**CASL Industry Council Meeting**
September 9, 2010

**Minutes**

The first meeting of the Industry Council (IC) for the Consortium for Advanced Simulation of Light Water Reactors (CASL) was held on September 9, 2010, at the facilities of the Electric Power Research Institute (EPRI) in Charlotte, NC. The meeting was chaired by John Gaertner of EPRI.

The meeting attendees and their affiliations are listed on Attachment 1 to these minutes. Attendance was by invitation only. Representatives from 16 organizations were invited. All sent representatives except Electricite de France, who could not attend but has confirmed their interest in future participation. In addition, five members of the CASL project team participated in the meeting – the program director, chief scientist, two focus area leads, and the manager of partners/alliances responsible for intellectual property and commercialization matters. The DOE Director of Advanced modeling and Simulation also participated.

The meeting followed the agenda included as Attachment 2 to these minutes.

After the introduction of each participant, John Gaertner presented the objectives of the meeting: 1) to familiarize prospective IC members with the DOE and CASL objectives, process, technical problems, and expected deliverables; 2) propose and discuss plans for the operations of the IC; 3) listen to the objectives, issues, and suggestions of prospective members, 4) formulate a set of actions to facilitate an effective IC going forward.

Alex Larzelere provided his DOE perspective on CASL and the role in nuclear power of advanced modeling and simulation. He identified four charges: 1) watchdog of CASL activity, 2) insistence on results and transfer of advanced technology to industry, 3) ensuring candid, critical review and evaluation of CASL, and 4) being an advocate and ambassador for advanced simulation technology. He invited the IC to help and participate in these charges.

Doug Kothe presented a detailed overview of the CASL project. He described the team, vision, mission, and scope. He stated specific CASL goals that would enable advances in nuclear energy. He described the CASL execution plan. Finally, he explained the role of the integrated, highly-coupled, multi-physics, Virtual Reactor product (VERA) including integral uncertainty quantification; that is, the vehicle for assuring that the science and technology developed through CASL is used and useful. The presentation spurred an active discussion. Key points of the discussion are included in the Round Robin results presented later.

Jess Gehin presented the specific "Challenge Problems" which have been selected and which will define the scope and priorities of the scientific activities, VERA requirements, verification needs, deliverables, and schedule for the first five-year scope of CASL. He then described the CASL process for using real issues, industry needs, and likely applications of CASL products to set research priorities and functional requirements for VERA. Finally, he described the plans for VERA validation for a specific operating reactor, interactions with NRC, and opportunities for potential end-users to review and use intermediate VERA deliverables. All of the above are the work of the Advanced Modeling Applications Focus Area. Discussion ensued, and key points are included in the Round Robin discussion.

John Turner described the vision, process, and technical elements of the VERA product. He confirmed the vision of an integrated, highly-coupled, multi-physics, virtual reactor product VERA including integral uncertainty quantification. However, he explained that VERA would begin as an integration of best available existing codes using an integration environment which will support evolution of this loosely coupled set of codes to a highly coupled and highly integrated suite of enhanced modular elements. Discussion ensued, and key points are included in the Round Robin discussion.

Paul Turinsky then described the technical underpinnings that are planned for the CASL deliverables and, in particular, the virtual reactor product. He explained the degradation mechanisms that would need to be modeled to represent materials performance for the challenge problems – this is the work of the Material Performance Optimization Focus Area. He described the advances in numerical and modeling methods planned to address the challenge problems – this is the work of the Modeling and Numerical Methods Focus Area. In particular, he discussed the challenges of coupling models with time and spatial scales spanning many orders of magnitude. He discussed the necessity for validation of new and enhanced models of material behavior and physical processes and the demands imposed by integrated uncertainty quantification – this is the work of the Validation and Uncertainty Quantification Focus Area.

John Gaertner then presented the plans for the structure and operation of the Industry Council. He emphasized the purpose of the IC to provide two-way communications of benefit both to the CASL team -- to assure that their deliverables were focused on the needs of end users -- and to the end-users and technology providers -- to assure that their businesses could plan to benefit from CASL deliverables by way of early and frequent engagement through the IC. He proposed qualifications for membership on the IC, and he suggested that an IC Steering Committee could be formed. These individuals would play a significant role interfacing between the IC and the CASL team, and the CASL project could cover their expenses for these duties. He proposed that the IC would meet three times per year. The next

meetings would be in January and May of 2011. Finally, he proposed that subcommittees of the IC could be formed to perform activities endorsed by the IC.

John Gaertner facilitated a Round Robin discussion, allowing each participant to present any issues, suggestions or concerns to the CASL team or concerning the operation or structure of the IC. Every prospective member presented points of interest, and they were summarized on the electronic whiteboard by the facilitator. These summarized points are presented in Attachment 3.

Finally, the CASL team distributed a survey form to each member, included as Attachment 4. The form queried 1) the level of future interest in IC participation, and 2) specific areas of interest within the scope of possible IC activities.

Action items from the meeting are enumerated below.

1. All presentations from the CASL team and the survey form are to be sent to each meeting participant.

2. Each prospective member was to complete and return the survey form to John Gaertner within on week.

3. Based on survey results, the charter members of the full IC and of the Steering Committee will be determined. These membership groups will be formed in advance of the next planned meeting.

4. A charter for the IC will be drafted and distributed to members for their consideration prior to the next meeting.

5. The comments from the Round Robin discussion will be consolidated into a smaller number of issues that will be the basis for discussions at the next meeting. The CASL team will formulate a response to each issue which will be shared with the IC membership prior to the next meeting.

The meeting was adjourned at 3:15 pm.

Prepared: October 21, 2010
By John Gaertner

## Attachment 1
## CASL Industry Council Meeting Minutes

### Attendance
September 9, 2010

| Organization | Candidate(s) | Contact Information |
|---|---|---|
| EPRI | John Gaertner | jgaertner@epri.com |
| ANSYS | John Swanson | john.swanson@ansys.com |
| AREVA | Tom Lotz | Tom.lotz@areva.com |
| Battelle | William Andrews | AndrewsW@battelle.org |
| Bettis | Robin McCollum | robin.mccollum@unnpp.gov |
| Boeing | Thomas Weaver | thomas.l.weaver@boeing.com |
| Cray Computing | Larry Hoelzeman | hoelzema@cray.com |
| Dominion | John Harrell | john.harrell@dom.com |
| Duke Energy | Tom Geer | Tom.Geer@duke-energy.com |
| Duke Energy | Steve Nesbit | Steve.Nesbit@duke-energy.com |
| GE Nuclear Fuels | Russell Stachowski | Russell.Stachowski@gnf.com |
| IBM | George Chiu | gchiu@us.ibm.com |
| Rolls Royce | Vittorio Badalassi | badalave@westinghouse.com |
| Studsvik | Kord Smith | kord.smith@studsvik.com |
| TVA | Daniel Stout | dpstout@tva.gov |
| Westinghouse | Sumit Ray | rays@westinghouse.com |
| CASL BOD | Dave Modeen | dmodeen@epri.com |
| DOE | Alex Larzelere | alex.larzelere@nuclear.energy.gov |
| ORNL | Doug Kothe<br>Director | kothe@ornl.gov |
| ORNL | John Turner<br>Lead, Virtual Reactor Integration | turnerja@ornl.gov |
| ORNL | Jess Gehin<br>Lead, Advanced Modeling | gehinjc@ornl.gov |
| ORNL | Jeff Cornett Manager<br>Pernerships/Affiliations | cornettjb@ornl.gov |
| NCSU | Paul Turinsky<br>Chief Scientist | turinsky@ncsu.edu |

**Attachment 2**

**CASL Industry Council Meeting Minutes**

**Agenda**

September 9, 2010

Charlotte NC

| | | |
|---|---|---|
| 8:30 | REGISTRATION AND COFFEE | |
| 9:00 | Welcome and Introductions | John Gaertner |
| 9:15 | DOE Perspective | Alex Larzelere |
| 9:30 | Description of the CASL Project | |
| | • Overview | Doug Kothe |
| | • Requirements, Validation and Applications | Jess Gehin |
| | • Vision of the Virtual Reactor | John Turner |
| | • Technology Elements | Paul Turinsky |
| 11:00 | Industry Council Plans | John Gaertner |
| | • Objectives | |
| | • Operations | |
| | • Membership | |
| | • Technology Transfer | |
| 11:30 | Round Robin: Objectives, Issues, and Suggestions from Members | All |
| 12:00 | LUNCH | |
| 1:00 | Round Robin (continued) | All |
| 1:30 | Incorporation of Round Robin Items into IC Plan | All |
| 2:30 | Actions and Plans Moving Forward | John Gaertner |
| 3:00 | Adjourn | |

**Attachment 3**

**CASL Industry Council Meeting Minutes**

**Comments from Round Robin Session**

September 9, 2010

1. Intellectual Property (IP) issues will be important and must be addressed as they arise.
2. Licensing and commercialization of software – define it early; have flexibility.
3. Address new fuel forms; include MOX (mixed oxide fuels).
4. Modularize VERA (acronym for the virtual reactor code) components. Users can substitute their own components or proprietary versions of generic components.
5. Degree of coupling – not too much nor too little. Current coupling is the baseline.
6. Define appropriate computer platform for VERA applications. Some say it must be on the desktop, but always plan for capability 5 years hence.
7. Consider maxim, "If you can't validate it don't include it". Features for sensitivity studies or further development can be in code but can be turned off. Define validation data by application early.
8. Uncertainty Quantification (UQ) propagation is critical to utilities.
9. Where is current state of practice adequate? – use this as a basis to prioritize. Make Requirements Documents available to the Industry Coucil for review early.
10. Make sure solution timing is in sync with problem timing. Manage expectations by defining deliverable dates and expected capabilities of milestone products.
11. Enable a hierarchy of solutions.
12. Simulator should have generic models of plants included so that is fully functional by all users at each release.
13. Transfer CASL technology into current methods also. This will mean papers and reports that can be used in addition to code modules.
14. CASL must be a center of excellence to investigate issues and solutions as well as write code.

15. Consider users with applications for heat generation beyond electricity production. Also do not focus only on Nuclear Regulatory Commission (NRC) licensed product.
16. Focus on 4-loop Westinghouse reactor plants must not limit broader applicability. Specifically, there is no clear plan for applicability to BWRs. Challenge problems narrowly defined.
17. An important VERA application will be to optimize designs of new LWRs including SMRs (small modular reactors).
18. Industry Council members must advise CASL so that its design, development, and release of products supports their business strategies and processes for use of products.
19. Make sure there are plans and data for high level validation of later VERA releases. Lack of high-level validation will limit flexibility of code use.
20. Need tighter link to up-rates and life beyond 60 years – how will it help us find the limits?
21. There needs to be a centralized communication plan among the technical and user communities.
22. Can we use modeling and simulation to foretell the next fuel issues? The next plant issues?
23. Caution: excluding coupled ex-vessel modeling could limit use and usefulness.
24. Two-phase flow is critical to most important applications; but coupled, physics-based, two phase models will not be developed till much later. This issue must have further consideration.
25. There is a high likelihood that planned activities will exceed the $25M/yr budget. Therefore, manage expectations, prioritize activities according to need, and emphasize solutions to problems vs. code product.
26. Verify that staffing and resources are compatible with the work plan.
27. NRC engagement is important – Industry Council should advise and participate with CASL on this interface. License considerations should not prevent the best technical solution from being developed.
28. Develop a "charter" for each challenge problem, identify gaps and data needs. Determine importance of uncertainties for each problem.

**Attachment 4**

**CASL Industry Council Meeting Minutes**

**Interest Form for Participants in the CASL Industry Council Meeting**
September 9, 2010

**Name:** _____

**Job title/description:** _____

**Organization/employer:** _____

**Contact information**

e-mail: _____

Phone: _____

Address: _____

_____

**Desired Level of Industry Council Participation**

IC Steering Committee ☐
Regular IC member ☐
Include on announcement/mailing list only ☐
Another Council (Commercialization, Science, Education, Communications/Economics)?

| **Areas of Interest** | high | med | low |
|---|---|---|---|
| Functional requirements and capabilities | | | |
| Validation and uncertainty quantification of Virtual Reactor components | | | |
| Virtual Reactor multi-physics codes and code development: models, algorithms, S/W architecture and implementation | | | |
| Scalable, efficient algorithms for next generation computer platforms | | | |
| Computer platforms and operating systems for applications | | | |
| Data analytics, user interface and visualization | | | |
| Real-time, immersive virtual collaboration technologies | | | |
| Materials performance models and methods | | | |
| Numerical computational methods | | | |
| Quality assurance requirements for safety related applications | | | |
| Achieving NRC acceptance for safety related applications | | | |
| Technology transfer, training and professional education of CASL results | | | |
| CASL as a continuing institute for advanced LWR computational science | | | |
| Validation and applications to CASL Challenge Problems | | | |
| Applications to fuel design and fuel performance (analysis or simulation) | | | |
| Applications to plant design and operational improvement (analysis) | | | |
| Applications to plant operations and training (simulation) | | | |
| Others: | | | |

**Comment:**