

GIF AMME Workshop on how modelling and simulation can enable the qualification of advanced manufacturing.

Lyndon Edwards, AMME-TF Chair

**National Director,
Australian Generation IV International Forum Research
ANSTO**

GIF-AMME-TF Background

- Getting new materials or new manufacturing processes qualified for use in Nuclear Reactors can be a long and tortuous process.
- The long lead times involved produce an effective and consequent barrier to market entry of advanced materials and manufacturing processes.
- Developments in advanced manufacturing are occurring much faster than our ability to introduce new materials and methods into nuclear design codes.
- This is stifling innovation and hampering deployment and effectively results in a barrier to market entry.
- These issues need to be addressed if advanced reactors are to be brought to the market in reasonable timeframes.
- GIF AMME Task Force formed to assess and address these issues.

GIF-AMME-TF History

- A survey establishing industry interest in Advanced manufacturing was held in 2019
- Workshop on Advanced Manufacturing held on Feb 18-19th 2020 engaged the private sector, including SMR vendors and supply chain companies. Details and video of workshop available at: https://www.gen-4.org/gif/jcms/c_115848/workshop-on-advanced-manufacturing
- Recommendations of workshop were embodied in revised 2021 Task Force Terms of Reference that defines objectives through three task groups:
 - * Requirements Capture
 - * Qualification, Demonstration and Deployment
 - * Design and Modelling
- This workshop focusses on how modelling and simulation can enable the qualification of advanced manufacturing
- As in our 2020 workshop, it will contain several interactive small group sessions with your peers where you will be asked to discuss and assess options and opportunities for the qualification of advanced manufacturing

Current GIF-AMME-TF Membership

MEMBER	COUNTRY	EMAIL
Eric Abonneau	FR	Eric.Abonneau@cea.fr
Davide Costa (technical secretary)	OECD/NEA	Davide.COSTA@oecd-nea.org
Lyndon Edwards (chair)	AU	led@ansto.gov.au
Lucian Ivan	CA	lucian.ivan.cnl.ca
Yu Kamiji	JP	Kamiji.yu@jaea.go.jp
Shehan Lowe	UK	shehan.lowe@sheffield.co.uk
Mark Messner (co-chair)	US	messner@anl.gov
Karl-Fredrik Nilsson (task lead)	EU	karl-fredrik.nilsson@ec.europa.eu
Satoshi Okajima	JP	okajima.satoshi@jaea.go.jp
Jeong-Yong Park	KR	parkjy@kaeri.re.hr
Manuel Pouchon	CH	manuel.pouchon@psi.ch
Isabella van Rooyen (task lead)	US	isabella.vanrooyen@inl.gov
Andrew Storer (task lead)	UK	andrew.storer@namrc.co.uk
Sebastien Teyseyre	CA	sebastien.teysseyre@cnl.ca
Kodai Toyota	JP	toyota.kodai@jaea.go.jp
Lefu Zhang	CN	lfzhang@sjtu.edu.cn

Group discussion essential to success of workshop

- Sadly, Face to Face participation still not possible due to Covid -19
- So Group discussion will be in ZOOM Breakout Rooms



Group discussion



Structure of workshop

Mon 8 Nov	Workshop on Advanced Manufacturing	
DAY 1		
Session 1 – Overview of workshop		
13:00 – 13.10	Welcome and Introduction, overview of AMME-TF, purpose of workshop! Lyndon Edwards ANSTO, AMME-TF Chair	
13:10 – 13:35	How Modelling and Simulation could be used to support the nuclear qualification of advanced manufacturing Albert To, University of Pittsburgh (20mins+5 min questions)	
13:35 – 14:00	Challenges to the use of M&S to support the nuclear qualification of advanced manufacturing: a nuclear engineer’s perspective Pierre-François Giroux, CEA (20mins+5 min questions)	
14:00 – 14:25	NRC Action Plan for Advanced Manufacturing Technologies Carolyn Fairbanks , NRC (20mins+5 min questions)	
Session 2 – Vendors and designers perspective: the view from the innovation front line		
14:30 – 14:50	David Huegel & Clint Armstrong, Westinghouse	(15mins+5min questions)
14:50 – 15:10	Jean-Marie Hamy, Framatome	(15mins+5min questions)
15:10 – 15:30	Murray Page Rolls-Royce	(15mins+5min questions)
15:30 – 15:50	George Jacobsen, General Atomics	(15mins+5min questions)
15:50 – 16:20	Summary and Panel Discussion	
Session 3 – Group activity 1		
16:20 – 18:00	Attendees split into allocated groups, which undertake the following activities with the group Moderator/Rapporteur:	
Includes break as necessary	a. Discuss and identify opportunities for Modelling & Simulation to accelerate qualification of Advanced Manufacturing	
	b. Analyse each identified opportunity (SWOT analysis or similar)	
	c. Prioritise, by likelihood of success, best opportunities for 2030 deployment	
	d. Agree communication for Rapporteur to give to meeting at start of Day 2 (Can develop presentation overnight if necessary)	
18:00	End of Day 1	

Structure of workshop

Tue 9 Nov	GIF AMME Workshop on Advanced Manufacturing DAY 2
Session 4 – Comparing Group Outputs	
13:00 – 14:20	Whole workshop undertakes the following activities: a. Rapporteurs from each group presents group output b. List agreed areas to be addressed and potential collaborative opportunities
14:20 – 14:50	Break
Session 5 – Group Activity 2	
14:50 – 16:00	Attendees split into new opportunity specific groups (those identified as having highest priority) and undertake the following activities: a. What needs to be done b. How can collaboration help? c. Identify and prioritize areas/ideas for AMME activities/projects d. Agree communication for Rapporteur to give to meeting after break
16:00 – 16:30	Break
Session 6 – Final Group Reporting and Meeting	
16:30- 17:30	Each Group present their findings and recommendations
17:30 – 18:00	Summarise discussion and consensus of meeting
18:00	End of Meeting

Group Activity ONE

The essential elements of Group Activity ONE are:

- I. Discuss and identify opportunities for Modelling & Simulation to accelerate qualification of Advanced Manufacturing
- II. Analyse each identified opportunity (SWOT analysis or similar)
- III. Prioritise, by likelihood of success, best opportunities for deployment
- IV. Agree communication for Rapporteur to present to workshop in session 4

I. Discuss and identify opportunities for Modelling & Simulation to accelerate qualification of Advanced Manufacturing

First “brainstorm” to identify the opportunities

- Opportunity 1 is
- Opportunity 2 is
- Opportunity 3 is
- Opportunity 4 is etc

II. Analyse each identified opportunity (SWOT analysis or similar)

OPPORTUNITY 1 ANALYSIS

Strengths

XCCXC

XCCCC

XCCCC

XCCCCC

Weaknesses

XCCXC

XCCCC

XCCCC

XCCCCC

Opportunities

XCCXC

XCCCC

XCCCC

XCCCCC

Threats

XCCXC

XCCCC

XCCCC

XCCCCC

II. Analyse each identified opportunity (SWOT analysis or similar)

OPPORTUNITY 2 ANALYSIS

Strengths

XCCXC

XCCCC

XCCCC

XCCCCC

Weaknesses

XCCXC

XCCCC

XCCCC

XCCCCC

Opportunities

XCCXC

XCCCC

XCCCC

XCCCCC

Threats

XCCXC

XCCCC

XCCCC

XCCCCC

II. Analyse each identified opportunity (SWOT analysis or similar)

OPPORTUNITY 3 ANALYSIS

Strengths

XCCXC

XCCCC

XCCCC

XCCCCC

Weaknesses

XCCXC

XCCCC

XCCCC

XCCCCC

Opportunities

XCCXC

XCCCC

XCCCC

XCCCCC

Threats

XCCXC

XCCCC

XCCCC

XCCCCC

II. Analyse each identified opportunity (SWOT analysis or similar)

OPPORTUNITY 4 ANALYSIS

Strengths

XCCXC

XCCCC

XCCCC

XCCCCC

Weaknesses

XCCXC

XCCCC

XCCCC

XCCCCC

Opportunities

XCCXC

XCCCC

XCCCC

XCCCCC

Threats

XCCXC

XCCCC

XCCCC

XCCCCC

Prioritise, by likelihood of success, best opportunities for deployment

Best: Opportunity 3: (reasons)

jgukkkhkhk
jhghjlljl

Better: Opportunity 2: (reasons)

lklkldgovj
khoiawhk

Good: Opportunity 3: (reasons)

nm,ngljhkdhgk
xlcjoidjgojgo

Agree communication for Rapporteur to present to workshop

Opportunity Ranking: aaaaaaa, bbbbbb, ccccc

Message 1: (reasoning)

jgukkkhkhk
jhghjlljl

Message 2: (reasons)

lkkllkjdgovj
khoiawhk

etc

Group Activity Two

- The essential elements of the second group activity are:
 - a. What needs to be done to make this opportunity successful*
 - b. Identify how can R&D collaboration can help?*
 - c. Identify and prioritise areas/ideas for collaborative AMME activities/projects to further progress*
 - d. Agree communication for Rapporteur to present to workshop*

*Discuss and identify opportunities for Modelling & Simulation to
accelerate qualification of Advanced Manufacturing*

Requirements for opportunity to be successful

Requirement 1: abcdef gh

Requirement 2: abcdef gh

Requirement 3: abcdef gh

Identify how can R&D collaboration help?

How can R&D help?

R&D effect/impact 1: abcdef gh

R&D effect/impact 2: abcdef gh

R&D effect/impact 3: abcdef gh

Identify and prioritise areas/ideas for collaborative AMME activities/projects to further progress

list areas/ideas for collaborative AMME activities/projects

idea 1: abcdef gh

idea 2: abcdef gh

idea 3: abcdef gh

*Analyse each identified opportunity
(SWOT analysis or similar)*

Idea 1. (e.g. round robin digital twinning exercise)

Strengths

xccxc

Xcccc

Xcccc

xccccc

Weaknesses

xccxc

Xcccc

Xcccc

xccccc

Opportunities

xccxc

Xcccc

Xcccc

xccccc

Threats

xccxc

Xcccc

Xcccc

xccccc

*Analyse each identified opportunity
(SWOT analysis or similar)*

Idea 1. (e.g. round robin digital twinning exercise)

Strengths

xccxc

Xcccc

Xcccc

xccccc

Weaknesses

xccxc

Xcccc

Xcccc

xccccc

Opportunities

xccxc

Xcccc

Xcccc

xccccc

Threats

xccxc

Xcccc

Xcccc

xccccc

*Analyse each identified opportunity
(SWOT analysis or similar)*

Idea 1. (e.g. round robin digital twinning exercise)

Strengths

xccxc

Xcccc

Xcccc

xccccc

Weaknesses

xccxc

Xcccc

Xcccc

xccccc

Opportunities

xccxc

Xcccc

Xcccc

xccccc

Threats

xccxc

Xcccc

Xcccc

xccccc

III. *Prioritise, by likelihood of success, the best ideas*

List opportunities in priority order with reasons

- Best is Opportunity #3 because:
reason (i)
reason (ii)
reason (iii)..... Etc
- Next best is Opportunity #2 because:
reason (i)
reason (ii)
reason (iii)..... Etc
- Next best is Opportunity #2 because: (and so on for all identified opportunities
reason (i)
reason (ii)
reason (iii)..... Etc

And so on for all identified opportunities....

III. Agree communication for Rapporteur to present to workshop

Group Ranking of Opportunities is : aaaaaaa, bbbbbb, cccccc, ddddd etc.

- Key message/principle 1
Blah, blah, blah
Blah, blah, blah, blah
- Key message/principle 2
Blah, blah, blah
Blah, blah, blah, blah
- Key message/principle 3
Blah, blah, blah
Blah, blah, blah, blah

To succinctly summarise conclusions of group

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**Thank you for your
attention.**