

Revised 6/25/07

Corps Hydro-Optimization Team Meeting
Minutes
May 16, 2007 Portland, OR

Attendees:

Charlie Allen, Corps HDC
Scott Bennett, Corps NWS (*phone*)
Ken Earlywine, Corps NWP
Gabrielle Foulkes, BPA
Ed Miska, Corps HDC
Tom Murphy, BPA (*co-chair*)
Richard Nelson, Corps HDC

Dan Ramirez, Corps HDC
Gerald Sauve, Corps NWW
Lee Sheldon, Corps HDC
Glen Smith, Corps NWP
Robert van derBorg, Corps NWP (*co-chair*)
Rodney Wittinger, Corps HDC

Introductions (*Exhibit 1*)

Tom Murphy reviewed the agenda. The minutes from 1/23/07 were accepted as written.

Type 1 (unit) optimization (*Exhibit 2*)

T1 optimizer/Winter-Kennedy taps automatic flushing system (*Exhibit 2*)

Dan Ramirez explained the HDC proposal for a T1 box that will provide W-K flushing control. He explained the difference between a steady state proposal and the old system. This proposal will create an equivalent box with improvements. Will the software be developed in-house or externally?

Timeline and tasks

FY 07 - HDC would develop and install a T1 box for a single unit (MCN U9), and collect a data set from which the cam curve can be developed. The unit will be under AGC and collect data during steady state, then it will be perturbed by adjusting the blade angle ± 1.5 degrees, and then achieve steady state again under a three day cycle. The goal is to validate the equipment and process of collecting the data. It will verify whether manual collection of data = index test data under two conditions – with and without fish screens. The initial focus is on the Walla Walla District because the units have upgraded 3D cam controllers in the governors.

FY 08 – index test – will be a verification of the data set and finalize the design of the T1 collection box and make sure that it will work for the entire project (not just one unit). During the year, HDC hopes to validate the data, and complete the transformation from proof of concept to prototype. They can be designing software now while waiting to collect and analyze the data. By the end of FY 08, there should be data sets that need reducing.

Following FY 08, the proposal is to propagate the testing and continue at the plant level looking at different units, as well as all units.

For the long term, do we need to hire someone to track all the data and keep it current and provide quality assurance? Someone needs to check to make sure that all cam curves are kept up to date and provide configuration control. This is a bigger workload than just managing index testing although some aspects will be automated. The work could also include benchmarking and system improvements. HDC will look at how to resource this.

There was a brief discussion of hardware and PCs, with screens that will be configured for each plant.

There was a discussion of the relationship of this work to the digital governor replacement program. The governor team is looking at lower Columbia projects for the near-term because new governors would include an upgraded controller. The governor team is working on specifications that will accommodate the optimization.

Follow-up actions:

- The Project Manager for T1 (Ken Earlywine) will put together a detailed milestone chart for the project on the Snakes and MCN initially with decision points to show critical paths and what work can be started now. Due 6/15
- Richard Nelson will provide a copy of the digital governor replacement program BCOE to Ed Miska for review.
- HDC will explore how to resource a quality assurance position

Blade angle measurement

Charlie Allen reported that mechanical work is going well and is on schedule (it needs to be ready by 9/30/07 to match the unit outage). The IDIQ contract is being negotiated. The date for completion of reassembly of JDA Unit 16 is Oct-Nov 2007 (delayed from July 2007). The project will be able to start taking measurements/monitoring as soon as the unit is running.

Software rewrite

Robert van der Borg reported that all work will be done in NWW, so the subagreement will continue to show line items. The cam function will be moved out of GDACS into a separate controller. Then it would be appropriate to ask the GDACS maintenance team (GMT) where to propagate the T1 optimizer next so that work can be scheduled in FY 08. Money will be reprogrammed and a statement of work will be generated by HDC for software modification, buying PLCs, etc.

Follow-up action:

- Robert van der Borg will put together a paragraph describing the T1 optimizer work so that money will be in place by 6/15.

Type 2 (plant commitment) optimization (Exhibits 3 and 4)

Ed Miska reviewed a list of PPEI optimizer Type 2 work that is underway in FY 07 (Exhibit 3). They will be developing basic functionality for GDACS operators by taking basic algorithms and cleaning them up so that the system can send correct information. ICCP will be complete by June 2008. Robert van der Borg would like to see milestones to show progress towards completion by ACSI by 9/30/07.

Exhibit 4 describes the future work for FY 08/09. HDC will be focusing on dynamic optimization that looks into the future for unit allocation while minimizing control changes. Eventually optimizing will use real-time feedback to reallocate and address short-term unit changes compared to value. Dynamic optimization depends on accurate feed forward being available, which BPA is working to make more accurate. BPA is looking at software to get better load forecasts within the hour, and the duty schedulers are working with a new short-term simulator to set out-hour (1 to 5 hours) setpoints.

The Corps can assume that feed-forward will be available, so they should keep working on planning work and design. It is important to include manual "what if" scenarios for operators. The accuracy of feed forward will affect the level of unit commitment. Future phases of dynamic T2 will depend heavily on the accuracy of BPA's feed forward.

Relation of T2 and NRTO – Tom explained that the interface aspects have been scaled back, although the ICCP protocol can share information between BPA and projects. T2 can perform all the solutions needed for unit commitment decisions at each project.

T3 (the systemwide analysis) is used at BPA to send out setpoints and forecasts.

Ed reviewed the issues relating to control activity, specifically looking at JDA Unit 16 which suffered from failing pins and linkages, noting that one effect can be too much mechanical wear and tear on the units. HDC is looking for ways to decrease the number of control activities from GDACS by changing the algorithms and sending intelligent signals. The capital workgroup (Mark Dasso) is looking at the issues of control and optimization and identifying what's best for the unit. Is there a maintenance issue about how to prevent failure from fatigue? HOT is interested in knowing whether the deadband can be increased.

Ed recommends that BPA (Power and Transmission) and the Corps establish a sub-team to develop a plan on what the agencies want to implement for T2 in future optimization for better optimization algorithms that balance both generation (mechanics) and economic (control costs) optimization through refinements. Ed will prepare a PMP and flow chart so that HOT can review proposals.

Follow-up action:

- Ed Miska will take the list of FY 07 work (Exhibit 3) and identify the work by ACSI tasks and HDC support to show which group is responsible for specific tasks and the schedule, along with milestones to show progress towards completion by ACSI by 9/30/07.

Smoothing curves

Charlie Allen reported that HDC found that curves reported to GDACS tables were in error. The data points were correct, but the tables for the cam curves were wrong by about .75% (25 MW). HDC is working on the fix which will take 8 hours for each of the 26 families. The error does not affect 1% operating limits but will require new discharge tables, with and without screens, for each family. The GMT will enter the data in the priority order requested by BPA based on economic value (starting with the lower Columbia River).

Index testing at JDA

Dan Ramirez stated that index testing is being reprogrammed and moved to MCN for a verification test

Market survey of method to calibrate W/K (absolute flow measurement) (Exhibits 5-9)

Exhibit 5 - Lee Sheldon reviewed the benefits of unit commitment. The graphs at TDA Units 1-14 show "perfect" unit commitment and economic dispatch to show the best and worst the powerhouse can do. Lee's conclusions: knowing absolute flow provides 1.25% improvement on powerhouse efficiency over random unit commitment. Lee described further analysis that he will be undertaking.

Exhibit 6 – Lee has mailed a Notice of Interest for publication.

Exhibit 7 – market survey of methods

Lee reviewed HDC's market survey, along with the goals and plan for the project. The feedback resulted in 5 candidate methods – including new ideas, improvements in existing methods, or adaptation of existing methods from other industries.

Exhibit 8 – Doppler basics

Exhibit 9 – Force beam elevator concept - described by Ken Earlywine

Follow-up action:

- Tom Murphy will send Lee Sheldon a spreadsheet with unit utilization data for calculating MW.

Machine 3-D cam operational survey

Charlie indicated that little support has been requested at this time. Will there be a report? What are the future directions? Calvin Hsieh currently files a report for each project. Jerry commented that the work should be covered under annual maintenance as indicated in the O&M manual.

Follow-up action:

- Charlie Allen will present a summary of machine 3-D cam operational survey findings at next HOT meeting.

Briefings from Rod Wittinger (Exhibits 10 – 15)

Turbine wetted surface rehabilitation (Exhibit 10)

Rod led a discussion of surface roughness effects on Kaplan turbine performance. His conclusion was that there was up to 3% performance degradation with a roughened surface on the runner. He summarized the next steps to define roughness and conduct a field test of coating systems with a spray-on compound.

Fixed blade or adjustable blade Kaplan repair strategy (Exhibit 11)

Rod reviewed recent pin failures at BLH turbines and the techniques to fix them. Should the pins be replaced before failure? Are there certain techniques that work better than others? Should the blades be fixed (welded in place) rather than adjustable? The team also looked at means of extending the remaining life of the blade adjustment mechanism (e.g., minimizing control operations). Funding for the study will be expense from the capital workgroup.

Proof of concept proposal for stay vane wicket gate gap closure (Exhibit 12)

There is a potential for cost sharing with HOT and the fish Turbine Survival Program. Should these improvements be made during future maintenance outages by filling the void between the stay vane and wicket gate with an extension? Rod will propose a shared project that could benefit both programs.

Computational improvements to existing scintillation data sets (Exhibit 13)

Rod identified the sites where data is collected, and described a proposal to remove, account for, or avoid the causes of turbulence distribution irregularities. New algorithms show potential improvements for scintillation measurements. The proposal is for additional studies to determine effects, which may require a look at old test data. HDC will propose funding for contractor and HDC to make the computations to improve the accuracy of flow data. HDC would identify which families should be recomputed.

Follow-up action:

- Robert van der Borg and Tom Murphy will identify which family should be recomputed and determine the costs of making computational improvements to existing scintillation data sets.

Potential collaborative efforts combining HOT, CEATI-HPLIG, EPRI, ASME, and others for leveraging PPEI funding (Exhibit 14)

Rod also summarized other organizations that are involved in R&D in absolute flow, Kaplan surface roughness, turbine rehabilitation, and optimization. Where and how does HOT (both Corps and Reclamation) fit in? Should we be sending people to see what kind of tests are being done?

Cam, 1%, and Flow tables (Exhibit 15)

Rod reviewed the process for coordination and approval for implementing updated tables. After approval, there are a number of steps in place for implementation, but not all notifications are happening in a timely manner. In the final step, HDC does a site survey to check that correct implementation of tables has been accomplished.

Status of subagreement

Robert van der Borg indicated that all new numbers are needed by June 15.

Action items (*Exhibit 16*)

The old action items were not reviewed and are generally covered in the discussion above.

Next meeting

The next meeting of the Corps Hydro Optimization Team will be held on **Tuesday August 14, 2007** (possibly in Walla Walla). Charlie Allen will present a summary of the machine 3-D cam operational survey at the meeting.

LIST OF FOLLOW-UP ACTIONS

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