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Pfronstetten-Aichelau, December 13, 2022

### **Reintegration into working life Loading 4.8 cubic meters of bulk material in the wheel loader via joystick**

*Alexander Klems has been driving wheel loaders for 21 years. In 2019, everything was going to be different. He never dreamed that a ruptured Achilles tendon could tear him away from his traditional job, but things turned out differently. During rehab, he also injured his knee. He could no longer operate the accelerator pedal of his Hitachi ZW 330 wheel loader, which he almost always has to step on when loading construction materials. Another solution was needed, which was found at PARAVAN thanks to the Space Drive drive-by-wire system.*



*At last, Alexander Klems can go back to his usual job. Thanks to the drive-by-wire system, he can operate the throttle, which he also uses to move 4.8 cubic meters of construction materials in the bucket, with just two fingers. The Space Drive control unit and the actuators on the pedals do the rest for him. Photo: AG für Steinindustrie*

The joy is clear to see on Alexander Klems' face as he was climbing back onto his work equipment for the first time. Back at his usual workplace. It wasn't that clear when he also severely injured his knee during rehab after tearing his Achilles tendon in 2019. The pain of permanently operating the gas pedal of his usual work machine was too great. But the wish that the 57-year-old wheel loader operator could return to his job at some point remained.

To give Alexander the opportunity to return to his old job after the long break and despite his restriction, a solution had to be found. This was found in a dialog between his company AG für Steinindustrie, the construction machinery specialist Kiesel and the German Employers' Liability Insurance Association for Raw Materials and Chemical Industry (BG RCI). "It was personally important to us that Alexander Klems should not retire from working life despite his health difficulties, but should be able to return to work," say AG Steinindustrie board members Cornelius Kirsche and Wolfgang Pitzen. Together, the responsible parties clarified what would be technically necessary for Alex to be able to operate a wheel loader again without pain. Technical support in the matter of vehicle adaptation for the disabled came from the Heidelberg branch of PARAVAN GmbH and Dietmar Bendinger, where, as in the Aichelau mobility park, advice, conversion, adaptation of vehicles and PARAVAN electric wheelchairs as well as driving school are offered.

An appropriate wheel loader was purchased and brought to the PARAVAN mobility specialists in Pfronstetten Aichelau for an initial technical assessment. It quickly became clear during the first inspection appointment that Alexander would no longer be able to operate the original accelerator pedal of the HITACHI ZW 330, as he uses the accelerator pedal not only to drive the wheel loader, but also to move the 4.8 cubic meter bucket when loading the construction materials. The continuous strain on his leg would simply be too great.

But the solution was quickly found, a switch to a hand control based on PARAVAN's Space Drive digital drive and steering system. For this purpose, a specially adapted input device was mounted directly on the left operating joystick of the wheel loader. With a light pull on the new input lever, Alexander can now trigger the throttle command with just two fingers. The rest of the work is done by the Space Drive digital drive-by-wire system. The control element (CPU) for the throttle function was integrated behind the driver's

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seat. "The big challenge in this project was attaching the new control element for the throttle function to the existing joystick," says Dietmar Bendinger, branch manager at PARAVAN GmbH in Heidelberg. In addition, in order to operate the loader efficiently, the accelerator and brake must be controlled separately. The servo motor on the gas pedal now converts the input commands into the correct movement of the accelerator pedal.

Should Alexander Klems' machine ever need to be operated by someone else, this can be done at any time. The Space Drive System can be deactivated and locked. This ensures that only he can activate and use the system. All other users continue to drive conventionally with a pedal.

The first driving tests with Space Drive were very positive: "At first I was sweating a bit, but then after minor technical adjustments I quickly got used to the new system." After a final detailed briefing on the new work equipment and a final acceptance by the TÜV, the Hitachi wheel loader goes back to Koblenz to the AG für Steinindustrie and Alexander can use it to do his old job again, using the HITACHI to direct construction material up to 4.8 cubic meters with the movement of just two fingers. "My thanks go above all to my employer, the employers' liability insurance association, the Kiesel company and, of course, PARAVAN GmbH, who together have made this possible."



*Alexander Klems can be pleased. He can now return to his usual workplace and load construction materials with his Hitachi ZW 330 wheel loader. A win-win situation for him and for his employer. Photo: PARAVAN*



*Now Alexander Klems can get back to his usual work. Thanks to Space Drive, he can now easily operate the gas pedal with his left hand. Photo: AG für Steinindustrie*

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*Last instructions and adjustments from the PARAVAN technician. Does the throttle lever sit optimally, are the throttle signals coming from below above the actuator on the pedal optimal, or should something still be adjusted? Photo: PARAVAN*



*At last, the 57-year-old can sit at his usual workplace again and load construction materials. Thanks to Space Drive, he can now move the 4.8 cubic meter bucket with just two fingers. Photo: PARAVAN*



*Practice and sensitivity are still required. But loading and still somewhat unfamiliar procedures will become an everyday routine. Photo: PARAVAN*

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*Hidden behind the seat is the heart of the Space Drive system. From here, the commands from the throttle are passed on to the CPU via a cable, and from there they are converted into control commands to the actuator on the accelerator pedal. Photo: PARAVAN*

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### About Paravan GmbH:

Paravan GmbH is the world market leader for highly customized vehicle solutions for the disabled. Around 180 employees develop and produce individually adapted automobile conversions, power wheelchairs at the company's headquarters in Pfronstetten Aichelau and at the branch office in Heidelberg. With its "one-stop shop" concept, Paravan pursues a holistic approach that begins with individual consultation. The technological highlight is Space Drive, an intelligent digital control system based on the drive-by-wire principle. Thanks to the active redundancy of the servo motors, it is completely fail-safe and the first in the world to be approved for road use. With the help of this innovation, severely disabled people, some without arms or legs, can drive a car independently and safely. It is not possible for these drivers to simply intervene in the steering wheel. Worldwide, Space Drive has proven itself on over one billion road kilometers in the last 20 years and is used by numerous industrial customers for test vehicles in the field of autonomous driving. The system is available as a retrofit kit with an open interface for all known vehicle types. [www.paravan.de](http://www.paravan.de)