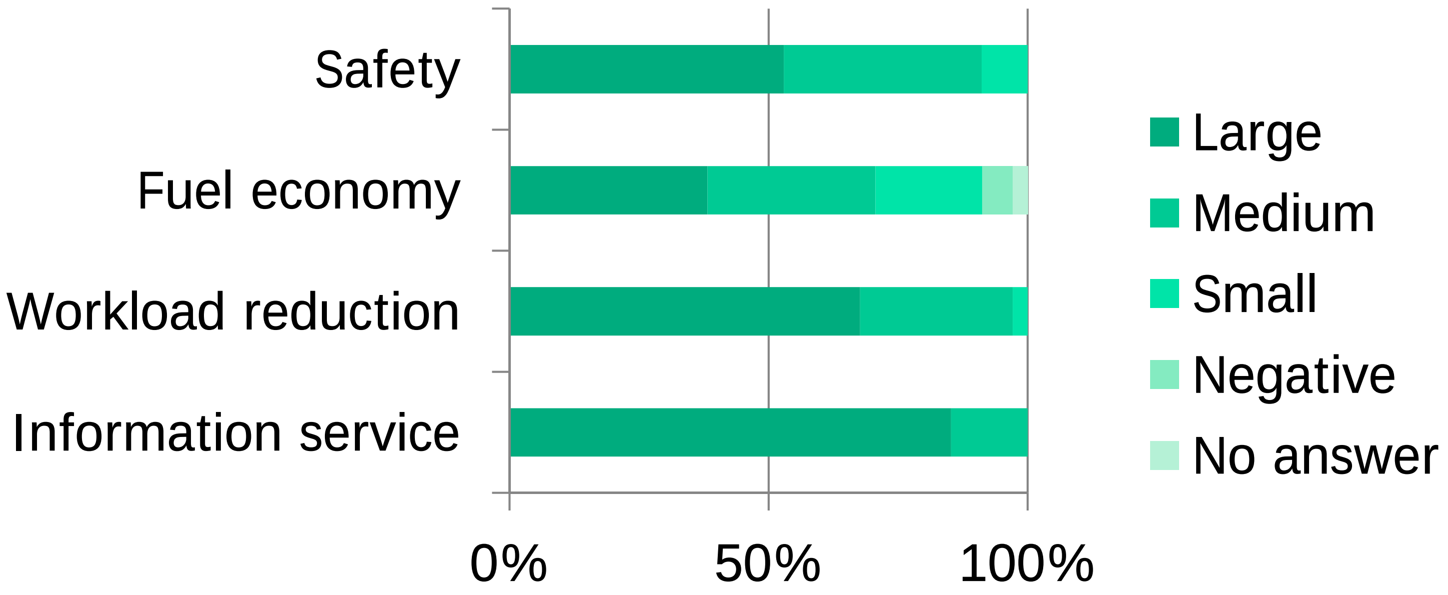
Data: experiments in FY2010

Demonstrations

- Date & site: Feb. 25 – Mar. 1, 2013, AIST test track
- Menu (* test rides for visitors)
  - *Automated platoon of 3 heavy tracks, 80 km/h, 10 m gap
  - Automated platoon of 3 heavy tracks and 1 light track, 80 km/h, 4.7 m gap
  - *CACC of 4 heavy trucks, 80 km/h, 30 m gap
  - A fully automated light track, 50 km/h, lane changing & emergency braking

Acceptance of CACC

- Experiments
  - February, 2013; on a test track
  - Subjects: 20 truck drivers and 9 freight company managers



Conclusions

- Experiments of an automated truck platoon for energy saving and environment
- Features of the technologies: Highly reliable technologies of sensing, V2V communications and control
  - Requirements on reliability for introduction
- Issues on automated truck platooning
  - Legal and institutional issues
  - Market and acceptance