Wireless Power Technology Roadmap

World Energy Transmission System 2003 Workshop
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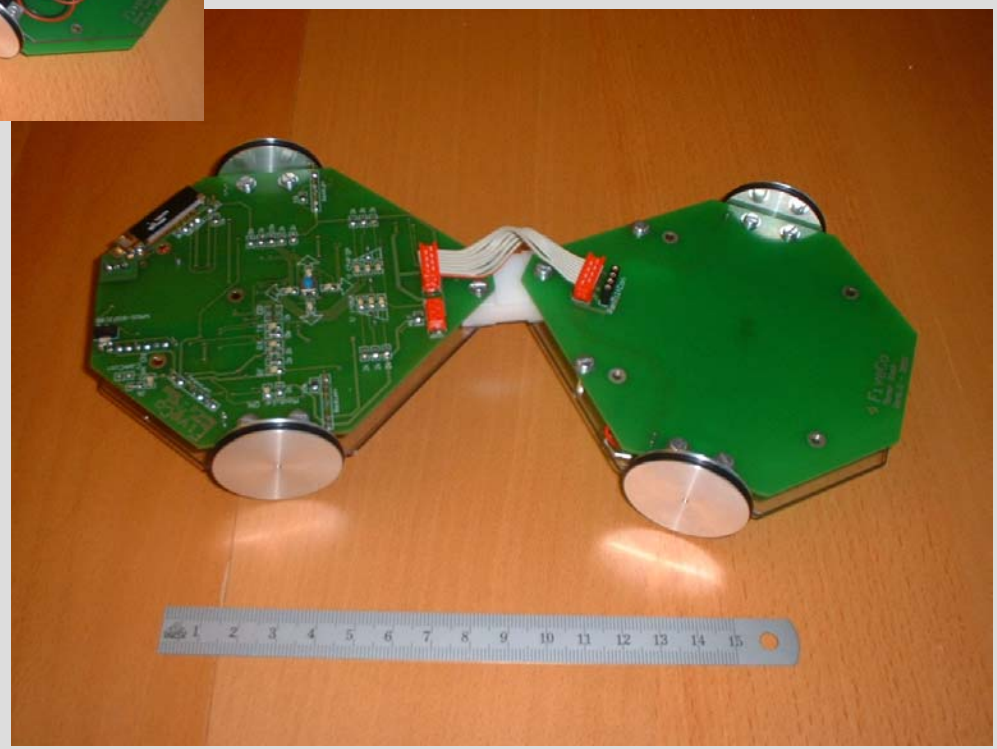
Meudon/Paris

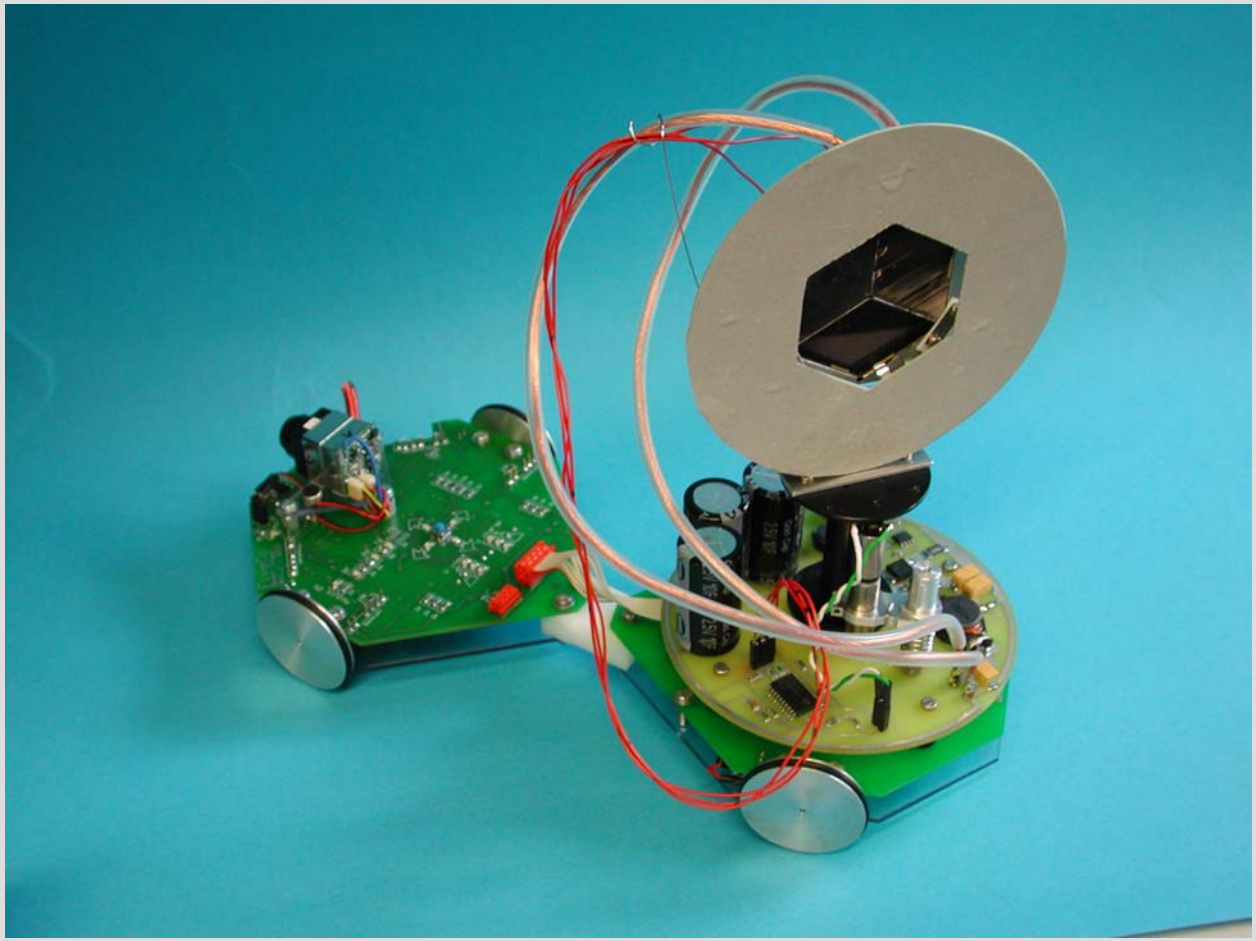
Frank Steinsiek, Christin Schäfer (U-KL)

WIRELESS POWER TRANSMISSION EXPERIMENT



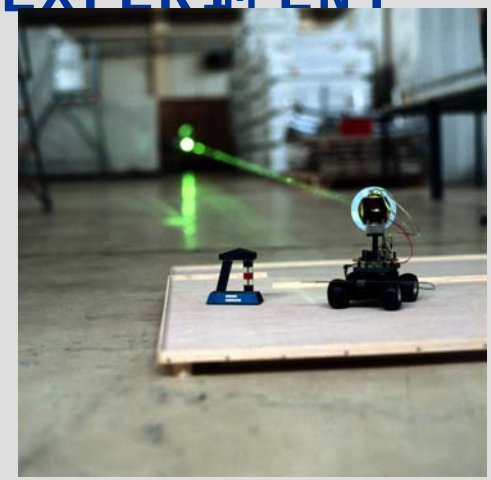
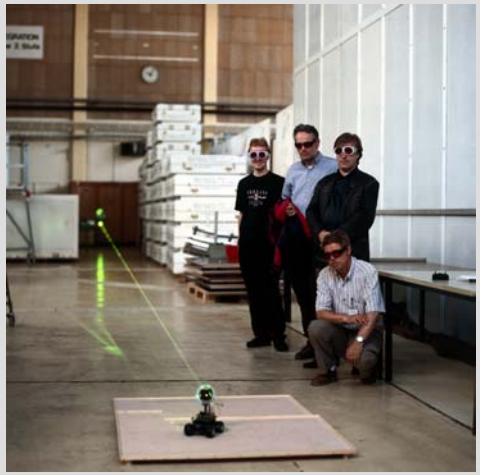
FIveCo Micro Rover

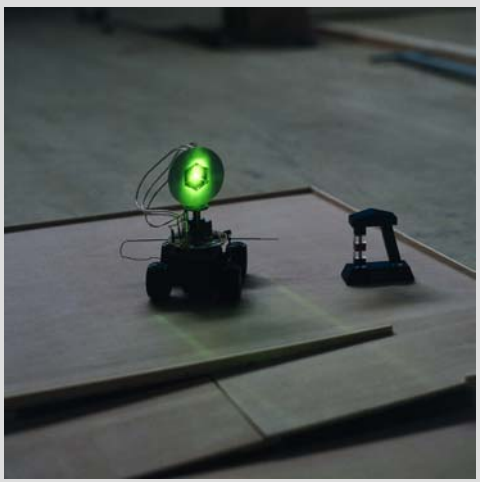
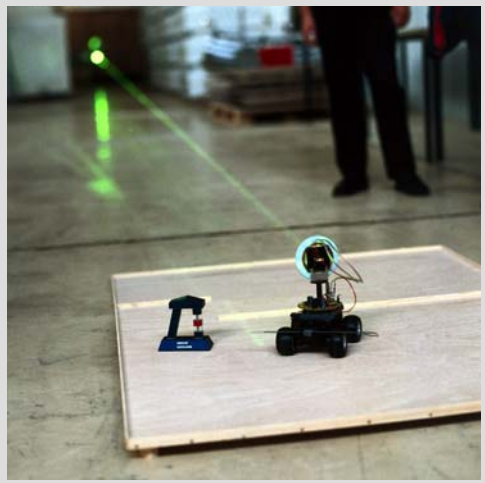
WIRELESS POWER TRANSMISSION EXPERIMENT



FIveCo Micro Rover with Receiver Panel

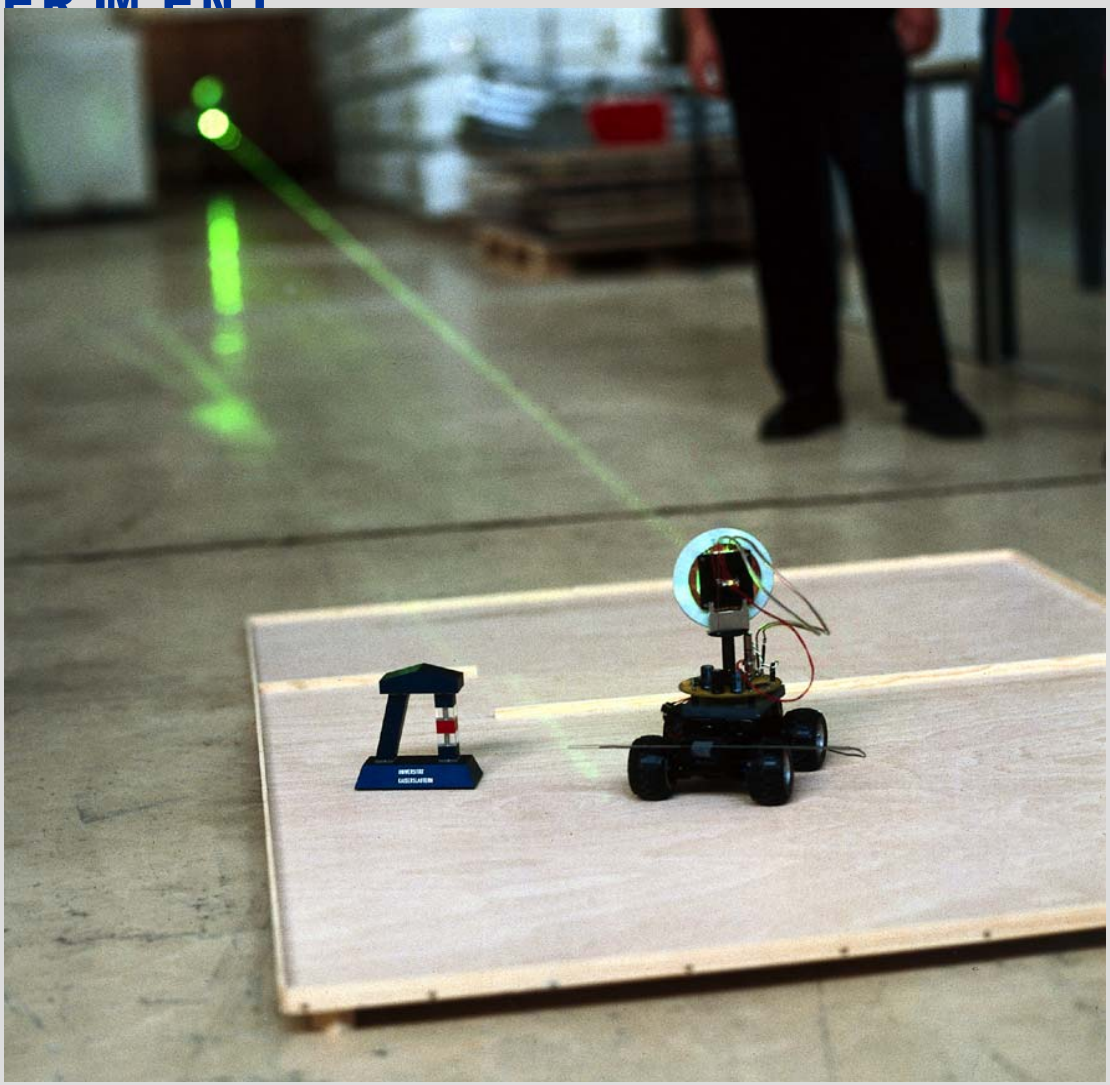
WIRELESS POWER TRANSMISSION EXPERIMENT

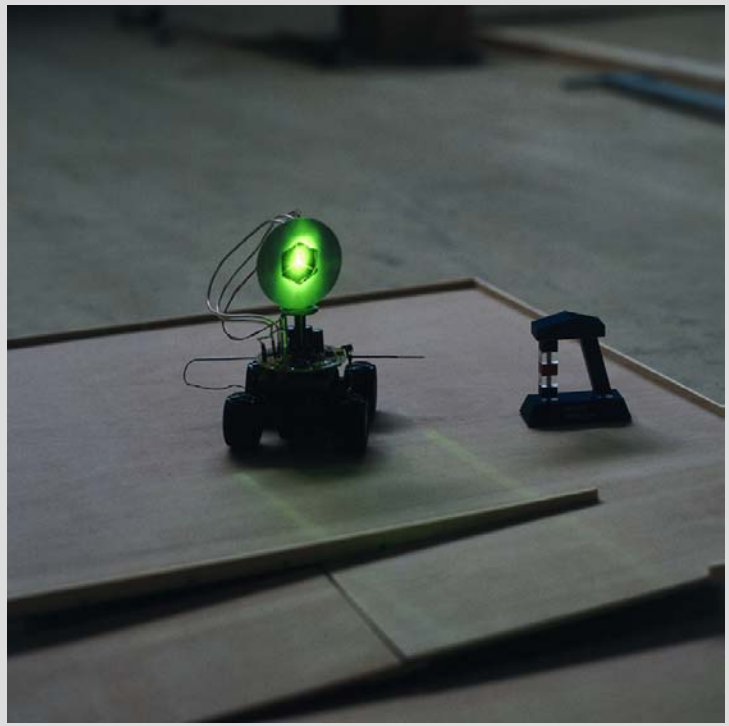

Experiment Set-up

WIRELESS POWER TRANSMISSION EXPERIMENT



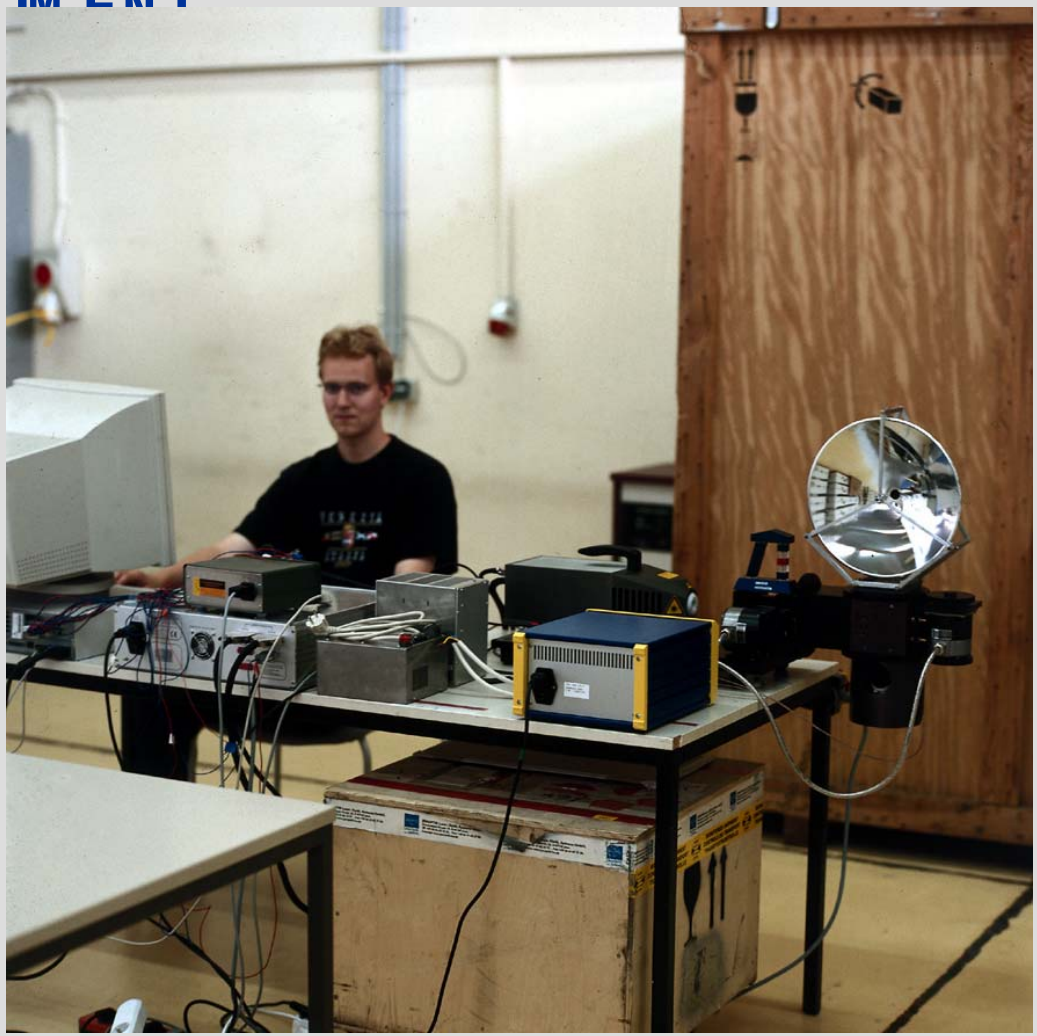
Transmission Chain

WIRELESS POWER TRANSMISSION EXPERIMENT



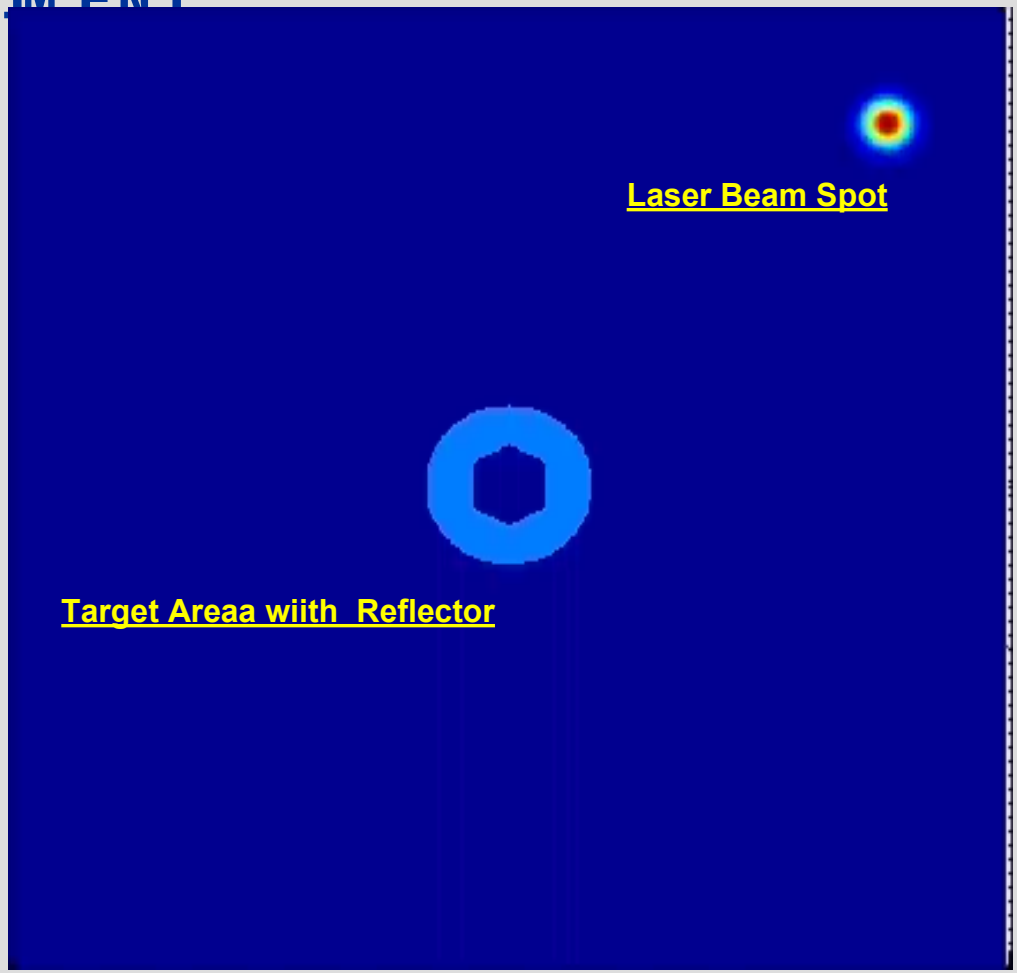
Laser Target Acquisition

WIRELESS POWER TRANSMISSION EXPERIMENT



Laser Transmission & Pointing System

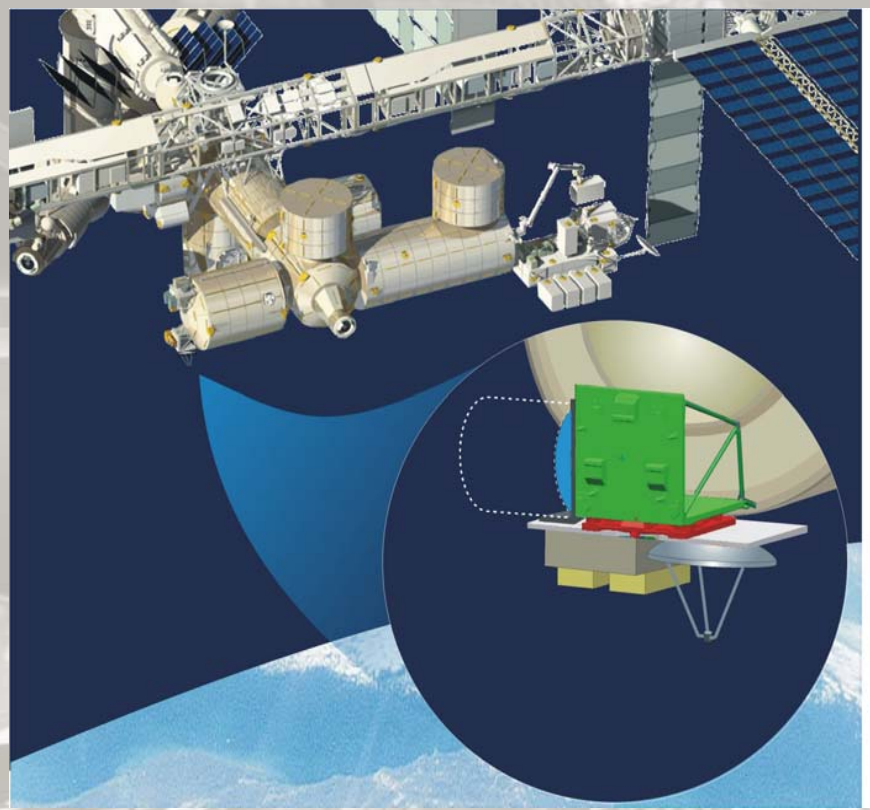
WIRELESS POWER TRANSMISSION EXPERIMENT



Laser Target Finding Process

Wireless Power Technology Roadmap

ISS - Experiment

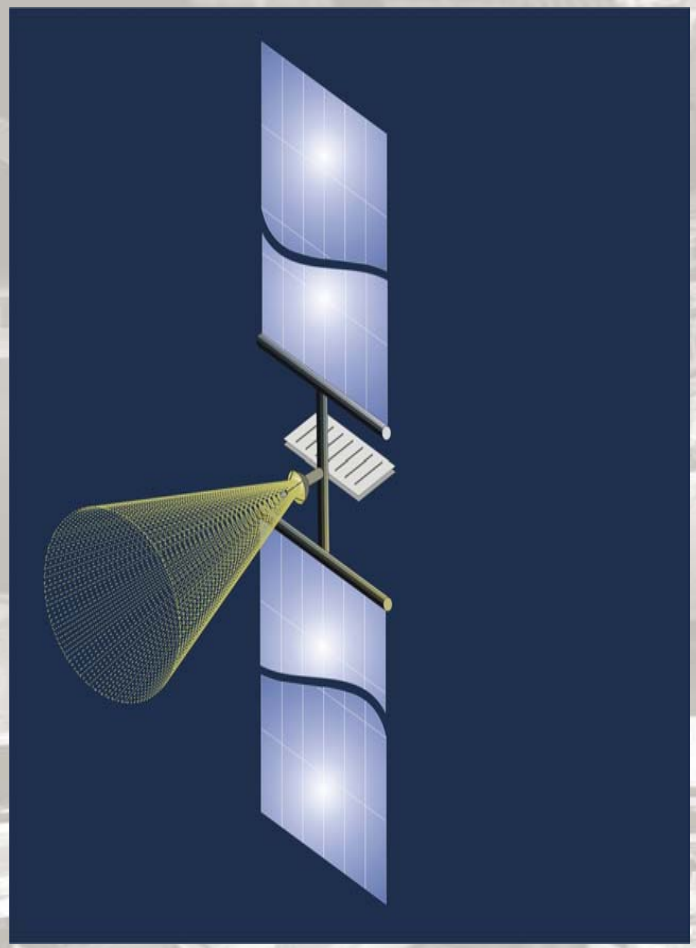


Mission data

Objective	*Demo of power transmission and pointing control loop*
Year	2006
Location	ISS-COF External P/L Facility / nadir
Duration	6 months
Mass	ca. 250 Kg
Launch	Shuttle or AR 5/ATV
Technique	diode / Nd:YAG laser
Power level	ca. 0,3 KW laser output
GND receiver	500 m/ photo elements integrated reflector steering control with ISS system

Wireless Power Technology Roadmap

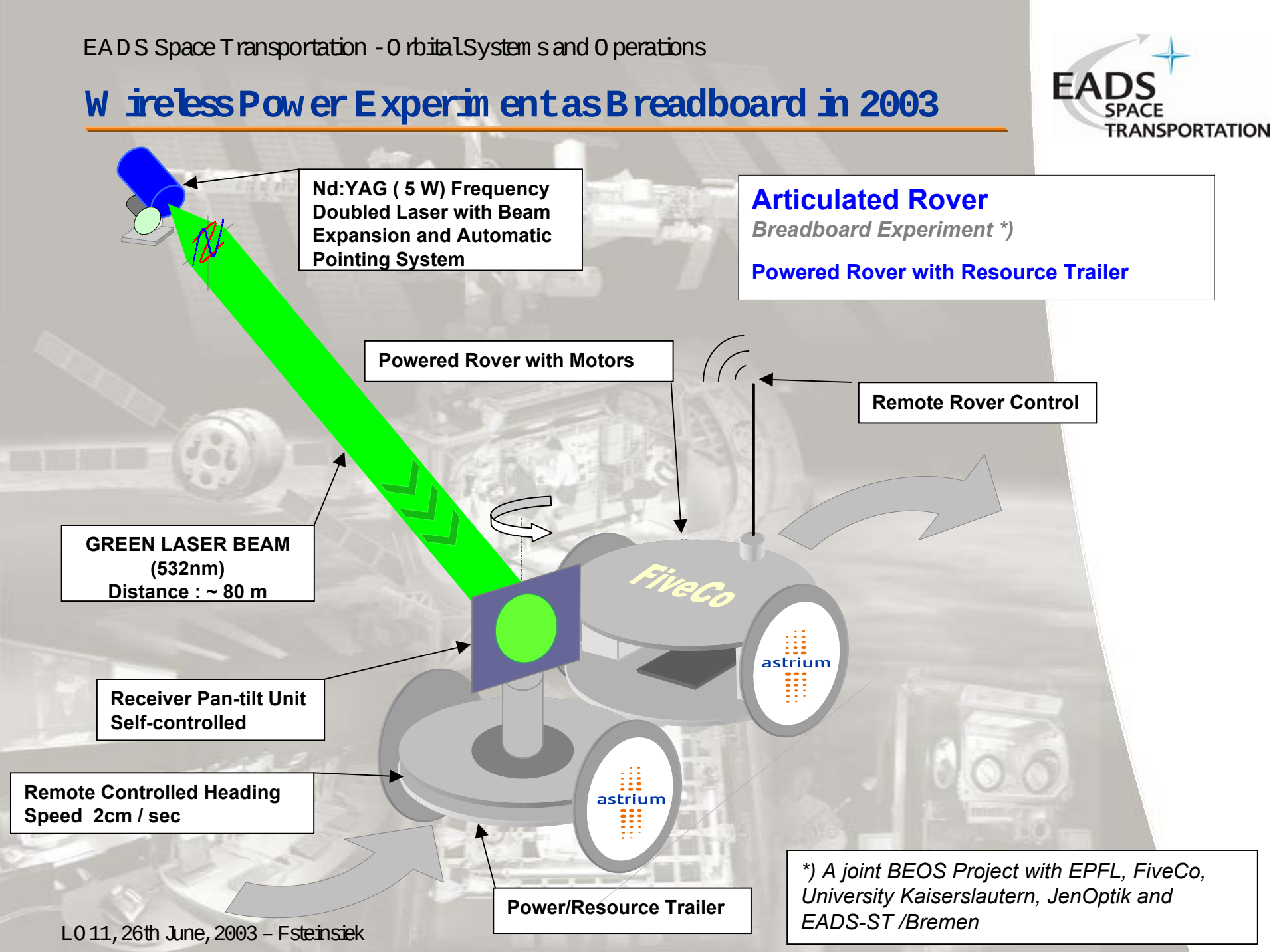
GEO Demonstrator



Mission data

Objective	*Demo of long distance power transmission and pointing control loop*
Year	2010
Location	GEO
Duration	36 months
Mass	max. 10 to
Sun collector	ca. 6000 m^2
Launch	Ariane 5
Technique	Nd:YAG laser
Power level	150 KW laser output
GND receiver	90 m diam. / photo elements integrated reflector steering control with ISS system

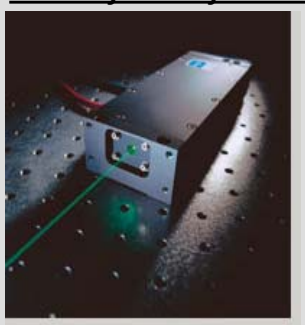
Wireless Power Experiment as Breadboard in 2003



Wireless Power Experiment as Breadboard in 2003

- Perspective reference scenario:
  - planetary exploration rovers for Mars, Moon
  - micro-g single-crystal growth plattorms at 10 -7 g in 500 km
- Ground experiment consists of :
  - Laser typ Nd:YAG, double frequency
  - GaInP-Solarcells for the receiver-panel
  - automatic receiver-panel pointing unit for incoming laser beam by light intensity sensing
  - automatic laser optics target acquisition (moving rover), pointing and target keeping by modulation filtering and using retro-reflectors at the target / optical displacement allocation
  - laser beam control by stepper motors (rough) and piezo crystals (accurate)
  - micro-camera onboard of the rover
- Experiment performance : powering of the rover micro-motors; video unit powering under evaluation; laser transmitter - rover distance : 80 m; loosing of target and re-acquisition; rover remotely controlled
- Teaming : EADS-ST (Astrium-SI), Uni Kaiserslautern, FHG-ISE, EPFL/FiveCo
- Main breadboard-components :

Laser-System by JENOPTIK



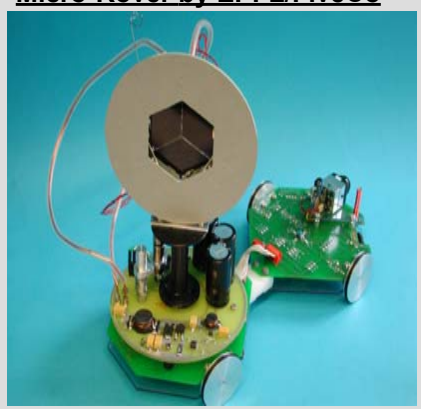
Specification

laser	Nd:YVO4 - disc laser, diode pumped
wavelength	532 nm
cw-mode output power	at 532 nm 0 ... 5 W

Mechanical Specification

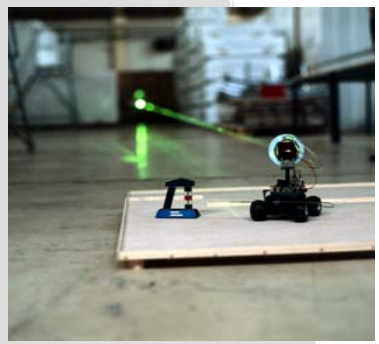
Laser head	dimensions (w x h x l) 40 x 70 x 200 (mm)
mass	ca. 15 kg

Micro-Rover by EPFL/FiveCo



Rover	
dimension	ca. 200x100x30 mm
mass	ca. 300 g
speed	ca. 25 mm/sec
power	1200 mW
payload	micro-camera
operation	battery, remote controlled

Experiment Set-up



Wireless Power Technology Activities

The Space Power Infrastructure (SPI) project aimes at a commercial application of ‚Power from Space' in the long term, but enbedded in an international economical, political and legal network

Wireless power ground experiments are part of the general SPI approach

Investigations in non-company key technologies, like laser, as design driving factors are essential, as basis for the work on the space systems itself

SPI systems in the near term as publicy funded projects (ESA, DLR, EU, UNO, World Bank, e.a.) and the identification of earlier, mid-term and promising ‚niche markets' seems feasible

Company key interests related to SPI are part of an overall strategy, as

space transportation (ETO, Orbit-Orbit)
space infrastructure
Space propulsion
space operations

Wireless Power Technology Activities

Major topics of conceptual work

Identification and quantification of medium / long-term customer markets and so called market niches or applications for the intermediate timeframe

Identification of future SPI-scenarios as long-term perspective based on Company Global Solar Energy Concept („GSEK“)

Establishment of a roadmap as implementation strategy („step-wise approach“) with intermediate milestone missions serving as actual decision platforms for the further proceeding

Definition of SPI-infrastructure in orbit (GEO & LEO) and on ground and concentration on functional key-systems in the roadmap as „intermediate“ elements:

- *GND-Demonstrations*
- *ISS-Experiment*
- *LEO/GEO-Demonstrators*
- *GEO Pilot Platform*
- *Investigations in the alternative Moon-based power scenario*

Wireless Power Technology Roadmap

Establishing the SPI Roadmap