Reload, Retune, Retest
“Refresh Your Simulator”
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PRO-FORMA REVENUE – ~$100M (LTM) \(^1\)

- **By Segment**: Nuclear Training & Consulting 60%, Performance Improvement 40%
- **By Industry**: Nuclear 79%, Fossil 13%, Process 4%, Engineering Services 2%, Other 2%
- **By Geography**: North America 93%, Europe 4%, Asia 3%
- **By End-User**: Utilities 75%, Energy/Other 12%, OEMs 5%, EPCs 5%, Government 3%

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\(^1\) Pro forma for the Absolute Consulting acquisition on September 20, 2017
Where we are headed...
Overview

- Why is “refreshing” your simulator so important?
- Defining Reload, Retune & Retest (Differentiating)
- The “triangle” of players
- The process steps are...
- Considerations & Conclusions
Why Refresh Your Simulator?

Some obvious reasons, some less so

• Post commissioning update to “as built”
• Significant “deltas” to actual plant
• DCS software upgrade “evergreen”

Need to reflect current plant tuning and performance
Why Refresh Your Simulator?

Some obvious reasons, some less so

• ANSI/ISA 77.20
  – Maintain design control to “Ensure that the simulator meets the training objectives.”
  – Test when “...significant simulator configuration or performance variations...”
Why Refresh Your Simulator?

• Simulator meets initial (or current) training needs (Trainer/Ops driven)
  – First time simulator buyer?
  – Prepare for future needs?
• Major DCS version upgrade on real plant controls (I&C Engineer driven)
Why Refresh – Recent Examples

• Software upgrades
  – DCS software upgrade
  – Modeling software upgrade
  – Operating system change

Generally requires a DCS reload and retesting with IC reshoot
Why Refresh – Recent Examples

• Significant change to operating mode
  – CCGT added OEM apps
  – Unit Fast Start
• Gas Conversion of unit(s)
• Upgraded to gray scaling HMI
• Upgraded turbine or AVR controls
• BET changes
  
  Some of these were significant model changes or additions
Defining Reload, Retune, Retest

• The word “retune” can get misapplied or misinterpreted

• What is it & what is it not?
  – Match critical parameters & plant system performance (Yes)
  – Remodel a plant system (?)
  – Scope change new models or fidelity changes (No)

• Definition in simulator standards
  It is a “process” that can be confusing, depending on who you are talking to
The “Triangle” of Players

It may take two to tango, but it takes three to refresh your simulator

• DCS Engineer
• Simulation Engineer
• Test Operator (vs nuclear)
• Others: when they’re needed, they are really needed (e.g., System Analyst, Plant I&C Engineer, Virtual DCS R&D, Senior Plant Operator, etc.)
The Reload Process

Collect running unit DCS files and install on the simulator virtual DCS

- What is outside basic scope? Does not typically include adding new virtual controllers, networks, new op workstations, exceeding licensed IO limits, etc.
- Post commissioning vs “evergreen” refresh
The Reload Process

• Prep work before loading on virtual DCS is specific to DCS vendor
• DCS and simulation engineers prove communication
• Post reload DCS support critical to schedule
  – Logic & graphics questions
  – Virtual DCS issue resolution
The Retune Process

Simulation engineer(s) adjusts and “tunes” plant systems models to meet revised performance data

• When, who, how done, what data needed, how long for this step, after this step support
The Retune Process

- Data retrieval
  - New IO list with proper data fields (tag changes, adds, deletes of points/names/addresses)
  - Heat Balance especially
  - PI data especially (100% & other load points per contract)
  - Transient data via trends
  - P&IDs/One Lines if changes known to a system
  - List of discrepancies and known issues
  - Existing model files
The Retune Process

• Analyze IO, DRs, & data then make model updates (vs model additions)
• Crank through the startup procedure
• Limits to IO changes/adds/deletes?
• If limited data
  – Proposal for “x” man-weeks support & travel
  – Options for additional weeks & travel
The Retest Process

Test operator, simulation engineer and DCS engineer reshoot IC’s and evaluate performance of the simulator

• When, who, where, how done, what data needed, how long for this step
The Retest Process

• Test operator formally needed after simulation engineers do initial updates

• Unit startup & shutdown
  – Reshoots ICs
  – Evaluates performance

• Simulation engineer tries to keep things moving while operator meticulously tests

• Consistent test operator or “leader”
The Retest Process

• Critical parameters matched with PI data
  – At contract agreed load(s) (e.g., full load)
  – Test transients (runbacks, certain trips)
  – MF’s spot tested as schedule allows

• Essentially FAT/SAT with document sign off
Schedule & Budget

• Where should a refresh be done?
  – Plant site is the default choice
  – DCS or simulation vendor facility (Evergreen)
  – Use of remote testing (VPN, who is remote?)

• Overall schedule – what impacts it?
  – How many years since last change
  – Degree of controls changes
  – Has the software versions been maintained
  – Test operator unavailable when needed
Schedule & Budget

• How to budget?
  – F(IO delta, DCS delta, data/HB delta, etc.)
  – Equalize via placeholder in spec
  – Future budget proposal

• How to treat surprises:
  – Unknown plant equipment or system changes
  – IO changes beyond the retune proposal
  – Local controls/interlocks changes (not DCS)

What info your sim vendor wishes they had when pricing...
Suggestion: Logging DRs

DR System big help if used by plant

• An online system where users can be easily added
• Different sections available for different types of discrepancies
• Severity of discrepancy can be assigned
• Discrepancy can be assigned to people, commented on, and edited
Discrepancy Reporting (DRs)

![Image of a screenshot of a software interface showing Discrepancy Reporting (DRs) with a table and a view of the interface layout.]

### Viewing Issues (1 - 50 / 150)

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Discrepancy Report Example

**View Issue Details**

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**Summary:** warm-up oil supply vs return flow calculation problem

**Description:** Please see explanation on attached screenshot.

There is an analog transfer block that sets the supply oil flow to 0 when the trip oil valve is closed. This, by itself, is harmless and also makes sense.

However, the problem is that the return oil flow is not similarly affected so the flow there is nonzero.

When the difference of these flows is taken, a negative number results. There is nothing in the logic to apply a lower limit of 0 and the negative number is subtracted (but subtracting a negative number becomes addition) from fuel flow on subsequent pages which causes the coal flow demand to back off.

To resolve this, I moved the analog transfer block to make the difference between supply and return oil flow equal to 0 when the supply valve is closed.

This change is already active in the simulator.

**Steps To Reproduce:**

**Additional Information:**

**Attached Files:**

warm up oil flow miscalculation affects coal flow demand.png (80,215) 2016-10-28 17:56

Conclusion – Final Thoughts

• Retune, refresh or evergreen?
• Duplicate system (plant training continues)
• Trainer may need to update his training documentation, lesson plans, instructor guides, student evaluation criteria, etc.
Conclusion – Final Thoughts

• This process should be integrated into the next ANSI/ISA 77.20
• Communication is critical
Thank you!

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