DENISON TURBINE REHABILITATION PLANNING

Status Report

Southwestern Federal Hydropower Conference

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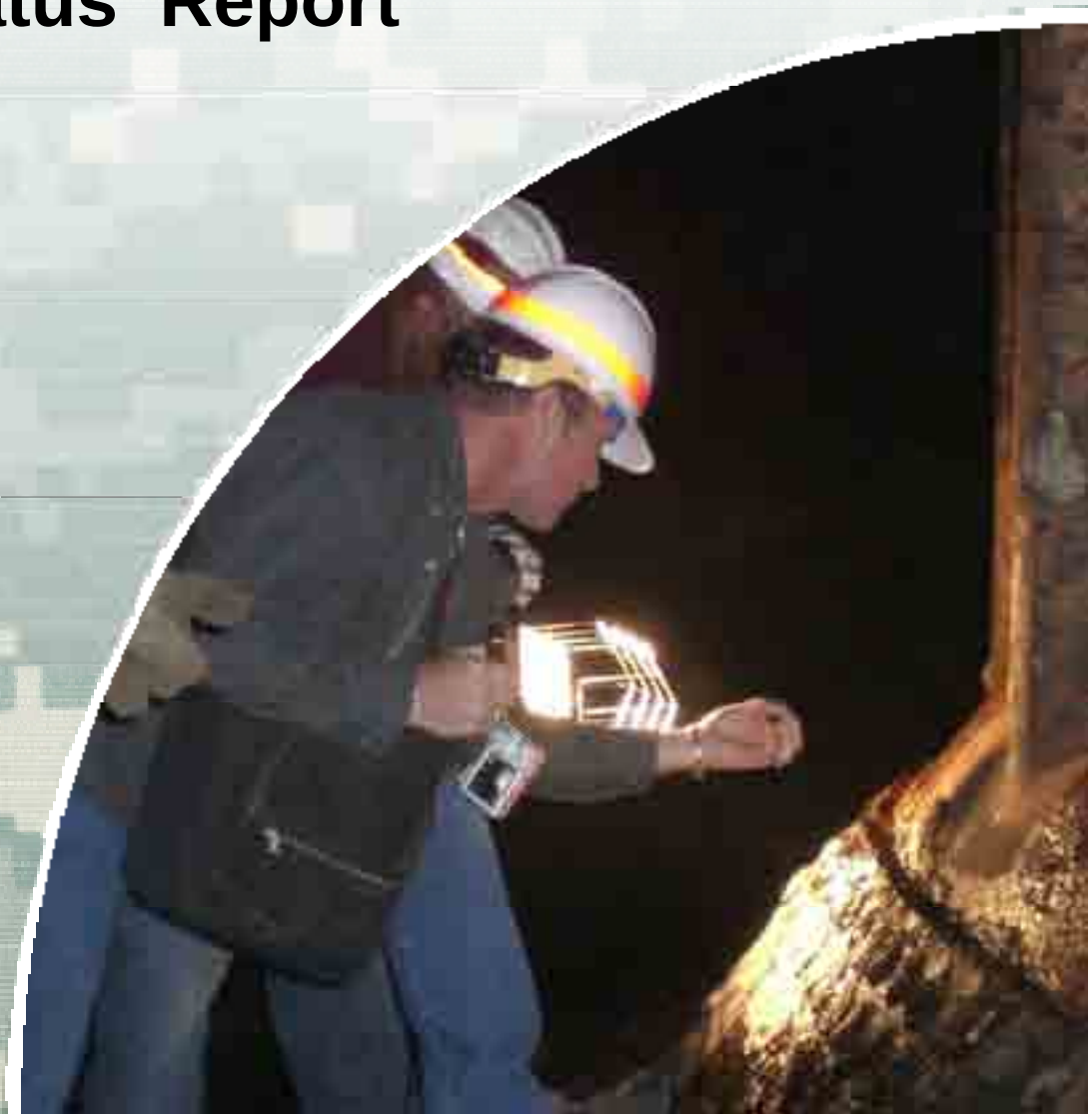


US Army Corps of Engineers

BUILDING STRONG®

Historic Context

Late 1990's: Index Testing, 4% Efficiency Decrease

Early 2000's: Generator Uprate Study

Mid 2000's: Generator Rewinds Completed
Capacity increase from 42.3 KVA to 53.5 KVA

Unit Condition

Units installed in late 1940's

Badly Corroded Wicket Gates, Facing Plates, Stay Vanes

Excessive Wicket Gate Leakage
- Brake Speed Switches reset to compensate

Runner Blade Entrance Edge Cavitation

Spiral Case and Stay Ring

Spiral Case and Stay Ring (2)

Stay Vane Leading Edge Corrosion

Facing Plate and Wicket Gate

Runner and Wicket Gates

THE STIMULUS

- American Reinvestment and Recovery Act

  ARRA, “The Stimulus”

- Tulsa District received funding to write P&S
  - Put People to Work—consultant writes the spec
  - HDC defines scope, monitors and reviews consultant’s work

The Process

- Perform a Power Output Study
- Identify the scope of the Rehabilitation
- Write the Specifications to COE standards and requirements

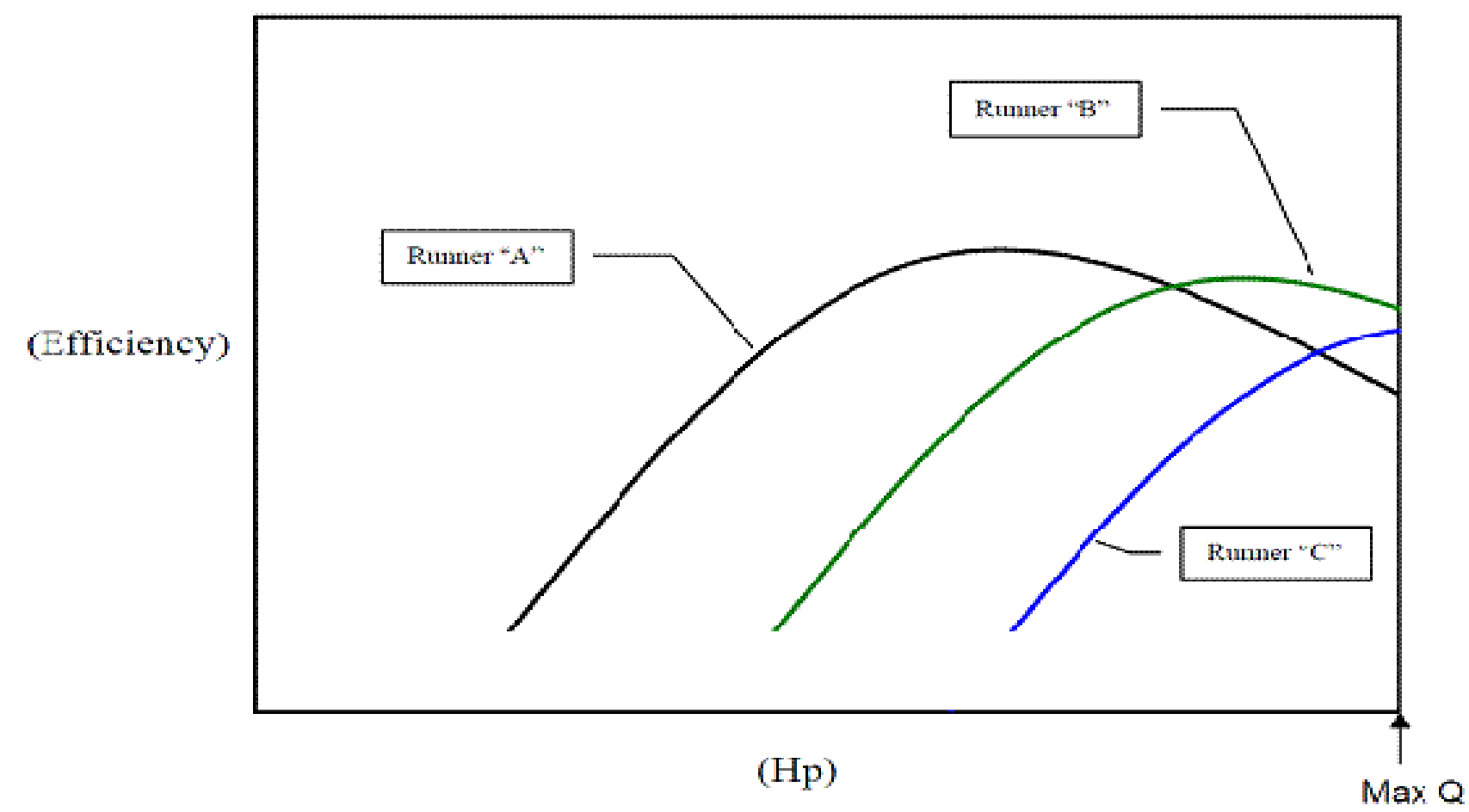
Power Output Study

- Investigate the Past, but define for the Future
- How much water is available?
- What are the downstream flow restrictions?
- Identify mechanical and electrical output limitations
- Identify how the turbine is used
  - Peaking, base load, line regulation, load following, other

Answers for Denison

- Peaking Machine
- No Functional Downstream Flow Restriction
- Generator Study identified mechanical and electrical limits
- Goal: Match Turbine output to capacity of rewound Generator.

Runner Design Parameters



Turbine Design Decision

Trade-off's of power vs. operational flexibility

Revenue analysis informs the decision

Cost – Benefit analysis complete in July

This is where we are in the process right now.

Going Forward

Plans and Specifications completed in Mid-September

Going Forward (2)

Decision to fund / not fund

Event Durations

- Solicitation Process—4 months
- Award Process—4 months
- Model Test—12 months
- Turbine Runner Manufacture—18 months
- First Unit Field Work, including rehab of existing parts—10 months
- Second Unit Field Work, including rehab of existing parts—10 months

QUESTIONS ?

Turbine Design Decision

Three Hydraulic Design Options

Max Efficiency at Max Power (pure peaking machine, single point operation)

Max Efficiency at 80% of Max Power (normal design with a broad operating range)

A compromise—Max Efficiency at 90% of Max Power