F-CLASS TECHNOLOGIES

October 2016

TURBINE TECHNOLOGY
SERVICES CORPORATION

Since 1983, TTS has provided innovation, high quality solutions and engineering expertise to clients worldwide.

Our offering to the mature gas turbine market includes:

- Parts supply
- Conversions, modifications and upgrades
- Engineering and on site services
- Power plant services
- Combustion and performance services

We know gas turbines and F-Class technologies.

CONTENT

- Performance Services
  - DLN Products & Services
  - Operational Flexibility & Performance Services
- Control System Support
- HMI Upgrades
- Component Life Tracking & Outage Management
- Capabilities Summary

TurbineTech.com

PERFORMANCE SERVICES

DYNAFLEX PERFORMANCE™

TTS' platform that provides operators a wide range of products and services that maximizes gas turbine output and efficiency, optimizes DLN combustor dynamics and emissions, and enhances operational *flexibility*.

Before a DynaFlex solution is proposed, we recommend:

- Our engineers review your needs

- Help establish your goals

- Tailor a solution that specifically addresses:
  - Your unit's operating parameters
  - Plant requirements
  - Business objectives.

All of the DynaFlex services apply to one or more of the following GT models and combustion systems:

- 7FA DLN-2.6

- 6FA DLN-2

- DLN-2.6

- 9FA DLN-2+

- DLN-2.6+

- 7EA / 6B / 5P DLN-1

DYNAFLEX KEY SERVICES & BENEFITS

Key Platform Services	Benefits
Maximizing Base Load Output and Efficiency	• Reduced fuel costs • Increases revenue generation • No impact on rated parts life
Improve Load Flexibility	• Increase peak capacity (as much as 2.5% above base load for an F-Class and 5% for E-Class) and efficiency • Extend turndown to lower loads (10+% for F-Class)
Fast Start Program Processes	• Improve plant start-up processes to capture potential new revenue and cost savings • Implement upgrades for Purge Credit to save 12-15 minutes in start-up times for combined cycle plants and reduce start-up times to base load to 10 minutes for simple cycle E-Class gas turbines • No impact on start-up reliability
DLN-Auto-Tuning for Seasonal and Load Variations	• Maintain emissions compliance in response to life cycle degradation, ambient variations, and fuel/Wobbe Index fluctuation • Reduce Lean Blow Out (LBO) trips • Reduce dynamics, extend parts life • Enhanced response timing to changing conditions/demands

TurbineTech.com

DLN PRODUCTS & SERVICES

- Auto-Tuning

- Operational Troubleshooting

- DLN - Tuning, Post-outage or Seasonal (On-site or Remote)

- DLN-1 High Load Auto Transfer

- CDMS (Portable or Permanent)

- DLN Training

TurbineTech.com

OPERATIONAL FLEXIBILITY & PERFORMANCE SERVICES

- Fast Start Program (Any Turbine Model)

- Base Load Performance Optimization

- Load Turndown Optimization

- Peak Fire Operation

- Adjustable Peak Firing

- Cold Weather Optimization

DYNAFLEX PERFORMANCE

TURBINE TECHNOLOGY SERVICES CORPORATION

TurbineTech.com

OPERATIONAL FLEXIBILITY & PERFORMANCE SERVICES

- Fogging/Wet System Optimization

- Control Curve Evaluation and Design

- Plant Performance Assessment and Evaluation

- Plant Performance Testing and Consulting

- Life Cycle AGP Upgrade Evaluation 7F .03 to 7F .04

- Correction Curve Development

CONTROL SYSTEM SUPPORT

TurbineTech.com

CONTROL SYSTEM SUPPORT

- Mark IV, V & VI Troubleshooting, Modification and Maintenance Services

- Start-Up and Commissioning Services

- Remote Access and Monitoring

- Cybersecurity Audits

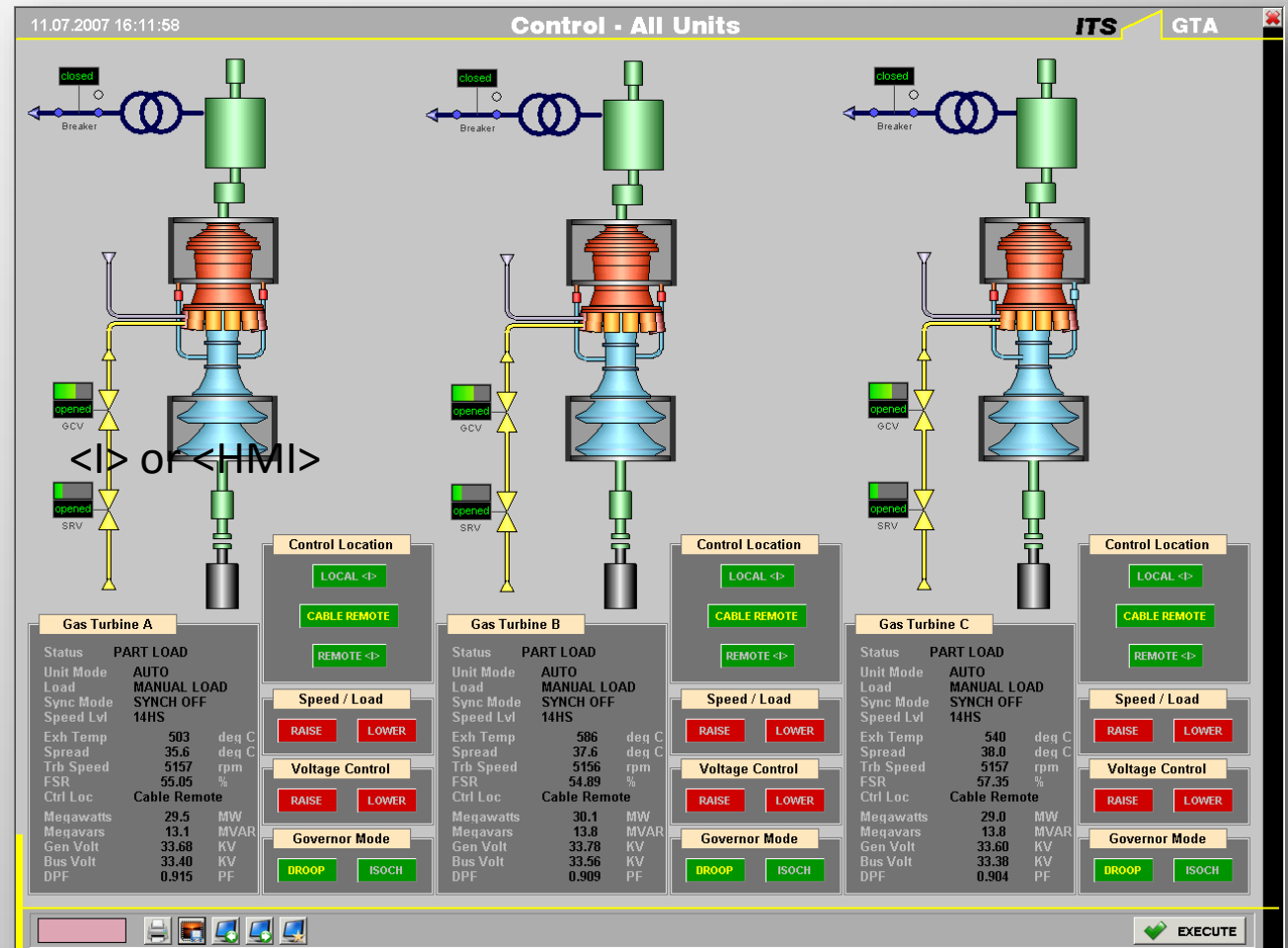- System Upgrades and Replacements

- Parts Support

TURBINE TECHNOLOGY
SERVICES CORPORATION

TurbineTech.com

HMI UPGRADES

TMOS
Gas Turbine HMI

TURBINE TECHNOLOGY
SERVICES CORPORATION
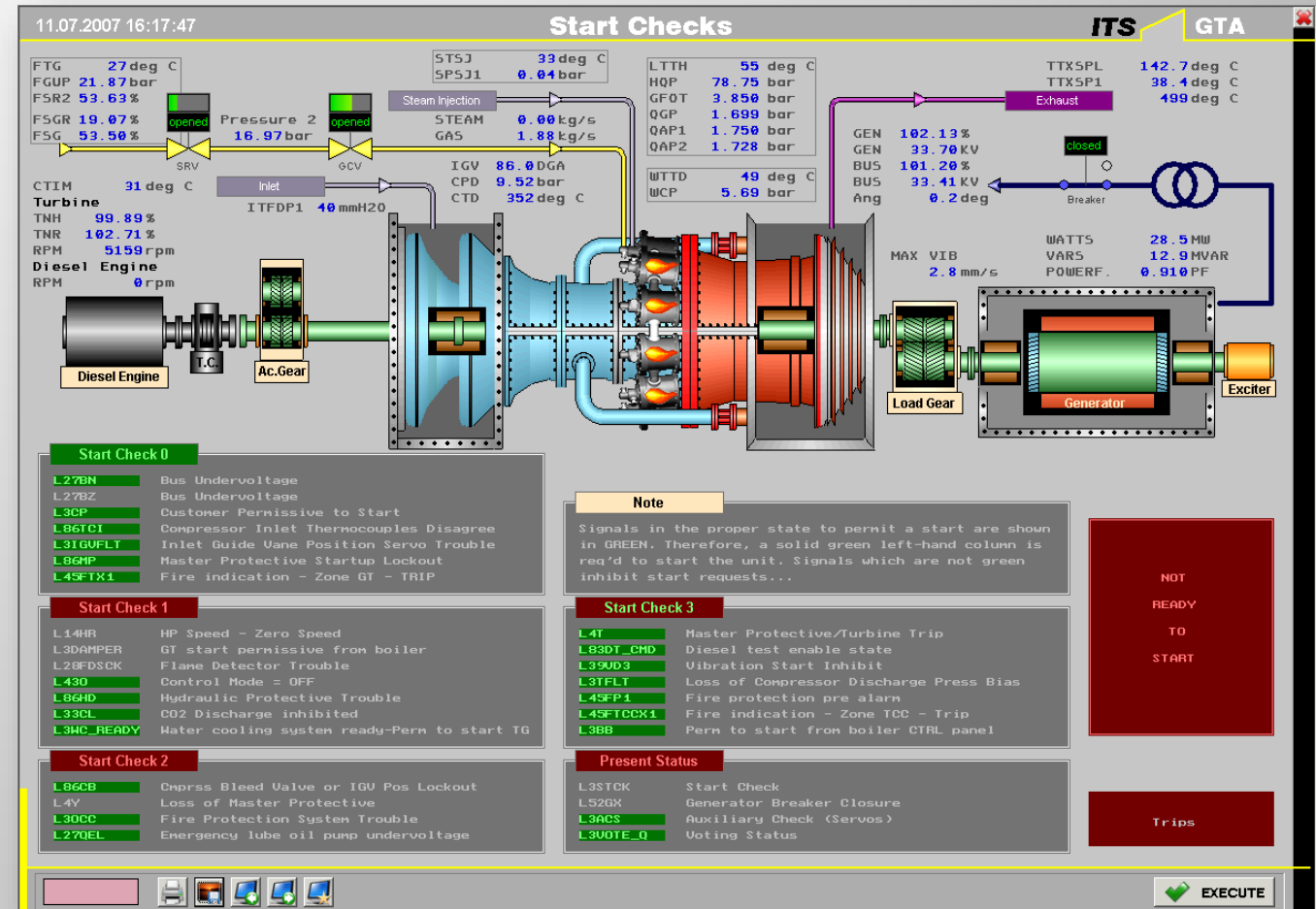
TurbineTech.com

EXISTING <I> or <HMI> ISSUES

- Original system hardware is obsolete.

- Software may not be NERC (cybersecurity) compliant.

- Capabilities are limited

- Inherent software and communication problems

- Not easily expanded

- Not redundant

TTS TMOS HMI

- Plug and Play Replacement, No Unit Shutdown Required

- Simplified Communication Architecture.

- No Proprietary GE Software or Cards.

- Complete System Redundancy

- Readily Expandable

- NERC Compliant

- Cost Effective, Especially for Multi Unit or Multi <HMI> Applications

LODESTAR – TURBINE PARTS MANAGEMENT SOFTWARE

Digital everything includes power plants and utilities.

Lodestar is a technical solution that can gather unprecedented amounts of data about parts and components of your gas turbine.

By weaving systems, data and people together, we create solutions that increase performance across many levels.

PROACTIVE MAINTENANCE PLANNING

It's important to understand the parts history of the machine in order to anticipate individual component conditions prior to the inspection.

MINIMIZE BUDGET/RISK

Better and clearer information on parts life and unit costs reduce inventory requirement, improve planning and reduce operational risks.

CONVENIENT/EASY ACCESS TO DATA

Lodestar is a cloud based program operated through a web browser. It does not require any specific hardware and can be viewed on a phone or tablet.

LODESTAR
Turbine Parts Management

TURBINE TECHNOLOGY
SERVICES CORPORATION

TurbineTech.com

LODESTAR – TURBINE PARTS MANAGEMENT SOFTWARE

BENEFITS

- Projected 16% cost savings from digital systems and processes.

- More fluid workforce… Lodestar is licensed by the unit and not by the "seat".

- Improved levels of innovation

- Engaged in an ecosystem with technology partners.

- Predictable disruptions minimizing downtime.

TurbineTech.com