



CNC
ONSITE

SPECIALIZED EQUIPMENT AND SERVICES

– for onsite repairs and maintenance

By Søren Schmidt Kellenberger

Who's CNC Onsite?

- Established 2012
- Focused on the wind turbine industry
- Service customers globally with in-situ work
- Specialists in onsite (in-situ) high precision machining



- Headquarter – Denmark
- Subsidiary under establishment/investigation (USA / Taiwan / Portugal)
- Workplaces

What we do

Onsite high precision machining

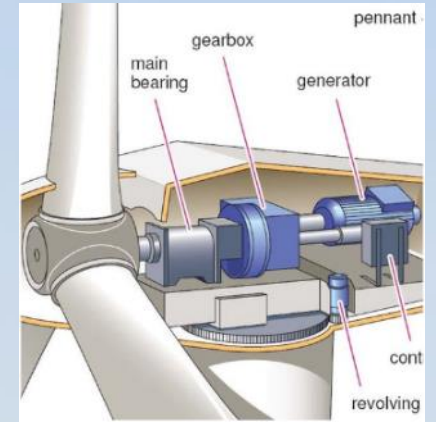
- Up tower repair
- Blade root end repair (inserts)
- Flange milling
- Customized machines

What we offer

- **Highly specialist technicians (GWO)**
- **Short response time**
- **Full flexibility**
 - All inclusive
 - Buy/lease equipment (incl. training of operators)



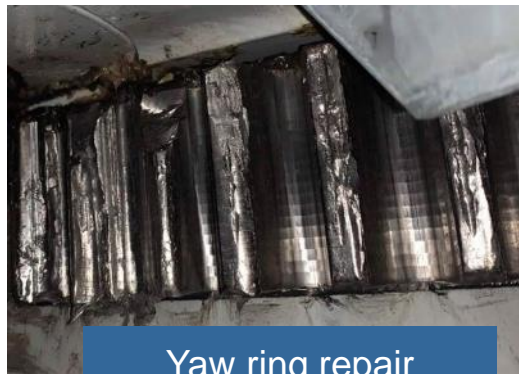
Up-tower repair and maintenance solutions



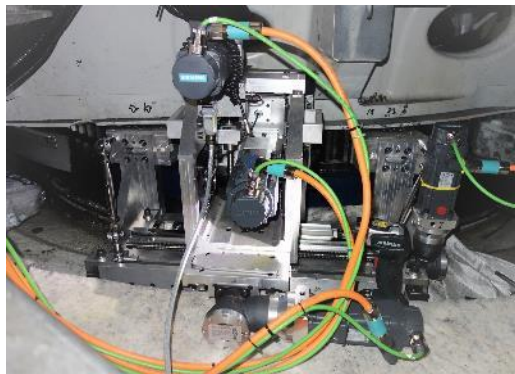
Up-tower repair

Up-tower repair

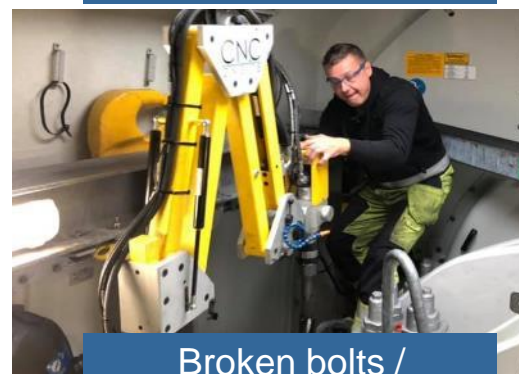
- Yaw ring teeth
- Yaw ring sliding surface
- Rotor lock
- Broken bolts/threads
- Generator shafts
- Torque arms
- Housings



Yaw ring repair



Rotor lock repair



Broken bolts /
damaged threads



Yaw ring repair

Challenges:

- Teeth get worn or brake
- Yaw ring exchange is expensive and time consuming

Solution:

Full CNC controlled machine. Can remove worn-/damaged sections and a new segment can be bolted in place.

Benefits:

- No disassembly of turbine
- No use of cranes
- Reduced downtime
- No bottlenecks
 - Crane availability
 - Spare part availability
- Not depending on weather windows
- Less coordination required

Step 1

Milling the damaged area



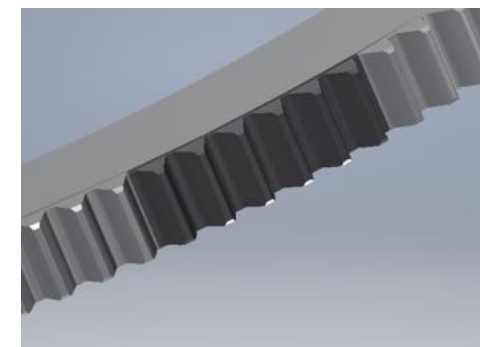
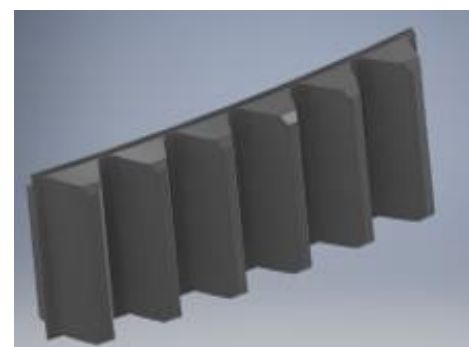
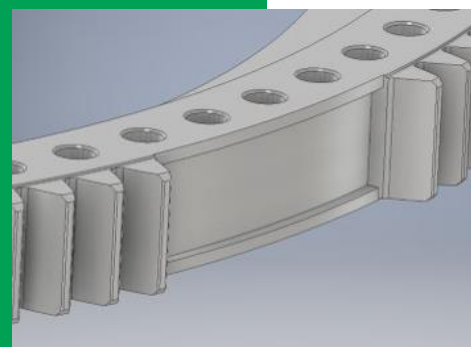
Step 2

Freeze the segment and mount it with special tool

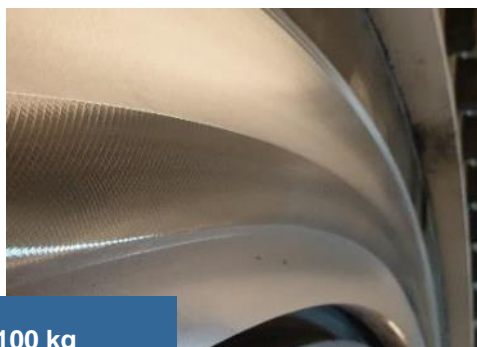
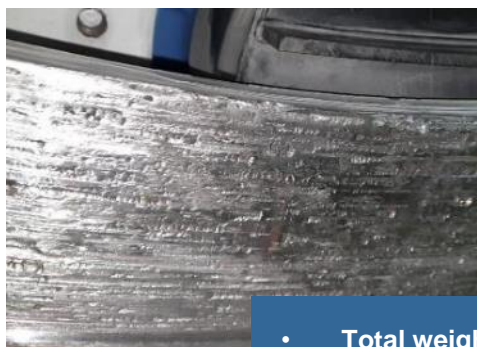


Step 3

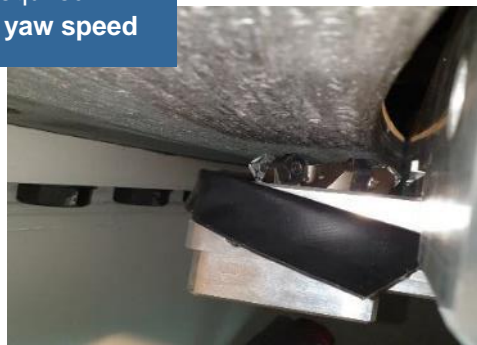
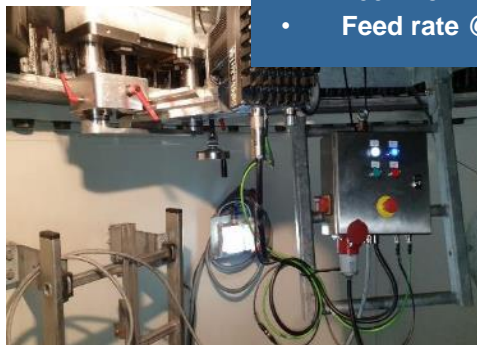
Freeze the segment and mount it with special tool



Disc Resurfacing tool



- **Total weight below 100 kg**
- **Max weight per piece = 50 kg**
- **Can cut both sides of disc**
- **400V 16Amp power required**
- **Feed rate @ normal yaw speed**



Challenges:

Surface get worn or damaged Yaw ring exchange is expensive and time consuming.

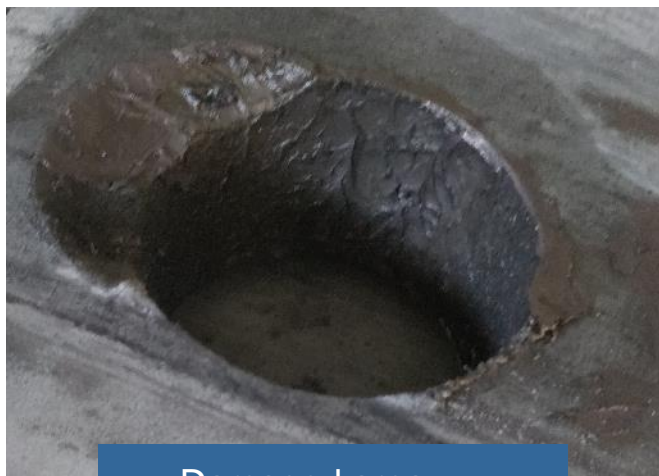
Solution:

Onsite refurbishment of the surface by use of mobile grinding machine.

Benefits:

- No disassembly of turbine
- No use of cranes
- Reduced downtime
- No bottlenecks
 - Crane availability
 - Spare part availability
- Not depending on weather windows
- Less coordination required

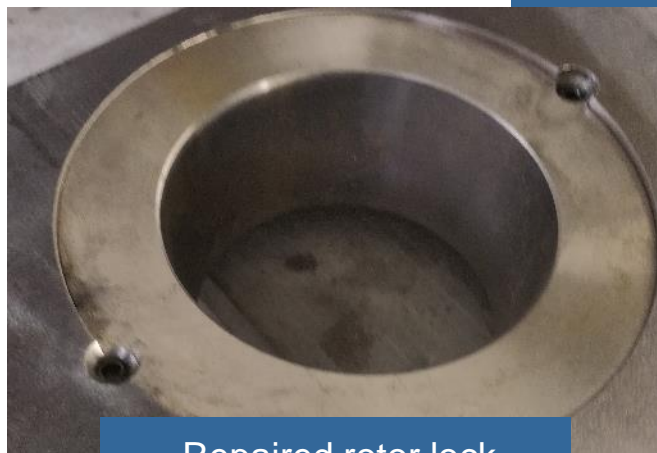
Rotor lock repair



Damaged area



Machine mounted



Repaired rotor lock

Challenges:

Rotor lock hole can get worn or damaged.

- Rotor lock system not functioning correctly.

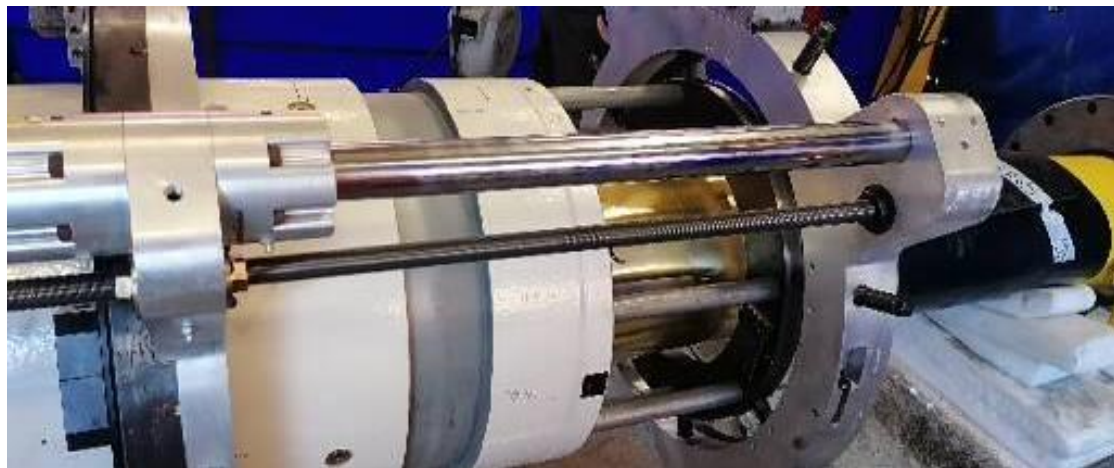
Solution:

Mobile machine for up-tower repair.

Benefits:

- Can be repaired up-tower.
- Ensure functionality of the system.
- Stop further damage development.

Generator shaft repair



Challenges:

Generator shafts can get worn or damaged by bearing inner rings or couplings spinning on the shaft.

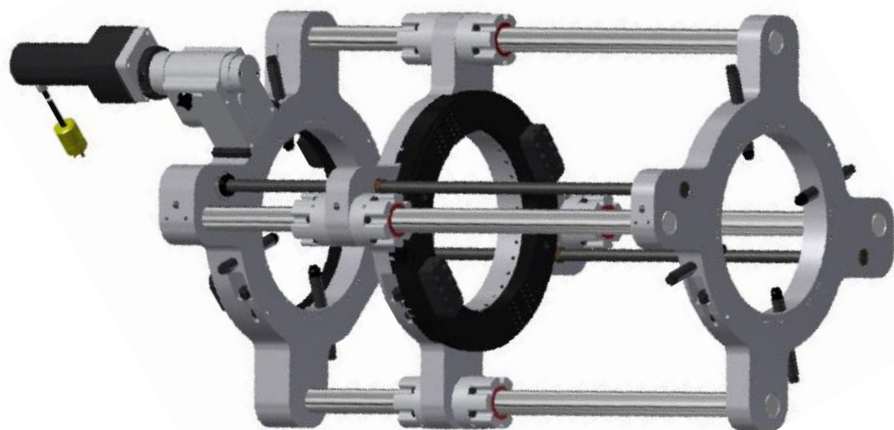
Repair with replacement generator is expensive and time consuming.

Solution:

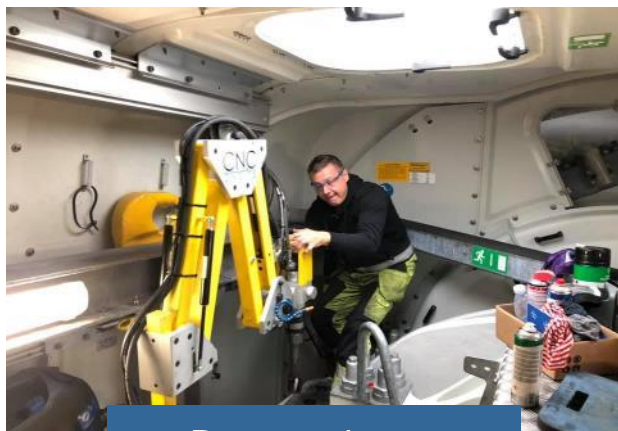
Mobile machine for up-tower repair.

Benefits:

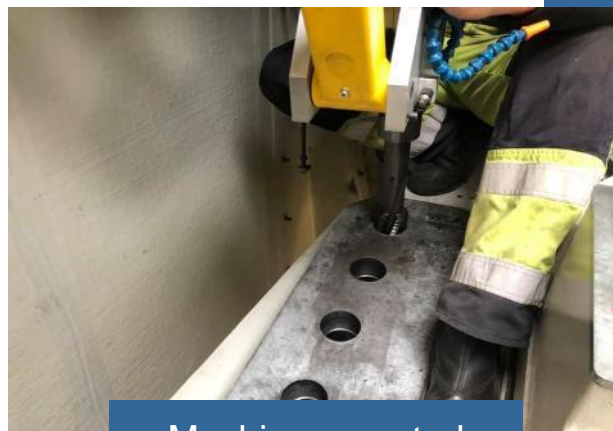
- Can be repaired up-tower
- Ensure functionality of the system
- Stop further damage development



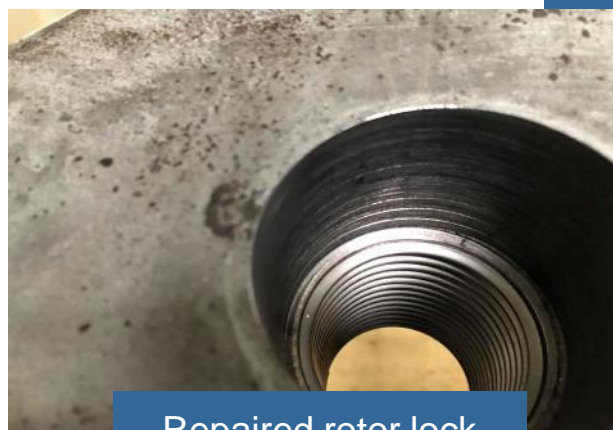
Broken bolts and damaged threads



Damaged area



Machine mounted



Repaired rotor lock

Challenges:

Bolts can break and/or threads can be damaged which can be critical to the integrity of the structure.

- Bolts placed in areas hard to access
- Standard equipment not suitable for up-tower use
- Not possible/very difficult to get the parts to a workshop

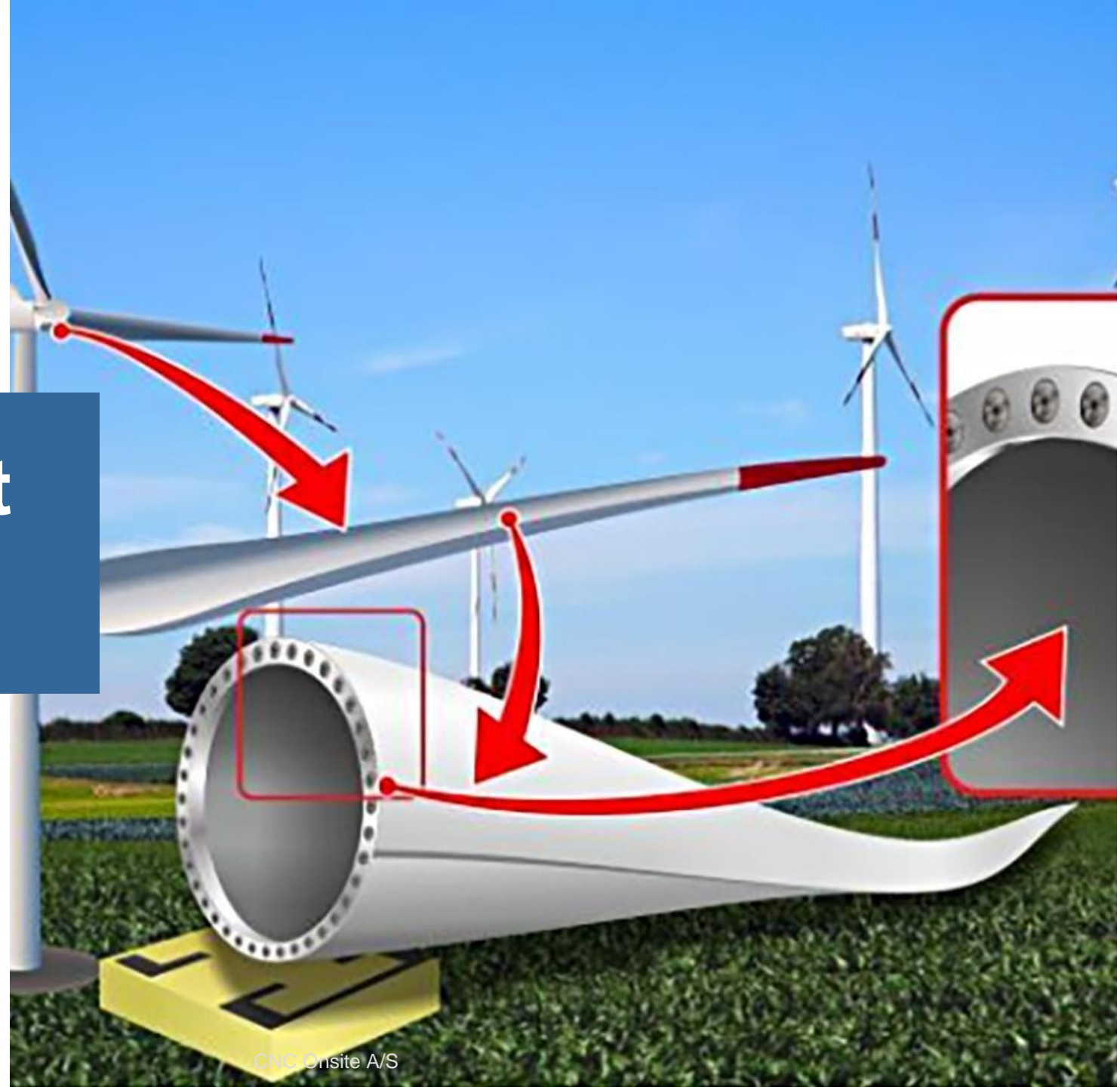
Solution:

Mobile machine for up-tower repair.

Benefits:

- Can be repaired up-tower
- Ensure integrity of the connection
- Stop further damage development

Blade root repair



Blade root repair

Loose bushings – full repair

Challenges:

Blade Root Ends can be damaged due to breakdowns or wear and tear after years in operation.

- Loose inserts
- Bolts jammed or broken
- Flange end damages

Solution:

Full CNC controlled machine. Can remove old inserts and/or do flange facing with very high precision.

Benefits:

- Reuse of blades instead of scrapping
- Onsite repair solution
 - no transport
 - no disturbance of ongoing production
 - reduced down time of turbine
- Fast and proven process



Blade root repair

Loose bushings – partly repair

Challenges:

Blade Root Ends can be damaged due to breakdowns or wear and tear after years in operation.

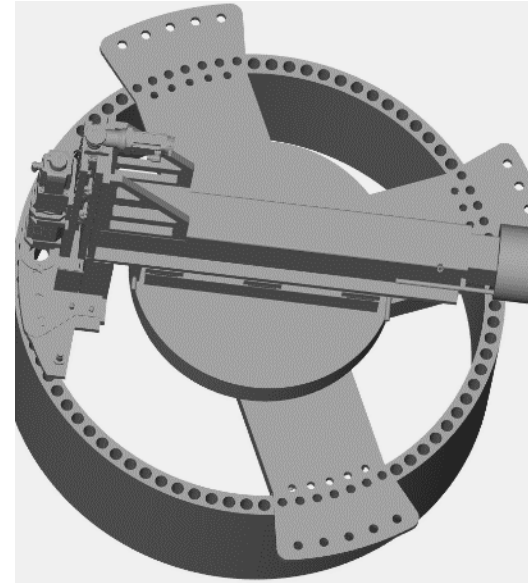
- Loose inserts
- Bolts jammed or broken
- Flange end damages

Solution:

Semi automatic machine. Can remove old inserts and/or do flange facing with high precision.

Benefits:

- Easy to install (directly on blade)
- Easy to operate
- Onsite repair solution
 - no transport
 - no disturbance of ongoing production
 - reduced down time of turbine



Blade root repair

Damaged contact surface

Challenges:

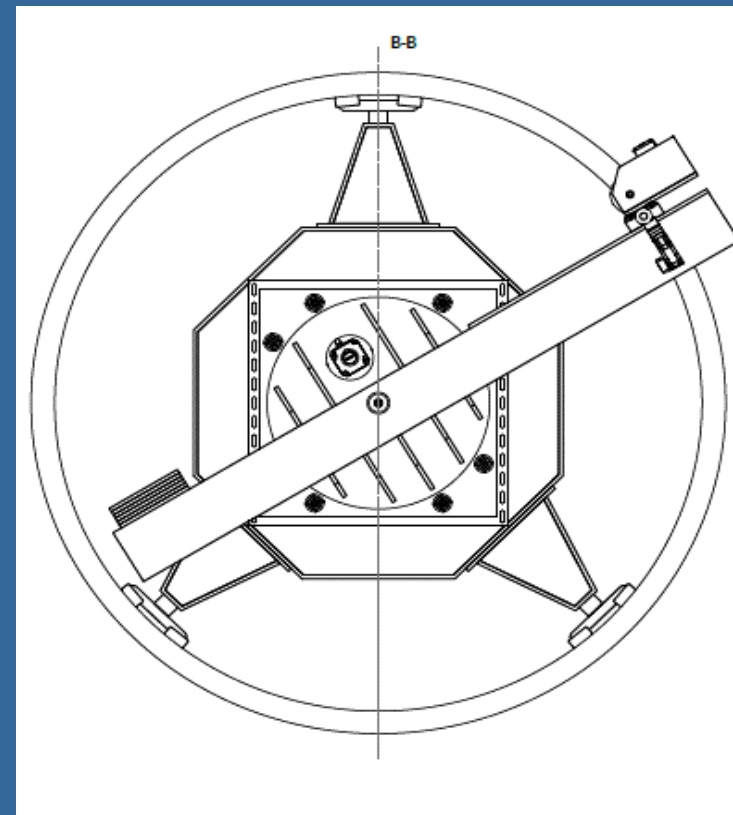
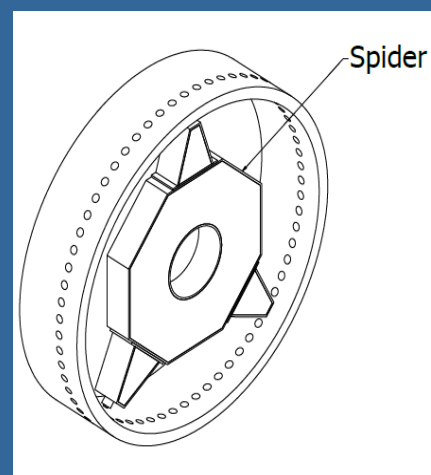
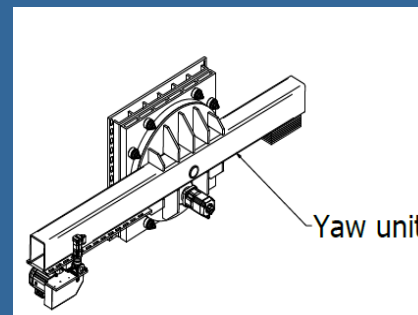
- Blade Root Ends can be damaged due to breakdowns or wear and tear after years in operation.
 - Loose inserts
 - Bolts jammed or broken
 - Flange end damages

Solution:

- Automatic machine. Can mill the contact surface with high precision.

Benefits:

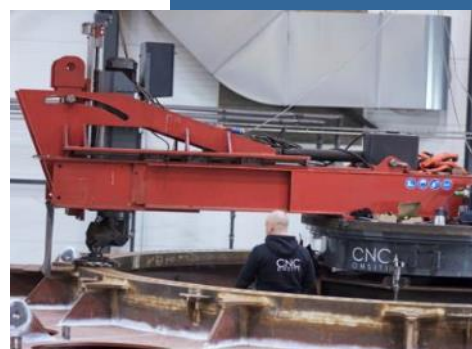
- Easy to install (directly on blade)
- Easy to operate
- Onsite repair solution
 - no transport
 - no disturbance of ongoing production
 - reduced down time of turbine



Flange milling

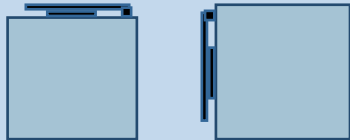
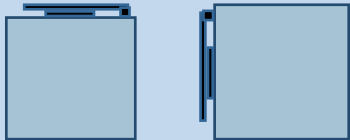

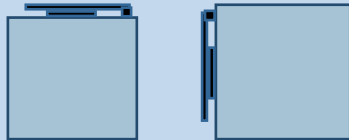


Flange milling examples



- Monopiles (MP)
- Transition Pieces (TP)
- Towers
- Tower stands
- Sea fastening
- Transport frames

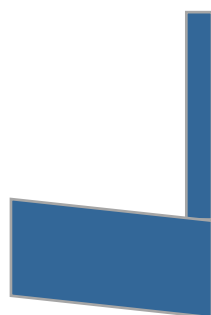
Current machine types

Type	Cæsar	Asterix	Obelix	Goliath
Flange size	Ø1.800 – Ø4.000	Ø2.000 – Ø6.500	Ø2.400 – Ø10.000	Ø6.000 – Ø10.000
Position	Horizontal / vertical 	Horizontal / vertical 	Horizontal 	Horizontal / vertical 

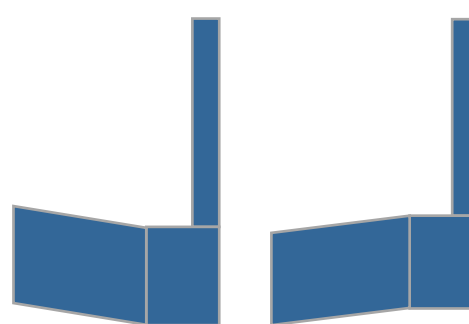
Machining possibilities:



Flat



Tilted



Double Tilted



Cæsar Ø1.800 – Ø4.000

Horizontal and
vertical



Asterix Ø2.000 – Ø6.500

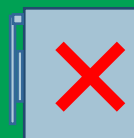
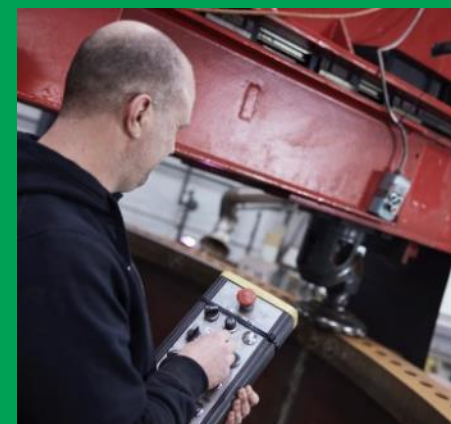
Horizontal and
vertical



Obelix

Ø2.400 – Ø10.000

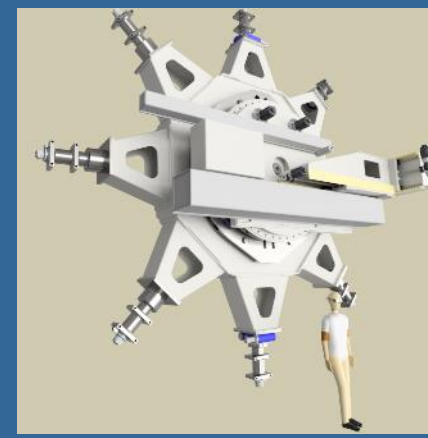
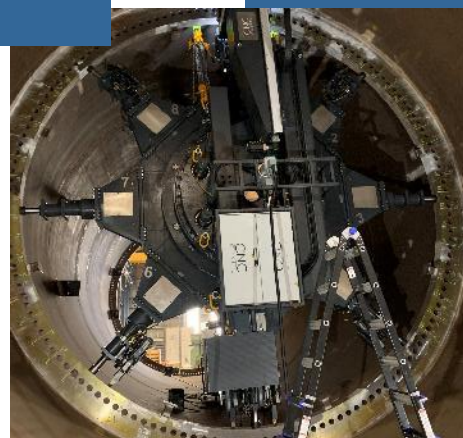
Horizontal



Goliat

Ø6.000 – Ø11.000

Horizontal and vertical



What level of precision can you achieve with large diameter flanges?

- Current requirements:

Parallelism 	Global flatness 360° 	Local  flatness 30° 
0,5mm	2mm	1mm

- Trend for future:

Parallelism 	Global flatness 360°	Local flatness 30°
0,5mm	1mm	0,5mm

Achievable:

It is possible to achieve better tolerances.

It is not possible to give an exact limit, but finer tolerances can impact fabrication costs and/or process time (more inspections and lower speed).



The largest flanges we can machine?

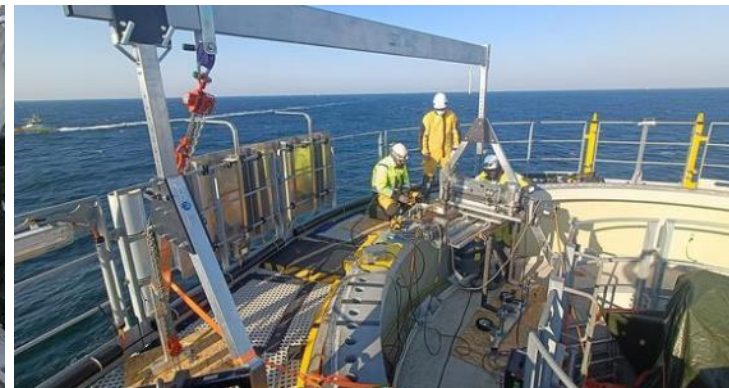
Now

- Maximum OD – 11.000mm
- Maximum flange width
 - No limit as such
 - 360mm is max pr overflow

In 5 years

- The concept can be scaled up to match requirements
- Considerations
 - Delivery time
 - Transport
 - Handling

Is machining offshore possible?



YES!

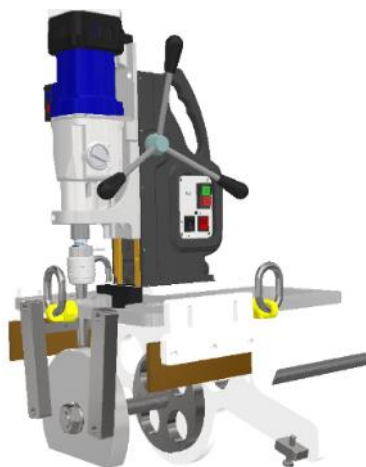
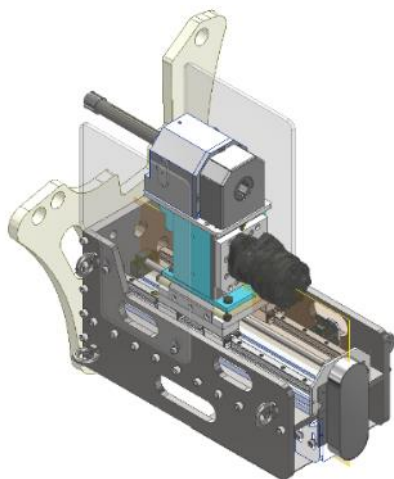
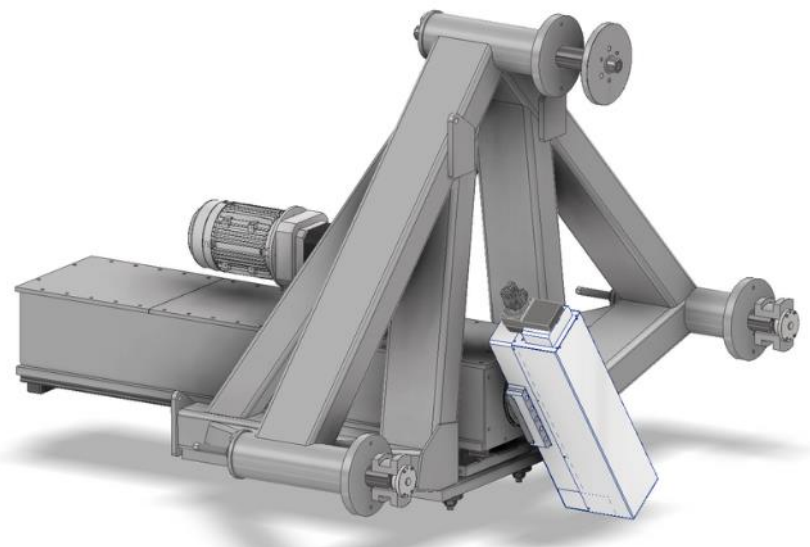


Customized machines

CNC Onsite develops and builds customized machines for onsite repairs.

Our experienced team of engineers and technicians ensure efficient solutions based on onsite experience and craftsmanship.

- Fast development process
- Proof of concept (based on standard components)
- Training of customers own employees



References

SIEMENS

Siemens Wind Power



VATTENFALL



A2SEA
powered by knowhow



LM WIND POWER
a GE Renewable Energy business


valmont  **sm**



ENERCON
ENERGY FOR THE WORLD

ENERGINET/DK

Ørsted



Why use mobile onsite machining?

Good business

- Lower repair costs
- Lower down time
- Lower work pressure on organization

Because

- Avoid main component exchange (repair instead of exchange)
- No need for mobile cranes
- No need for turbine disassembly
- No heavy logistics (transport avoided)
- Less sensitive to weather conditions
- Not depending on workshop availability

Management team



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Contact informations

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