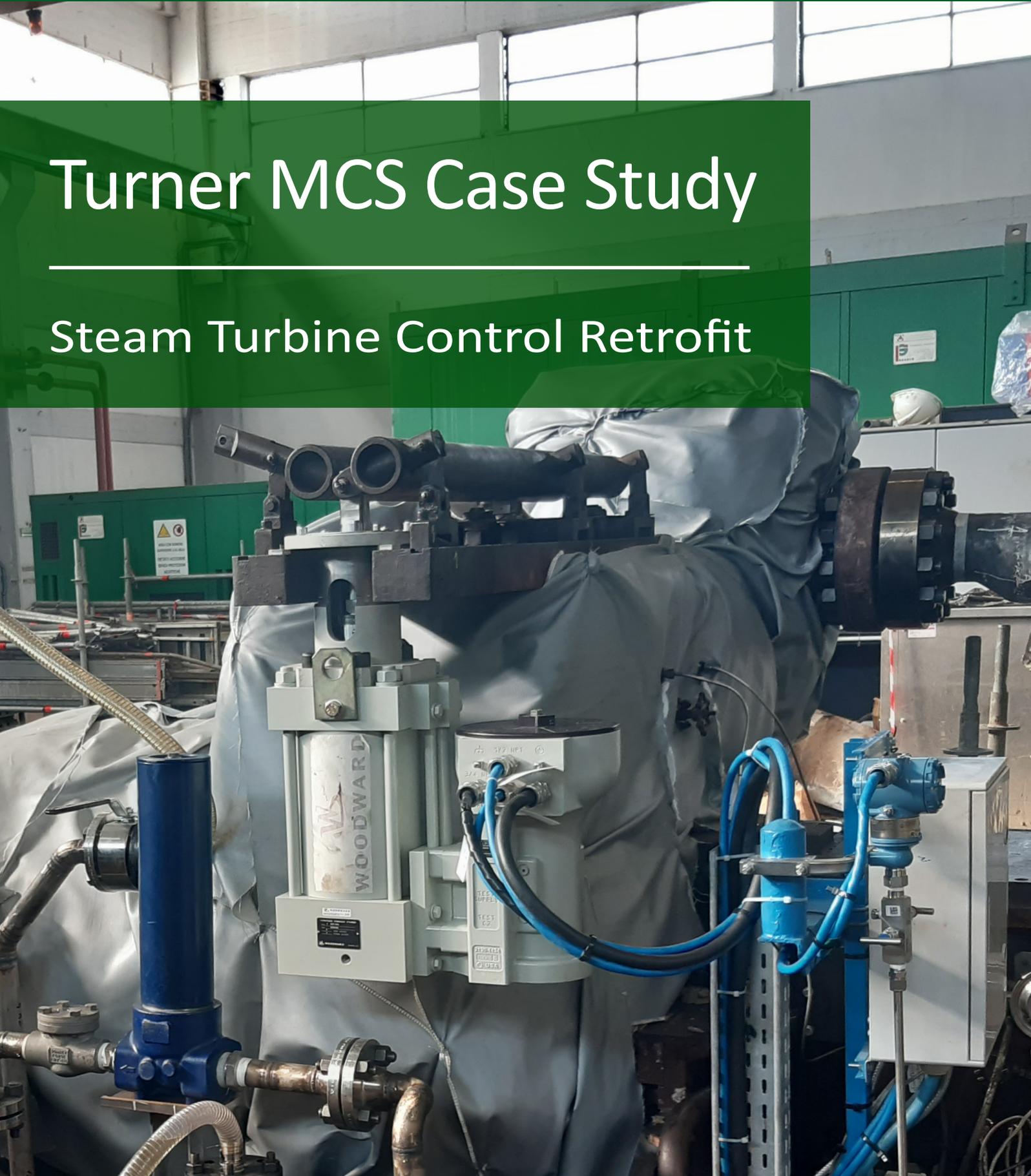


November 2021

Turner MCS Case Study

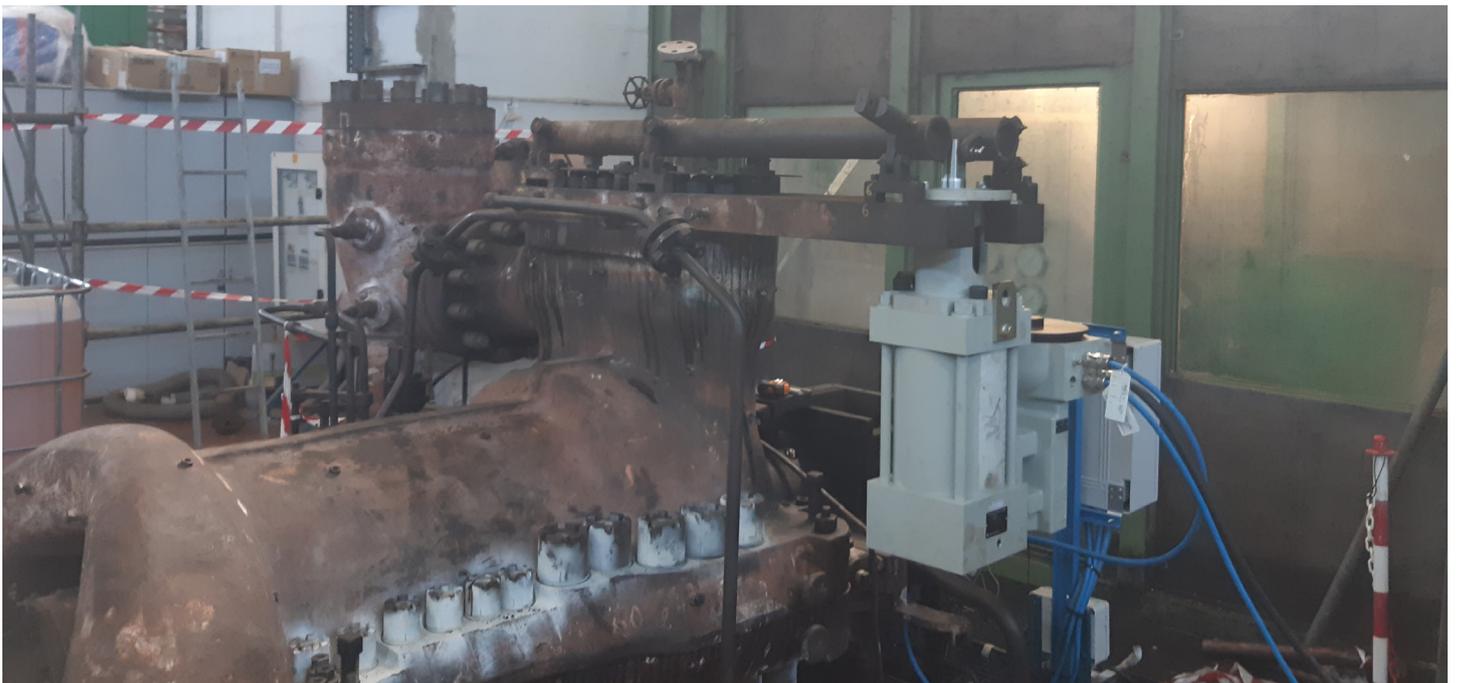
Steam Turbine Control Retrofit

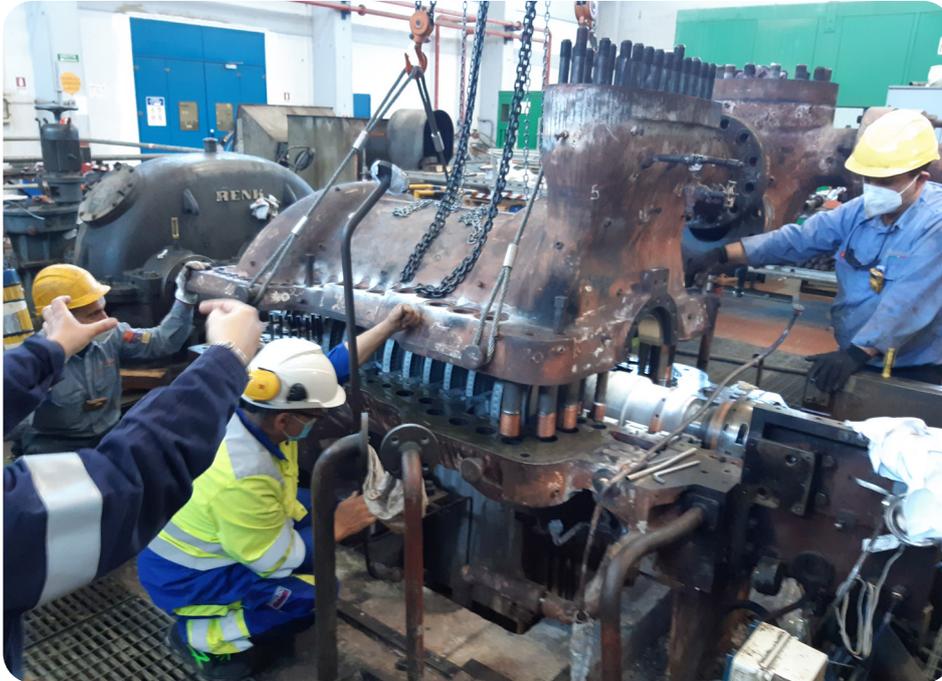


OLD ACTUATOR



NEW ACTUATOR





Introduction

Turner MCS was invited by ENI to completely modernize their fifty-year-old Ansaldo steam turbine driving a medium voltage generator. Using digitally controlled electro-hydraulic actuation the customer has gained highly accurate and reliable automatic start up from standstill up to generator sync speed without the need for operator intervention. The new system also removed the need for manual adjustments and re-calibration that was required with the original mechanical system. A valuable new feature of the system is the event and data logger used for root cause analysis and to monitor turbine performance.



IMPROVEMENTS

- High Tolerance to oil contamination
- Actuation using lube oil
- Increased accuracy
- Faster response
- Automatic start sequence up to sync speed
- Event logging

SCOPE

- Electro-hydraulic actuation
- Double acting cylinder
- Return spring
- Accumulator
- Custom linkage
- Digital Speed Control
- Vibration monitoring
- Overspeed protection
- Speed probe installation with gearwheel
- Control cabinet

FACT SHEET

Turbine: Ansaldo
Generator: Tecnomasio
Power: 13 000 kVA
End-User: ENI
Location: Livorno

Mechanical Installation

The existing actuation system was replaced by Woodward's VariStroke hydraulic double-acting cylinder with a return spring in fail-safe position. The cylinder's piston is positioned by the VariStroke's high torque rotary servo valve, allowing precise adjustment with high tolerance to impurities in the control oil. This reduces the impact on existing oil lines by using the same oil as used for lubrication of the turbine's bearings. For quick response in case of generator load rejection, in addition to the return spring, an accumulator was added to the oil supply line.



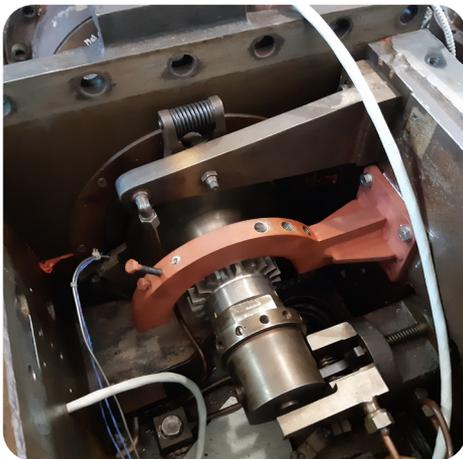
Project Execution

Turner's project management process allows us to be flexible and competitive and to meet the stringent demands of our clients. A dedicated team takes care of the entire project, from the site survey to the engineering and up to the commissioning and training for site personnel, leaving the customer with a completely functional, workable and open control system.



Digital Control

Control of the steam turbine is performed by Woodward's Flex 500 digital controller. A special gearwheel on the turbine shaft was designed and installed to measure the turbine speed. For increased reliability the demand signal is sent to the actuator using dual redundant wiring. The control software has been developed by Turner MCS to fully comply with customer and system requirements, defining ramp rates, critical speeds, automatic and manual sequences, etc.



Monitoring & Protection

The existing vibration monitoring system has been updated using the Emerson AMG6500 rack for the acquisition of all installed probes and by adding an overspeed protection module that uses 2oo3 voting logic. For this, 3 additional (active) speed sensors have been installed facing the same gearwheel as the (passive) probes used for speed control.

Control Cabinet

The control, monitoring and protection systems were installed in a pre-assembled control cabinet designed, assembled, tested and supplied by Turner MCS. A door mounted Panel PC for troubleshooting and maintenance has been supplied as well, providing site personnel with the possibility to interface with the control system.

HARDWARE USED

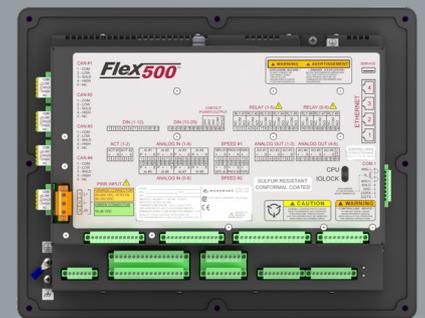
Woodward VariStroke

- Steam Valve Actuation



Woodward Flex 500

- Steam Turbine Control



Emerson AMG6500

- Vibration Monitoring
- Overspeed Protection



Turner Range of Services

LSTK Projects, Retrofits & Upgrades
Turner ECS delivers reliable retrofit solutions for a wide range of prime movers and other applications. This includes lump sum turnkey projects on turbines and compressors.

Genuine Parts & Service Exchange
Turner ECS has the largest stock of parts, service exchange governors and electronics in Europe and can provide a fast turnaround service.

Product Training
Turner ECS can provide official Woodward product training covering both theoretical and practical training on a wide range of Woodward products.

Electronic Repair & Mechanical Governor Overhaul Service
Turner ECS provides a comprehensive overhaul and repair service for electronic, mechanical and hydraulic governors.

World Wide Field Service
Turner ECS field service engineers and technicians provide comprehensive solutions for commissioning and on-site repair.

Service Contracts
Turner ECS provides long term service contracts to support users with Woodward governors and/or control products and electronic control systems.



ROTATING EQUIPMENT CONTROL SOLUTIONS DELIVERED ACROSS EUROPE & THE MIDDLE EAST

Turner ECS is an official Woodward Channel Partner with offices located in:

- The Netherlands
- England
- Germany
- Italy
- Abu Dhabi
- Qatar
- Saudi Arabia

Turner ECS also operates and manages an extensive network of official agents throughout Europe & the Middle East

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