

# MOTION FOR SIMULATORS

Solutions starting at 120.000 € EX WORKS

## MFS XPLORER

Full Motion Integrated Visuals and Dome Enclosure

### General information

Suited for flight simulators  
From High-End Enthusiast Flight Experience  
To  
Certified Professional Flight Training  
FNPT II | AATD | FTD



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# 1 Why a motion system makes a difference

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Motion matters. Regardless, if you offer a true Flight Experience to enthusiast, or if you offer professional Flight Training to Pilots in their initial training phase or to experienced pilots preparing for difficult or abnormal flight conditions and operations.

That's why the **Xplorer 6** is a unique Full-Flight platform that utilizes a most-modern 6 Degree-of-Freedom (DoF) Motion Platform as a consequent enabler and characteristics. When budget is limited, MFS recommends the **Xplorer 3** based on a 3 DoF Motion Platform.

With **Xplorer**, pilots learn their primary flight skills in a device that provides accurate motion feedback transition to the real aircraft in less time because they know what it "feels like" to fly. They are less anxious in the cockpit, have better touch on the controls, and know why you need right rudder in the climb.

Operating a Full-Motion Flight Simulator that is affordable, durable and that can be operated at lowest life-cycle cost will be of high interest to many flight schools around the globe. It will increase the level of achievable training quality and creates a significant competitive edge for a flight school.



## 2 The motion experience for everyone

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**Xplorer 6** comes equipped with MFS' high-quality 6 DoF electrical motion platform. It's the top of the line product from MFS offering full control over pitch, roll, heave, sway, surge and yaw. **Xplorer 3** comes equipped with MFS 3DoF electrical motion platform offering full control over pitch, roll and heave.

**Xplorer** is powered by MFS's most-realistic customizable motion cueing algorithms (washouts, extra generated motion on event). Those create a dynamic behavior simulation of all relevant aspects of the aircrafts flight envelope, including turbulences, take-off and landing force representation, effect of braking push, landing touchdown, but also vibration on the ground and much more.



## 3 About Motion for Simulators SRL

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Motion For Simulators (MFS) was founded in 1998. The team is composed of talented individuals with complementary education and skills, including electro-mechatronic engineers and software engineers.

The mission and aim of Motion For Simulators is to develop, produce and support best-in-class and high-quality Motion Systems, Visual Solutions and individual solutions to customers in the automotive and flight simulation industry. Offering the best-value-for-money ratio and allowing motion systems to enter into applications and sector were motion would have been too expensive in past is a key motivation at Motion for Simulators.

Motion for Simulators provides a wide portfolio of motion products with various degree-of-freedom, payloads and sizes as well as visual solutions and fully enclosed cabins. Those products can be tailored into any customer-specific and individual solution. The experienced team of engineers and technicians listens, understands and designs exactly to the use-case and avoids expensive gold-plated solutions.

Motion for Simulators provides a modern and powerful software-package which each Motion System solution. An Ethernet connection to the motion controller gives you plug and play access to the MFS motion controller which communicates via CAN BUS with the servo drives. The high bandwidth of this standard communication channel ensures maximum performance of the motion platform servo drives giving you quick response time to get the best out of your system.

This allows simulating for a wide range of applications, from slow and soft movement to rough and very hard vibration.

# 4 Introduction to MFS *Xplorer*

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## 4.1 *Xplorer* Device Applications and Certifications

The *Xplorer* Full-Motion Flight Simulator offered for any simulator is a scalable and modular Training System covering a wide range of applications and configurations.

With a primary focus on enabling high-quality and professional training that comes at the best-in-class value-for-money ratio, *Xplorer* also sets a new standard for high-quality Flight Enthusiast Simulator experience.

When combined with an adequate flightdeck, the *Xplorer* Full-Motion Training System can be configured to comply with the following standards and qualification levels:

### **Federal Aviation Administration (FAA)-Certification**

For training certifiable by the FAA as an Advanced Aviation Training Device (AATD) or as a Flight Training Device (FTD) Level 4, 5 and 6.

### **European Aviation Safety Agency (EASA)-Certification**

For training as a device that can be certified as an EASA Basic Instrument Training Device (BITD) and EASA Flight Navigation Procedure Trainer Level 2 MCC (FNPT II MCC).

### **Training applications covered**

- Jet Transition Training
- Jet Orientation Training
- Multi Crew Coordination Training (MCC)
- Procedural and SOPs training
- Crew Resource Management Training (CRM)
- Type Rating Preparation
- Systems Familiarization
- Instrument training including glass cockpit familiarization
- Emergency Response Procedures Training
- Threat and Error Management

Training Credits will be granted for up to 50% of initial and transition type rating and or MPL, MCC, jet orientation course and IFR.

## 4.2 Technical Description of *Xplorer*

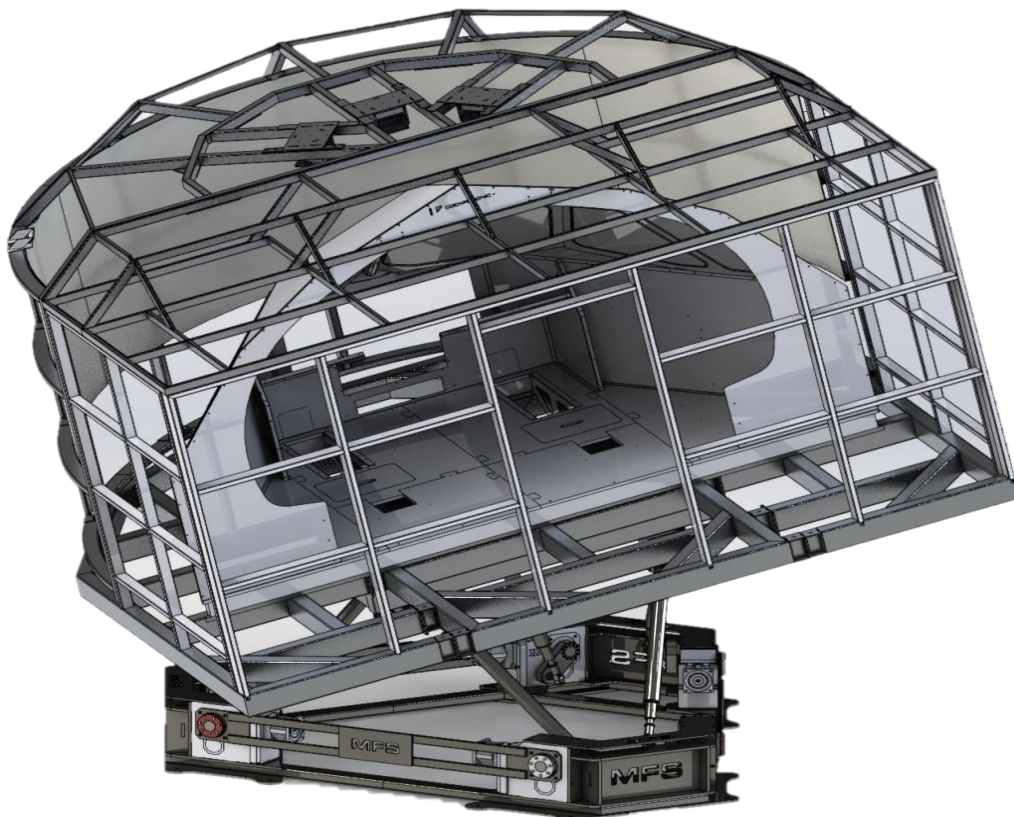
### 4.2.1 *Xplorer* General Description

The *Xplorer* is capable of representing all aspects of the aircrafts operational envelope.

The optional flight deck sits on a powerful MFS 6 or 3 Degree-of-Freedom electrical motion platform, surrounded by a Full-Dome-Enclosure and enhanced by a powerful 3-channel Visual System that provides high-fidelity out-the-window view and scenery with a minimal field of vision of 200 x 40 degrees.

Optionally, *Xplorer* can be provided with a Collimated Visual System and FAA Level D compliant Image Generators as well as extra space in the back to allow an On-Board Instructor operator Station.

Behind the space allocated for the Training Device' Flight Deck is enough space to accommodate a small Instructor Station with enough room for an instructor or one observer.





## 4.2.2 Xplorer Motion Platform

The **Xplorer** is based on a powerful Motion For Simulators (MFS) 3 (**Xplorer 3**) or 6-DoF (**Xplorer 6**) electrical Motion System. These platform are ideally suited for the high demands of Flight-Simulator applications and offers low procurement costs combined with lowest life-cycle and maintenance cost. **Xplorer 6** should be selected for flight simulation application unless cost is an issue.

An **Xplorer 3** will not be suited for demanding customer but will be perfectly suited to low cost simulators which require motion and are mostly used as entertainment. The 3DoF motion platform will be lacking in many sensations such as asymmetric flight and ground handling. It will provide motions cues such as take-off heave, landing bump, uneven ground, turns, turbulences.

An **Xplorer 6** is the ideal solution when budget is not an issue. The simulator will allow for the replication of all sensations with excellent fidelity and include higher realism in rough weather. Asymmetric flights, engine failures and ground handling are well simulated.

### The motion platform includes the following elements :

- mechanical equipment
- control unit (electrical cabinet)
  - o *schneider electric servo drives*
  - o *schneider electric motion controller*
  - o *schneider electric servo motors*
- Cables from control unit to motors (2 per motor)
  - o Standard length 10 meters
    - more length is available as an option
- 2 E-stop buttons - Emergency stop buttons inside and outside the cabin

The key features of the **Xplorer** Motion Platform are:

- CE Compliant
- Solid industrial quality
- Reliable components: servo motors, drives and motion controller manufactured by Schneider electric
- Engineered by a team of highly skilled and experimented mechatronic engineers
- Operation 24/7 with no overheating issue
- Designed to run in a failsafe environment
- Silent operation
- Long life span
- Compact dimensions with minimum base height (4meters)
- Customization service available

- Micro vibrations elimination system
- Ultra-high standard update rate of 4msec (250Hz) - & Up to 1msec if required (optional)
- Software communicates with the motor drives directly (no external sensors - no external encoders - no extra motion controller) - The lesser components in the chain, the more accurate the communication & the faster the response time.
- High-end industrial AC electrical servo technology
  - Servo control systems are best suited to high speed, high torque applications that involve dynamic load changes (Very high dynamics))
  - Servos are excellent in applications requiring speeds greater than 2,000 RPM and for high torque at high speeds or requiring high dynamic response
  - Overall better quality
  - Ultra-smooth operation
  - High resolution motor encoder (over 2 million positions per motor rotation)
  - Excellent position control and repeatability
  - Reactiveness
  - Very compact compared to asynchronous solutions and hydraulic machines
  - Very balanced relation between nominal and peak power
  - Drivers may be installed next to each other.
  - Sincos absolute encoder in the motor >automatic motor recognition
  - Drive equipped with SIM card slot for eventual parameter upload / download
  - All connections on puller plugs
  - Absolute encoder > no homing required
  - Very extended tuning possible
  - Silent
  - Do not need extra cooling and have a remarkable torque
- Helical Bevel gearbox
  - Cost friendly
  - High efficiency
  - Low backlash
  - Low maintenance
  - Sturdy
  - High power density
  - Overall space-saving installation thanks to the right angle output shaft
- Low power operation requirements - minimal operation cost
- CAN Technology for communication between motion controller, drives and servo motors (CAN: (Controller Area Network), standardized open fieldbus over which the drive units communicate with one another)
- Fast Ethernet communication between controlling PC and motion controller - No installation, driver, USB needed (one Ethernet socket is enough)

- Minimal maintenance / highly reduced cost compared to hydraulic machines and other electrical motors (visual checks, torque check...)
- Accurate motion control thanks to the geometry driven software
- Accurate Motion Base Software: The true inverse kinematics model is encoded in the motion control software to generate the right servo trajectories related to the desired platform motions. It therefore compensates any non-linearity included in the mechanical architecture.
- Platforms can be run in serial from one machine
- No hidden extra costs (maintenance, repair, operation)
- Reliable company, over 20 years in the business with world renown customers
- Easy repair/replacement
- Emergency stop button and safety features
- High quality powder coating paint



### 4.2.3 *Xplorer* Dome Enclosure

The *Xplorer* Motion Flight Simulator comes with a full-dome-enclosure ensuring perfect fit around the flight deck.

There are 4 sizes available:

- **S** for cockpits up to 2m of width (ex : GA, Small airliner with HD screens)
- **M** for cockpits up to 3m of width (Recommended for a B737)
- **L** for cockpits up to 3.5m of width (Recommended for an A320)
- **XL** for cockpits up to 4.2m of width (Recommended for an A380)

MFS can provide larger *Xplorer* systems. Price will be quoted depending on project specifications.

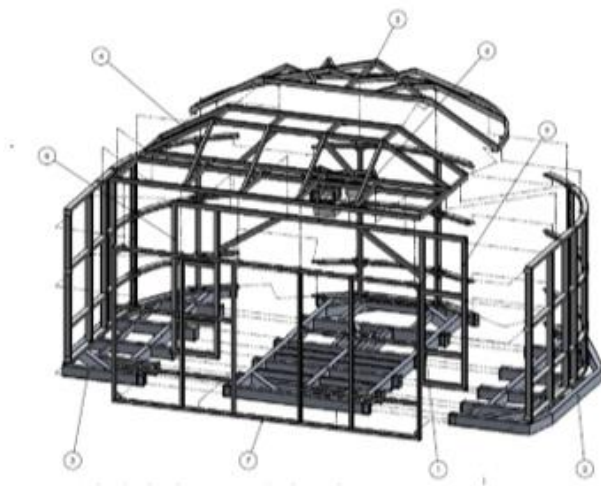


keeps it light and rigid, yet cost-effective.

With a moving payload whose weight is directly supported by the actuators, the same design guidelines as the one used in aeronautics apply: light but performant.

It is therefore not surprising that similar technologies are involved. The enclosure is based on a sturdy aluminum structure that

A mix of extruded metal sections, laser cut and machined parts combined using welded, riveted and bolted assemblies takes the best from each technique to ensure functionality, ease of transport and installation.



The volume is closed using high quality composite panels that provide the appealing aesthetic touch of a white mid-gloss finishing surface.

As a result, the motion compliant enclosure prevents undesired vibrations and offers a rigid structure to support peripherals such as the visual bridge and screen.

Finally, the Dome is composed of different sections for easy packaging, shipping (fits

in one container) and assembly.

The Dome enclosure includes the following elements :

- an upper platform
- a lasered floor layer (that can be customized)
- a full modular enclosure cabin
- fan extractors
- a sliding door
- a separation wall between cockpit and rear side of the cabin
- On/off light switch + light for the rear of the cabin

#### 4.2.4 *Xplorer* Visuals

The *Xplorer* Dome Enclosure is enhanced by a powerful 3-channel Visual System that provides high-fidelity out-the-window view and scenery with a minimal field of vision of 200 x 40 degrees.



It includes the following elements:

- Case Study & system design
- Projector preselection
- Computer recommendation
- 3 high quality HD Projectors (4000 lumens minimum)
- Solid and adjustable (motion ready) projectors mount
- Curved screen
- Configuration of the visual system

*Optionally, **Xplorer** can be provided with 4K projectors instead of HD or with large HD/4K screens (TV) and finally with a Collimated Visual System and FAA Level D compliant Image Generators as well as extra space in the back to allow an On-Board Instructor operator Station.*

# 5 Summary

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## 5.1 What is included in the *Xplorer* product ?

Please, note that MFS also supplies fully integrated flight simulators.

This document is aimed at customer already owning a fixed base flight simulator or willing to purchase/build the flight simulator on their own.

The *Xplorer* base package includes the following elements only :

- One Motion platform (Type : 3DoF or 6Dof) (Size : S - M – L – XL)
- One Upper platform (Size : S - M – L – XL)
- One Dome fully closed + door(Size : S - M – L – XL)
- One Visual Solution (3 options)
  - o Curved screen – 3 HD projectors (4K optional) – Adjustable projectors support)
  - o HD screens support + (screens optional)
  - o *Collimated solution (to be quoted)*
- Two Emergency switches
- One flashing light (beacon)
- Extractor fans
- Light in the cabin and ON/OFF switch
- Software suite

## 5.2 What is not included ?

The *Xplorer* base package does not include :

- Optional
- Ballast kit : When anchoring to the floor is prohibited :
- Stairway
- Fences
- Computer for the visual
- Computer for the flightdeck instruments
- The flight Deck
- The instrument software
- The instructor station hardware and software and seat
- Sound and intercom system

- The finishing layer for the floor (metal, carpet) to cover the upper platform floor that must be customized to your needs
- Air Conditioning & ventilation System
- Space for an onboard instructor station and passenger seats.

## 6 *Xplorer* Instructor Training

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***Xplorer*** Instructor training includes all steps

- how to start, use, pause and shutdown the *Xplorer*
- how to calibrate the system
- how to allow remote support
- how to stop the system in case of an emergency and safely restart it
- how to check the system for safe operation
- how to check system for malfunction
- how to solve common issues (power loss, cable not properly fastened,..)

# 7 *Xplorer* Maintenance Service

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## 7.1 General Maintenance information

Motion For Simulators prides on providing first class customer service and support. We have incorporated several unique features into our device design to increase reliability and minimize down time. Support of software is accomplished via the internet.

Due to high voltage components used in motion platform of Motion For Simulators, customer should not try to perform maintenance or repair on its own. Even if the occurrence of a fault is unlikely considering the industrial quality of the components being used and the tests conducted, in the case of a fault, MFS will assist the customer designated technician via remote online support if possible or on site support.

Should a fault in one component be identified, MFS will ship a new element typically within 72 hours after reception of the fault when stock allows if the faulty component can be removed and replaced by customers safely (for the technician and the machine). Otherwise, MFS will send a qualified technician on site within a couple weeks depending on customer location in the world. Typically, MFS will strive to send a technician on site within 72 hours regardless of location in the world. Travel and labor costs will be supported by customer.

To avoid any down time in case of stock shortage, customer can purchase a maintenance package including:

- Extra set of servo-drive cables
  - Extra drive
  - Extra servo motor
  - Set of screws, bolts, electrical components and tools needed to replace these parts
- In this case, it is likely that MFS will be able to remotely support via internet for minimum down time

## 7.2 Short-Term Maintenance Service

For the initial operating phase of the *Xplorer* which is defined to be a 3 Month period after the end of successful hand-over to customer, Motion For Simulators offers a professional Hot-Line Services Support.



It includes the guaranteed access of the customer's technical staff to a competent and experienced services technician of Motion For Simulators. Our technicians can be reached via mobile phone (including WhatsApp and Skype) or email and will insure immediate response. Depending on the nature of a reported problem or the question raised, he may be able to help immediately, or will initiate the necessary next steps. In any case, fastest response and help will be provided.

### 7.3 Long-Term Maintenance Service

Motion For Simulators proposal for the **Xplorer** includes a Long-Term-Maintenance Service for the first year of operation. This covers a 1-Day inspection and update of the **Xplorer** at customers facility or facilities once a year.

For the first year, customer will be required to support travel expenses of MFS staff.

A forfeit will be required for a system located in Europe and another one for a system located in the rest of the world.

Regular status monitoring and health inspection will be done by the designated Motion For Simulators Maintenance Technician via an Internet-based-Web-Access.

An extension of the Long-Term-Maintenance Service for one or multiple additional years can be ordered at Motion For Simulators. Any other year will be charged. This price includes MFS travel expenses and software updates when available.

## 8 Xplorer Warranty

The **Xplorer** is guaranteed to be free from manufacturers defects to the original Purchaser for the duration of 24 months from the date of Purchasers execution of the Acceptance Test. Motion For Simulators will repair or replace any parts that are deemed defective in material or workmanship or both.

Labor and parts will be provided without charge during the entire warranty period; however, the Purchaser will be responsible for all of MFS travel costs (airfare, car rental, hotel and per diem) incurred to service and repair the Device. After expiration of the warranty period, the Purchaser will be responsible for all labor and/or replacement part charges.

If, in the sole judgment of Motion For Simulators, the device is deemed to be irreparable, MFS will replace the Device. The purchaser will be responsible for all travel and shipping expenses incurred to replace the device.

This Limited Warranty will not apply if, in the sole judgement of Motion For Simulators, the Device damage occurred because of accident, misuse, abuse, unauthorized parts/service/repair, improper or unreasonable use, neglect, theft, vandalism, casualty, or other cause not within the control of Motion For Simulators. Similarly, this Limited Warranty is void if the device has been modified or altered in any way, including alteration or removal of serial numbers.

General Terms of conditions of Motion For Simulators furthermore apply for anything not listed here and can be freely obtained or consulted on our website.

# 9 Prices

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## 9.1 Xplorer Prices

- Xplorer 3S :
- Xplorer 6S :
- Xplorer 3M :
- Xplorer 6M :
- Xplorer 3L :
- Xplorer 6L :
- Xplorer 3XL :
- Xplorer 6XL :
- Xplorer CUSTOM :

## 9.2 Xplorer Options

**Customer should always discuss available space (available footprint and height) with MFS before any purchase. MFS recommends having at least 4 meters of height available. MFS can customize standard systems so that they can fit within lower ceiling rooms or take advantage of the higher ceiling clearance.**

### - Rear cabin upgrade 1

The base Xplorer only allows for a jumpseat to be placed on board which is enough for customer who do not need an on-board instructor station and/or room for onboard passengers. The maximum allowed persons on board with a base system will be 2 to 3.

This option gives you 150 cm of space available (from rear of pilot/copilot seat in back position) for an instructor station, passengers, comfortable jumpseat. (optional instructor station and seats not included – ask for more information).

This option also includes (on top of the extra 150 cm cabin space + larger upper platform and motion platform) the electric hardware upgrade to cope with extra system weight (+payload) and size of the cabin. This system lets you fit up to 6 persons on board.

- **Visual Upgrade 1**

- *Higher quality projectors 2.560 x 1 600 (WQXGA) native (F80-Q7 BARCO or equivalent)*
- *Visual system structure upgrade (heavier projectors)*
- *Mechanical and Electric Hardware (motors...) upgrade to cope with visual system (heavier projectors 25 kgs to 30 Kgs instead of 1 Kgs each when using HD projectors + extra weight of the holding structure and mechanism).*

- **Visual Upgrade 2**

- *Higher quality projectors 3 840 x 2 400 (UHD 4K) / 2 560 x 1 600 (WQXGA native) native (BARCO F80-4K7 or equivalent)*
- *Visual system structure upgrade*
- *Electric Hardware upgrade to cope with visual system (heavier projectors 25 kgs to 30 Kgs instead of 1 Kgs each + holding structure and mechanism*

- **Collimated display ready system**  
**Collimated display on board system**  
**Level D ready system**

The Xplorer system is designed to offer maximum quality and performance within limited space.  
MFS can supply higher end systems.  
These systems are quoted.

- **Stairway on wheel :**

- **Motorized stairway on wheel :**

- **Air conditioning system :**

- **Weight/ballast**

*This options is available for our smaller system up to 6L with no rear cabin.*

*This option cancels the need to anchor the system to the ground/floor.*

*The lower part of the motion platform is different than the standard version as it includes several locations to add steel plates to maintain the platform in place on the floor. This option includes ballast plates and the platform modification:*

- **Ethernet capable touchscreen/laptop to control the motion :**  
*Support and motion softwares preinstalled.*
  
- **One passenger seat :**
  
- **Instructor station :**
  - *One seat*
  - *One computer*
  - *One desk*
  - *One touch screen*
  - *Keyboard and mouse*
  
- **Extra E-stop button**

Special requirements can be discussed and quoted.

### 9.3 *Xplorer* On-site installation and training cost

Installation and training on customer site are compulsory.  
Customer must also take care of our team travel expenses.

Prices below are indicative forfeits and include travel expenses and installation costs.  
They are provided as an indication only. Customer should refer to the quoted price which may vary according to final installation site. Depending on system type, installation will usually last between 3 and 7 days.

- *Xplorer*
  - Installation and Training in Europe (3 persons):
  - Installation and Training outside of Europe :

### 9.4 *Xplorer* packaging and transport

Packaging and transport must be paid by customer.

Prices are provided as an indication only. Customer should refer to the quoted price which may vary according to final installation site.

- *Xplorer* in Europe :
- *Xplorer* in the rest of the world :

Transport is conducted by sea container and takes approximatively 6 weeks.

There is a possibility to ship by air when time is critical or location makes it easier This should be discussed with MFS.

Shipping can be handled for customer at cost + an administrative forfeit of 300,00€.

### 9.5 VAT and other taxes

Prices mentioned are excluding VAT and any taxes (in Belgium or elsewhere).

- Customers without a valid VAT number inside the EU economic union will need to add an extra VAT cost of 21%
- Customer with a valid VAT number inside the EU economic union
- Customer outside of EU are not required to pay VAT to MFS.



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