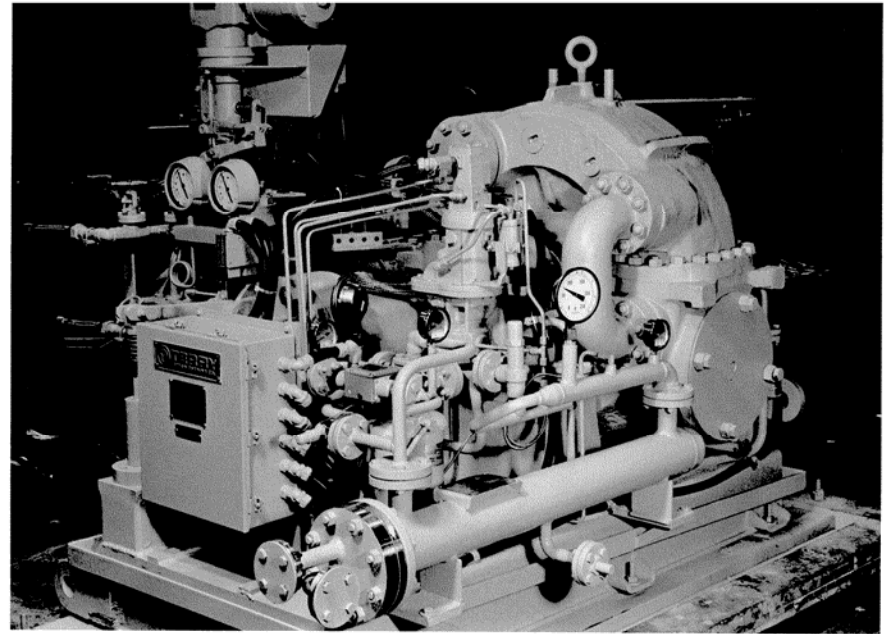
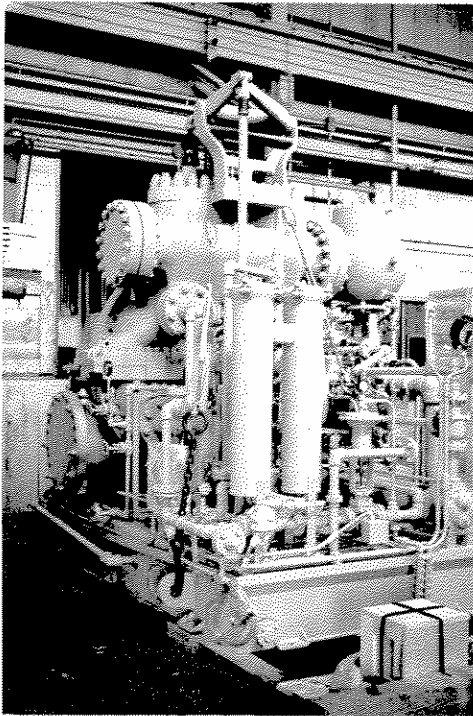


D-R Electronic Governor Conversion Project

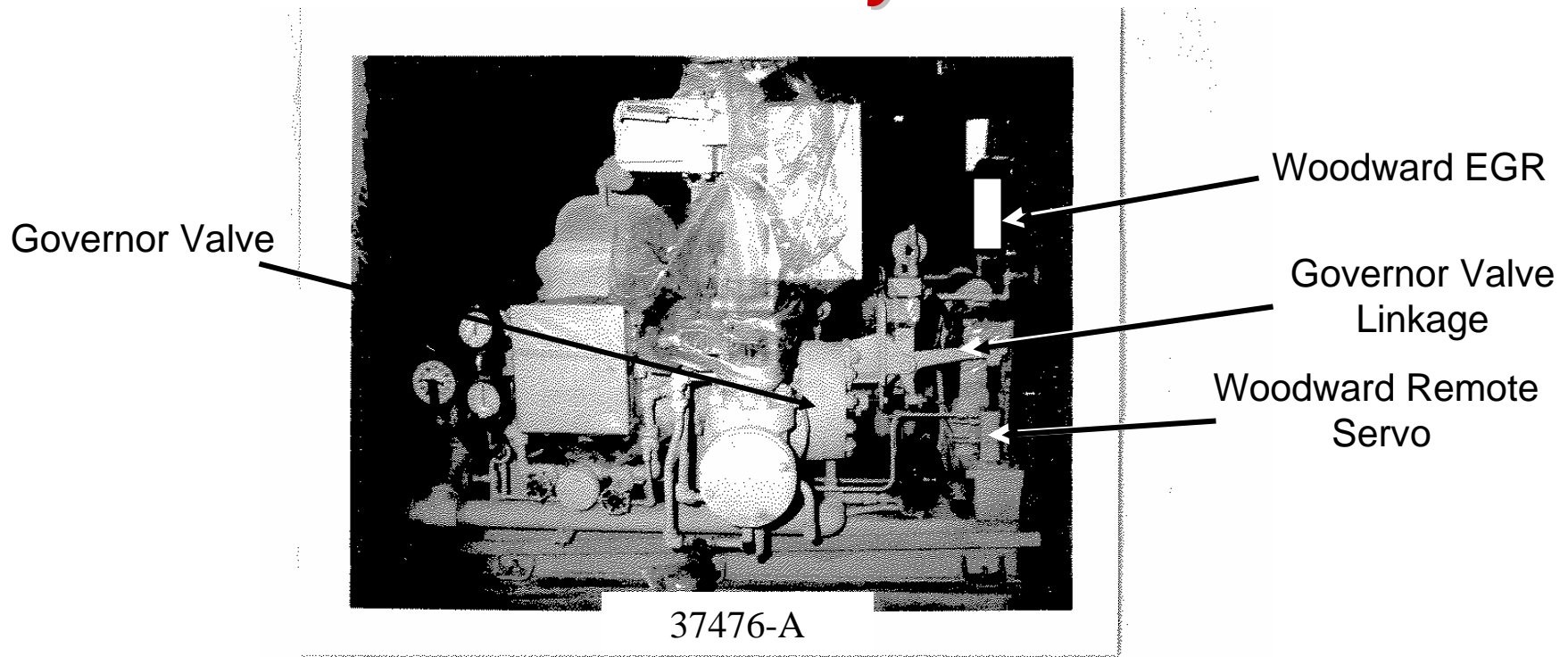


Presented By: Mark Konieczny / Joe Menichino
Dresser-Rand Nuclear Product Engineering
March 2005

Turbine User Base

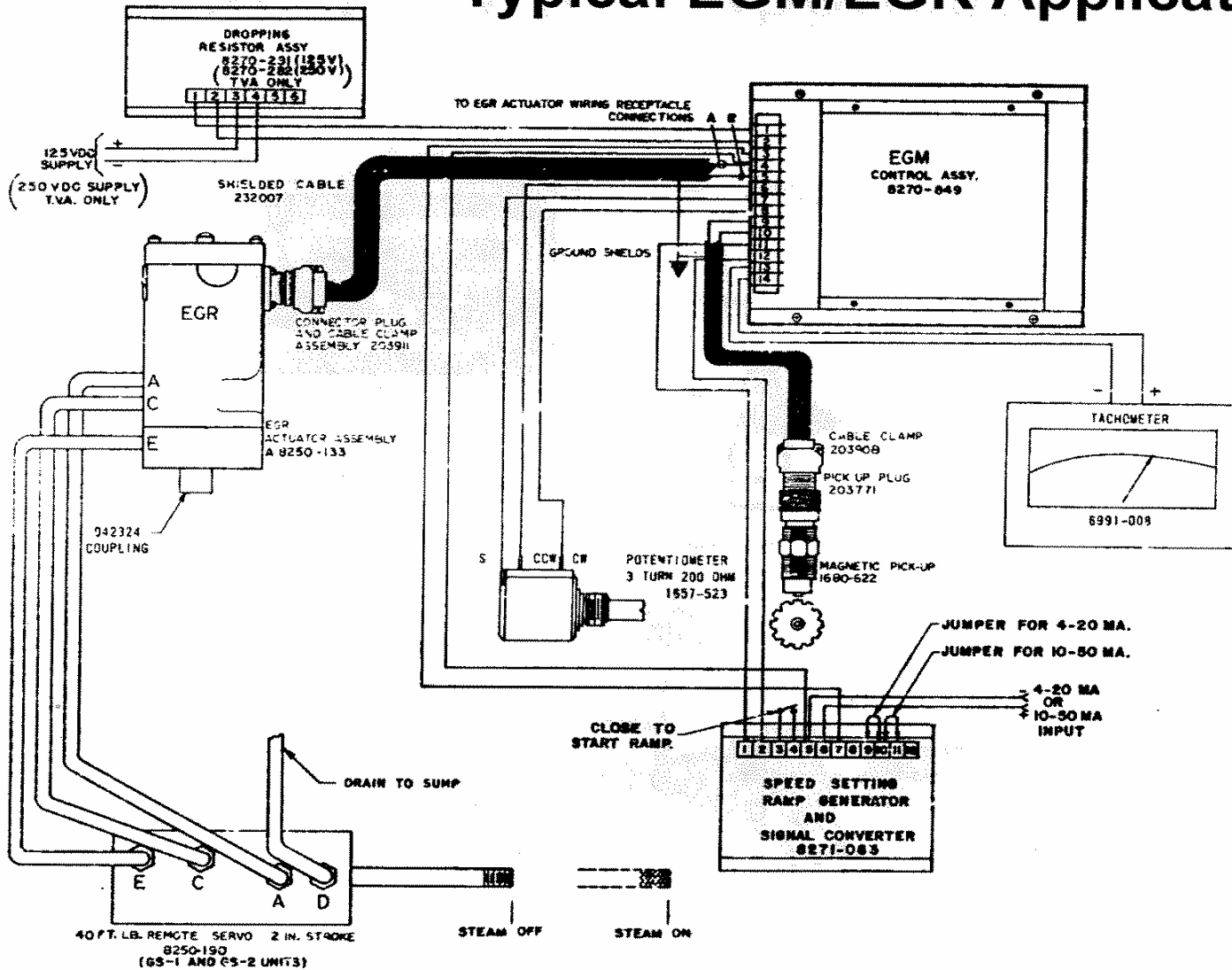
- Approximately 220 Systems, including Aux Feedwater, RCIC and HPCI Pump Drives Worldwide.
- Approximately 200 in USA.
- 140 Electronic Speed Control Systems in Service.
- 20 Nuclear Power Plants, with Electronic Governors, Supported by Marubeni in Japan.

Typical Current Governor Speed Control System



Commercial Nuclear Turbines Presently Control Speed Utilizing Woodward Governor Systems

Typical EGM/EGR Application



Critical Dependencies

Installations depend on:

EGR/EGM Controllers which are slowly becoming obsolete

EGR / Remote Servo is dependent on turbine rotation to provide hydraulic oil pressure to function

D-R Control System Conversion Design Goals

Design Selection and Performance Tests

Complete by 3/15/05

Mild Environment Qualified Unit tested
and ready for sale by the second
quarter of 2005.

Harsh Environment Qualified Unit tested
and ready for sale by the fourth
quarter of 2005.

New Turbine Control System Block Diagram

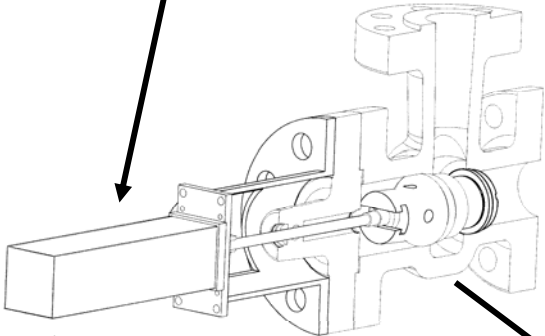
4-20 or 10-50 MA Demand Signal



Magnetic Pickup



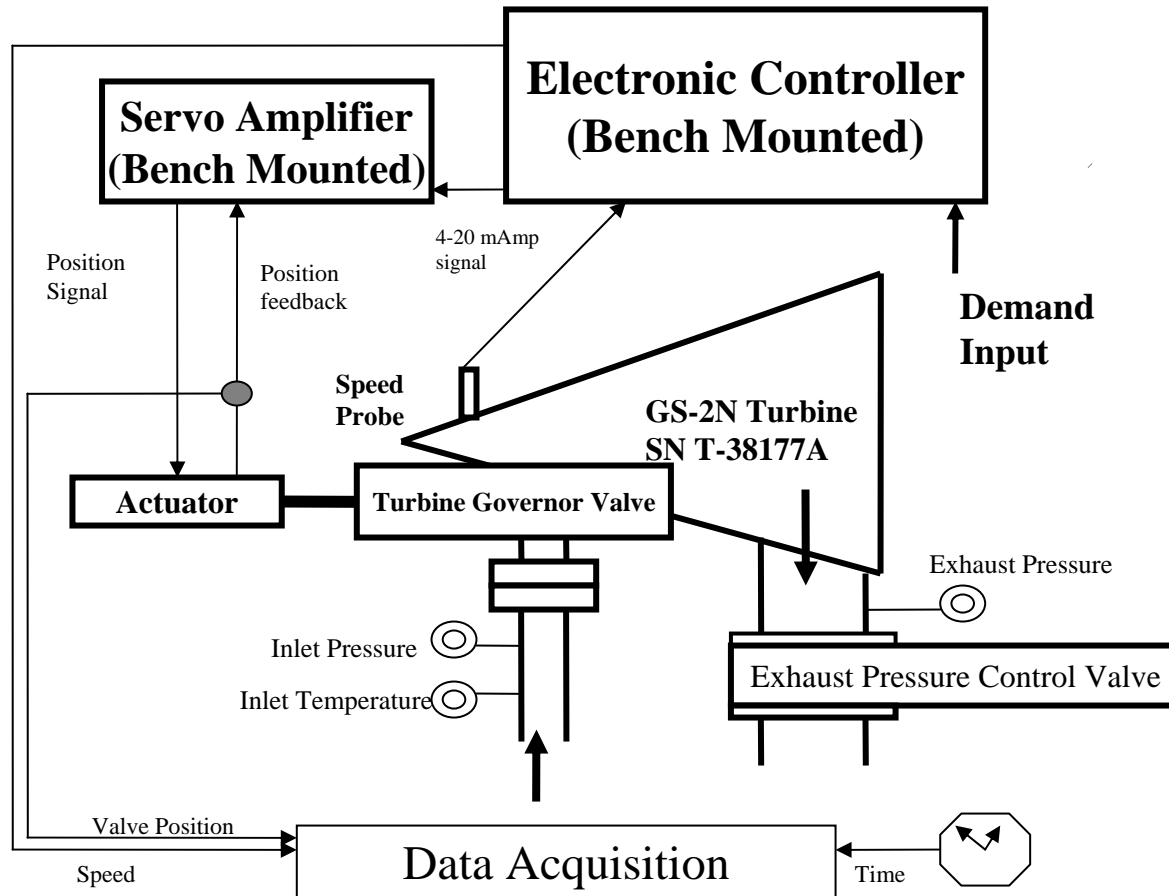
Digital Speed
Controller



Electric Actuator

Governor
valve direct
coupled to
actuator

Digital Governor Setup Schematic



Old and New System Comparison

Existing Woodward System

EGM controller

EGR actuator driven by turbine spiral or worm gears

- Requires Lube Oil from Turbine Hydraulic system

RGSC - Ramp Generator Signal Converter

Remote servo

Mechanical Linkage

Lever Type

Cam Type

125 VDC 3-1/2 to 4-1/2 AMP total power requirement

Optional Dropping resistor

Proposed New System

Digital controller

Electro-mechanical Actuator with driver

- Built in resolver position feedback
- Direct mounted to governor valve stem

125 VDC, 4 AMP (total power requirement)

Eliminated Elements

- Driven EG-R
- Capped EG-R Location
- Remote Servo & hydraulic subsystem
- Mechanical linkage between servo & stem
- EGM / RGSC / Dropping Resistor

New Speed Control System Specifications and Attributes

- 1) Externally configurable via laptop computer
- 2) Goal-120 VAC, 125VDC, 250VDC power supply
- 3) Total power consumption less than 500 watts
- 4) State of the art digital design
- 5) Direct coupled electro / mechanical actuator
- 6) Part 21 Safety related dedication
- 7) Mild and Harsh Environment Qualification Options

Advantages

Start Transient Control: Open or closed valve start options- eliminate start-up over speed trips and associated problems

Actuators successfully used in commercial turbine control and military applications

Direct coupled actuator eliminates linkage components and improves control system response

Remaining D-R Design Activities

- Final Component Selection
- Conclusion of Performance Qualification Test Series
 - In process- see additional data ** trans 0202 15 0209
- Complete Environmental Qualification Test Program **
 - EMI/RFI Test Program \$\$
 - Seismic Test Program
 - Mild Environment Qualification Program
 - Harsh Environment Qualification Program

Questions - Discussion Points

- Operational Qualification Limits actually required by plants?
- Constraints at Plants
- Potential for Plant System Design Changes?
- Time Tables for System Upgrades?
- Customer Questions?

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