

Typical Simulator Change: Hardware +
Software

Work Request to Address Simulator Hardware Changes



SWR67920 EC 118358: Replace obsolete GTTM with SmartView paperless data acquisition system installed

Sub-tasks: SWR73100-S (outstanding) SWR73250-S (installed) SWR73251-S (installed) SWR73258-S (installed)

Line Of Business: PA
Project/Flag: OM&A/none
Major System: Control Panel / Room (USI: 64121 - TR-410)
Job Type: Station Change
Platforms Affected: FS,DT **Software Required:** y

Urgency: 7 (Improves Product)

Direct exercise impacts: none identified

Raised By: Ledger, David

Reviewed: Paterson, Bob

Assigned To: Yang, Jerry **Effort:**280 hrs est ,224 hrs act

Simulator Installation: Q3 2015 **Work Started:** n/a **Station Installation:** future

Offered By: Yang, Jerry (Date: 2016-07-15)

Accepted/Rejected By: (not accepted or rejected)

Rejections: 0

Lesson Plan Reference File: none

Storepoint Reference File: none

Document Reference File: none

Problem Description:

The Generator Turbine Temperature Monitoring (GTTM) is obsolete and in need of replacement. This EC affects 64121-TR410 on MCR panel 3B2. Perform same replacement in simulator.

Additional SWR's will be needed for virtual panel update and possibly modeling when EC details are settled.

Manufacture's manual available (I don't know for how long) at
"\\corp.opg.com\Pickering\Modifications - Pickering A\Master EC's\MASTR-118358"

Review - Comment:

By: Paterson, Bob on date: 2012-11-14

Need to get new manufacturer info, manual and investigate costs

Assign to Yang, Jerry - Comment:

By: Paterson, Bob on date: 2012-11-14

Investigate new manufacturer equipment

Additional comment:

By: LaPointe, David on date: 2012-11-15

Contacted Sandi Roy. The system will be installed in outage "1341", but there doesn't seem to be an indication when this is: probably spring. This seems a very short and unlikely project time frame. John Fagan is reported as the correct contact.

Additional comment:

By: Yang, Jerry on date: 2013-01-10

According to email communication with John Fagan, the station installation schedule is as following:

Plan on installing U4 in September 2013

Plan on installing U1 in September 2014

The device CatID is 668110.

Review - Comment:

By: Ledger, David on date: 2014-03-24

Passport shows this EC as ACTIVE since January 28, 2014.

Review - Comment:

By: Paterson, Bob on date: 2014-03-27

Need to Obtain information and costs for implementation. Most likely physical fidelity is all that is required to met current training requirements.

Assign to Yang, Jerry - Comment:

By: Paterson, Bob on date: 2014-03-27

investigate

Additional comment:

By: Ledger, David on date: 2014-04-01

FYI:

Child MOD-DSGN 125755 shows as APPROVED as of April 1, 2014 in Passport.

Solution:

By: Yang, Jerry on date: 2016-07-11

Pkauzf.c was created to handle communications between the SCS and the GTTM emulator.

Technical Details:

By: Yang, Jerry on date: 2016-07-11

Installation Instructions:

By: Yang, Jerry on date: 2016-07-11

Solution:

By: Yang, Jerry on date: 2016-07-11

Initial version needs more works. Another one will be offered later.

Technical Details:

By: Yang, Jerry on date: 2016-07-11

Installation Instructions:

By: Yang, Jerry on date: 2016-07-11

Solution:

By: Yang, Jerry on date: 2016-07-15

Added power failure for the GTTM.

Technical Details:

Attached Documents: none

Software Changes:

Work Package:none

First Release:pa20160729

SDB changes: none initiated

Change #35696 (2016-07-11) Releases: pa20160729 pa20160729 pa20160729

Installed: PA:enpascs2 by Goodhand, Michael (2016-09-06)

Files...

... //pa2/dev/src/module/Makefile#43 edit
... //pa2/dev/table/module_table.dat#69 edit

Change #35697 (2016-07-11) Releases: pa20160729 pa20160729 pa20160729

Installed: PA:enpascs2 by Goodhand, Michael (2016-09-06)

Files...

... //pa2/dev/src/module/pkauzf.c#1 add

Change #35720 (2016-07-15) Releases: pa20160729 pa20160729 pa20160729

Installed: PA:enpascs2 by Goodhand, Michael (2016-09-06)

Files...

... //pa2/dev/src/module/pkauzf.c#2 edit

Test Recording System Information:

Recommended tests: none

Additional tests: none

Work Request to Address Simulator Software Changes



SWR73100-S The Generator Turbine Temperature Monitoring (GTTM)
Software Modeling

outstanding

...sub-task of SWR67920

Line Of Business:	PA
Project/Flag:	OM&A/none
Major System:	Models (USI: 64121)
Job Type:	Scope Change
Original Job Type:	Turbine
Platforms Affected:	FS,DT
Software Required:	y

Urgency: 7 (Improves Product)

Direct exercise impacts: none identified

Raised By:	Yang, Jerry
Reviewed:	Deljouravesh, Rama
Assigned To:	Ho, Thomas Effort: 280 hrs est ,403 hrs act
Simulator Installation:	Q3 2016 Work Started: n/a
Offered By:	Ho, Thomas (Date: 2016-07-10)
Accepted/Rejected By:	(not accepted or rejected)
Rejections:	0

Lesson Plan Reference File:	none
Storepoint Reference File:	none
Document Reference File:	none

Problem Description:

The Generator Turbine Temperature Monitoring (GTTM) is obsolete and in need of replacement. This EC affects 64121-TR410 on MCR panel 3B2. Perform same replacement in simulator.

Additional SWR's will be needed for virtual panel update and possibly modeling when EC details are settled.

Manufacture's manual available (I don't know for how long) at
"\\corp.opg.com\Pickering\Modifications - Pickering A\Master EC's\MASTR-118358"

Sub-task description:

By: Yang, Jerry on date: 2016-02-16

This work request is for software engineers to implement software modeling that drives GTTM emulator. The emulator hardware is currently under development. Generator turbine temperature data is required to feed into the monitoring display.

Additional comment:

By: Goodhand, Michael on date: 2016-02-17

Attached Manufacture's manual in sections...

Review - Comment:

By: Paterson, Bob on date: 2016-02-17

Station Change was to install a computerized GTTM system to replace the old paper recorder. This is a scope change for the simulator since training was not previous required on this device for the

last 40 years but is a requirement now due to a station incident. Scope of Modeling software will need to be increased to match.

Assign to Deljouravesh, Rama - Comment:

By: Paterson, Bob on date: 2016-02-17

Scope of Modeling software will need to be expanded for GTTM. Inputs from the DCCs may be modeled already.

Assign to Paterson, Bob - Comment:

By: Deljouravesh, Rama on date: 2016-02-19

For Thomas.

Best approach would be to scale the FPSS reference temperature distribution by the loss terms/cooling. At this point there does not appear to be a need for a more detailed simulation of the underlying process. Post implementation testing would be needed to confirm this.

Assign to Ho, Thomas - Comment:

By: Paterson, Bob on date: 2016-02-22

Please implement model and virtual panel pages for summer outage

Solution:

By: Ho, Thomas on date: 2016-05-18

Extend the size of the I_AND_C_MODEL CDB section

Technical Details:

By: Ho, Thomas on date: 2016-05-18

In preparation for the upcoming GTTM work, the size of the I_AND_C_MODEL section was extended by Arden Lo from 3x8K blocks to 5x8K blocks. This shifts all subsequent sections, requiring a new binary storepoint (FPSS example provided by Phil Coulter from symbolic restore) to be used going forward. A blank CDB with the new start/end markers is being submitted at this time.

Installation Instructions:

By: Ho, Thomas on date: 2016-05-18

All binary storepoints must be re-created from the included FPSS binary point, or with a symbolic restore.

Additional comment:

By: Ho, Thomas on date: 2016-07-10

A few meetings were held with training (primarily John Soares) to discuss the training requirements for this system. On April 23, 2016, it was mentioned that the OM response to certain (but not all) GTTM alarms required an increase in lagging generator MVAR output to reduce temperatures, which was an effect beyond the scope of the current simulation. It was agreed that primary concern was to have points move in the correct directions, with less importance on magnitudes, and then followed by rates of change. Additionally, it was mentioned that point-by-point override capability would be a useful to have point-by-point override capability. Regarding the GUI and fidelity, it was considered most important for the fullscope hardware panels, with accuracy on the desktop desirable to the extent feasible. Also, it was mentioned that the second GTTM unit, 64121-TR411 in the control equipment room, would also be desirable to have simulated.

Therefore, the decision was made to add point-by-point override capability under subtask 73251-S, by replicating the approach used for DCC overrides (same set of SDB shadow labels, user interface via xoverride ('computer override') etc).

For the temperature responses, further research suggested that the reason for increased lagging MVAR reduction was to reduce heating in the end regions due to axial leakage flux producing eddy-current losses in the end laminations, which was an effect most significant when operating in leading MVAR (underexcited) range. It was considered that one possibility for achieving the required response was a "lumped parameter thermal network", since this method should show the correct directions of changes in response to each of the heating/cooling sources (affecting different areas of the stator) to temperatures at different point, plus approximate the dynamics and absolute values depending on the accuracy/detail of the model. By using

Additional comment:

By: Ho, Thomas on date: 2016-07-10

the analogy between the equations of heat conduction and DC circuits, the existing techniques for simulating station electrical systems could be used for this problem.

Since the modeling of essentially all of the GTTM instrumentation was outside the original scope of simulation, it is not possible to fully simulate those systems without directly remodeling those parts of the simulator in greater detail. Since that was outside the scope of this project, the approach chosen in the current version, for both the main generator thermal-network model, and other instruments such as turbine metal temperatures, is to essentially apply the existing simulated quantities as fixed boundaries from which additional readings can be interpolated/extrapolated. This should provide reasonable response in relation to other system changes, but may not be able to simulate all magnitudes/values to high accurately since these new readings are dependent on the results of the original coarser model. The initial release of this calculation was developed using a number of references and station drawings (but no detailed engineering on the generator design was available), and was tuned to provide reasonable response for overall realism on the simulator. As a result of this tuning for overall/visible response, the overall calculations can be considered empirical exact engineering values internal to the calculation may have diverged from actual values.

For the GTTM device, the decision was made to move alarm processing to the SCS module, since it would be needed for desktop simulator, store/restore capability, and to accurately produce the DCC AN333 "GTTM recorders annunciation". A software simulation was developed and instances created for for the CER and MCR, including restorable message history. Due to the large number of CDB variables required, trending was implemented on the virtual panel for TR410 only.

Solution:

By: Ho, Thomas on date: 2016-07-10

increase maximum number of variables allowed by glimpse

Technical Details:

By: Ho, Thomas on date: 2016-07-10

For the upcoming GTTM changes, it was found that the new virtual panels exceeded the previous 20000 datasource limit allowed by glimpse. This value is being patched to 25000 to support these new panels.

Solution:

By: Ho, Thomas on date: 2016-07-10

Initial Release of Pickering 1-4 GTTM Simulation (64121-TR410 and TR411)

Technical Details:

By: Ho, Thomas on date: 2016-07-10

This submission includes the initial version of the Pickering 1-4 simulator software implementation (desktop and common software). This implementation consists of new module pkaugy.f90 which implements the thermal network simulation of the generator (stator) temperatures using the standard admittance-matrix solution technique (with capacitance). See the attached model report for further information on references, derivations, etc. The other new module pkaugz.c implements the simulation of the remaining GTTM instrumentation, applying additional logic/calculations for the GTTM inputs, including additional (simplified/approximate) calculations to derive reasonable approximations for turbine casing, bearings, main exciter temperatures which were also outside the original scope of simulation. This module also handles the GTTM device simulation for both TR410 and TR411. Header file pkaugz.h includes configuration parameters such as alarm set points etc. Please see the attached documentation for further details. Additional changes include the virtual panels and interfaces to existing models (grasp) to obtain the inputs to these calculations.

Installation Instructions:

By: Ho, Thomas on date: 2016-07-10

The virtual panels will require change #35690 for increased variable limit. The CDB changes require #35587. This code also interfaces to the GTTM override interface in 73250-s/73258-S. Finally this software is intended to be installed together with the fullscope panel changes, but this software has no dependencies to the HW. A temporary patch is current in place to disable restore of trends and message history, pending HW support of those functions. Note- calculation of two MCR meters 64118-TI410/408 moved into new gz module to use common code as gttm TCs. FPSS value of latter meter will change

Solution:

By: Ho, Thomas on date: 2016-07-10

correction to previous submission- additional file reqd

Technical Details:

By: Ho, Thomas on date: 2016-07-10

this file should have been included with the previous submssion

Attached Documents:

1. Manufacture manual CH2	By: Goodhand, Michael on date: 2016-02-17
2. Manufacture manual APXD	By: Goodhand, Michael on date: 2016-02-17
3. Manufacture manual APXE	By: Goodhand, Michael on date: 2016-02-17
4. Manufacture manual TOC	By: Goodhand, Michael on date: 2016-02-17
5. Manufacture manual CH8	By: Goodhand, Michael on date: 2016-02-17
6. Manufacture manual APXA	By: Goodhand, Michael on date: 2016-02-17
7. Manufacture manual APXB	By: Goodhand, Michael on date: 2016-02-17
8. Manufacture manual APXC	By: Goodhand, Michael on date: 2016-02-17
9. Simulator GTTM Alarm Implementation	By: Ho, Thomas on date: 2016-07-10
10. Manufacture manual CH1	By: Goodhand, Michael on date: 2016-02-17
11. Manufacture manual CH3	By: Goodhand, Michael on date: 2016-02-17
12. Manufacture manual CH4	By: Goodhand, Michael on date: 2016-02-17
13. Manufacture manual CH5	By: Goodhand, Michael on date: 2016-02-17
14. Manufacture manual CH6	By: Goodhand, Michael on date: 2016-02-17
15. Manufacture manual CH7	By: Goodhand, Michael on date: 2016-02-17
16. GTTM CDB interfaces (for HW implementation)	By: Ho, Thomas on date: 2016-07-10

Software Changes:

Work Package:none

First Release:pa20160729

SDB changes: PA (closed)

In pasdb:

This work request contains:

3697 added labels.

Break down by type:

This WR contains 4 Testing IF_CONT_TA labels in the SDB.

This WR contains 5 Testing IF_MALF_TF labels in the SDB.

This WR contains 3688 Testing I_AND_C_MODEL labels in the SDB.

Change #35587 (2016-05-18) Releases: pa20160729 pa20160729 pa20160729

No record of test or installation for this change.

Files...

... //pa2/dev/cdb/pa.base.cdb#220 edit
... //pa2/dev/storept/PT01_FPSS.info#5 edit
... //pa2/dev/storept/PT01_FPSS.stp#5 edit
... //pa2/dev/storept/PT01_FPSS.stp.grasp#5 edit

Change #35690 (2016-07-10) Releases: com20160729

No record of test or installation for this change.

Files...

... //com/dev/src/x/glimpse/datasource.h#8 edit

Change #35691 (2016-07-10) Releases: pa20160729 pa20160729 pa20160729

No record of test or installation for this change.

Files...

... //pa2/dev/cdb/pa.base.cdb#223 edit
... //pa2/dev/db/cdbauxdb.sdb.dat#81 edit
... //pa2/dev/db/malfdb.sdb.dat#89 edit
... //pa2/dev/lfdata/drawings/pka_outputs/pka_outputs_MONITOR_GTTM_CER.d#1 add


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... //pa2/dev/ifdata/drawings/pka_outputs/pka_outputs_monitor_gttm_tempbox_graph1.d#1 add
... //pa2/dev/ifdata/drawings/pka_outputs/pka_outputs_monitor_gttm_tempbox_graph2.d#1 add
... //pa2/dev/ifdata/drawings/pka_outputs/pka_outputs_monitor_gttm_trend_normalized.d#1 add
... //pa2/dev/ifdata/drawings/pka_outputs/pka_outputs_monitor_gttm_trend_pfmarker.d#1 add
... //pa2/dev/ifdata/drawings/pka_outputs/pka_outputs_monitor_gttm_trendpoint.d#1 add
... //pa2/dev/ifdata/menus/SIM.panel.menu#12 edit
... //pa2/dev/ifdata/views/virtual_panels/a3b_2.v#18 edit
... //pa2/dev/ifdata/views/virtual_panels/acer_pl70.v#1 add
... //pa2/dev/src/module/Makefile#42 edit
... //pa2/dev/src/module/pkaugy.f90#1 add
... //pa2/dev/src/module/pkaugz.c#1 add
... //pa2/dev/src/module/pkaugz.h#1 add
... //pa2/dev/src/module/pkauut.f#7 edit
... //pa2/dev/src/modxml/bmp36000.xml#12 edit
... //pa2/dev/src/modxml/f3a4323003a_1.xml#12 edit
... //pa2/dev/src/modxml/gcp41230.xml#11 edit
... //pa2/dev/src/modxml/gfp41221112_1.xml#7 edit
... //pa2/dev/src/modxml/ggp4122_1.xml#11 edit
... //pa2/dev/src/modxml/gsp41240.xml#14 edit
... //pa2/dev/src/modxml/u8_instruments1.xml#11 edit
... //pa2/dev/src/modxml/u8_instruments2.xml#9 edit
... //pa2/dev/storept/init/padev.init#469 edit
... //pa2/dev/table/module_table.dat#68 edit
```

Change #35692 (2016-07-10) Releases: pa20160729 pa20160729 pa20160729

No record of test or installation for this change.

Files...

```
... //pa2/dev/ifdata/drawings/pka_outputs/pka_outputs_monitor_gttm_tempbox_graph_bkgnd.d#1
add
```

Test Recording System Information:

Recommended tests: none

Additional tests: none