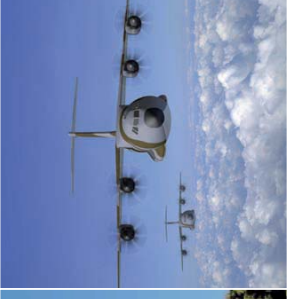
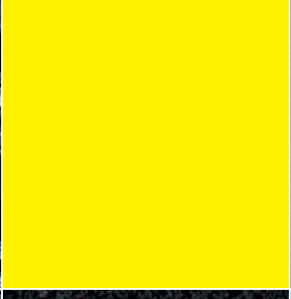
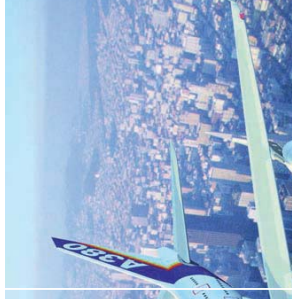
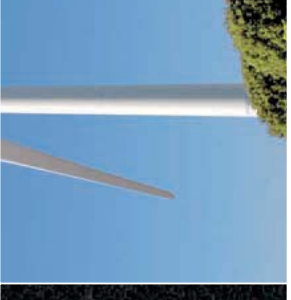
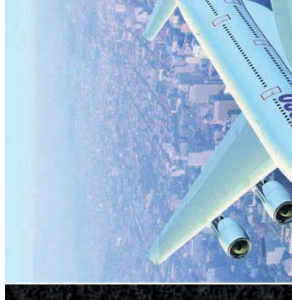




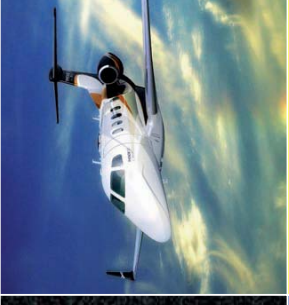
**Total Solution  
for Carbon Fiber  
Manufacturing**



6-7 Torrestiberlayup  
 8-9 Torrestiberlayup  
 10-11 Torrestiberlayup  
 12-13 Torrestiberlayup  
 14-15 Torrestiberlayup  
 16-17 Torrestiberlayup  
 18-19 Torrestiberlayup  
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 22-23 Torrestiberlayup  
 24-25 Torrestiberlayup



The World's Most  
 Comprehensive  
 Range of Solutions  
 for High Productivity  
 Composite  
 Manufacturing  
 Systems



## Total Solution for Carbon Fiber Manufacturing

MTORRES has developed over the years the widest range of systems to automate, with the highest flexibility and productivity, the composite components manufacturing process.

Ranging from Automatic Tape Laying and Fiber Placement Systems for lamination, Ultrasonic Cutting, Routing and Drilling with Flexible Tooling

Machines for net trimming, Ultrasonic Inspection for non destructive test to Automated Assembly Jigs, MTORRES provides the most comprehensive, productive and well proven range of solution.

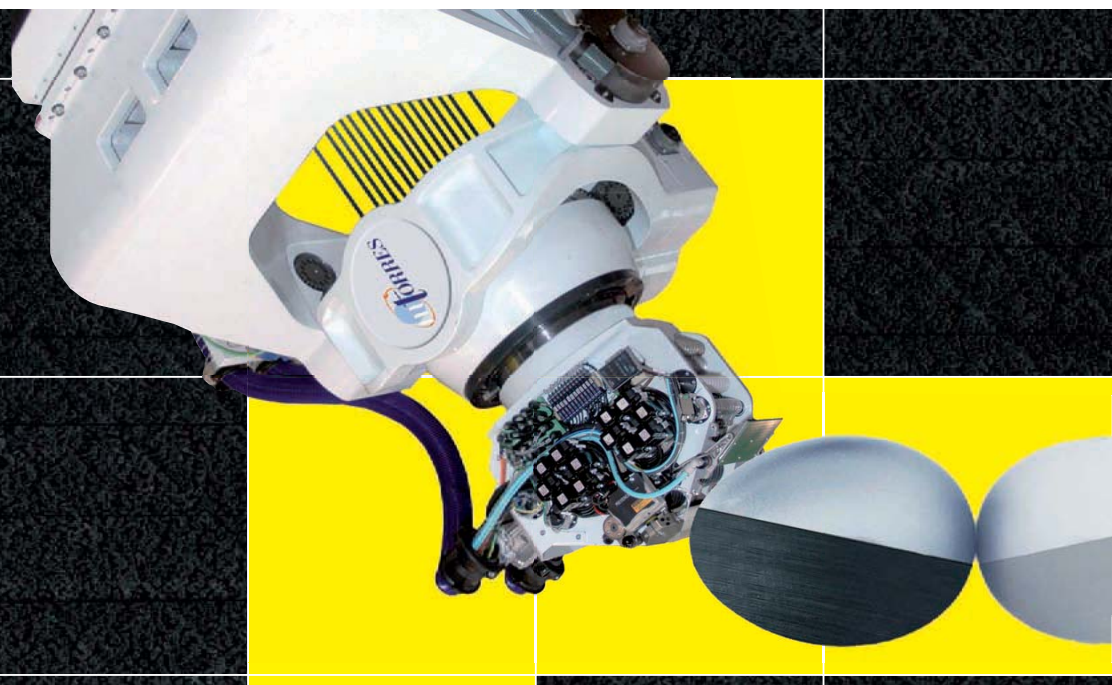
MTORRES strong Engineering and Project Management capabilities ensures the capacity to define, manage and successfully implement complex integrated projects and to provide Turn Key global solutions to our customers.

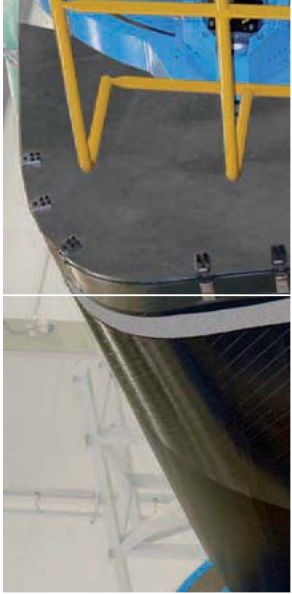
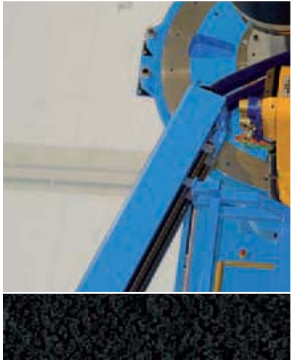
That powerful engineering capacity has allowed the development of a number of special projects, as well as an array of software solutions, such as TORLAY and TORFIBER software packages for easy programming of Lamination equipment, as well as a highly specialized software packages for Spring Back Compensation for composite machining applications.

Our products cover all types of composite materials: carbon fiber and glass fiber, prepreg, dry fabric or thermoplastics and processes such as automatic lamination, Resin Infusion, Out of autoclave processes, etc.

Sectors of activity range from aerospace, naval industry, renewable energy and transportation sector in general.

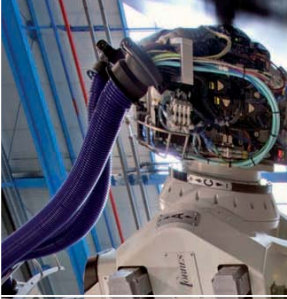
## In the face of fragility maximum precision





**OPTIONS**

- Automatic splicer
- Automatic miss add/miss cut
- Ultrasonic cutting system
- Wireless pendant
- Automatic polyethylene disposal



# TORRESFIBERLAYUP

**Automatic Fiber Placement Machine**

The TORRESFIBERLAYUP is a machine designed to provide the highest productivity when it comes to fabricate high contour carbon fiber aircraft components, although a 2D for high speed flat lamination, providing huge scrap material savings is also available.

Its unique tow cutting and adding system at full speed design concept allows the machine to cut, add and lay down consistently and accurately at 60 mpm, ensuring the highest productivity fiber placement solution available in the market.

It is a modular concept system that allows the design and delivery of virtually any configuration of machine in terms of number of tows, (1/8", 1/4", or 1/2") as well as the tow width and machine size.

Also, the machine can be delivered under different architectures, Cantry Type, Column Type, with or without a Head Stock - Tail Stock system for revolution parts, etc.

As an option, the machine may include a set of Automatic Tow Splicing Systems, one per tow, set up at the creel house, to boost even further the productivity of the TORRESFIBERLAYUP. It works by automatically splicing the end of a spool to the beginning of the next spool remarkably reducing unproductive time and saving recurring scrap cost.

The TORRESFIBERLAYUP has been specially designed for extremely high speed and high productivity fully automatic process to fabricate high contour carbon fiber parts.



Applications include manufacturing of flat, mild curvature as well as high contour carbon fiber components.

A highly advanced and sophisticated programming /simulation software package, TORFIBER, allows the programmer to generate, simulate and analyse the part program, within a CATIA environment, before the MTORRES provided postprocessor generates the CNC program.



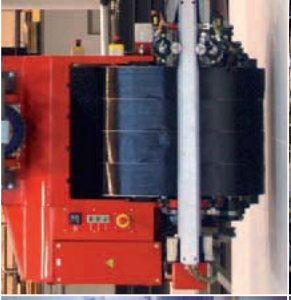
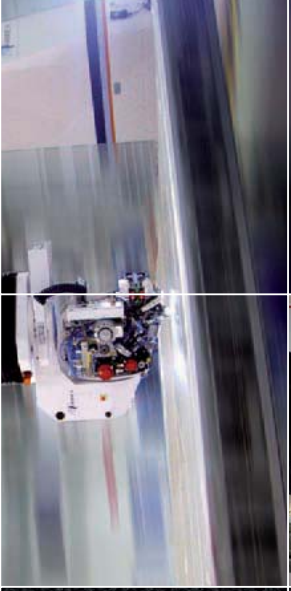
**OPTIONS**

- Scrap saving software (Multitape option only)
- Mould scanning system
- Laser contour marking



**OPTIONS**

- Ultrasonic cutting system
- Multitape
- Automatic defect detection system
- Mould deviation compensation system
- Automatic knife calibration
- Automatic knife cleaning



# TORRESLAYUP

**Automatic Tape Layer Machine**

The particular tape laying head design provides the best compacting results, avoiding the need of any debulking operation while fabricating a part.

The TORRESLAYUP runs with 300, 150, and 75 mm (12", 6" and 3") wide single tapes and can lay up to 600 mm wide band (24") in multitape configuration.

Different multitape configurations are available (4x150 – 4x75mm – 2x150mm) to provide the capability to lay down several tapes simultaneously in order to simultaneously boost productivity by increasing band width, scrap reduction by means of independent control of each tape and scrap reducing strategies as well as enabling the machine to lay up on quite

sharp geometries with high productivity rates by using several narrow tapes.

TORRESLAYUP can be built in various sizes to meet customer requirements.

Its two ultrasonic knives, assembled on a set of four NC controlled axes, provide the capability to perform complex tape cuts during the lay up process.

A tape defect laser detection system allows the machine scrapping any defective portion of the tape, and avoid its lay-up on the part.

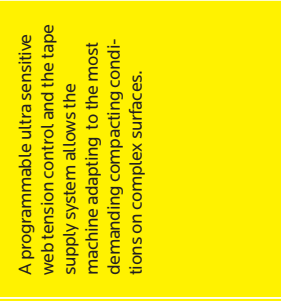
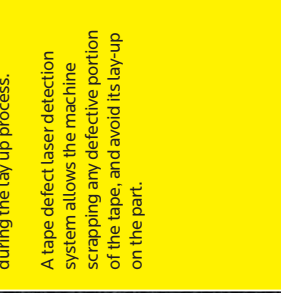
**The TORRESLAYUP is an 11 axes Gantry CNC tape layer machine, that has been specially designed for high speed tape laying of compound contoured aircraft structural components.**

A programmable ultra sensitive web tension control and the tape supply system allows the machine adapting to the most demanding compacting conditions on complex surfaces.

Among a number of options available, the machine may include an ultrasonic cutting system to cut uncured composite parts right after the layup avoiding the need of a dedicated machine for this purposes.

A highly sophisticated programming software package, TORLAY, allows the programmer to simulate, optimise and modify every single tape, ply and layer associated parameter properly. Then, a built-in postprocessor automatically generates the part CNC program. In addition, a Part History software package is provided, to keep control of production relevant events.

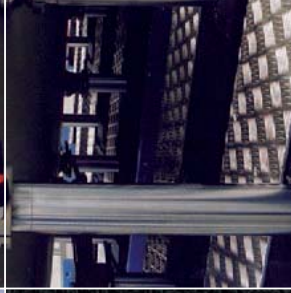
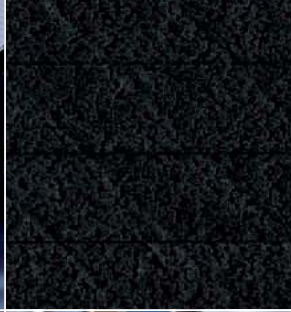
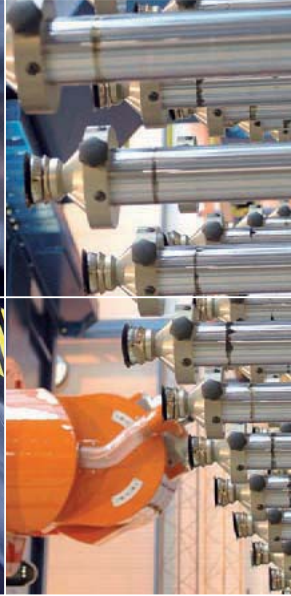
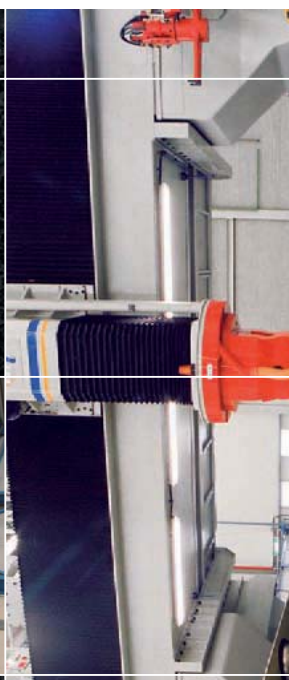
Applications include manufacturing of flat, curved, or compound contoured carbon fiber parts.



- OPTIONS**
- Volumetric compensation system
  - Temperature controlled enclosure
  - Tool management
  - Automatic calibration



- OPTIONS**
- Laser based vision system
  - Photogrammetry measuring system
  - Dry/wet machining
  - Temperature compensation



# TORRESMILL®

## 5 Axis Gantry/Column Routing And Drilling Machine

The well proven lightweight, sturdy and torsion free gantry or column concept enables the machine to provide the maximum acceleration-deceleration at the highest feed rates.

A high frequency spindle provides appropriate spindle revolutions for optimal cutting at maximum feed rates.

TORRESMILL® Gantry or Column Milling Machines are built in various sizes to meet customer requirements and specifications.

The TORRESMILL® 5 axes High Speed Milling Machine can be integrated with different solutions to fulfill the particular requirements of the customers, as far as part/tooling handling is concerned. A headstock/tail stock system fully integrated with the TORRESMILL®, to allow routing and drilling of one piece fuselage section, has been successfully implemented. Also, a fully automated palletized system integrated/interfaced with the TORRESMILL® allows the automatic management of hard tooling. However, the most flexible solution for parts machining is integrating the TORRESMILL® with a TORRESTOOL® flexible tooling system.

**TORRESMILL® 5-axis gantry DNC-CNC high speed milling machine series has been specially designed for high speed milling and drilling of aircraft Carbon Fiber structural components.**

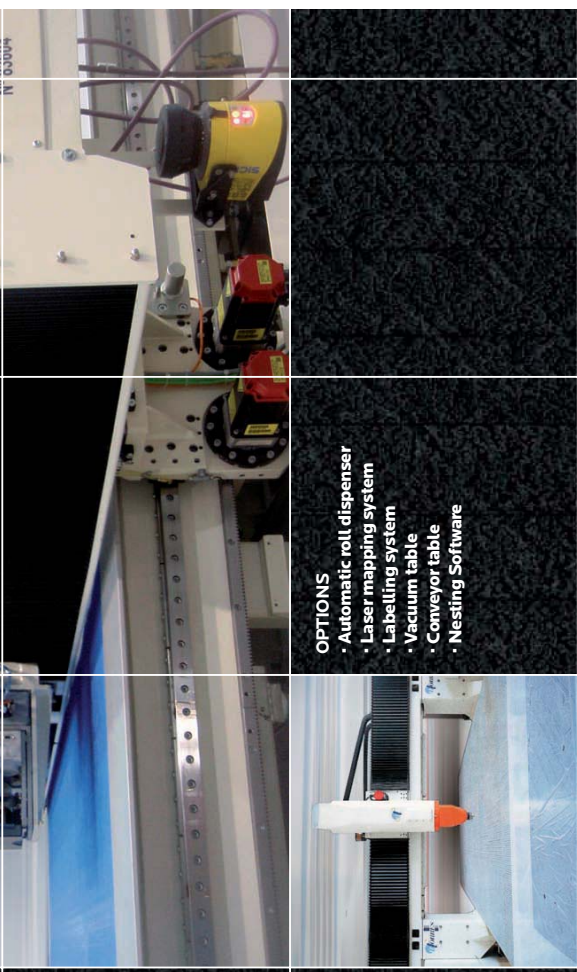
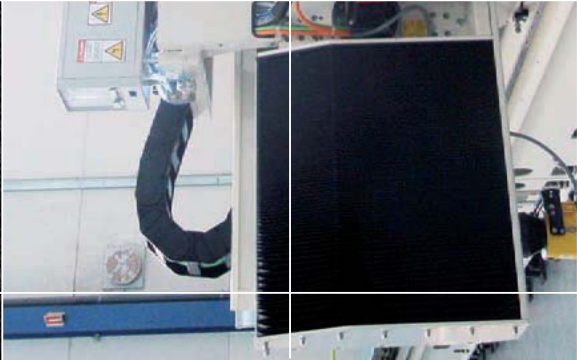
The TORRESMILL® can work on both dry and wet operations. When working on dry mode, the most efficient dust removal system available ensures the absolute lack of dust in the installation and its surroundings. Also, the TORRESMILL® ancillary equipment allows the machine to work on wet conditions, by applying either flooding or mist coolant to the cutter.

A unique MOTORRES developed software to offset the effect of spring back on Composite components is optionally available. This software compares the theoretical vs real part shape and corrects the CNC program accordingly. It can also be delivered with a simulation software to minimize ready to work time and the risk of collisions. The machine comes with a sophisticated built in executive software package (HM) to allow an extremely easy machine operation, as well as its maintenance, providing self-diagnosis routines etc.

Optionally postprocessor for both the TORRESMILL® can be provided to generate the part program.



- OPTIONS**
- Automatic cutter orientation system
  - Cutter braking detector system



- OPTIONS**
- Automatic roll dispenser
  - Laser mapping system
  - Labelling system
  - Vacuum table
  - Conveyor table
  - Nesting Software

# TORRESPANEX

## Ultrasonic Composite Cutting Machine

The lightweight, sturdy torsion free gantry concept enables the machine to provide maximum acceleration-deceleration at the highest feed rates.

An ultrasonic cutting system provides the appropriate high frequency vibration capabilities for optimal cutting conditions and maximum feed rates.

The well proven modular machine system is the basis for each individual application.

TORRESPANEX Gantry cutting machines are built in various sizes to meet customer requirements and specifications.

Optionally an Automatic Tool Changer for different SONOTRODES utilization, as well as Part Labelling capabilities are available.

The machine may also include a vacuum table to support the component to be cut or a conveyor for easy part loading/unloading can be provided.

Applications may include net cutting of compound contoured fuselage panels, wing skins, composite structures, frames, stringers, etc.

A nesting software is optionally available to optimize the material usage.

Also a user friendly HMI is provided to facilitate machine operation.

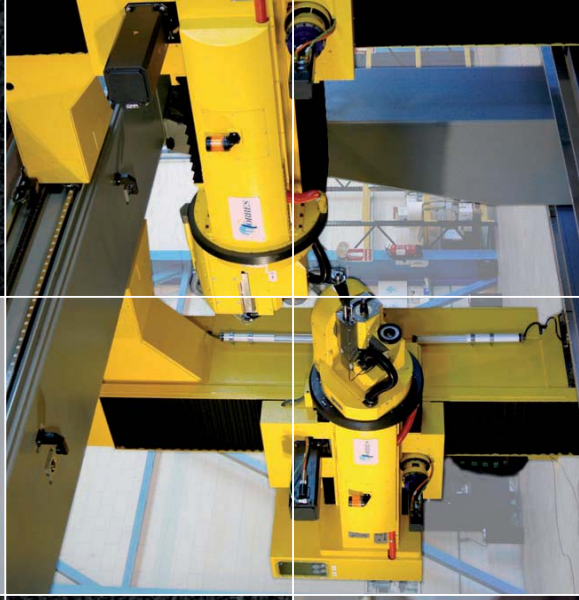
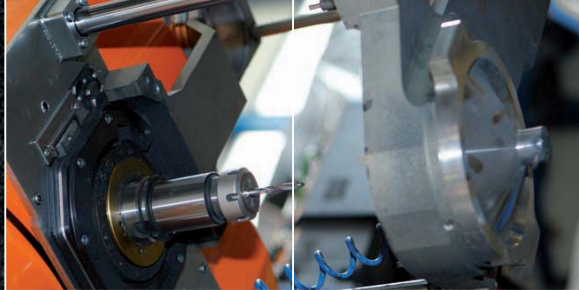
A postprocessor can optionally be provided.

**The TORRESPANEX 6-axes Gantry CNC high speed ultrasonic cutting Machine has been specially designed for High Speed Cutting of aircraft uncured composite structural components.**

- Vision based measuring system
- Pressure foot
- Countersink depth control
- Wet/dry drilling
- Environmental controlled enclosure



- Volumetric compensation software
- Customized CNC cycles
- Temperature compensation system



# TORRESDRILL

## 5 axis Gantry/Column Drilling and Countersinking Machine

The well proven lightweight, sturdy and torsion free gantry or column concept enables the machine to provide the maximum acceleration-deceleration at the highest feed rates, delivering the most demanding accuracy.

A high frequency spindle provides appropriate spindle revolutions for optimal drilling and countersinking at maximum feed rates.

TORRESDRILL Gantry or column Drilling Machines are built in various sizes to meet customer requirements and specifications and can be built for milling purposes too.



The TORRESDRILL, can be integrated with different solutions to fulfill the particular requirements of the customers, as far as part/tooling handling is concerned. A fully automated palletized system integrated/interfaced with the TORRESDRILL allows the automatic management of hard tooling. However, the most flexible solution for parts machining is integrating the TORRESDRILL with a TORRESTOOL®; flexible tooling system.

The TORRESDRILL has been successfully implemented on drilling/countersinking applications at aircraft structural assemblies, such as wing/central wing box joint, fuselage assemblies, etc.

A unique pressure foot design provides an efficient and highly accurate solution for countersinking Carbon Fiber parts or a stack of different materials, CF, AL, TI, etc.

A unique MTORRES developed software to offset the effect of spring back on Composite components is optionally available. This software compares the theoretical vs real part shape and corrects the CNC program accordingly. Also, a simulation software to minimize ready to work time and the risk of collisions can be provided. The machine comes with a sophisticated built in executive software package (HMI) to allow an extremely easy machine operation, as well as its maintenance, providing self-diagnosis routines, etc.

The TORRESDRILL Automatic Drilling and Countersinking Machine has been specially designed for high speed drilling and countersinking Carbon Fiber components as well as stacks of different materials.

Optionally postprocessor for the TORRESDRILL can be provided to generate the part program.



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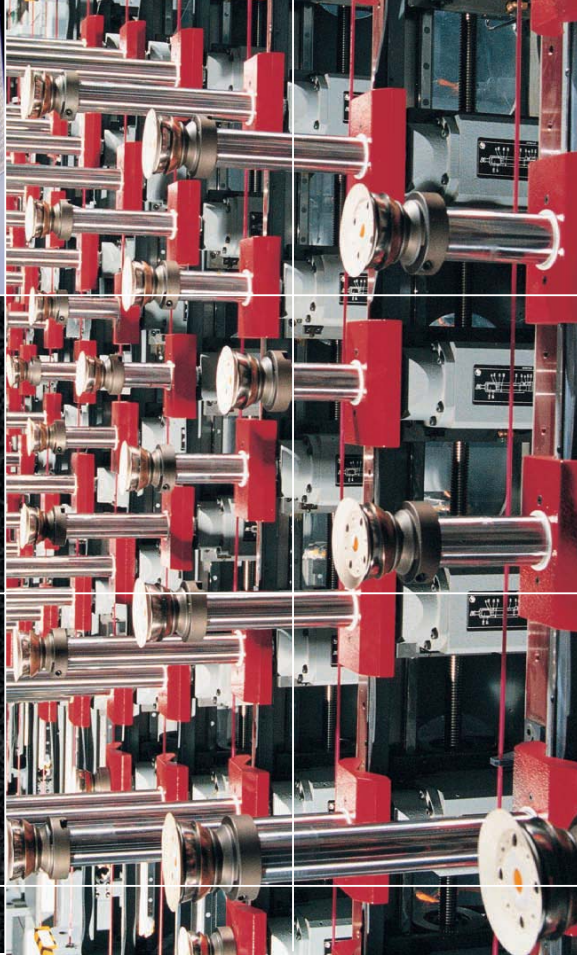
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#### OPTIONS

- Automatic repositioning software integrated with TORRESMILL® or TORRESLASER®
- Multipart set up software
- Absolute positioning system



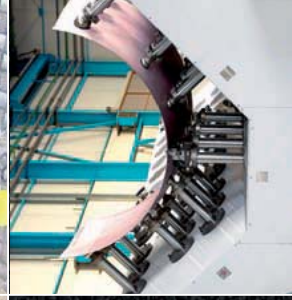
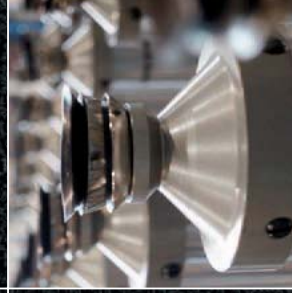
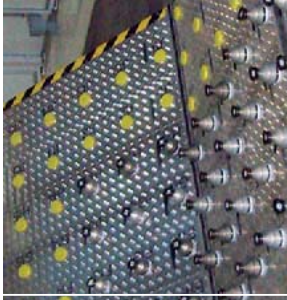
## TORRESTOOL®

### Multiflexible Universal Holding Fixture

The TORRESTOOL® is a modular concept consisting on a number of carriages that move on the X-axis direction, with a number of supports per carriage, that move on the Y and on the Z axes.

Each support rod has a self adjusting 45° tilting capability vacuum holding cup on the top. In certain applications a part clamping device is set up on top of the rod instead.

The TORRESTOOL® is controlled from a PC where all part programs are downloaded from, into the MTORRES developed multiaxes controlled system to trigger the TORRESTOOL® repositioning process.



#### OPTIONS

- Part automatic searching
- Vacuum level control
- Special attachments and cups to fixture complex surface components

By integrating the TORRESTOOL® with the TORRESMILL® or TORRESBRILL® or TORRESLASER®, the system provides the highest degree of flexibility on their milling, drilling or laser cutting operations, reducing change over time from one part configuration to next to a maximum of two minutes. All supports rods with vacuum cups or clamping devices move simultaneously in the X/Y/Z axes and are automatically locked in their final positions.

TORRESTOOL® Universal Holding Fixtures are available in different design configurations, horizontal, vertical, round, 3 Axis, single axis, etc, and in any required size to be integrated with other MTORRES machines.

All supports rods move simultaneously in X, Y, Z axes and are automatically locked in their final position. All motions are servo-driven and NC controlled.

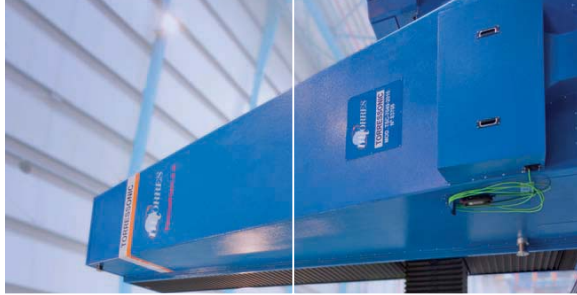
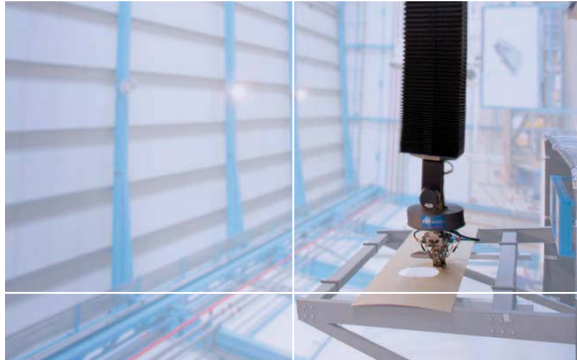
Ground guideways, rack and pinion and ballscrews systems are used to drive the axes.

The TORRESTOOL® has a sophisticated built in executive software package (HM) to allow an extremely easy machine operation, as well as its maintenance, providing self-diagnosis routines etc.

Optionally postprocessor for the TORRESTOOL® can be provided to generate the part program.

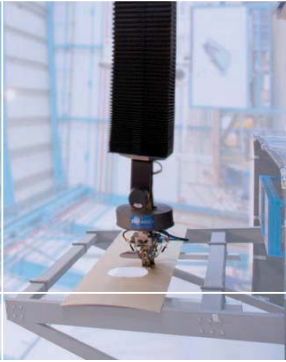
Applications are machining, assembly, laser scribing, etc.

The TORRESTOOL® is a Multiflexible Universal Holding Fixture specially designed to support in space aircraft structural components, while they are machined or laser cut.



**OPTIONS**

- Automatic end effector changer
- Flexible part holding (Special TORRESTOOL®)



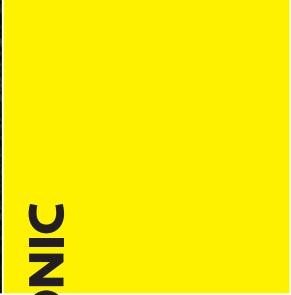
**OPTIONS**

- Automatic cleaning
- Automatic defect evaluation
- Non contact probing system
- Defect marking system
- Cartesian Axis machine
- Robotic special cell water suction system



**TORRESSONIC**

**Ultrasonic Inspection Machine**



TORRESSONIC concept provides a harmonic set of accurate, stiff and reliable mechanics, control electronics and software subsystems, working together to make an advanced ultrasonic unit to scan a part capturing data according to a defined strategy.

TORRESSONIC system are always customized and built on any architecture to fulfill specific customer requirements, in particular those related to productivity and cost effectiveness.

MOTORRES has signed a collaboration agreement with another well-known Spanish company named TECNATOM in order to join their capabilities for developing and supplying high added value inspection systems.

The conventional NDI Technologies, Pulse-Echo and Thru transmission, either via water jet or immersion, either single channel or multichannel, are well proven and available.

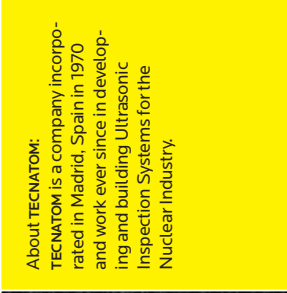
In addition Multichannel Phased Array Technology is also available and has been integrated and is operational in the latest TORRESSONIC installations.

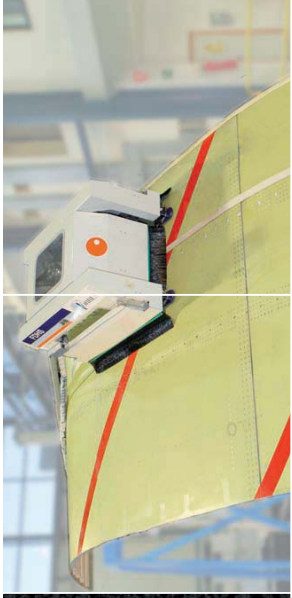
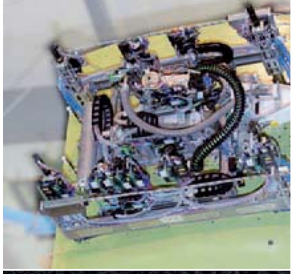
Under the agreement with MOTORRES, the TECNATOM deep know how and expertise on the fields of end effectors, electronics and software for NDI systems is made available to our customers by integrating them on the TORRESSONIC machine.

**TORRESSONIC provides a frame in which several ultrasonic scanning applications can be implemented, from water-jet thru-transmission equipment to pulse-echo, and phased-array systems for large aircraft structural parts NDI.**



**About TECNATOM:**  
TECNATOM is a company incorporated in Madrid, Spain in 1970 and work ever since in developing and building Ultrasonic Inspection Systems for the Nuclear Industry.





# Flexible Drilling Head [FDH]

## 5 Axis Crawling Drilling And Riveting Machine

The FDH is a 5 interpolated axis drilling machine with modular design for easy system customization.

Its principle is to 'walk' over the aircraft fuselage, holding on place by means of a set of vacuum cups. Once the FDH walks to position, gets locked with the vacuum cups and is ready to perform the drilling/riveting operation.

After drilling/riveting at the current area, the FDH walks one more step, by releasing the vacuum at half of the cups and moving them one step ahead, where it will lock them on place again getting ready for the next drilling/riveting operation.

The FDH does not need any additional guiding system mechanically engaged to the Aircraft to walk on its fuselage, irrespective of its position, even upside down.

FDH is a 5 axes autonomous platform that carries the necessary end-effectors for drilling and countersinking.

A 5 minutes set up on place by 2 operators is enough.

The robot optimal design ensures the best drilling and countersinking positioning accuracy and a high speed performance at the lowest weight.

A vision and laser system ensures that the FDH follows the desired path and correct CNC program from theoretical to real path.

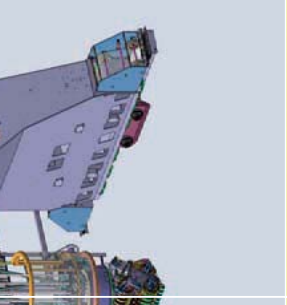
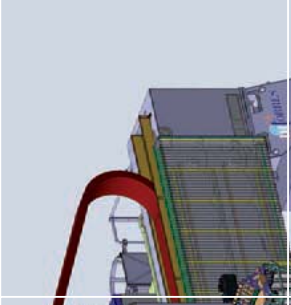
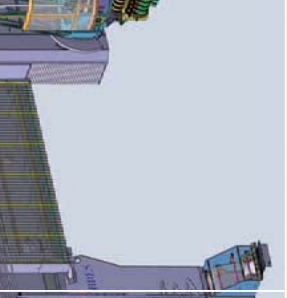
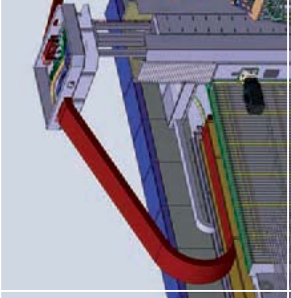
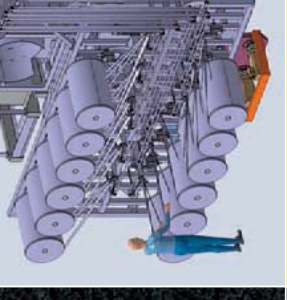
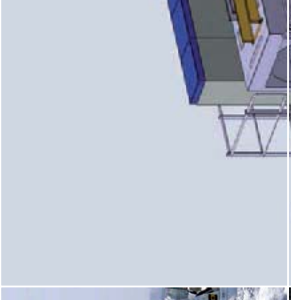
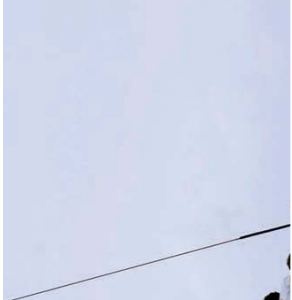
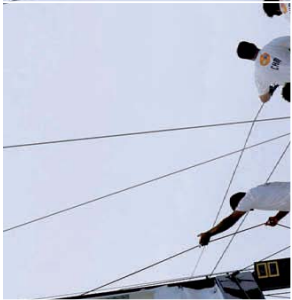
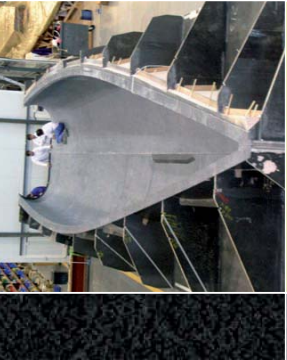
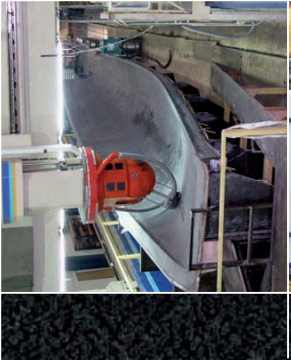
The FDH may work and walk on most of the current aircraft models from smaller aircraft to the largest jetliners.

Applications are drilling and riveting circumferential, longitudinal and conical joints.

A portable electric cabinet is provided, connected to the FDH by means of a minimum hosing/wiring harness.

A MTORRES developed control system allows the FDH to work without needing a conventional CNC system.

**FLEXIBLE DRILLING HEAD (FDH) 5 Axis Drilling Crawler Robot is a portable and autonomous drilling and riveting stand alone robot.**



# Special Projects on Composites

MTORRES is in a unique position to apply at other industrial sectors using composites, its extremely wide knowledge and experience on composite manufacturing systems at the Aerospace Industry.

From that stand point, Composite solutions for boat and wind mill blades manufacturing processes have been successfully implemented in the past. As a result, a number of Boats and Wind Mill Blades have been built at MTORRES facilities in recent years.

Additional industrial sectors using composite materials are also targeted as potential users of the MTORRES technology.

Our Aerospace Industry well known solutions can be applied, have been applied and will be applied to other products manufacturing processes at other industries.

Not only in the case of prepreg material processes but Resin Infusion, Dry Material lamination, Thermoplastics lamination, etc are areas in which MTORRES is currently involved on a number of development projects to implement new solutions, as well as modified and adapt existing solutions, on an industrial manner.

In addition to composite components fabrication other stages of the process can be accomplished as well. Current MTORRES technology, experience and powerful engineering capabilities allow us to address a comprehensive process solution, from the lamination equipment to components cutting, machining, inspecting, as well as assembling processes. Summarizing, a total composite manufacturing solution can be provided out of a single source.

This is an area in which MTORRES intends to grow in the years to come by adapting the well proven technologies to the particular and specific needs that other applications and processes demand.

Automation of those processes are key to reduce cost and increase productivity, quality, exchangeability and consistency and MTORRES solutions are perfect to fulfil those goals.

# Software

## 1. Automatic Tape Layer Programming Software Torlay

TORLAY is a CATIA V5 fully integrated application developed by MTORRES to allow the creation of CNC part programs for TORRESLAYUP in an easy and user friendly manner. It allows the programmer to use all the initial tooling designs that they have in CATIA V5 without any loss of information due to CAD format.

The programmer enters a number of parameters into the system to generate the tape trajectory using base surfaces, ply contours and laying orientations. It helps the user to define machine and material constraints (minimum length, allowed cutting angles, minimum tape width, etc) to easily obtain an executable CNC program. Other laying parameters such as scrap area, flow area, clear surface, laying feed rates, etc can also be determined from the TORLAY application.

TORLAY displays what the ply will look like based on the parameters that the programmer entered for him/her to deuplicate the ply by modifying those parameters.

## 2. Automatic Fiber Placement Programming Software Torfiber

As in the case of the Tape Layer Machine, TORFIBER is a CATIA V5 fully integrated application developed by M. TORRES to allow the creation of CNC part programs for the TORRESFIBERLAYUP in an easy and user friendly manner. It allows the programmer to use all the initial tooling designs that they have in CATIA V5 without any loss of information due to CAD format.

The programmer enters parameters into the TORFIBER program to complete the ply definition. The system is very comprehensive and flexible allowing the programmer to take different laying strategies. Again, the system displays the ply on the screen for the programmer to analyze and eventually modify some of the parameters entered to obtain a fully satisfactory and machine doable ply.

The integrated software allows the creation of machine executable files directly from the DELMIA V5 environment.

TORFIBER application generates all the laying process information in the CATPROCESS document, in the DELMIA environment. It also post processes the information in the CATPROCESS document to generate a CNC file.

## 3. Simulation

MTORRES has developed unique solutions for machine simulation. Our software solution for automated MTORRES composite CNC machines are fully integrated in DELMIA V5.

MTORRES simulation software reads CAD models and NC programs and simulates these programs on a virtual machine, detecting collision between machine and parts. These features allow correcting programming errors, avoiding machine collisions or defective parts.

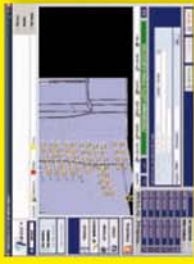
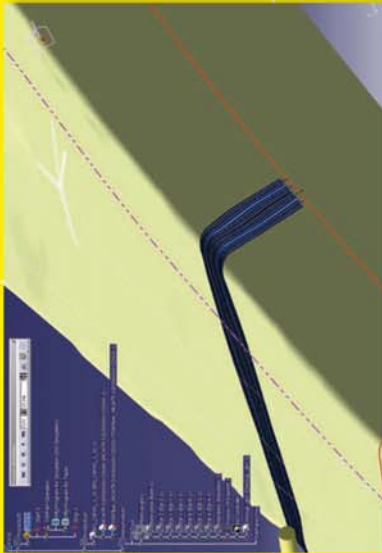
## 4. HMI

HMI applications are developed to create user friendly applications that allow the machine operator to work with the NC in complex manufacturing process, driving the machine operator through the correct options.

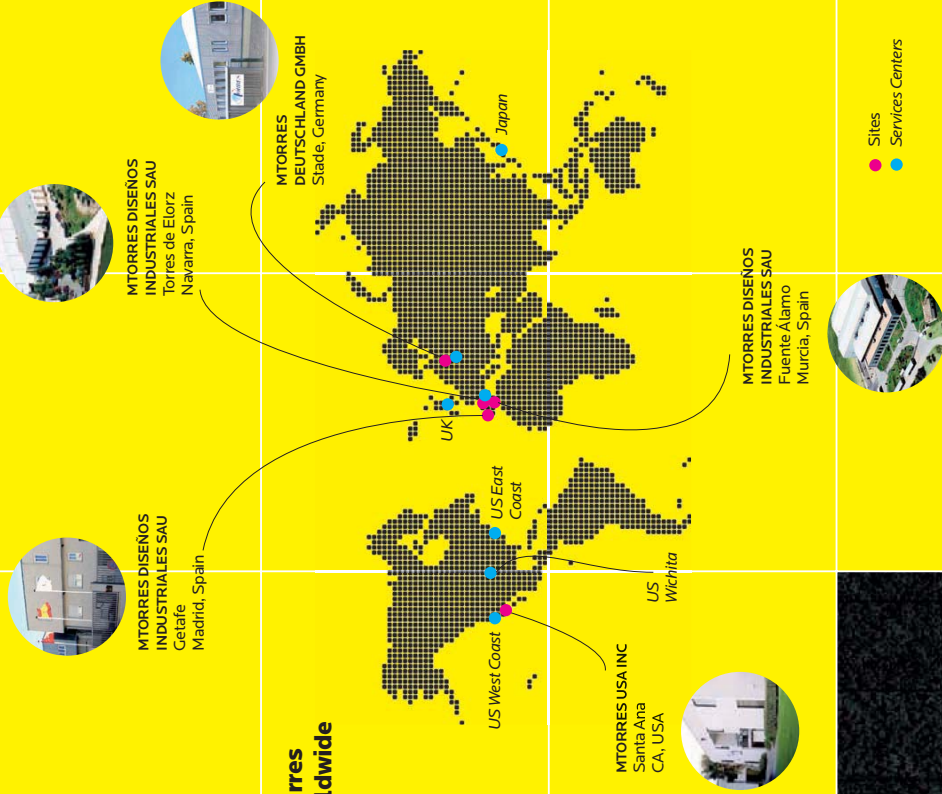
MTORRES HMI's are specifically designed for each application providing the maximum flexibility and quick learning curve for Operators.

These are the main features:

- NC files management
- Controlled restart of NC files
- Allow the user to launch rototranslation process
- Control tool life
- Process parametrization
- TIP trajectory visualization
- Process reports generation



## MTorres Worldwide



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