Minutes of the 4th "AutoMatIC" (Automotive Materials Intelligence Consortium) Meeting

General Motors, Warren, MI, USA

14-15 April 2016

Attending:

Vesna Savic	GM
David Helmer	GM
Denise Massa	GM
Paul Crepeau	GM
Paula Reinhardt	GM
Arthur Fairfull	Granta Design
Dale Delgado	Granta Design
Dan Williams	Granta Design
Najib Baig	Granta Design
Mustafa UllahKhan	Honeywell Turbo Technologies
Gerry LaRue (Webex)	Honeywell Turbo Technologies
Mark Blagdon	Jaguar Land Rover
Peter Seggewiß	KSPG Automotive
Pierre Osmond	PSA Peugeot Citroën
Brett Rickett (Webex)	Molex
Charlie Manlapaz (Webex)	Molex

Summary of Actions:

Minute	Action	Actioned
1.3	Add and circulate “AutoMatIC Influence” summary	Granta
2.5	GM and JLR consider joint approach to HP re. substance declaration ‘broker approach’	GM (DM) and JLR (MB)
3.4	Add “Influenced, modified, accelerated” data to AutoMatIC Influence summary	Granta
6.4	Add discussion on managing data for different duty cycles to next meeting’s agenda poll	Granta
7.6	Ensure ‘app switching’ is in the roadmap	Granta
8.1	KSPG to demonstrate ‘lessons learnt’ database at next meeting	KSPG (PS)
8.4	Investigate tabular data comparison in Python	Granta
11.2	GM to provide an example of data that uses algebraic expressions defined at different parts of a parameter space	GM (VS)
13.7	JLR to circulate blanked-out version of ROI spreadsheet	JLR (MB)
16.2	Make new Metals Template available online	Granta
16.4	Add adhesives, wear & tribology to next meeting as a project	Granta
17.2	Longer member updates next meeting	Granta

Minutes – Thursday 14 April, 2016

1. Welcome/Agenda Review

1.1 Richard Painter welcomed members to the 4th AutoMatIC meeting and provided an update on news from Granta.

1.2 Dan Williams provided a recap of the previous meeting's minutes and the recent agenda vote—and explained how these influenced this meeting's agenda.

1.3 The comments about influence prompted a discussion about how Granta can help with justification for members' attendance. It was agreed that Granta would add a section on "AutoMatIC Influence" to the meeting minutes, which could be used to prove the value of the consortium to members' management. **[Action: Granta]**

2. Member presentation - GM

2.1 Dave Helmer from GM presented a member update. He described the 'conveyor belt' approach to reviewing and cleansing data prior to import into MI, and the multiple areas of implementation (CAE Vehicle, CAE Global Propulsion Systems, Materials Approved Source List and Teamcenter Integration).

2.2 The Material Approved Source List has two goals: integration with CAE and Teamcenter materials, and co-location of material approvals into a single source list. There are approximately 50,000 approvals and supporting attachments.

2.3 Phase 2 of this project will involve the migration of an Appearance Database. Anticipated challenges include data size (~30,000 new records) and the implementation of Granta's upcoming workflow engine.

2.4 Denise Massa provided an update on her part of the project, which is focusing on Teamcenter integration and substance management. GM's goal is to capture substances as part of the material certification process—one benefit being that if subsequent IMDS substance declarations differ from those originally certified, GM will be able to respond more quickly.

2.5 Arthur Fairfull asked how GM was planning on achieving 100% disclosure of substances. This is still TBD but Denise described a 'broker approach' whereby substance declarations could be held by a 3rd party for confidentiality reasons but queried when needed by OEMs. Mark Blagdon said that JLR had similar needs—it would make sense for GM and JLR to approach HP together to try to progress this broker idea. **[Action: JLR and GM]**

3. Software update

3.1 Dan Williams provided a software update, firstly a review of recently released software (MI Version 9, released December 2015), and then a preview of plans for the remainder of 2016.

3.2 On seeing the recently released MI:Scripting Toolkit, Mark Blagdon commented that a useful application of data visualization and analysis tools would be able to calculate and display different stress-strain curves on the fly. For example, both True and Engineering Stress-Strain curves might be needed by users – storing both in the database leads to duplication and excessive database size and complexity. A tool to calculate and display the desired curve on the fly instead of storing them in the database would be valuable.

3.3 Dan Williams presented the MI roadmap and highlighted areas which were directly influenced by AutoMatIC. These include PLM integration, Material approval processes, Standard analysis methods, Managing Data for CAE, Workflow, Welding & Joining schemas, and License/User Management.

3.4 Members commented that it would be useful to provide this level of detail in the AutoMatIC Influence summary – which projects have been modified, which have been influenced, and which have been accelerated due to AutoMatIC influence. **[Action: Granta]**

3.5 Dan Williams provided more information about License & User Management. Due to consortium influence, Granta has prioritized a project for the summer of 2016 in this area. Goals include: making management of users easier through reporting & statistics, providing enforcement so that customers can ensure compliance, promoting growth by making it easier for customers to provide 'teaser' access to the software, and ensuring IT department acceptance.

3.6 Mark Blagdon mentioned that granularity of 'who has been doing what' would be desirable in any reporting and statistics. For example, which users have read data, and which have extracted or exported materials cards? Mark also commented that it would be helpful if any new statistics could use retrospective data from server logs, rather than starting to gather data from scratch, as it might take 18 months to collect useful user statistics.

4. Technical Session – Integration in the Enterprise (Part 1)

4.1 Arthur Fairfull led a technical session on integration. He presented three 'categories of value' associated with PLM integration: (i) derivation of the approved, traceable materials information subset published for enterprise use, (ii) assignment of relevant materials from that subset to design or product structure, and (iii) analytics and reporting on these assignments.

4.2 Granta's recent white paper, which provides more detail on these value areas and offers a checklist of considerations for planning materials integration with CAD and PLM was well received by the group.

4.3 The group collectively completed a spreadsheet of their position and opinion in four key areas: (i) How well materials information is integrated today, (ii) the motivations for better integration, (iii) the biggest challenges that are holding back better integration, and (iv) the most important focus for Granta.

4.4 The discussion was paused to be resumed later – see section 9.

5. Guest presentation - Molex

5.1 Brett Rickett joined by WebEx to present a guest presentation on behalf of Molex. Molex produces hundreds of thousands of distinct products, making materials choice highly strategic. Molex have recently begun implementing GRANTA MI as a replacement for their legacy system which had been in place for over 15 years.

5.2 Brett highlighted several of the drivers for this change, including the desire for a single source of the truth, better leverage of CAD and PLM systems, and a desire to integrate information from enterprise systems (such as environmental compliance, cost and availability) into engineering design tools.

5.3 There was an in-depth discussion about the current limitations of functional and other parameterized data in GRANTA MI. Of particular interest to Molex is the ability to be more flexible in the way parameters are expressed in searches. For example, instead of asking "What materials have a strength greater than 100MPa at 23 degrees C", it might be desirable to provide ranges of parameters (e.g. "What materials have a strength greater than 100MPa between 22 and 27 degrees C") or ignore parameters (e.g. "What materials have a strength greater than 100MPA at *any* temperature?").

5.4 Vesna Savic mentioned similar challenges at GM, although in GM's case the data type might be Muti-Value Data or Tabular Data, rather than Functional Data. The need, however, is very similar across several members: more flexibility to specify the parameters within searches.

6. Member presentation - Honeywell

6.1 Mustafa UllahKhan presented Honeywell's member update.

6.2 Although Honeywell's aerospace business is making significant use of Granta, it is still relatively unknown within the turbochargers business. There was a discussion about training and knowledge sharing. At Honeywell, Doug Hall has a 'train the trainers' role, supplemented by Engineer User Guides for a wider audience. Brett Rickett mentioned that Molex has taken an approach of regular training webinars, both mornings and afternoons to maximize global attendance. Recording demos and putting them on a training site is also a viable approach.

6.3 Other approaches to training and user engagement were discussed – including monitoring user logs to ensure regular traffic and identify problems; interviews and surveys; and a review process.

6.4 Mustafa presented some of the more complex data challenges in turbochargers – particularly data captured for different duty cycles. Honeywell's products are used in a huge range of applications resulting in vastly different duty cycles. Members discussed approaches to managing this kind of data which depends on a duty cycle which varies with time. A discussion on this subject was proposed for next meeting's agenda. **[Action: Granta]**

7 New Tools for CAE

7.1 Dan Williams presented a preview of some planned work at Granta that will extend MI:Explore to provide more capabilities of relevance to managing materials data for simulation.

7.2 There was a discussion about typical patterns of usage within the CAE community. In many cases, CAE users are consumers of material cards which have already been exported from Granta – there is no human interaction. However, some cases were identified where better tools could be valuable.

7.3 One example, raised by Mark Blagdon, was where users want to understand materials better, rather than just export their data. Tools to support curve comparison or combining datasets would help here – such as the example mentioned previously about converting stress-strain curves directly within an app, rather than having to store multiple versions in a database.

7.4 GM raised another example: the ability to 'preview' a material card within the app. If a card could be viewed with one or two clicks, that would be useful. Even better would be able to make a change to the card either directly in the card or by using a more intuitive view of the data.

7.5 Paul Crepeau showed a brief example of GM's Powertrain materials spreadsheet which presents information in an intuitive way to users before allowing export to card format. This kind of intelligent display of material properties is highly prized. However, the question arises whether the 'perfect' view of material properties is highly domain, discipline and company specific (a case which would lend itself well to custom Excel spreadsheets) or whether it would be possible to generalize a view of materials properties in a way that could be captured in an off-the-shelf app.

7.6 GM raised the question of how Granta would avoid user confusion that might result from a proliferation of apps – one advantage of MI:Viewer is that users know it's the only place they need to go. Granta should make sure an intuitive approach to 'app switching' is in the roadmap. **[Action: Granta]**

8 Member Presentation – KSPG

8.1 Peter Seggewiss presented KSPG's member update. KSPG currently have 150 users of MI but an interesting opportunity to reach a much larger community (~850 users) has come up in relation to a 'lessons learnt' database. Peter thought that this database might be ready to demonstrate at the next AutoMatIC meeting. **[Action: KSPG]**

8.2 A big question mark at KSPG is the company's PLM direction. The organization is due to make a decision on its choice of PLM software soon—the choice may have an impact on the way materials data is consumed around the organization.

8.3 In the meantime, KSPG support CAD users via a 'picklist' of materials for assignment in CATIA, which provide densities but no other material properties. There is currently no connection between this picklist and the MI database which is used by CAE. Understanding how materials property data will integrate with the future PLM system will be a key next step.

8.4 Peter raised some questions and ideas for the GRANTA MI software. One area of particular interest is to be able to compare tabular data across multiple materials, which would require some kind of statistical summary within a tabular cell of all the corresponding cells in the records

concerned. Dan Williams pointed out that the forthcoming MI:Scripting Toolkit for Python (planned release May 2016) would allow MI to take advantage of the extensive open source statistical analysis libraries provided with Python, such as the 'Pandas' library. Dan offered to investigate this particular use case within Python. **[Action: Granta]**

9. Integration in the Enterprise – Part 2

9.1 Arthur Fairfull concluded the morning's session to complete a matrix of members' current status and challenges related to PLM integration. *Note: The completed matrix is available on the AutoMatIC Members site.*

10. Technical Session – Automating Key Workflows

10.1 Dan Williams provided an update on Granta's plans to release a Workflow capability in MI Version 10. The primary focus will be supporting key 'request/review/approve' task-based workflows.

10.2 The subject of configuration was discussed. There is a spectrum of configurability, ranging from complete flexibility (a programming language), via 'drag and drop' workflow editors, to relatively inflexible 'cookie cutter' workflows configured via simple files or tables. One user story raised by Mark Blagdon and others was that of troubleshooting – if a workflow is expressed in text form, there should be an easy way to check that it is valid, such as whether there are states which do not possess an exit point, or states which have no entry point.

10.3 Vesna Savic asked whether reminder notifications could be sent to relevant users if a workflow remains in a particular state for more than a certain time.

Day 1 concluded with a Members' Dinner in Warren.

Minutes – Friday 15 April, 2016

11. Member Presentation – GM

11.1 Paul Crepeau presented a more in-depth look at how he represents materials properties for Powertrain CAE within MI.

11.2 The tool is heavily reliant upon Tabular Data. This presents complications for searching. Vesna Savic pointed out that the GM CAE database, on the other hand, makes use of Multi Value Attributes – but the requirement for searching is equally valid. Vesna also mentioned a desire to store equations as multi-valued data, e.g. a particular expression which is valid for a particular region of parameter space. She offered to send Granta an example of such data. **[Action: GM]**

11.3 The Powertrain database revealed various challenges for which other members were able to offer solutions or ideas. These challenges included: displaying the existence of files to users without providing access to the contents of the files; linking to individual MI records from external sites such as Sharepoint (the most common entry point of access for the Powertrain CAE data today); capture

of test data in addition to processed data (Paul and Vesna thought this was in general not a priority, except in some specific cases such as for elastomers.)

12. Member Presentation – PSA

12.1 Pierre Osmond presented PSA's member update, describing the current contents and architecture of their MI database implementation. The system is relatively 'heavy' with data – in particular images and videos, and a recent addition of spot weld data which has more than 40,000 records. All of these have presented performance challenges as well as difficulty in giving users a simple overview of the data in the system.

12.2 Another challenge relates to the large number of independent database tables within the system – it could still be argued that there is no single 'gold source' of data.

12.3 PLM Integration is desired – in PSA's case this means to ENOVIA.

12.4 More short term, Granta's Workflow plans are of interest to support an approval process, and PSA have plans to implement a tribology database.

13. Member Presentation – JLR

13.1 Mark Blagdon presented Jaguar Land Rover's member update. Echoing PSA's previous presentation, JLR have 12 material databases in MI, and an ongoing challenge to link or merge them in the best way.

13.2 Provision of information to CAE and helping them understand what data is available is still one of the primary use cases. JLR have recently developed an Optistruct exporter and expressed an interest in better training/documentation for exporter writing (or improvements to the exporter technology to make writing exporters easier) to support future requirements such as an Autoform exporter.

13.3 The Workflow plans for MI10, particularly in light of Dave Helmer's presentation on GM's plans for managing material appearance approvals in MI, are of interest to JLR who have a 'soft trim' database in MI which was one of the first databases they built.

13.4 User training was discussed further. JLR provide 10 minute training videos plus a regular Newsletter which is sent to existing users and managers of other relevant departments.

13.5 This topic led on to a discussion of usage logging and reporting. Mark explained how JLR use spreadsheets to track usage and interpret Granta's server log to try to get a better understanding of usage, but the current approach is not sufficiently robust and often provides erroneous data. Requirements in this area include: (1) Unique users and number of users per day, (2) For each user, what have they accessed? (3) For each database, who has used it, particularly those outside the group for which the data was originally intended (4) Usage information categorized by user, by database and by users' departments.

13.6 Mark presented a Roadmap Vision for JLR based on a similar presentation by Rolls-Royce at the Granta UK User Group Meeting. This was well received.

13.7 Also well received was a presentation of how JLR have attempted to quantify the Return on Investment for GRANTA MI. Mark offered to send a blanked out copy of this spreadsheet to members. **[Action: JLR]**

14. Technical Session – Materials data management

14.1 Najib Baig chaired a session on materials data management based on a number of highly voted topics from the agenda poll.

14.2 The first topic centered on processes for data collection: knowledge and experience; data from suppliers; and legacy data. Members discussed various approaches to this kind of data challenge. With 'knowledge management', one of the biggest challenges is to help end users understand what's available. Ideas such as the ability to hover over an embedded or linked file to see a preview of its contents, and being able to append the 'date uploaded' to file attributes, were discussed.

14.3 Supplier standardization was also discussed as part of this first topic. PSA have developed a template for suppliers to fill in; JLR also do this for their paint database. GM, on the other hand, take the approach of entering data themselves, to eliminate the errors and gaps that result from importing supplier data directly.

14.4 The second topic discussed was about tailoring MI to different disciplines, particularly fatigue data. Mark Blagdon reiterated that a capability to transform curves on the fly – in this case strain life to stress life conversions – would be valuable. Much fatigue data is represented by equations (the "EELs attribute" in MI lends itself well to this) but additional capabilities such as being able to define EELs at different parameters (e.g. using Multi Value Attributes) and being able to change the parameter used on the X axis of EELs were raised as potential gaps.

14.5 The final topic was security and global synchronization. The conversation centred around ways to handle multiple servers, particularly the process of migrating from a test to a production server.

15. Industry report

15.1 Dan Williams discussed the 2015 Industry Report, and the modifications that could be made to the voting sheet for the upcoming 2016 Report. Additional areas which members would like to capture are: Blockers (such as a free text field for explaining what has prevented each organization from reaching a particular goal in the last year) and ROI (a way to capture the top justifications members have for moving from one step to another in the Industry Matrix.)

16. Technical projects update

16.1 Dan Williams presented an update on the Welding & Joining schema, which is being merged with Granta's overall Metals Template so that it can be maintained going forwards as a standard

product. The consortium's work on the template has been well received and is the subject of a webinar and a conference presentation during April.

16.2 Members asked for this new release to be made available online in addition to as a download. **[Action: Granta]**

16.3 A discussion took place about what areas the group could focus on for the coming year's projects. A quick poll was taken of the five member companies present:

Adhesives	3 votes
Lubricants	2 votes
Wear & tribology	4 votes
Corrosion	3 votes

16.4 Granta has another project in the area of adhesives; it was suggested that adhesives, wear and tribology therefore be topics for a deeper dive at the next meeting. **[Action: Granta]**

17. Consortium process review; next meeting

17.1 Richard Painter concluded the meeting with a feedback session and a look to the next meeting.

17.2 Members get particular value out of the other members' updates and the resulting discussions. It was proposed to increase the length of member updates for next time; the Granta roadmap/technical sessions could be reduced or done by Webex. **[Action: Granta]**

17.3 Richard Painter mentioned that Mazda intend to join the consortium. It was asked whether members thought they would be able to get travel budget approved for a meeting in Japan, but the conclusion was that this would be harder to justify.

17.4 KSPG will host the next meeting (October 2016) in Germany. Mustafa UllahKhan kindly offered to host the following meeting (April 2017) in Plymouth, MI.