東工大でのローバー開発

Three Wheeled Rover “Tri-Star II”

Shigeo Hirose, Naritoshi Ootsukasa, Takaya Shirasu, Hiroyuki Kuwahara, and Kan Yoneda：
Fundamental Considerations for the Design of a Planetary Rover, Proc. ICRA, Nagoya, pp.1939-1944 (1995)
(IEEE Robotics and Automation Society 1995 Best Conference Paper Award 1995.5.26)

Demonstration of Tri-Star II

“Rover Round Up” at Santa Monica Beach in 1997

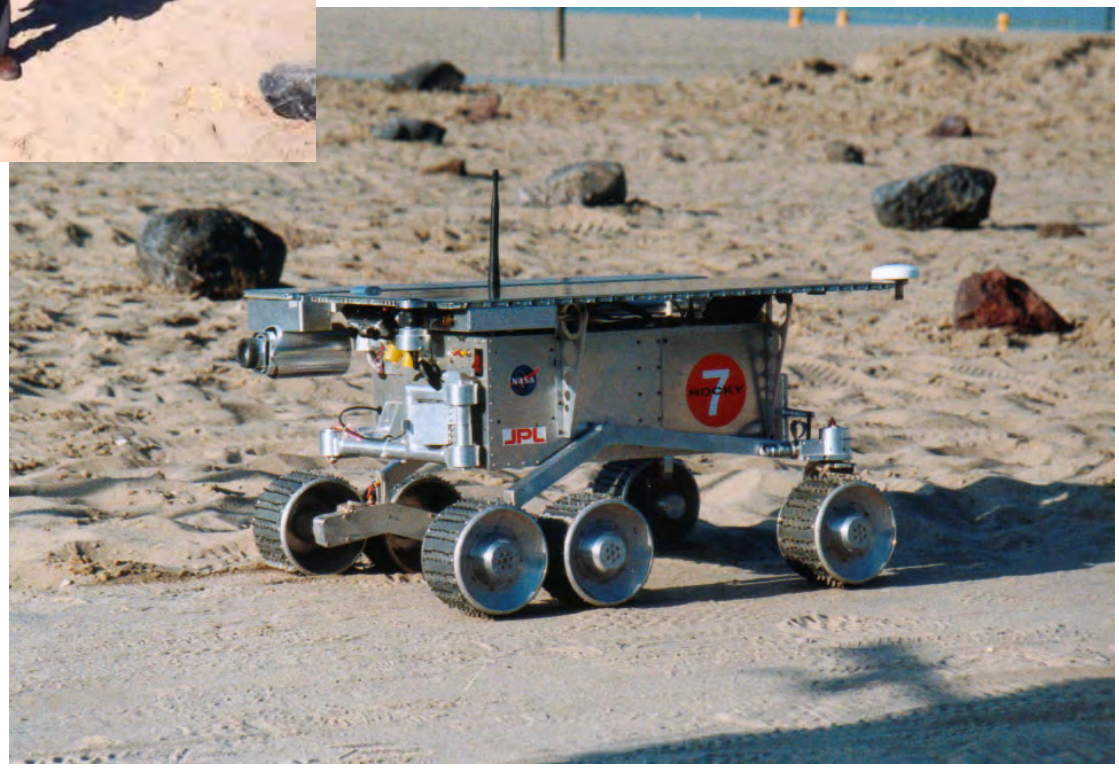
morning

deploy

Hill climb

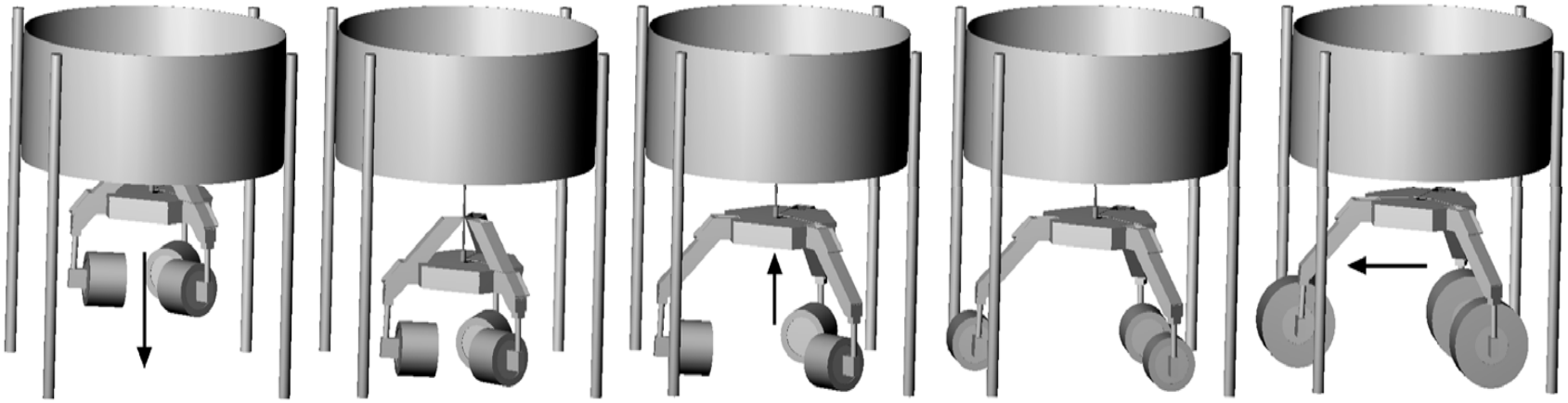
Over Rocks

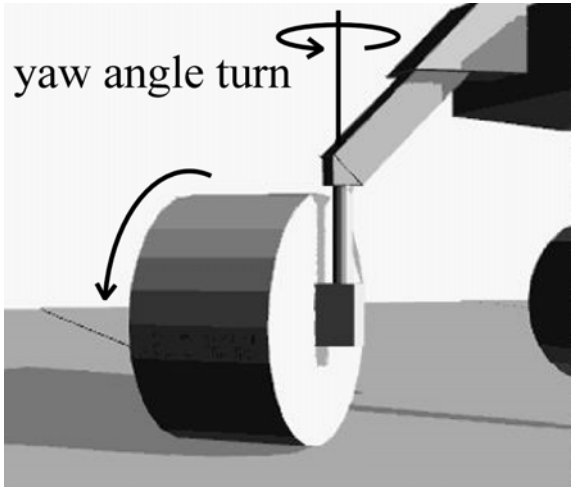
Marshod Russia

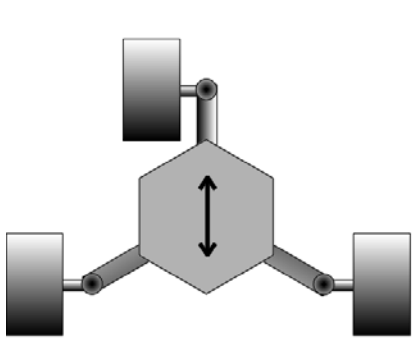


Rocky 7 NASA

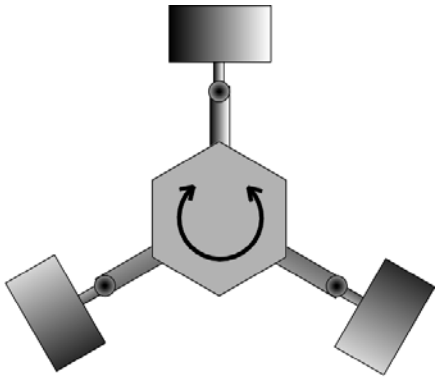
Variable Motion Mode of the Tri-Star





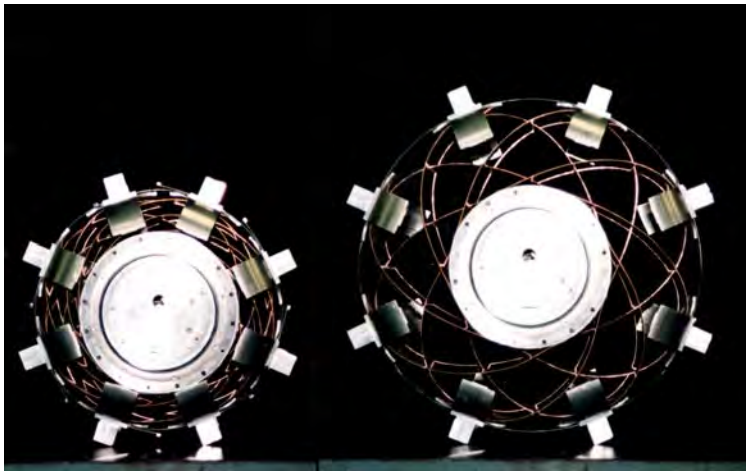


(forward motion)



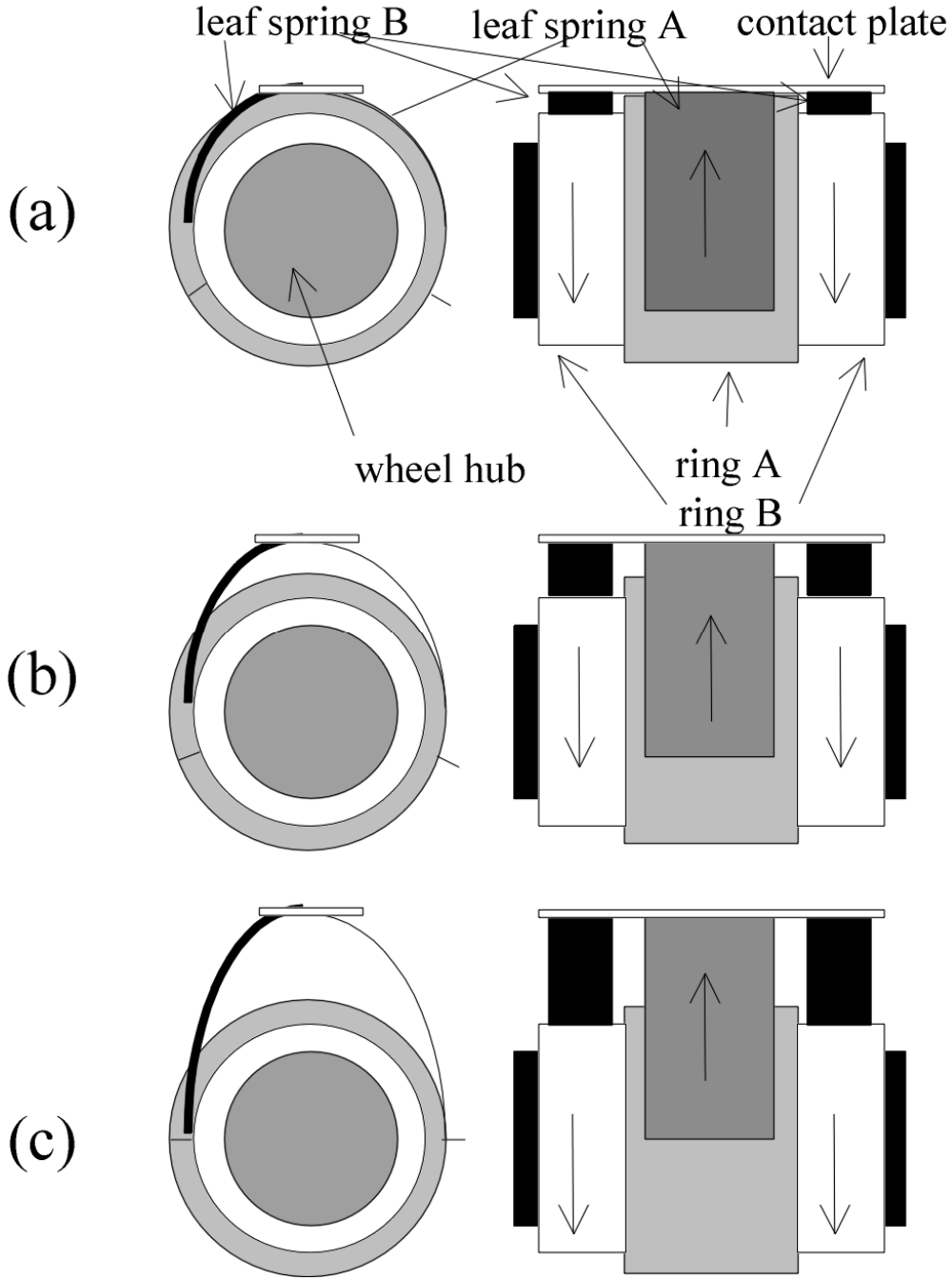
(turning motion)

Expandable Wheel



Manual

Auto



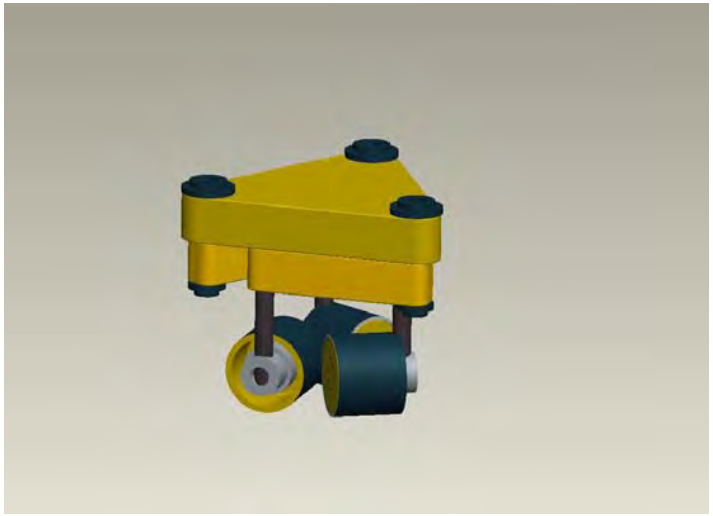
Our Tri-Star II has influenced the rover design of the world

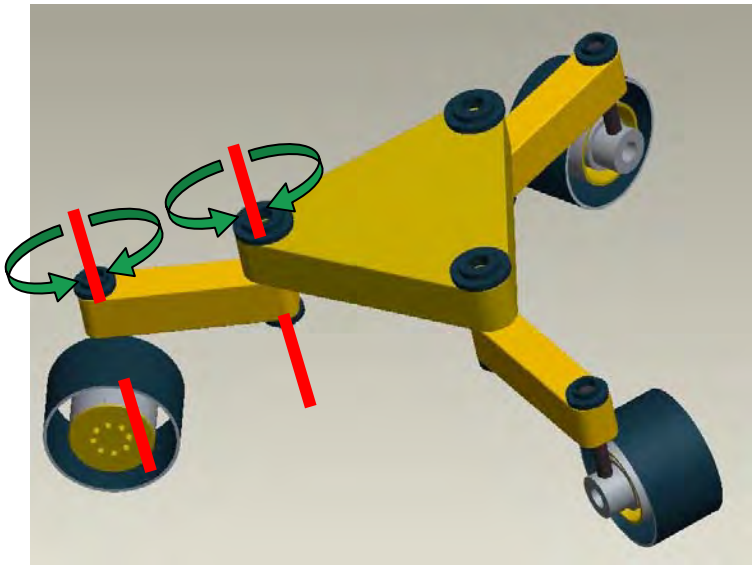
Inflatable Rover Robotics Institute CMU

Jones, J.A. “Inflatable Rover Demonstration,” *video proc of IEEE Conf. on Robotics and Automation*, (ICRA) San Francisco CA, May **2000**

http://www.ilcdover.com/SpaceInf/solararrays/rover.htm

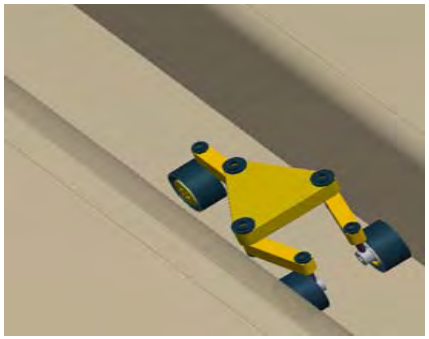
Tri-Star III





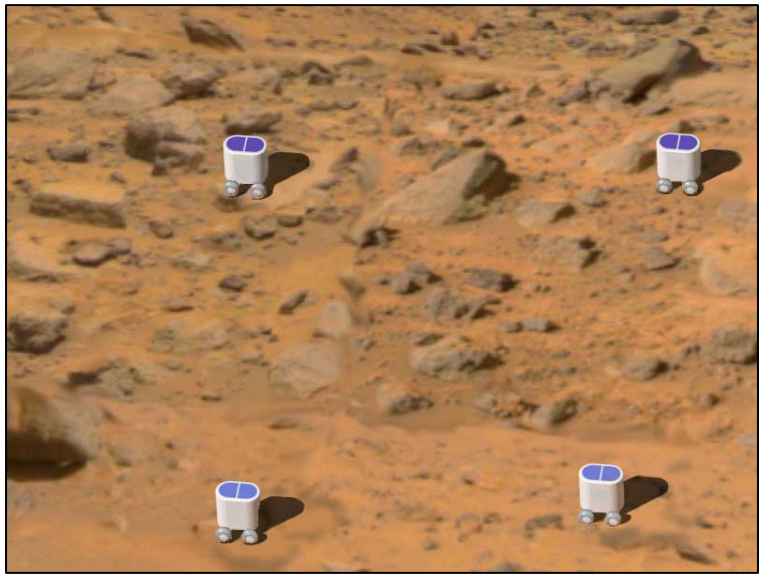
Retracted

Expanded

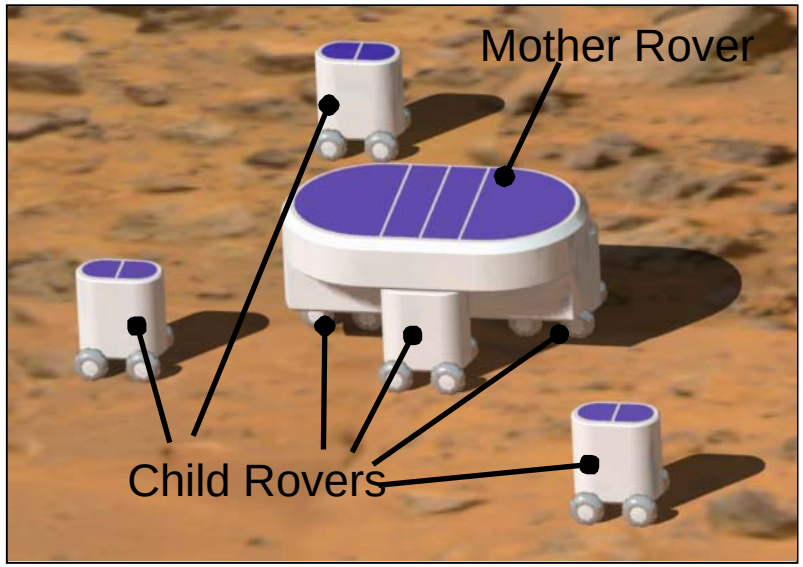


Tri-Star III has the ability to change its posture while it is moving.
This function enhances its mobility and other performances.

Single rover system



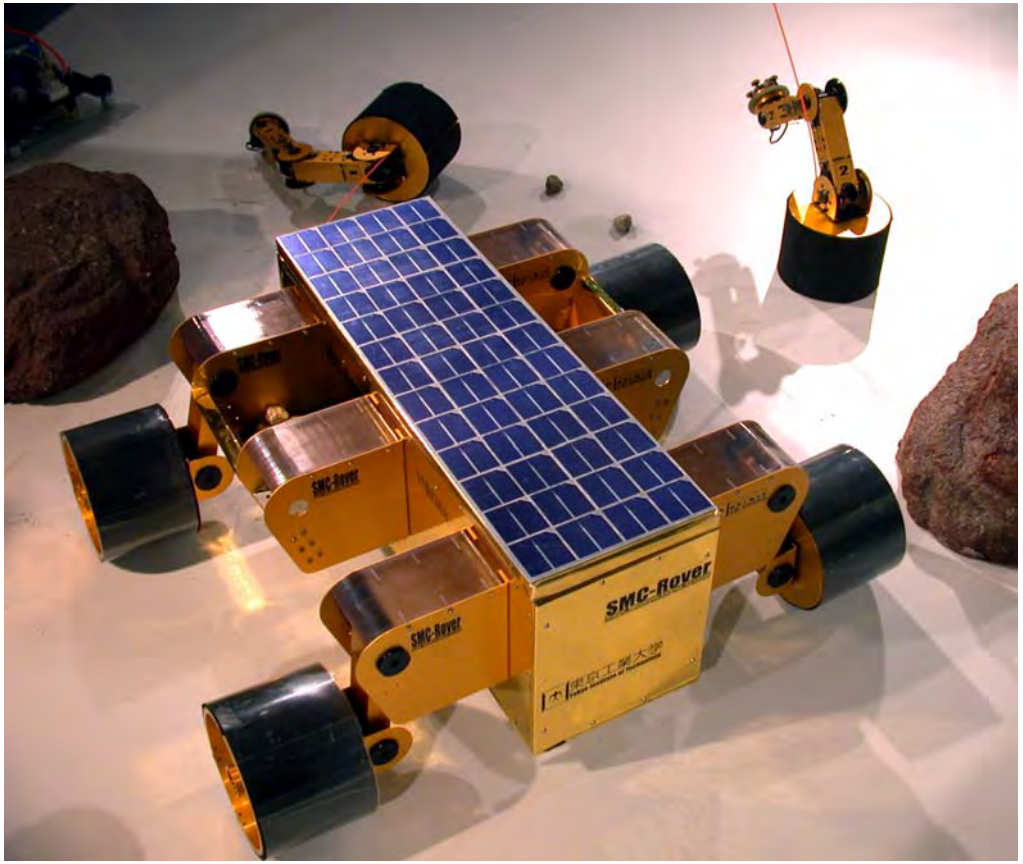
Multiple homogenous rovers



Introduction of Parent-children type rover

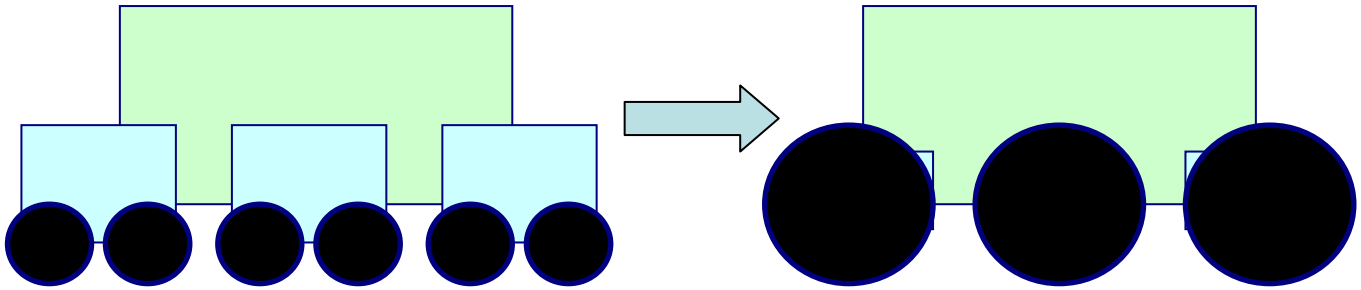
SMC Rover 1999

Super Mechano-Colony (SMC) Rover has detachable wheels which, named Uni-Rover, consists of cylindrical wheel/ body and arm/connecting mechanism. Uni-Rover acts as independent child rover and performs many tasks such as sampling of the rocks.

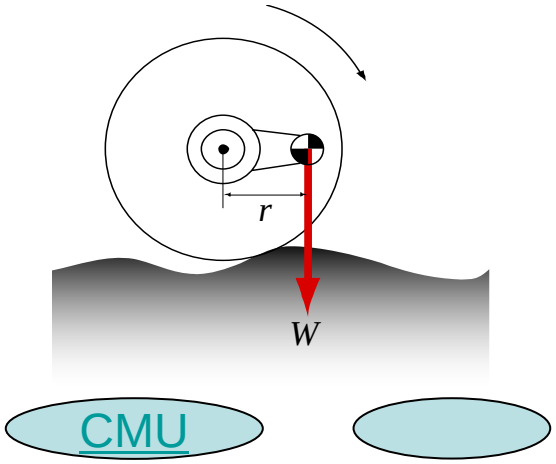


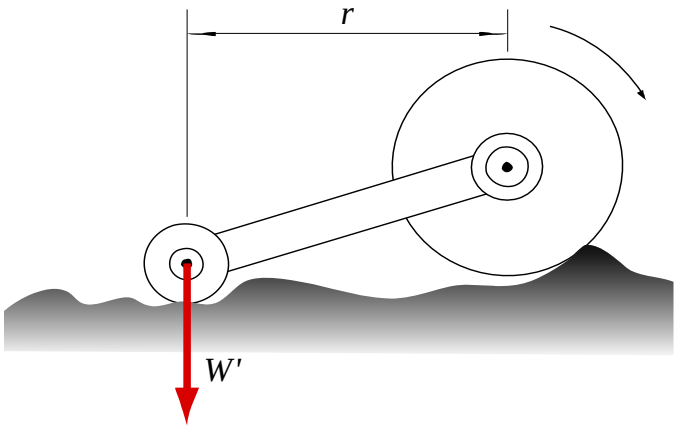
K. Motomura, A.Kawakami, S.Hirose: SMC Rover: Planetary Rover with Transformable Wheels, Proc. ICRA, 2003, Taipei (best video finalist)

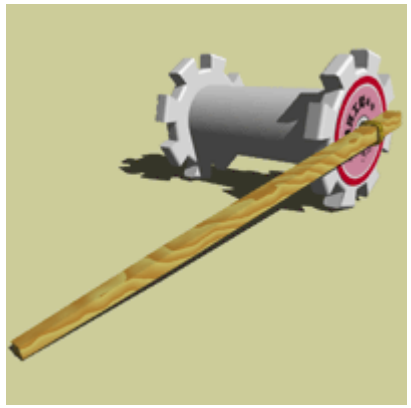
Why “single” wheel with arm



Large wheels maximize the mobility on rough terrain







Arm can support reaction force to produce propulsive force

Spool tank : Source of imagination

Souki II

Modified model of Uni-Rover with two wheels and 5 dof arm




Shintaro Mizunuma, Kazuhiro Motomura, Shigeo Hirose: Development of the Arm-Wheel Hybrid Robot “Souki-II” (Total System Design and BasicComponents), IROS, St. Louis, 4535-4540, 2009

Stair Climbing

Single Souki-II

- It can climb but takes time.

Two docked Souki-II

- It climbs much easier.

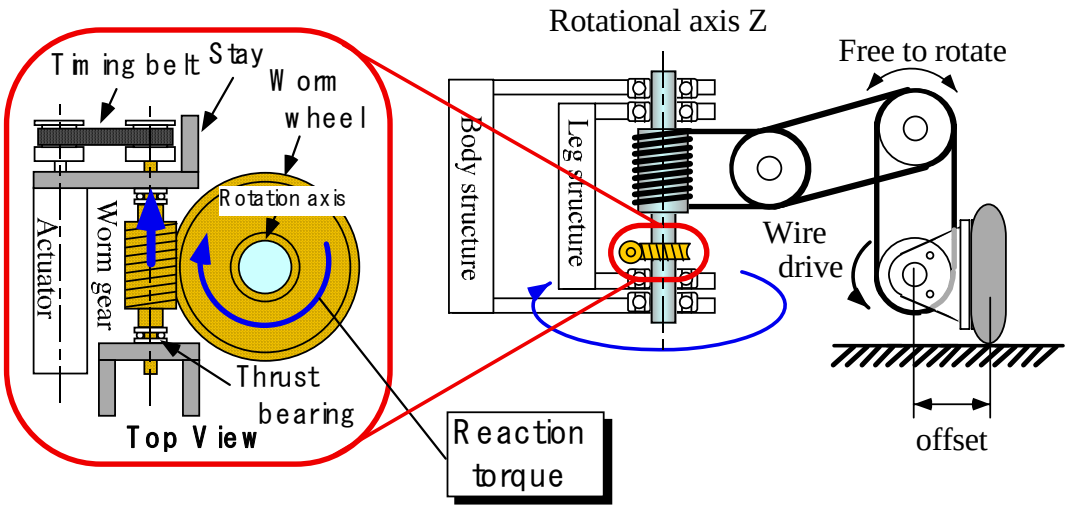
他のトランスフォーマー型（形状可変形）ロボット

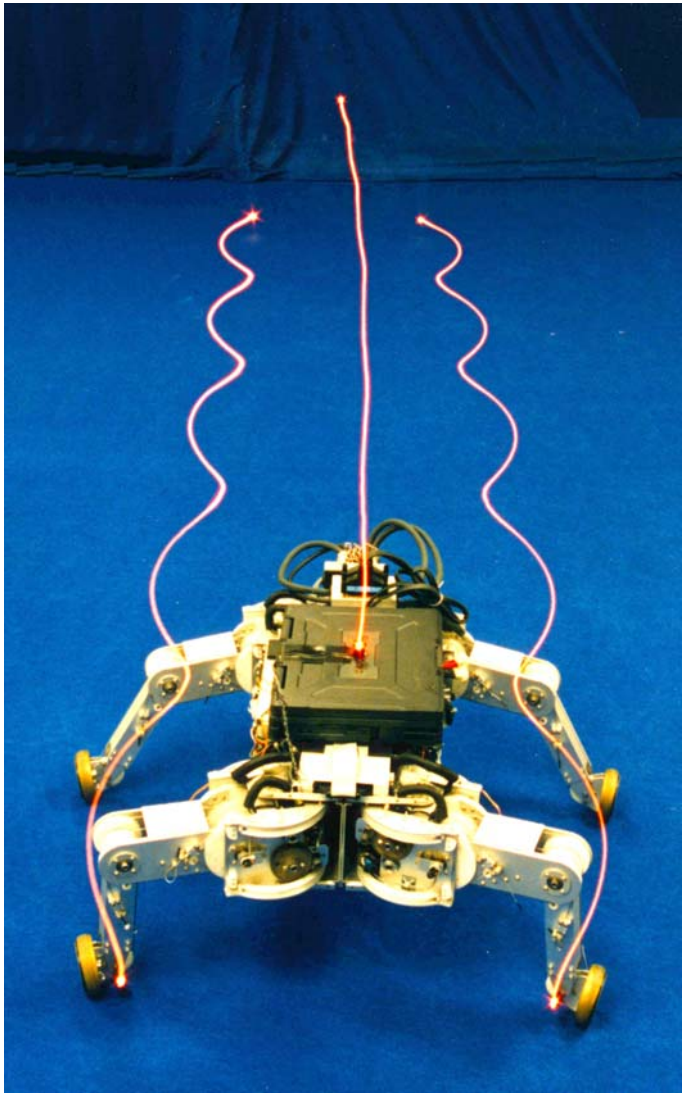
M-TRAN

産総研　東工大(村田智）

Tokyo Tech Prof. Satoshi Murata

Roller Walker

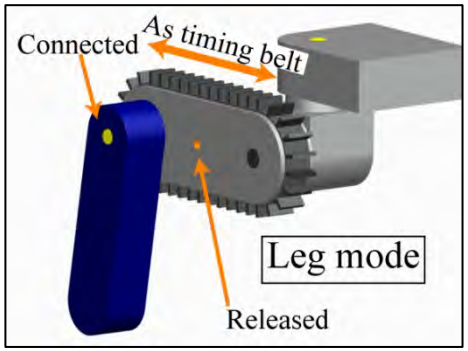


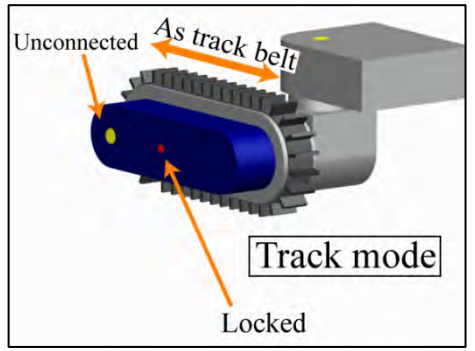


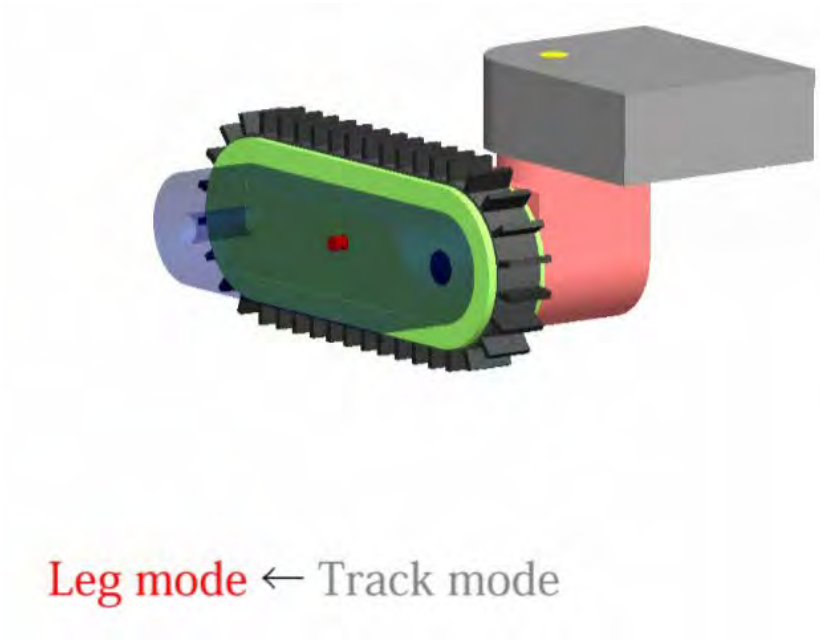
TITAN X

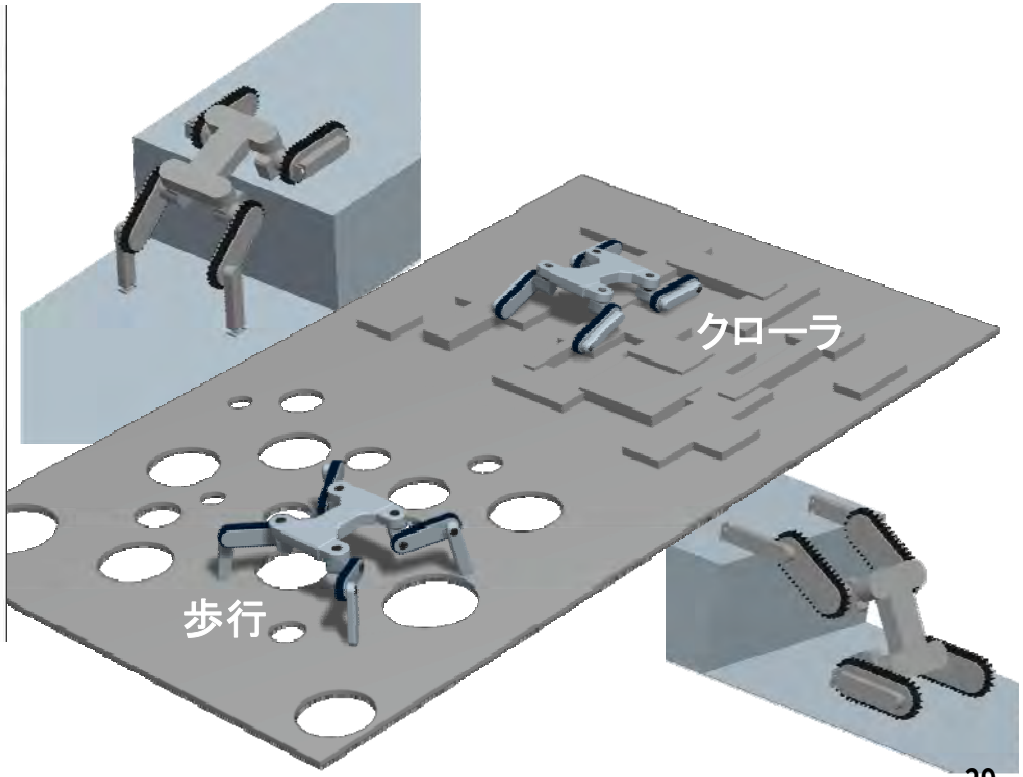
Change the transmission belt to the crawler!

脚先への動力伝達手段=移動のための推進手段

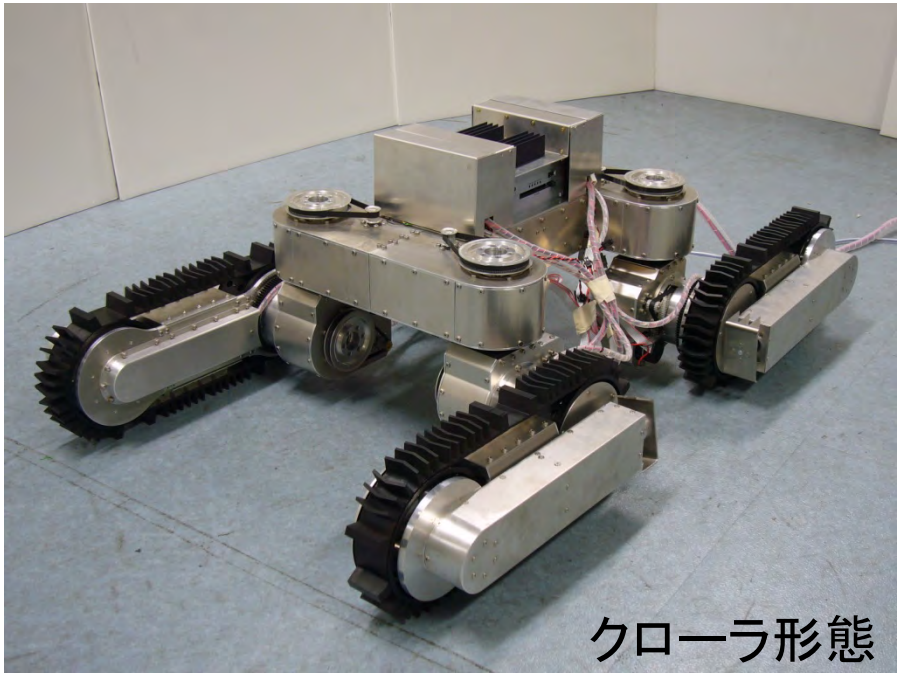


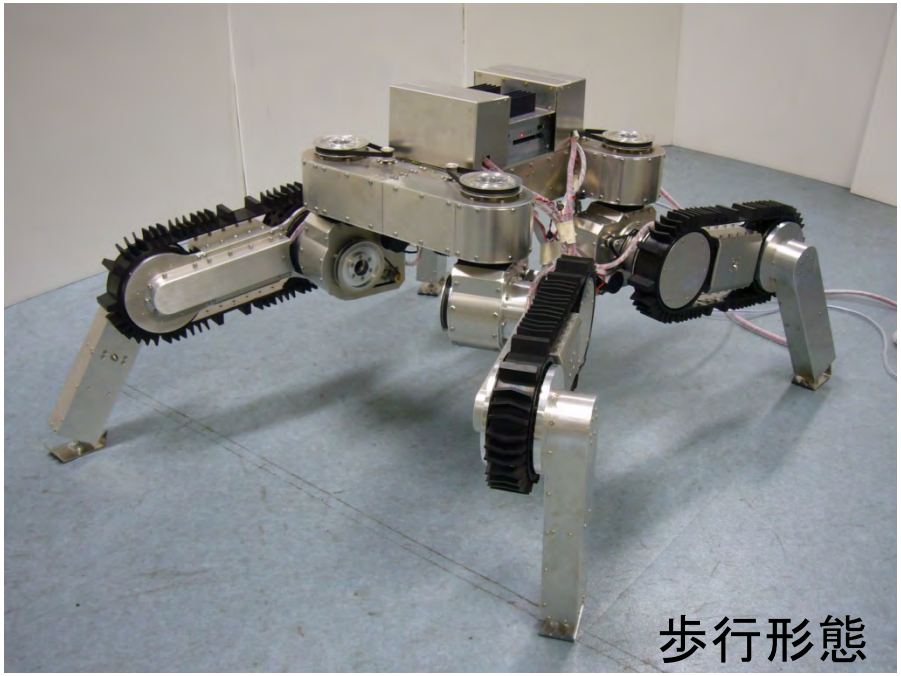






Specification of the TITAN X





Length × Wedth × Height	890mm × 581mm × 303mm (Crawler Posture)
Mass	23 2kg
Degrees of Freedom	16 DOF
	Leg Joints (脚関節) : 12 DOF Changing Mechanism (形態切替機構) : 4 DOF

おわりに

- 人寄せパンダのようなロボット開発ではなく、国際的に評価される真に役立つ月探査ロボットの開発を進めるためには、その形態の選択に最大限の注意を払うべきである。
- 月面のような極限環境で機能するトランスフォーマー型ロボットの研究開発は、日本のお家芸である「からくり」の技術を現代に復活させようとするものであり、日本の独自性を発揮しやすく、また人々をわくわくさせる。
- トランスフォーマー型ロボットの研究開発はまた、地球環境保全、食糧危機、グリーンエネルギー生成などの世界的課題を解決していく鍵となるフィールドロボティックス関連の産業を発展させる起爆剤にもなる。
- 2020年頃に向けて、この分野の技術開発へ「持続する」サポートが続けられることが望まれる。