04.3C-DeployingTheModel

Automated CBM decision making

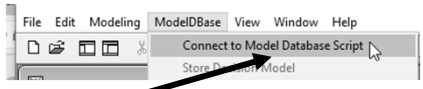
The analysis and model building phase is complete.
We'll place the predictive model to work. Eventually there will be many models, each monitoring a specific failure mode.

We'll show how the EXAKT decision agent applies each model according to a schedule and writes its decisions to a **Decision Models Decision Records (_DMDR)** database access by the EAAM system and action by the maintenance department.

1

Creating and Attaching the DMDR database

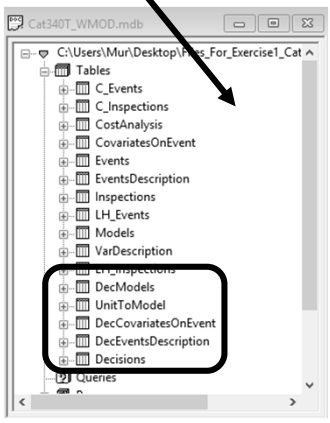
1



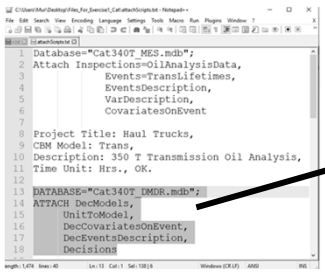
Click anywhere in this window pane to activate the ModelDBase menu items.

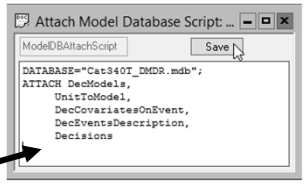
1. Click anywhere in the left pane. Select "ModelDbase" and select "Connect to Database Script".
2. Copy (from attachScripts.txt) the second script. Paste into Attach Model Database Script text area. Hit Save
3. Notice that several new tables appear in the tree. This means that the links to the Models database are set up, and we proceed to the actual export in the next slide.
4. Notice a new database "Cat340T_DMDR.mdb" appears in the working folder

3

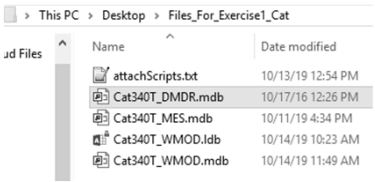


2





4

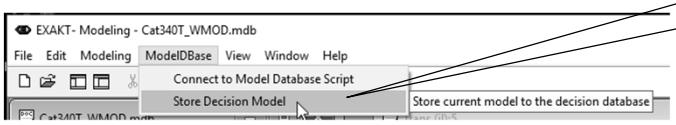


2

Exporting the model to the DMDR database

If Store Decision Model is not active it means that you didn't save the Decision Model. Go back to Decisions, Decision Model Parameters, enter the data and save.

1



Make sure "il" is the active model.

1. Select “ModelDbase” as in the previous slide. Then select “Store the Decision model”.
2. Examine the tables DecModels, UnitToModel, DecCovariatesOnEvent, DecEventsDescription to see just what information has been exported to the external database.

You may close the EXAKT for modelling program (but you can also just minimize it leaving it open for another step later.

2

DecModels

Model	SubModel	Default	Description	InspectionInterval	FailureCost	ReplacementCost	ModelType	TimeUnit
Trans	il	1		200	4800	1200	PHM	h

UnitToModel

UnitName	ModelName
17-66	Trans
17-67	Trans
17-77	Trans
17-79	Trans

DecCovariatesOnEvent

ModelName	Event	StartingDate
Trans	B	1/01/1900
Trans	OC	1/01/1900
Trans	ES	1/01/1900
Trans	EF	1/01/1900
Trans	*ES	1/01/1900

DecEventsDescription

ModelName	EventName	Precedence
Trans	OC	1
Trans	EF	2
Trans	ES	3
Trans	B	4

Slide 3

3

The EXAKTd agent

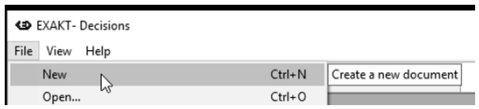
1

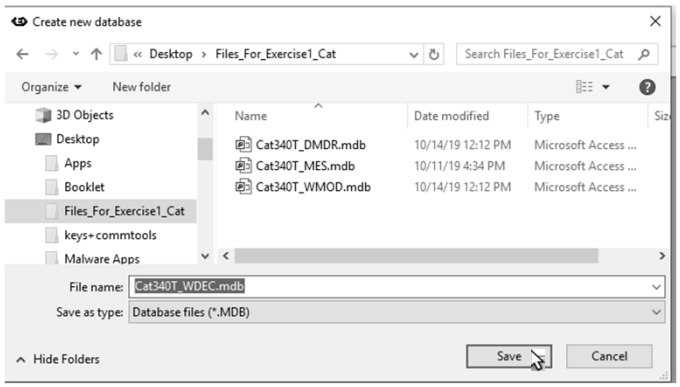
1. Launch EXAKT for Decsions.

Slide 4

4

Create a working database for the EXAKTd agent



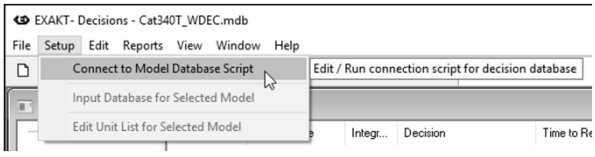


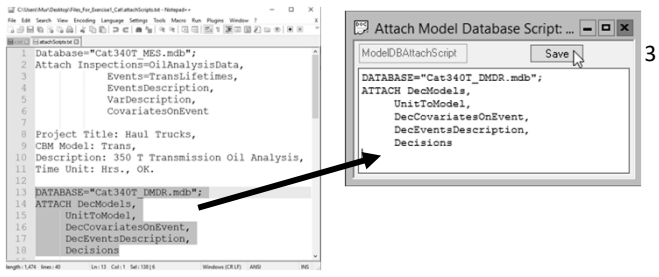
1. Hit File and select New.
2. Navigate to your working folder.
3. Enter a file name Cat340T_WDEC.mdb,
4. Hit Save.

Slide 5

5

Link to the DMDR database where the model has been stored





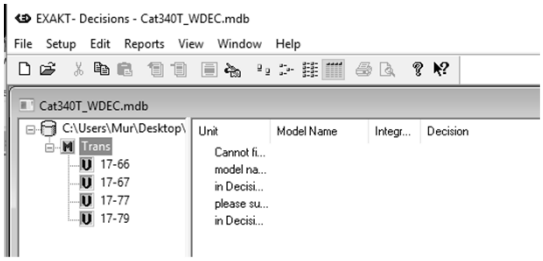
Now link to the Models database.

1. Hit Setup. Then select “Connect to model database script”
2. Copy and paste the same script from the same text file. (It may still be in your clipboard.)
3. Hit Save

Slide 6

6

Exposing the units to be monitored by the model “Trans”



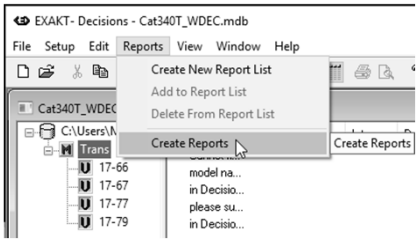
1. Expand the failure mode “Trans” in the tree.

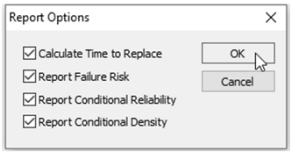
This will display the equipment units monitored by the decision model “Trans”.

Slide 7

7

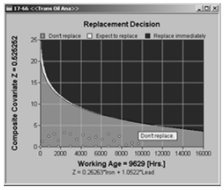
Running the model on all units



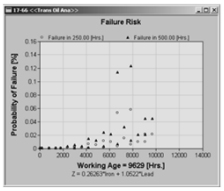


1. Hightlight "Trans".
2. Hit “Reports”.
3. Select “Create reports”. and hit the all 4 checkboxes.
4. Hit OK
5. Cycle through all of the graphic displays by hitting PgDn and PgUp. Also hit the **Full Report icon** on the tool bar:

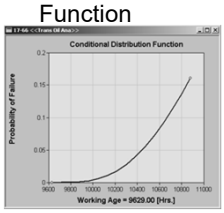
Replacement Decision



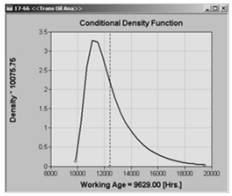
Failure Risk



Conditional Distribution Function



Conditional Density Function

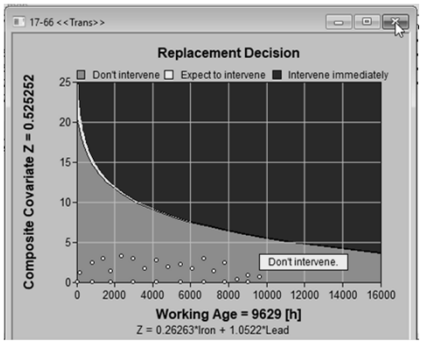


Slide 8

8

Exception Summary report

1

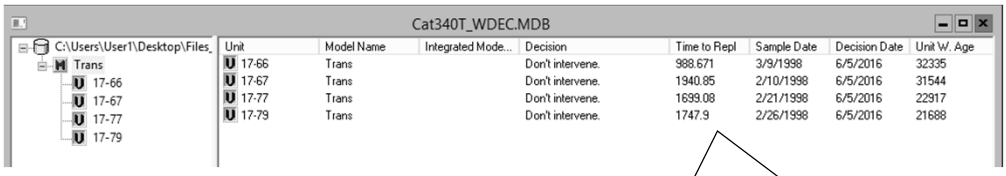


A more interesting report for CBM Decision Automation is the Summary listing the units, their failure modes and current status, including the optimal decision remaining time prior to potential failure.

1. Close the graphic report
2. Examine the summary report

The displayed information comes from the Decisions table in the DMDR database. The report can be displayed from the EAM system, the Predictive Analytics dashboard, Excel, or any other convenient application.

2



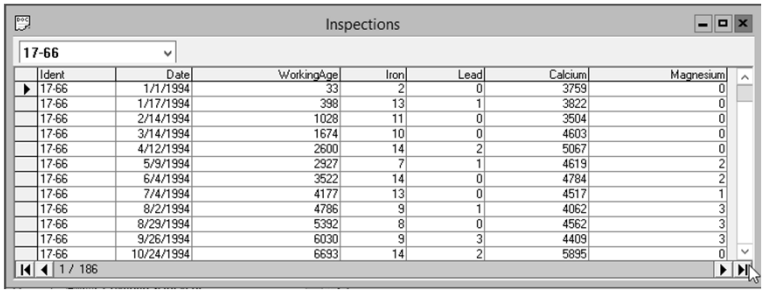
Unit	Model Name	Integrated Mode...	Decision	Time to Repl	Sample Date	Decision Date	Unit W. Age
17-66	Trans		Don't intervene.	988.671	3/9/1998	6/5/2016	32335
17-67	Trans		Don't intervene.	1940.85	2/10/1998	6/5/2016	31544
17-77	Trans		Don't intervene.	1699.08	2/21/1998	6/5/2016	22917
17-79	Trans		Don't intervene.	1747.9	2/26/1998	6/5/2016	21688

Note that all equipment are healthy with respect to this failure mode. We'll simulate a problem in the next slide.

9

Simulate a problem

2

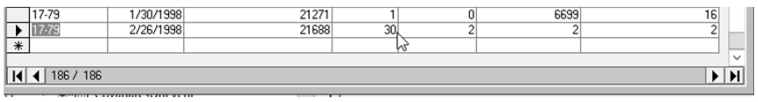


Ident	Date	WorkingAge	Iron	Lead	Calcium	Magnesium
17-66	1/1/1994	33	2	0	3759	0
17-66	1/17/1994	398	13	1	3822	0
17-66	2/14/1994	1028	11	0	3504	0
17-66	3/14/1994	1674	10	0	4603	0
17-66	4/12/1994	2600	14	2	5067	0
17-66	5/9/1994	2927	7	1	4619	2
17-66	6/4/1994	3522	14	0	4784	2
17-66	7/4/1994	4177	13	0	4517	1
17-66	8/2/1994	4786	9	1	4062	3
17-66	8/29/1994	5392	8	0	4562	3
17-66	9/26/1994	6030	9	3	4409	3
17-66	10/24/1994	6693	14	2	5895	0

1. Go back to EXAKTm (CBM Modeling App).
2. Double click on the Inspections table, and navigate to the last record by hitting the >| icon at bottom right corner.
3. Change the Iron value in the last row from 3 to 30 and hit the uparrow to complet the transaction.
4. Switch back to EXAKTd.
5. Double click on 17-79 in the report. This will rerun the report on the modified Iron value.

Now the recommended decisión is "Intervene immediately"

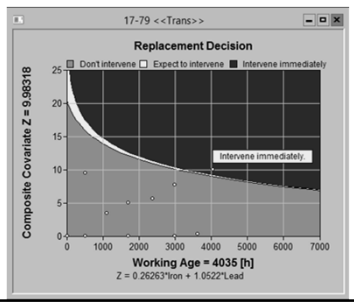
3



17-79	1/30/1998	21271	1	0	6699	16
17-79	2/26/1998	21688	30	2	2	2

5

Unit	Model Name	Integrated Mode...	Decision	Time to Repl	Sample Date	Decision Date	Unit W. Age
17-66	Trans		Don't intervene.	988.671	3/9/1998	6/5/2016	32335
17-67	Trans		Don't intervene.	1940.85	2/10/1998	6/5/2016	31544
17-77	Trans		Don't intervene.	1699.08	2/21/1998	6/5/2016	22917
17-79	Trans		Intervene immediately.	0	2/26/1998	6/5/2016	21688



10

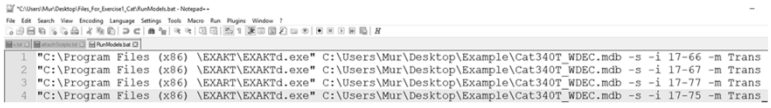
Automating the model

1. Copy the four commands under "Automation:" from the attachScripts.txt file and paste them into a new text file called, for example, "RunModels.bat". (Substitute your name for "Mur".
2. Open command box
3. Copy the SCHTASKS command from the attachScripts.txt file
4. Paste it into the command box

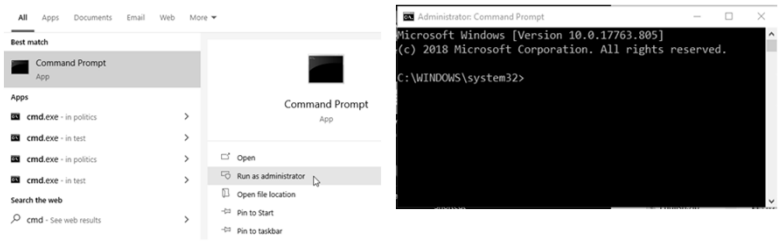
This task "cbmrun" runs RunModels.bat on the last Saturday of each month.

5. You can delete the task from the Schedule with "SCHTASKS /Delete /TN cbmrun

1



2



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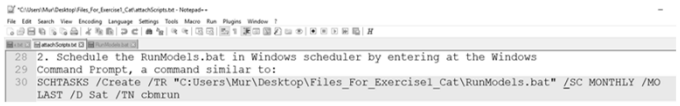
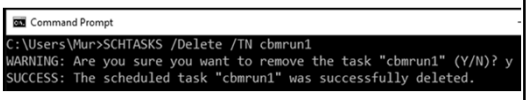
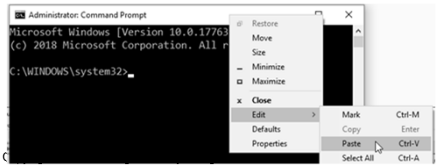
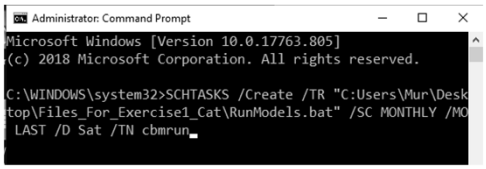


5



4





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