



**American Nuclear Society
Fusion Energy Division
June 2010 Newsletter**

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Letter from the Chair, Lance Snead, Materials Science and Technology Division, Oak Ridge National Laboratory, Oak Ridge, TN.

With the upcoming American Nuclear Society (ANS) annual meeting, to be held in San Diego June 14-18, I have been spending time reviewing the Fusion Energy Division (FED) in preparation for the bi-annual Board of Directors presentation. As part of this presentation, we are in the process of working with ANS on the Professional Division Metrics, which are the primary tool used by ANS to evaluate the Divisions. Our 2008 metrics were outstanding, and in fact were the best metrics of all Divisions. The draft 2009 metrics (that we are still developing with ANS) are given below. Basically, green is good, white acceptable, and red means that we are in need of improvement and ANS will be looking to help us. In 2008 we had a nearly perfect (all green) board with no red. In 2009 we are still exhibiting very healthy performance, though in the areas of Division meetings we have temporarily dipped. However, this is a normal state of affairs for the FED as we are on a two-year schedule for the TOFE conference and we co-sponsor the Nuclear Fuels and Structural Materials series, both of which fall on even years. This also explains the choppy nature of membership increase, which on average has been quite healthy.

Also of note, and which will be a focus of the upcoming FED meeting, is the proposal to institute a new FED student scholarship. The concept is for a graduate award to be established for deserving students working in the area of fusion sciences. An outline of the scholarship has been presented to ANS and has received preliminary approval. At the upcoming meeting we plan to discuss some of the details of the proposal and decide on a path forward. I encourage each of you to attend or call into the meeting and contribute to the discussion.

Professional Division Metrics Fusion Energy Vitality Measures – CY 2009

Division Meetings	Division Governance	Division Contributions to Society	Division Services to Membership
<p style="text-align: center;">National Meeting Participation</p> <p>2008 Annual: 0 session / 0 panel 2009 Winter: 1 session / 0 panel</p>	<p style="text-align: center;">Succession Planning</p> <p>Included in 2004-08 Strategic Plan Updated 2009</p>	<p style="text-align: center;">ANS Position Statements</p> <p>12 Fusion Energy, Revised 2008 (Active)</p>	<p style="text-align: center;">Professional Development</p> <p>Established Program Committee - 2006 P. Wilson on ANS Professional Development Committee National Ignition Facility Workshop at 2008 TOFE</p>

<p>Class I, Class II Topicals +25% attendance (135/200) 15th Topical: TOFE 2004 (142 full papers) 18th Topical Mtg on Technology of Fusion Energy</p>	<p>Membership Trends</p> <p>764/801 members +4.8% change 2006 801/805 members +.5% change 2007 805/827 members +2.7% change 2008 827/829 mbrs +.2% change 2009</p>	<p>Participation with Outside Professional Societies</p> <p>Fusion has liaison with IEEE Publishes in other journals Special Edition Journal of Nuclear Materials TMS/ASTM joint symposia</p>	<p>Scholarships</p> <p>No scholarship established 2009 contributed to ANS NEED Scholarship Developing FED Scholarship 2009</p>
<p>Class III Topicals (Embedded)</p> <p>15th Fusion Topical - Nov 02 17th Topical Mtg on Technology of Fusion Energy (TOFE – Nov 2006) 157 full papers 2008 Embedded Topical co-sponsor Nuclear fuels – 111 summaries</p>	<p>Communications</p> <p>2 newsletters in 2009 Website updated 2009</p>	<p>Society Leadership</p> <p>2 of 4 PDC: 75% Exec Comm? All NPC Presentation to BoD June 2008</p>	<p>Peer Recognition/Awards</p> <p>Edward Teller FED Awards (Achievement & Technical Accomplishment) Best Student Paper Award Subcommittee to support Fellow Nominations</p>
	<p>Division Planning</p> <p>2004-08 Strategic Plan submitted to PDC Chair 2009 Reviewed document</p>	<p>Non-Meeting Publications</p> <p>Fusion Science & Technology Journal ANS Standards activities</p>	<p>Student Support</p> <p>2009 Student Conference 2009 Student Travel</p>
		<p>Division's Commitment to YMG</p> <p>Appointed P. Calderoni, Liaison 2009 Provided financial support 2009 Young Professional Congress support</p>	

New ANS “Fusion” Fellows – June 2010, Nermin A. Uckan, FS&T Editor, Oak Ridge National Laboratory, Oak Ridge, TN.

The election to the rank of Fellow within the ANS recognizes the contributions that individuals have made to the advancement of nuclear science and technology through the years. Selection comes as a result of nomination by peers, careful review by the Honors and Awards Committee, and election by the Society's Board of Directors. The list of current fellows, nomination steps, guidelines, and nomination forms can be found at <http://www.ans.org/honors/va-fellow>.

It is a pleasure to report that we have a new ANS “Fusion” Fellow added to the honors rank: Prof. Farrokh Najmabadi. Congratulations, indeed for a well-deserved honor.

Farrokh Najmabadi, ANS member for 30 years, will be recognized as a Fellow of the American Nuclear Society during the ANS Annual Meeting, held in San Diego, CA, June 13-17, 2010. Farrokh Najmabadi is the Professor of Electrical Engineering and the Director of the Center for Energy Research at the University of California-San Diego (UCSD). In addition to research and teaching in fields related to nuclear energy and electrical engineering, Prof. Najmabadi oversees the internal operations and external relations for a major university energy research center. In this role, he promotes increased attention to energy research and fosters the growth of both nuclear and non-nuclear research activities and collaborations at UCSD.

Farrokh Najmabadi earned the highest grade of ANS membership for his extraordinary research initiatives and contributions to fusion science and technology, his dedication to nuclear/fusion engineering education, and his service to the ANS. Prof. Najmabadi’s game changing seminal work and leadership on the ARIES series fusion power plant studies had a major impact on the world fusion development path. His work has impacted the direction of fusion research both in the US and internationally, especially in the areas of power plant relevant tokamak physics regimes, use of advanced technologies (like SiC composites) needed to make fusion competitive, and alternative confinement concepts and applications of fusion energy.

FED has two dozen or so Fellows and the FED Officers/Executive Committee have been encouraging all FED members to actively engage in nominating deserving colleagues to the fellowship grade. During the past couple of years, FED members have been working diligently to add one-to-two well-deserving colleagues a year to the FED Fellows roster. We need to continue this positive trend and keep nominating our colleagues. Please remember that one cannot get recognized and elevated to Fellow status, unless nominated. The FED “red-team” Fellows will be happy to provide guidance and help review nomination packages. Feel free to contact uckanna@ornl.gov for questions.

List of Officers and Executive Committee Members, Farrokh Najmabadi, Center for Energy Research, University of California-San Diego, La Jolla, CA.

We are pleased to welcome the new FED Executive Committee Officers and members. Vice-Chair Lee Cadwallader (INL) becomes our new Chair and Minami Yoda (GIT) has been elected as the new Vice-Chair/Chair-Elect. Mark Anderson (University of Wisconsin) remains Secretary/Treasurer to complete the second half of his term of office. The newly elected Executive Committee members are Paul Humrickhouse (INL), Keith Rule (PPPL), and Mark Tillack (UCSD).

We would like to thank the Executive Committee members whose terms have just ended, Patrick Calderoni (INL), Mohamed Sawan (University of Wisconsin), and John Sethian (NRL). We also would like to thank our departing Chair, Lance Snead, for his service to

the FED in the past year. Lance will now become Past Chair and the nominating committee chair. The Executive Committee members for 2010/2011 are:

FED Officers:

Lee Cadwallader (INL)	(10-11)	lee.cadwallader@inl.gov	Chair
Minami Yoda (GIT)	(10-11)	minami.yoda@me.gatech.edu	Vice-Chair
Mark Anderson (UW)	(09-11)	manderson@engr.wisc.edu	Sec./Treas.

Executive Committee Members:

Lucile Dauffy (LLNL)	(09-12)	dauffy1@llnl.gov
Paul Humrickhouse (INL)	(10-13)	paul.humrickhouse@inl.gov
Rick Kurtz (PNNL)	(09-12)	rj.kurtz@pnl.gov
Art Nobile, Jr. (LANL)	(08-11)	anobile@lanl.gov
Wayne Reiersen (ORNL)	(08-11)	reiersenwt@ornl.gov
Keith Rule (PPPL)	(10-13)	krule@pppl.gov
Shahram Sharafat (UCLA)	(09-12)	shahrams@ucla.edu
Mark Tillack (UCSD)	(10-13)	mtillack@ucsd.edu
Alice Ying (UCLA)	(08-11)	ying@fusion.ucla.edu

Past Chair:

Lance Snead (ORNL)	(10-11)	sneadll@ornl.gov
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FED Standing Committee Chairs:

- Nominating: Lance Snead (ORNL)
- Honors and Awards: Neil Morley (UCLA)
- Program Committee: Jake Blanchard (UW)

FED Representatives on National Committees:

- ANS Public Policy: Lance Snead (ORNL)
- ANS Publications: position open

Editors:

- Newsletter: Laila El-Guebaly (UW), Dennis Bruggink (UW)
- Fusion Science and Technology Journal: Nermin Uckan (ORNL)

Liaisons to other organizations and ANS divisions:

- ANS Board: Ken Schultz (GA)
- MS&T: Lance Snead (ORNL)
- IEEE: George Miley (UIUC)
- RPS: Paul Wilson (UW)

FED Webmasters:

- Mark Tillack (UCSD) - FED Website
- Dennis Bruggink (UW) - UW Website

19th ANS Topical Meeting on the Technology of Fusion Energy, Farrokh Najmabadi, University of California-San Diego, and Shahram Sharafat, University of California-Los Angeles, CA.

The “embedded” 19th ANS Topical Meeting on the Technology of Fusion Energy (TOFE) is scheduled to be held November 7 - 11, 2010 in Las Vegas, Nevada. Dr. Farrokh Najmabadi is the General Chair and the Technical Committee consists of Dr. Shahram Sharafat - UCLA (Chair), Dr. Hideyuki Takatsu – JAEA, Japan (Vice Chair), and Dr. Laila El-Guebaly – University of Wisconsin-Madison (Vice Chair).

The overarching theme of the meeting is “Fusion Technology in the Age of Burning Plasma.” The meeting will begin with a reception at the conference center on the evening of Sunday, November 7, 2010, and the technical program begins on Monday, November 8. The meeting banquet will be held on the afternoon of Wednesday, November 10, at 6 PM. Technical sessions will resume on Thursday, November 11, and the conference will adjourn before noon that day.

Technical Program

The 19th TOFE will be a three-day meeting with plenary, oral, and poster sessions. There will be plenary papers (10), a mix of invited (30) and contributed oral papers (60), and a substantial number of poster papers (about 100). In addition, special sessions are being planned on various topics (e.g., ITER, NIF, CTF, Fusion Relevant Neutron Sources, Pathways to Demo, etc.). We expect many fusion technology professionals from the US and abroad to attend the 19th TOFE to share their recent results on “Progress of Major Experiments and Next Facilities on the Pathway to DEMO.” Accepted papers will be published in the Fusion Science and Technology Journal.

TOFE-19 Website

A dedicated TOFE-19 website has been created and is maintained by M. Tillack (UCSD) and can be found at: <http://fed.ans.org/TOFE19/>. The website now contains links to the “Call for Papers” brochure, the abstract submission page, as well as an abstract template. New information regarding student travel assistanceship application procedures will be added shortly. The ANS FED will give up to 6 travel assistanceships to students who are presenting a paper at the TOFE. These assistanceships are about \$500 each. We encourage institutions to circulate this information to their students.

Key Dates

The following key dates have been determined:

- | | |
|---------------|--------------------------------|
| May 15, 2010 | – Second Call for Papers |
| June 1, 2010 | – Third Call for Papers |
| June 15, 2010 | – Abstract Submission Deadline |
| Aug. 1, 2010 | – Acceptance Notifications |
| Nov. 11, 2010 | – Full Paper Submission |

We look forward to another highly successful TOFE meeting.

Call for Nominations, ANS-FED Awards, Neil B. Morley, University of California-Los Angeles, Los Angeles, CA.

The Honors and Awards Committee of FED/ANS is seeking nominations for Fusion Energy Division of ANS Awards:

- 1) **Outstanding Achievement Awards:** This award is for recognition of a continued history of exemplary individual achievement requiring professional excellence and leadership of a high caliber in the fusion science and engineering area.
- 2) **Technical Accomplishment Award:** This award is for recognition of a specific exemplary individual technical accomplishment requiring professional excellence and leadership of a high caliber in the fusion science and engineering area.

Detailed descriptions of the awards and past recipients can be found at <http://fed.ans.org/awards.shtml>. Note that nominees will only be considered for the particular award for which they are nominated, and that nominees from 2008 will be automatically reconsidered.

Deadline for nominations is August 1, 2010 for the awards to be presented at the 19th ANS Topical Meeting on the Technology of Fusion Energy, embedded in the ANS Winter Meeting and Nuclear Technology Expo to be held November 7-11, 2010 in Las Vegas, Nevada.

Nominations can be made by individuals and submitted anytime to the FED Honors and Awards Committee Chair (N. Morley). Nomination package should include:

- a) Nominee's CV
- b) A description of exemplary achievement(s)
- c) Support letters (and/or co-signature on the nomination form)

Details are available at the URL provided above.

Please send nominations to:

Neil B. Morley
43-133 Engineering IV
Mechanical and Aerospace Engineering, UCLA
Los Angeles, CA 90095-1597
morley@fusion.ucla.edu

Electronic submission via email is encouraged.

An Outstanding Student Paper Award will also be given at the TOFE meeting; all indicated student papers will be automatically considered. Details will be forthcoming in conjunction with the meeting announcements.

Treasurer's Report, Mark Anderson, University of Wisconsin–Madison, Madison, WI.

In the fall and winter of 2009, the Fusion Energy Division made three funding disbursements:

- \$500 contribution to the ANS Nuclear Engineering Education for the Disadvantaged (NEED) fund,
- \$1000 contribution to the ANS annual student conference (which was held at the University of Michigan, Ann Arbor),
- \$300 contribution to ANS headquarters for nuclear student travel to ANS national meetings.

The FED received a check from the 18th Topical Meeting on the Technology of Fusion Energy (TOFE) from Jeff Latkowski (LLNL) for \$19,114.

The FED received a member allocation of \$1,654 at the beginning of 2009. That allocation has increased from the typical \$1 to \$2 per division member. As of May 10, 2010 the Fusion Energy Division has a balance of \$34,745, which includes the \$1000 donated to the ANS student conference, the disbursement of the \$500 to NEED fund and \$300 to ANS HQ for nuclear student travel to ANS National meetings. Planned expenses for the remainder of this year include:

- \$1500 for awards and plaques for the 19th TOFE topical meeting
- \$3000 for 6 fusion students to travel to the TOFE conference
- \$600 in telephone costs for the scheduled FED executive committee meetings.

There is also a \$500 “other expenses” item in the annual budget to accommodate any unforeseen issues. The total expenses for 2010 sum to an estimated \$7400. Other income expected in 2010 includes an estimated revenue of \$4500 from the 19th TOFE that will be embedded in the ANS winter meeting (November 2010, Las Vegas, NV) and \$1600 for member allocation. This should leave an anticipated balance of \$35,245 at the end of the 2010 calendar year.

Fusion Award Recipients, Laila El-Guebaly, Fusion Technology Institute, University of Wisconsin-Madison, Madison, WI.

Fusion awards have been established to formally recognize outstanding contributions to fusion development made by members of the fusion community. The following awards (listed in alphabetical order) were available to the newsletter editor at the time of publishing this newsletter. We encourage all members of the fusion community to submit information on future honorees to the editor (elguebaly@engr.wisc.edu) to be included in future issues. The ANS-FED officers and executive committee members congratulate the honored recipients of the 2009/2010 fusion awards on this well-deserved recognition and our kudos to all of them.

Alfvén Prize

The winners are **Allen Boozer** (PPPL & Columbia University, USA) and **Juergen Nuehnenberg** (Max-Planck-Institut für Plasmaphysik, Greifswald, Germany). The award will be presented on June 21-25, 2010 at the 37th European Physical Society Conference on Plasma Physics, Dublin, Ireland.

Chinese Awards

Dr. **Vincent Chan** (General Atomics, USA) received the 2009 International Science and Technology Cooperation Award of the People's Republic of China for his contributions in promoting Sino-USA fusion cooperation.

Prof. **Mohamed Abdou** (UCLA, USA) has been awarded one of 20 "2010 Einstein Professorships of the Chinese Academy of Sciences". **Abdou** was selected for his pioneering contributions and outstanding leadership in the thermal, nuclear, and fusion fields.

DOE Lawrence Award

University of Maryland fusion scientist **William Dorland** is one of six persons chosen by the US Department of Energy to receive its 2009 E. O. Lawrence Award "for their outstanding contributions in research and development supporting the Department of Energy and its missions." **Dorland** is cited "for his scientific leadership in the development of comprehensive computer simulations of plasma turbulence, and his specific predictions, insights, and improved understanding of turbulent transport in magnetically-confined plasma experiments."

Foreman Award

The recipient of the 2010 Foreman Award is **Diana Schroen**, General Atomics, USA. The award was presented at the 19th Target Fabrication Meeting, February 21-26, 2010, Orlando, Florida.

Miguel Catalan Investigation Award

Prof. **Raul Sanchez** received the Miguel Catalan Investigation Award by the Comunidad de Madrid for his work in plasma physics and fusion. The prize recognizes excellence in research and scientific achievement by researchers under the age of 40. In addition to his position with ORNL, **Sanchez** is a professor at the Universidad Carlos III, Madrid, Spain.

PPPL Awards

The US Princeton Plasma Physics Laboratory (PPPL) honored four fusion energy researchers - **Robert Kaita, Dick Majeski, Lane Roquemore, and Leonid Zakharov** - for their scientific accomplishments.

Physicists **Kaita, Majeski, and Zakharov** received the Kaul Prize for Excellence in Plasma Physics Research and Technology Development. The Laboratory cited the Kaul Prize recipients for their pioneering work in the use of liquid lithium metal as a renewable wall for fusion devices.

Roquemore, an engineer, received the PPPL Distinguished Engineering Fellow award for his many contributions to the development of fusion science, with particular emphasis on new frontier diagnostic development.

News from Fusion Science and Technology (FS&T) Journal, Nermin A. Uckan, FS&T Editor, Oak Ridge National Laboratory, Oak Ridge, TN.

As of mid-February, 2010, FS&T has moved to Editorial Manager (EM), an online manuscript submission and review system developed by Aries Systems. You may access the new site at <http://fst.edmgr.com/>. When the new site was launched, FS&T sent emails to individuals that were in the FS&T database who had been authors and/or reviewers over the past five years. The emails contained the individual's username and password to get into the system. If you have not already done so, you can log into the system and update your contact information and preferences, or request/change your password.

During the past twelve months (May 1, 2009-April 30, 2010), FS&T received 230 manuscripts for regular issues, plus 48 camera-ready papers from the 2009 Carolus Magnus Summer School for FS&T Transactions. [Transactions are FS&T supplements and not fully refereed in the same sense as the journal issues.]

The following special (dedicated) issues have been published during 5/1/09 to 4/30/10:

- Selected papers from 18th IFE Target Fabrication – FS&T Apr./May 2009
- TOFE-08 Proceedings (parts 1 & 2) – FS&T Jul./Aug. 2009
- Tore Supra Tokamak (Cadarache, France) – FS&T Oct. 2009
- 9th Carolus Magnus Summer School – FS&T Trans. Feb. 2010
- Selected papers from APS-DPP 2009 Mini-Conf. on Mirrors –FS&T May 2010

The following special (dedicated) issues are scheduled for the remainder of 2010:

- Large Helical Device (LHD) 10th Anniversary - FS&T Jul./Aug. 2010
- Selected papers from 6th Fusion Data Validation & Analysis – FS&T Nov. 2010

The following special (dedicated) issues are confirmed for 2011:

- Selected papers from 19th IFE Target Fabrication – FS&T Jan./Feb. 2011
- Open Systems 2010 Proceedings – FS&T Trans Feb. 2011
- Selected papers from 2010 EC-16 – FS&T Apr./May 2011
- 9th Tritium 2010 Proceedings – FS&T double issues (2011)
- 19th TOFE 2010 Proceedings – FS&T double issues (2011)

The following issues are being planned (or under discussion) for 2012 and beyond:

- Cluster of fusion papers from ICFRM-2011 – FS&T regular issue(s) (2012)
- ICENES-2011 Proceedings – FS&T Transactions (2012)
- 10th Carolus Magnus Summer School 2011 – FS&T Transactions (2012)
- JT-60U (update of JT-60 Special 2002) – FS&T (in planning)
- JT-60SA (part of JA-EU ITER Broader Approach) – in planning
- DEMO Studies (EU, JA) – FS&T regular issue (in planning)
- IFMIF (EU, JA) – FS&T regular issue (in planning)
- KSTAR (Korea) – FS&T regular issue (in planning)
- W7-X (Germany) – FS&T regular issue (under discussion)
- Test Blankets (ITER Partners) – FS&T regular issue (under discussion)

Please check for your library subscription. Electronic access to FS&T is available from 1997-to-current. Tables of contents and abstracts of papers can be accessed at <http://www.ans.org/pubs/journals/fst/>. Individual and library subscribers can access the full text articles at <http://epubs.ans.org/>. Please send your comments on FS&T contents and coverage as well as suggestions for potential future topical areas that are timely and of interest to fst@ans.org.

ONGOING FUSION RESEARCH:

ASME Division IV Magnetic Confinement Fusion Energy Devices, W.K. Sowder, Quality Management Services, and Richard W. Barnes, PE-Anric Enterprises Inc., USA.

I Forward

There is an ongoing effort within the ASME (American Society of Mechanical Engineers) Section III Codes and Standards organization approved by the ASME Board of Nuclear Codes and Standards to develop rules for the construction of fusion-energy-related components such as vacuum vessel, cryostat and superconductor structures and their interaction with each other. These rules will be found in Division IV of Section III entitled “Magnetic Confinement Fusion Energy Devices (BPV III)”. Other related support structures, including metallic and non-metallic materials, containment or confinement structures, fusion-system piping, vessels, valves, pumps, and supports will also be covered. The rules shall contain requirements for materials, design, fabrication, testing, examination, inspection, certification, and stamping. The formation of a new Work Group Fusion Energy Devices that will develop these rules is just beginning to develop its membership and future working group support structures.

II Introduction

Current ASME Code rules do not adequately cover the design, fabrication or construction of the magnetic confinement fusion energy devices (e.g. tokamak devices) that are currently being considered for future DEMO construction or to provide support to ongoing projects, such as ITER and others. The current rules need to be modified to meet some of these future needs. However, it has been recommended that a complete new set of rules be developed specifically for these new devices to cover design, construction and inspection/testing. In addition, it is anticipated that operation and maintenance requirements for these fusion energy devices will also require a new set of rules or major modifications to existing ASME OM (Operations & Maintenance) Code. It is necessary that these new rules will contain the best available methods and technology in each area.

It is anticipated that the general scope and format of the new fusion device rules will be generally the same as the current scope of Section III but major changes will be reviewed, considered and addressed because of the differences and functions between a fusion-based facility and a typical fission facility.

In order to efficiently develop these new rules, a Division IV Fusion Device Roadmap is being developed to guide the formation of a Fusion Device Project Plan that will focus resources on all areas of the proposed rules being considered for development, as well as providing project management to this development effort. The Fusion Device Project Plan development will be based on the assumption that a complete set of new Code rules is needed by regulators for their future adoption.

The Division IV Fusion Device Rules will be developed by various project teams within the Sub-Group on Magnetic Confinement Fusion Energy Devices of the BPV Committee

on Construction of Nuclear Facility Components (III) and will be coordinated with other impacted organizations both inside and outside ASME. A Stakeholder Task Group reporting to the Chairman of the BPV Committee on Construction of Nuclear Facility Components (III) and the Chairman of the Sub-Group Magnetic Confinement Fusion Energy Devices will be formed to identify stakeholders and their needs, and develop recommendations and approaches to be incorporated into the new Division 4 Code rules.

It will be necessary to reach a broad consensus from a large stakeholder group at each step of the Code rule development process. These stakeholders are globally based in various countries and organizations, consisting of facility owners, standards development organizations (SDO), regulators, governmental agencies, scientific user communities and existing facilities with real-time experiences and needs. It is expected that the development process decisions may indeed deviate from the standard ASME practices and, in some cases, even run counter to normal ASME code direction; but in each case, the resulting Code rules will be in accordance with the ASME Charter for the BPV Committee on Construction of Nuclear Facility Components (III).

As this process evolves, the Fusion Device Project Plan will be updated to consider the effect of each decision on all aspects of the Code rule development activities. As the project teams, task groups, and committees deliberate, it is anticipated that some of these decision and tasks will be modified or eliminated from consideration and others will be added.

The Division IV Fusion Device Roadmap and Project Plan also recognizes that many of the components of a fusion device will not fit into the standard ASME Section III component descriptions, its Charter, or even within its historical code equipment rules. In these areas that are outside of the ASME arena of code activities, the project plan, and ultimately the Code rules, will provide a path forward for the Fusion Device users to direct their future efforts of inquiry.

The Fusion Device Project Plan will include a suggested organization for the new ASME Division IV Sub-Group on Magnetic Confinement Fusion Energy Devices and will identify project teams to begin the development process for these code rules.

The philosophy used to generate the suggested organization is:

- Designate dedicated project teams to begin exploring proposals for modification of existing rules or pursue new rule development.
- Each project team is to determine the best available technology and if existing standards are available, what current operating facility lessons learned exist for each portion of the rules and consider recent work of other SDOs as well as the technical user base. It is recognized that this process is well underway in many areas of the fusion community and it is desirable to build on those efforts and not duplicate.

The Fusion Device Project Plan will ensure a close liaison is maintained among all project teams and activities to assure that design, construction and post-construction rules are complementary and consistent. The Fusion Device Project Plan focuses primarily on

those tasks that are needed to develop code rules. Tasks that may be needed to demonstrate performance or for specific designs are outside of the scope.

III Organization

This Fusion Device Project Plan proposes a phased approach for the development of ASME rules for the Fusion Device Code:

- Phase I Activities: Invite from stakeholders design conditions or needs that could be used for immediate application. Those identified design conditions or needs may need ASME code cases or consideration of new rules for materials, R&D needs, and activities that have been identified as potentially important for licensing by a regulator.
- Phase II Activities: Develop actual code rules to be incorporated into the new Division IV code to meet the needs identified by stakeholders worldwide for facilities that will be designed 10 years or more from now.

The term R&D as used in this Project Plan is intended to include the following categories of tasks:

- Physical tests to develop material properties and information about the long-term performance of materials.
- Development and validation of new design and analysis methods.
- Development of new methods for fabrication and examination.

A recommended organization will be provided as an attachment to the Fusion Device Project Plan. It has already been stated and understood that in some cases, ASME Code rules will not be developed to address a particular component or item, but that other SDOs or regulatory bodies will provide path forwards with rules or guidance.

IV Administrative and Technical Work Activities

1. Establish an organizational structure to oversee the Phase activities.
2. Identify working groups along the lines of the major fusion components, e.g.
 - Magnets
 - Vacuum Vessel
 - Primary Containment Components
 - Structural Components
3. Establish Physical Boundaries: Establish physical boundaries for the scope of coverage to be considered for fusion design and operating facilities and proposed future fusion facilities. The scope should not be limited to only components that are in or directly support the operation of the Fusion Device, but should include secondary operations as well. These secondary operations or downstream facilities may be constructed and maintained using existing “non-nuclear” codes and standards.
4. Standard Component Classification System: Develop an appropriate system for classification of components and supports.
5. Establish Technical Framework: Examine the technical and organizational approaches in the existing facilities and SDOs such as current ASME code rules including Section III and Section VIII-Division 2, JSME (Japan Society of

- Mechanical Engineers) and EN (European Engineering) Standards. This activity should involve examining design, fabrication, examination and testing methods being used throughout the world, and then selecting the best of those for inclusion into this Fusion Code. In many cases, alternatives are provided for flexibility.
6. Organization of Fusion Code Section Format: The organization of sections, paragraphs, appendices, etc. should be established to facilitate draft development. The objective should be to maintain a parallel structure so that rules that apply to both new and post-construction activities can easily be jointly developed and maintained
 7. Develop Common Terminology and Units of Measure: A common understanding of terminology, acronyms, abbreviations and units of measure must be developed for use in all Fusion Code rules. It is suggested that the SI system be the primary units, but provisions for the use of alternative units should be made as well.
 8. Develop Overall Guidance: In order to provide guidance for developing new code rules, it will be necessary to develop general guidelines for Code rules, global interfaces, interaction with other SDOs worldwide, copyright issues and territorial disputes between competing organizations.
 9. Develop Rules of Design Requirements: In many cases, components can be designed by various design rules existing within the host country regulations or the adoption of the ASME Design methodology within Section III. Design methodologies should be developed for application at the host country location using their local regulations where practical, for all components for future Fusion Devices. However, regulatory acceptance must be considered.
 10. Update rules for welding and post-weld heat treatment.
 11. Develop rules for NDE (Non-Destructive Examination) for new and post construction.
 12. Interface Task Force: Establish an Interface Task Force with representatives from impacted SDOs and Regulators to reach a consensus on responsibility for requirements in all areas where standards are needed.
 13. Safety Criteria: Develop high-level safety criteria and requirements and obtain approval from the Regulators
 - Reach agreement on a process for developing component classification rules
 - Develop component classification rules and obtain approval from the Regulators.
 14. Define responsibility for civil / structural engineering standards.
 15. Confinement: Develop a consensus among all stakeholders on a standardized functional specification for confinement methods.

V Recommended ASME Approach and Organization

The following committee organization structure is recommended as a beginning for the timely development of ASME Code rules. This structure is intended to support the tasks and activities that should be completed prior to, or in parallel with, the development of the Code rules. The proposed committee organization involves a large number of project teams that are each responsible for a portion of the Code rules. However, it is important that these teams not work in isolation. It is therefore necessary that each team present a

detailed summary of their current activities to the next higher-level group that they report at each ASME Code Week meeting. Some of the project teams have been designated as “ad-hoc” teams, to indicate that they are not expected to be a permanent part of the Code Committee structure, but would exist only until the task that they have been assigned is complete.

Sub-Group Magnetic Confinement Fusion Energy Devices A standing Subgroup under the BPV Committee on Construction of Nuclear Facility Components (III) with primary responsibility for developing and maintaining the Section III Division 4 Code Rules.

Stakeholder Task Group- This Task Group reporting to the Chairman of the BPV Committee on Construction of Nuclear Facility Components (III) and the Chairman of the Sub-Group Magnetic Confinement Fusion Energy Devices is to identify stakeholders and their needs, develop recommendations and approaches to be incorporated into the new Division 4 Code rules.

Task Group on Conformity Assessment This Task Group will develop recommendations for modifications to the existing QA and Stamping requirements that are sensitive to the various international users’ local system of control.

Work Group on Design- This work group will review existing design methodologies and activities for possible combination or use “as written” in accordance with the local requirements.

Project Team on Design Specifications This Project Team will use the current information for developing a design specification model as well as what stakeholders/SDO are using in other countries as their approach.

Project Team on Design Rules This Project Team should develop rules with standardized solutions for common components.

Work Group on Materials Responsible for material inquiries for possible Code Cases as well as new materials identified for inclusion into Section II and Section III respectively.

Task Group on Fabrication Incorporate most of the rules from the existing books, but consider the need for new rules to address unique requirements of the fusion components.

Task Group on NDE This Task Group should develop compatible NDE requirements for new and post construction. The rules in existing books should be adopted and Section V should be referenced to the extent practicable. However, the Task Group should ensure that the measurements and evaluations made during new construction provide an appropriate baseline for the measurements that will be made during operations.

Recently Published Fusion Books

Nuclear Reactors, Nuclear Fusion and Fusion Engineering. NOVA Science Publishers, Inc.: Hauppauge, New York, USA. ISBN: 978-1-60692-508-9 (2009):

- Chapter 6: Laila A. El-Guebaly, “History and Evolution of Fusion Power Plant Studies: Past, Present, and Future Prospects,” pages 217-271.
- Chapter 9: L.A. El-Guebaly and L. Cadwallader, “Recent Developments in Safety and Environmental Aspects of Fusion Power Plants,” pages 321-365.

Superconducting Magnets and Superconductivity: Research, Technology and Applications. NOVA Science Publishers, Inc.: Hauppauge, New York, USA. ISBN: 978-1-60741-017-1 (2009):

- Chapter 8: L.A. El-Guebaly and L.M. Waganer, “Radiation Shielding Schemes and Advanced Fabrication Techniques for Superconducting Magnets,” pages 275-291.

W.M. Stacey, **An Introduction to the Physics and Technology of Magnetic Confinement Fusion.** WILEY-VCH Publishers: Berlin, Germany. 2nd Edition, 2010, 246 pages, ISBN: 978-3-527-40967-9.

W.M. Stacey, **The Quest for a Fusion Energy Reactor: an Insider’s Account of the INTOR Workshop.** Oxford University Press: Cary, North Carolina, USA, 2010. ISBN13: 978-0-19-973384-2. ISBN10: 0-19-973384-8

Calendar of Upcoming Conferences on Fusion Technology

2010:

ANS Annual Meeting

June 13-17, 2010, San Diego, CA, USA

<http://www.ans.org/>

26th Symposium on Fusion Technology – SOFT-2010

September 27- October 2, 2010, Porto, Portugal

<http://soft2010.ipfn.ist.utl.pt/>

23rd IAEA Fusion Energy Conference

October 11-16, 2010, Daejeon, Korea

<http://www-pub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=38091>

9th International Conference on Tritium Science and Technology

October 24-29, 2010, Nara, Japan

<http://tritium2010.nifs.ac.jp/>

ANS Winter Meeting

November 7-11, 2010, Las Vegas, NV, USA

<http://www.ans.org/>

ANS 19th Topical Meeting on the Technology of Fusion Energy – TOFE-2010

November 7-11, 2010, Las Vegas, NV, USA

<http://fed.ans.org/TOFE19>

52nd American Physical Society - Division of Plasma Physics (APS-DPP) meeting

November 8-12, 2010, Chicago, IL, USA

<http://www.apsdpp.org>

Fusion Power Associates Annual Meeting
December 1-2, 2010, Washington, DC, USA
<http://fusionpower.org/>

2011:

ANS Annual Meeting
June 26-30, 2011, Hollywood, Florida, USA
<http://www.ans.org/>

24th Symposium on Fusion Engineering – SOFE-2011
June 26-30, 2011, Chicago, IL, USA
neumeyer@pppl.gov

15th International Conference on Emerging Nuclear Energy Systems (ICENES-2011)
May 15-19, 2011, San Francisco, CA, USA
<http://www.icenes2011.org/>

10th International Symposium on Fusion Nuclear Technology - ISFNT-10
September 11-16, 2011, Portland, OR, USA

15th International Conference on Fusion Reactor Materials - ICFRM-15
October 16-21, 2011, Charleston, North Carolina, USA
katohy@ornl.gov

ANS Winter Meeting
October 30-November 3, 2011, Washington, DC, USA
<http://www.ans.org/>

53rd American Physical Society - Division of Plasma Physics (APS-DPP) meeting
November 14-18, 2011, Salt Lake City, Utah, USA
<http://www.apsdpp.org>

2012:

ANS Annual Meeting
June 24-28, 2012, Chicago, IL, USA
<http://www.ans.org/>

ANS 20th Topical Meeting on the Technology of Fusion Energy – TOFE-2012

54th American Physical Society - Division of Plasma Physics (APS-DPP) meeting
October 29-November 2, 2012, Providence, Rhode Island, USA
<http://www.apsdpp.org>

ANS Winter Meeting
November 11-15, 2012, San Diego, CA, USA
<http://www.ans.org/>

2013:

ANS Annual Meeting
June 16-20, 2013, Atlanta, GA, USA
<http://www.ans.org/>

ANS Winter Meeting
November 10-14, 2013, Washington, DC, USA
<http://www.ans.org/>

55th American Physical Society - Division of Plasma Physics (APS-DPP) meeting
November 11-15, 2013, Denver, Colorado, USA
<http://www.apsdpp.org>

2014:

56th American Physical Society - Division of Plasma Physics (APS-DPP) meeting
October 27-31, 2014, New Orleans, USA
<http://www.apsdpp.org>

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