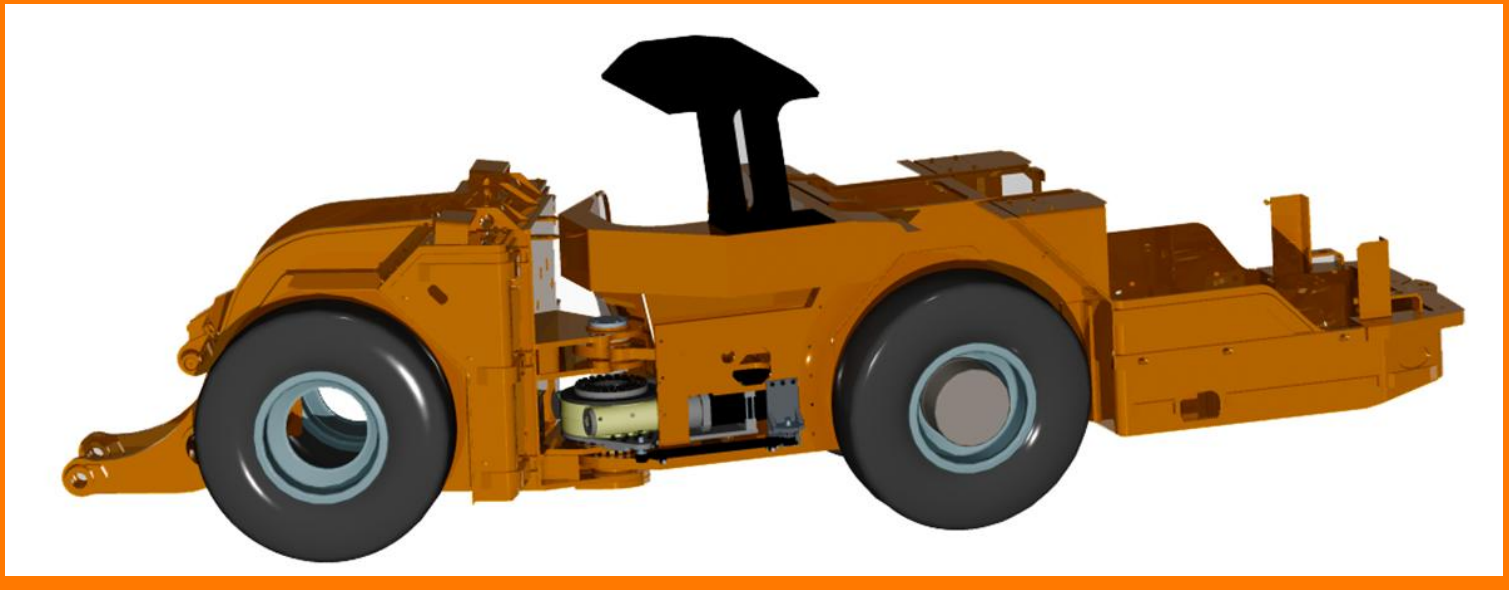
Aalto University
School of Engineering

Tubridi



Panu Sainio

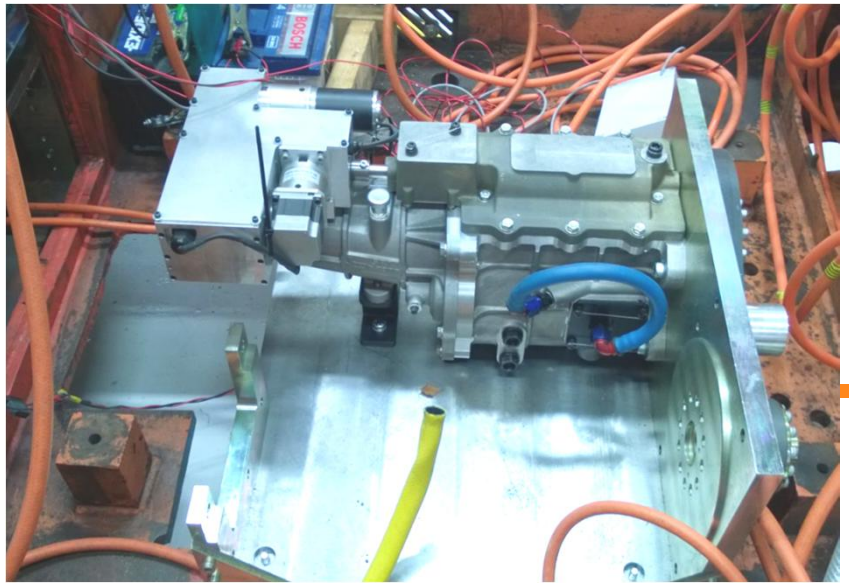
ECV seminaari 8.10.2015

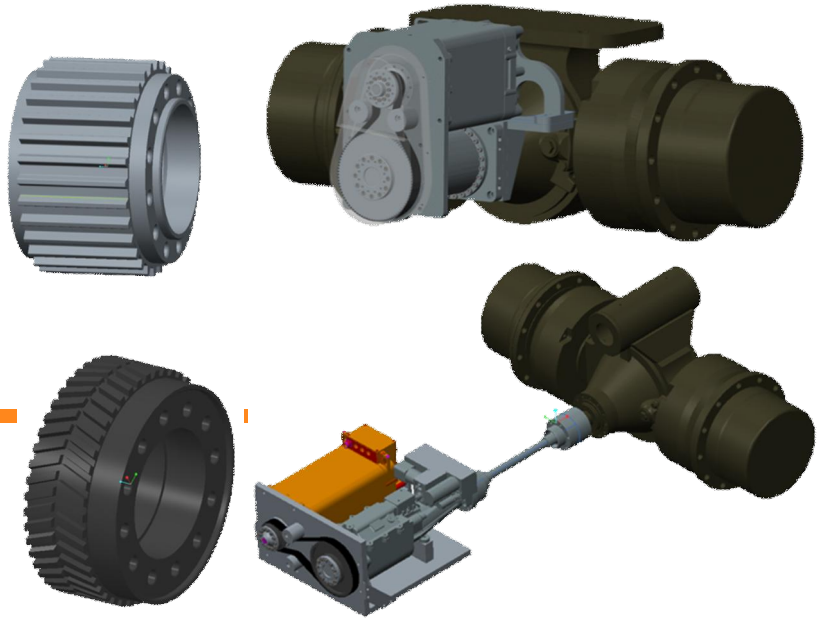
Tubridi – The test mule

- ”Research by engineering” approach
- We will make drivable hybrid loader – the great challenge
- Loader represents surprisingly general machine for Finish NRMM industry, original power class 90kw
  - Electrically driven front and rear axles
  - Lifting/lowering of the bucket i.e. big hydraulics
  - Articulated steering
  - It is heavy enough
- Loader supported by student projects, where we learn by electrifying a mini-excavator

Belt drives – perhaps not the conventional for this but let us explore the boundaries

Expect life time 10 000h	Front axle	Rear axle
Gearing	3:1	2:1
Continous power / moment	67kW / 160Nm	85kW / 220Nm
Max power / moment	150kW / 430Nm	150kW / 530Nm
Speed range	+-10 000 rpm	+-10 000 rpm
Belt drive components	Gates, direct teeth	Goodyear, V-shape





Electromechanical actuation: Motivation

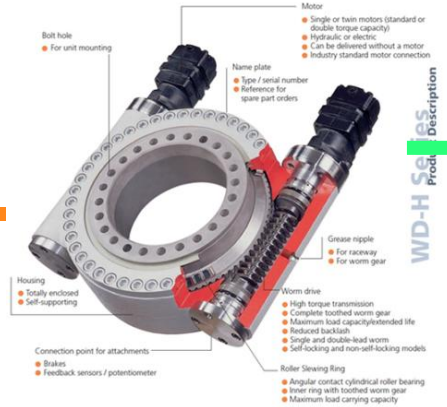
Conventional solutions done by 1-2 hydraulic cylinders

This opens new opportunities for controllability & accuracy & sensitivity

- ✓ Soft and slow movements vs. very fast and sharp performance if needed
- ✓ Self straightening can be implemented
- ✓ Steering degrees can be adapted by driving speed, direction and bucket position / load

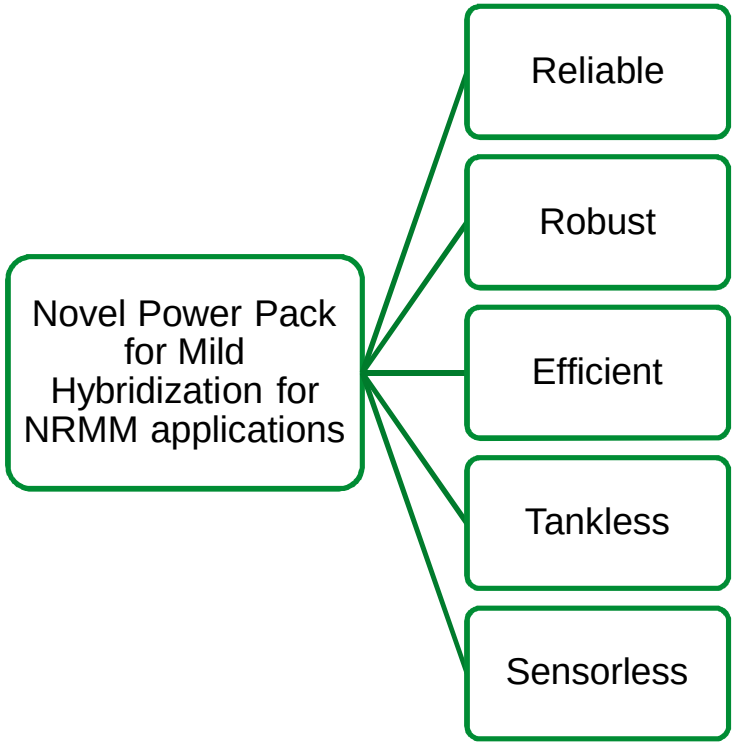
Opens new opportunities to construction

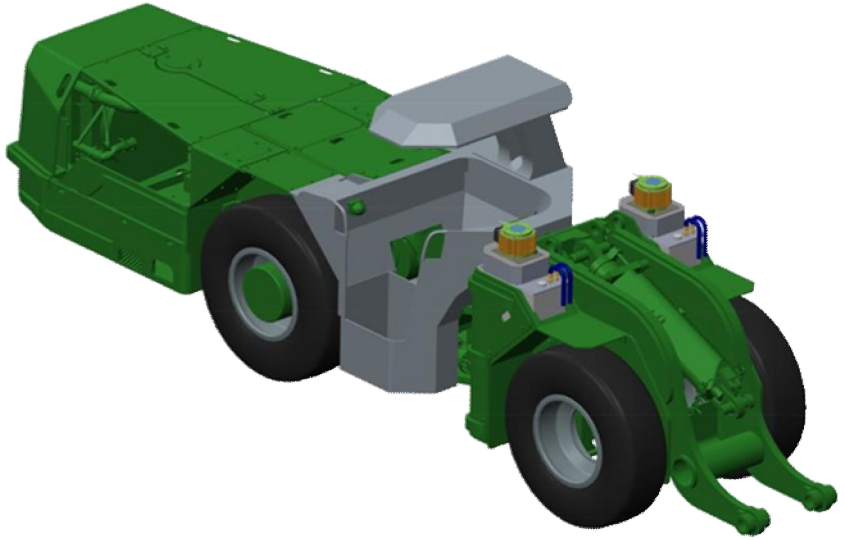
Does not demand hydraulic flow i.e. for full electrical machines



EL-Zone project continues direct driven hydraulic research, by Tekes 1.10.2015- 30.9.2018

Will continue Tubridi loder DDH part
Companies involved: ABB, Bosch Rexroth, FIMA, Hybria, Raute, Sandvik, VISEDO





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Summary and future opportunities

Key findings of the research

- ✓ Electromechanical movements – control is a challenge but it brings benefits
- ✓ Get yourself familiarized with modern belt drives
- ✓ Hydraulic is developing all the time – good engineering is valued here. When you need a huge cooler ask yourself why…

Exploiting this research for business?

- ✓ Automation and remote control of machines will become – new business models, more rent/leasing are hungry for information.
- ✓ Less waste heat (cooling and exhaust) for under ground & indoor operations, also lower fuel consumtion
- ✓ Tier V will come 2019/2020 = down size your diesel and improve the performance at the same time