

VIDEOLINK



See SPACER 250
in action:
bit.ly/spacer250



**Electrically
powered**

**Radio remotely
controlled**



**Optimises limited
space in the hangar.**

**Only one person
required for operation**

**Loads and unloads
the nosewheel
automatically with
one tap on the remote**

**No driving license
required.**

**Minimal maintenance
and operational costs.**



Mototok SPACER 250

The safest and most effective way of
moving aircraft towbarless.
Electrify your Ground Handling.



HANGAR
OPTIMIZATION



TOWING
CAPACITY
250 T



AVION REVUE
Excellence Award 2019
Handling of the Year



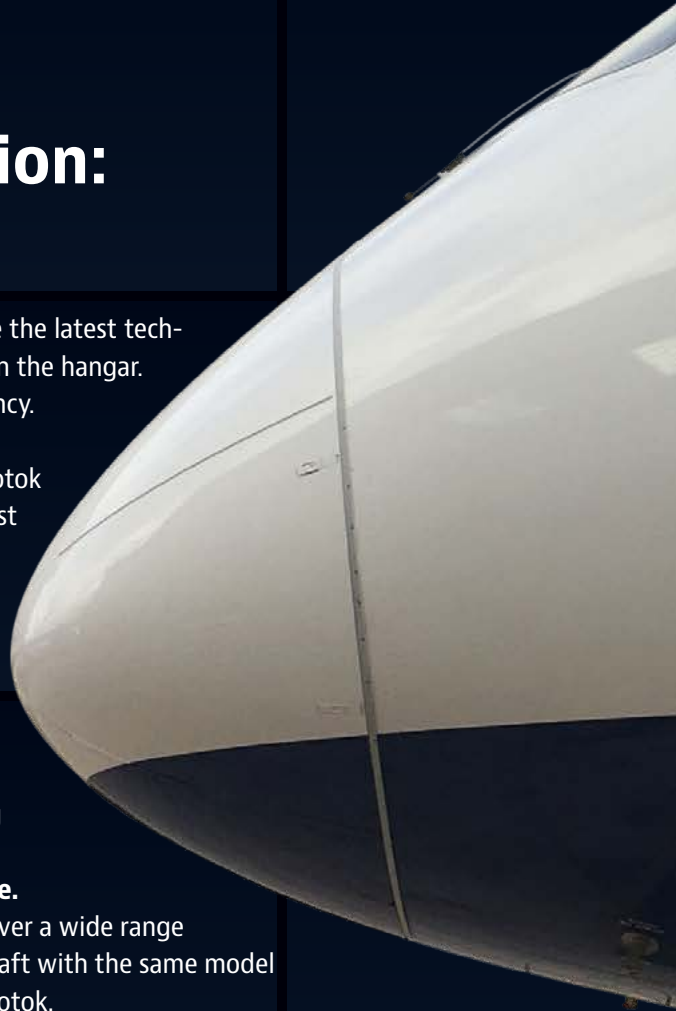
2019
PRODUCT LEADER
OF THE YEAR www.aviationspro.com

mototok
easy moving

Efficiency in a new dimension: SPACER 250

Our basic philosophy in the development of all our equipment is to use the latest technology – for the greatest possible innovation both on the tarmac and in the hangar. Our aim is always to significantly increase your ground handling efficiency.

For moving aircraft easily with an MTOW up to 250 tonnes Mototok SPACER 250 is equipped with two powerful AC motors of the highest quality of German manufacture. The batteries are on the same highest technological level. The battery charger with microprocessor regulation ensures a rapid and gentle charging of the batteries in about 6 hours. All Mototok tugs are equipped with the most modern processor controlled electronic components. To reduce the susceptibility to failure Mototok SPACER 250 comes up with an integrated CAN-BUS.



The 4 biggest advantages of using an electric driven Mototok tug

1. Cost effective.

- Low personnel costs by means of wireless transmission control – the operator is essentially a “wing walker” himself.
- No governmental driving licence required. Every trained person (3-4h of training) is able to move an aircraft with a Mototok.
- Extremely low maintenance costs.

2. Safe.

- Hydraulic fixation of the nose wheel.
- Fully programmable speeds, braking curves, initial torques and over steering protection – Controlled and regulated by internal microprocessor.
- Gentle treatment of the landing gear.
- Oversteering Protection System

3. Flexible.

- Maneuver a wide range of aircraft with the same model of Mototok.
- 100 % circumferential visual control around the aircraft.

4. Easy-to-use.

- Docking takes a matter of seconds. Simply drive the Mototok up to the nose gear. The wheel is hydraulically fixed – ready for take off!
- Radio remote controlled operating under an industrial frequency code approved for airports.
- Automatic connection to the aircraft’s nose gear with one click.
- No straps, no winch, no tools required.



**SPACER 250 is
compatible to
following aircraft**

BOEING 787
BOEING 777-X
BOEING 767
BOEING 757
AIRBUS 350
AIRBUS 340
AIRBUS 330
AIRBUS 320 Family
AIRBUS 220
EMBRAER E-Jets

Mistakes and technical alterations
reserved. List is not complete.

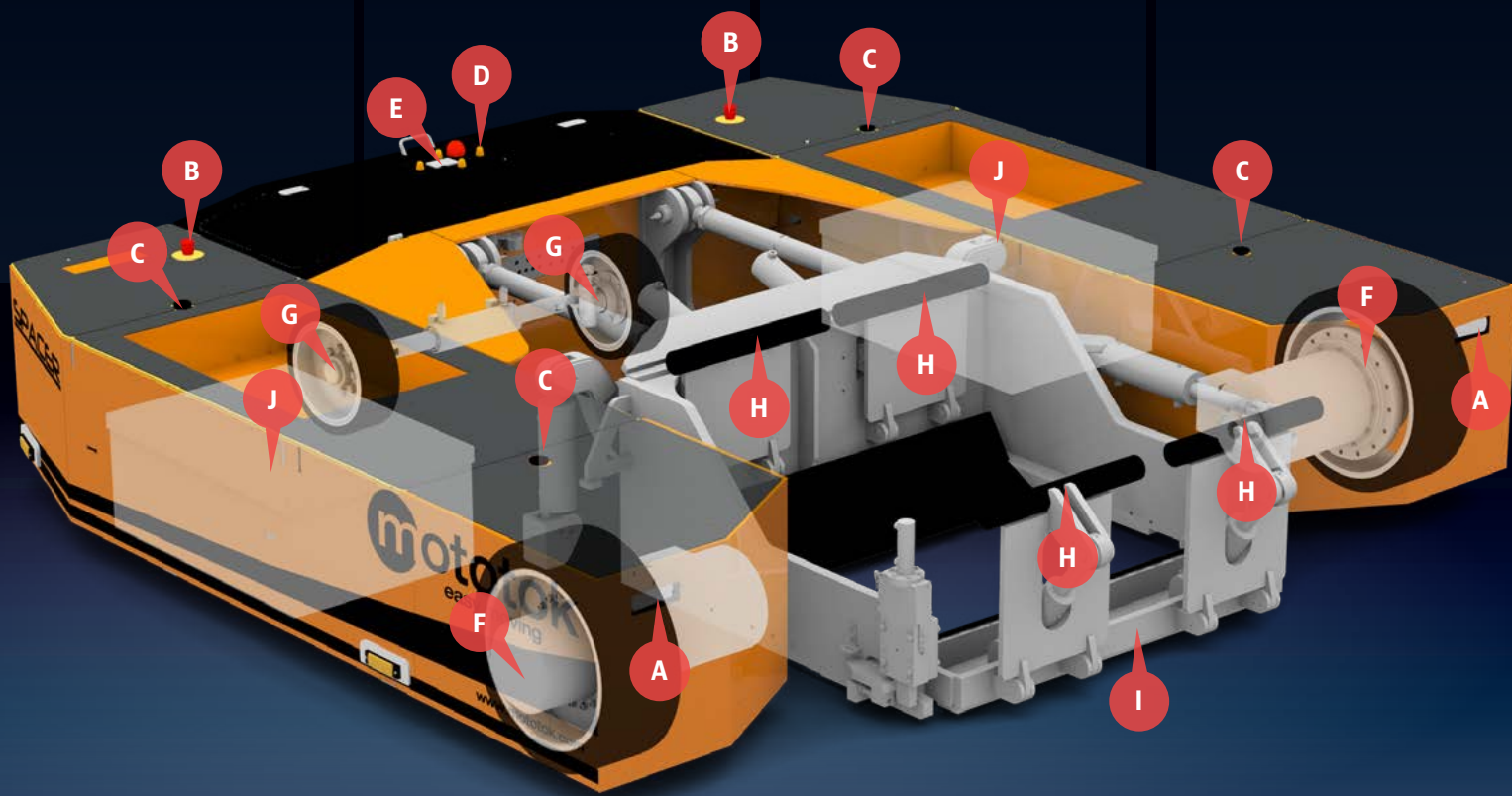


Take a look inside.

Mototok is a battery powered pedestrian controlled vehicle capable of moving a wide range of aircraft types.

Mototok is steered by a remote console connected to the tug either via radio or a coiled steel wired armoured cable of 15 meters length (extended). This enables the operator to view the aircraft and tug from the safest position whilst giving the best visibility. The tug can be positioned, engaged and disengaged from the aircraft by the operator remotely.

- A. Headlights
- B. Emergency stop
- C. Thread for the pink transporting eyebolts
- D. Driving direction indicator lights
- E. Display
- F. Driving gears
- G. True ackermann steering wheels
- H. Nose wheel securing clamps
- I. Hydraulic automatic door
- J. Batteries



Operating procedure.



Engaging and Disengaging the Nose Wheel

The engaging procedure can be started automatically by pressing just one button on the remote control:



1. Drive the Mototok with opened hydraulic door and lowered platform towards the nose wheel of the aircraft until the nose wheel touches the sliding table. Then press the start-button on the remote control.



2. The hydraulic door closes ...



3. ... and clamps the nose wheel with a specified pressure.



4. The platform lifts up and raises the nose wheel. The whole procedure takes about 10-15 seconds.



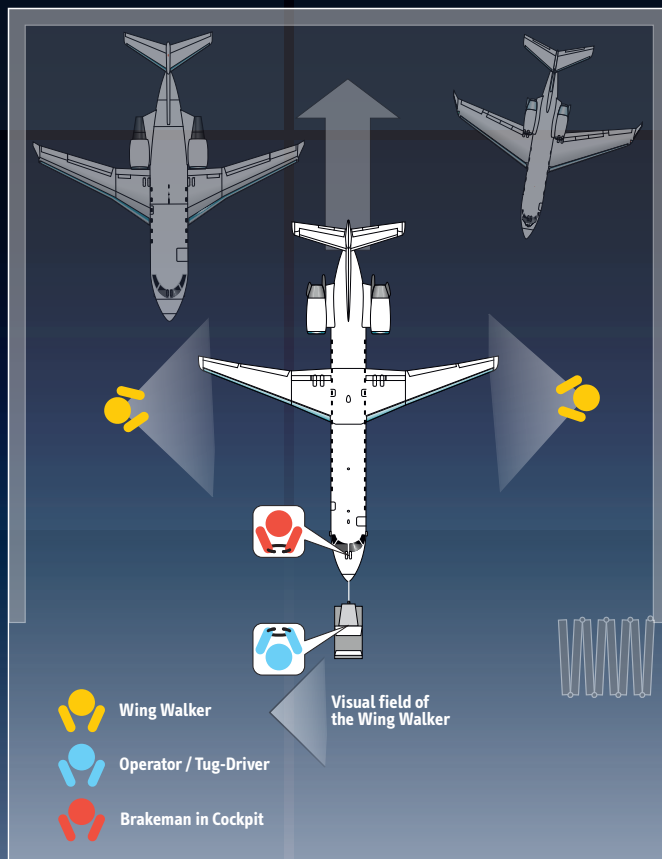
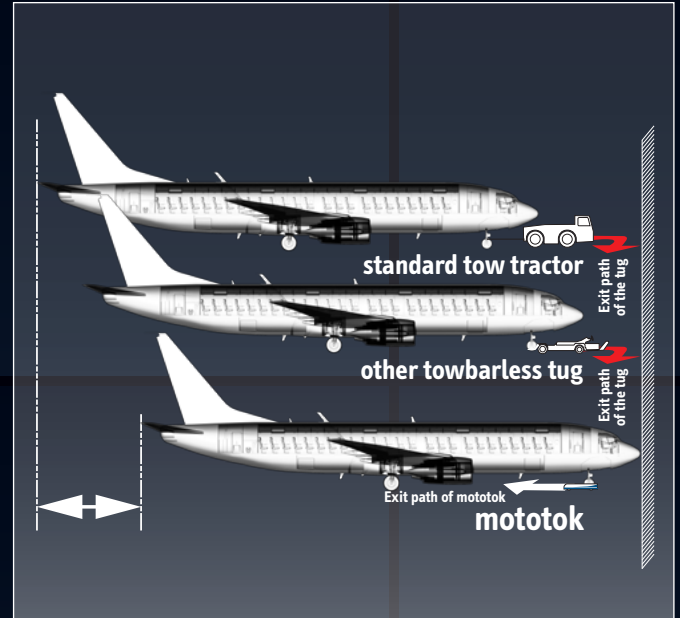
Hangar Operations: Increase your Hangar Space up to 150%.



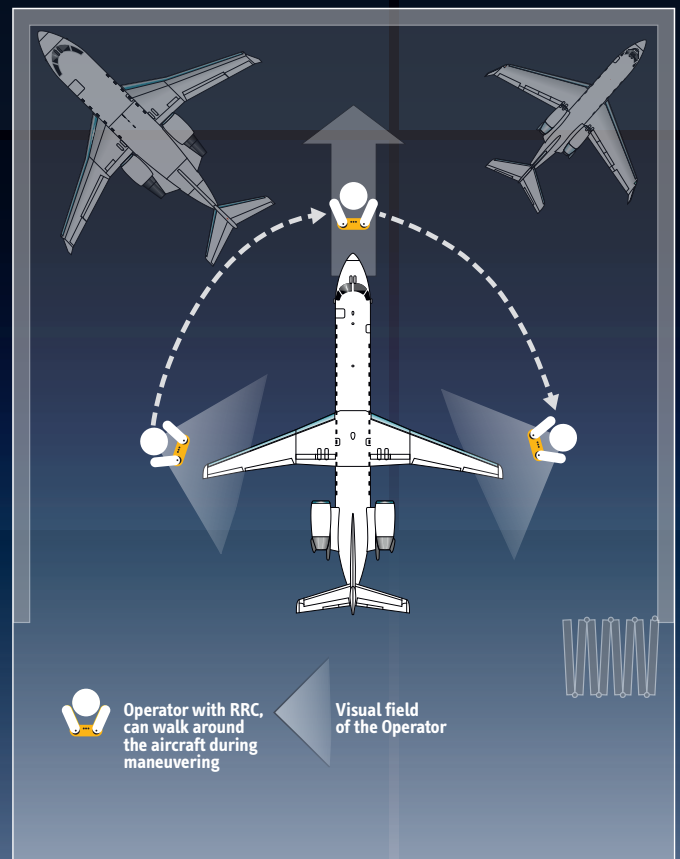
Mototok excels in tight situations: Park your aircraft safely, easily and effectively where you want: In the hangars corner, directly towards the hangars wall or near by other aircraft in the hangar. Save space in the process – depending on your hangar situation up to 60%.

Operating with normal tugs with or without a towbar is intricate. Turning the nose wheel whilst maneuvering without moving the aircraft is impossible. And you have to consider the exit path of the tug. Thus parking the aircraft with old technology is unprofitable. You are not able to use your hangars full capacity.

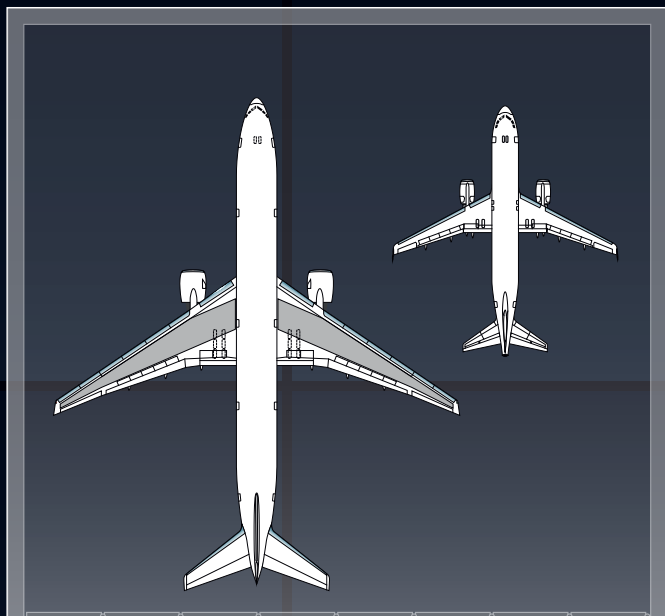
The low height, the compact design and the radio remote control of Mototok tugs gives you the fully control of the hangars space. It saves costs through optimized use of limited space.



Towing with a conventional Tractor: At least 4 Persons needed



Circumferential view – only one person with a radio remote control (RRC) needed for moving the aircraft



Typically situation in a hangar – managed with a conventional tow tractor.

The biggest disadvantages are:

- All aircraft faces to the hangars gate because you have to consider the exit path of the tow tractor. Parking directly in a hangars corner is impossible.
- The distance between the aircraft has to be acceptably big. Maneuvering with a tow tractor means you have to move the machine to turn the nose wheel. Turning the nose wheel without moving the aircraft is impossible!

In our example you are only able to put a B777 together with a A320 in the same hangar.

You are not able to use your hangars full capacity!



Same hangar – more aircraft in it with Mototok SPACER 250.

- Park your aircraft directly towards a wall or in the hangars corner. You don't have to consider the exit path of Mototok due to Mototoks very compact design.
- „Stack“ aircraft – park your aircraft with extreme minimal distance. Maneuvering in extreme tight situations is from now on no problem.

For our example it means, that you can park three more A320 (or similar) in the same hangar.

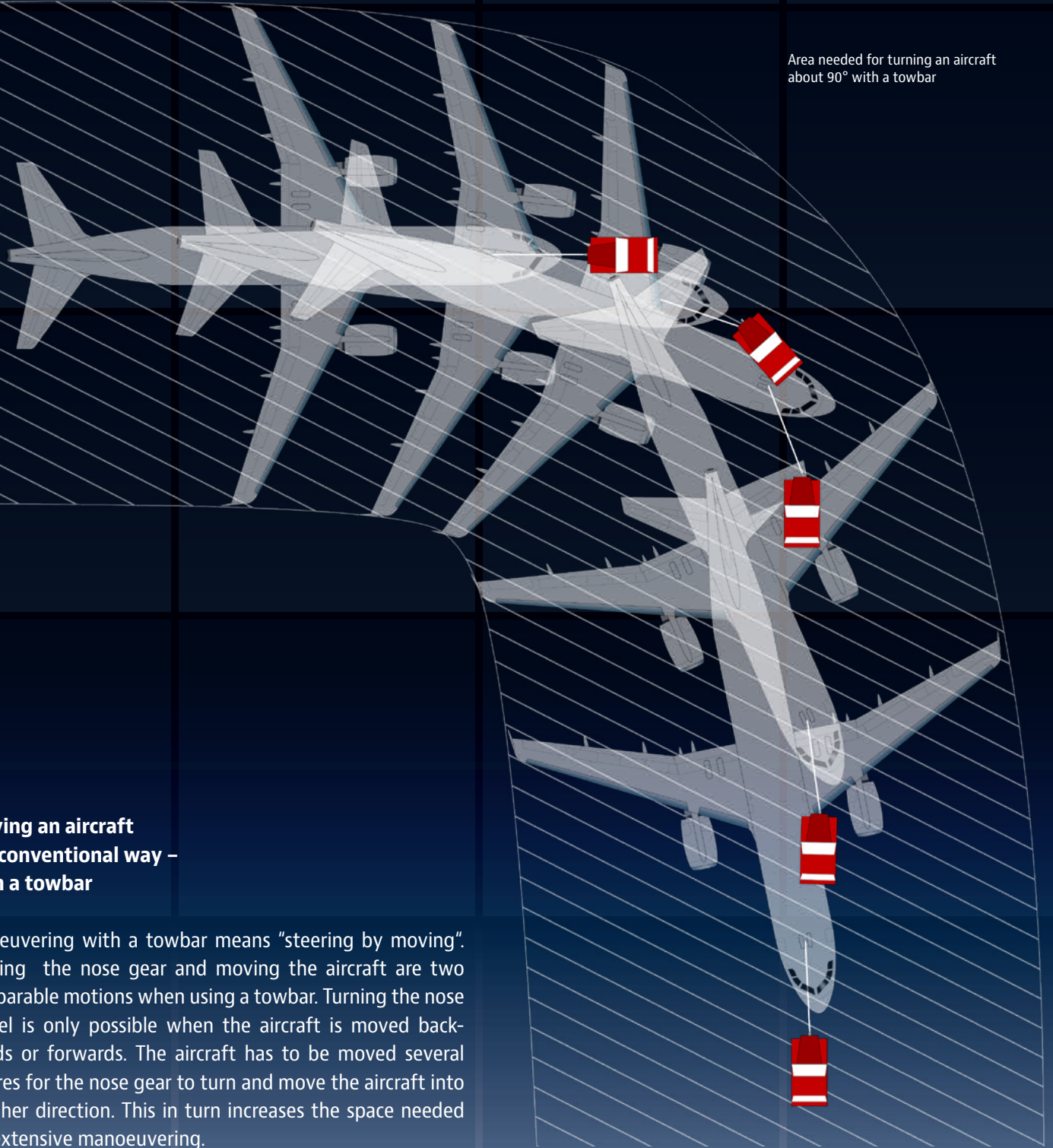
Increase the capacity of your hangar up to 150% by optimizing parking space!

How does Mototok move aircraft in such an effective way?

Area needed for turning an aircraft about 90° with a towbar

Moving an aircraft the conventional way – with a towbar

Maneuvering with a towbar means “steering by moving”. Turning the nose gear and moving the aircraft are two inseparable motions when using a towbar. Turning the nose wheel is only possible when the aircraft is moved backwards or forwards. The aircraft has to be moved several metres for the nose gear to turn and move the aircraft into another direction. This in turn increases the space needed for extensive manoeuvring.

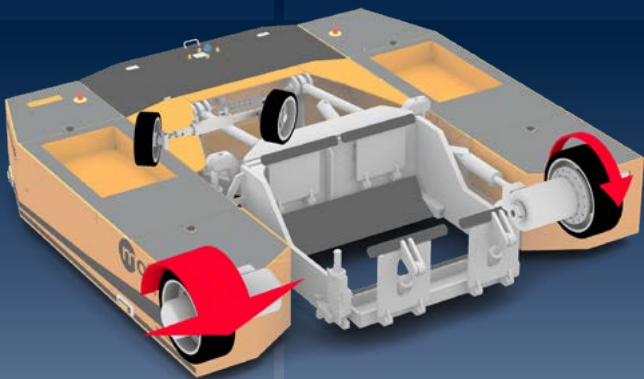
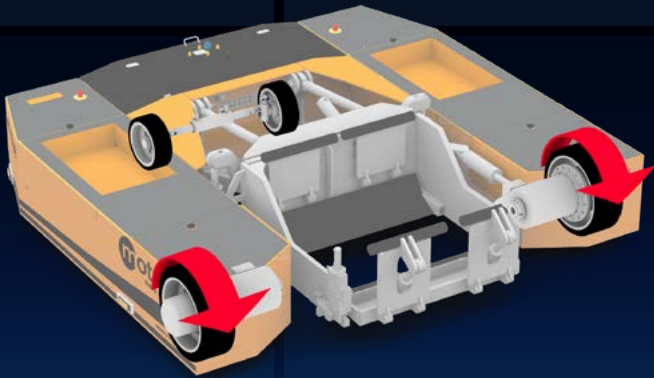
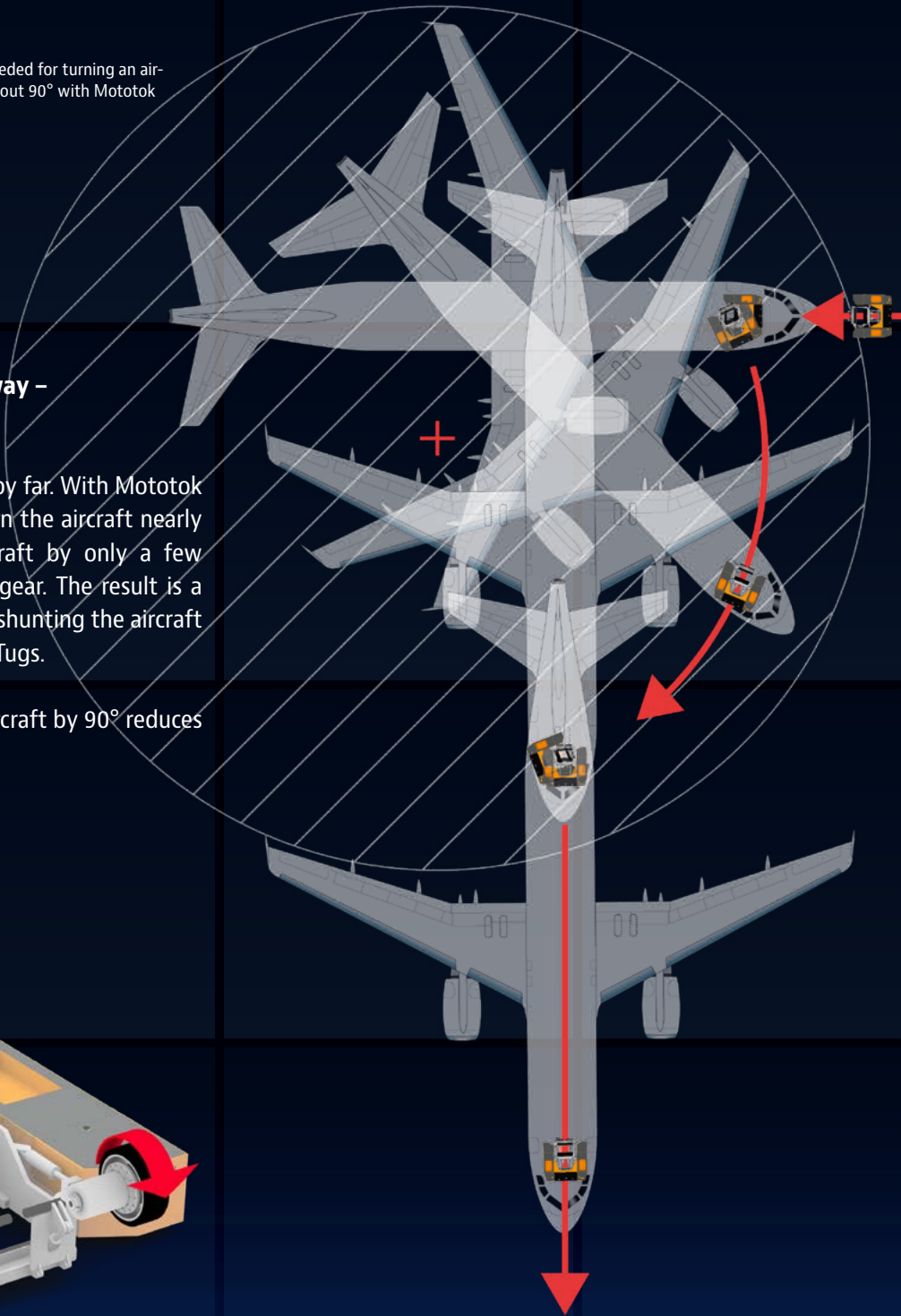


Area needed for turning an aircraft about 90° with Mototok

Moving an aircraft the innovative way – with Mototok!

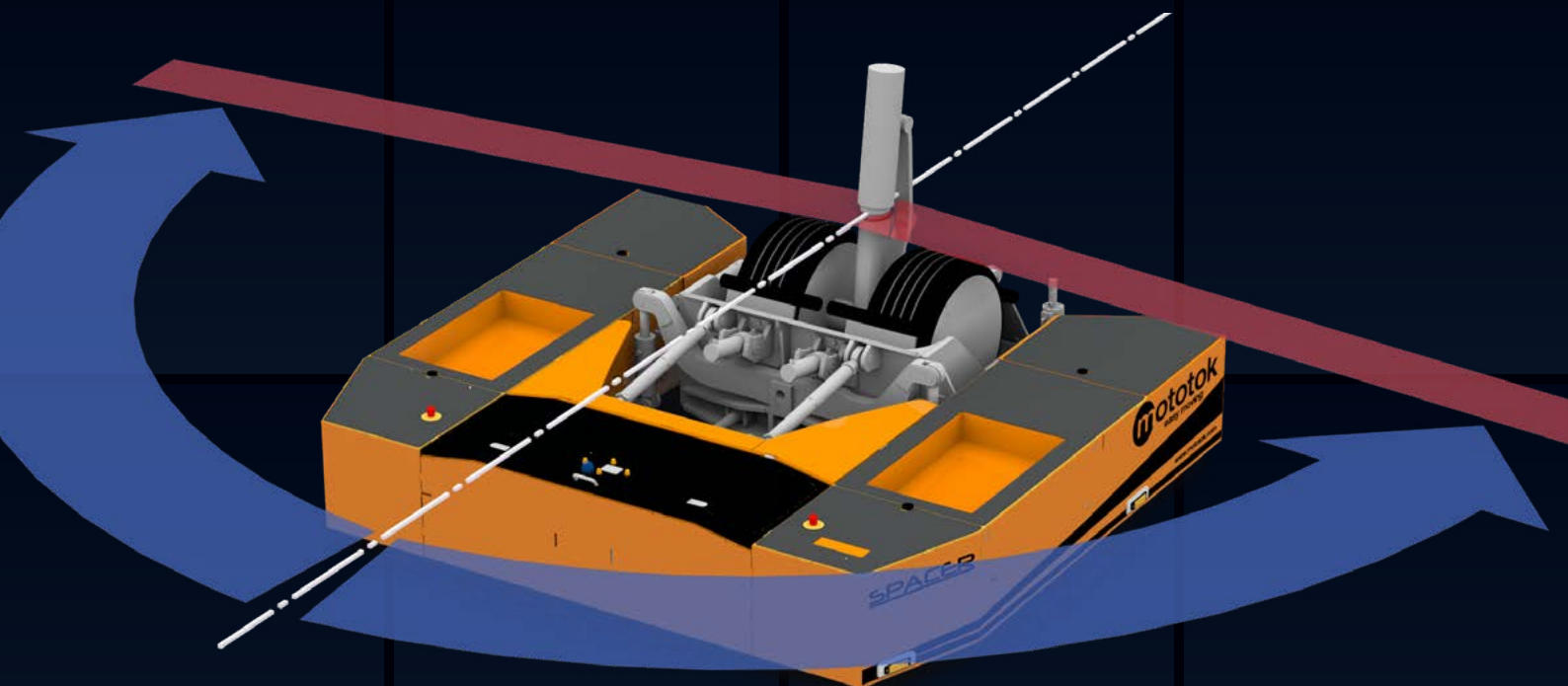
Manoeuvring with Mototok is easier by far. With Mototok SPACER 250 it is almost possible to turn the aircraft nearly on the spot. Mototok pulls the aircraft by only a few centimeters and then turns the nose gear. The result is a minimum requirement of space whilst shunting the aircraft – the deciding advantage of Mototok Tugs.

This example shows that turning an aircraft by 90° reduces manoeuvring space to nearly a circle.



The steering of a Mototok is performed through different rotating speed of both processor-controlled wheel-hub motors and with the help of Mototoks True Ackermann Steering System. The motors carefully control the torque proportionally to each of the drive wheels.

Safety first: i-NPS – Intelligent Nosegear Protection System.



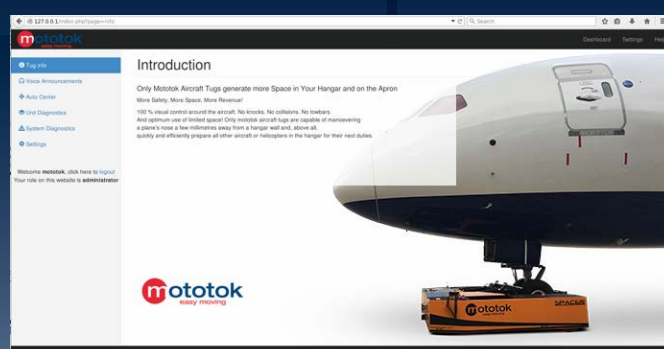
Achieve more safety in your daily operation: Intelligent Nosegear Protection System (i-NPS) is our newest contribution to prevent damages on the nose gear whilst shunting the aircraft. Equipped with several sensors which measures the forces and torques on the nose gear, Mototoks oversteering protection system commences, when the torque reaches a set limit. Damages of the sensitive nose gear is hereby impossible.

i-NPS gives an alarm output and stops the Mototok immediately. After the oversteering and stop occur, the operator can correct the movement and continue immediately.

Advantages

- Intuitive and easy handling
- Information for operators over the display of the Mototok and over electronic speech synthesis with the wireless headset
- Information for technicians over Mototok APP with Laptop or tablet

Main Unit Diagnostic			
Application Service Test	Application Service	Application Status Test	Application Diagnostic message
ThrustVectoring	0.001	Active	Diagnostic Message active
EngineControl	0.001	Terminated	No message
WingPositioning	0.001	Terminated	No message
Wing	0.001	Active	Wing stop active
WingPositioning	0.001	Active	WingPositioning active
WingPositioning	0.001	Terminated	No message
WingPositioning	0.001	Terminated	No message
WingPositioning	0.001	Terminated	No message
WingPositioning	0.001	Terminated	No message
WingPositioning	0.001	Terminated	No message
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WingPositioning	0.001	Terminated	No message
WingPositioning	0.001	Terminated	No message

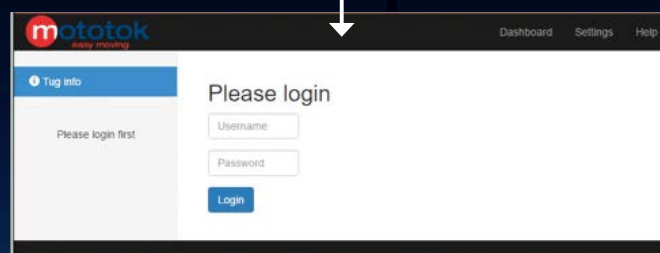


Ground Handling goes Digital – the new soft- and hardware features.



Mototok SPACER 250 comes with a central processing unit (CPU) for features and adjustments relating to

- Towing and braking forces
- Oversteering protection
- Voice announcements
- Unit diagnostics
- Log files
- User access



Log in for operation

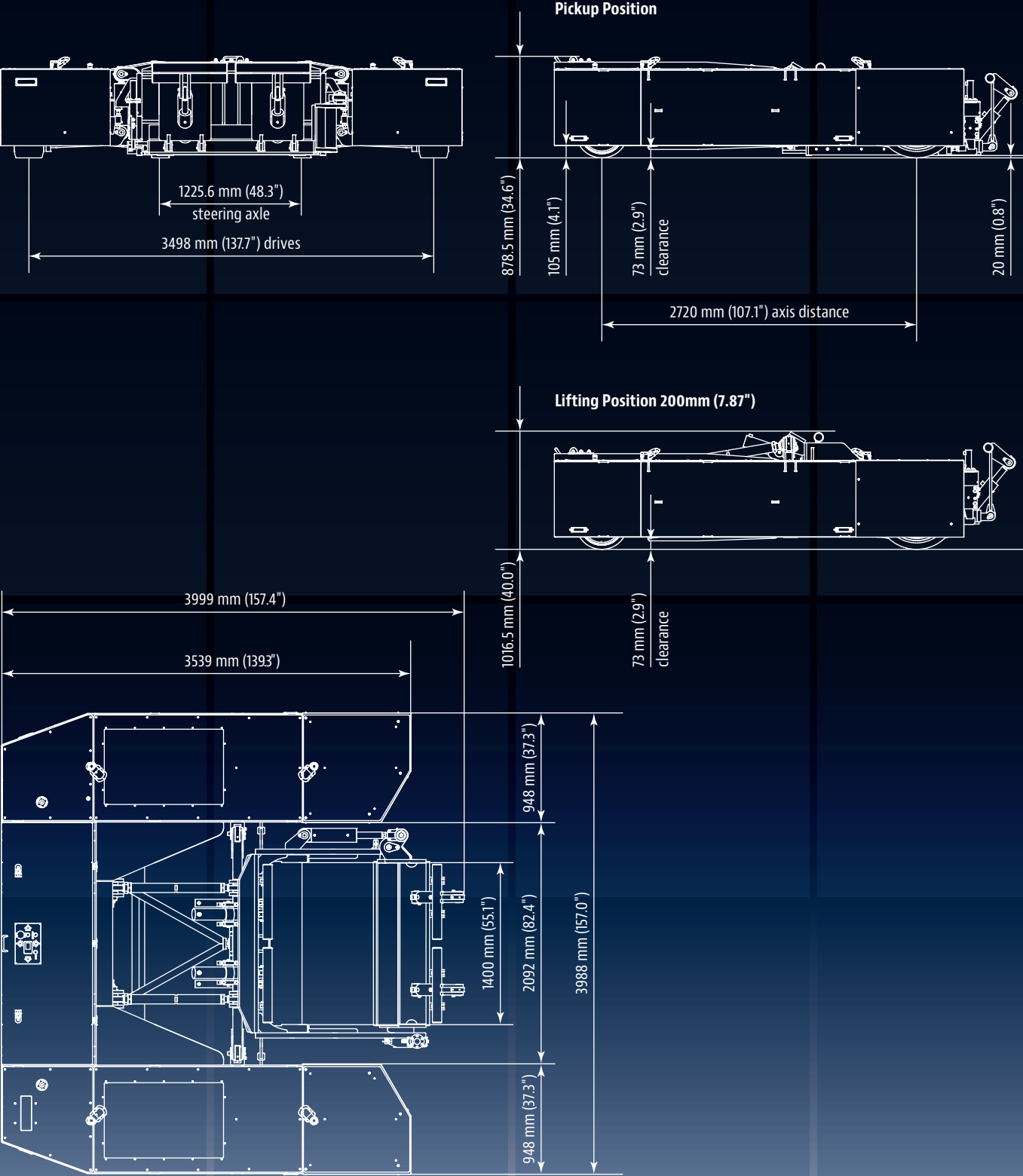
The quickest log in can be done via a RFID-card and an appropriate card reader on the machine. According to the authorization level, the user is able to move the Mototok, check or adjust the settings or read out the log files.




Log in for administration and maintenance

The CPU can be linked with any mobile device (smartphone, tablet or laptop) directly via WLAN or as a cloud service. Once you are linked to the system, you are able to manage many adjustments of the Mototok.

Dimensions

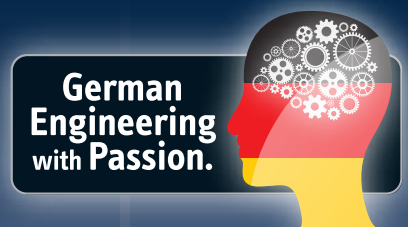


Technical Data

Mototok		Spacer 250	
Use for		double nosewheel	
			
Maximum towing capacity 1)		250 t	
		551156 lbs	
Maximum nosewheel weight capacity		22000 kg	
		48502 lbs	
Dimensions		width	3988 mm
			157.01 inch
		length	3999 mm
			157.44 inch
		overall height	879 mm
		pickup position	34.61 inch
		overall height	1017 mm
		lifted position	40.04 inch
Ground clearance		73 mm	
		2.87 inch	
Width of the wheel opening		1400 mm	
		55.12 inch	
Depth of the wheel opening		min.	650 mm
			25.59 inch
		max.	1200 mm
			47.24 inch
Platform lifting height		200 mm	
		7.87 inch	
Unladen weight		13000 kg	
		28660 lbs	
Time to load/fix aircraft		approx. 15 sec	
Speed		4 km/h	
		2.49 mph	
Possible terrain		Concrete, stone	
Tyres		Puncture-proof tyres	
Radio remote control (with safety features, waterproof, certification of conformity), worldwide safety approval, including airports, TÜV certified			
Optional Equipment			
Hydraulic nosewheel securing ²⁾		inclusive	
Charger		inclusive	
Driving light (LED, 10,000 hour operating life, very high beam range)		inclusive	
Yellow flashing light		inclusive	
Safety beeper		inclusive	
Military spiral cable connection (15 m) between aggregate and control unit		available	
Automatic controls by ground markings (AGV functionality)		available	
Adaptations for special demands (i.e. military version / range of production)		available	
Mistakes and technical alterations reserved / Date 05.2019			
1) The stated towing capacity is valid for towing on normal ground conditions without any incline.			
2) This prevents the nosewheel from rising and slipping out of position. The securing device is hydraulically lowered onto the nosewheel and securely locked at the push of a button. Standard: mechanical securing system.			

Some technical data of the Mototok SPACER 250 may change due to further development and are not fixed yet. Most of the images are for illustration purposes only and may not perfectly or accurately depict the final design and size of SPACER 250.

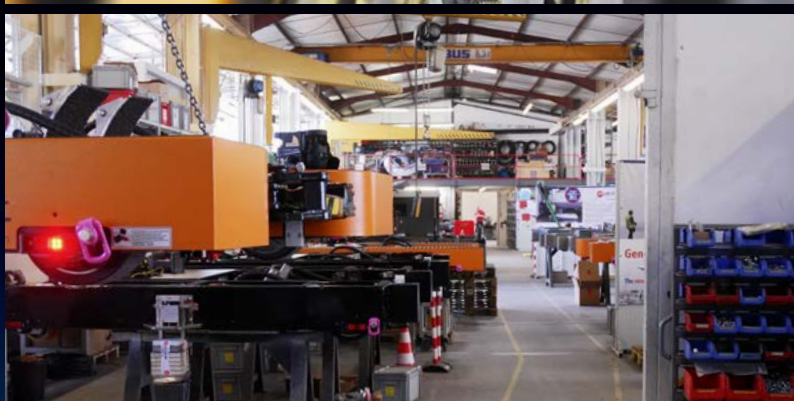
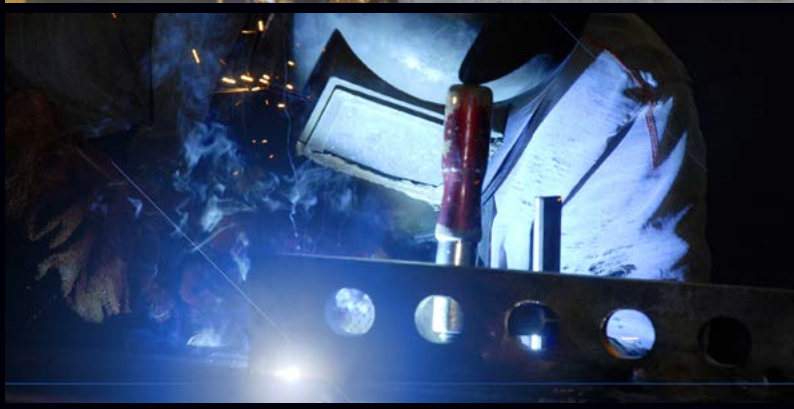
The Power of Engineering – Made in Germany.



Our innovative built to last aircraft tractors are best equipped for daily heavy use as they consist of high-grade material, hand-picked components according to the finest engineering designs. Our products are capable of withstanding the toughest conditions when exposed to wind and salt water. Thanks to a selection of the finest materials, only limited maintenance is necessary.

Our production process corresponds and applies to all necessary demands and conditions required in the engineering industry.

2006/42/EC	Machinery Directive (MD)
2014/35/EU	Low Voltage Directive (LVD)
2014/30/EU	Electromagnetic Compatibility Directive (EMC)
2014/53/EU	Radio Equipment Directive (RED)
EN 1915-1	Aircraft ground support equipment – General requirements – Part 1: Basic safety requirements
EN 1915-2	Aircraft ground support equipment – General requirements – Part 2: Stability and strength requirements, calculation and test methods
EN 12312-7	Aircraft ground support equipment – Part 7: Aircraft movement equipment
EN ISO 12100	Safety of machinery – General principles for design – Riskassessment and risk reduction
EN 1175-1	Safety of industrial trucks – Electrical requirements – Part 1: General requirements for battery powered trucks
EN ISO 4413	Hydraulic fluid power – General rules and safety requirements for systems and their components
EN ISO 13849-1	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
EN 60204-1	Safety of machinery – Electrical equipment of machines – Part 1: General requirements



Satisfaction guaranteed – our customers

(extract)

Airports

Bern	Switzerland	Airport	Several Aircraft
Birmingham	USA	Shuttlesworth International Airport	Several Aircraft
Burbank	USA	Bob Hope Airport	Several Aircraft
Cannes	France	Mandelieu Airport	Several Aircraft and Helicopter
Chicago	USA	Chicago Executive Airport	Several Aircraft
Dallas	USA	Dallas Love Field	Several Aircraft
Denison	USA	North Texas Regional Airport	Several Aircraft
Dresden	Germany	Airport	General Aviation
Dublin	Ireland	International Airport	Several Aircraft
Glasgow	UK	International Airport	Several Aircraft
Indianapolis	USA	International Airport	Several Aircraft
Kuala Lumpur	Malaysia	Sultan Abdul Aziz Shah International Airport	Several Aircraft
London	UK	Luton Airport	Several Aircraft
Lugano	Switzerland	Airport	Several Aircraft Helicopter Agusta and others
Lyon	France	Saint Exupery Airport	Several Aircraft and Helicopter
Malaga	Spain	Airport Costa del Sol	Several Aircraft and Helicopter
McKinney	USA	National Airport	Several Aircraft
Minneapolis	USA	Saint Paul International Airport	Several Aircraft
Moskow	Russia	Domodedovo Airport	Several Aircraft and Helicopter
Orlando	USA	Sanford International Airport	Several Aircraft
Panama	Panama	Albrook „Marcos A. Gelabert“ International Airport	Several Aircraft
Philadelphia	USA	International Airport	Several Aircraft
Provo	USA	Municipal Airport	Several Aircraft
Santiago de Chile	Chile	Arturo Merino Benítez International Airport	Several Aircraft
Seattle	USA	Tacoma International Airport	Several Aircraft
Seattle	USA	King County International Airport	Several Aircraft
Sion	Switzerland	International Airport	Several Aircraft
Truckee	USA	Tahoe Airport	Several Aircraft
Tulsa	USA	International Airport	Several Aircraft
Waukegan	USA	Regional Airport	Several Aircraft
Zürich	Switzerland	International Airport	Several Aircraft and Helicopter

FBO / MRO

ACC Columbia, Hannover & Cologne	Germany	Global & others
ACI Jet Center	USA	Several Aircraft
AERO Dienst, Nuremberg	Germany	FBO
Air Service Basel	Switzerland	G5, Global Express, Boeing 737
AirMec	Angola	MRO / Military Aircraft
Alpark SA	Switzerland	Several Aircraft
Cannes	France	Several Aircraft and Helicopter
Centeravia		Several Aircraft
DUNCAN Aviation	USA	Several Aircraft
Flying Group, Antwerpen	Belgium	Several Aircraft
Glasgow	UK	Several Aircraft
Hawker Pacific Asia Pte Ltd	Singapore	Several Aircraft
Jet Alliance Vienna	Austria	Several Aircraft
Jet Legacy Center, Tulsa	USA	Several Aircraft
JetAviation, Geneva	Switzerland	Several Aircraft
London	UK	Several Aircraft
Lyon	France	Several Aircraft and Helicopter
Panaviatic Ltd	Estonia	Several Aircraft
Perth	Australia	FBO
Santiago de Chile	Chile	Several Aircraft
Sapura Aero	Malaysia	Several Aircraft
Silk Way Airlines, Baku	Azerbaijan	Several Aircraft
Starport Aviation	USA	Several Aircraft
Synergy Flight Center	USA	Several Aircraft
Tarkim Air	Turkey	General Aviation
XJEt	UK	Several Aircraft
FAI Nürnberg	Germany	Several Aircraft
Executiv Jet Service	Switzerland	Several Aircraft
Alpin Sky Jets	Switzerland	Several Aircraft
Aeroground Berlind GmbH	Germany	Several Aircraft
DC Aviation GmbH	Germany	Several Aircraft
Dedeman	Rumänien	Several Aircraft
Execujet New Zealand	Neuseeland	Several Aircraft
Falcon Aviation Services	UAE	Several Aircraft
JetEx	UAE	Several Aircraft
Flying Service	Belgien	Several Aircraft
GCH Aviation	New Zealand	Several Aircraft
Hawker Pacific Asia Pte Ltd	Australia	Several Aircraft
Jet Flight Air Services	New Zealand	Several Aircraft
Japat AG	Switzerland	Several Aircraft
Luxembourg Air Rescue	Luxembourg	Several Aircraft
Volkswagen AG	Germany	Several Aircraft
ADAC Luftrettung	Germany	Skidded Helicopter

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airservicebasel

 **BOEING**

 **ENZIES**
AVIATION

Alaska Airlines

BRITISH AIRWAYS

Gulfstream

Aircraft Manufacturers

Airbus S.A.S., Hamburg	Germany	Spacer
BOEING	USA	Plant in Philadelphia AGV
BOMBARDIER, Montreal	Canada	Global Express Delivery Center
Dassault Aviation	France	Twin
EMBRAER S.A.S. José dos Campos	Brazil	Embraer 195, 190, 175, 170, KC 390
Korea Aerospace Industries Inc (KAI)	South Korea	
Pilatus Aircraft Ltd	Switzerland	PC 12 Maintenance & Delivery
Rosvertol PLC	Russia	Helicopter Production MI-series
Sikorsky	USA	
Suchoi	Russia	
Turkish Aerospace Industries, Inc. (TAI)	Turkey	F 16 Fighter Maintenance Facility, Tiger Maintenance Facility
Xi'an Aircraft Company	China	Y 20

Corporations

Abbvie	USA	
ABP Food Group	Ireland	
Access Aviation	UK	
ACM	Chile	
ACSI Corporation	USA	
Alpine Sky Jets	Switzerland	
American Colors International	USA	
Anglo American	South Africa	Agusta AW139, G5
C & P Aviation	USA	
Caribbean Investor Group	USA	
CNH Industrial	The Netherlands	
Columbia Pacific Management	USA	
Comcast	USA	Several Aircraft
Cook Canyon Ranch	USA	
Disney	USA	
Gazprom Avia, Moscow	Russia	Falcon Jets
Harbert Aviation	USA	
Home Depot	USA	Several Aircraft
Indianapolis Colts	USA	
L-3	USA	Several Aircraft
Novartis AG (JAPAT AG), Basel	Switzerland	Global Express, EC 135
OAO Gazprom	Russia	Several Helicopter & Aircraft
Regions Financial Group	USA	
State Farm	USA	Several Aircraft
Taxxas	USA	
The Boler Company	USA	
The CocaCola Company	USA	Several Aircraft
The Duchossois Group	USA	
TLS Aviation	USA	

Government

Sultanat of Oman	Oman	Eurocopter Super Puma Fleet
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Military

Brazil Navy	Brazil	Onboard Helicopter
CASSIDIAN Manching (EADS)	Germany	Tornado & Eurofighter
China Military	China	All kind of Aircraft, Helicopters
Columbian Air Force	Columbia	
Danish Army	Denmark	Challenger, Agusta EH 101, F 16
French Navy / Air Force	France	Rafale Fighter, SuperPuma, NH 90, EC 155, Panther
Israel Airforce	Israel	Alenia Aermacchi M-346 Master
Korea Navy	South Korea	Onboard Helicopter
Pakistan Military	Pakistan	HELIMO for Helicopters with skids
Peru Navy	Peru	Helicopter on the BAP Pisco
South Korea Coastguard	South Korea	Onboard Helicopter
Thailand Army	Thailand	
U.S. Army National Guard	USA	M 528
US Airforce (in England)	UK	F 15
Venezuela Military	Venezuela	Helicopters with skids & with wheels

Special Forces

Federal Police	Germany	Helicopter Super Puma, EC 155
Guardia di Finanza Rome	Italy	ATR

Airlines

Aegean Airlines	Greece	
Asiana Airlines	South Korea	
Air Nostrum, Líneas Aéreas del Mediterráneo S.A	Spain	
Alaska Airways, Seattle	USA	BOEING 737 Family
British Airways	UK	AIRBUS 320 Series
HOP!	France	
Iberia, Líneas Aéreas de España S.A.	Spain	Spacer for BOEING and Airbus
Thomson/TUI, Luton	UK	BOEING 737 Family

Pushback

Allegiant Air	USA	
ANA – All Nippon Airways	Japan	
British Airways	UK	28 Machines at Heathrow T5
Changsha Huangpi Airport	China	
DNATA	UAE	Demo
Figari-Sud Corse Airport	France	
FRAport	Germany	Demo
Iberia	Spain	15 Machines at Madrid Barajas 15 Machines at Barcelona El Prat
JetBlue	USA	Demo
Rovaniemi Airport	Finland	Demo
TCR	UK	

BOMBARDIER
the evolution of mobility

DASSAULT
AVIATION

EMBRAER

JET AVIATION

DUNCAN
AVIATION

IBERIA

PILATUS

TUI Travel PLC

Mototok.

REVOLUTIONARY – FINDING INNOVATIVE SOLUTIONS OUT OF NECESSITY

Mototok was founded in 2003 by Kersten Eckert, avid aviator and creator of the Mototok, and his friend and partner Thilo Wiers-Keiser.

FUELLED BY PASSION

The invention of our aircraft tugs is a deeply personal story that began with Kersten Eckert's first solo flight at 18. His growing aggravation about a process efficient-minded Eckert considered far from ideal: Maneuvering the aircraft while on the ground. You know the rigmarole: Waiting for the machine being laboriously transported out of the hangar, depending on having two or even three people available to watch his wings and fuselage, needing a pilot to sit inside the aircraft ready to brake if needed ...Eckert became determined on finding not only a better, but the perfect way in terms of space, speed, and effort.

CREATING THE PERFECT PRODUCT

5 years of detail-oriented developing time later, the first Mototoks hit the market: Battery-powered industrial tugs providing an all-round view around the aircraft by high technology remote control, operated by a single person.

By now, there are Mototoks available for all aircrafts up to 250 tonnes. They are in use by international FBOs, MROs, aircraft manufacturers, special forces, airports, airlines, navy, military, industrial companies, businessmen and individuals with their own fleet.

Learn more about Mototok at www.mototok.com.



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AIRBUS

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