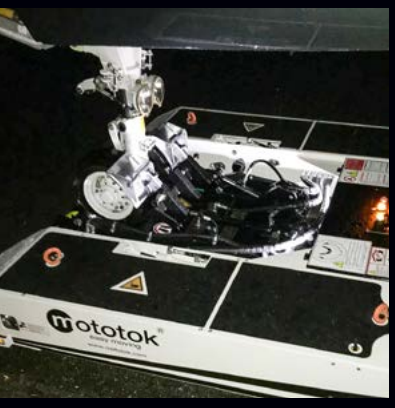
Electrically powered

Radio remotely controlled



Extreme low height

Only 1 person required for operation

Park your aircraft using the last corner of your hangar and save space

Flexible use for all aircraft up to 28 tonnes

German Engineering with Passion.

M-SERIES 505 / 515 / 528

HANGAR OPTIMIZATION

TOWING CAPACITY UP TO 28 t 61.730 lbs

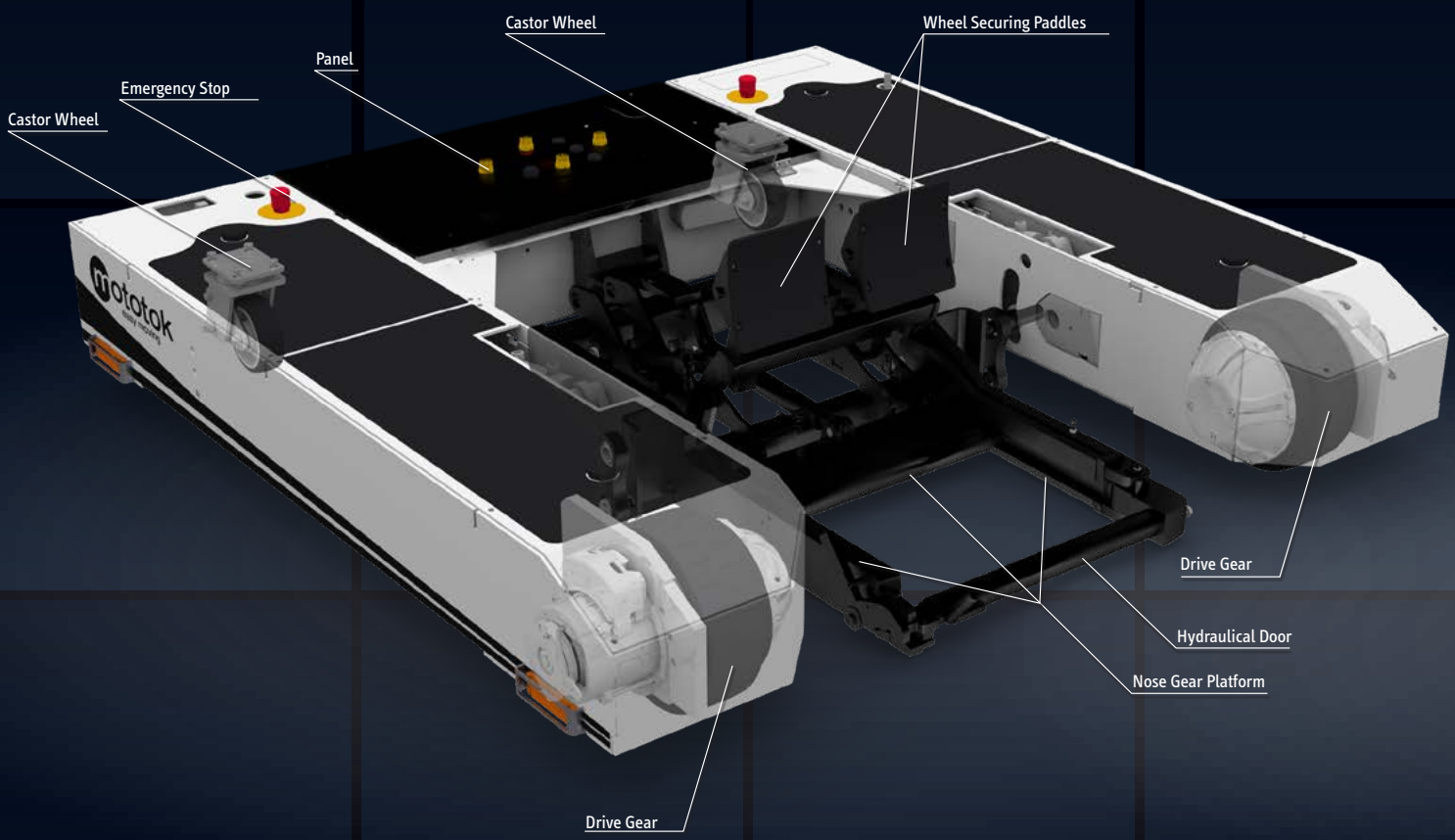
The safest and most effective way of moving aircraft towbarless.
Electrify your Ground Handling.

mototok
easy moving

4221 / 12-2017

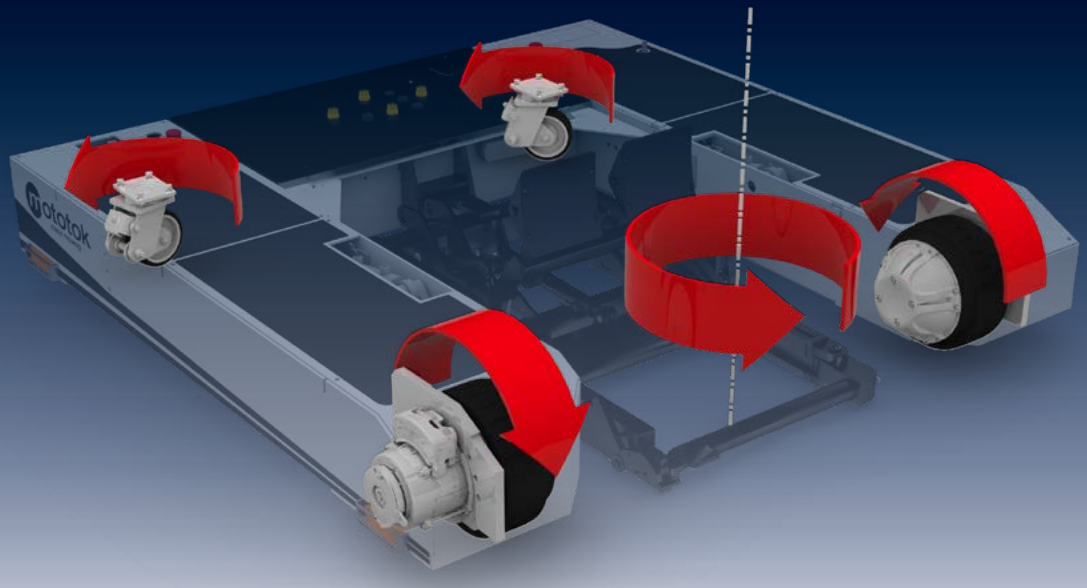
**There are many different features of the Mototok M-Series compared to any other tug in the industry:
Flexibility, safety, cost savings –
with the highest ROI in the Market.**

A big idea in a small format. Name: Mototok. Distinguishing features: Fully electric drive. Revolutionary in its simplicity. Extremely compact. Uniquely flexible. And very high performance. With the remote control feature of the Mototok, the operator is able to move anywhere around the aircraft to see every vantage point.
The operators eyes never leave the aircraft while it is in movement.



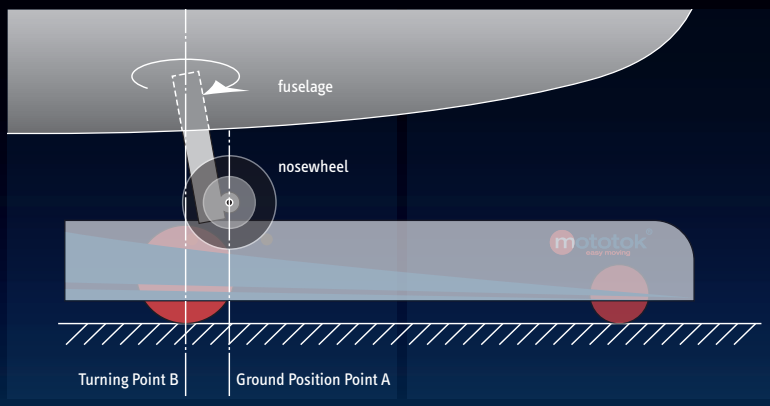
Take a look inside.

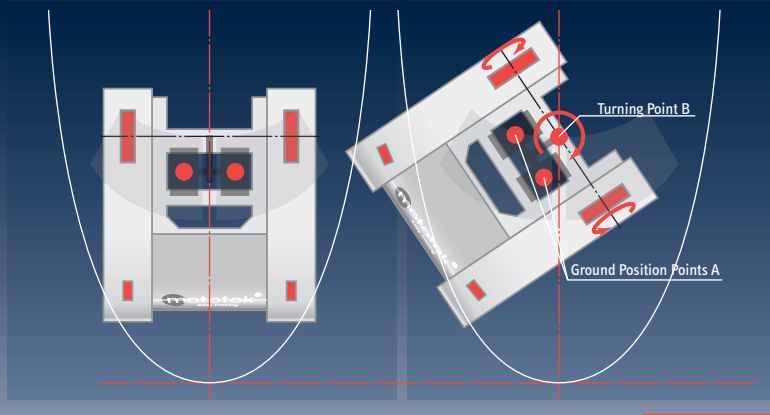
Extremely powerful electric motors driven by high-performance, maintenance-free batteries with high cycling capability, regulated and controlled by two high-performance microprocessors provide enormous driving forces. Extremely high initial torque ensures smooth acceleration, particularly at the start. Storage capacity is sufficient for lots of operations, depending on workload.



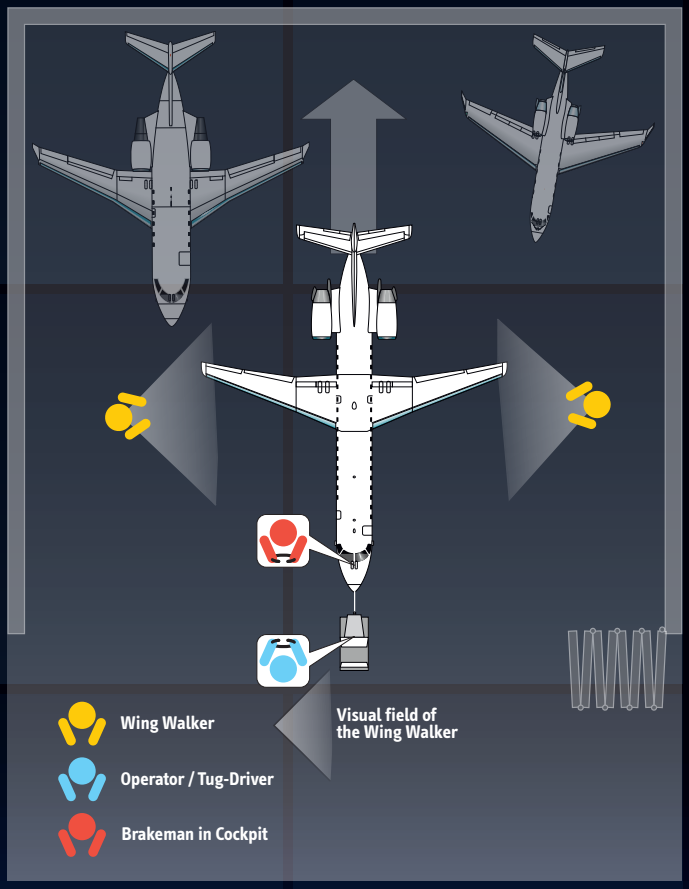
Turning on the spot with no wingtip movement: The Mototok principle.

Mototok is intelligent. The steering of a Mototok is performed through different rotating speed of both processor-controlled wheel-hub motors. A perfect turn on the spot is naturally no problem: one motor rotates forwards, the other backwards. Both motors recognise rotational resistance and carry out a precise turning manoevre. The aircraft remains almost immovable from its location during the turn. Therefore, accidents through collisions are practically out of the question. Additionally, transverse forces are not inflicted upon the nosewheel and landing gear hence no damgage will be caused to the bearings and other landing gear related components. According to the relative rotation speed of both driving wheels every route can be performed.

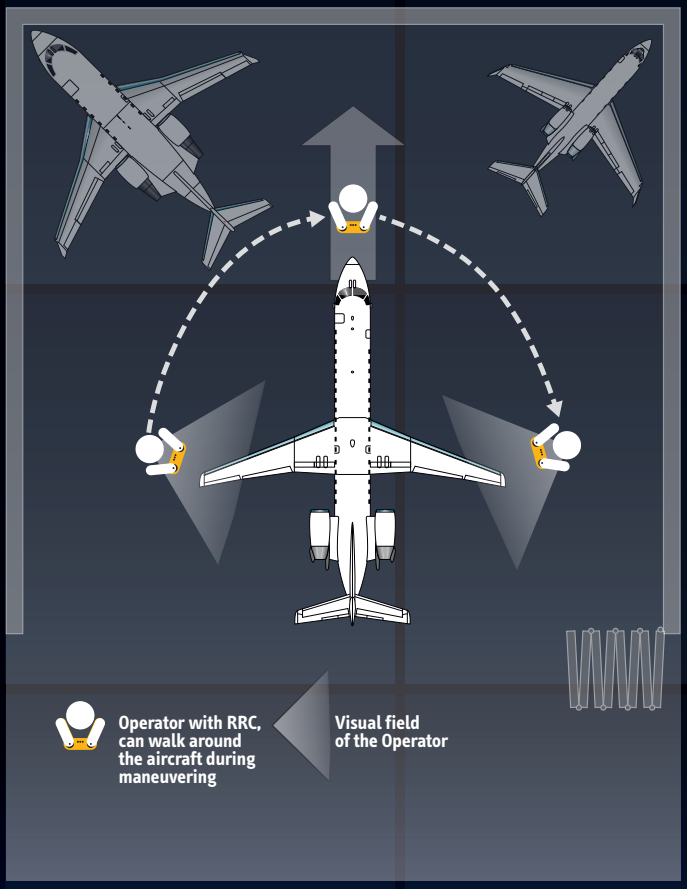




The top advantages of using a Mototok tug



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

- Industrial radio remote control. The operator is able to walk around the aircraft during maneuvering – he is essentially his own „wing-walker“
- fast and easy connection to the nose gear. Engaging and disengaging is done in seconds – and with our Model 528 automatically by a tap on the remote.
- No exit or entry path to consider for engaging and disengaging of the nose gear. Park your aircraft where you want – closely against a wall or in the hangar's corner
- Low to no maintenance costs. No bulky diesel engine –clean electric drive.
- Uniquely designed and microprocessor controlled.

Cost effective.

- Low personnel costs by means of wireless transmission control – the operator is essentially a “wing walker” himself
- Increases the number of aircrafts in your Hangar
- No driving licence required
- Extremely low maintenance costs, no maintenance plan necessary

Safe.

- Hydraulic fixation of the nose wheel
- Gentle treatment of the landing gear with a built in hydraulic system
- 100 % circumferential visual control around the aircraft. No knocks. No collisions. Optimum use of limited space!

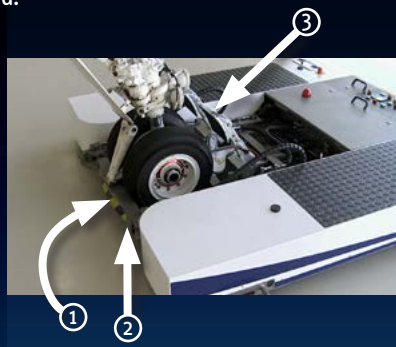
Flexible.

- Maneuver a wide range of aircraft with the same Mototok-model
- Connect the aircraft from the front or the rear

Easy-to-use.

With the automatic door of the Model 528 docking takes a matter of seconds. Simply drive the Mototok from the rear or front up to the nose wheel. The wheel is then hydraulically fixed firmly in position and raised – ready for take off! All this with no awkward strap, no inconvenient winch. No bolts or tools are required.

- Radio remote controlled operating under an industrial frequency code approved for airports.
- Automatic connection to the aircraft‘s nose wheel with one click.
- No straps, no winch, no tools required.

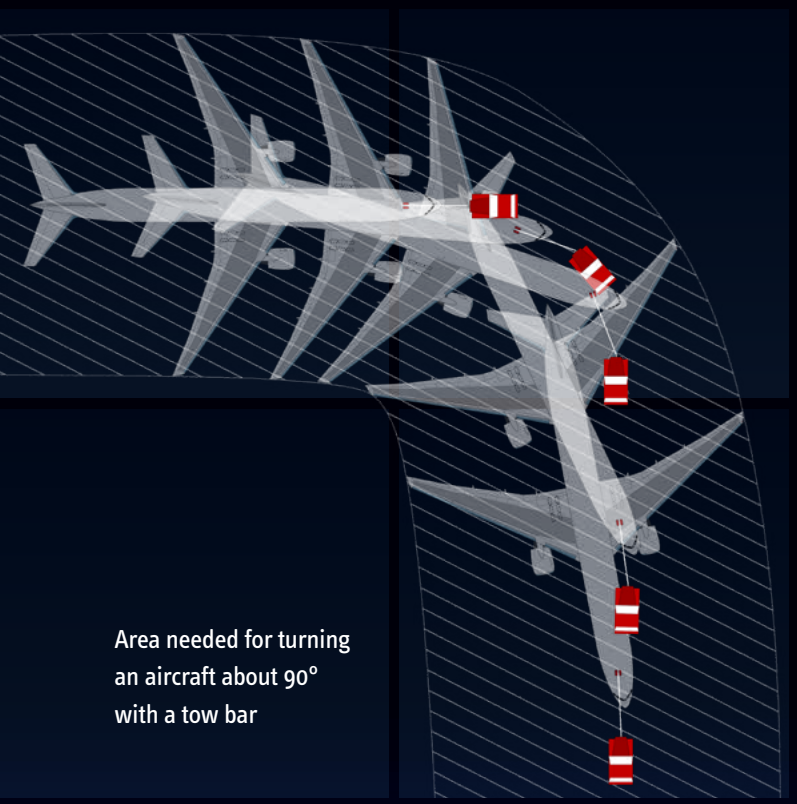


Automatic One-Click Loading with the M-Series M528.
As simple as pressing a button:

1. The door closes hydraulically
2. The platform lifts up
3. The securing paddles clamps the nosewheel gently

Why is Mototok the best tug system in the market? A comparison between towing principles.

Conventional tow tractor with a tow bar

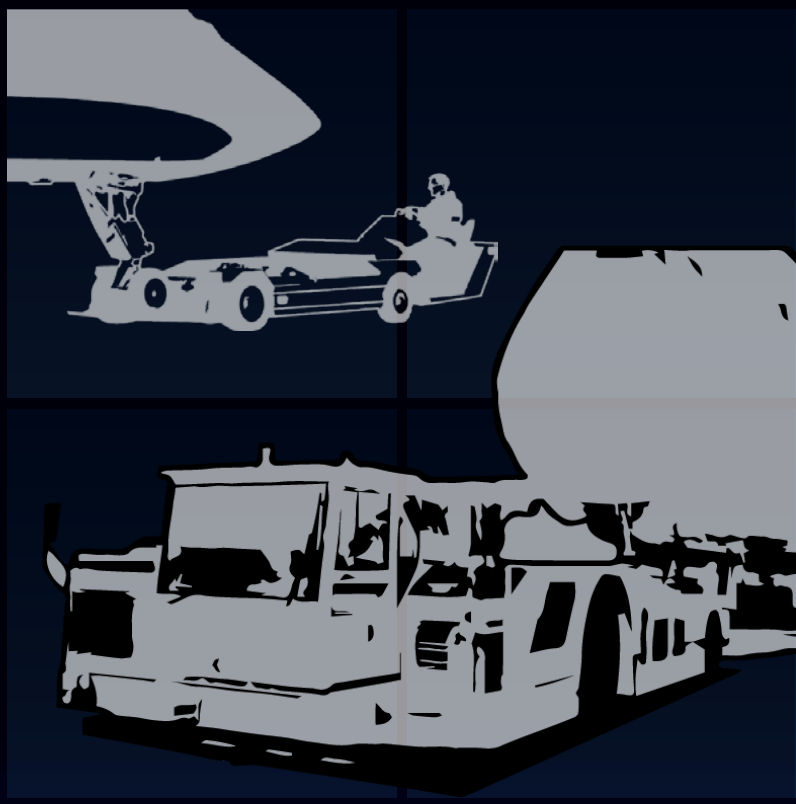


Area needed for turning an aircraft about 90° with a tow bar

Maneuvering with a towbar means “steering by moving“. Turning the nose gear and moving the aircraft are two inseparable motions when using a tow bar. 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 manoeuvering.

- Many different tow bars have to be stored for different types of aircraft
- High risk of accidents and damage of the aircraft
- Minimum second person as a „wing walker“ needed because the driver has no overview from his position
- High maintenance level due to combustion engine

Other towbarless tugs

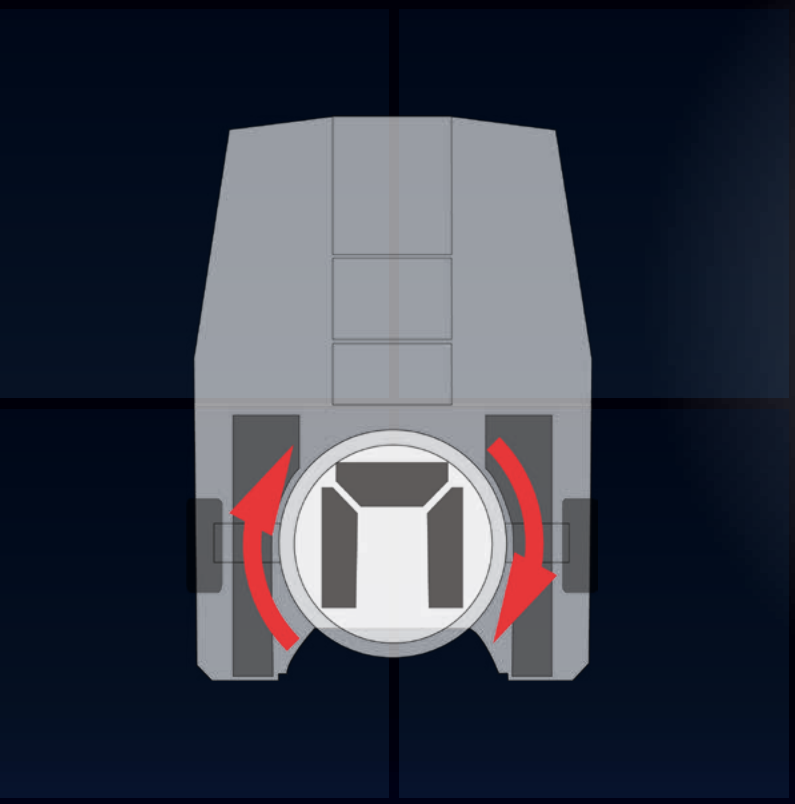


This principle means also “steering by moving“. The space requirement is approximately the same as with using a tow bar.

- Winches and straps for fixation often needed
- Minimum second person as a „wing walker“ needed because the driver has no overview from his position
- the vehicles have big dimensions and need a lot of parking space

Best Choice!

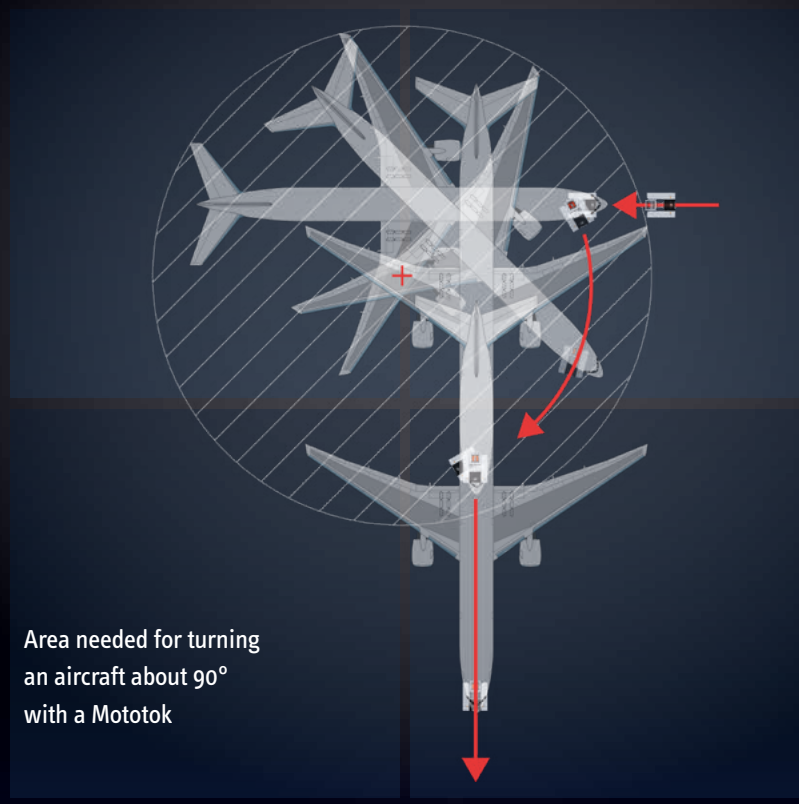
Tugs with a rotary table



This type of tug loads the nose gear on a rotary table.

- Can load the aircraft only from the left or right side of the aircraft – not directly from the front or the rear
- No automatic fixation of the nose gear – there is no technical way to route hydraulic power onto the free rotary table
- Undefined behavior of the free rotary table whilst pushing the aircraft. During pushing, the rotaring table has to be fixed in position. So the assumed advantage of an oversteering protection thanks to the free rotation of the table do not work whilst pushing.

Moving an aircraft the innovative way – with Mototok!



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

Manouevering with Mototok is the easiest by far. The fuselage and wingtips remain in position whilst turning the nose gear on the spot for manoeuvering. With Mototok both turning the nose gear and moving the aircraft are two completely different movements – the deciding advantage of the Mototok tug sytem. The result is a minimum requirement of space whilst shunting the aircraft. This example shows that turning an aircraft by 90° reduces manoevering space to a circle.

- + Best overall sight thanks to remote controlled maneuverings
- + No winches, no straps, automatic convenient and automatic quick nose gear loading
- + Low maintenance thanks to full electric drive
- + Lowest space requirement when pushing or pulling the aircraft
- + Safe thanks to oversteering protection

“Our Mototok is the second best piece of equipment in the hangar (the airplane is first)!“

“The ease of operation and the ability for one person to safely maneuver our plane in and out of our hangar because of the industrial remote control wing walker feature is unbeatable. This is a quality machine, very reliable.“

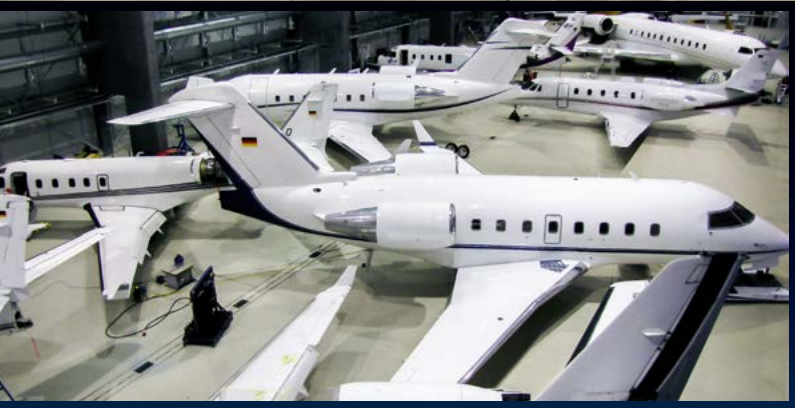
Steve Nelson, Aviation Manager & Chief Pilot, TLS Aviation LLC

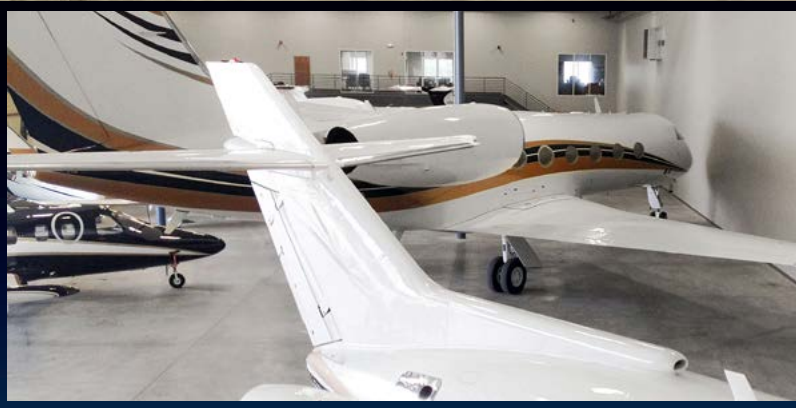
Top: The view outside a standard tug – the operator needs at least two additional wing walkers.

Middle: Working with conventional tugs

Bottom: Using towbars or other towbarless sytems means cumbersome handling

Moving an aircraft the innovative way – with Mototok: Circumferential view around the aircraft, easy and convenient handling





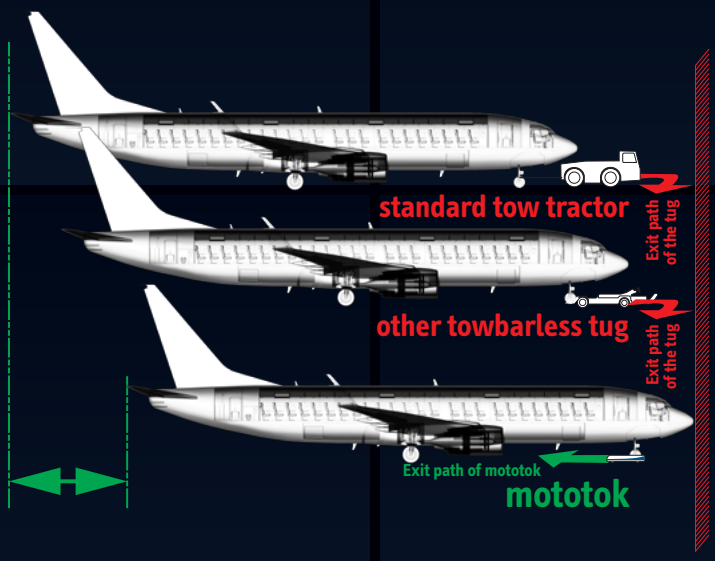
Mototok for Hangar Operations: Only Mototok generates up to 40% more space in your hangar.

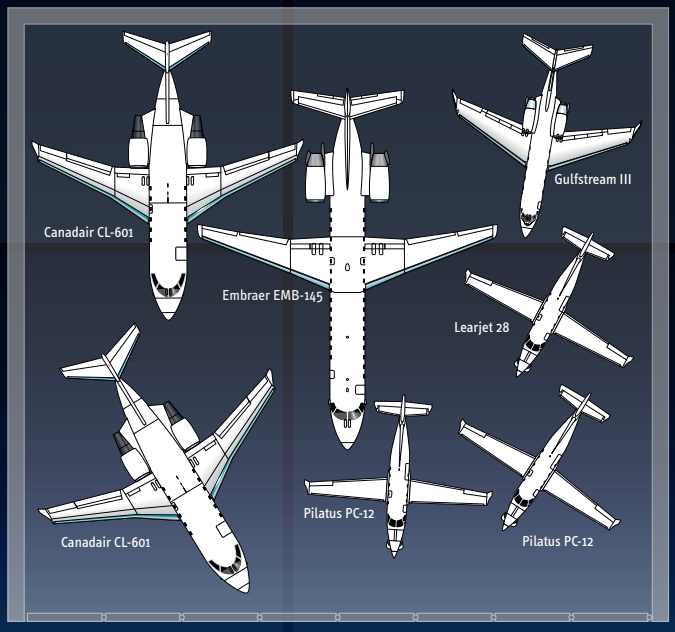
HANGAR OPTIMIZATION

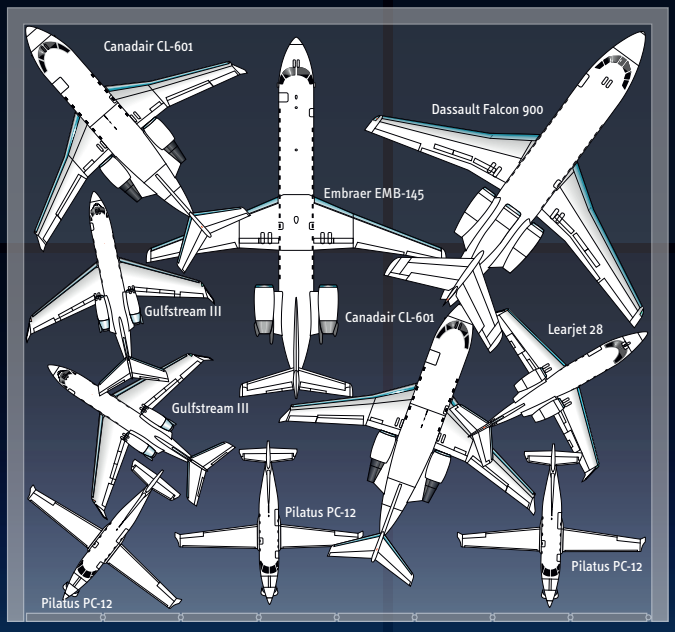
Mototok excels in tight situations: Park your aircraft safely, easily and effectively where you want: In the hangars corner, directly towards the hangars wall or near by other aircraft in the hangar. Save space in the process – depending on your hangar situation up to 40%.

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.







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!

You are not able to use your hangars full capacity!

Same hangar with electric wireless remote controlled mototok aircraft tug:

+ 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. Mototok turns the nose wheel on the spot with no movement of the aircrafts fuselage or wingtips. Maneuvering in extreme narrow situations is from now on no problem.

Increase the capacity of your hangar up to 40% by optimizing parking space!

M 528:
Fully equipped model with automatic nose wheel reception and fully remote controllable hydraulics

Enhanced Remote Control Unit of the M 528

It's your decision.

M 528 / Towing capacity 28 t (61700 lbs)

The M 528 is a fully equipped aircraft tug with automatic loading functions for a convenient and quick loading and releasing of the aircrafts nose gear.

Includes the following features:

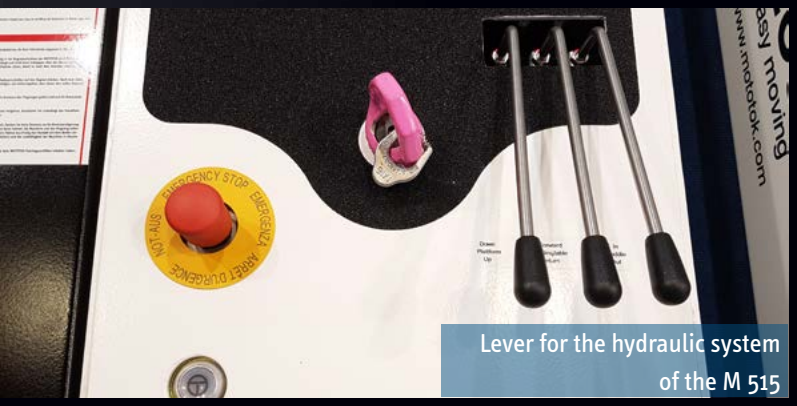
- Enhanced radio remote control for all features like loading and unloading the aircrafts nose gear, lifting and unlifting the platform, driving and steering functions
- Full hands free hydraulic door, fully automatic 1-click-loading-system
- LED high beam driving lights
- Safety flashlights and beeper
- Safety nose wheel paddles for a safe and gentle clamping of the nose gear – 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 on the remote control.

Optional features:

- Ground power cable for gound power connection 13,4V / 25,6 V (short time up to 4600 A)
- Trailer coupling adaptor for multi-functional extensions
- Automatic controls by ground markings and camera (AGV functionality)
- Military spiral cable connection (15 m) between Mototok and control unit
- Saltwater resistance
- Standard Oversteering Protection System with Shearpin

M 515:
Easy usable with a manual hydraulic nose wheel reception

M 505:
Entry level model with manual nose wheel rocker



Lever for the hydraulic system of the M 515

Standard Remote Control Unit of the M 505 / M 515

M 515 / Towing capacity 15 t (33000 lbs)

The M 515 comes with a manual hyraulic aircraft loading system

Includes the following features:

- Standard radio remote control for driving and steering functions
- Safety nose wheel paddles for a safe and gentle clamping of the nose gear – 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 on the remote control.

Optional features:

- LED high beam driving lights
- Safety flashlights and beeper
- Ground power cable for gound power connection 13,4V / 25,6 V (short time up to 4600 A)
- Trailer coupling adaptor for multi-functional extensions
- Automatic controls by ground markings and camera (AGV functionality)
- Military spiral cable connection (15 m) between Mototok and control unit
- Saltwater resistance
- Standard Oversteering Protection System with Shearpin

M 505 / Towing capacity 5 t (11000 lbs)

The M 505 is our entry level model with an easy to use nose gear rocker for loading the aircraft. The nose gear platform is rotatably mounted.

Includes the following features:

- Standard radio remote control for driving and steering functions

Optional features:

- LED high beam driving lights
- Safety flashlights and beeper
- Ground power cable for gound power connection 13,4V / 25,6 V (short time up to 4600 A)
- Trailer coupling adaptor for multi-functional extensions
- Automatic controls by ground markings and camera (AGV functionality)
- Military spiral cable connection (15 m) between Mototok and control unit
- Saltwater resistance

Technical Data

M-SERIES

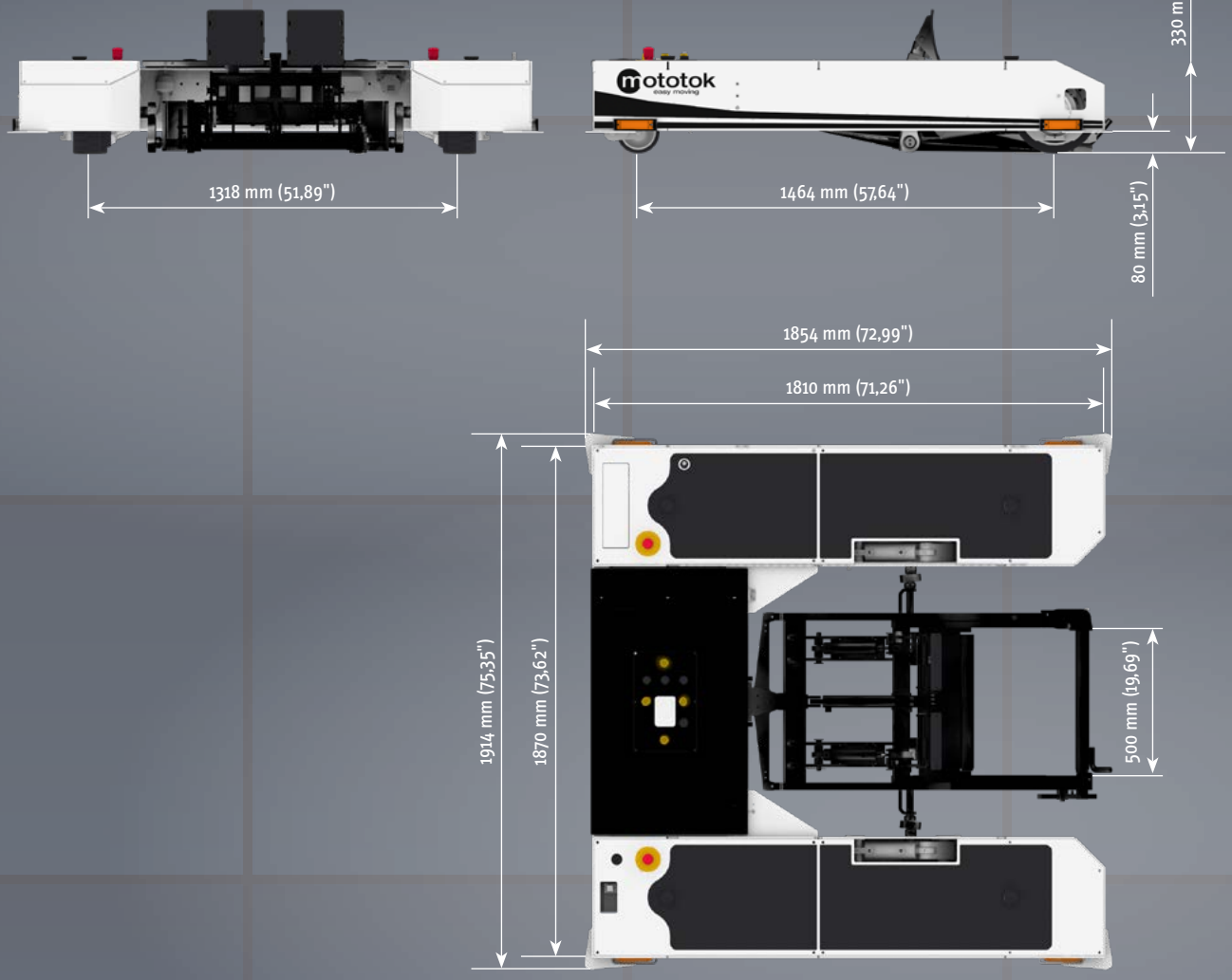
		M 505	M 515	M 528
Use for		single nosewheel 	single & double nosewheel, wheeled helicopter 	single & double nosewheel, wheeled helicopter 
Maximum towing capacity [1]		5 t	15 t	28 t
		11023 lbs	33069 lbs	61729 lbs
Maximum nosewheel weight capacity		0,6 t	1,5 t	2 t
		1323 lbs	3307 lbs	4409 lbs
Dimensions (without antenna, grips on the surface)	width	1914 mm		
		75,35 inch		
	length	1854 mm		
		72,99 inch		
	height	330 mm		
		12,99 inch		
Ground clearance		80 mm		
		3,15 inch		
Max with of the Nosewheel		160 mm	500 mm	500 mm
		6,3 inch	19,69 inch	19,69 inch
Nosewheel diameter	min.	330 mm	150 mm	150 mm
		12,99 inch	5,91 inch	5,91 inch
	max.	445 mm	500 mm	500 mm
		17,52 inch	19,69 inch	19,69 inch
Unladen weight		900 kg	900 kg	1000 kg
		1984 lbs	1984 lbs	2205 lbs
Time to load/fix aircraft (approx.)		60 sec	10 sec	10 sec
Motor performance		1,3 kW		
Speed		1,45 m/s		
		5,22 km/h		
		3,25 mph		
Batteries (maintenance-free, deep cycle gel batteries)		4 x 115 Ah		
Voltage		48 V		
AC Microprocessor controlled electric motor		✓		
Range (depending on the workload		2 days		
Possible terrain		Concrete, stone, asphalt		
Tyres		Puncture proof tyres		
Standard Radio remote control		✓	✓	–
Advanced radio remote control (with safety features, waterproof, certification of conformity), worldwide safety approval including airports,TÜV certified		–	–	✓
Full hands free hydraulic door, fully automatic 1-click-loading-system		–	–	✓
Driving light (LED, 10,000 hour operating life, very high beam range)		available	available	✓
Yellow flashlight		available	available	✓
Safety beeper		available	available	✓
Optional Equipment				
Ground power cable for gound power connection 13,4V / 25,6 V (short time up to 4600 A) [2]		available	available	available
Trailer coupling adaptor for multi-functional extensions		available	available	available
Automatic controls by ground markings (AGV functionality)		available	available	available
Adaptations for special demands (i.e. military version / range of production)		available	available	available
Military Equipment				
Military spiral cable connection (15 m) between Mototok and control unit		available	available	available
Saltwater resistance		available	available	available
Safety Equipment				
Safety Nosewheel Paddles [3]		–	✓	✓
Standard Oversteering Protection System with Shearpin		–	available	available

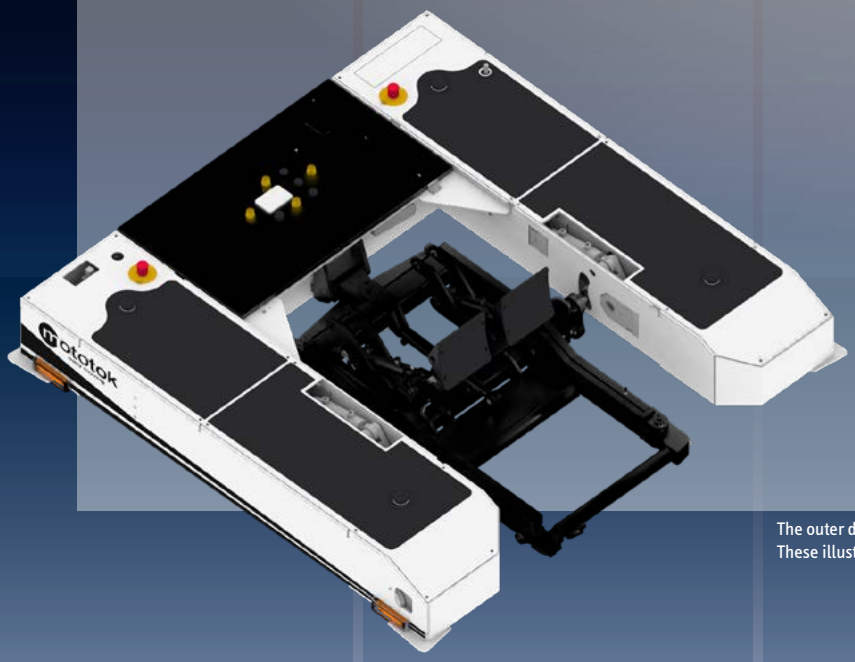
Mistakes and technical alterations reserved / Date 12.2017

1) The stated towing capacity is valid for towing on normal ground conditions without any incline.

2) In most aircraft, the generator voltage is 28.4 V. The 25.6 V on-board batteries are charged with this voltage. With the mototok ground power supply, the on-board voltage can be maintained and used to start the turbines. Functionality depends on the electronic of the aircraft.

3) 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.





The outer dimensions of the three models M 505 / M 515 / M528 are identical.
These illustrations show the M 528

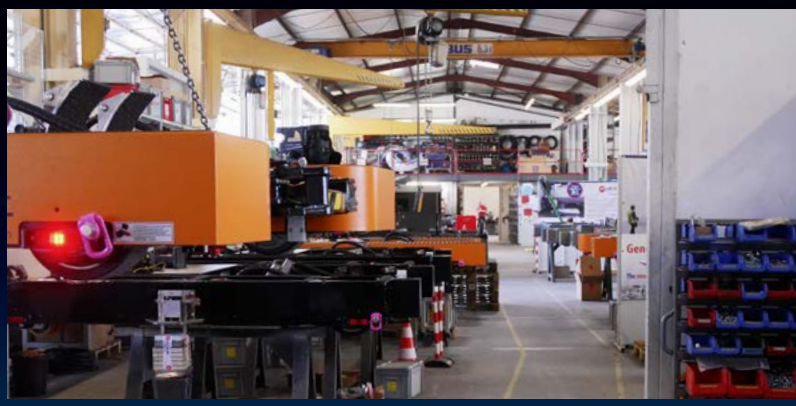
Working with fire and steel: German art of engineering.

German Engineering with Passion.

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.

DIN 18800, DIN 15018, DIN 4112, DIN EN 15614-1, EN 287-1	Certificate of Welding
EN 12895	Immunity requiremts
EN 61000-4-2	Eletrostatic discharge
EN 61000-4-3	Radio-frequency electromagnetic field
DIN 4112, DIN 18800, DIN15018, DIN 4132, DIN 1055	Statics Calculation
DIN EN 10025, DIN 1543, DIN 1013, DIN 17210, DIN 10149-2	Material Steel
2006/42/EC	Machinery Directive (European Community Legislation)
2004/108/EC	EMC Directive (European Community Legislation)
EN 292-1	Safety of Machinery – Basic Terminology, Methodology
EN 292-2	Safety of Machinery – Technical Principles and Specific:ations
EN 418	Safety of Machinery – Emergency Stop Equipment, Functional Aspects
EN 954-1	Safety of Machinery – Safety-Related Parts of Control Systems
EN 95/16/EG	Safety of Machinery – May, 17th 2006
EN 1050	Safety of Machinery – Principles for Risk Assessment
EN 60 204-1	Safety of Machinery – Electrical Equipment of Machines
EN 60 529	Degrees of Protection Provided by an Enclosure
EN 1175-1	Safety of industrial trucks – Electrical requirements for battery powered trucks
EN 13849-1 PL 1 EN	Safety of Machinery – Safety-related parts of control systems
EN 1915	Aircraft ground support equipment – Basic safety requirements
PrEN 12312-7	Aircraft ground support equipment – Aircraft movement equipment
EN 51 000-6-4 (SAE J551 expired code equivalent)	Radiated Electromagnetic Emissions (3rd party tested/certified)



Satisfaction guaranteed – our customers (extract)

Airports

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

FBO / MRO

AirMec	Angola	MRO / Military Aircraft
Perth	Australia	FBO
Jet Alliance Vienna	Austria	Several Aircraft
Silk Way Airlines, Baku	Azerbaijan	Several Aircraft
Flying Group, Antwerpen	Belgium	Several Aircraft
Santiago de Chile	Chile	Several Aircraft
Panaviatic Ltd	Estonia	Several Aircraft
Cannes	France	Several Aircraft and Helicopter *
Lyon	France	Several Aircraft and Helicopter *
ACC Columbia, Hannover & Cologne	Germany	Global & others
AERO Dienst, Nuremberg	Germany	FBO
Sapura Aero	Malaysia	Several Aircraft
Hawker Pacific Asia Pte Ltd	Singapore	Several Aircraft
Air Service Basel	Switzerland	G5, Global Express, BOEING 737
Alpark SA	Switzerland	Several Aircraft
JetAviation, Geneva	Switzerland	Several Aircraft
Tarkim Air	Turkey	General Aviation *
Glasgow	UK	Several Aircraft
London	UK	Several Aircraft
ACI Jet Center	USA	Several Aircraft
DUNCAN Aviation	USA	Several Aircraft
Jet Legacy Center, Tulsa	USA	Several Aircraft
Starport Aviation	USA	Several Aircraft
Synergy Flight Center	USA	Several Aircraft
Centeravia		Several Aircraft

Aircraft Manufacturers

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

Corporations

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

Military

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	*
CASSIDIAN Manching (EADS)	Germany	Tornado & Eurofighter	*
Pakistan Military	Pakistan	HELIMO for Helicopters with skids	*
U.S. Army National Guard	USA	M 528	
Venezuela Military	Venezuela	Helicopters with skids & with wheels	*

Airlines

Air Nostrum, Líneas Aéreas del Mediterráneo S.A	Spain	Challenger, Agusta EH 101, F 16	*
Iberia, Líneas Aéreas de España S.A.	Spain	Spacer for BOEING and Airbus	
British Airways	UK	AIRBUS 320 Series	*
Thomson/TUI, Luton	UK	BOEING 737 Family	
Alaska Airways, Seattle	USA	BOEING 737 Family	

Special Forces

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

Government

Sultanat of Oman	Oman	Eurocopter Super Puma Fleet	*

* Mainly Helicopter Operations

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About mototok

With the mototok, logistical tasks at Aircraft Production Line Facilities, MRO, FBO and Airport Operations can now be solved in more effective, safe and economical manner.

Whatever logistical requirement, the mototok's ability to generate more space safely and precisely with the added advantage of a complete hands free connection to the nosewheel, hydro-pneumatic suspension system and a free roaming 100% visibility anywhere around the aircraft have put them in a class of their own.

Only the mototoks can maneuver an aircraft's nose, tail section or wing just a few millimeters away from a hangar wall or the next aircraft body part. By simply applying the creeper snail mode speed feature on the remote control, the operator can slowly inch the aircraft safely and effectively to its final resting place in the production line, maintenance stand, hangar corner or parking area.

mototok has primarily self-developed this innovative wireless transmission control dual-motor-principal technology which applies proven digital control engineering mostly used the automotive and truck industries.

Due to a decentralized alignment of the mototok's standardized CAN bus components, the need of cable complexities is no longer an issue. Because of this unique ability, we have convinced the world's foremost Aerospace companies including AIRBUS, The BOEING Company, CASSIDIAN, DASSAULT, EMBRAER, BOMBARDIER and PILATUS who operate mototoks in their day to day operations and know firsthand the major advantages they have to offer.

Learn more about mototok at www.mototok.com.

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