



# MMS

Leading Innovation  
with Proven Technology

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# Mirror Milling Star



# MMS



Mirror Milling Star is the digital machining solution for high-speed milling, drilling and trimming of 3D aluminum or composite fuselage panels.

Thanks to its surface scanning system, the machining adapts to the real shape of the panel and the dual 6-Axis heads, arranged in a mirror configuration, guarantee an unequalled level of precision by controlling symmetry and the pocket depth bottom thickness, regardless of their complexity or diversity.

01 Flexible machining

02 Proven solution

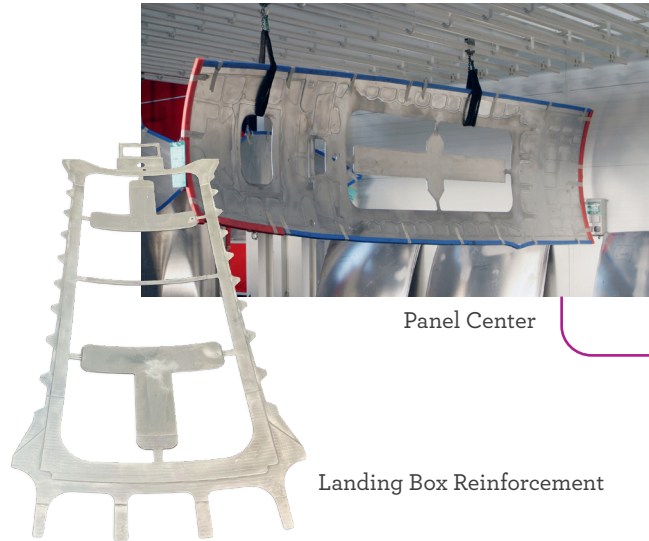
03 Sustainable results



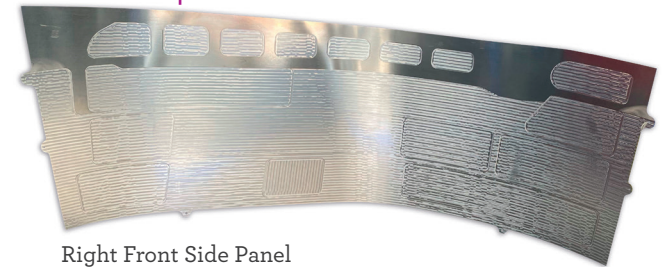
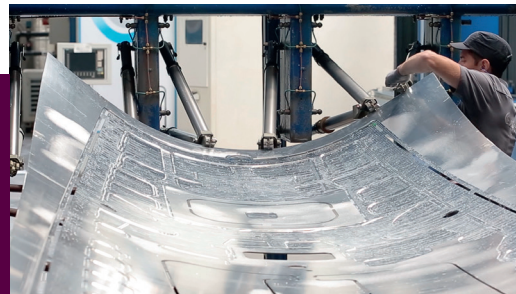
MMS Mirror Milling Star

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# Mass production of skin panels aircrafts and space launchers waffle parts



Canopy



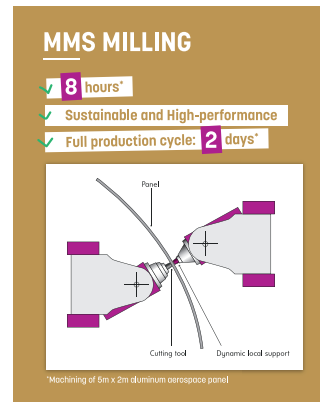
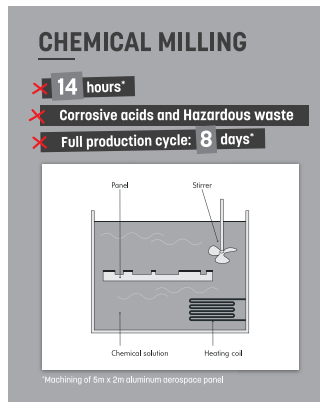
Right Front Side Panel

Along with complete life-cycle support, assistance, and solid technological collaboration, MMS Mirror Milling Star has been customized on request to meet the highest industry standards and quality.

## Advanced mechanical milling solution designed to replace chemical milling

12-Axis synchronized action

- Scan & MAP Milling Adaptive Process to morph the ISO milling program to the real shape of skin panel
- Local support head maintaining contact and avoiding vibrations
- Ultrasonic sensor for thickness measurement
- Cutting head & support head full synchronization for dynamic adjustment



No chemical product consumption  
No chemical product evacuation and treatment  
50% less electrical power consumption  
Chips and extra raw material recycling

# Digital Machining Solutions

Leading your machining process with digital tools, from balancing to final control

## MPT - MMS

Full MMS Programming Tools  
Shrink your global programming phase  
from 3 weeks to 3 days !

Phasing and automatization of: panel balancing  
on the frame, clamping arm and jack table  
positioning, laser projection, trimming, drilling  
& pocketing NC code generation within the  
appropriate milling strategy.

## MAP-B - MMS

Reduce your calculation process time  
from 20mn to 2 mn and improve your  
capacity to address high complex parts

New release of the famous software: morphing  
the theoretical Cad part to the digitalized  
surface of the real part and automatically  
generating the NC code of the machine.

## Visu 3D - All Fives solutions

Manage your quality thanks to machined  
part 3D visualization

Real time data monitoring while machining:  
capturing the position of the cutting point and  
quality/ process metrics at the same time, then  
create a 3D view of the product.

## 3D Vit - MMS

Achieve high-quality metrology of  
panels, at low cost

Virtual Inspection Tooling: Jigless dimensioning  
metrology of skin panel after MMS process.  
High accuracy Laser Tracker solution with  
Fives algorithms  
No tooling and reduced CAPEX.

INDUSTRIALIZATION

MMS MACHINING

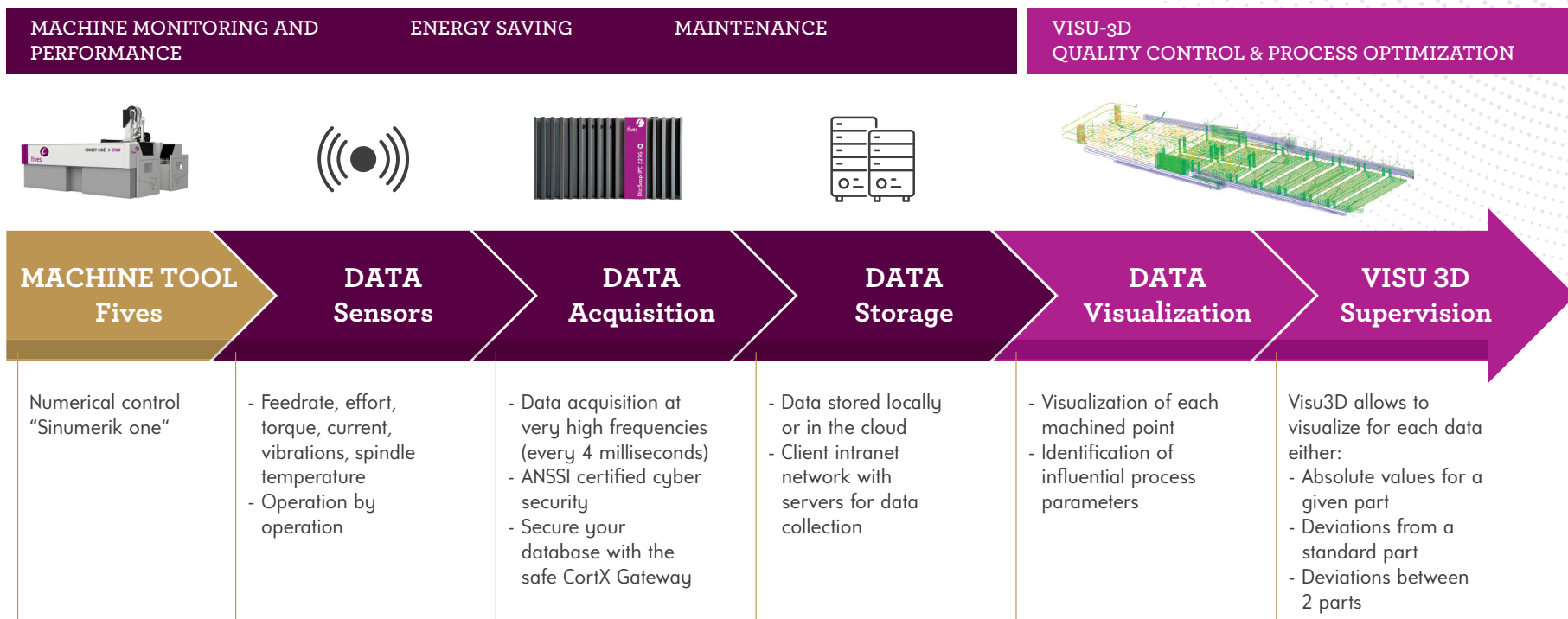
IN PROCESS CONTROL

POST PROCESS CONTROL

Proven process with digitalization readiness  
improves production capacity and adaptability.

# VISU 3D - Master your machining process & Optimize your costs

Industrial performance: your 4.0 connected machine tool





Up to  
**-30%**

### INDUSTRIALIZATION

Reduction in the number of iterations up to validation of parts for industrial production

Up to  
**-10%**

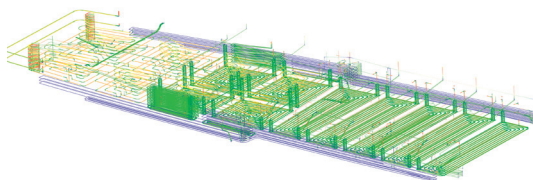
### MACHINING CYCLE

Optimization of trajectories and cutting conditions

Up to  
**-60%**

### QUALITY CONTROL

Improving the monitoring plan as needed



## VISU 3D - Fast, easy and precise visualization of your machining

Correlate process data with part quality



Reduce total time and optimize your costs

Industrialization - Machining - Final control

1

Improve the quality of your parts

2

Master traceability

3

Visu 3D - All Fives solutions  
Manage your quality thanks to machined part 3D visualization

Real time data monitoring while machining: capturing the position of the cutting point and quality/ process metrics at the same time to create a 3D view of the product.

# Flexible machine

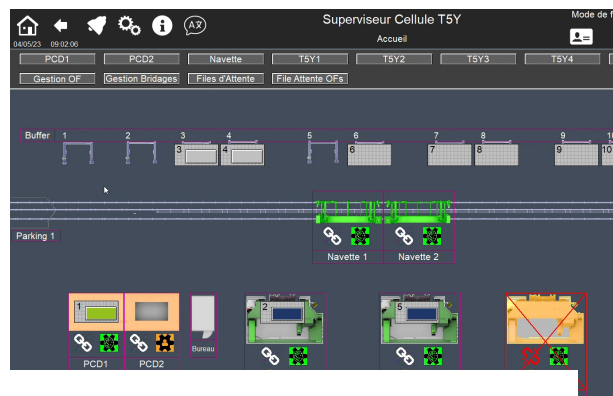


## LARGE RANGE OF PANELS

### FLEXIBLE PARTS TOOLING

- Universal clamping frame for all types of panels
- Surfacing, drilling and routing operations in one set-up and in one MMS
- Save money: 65% save time, 50% floor saving compared to chemical, less CAPEX
- Both panel sides machining without unclamping

MMS Mirror Milling Star offers the shortest ever skin manufacturing cycles with outstanding quality skin surface and dimensional accuracy.



## FLEXIBLE MANUFACTURING SYSTEM

### FM FLEXIBLE MANUFACTURING SUPERVISOR

- Automated solution, simple, robust and reliable
- Optimize the production flow on large diversity of parts type
- Supervision system ergonomics, simple operations designed for operators
- Excellent expertise with more than 30 years of experience in Fives supervision

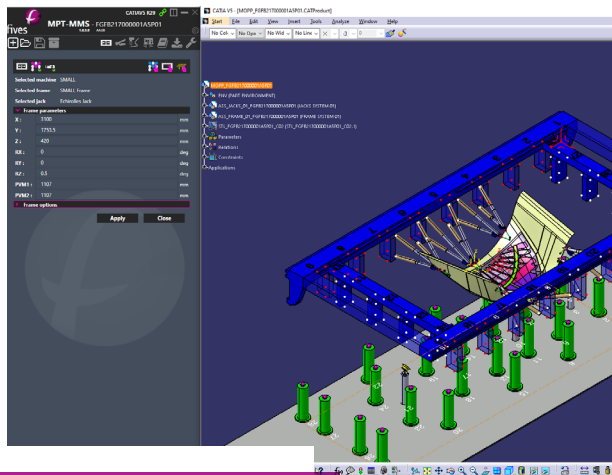


## UNMATCHED PRODUCTIVITY

### HIGH SPEED MACHINING

- 30,000 RPM spindle
- Feed rate 15m/min
- High dynamic stiffness
- Fast automation process
- High machine availability

# Proven solution



## EASY TO MANAGE

### END TO END DIGITAL SOLUTION

- Easy programming, Fives CAM and post-processor solution
- Only 3 days to program a new part thanks to MPT Management Programming Tool
- Production optimization thanks to process visualization
- Secured connected solution and data collection: Fives CortX / Diziscope



## HIGH QUALITY FINISHED PARTS

### PROVEN PROCESS

- Accurate thickness control for better panel weight control
- High repeatability and consistent quality
- Outstanding surface quality
- Highly accurate, clean and dry parts



## FIVES PROCESS EXPERTISE

### STRONG EXPERIENCE AND EXPERTISE IN PRODUCTION

- R&D demo center and workshop available for tests
- Aerospace EN9100 Certified
- Panels production manufacturer for the world's largest industrial groups
- Turnkey solution: from trials to industrialization
- Secured and optimized production

Over 25,000 panels produced in 15+ years for the world's leading aerospace players.

# Sustainable results



## ENERGY SAVINGS

### GREENER THAN CHEMICAL MILLING

- 100% chips recycling, no chemical sludge
- Optimized panels for lighter aircrafts
- Conform to reach regulation



## COST SAVINGS

### EFFECTIVE SOLUTION

- Drastic reduction of power consumption during production thanks to data expertise, up to 30% compared to chemical milling
- Reduction of cycle time and Work in Progress
- From formed raw panels to finished skin panels in a single MMS cycle
- Easy vertical integration
- Universal tooling frame avoiding CAPEX

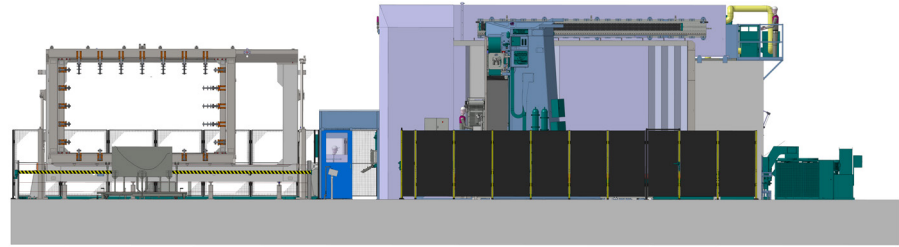
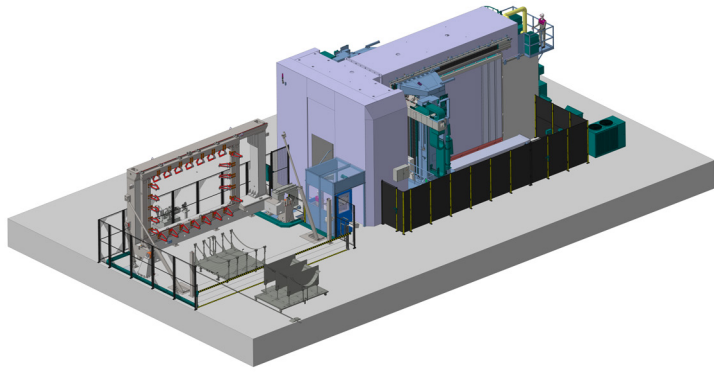


## MADE TO LAST, FIVES DESIGN EXPERTISE

### 150 YEARS OF EXPERIENCE IN MACHINE-TOOLS

- Heavy duty engineering, high-quality manufacturing
- Innovative design and process
- 5-Axis head made by Fives
- Designed and produced in France

MMS Mirror Milling Star, your advanced, digital and eco-friendly solution



## MMS | SPECIFICATIONS

### Parts support

Reconfigurable clamping frames

### Size (raw panel)

Max part: adaptable configuration  
 Standard part: 4 m x 2,5 m - 157 in x 98 in  
 to 12 m x 3,5 m - 236 in x 98 in

### X Axis (Column)

Travel / Stroke 4800 - 6800 mm - 188 - 267 in  
 Speed / Feed rate 30 m/min - 1181 ipm

### Y Axis (Saddle)

Travel / Stroke 3000 mm - 118 in  
 Speed / Feed rate 30 m/min - 1181 ipm

### Z Axis (Ram)

Travel / Stroke 1600 mm - 62 in  
 Speed / Feed rate 20 m/min - 787 ipm

### B Axis (Rotary)

Travel / Stroke +/- 90°  
 Speed / Feed rate 10 rpm

### A Axis (Rotary)

Travel / Stroke +/- 90°  
 Speed / Feed rate 10 rpm

### HF-Spindle

Max Power (SI) 20 kW to 63 kW  
 Max Speed 30 000 rpm  
 Taper HSK

# GLOBAL SERVICES

## OPERATION

- OEM spare parts and other brands
- Customer support 7 days a week
- Preventive maintenance
- Sub-assembly repair
- Workshop machinery relocation

## OPTIMIZATION

- Certified training
- Consulting (setting-up, operation...)
- Expertise and certifications
- Process optimization

## EVOLUTION

- Refurbishment - Machine rebuilding
- Mechanical transformation
- Retrofit (NC and automation)
- Retooling
- Obsolescence management



50 field technicians and experts

3 000 parts items in stock in Europe

3 shops floor dedicated to refurbishment



fives

Industry can do it

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