



Digital product development for green transformation of industry

Tobias Larsson
Professor



Department of
Mechanical Engineering



Product Development
Research Lab

AIRBUS



Tobias Larsson

VOLVO CC

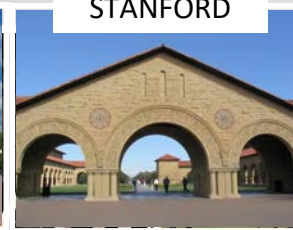


Product Development
Research Lab

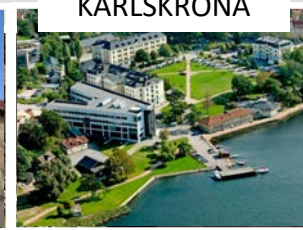
LULEÅ



STANFORD



KARLSKRONA



VOLVO CE



BOMBARDIER



GKN AEROSPACE



TETRAPAK



HOCKEY

Contribution to the Sustainable Development Goals

The Sustainable Development Goals are a call for action by all countries – poor, rich and middle-income – to promote prosperity while protecting the planet.

We contribute to the below goals, where #9 and #12 are our high impact goals.



Read more at: https://www.productdevelopment.se/?page_id=8573

WE SUPPORT THE ONGING DIGITALISATION JOURNEY



202X

Digital Twin (live synchronized and simulated/predicted behaviour. IoT. Industry 4.0. AI. Machine Learning)



201X

All digital (design, testing, simulation, optimisation, processes)



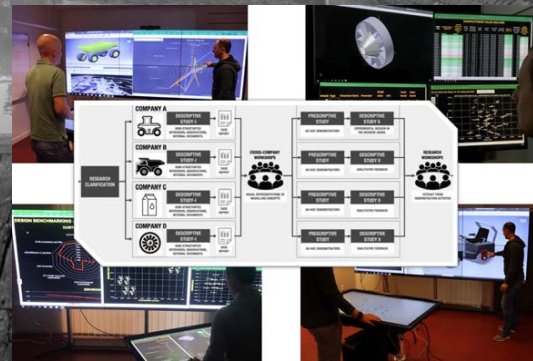
200X

Combinations of manual activities and digital contents



199X

Manual drawings, manual operations, manual X



165X

Model of the naval vessel Gustav Adolf.



Digital Twinning can be used to connect product development and innovation engineering to societal impact of a solution including circularity. It will be the dominant support tool for engineers, business developers, and urban planners the upcoming years

Volvo Concept Lab

Volvo Concept Lab is a joint visionary communication platform for the Volvo Group and the Volvo Product Brand. Through Volvo Concept Lab, we showcase cutting-edge ideas and innovative concepts that meet our customers' future needs and accelerate the transition to a sustainable future.

NEWS AROUND THE WORLD



Electric site, reduces carbon emissions up to 95 %

Electric site is a complete site solution aimed to transform the quarry and aggregate industry, by reducing carbon emissions by up to 95% and total cost of ownership by up to 20%. The electric site project aims to electrify a transport stage in a quarry - from excavation to primary crushing and transport to secondary crushing.

It involves developing new machines, work methods and site management systems - together these things form a complete site solution. Prototype machines that make up the electric site system includes a prototype electric hybrid wheel loader, and a grid-connected excavator. New technology encompasses machine and fleet.



Volvo CE unveils futuristic innovations

Volvo Construction Equipment showcased a range of futuristic concepts and innovations from electrification to intelligent machines and total site solutions at the company's Innovation Forum in Eskilstuna, Sweden.

[Learn more >](#)



Life-saving technology helps unprotected road users

Volvo's city buses are being fitted with Pedestrian and Cyclist Detection. The new system is a combination of camera-based technology, an image processor and algorithms for recognition of pedestrians and cyclists.

The system also includes a background sound to alert other road users to the bus's approach. And if an incident is likely to occur, the bus's horn is automatically activated. The alerts are activated when a potential hazard occurs.

[Learn more >](#)



Our first completely autonomous truck

The self-driving FMX truck is part of a research and development project involving autonomous vehicles, intended to create greater business advantages for customers, mainly in the mining industry.

The system also includes a background sound to alert other road users to the bus's approach. And if an incident is likely to occur, the bus's horn is automatically activated. The alerts are activated when a potential hazard occurs.

[Learn more >](#)



Electric Road Systems

Vehicle capable of being charged directly from the road during operation could become the next pioneering step in the development towards reduced environmental impact. The Volvo Group participates in several projects to find solutions for this future technology.

[Learn more >](#)



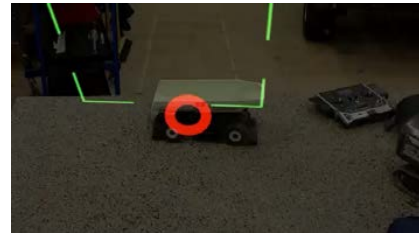
Trucks talking to each-other in multi-brand platooning project

In a new Swedish research project Volvo will test platooning to reduce carbon emissions and to improve goods transport efficiency. But the full potential of platooning can only be realized when trucks from different manufacturers communicate and find each other.

[Learn more >](#)



Manufacturability	23%	weight	5
Weight	12%	weight	2
Maintainability	16%	weight	3
Knowledge Pool	5%	weight	4
Adaptability	14%	weight	3
Lifetime	22%	weight	2
Brand Advancement	8%	weight	2



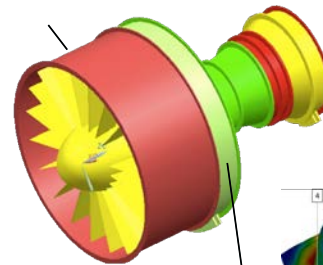
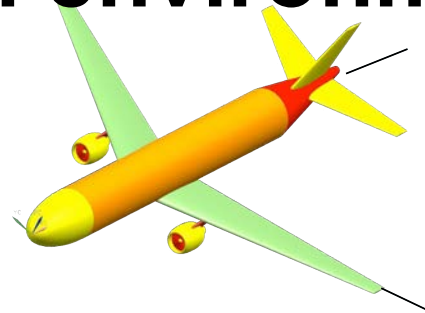
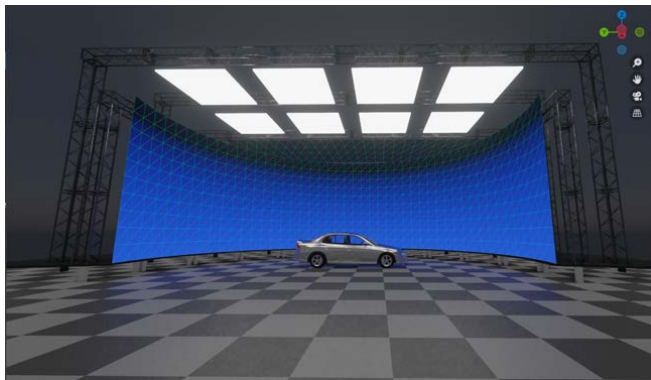
PRODUCT DEVELOPMENT
Our digital product development system is within the area of mechanical engineering, with a focus on supporting the development of sustainable products and services.

[READ MORE](#)

DIGITALA TVILLINGAR FÖR INNOVATION OCH DESIGN

EduDTC helps validate new materials for lighter and more environmentally friendly cars

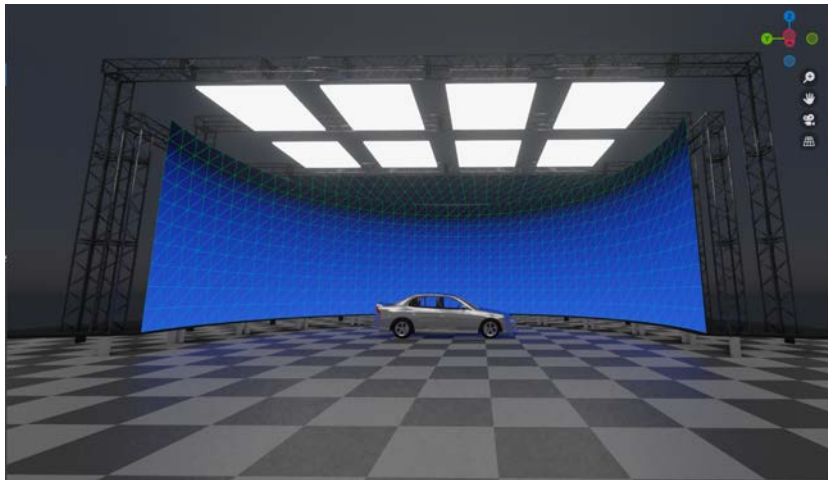
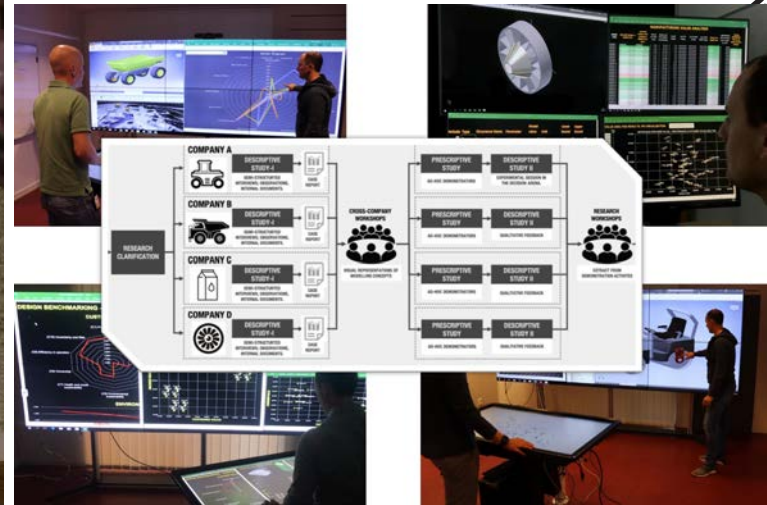
Applied research environment



Translation

Prediction

Productdevelopment.se





Portfolio



Future Fossil Free Rock Loading Solution | 2022:

Tobias Larsson • June 29, 2022 • Projects Research

The rock material industry is one of the 21 industries that participate and together these 21 cover more than 70 percent of the emissions in Sweden. Achieving the high environmental goals in rock material production requires not only a transition to fossil- and emission-free operations, but also new thinking in terms of process and new machine concepts. The approach is to develop a new system solution for rock unloading that takes into account the boundary conditions that electrification entails. The long-term goal is to make the ballast production chain fossil-free. The subsystem in focus of this project is the process...

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YAVIM - Validation of virtual models used for simulation of autonomous vehicle systems | 2022:

Tobias Larsson • January 7, 2022 • Projects Research

In order to achieve scalability and robustness, verification and validation (V&V) of self-driving vehicle systems need to be largely performed virtually. This requires validated models on sensors, vehicles and environments where the systems are to operate. The aim of this pre-study is to identify state-of-the-art (SotA) and high-priority research questions within methods for validating models required for virtual V&V of self-driving vehicle systems within a fenced area, and to formulate a joint project application with identified key actors for further studies. The pre-study is expected to result in a SoA report and in a joint project application with identified key...

[READ MORE](#)



TRUST-SOS - TRUSTed - Site Optimisation Solutions | 2021:

Tobias Larsson • December 7, 2021 • Projects Research

In the project we are developing digitalized services to increase the level of trusted decision making to optimize overall site systems in off-road transport applications. By developing data-driven models for real-time simulation and optimization of customer site operations, combined with advanced data analytics, we move from the current experience-based process to a model-based process that will enable us to define customer value in terms of services and trusted decision support. Developed models will be tested in a reality testbed for a final demonstration. The project will deliver in the short- and medium term in the form of services and...

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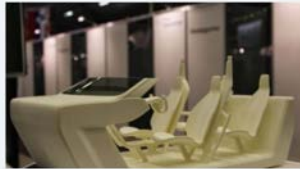


SINAM - Collaboration as Enabler for Light Weight Vehicles | 2019-2013

Tobias Larsson • June 9, 2013 • Completed projects Research SE, IT

Objective: SÄNAUTT is a collaborative project driven by the common goal of strengthening the competitiveness of the Swedish automotive industry through lightweight innovation. Academics, automotive suppliers and one vehicle manufacturer collaborated in the research and development of design concepts aimed to cost effectively reduce the weight of a classic family saloon by 30-40%. Increase supply chain collaboration to create new products and services that increase competitiveness. Enable organizations to efficiently integrate research in innovation, technology (with focus on light structures) into development of new solutions within automotive supply chain. BTH Participants: Tobias Larsson, Massimo Panerotto BTH project leader Prof Tobias Larsson Team...

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ISRU - Lunar mining and in-situ resource utilization | 2022:

Tobias Larsson • June 3, 2022 • Projects Research

The project will evaluate prospecting in lunar orbit and on the surface. The study will consider mining and construction capabilities as well as in-situ processing of resources. The project is funded by Canadian Space Agency. Project into BTH project leader: Professor Tobias Larsson Time span: 2022-2023 Funding: \$248,000 (Canadian Space Agency) Partners: BTH Canadian Space Mining Corporation Canadian Space Agency Related links: The Canadian Space Agency funds novel ideas for potential Moon infrastructure (2022-06-03) A Concept Design to Enable Lunar Mining (MSc thesis 2022)

[READ MORE](#)



Virtual Production Studio Lab | 2022:

Tobias Larsson • June 20, 2022 • Projects Research

The Virtual Production Studio Lab project is led by Blekinge University of Technology and will be a technically innovative arena and a place where the movie and gaming industry meets the traditional manufacturing industry and creates excellence in Blekinge. The VPSL will be the infrastructure foundation for a cluster within Virtual Production, and together with the business community do research and develop the technology, as well as create training courses and educational programmes to secure the skills needed around the technology. Potential final installation with curved main screen, and movable screen and also roof screen. Prototype installation During November 2022...

[READ MORE](#)



ASPECT - A System for Electric and Connected Transport Solutions | 2021:

Tobias Larsson • December 7, 2021 • Projects Research

Project ASPECT aims to, based on learnings from pilot Electric-Site, lift the technology to an energy optimized solution to scale in both volume and size. Focus for this project is within confined area. The project includes design of energy infrastructure, electric system on machines and site management system. Furthermore it includes validation of digital infrastructure for system, method and requirements on infrastructure, digital twin for energy optimized system and to understand if it is possible to increase energy efficiency by using teleoperation. Aspect aims to design a system of electrified machines in a confined area. Together with partners in the...

[READ MORE](#)



Wave Power System Development | 2010-2012

Tobias Larsson • April 9, 2012 • Completed projects Research

Project completion brief: BTH-PORL-Project-OHT-completed.pdf in cooperation with Ocean Harvesting Technology. Participants: A. Berghuvud, A. Josefsson, C. Hedberg PhD thesis of Andreas Josefsson: Identification and Simulation Methods for Nonlinear Mechanical Systems Subjected to Stochastic Excitation

[READ MORE](#)



Strategic Research Agenda: Blue Energy | 2012-2013

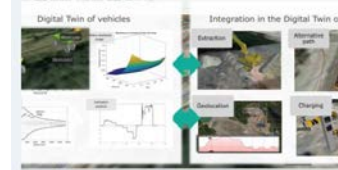
Tobias Larsson • May 3, 2012 • Completed projects Research

Blue Energy - Project Description for the development of strategic research and innovation agenda in marine energy, B3 Energy, en strategisk Innovationsagenda för Marin Energi. Ocean energy is an area with great potential to create benefits for the environment and climate, together with jobs and sustainable growth. Sweden is in a unique opportunity to become a leader in this growing industry of the future. In order to succeed, besides political action in the form of long-term rules, increased collaboration between industry, research institutes, academia and the public sector is needed. A strategic research and innovation agenda that brings together a broad...

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Digital Twin of vehicles

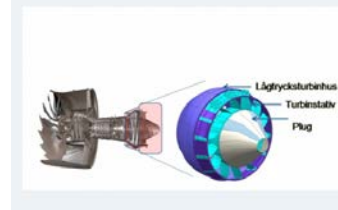


eTWIN - Digital-Twin enabled Transition into Electromobility and Autonomy in Construction Equipment | 2021

Tobias Larsson • March 29, 2021 • Completed projects Research

[<_row_line_container="yes" force="no" column_align="middle" video_mute="no" id="219975" [<_column_width="1212" video_mute="no" id="604982] [<_column_text_id="726753"] Concluding remarks Wrapping up the eTWIN project, with Alessandro Bertoni This project has demonstrated the capabilities of creating a digital twin of typical mining operations by combining the simulation of the energy consumption and performances of single electrical vehicles with specific productivity requirements and topographic configuration of the overall mining site. This allows the evaluation of the economic and environmental impact of the transition toward electromobility in mining, as well as supports the requirements definition for electrical vehicles. The project encompassed the simulations of electrical haulers based both on real...

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VITUM - Virtual Turbine Module demonstrator | 2014-2017

Tobias Larsson • April 9, 2014 • Completed projects Research

The aim of the project is to demonstrate how innovative solutions can be developed if traditional modular and component interfaces are challenged and to enable a hardware demonstrator for Clean Sky II. The project aims to develop and demonstrate technologies and capabilities that can be realized in a several components in a turbine module are functionally integrated. An example is the "integrated plug" concept that is used to focus and drive progress in the project. Deliverables from the project is an open platform where variable geometric models that can be tailor ed to alternative engine architectures. Also, the establishment of...

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MOVING DIRT REINVENTED

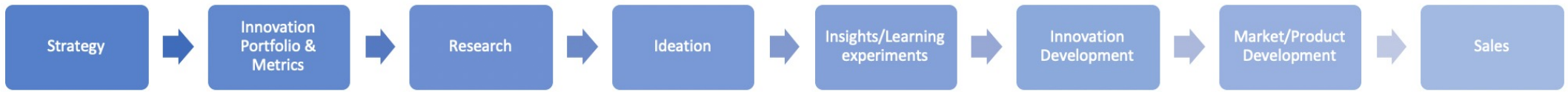
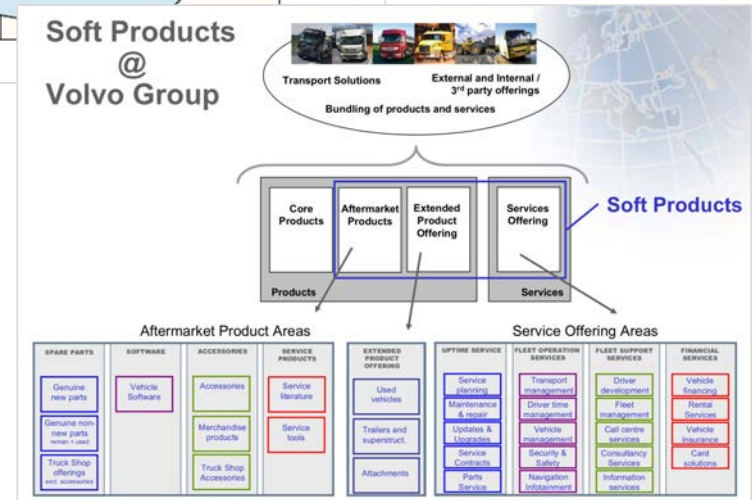
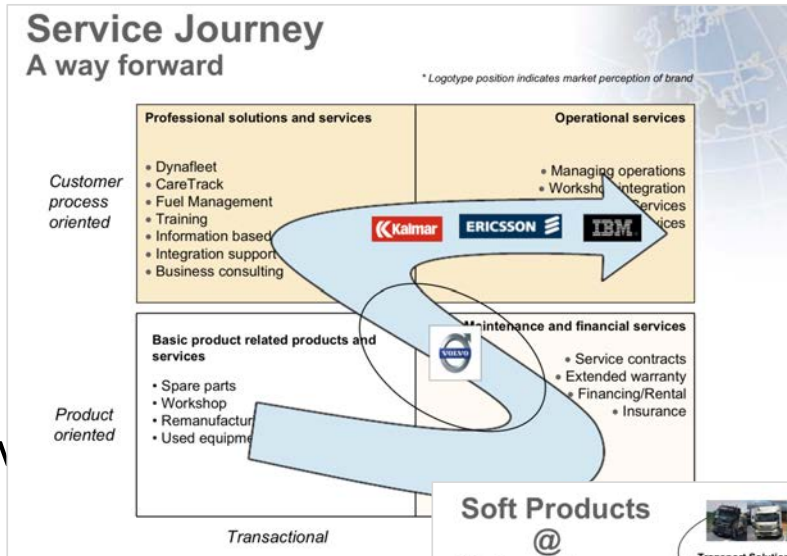


Strategic choice



Assess innovation to secure sustainable and profitable growth

November 10, 2011



Support change

DISRUPTIVE TECHNOLOGIES – PARADIGM SHIFTS OF THE FUTURE

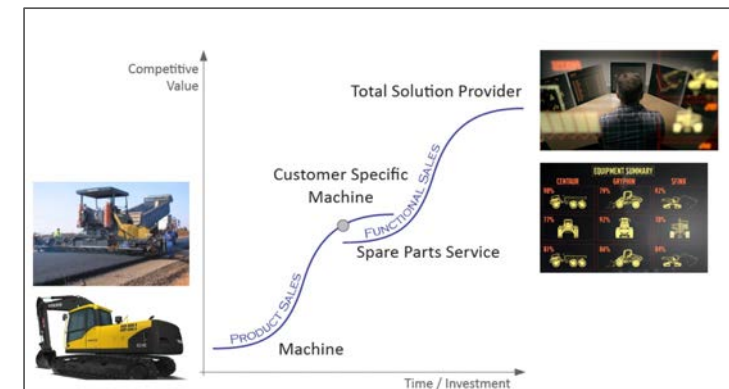
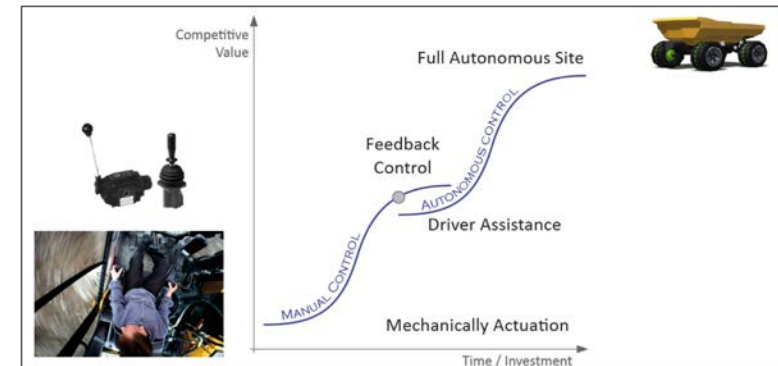
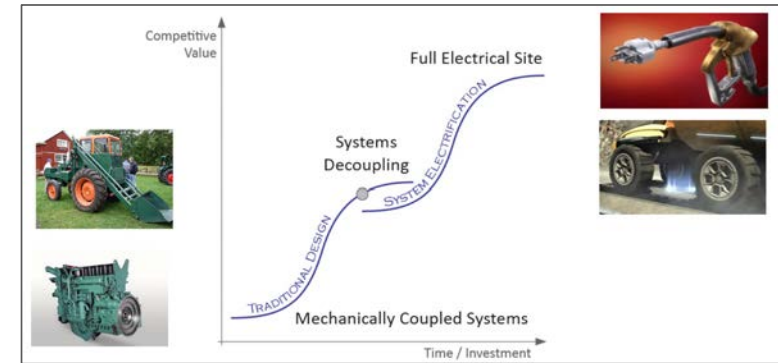
- Methods, tools and training to deal with continuous change towards sustainability
- Understanding potential of technologies to come, and act today
AI/IoT/Automation/Energy/...



TECHNOLOGY PARADIGM SHIFT
- SYSTEM DECOUPLING

TECHNOLOGY PARADIGM SHIFT
- INTELLIGENT MACHINES

BUSINESS PARADIGM SHIFT
- TOTAL SOLUTION PROVIDER

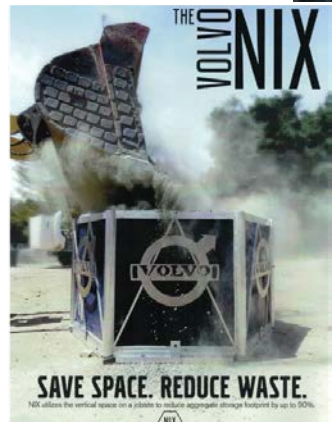
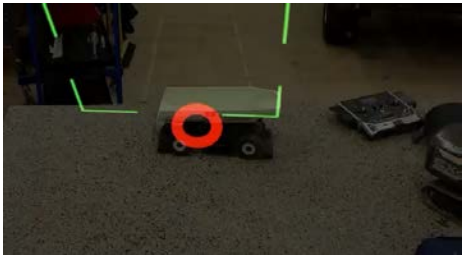


TOMORROW BEGINS TODAY

CHANGE STARTS HERE

Join us on the journey towards a more sustainable construction industry.

Prototypes & experiments



DESIGN SPRINTS

20180619 - Volvo CE Emerging Technologies Workshop



Innovation Model

The Innovation Model provides a framework to secure our ability to be innovative

It supports the innovation process

Purpose to strengthen the company's innovative capability

address the entire innovation process from ideation to innovations available on the market generating revenue



Building tomorrow, innovating today
Volvo CE Specialist & iCoach 10^x workshop

Volvo^x
Your skunk works

MISSION:
Disrupt the industry of moving dirt

10^x labs
we don't do incremental

Most innovation dies inside companies if it's anything other than incremental, because it threatens the beast...

EXPLORATION

...the day before something is truly a breakthrough, it's a crazy idea. And crazy ideas do not survive well inside well-established companies...

DIVERGENT PROTOTYPING

PEER CALIBRATION

CONVERGENT PROTOTYPING

EXPONENTIAL ROADMAP

TEKNIKA HÖRSKOLA

VOLVO

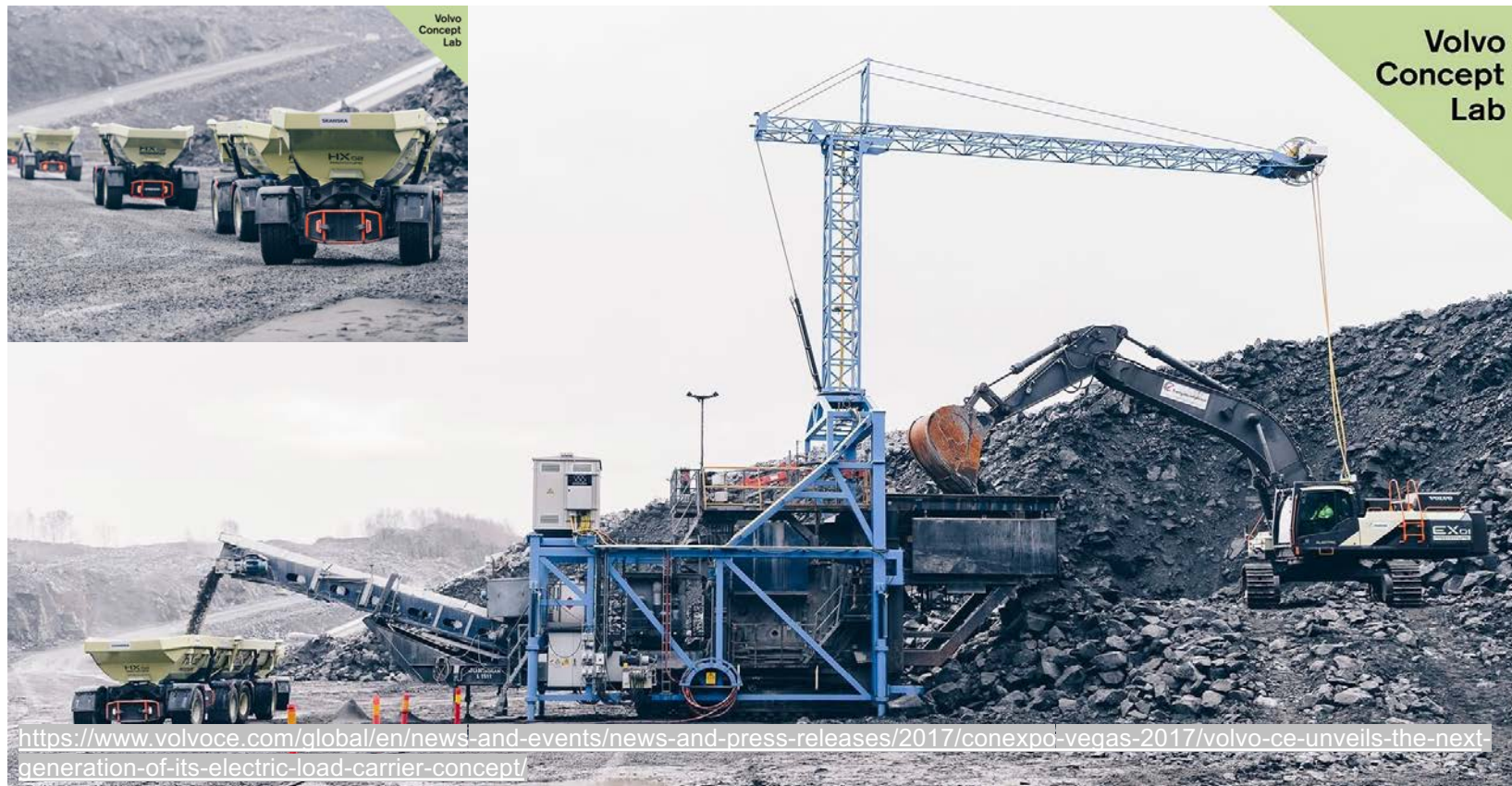
TEKNIKA HÖRSKOLA
BTH
in real life

PhD defense June 16 – Jenny Elfsberg

Electric hauler, semi-electric loader



KOLDIOXIDUTSLÄPPEN HAR MINSKAT MED 98 % PÅ VOLVO CONSTRUCTION EQUIPMENTS OCH SKANSKAS ELECTRIC SITE



Change delivered – WITH PSS OFFERINGS

■ Press release

VOLVO CE UNVEILS ELECTRIC COMPACT EXCAVATOR AND WHEEL LOADER AT BAUMA

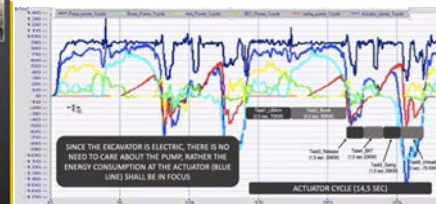
4/10/2019

By Press Information

Volvo Construction Equipment has unveiled two zero-emissions machines – the ECR25 excavator and L25 wheel loader – from its new range of electric compact machines.



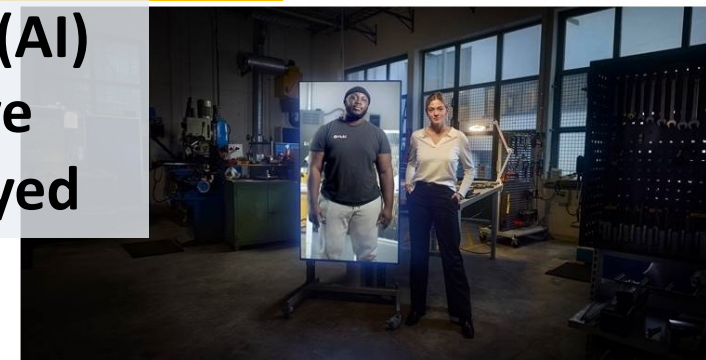
Continued change



Digital experiments with modelling/simulation (AI) and connected to live solutions being deployed

OASIS & NOMAD

from our ECV Support Solution



CHANGE STARTS WITH GODSON AND HEDVIG

WHO WILL "MOVE DIRT" ON MARS?

MARS 2020 ROVER
Depot Caching Strategy



We start with the moon...



- Landing Site
- Region of Interest
- Sample Tube
- Primary Mission
- Extended Mission

JOURNEY TO MARS

Partner network



COAUTHORING PUBLICATIONS

COAUTHORING PUBLICATIONS AND RESEARCH PROPOSALS

COAUTHORING RESEARCH PROPOSALS

Luleå University of Technology

Linköping University

Chalmers

SWEREA

Vilnius Gediminas University

University of Gothenburg

University of Manchester

Denmark Technical University

Tomsk Polytechnic University

Queen's University

University College Dublin

Delft University of Technology

Fraunhofer

University of Southampton

Bremer IPL

TU Bergakademie Freiberg

Stanford University

Mines St. Etienne

University of Vienna

MTA Sztaki

McGill University

École polytechnique Lausanne

University Politecnica of Bucharest

University of Alabama

INSA Toulouse

University of Bergamo

Institut Sup. de l'Aéronautique et de l'Espace

University of Zagreb

University of Sofia

Shanghai Jiao Tong University

UNINOVA

Instituto Superior Tecnico

University of Piraeus

RMIT University



Collaboration





TEKNIKA HOGSKOLEN
BTH

FRÅGOR?

Professor Tobias Larsson, tlr@bth.se



Department of
Mechanical Engineering

Product Development
Research Lab

