

IEA
INTERNATIONAL ENERGY AGENCY

OECD
ORGANIZATION FOR ECONOMIC
COOPERATION AND DEVELOPMENT



AIE
AGENCE INTERNATIONALE DE L'ÉNERGIE

OCDE
ORGANISATION DE COOPÉRATION ET
DE DÉVELOPPEMENT ÉCONOMIQUES

April 1, 2009

Program Plan for Collaborative Task Sprays in Combustion

The "Sprays in Combustion" was officially accepted as a Collaborative Task by the Executive Committee of the Combustion Agreement in Paris in May 11, 2006.

Acceptance of these rules

These rules were accepted by charter member countries in April 1, 2009.

Overall Task Scope and Objectives

The main focus of the Collaborative Task is on engine sprays, including compression ignition engines, spark ignition engines and new engine combustion concepts, as well. Also sprays of advanced fuels are included. Basic spray phenomena studies are also accepted. Other combustion related spray studies can be accepted as subprojects too.

Sprays play a major role in air/fuel mixing. Therefore the role of the sprays in combustion is very important. The improved performance of internal combustion engines and emission reduction are the ultimate goals of the spray studies. The collaborative task will have sub-projects on computational and experimental research. The aim is to increase the understanding of spray physics and also promote collaboration between experimental and computational research.

Organization and Coordination

The collaborative task has a chair and a co-chair. The chairs are nominated by the Executive Committee of the Combustion Agreement. The chairs should represent different member countries. The division of the duties between chairs is agreed between the chairs.

The Collaborative Task has a Technical Committee *nominated by member countries*. The Technical Committee has a chair and two members. The members of the Technical Committee should represent different member countries of the Combustion Agreement.

The IEA Combustion Agreement, also known as the IEA Implementing Agreement on Energy Conservation and Emissions Reduction in Combustion, functions within a framework created by the International Energy Agency (IEA). Views, findings and publications of the IEA Combustion Agreement do not necessarily represent the views or policies of the IEA Secretariat or of all its individual member countries.

The responsibilities of the Technical Committee include

- the approval of subprojects in the Collaborative Task
- keeping record on subprojects and their main results
- archiving subproject Task Leaders Meeting reports and presentations and other presentations together with ExCo secretary
- to make yearly reports to Combustion Agreement

The Technical committee does keep a record on internal meetings and decisions. The meetings can be held as real meetings for example in connection with TLM meetings but also by phone or email. The records of the meetings should be numbered consecutively.

The Technical Committee can nominate a Technical Coordinator or Research Manager to help in arranging meetings, in reporting and in documenting.

Charter Member Countries in 2006 and Their Subtasks in 2006

UK: Sub-task number 1.2K2,
Studies of Evaporating Sprays; Issues & Diagnostic Tools

Italy: Sub-task number 1.2C
Air Motion Investigation in Diesel Engines

Japan: Sub-task number 1.2K3
An Experimental and Theoretical Study of Engine Sprays

Japan: Sub-task number 1.5F
Spray and Combustion in Diesel Engine

Japan: Sub-task number 3.4B
Investigate Dynamic Spray Characteristics by Image Processing

Switzerland: Sub-task number 1.2K4
Low Emission Combustion Technologies for High Efficiency Energy Converters

Finland: Sub-task number 1.2H
Fuel Spray Modeling for Diesel Combustion Simulation

Finland: Sub-task number 1.2J
In-cylinder Flow Fields of Diesel Engines

Provisions for adding additional subprojects

Additional members and subprojects are accepted by the Technical Committee according to a written application. In case of different opinions in the Technical Committee or between the Applicant and Technical Committee, the Executive Committee of the

Combustion Agreement will make the final decision. The decision should be based on the technical content and its suitability to the overall Collaborative Task objective.

Subproject application should include at least

- Title
- Responsible Organization
- Principal Investigator
- Contact Information
- Main objectives
- Funding
- Planned Duration
- Milestone Chart
- Reporting

The subproject will be considered finished according to the planned duration, unless a written notice of continuation is made. A subproject will be regarded as finished too, if not reported in two successive Task Leader Meetings or other meetings or work shops of the Collaborative Task.

Milestone Chart

The focus of the Collaborative Task is on science and collaboration of improving the computational methods and experimental diagnostics to increase the understanding of spray phenomena and thus improve combustion performance and reduce emissions. The milestones will be based on the subprojects.

Planned Meetings

Yearly Collaborative Task meetings (sessions) are arranged in connection of Task Leader Meetings of the Combustion Agreement together with the local organizers. There is a possibility and also aim to arrange additional meetings and work shops within the Collaborative Task to enhance collaboration. There is possibility of also non-members to take part and make presentations in meetings other than the official Task Leaders Meetings. The costs of additional meetings should be split out between the participants.

Deliverables, reports and presentations

Yearly Task Leader Meeting presentations and extended abstract style reports are expected on every subproject. The reports are also used for reporting to the Agreement. Other meetings and work shops can be arranged with presentation material only. Other reports and publications elsewhere should be named in the subproject reports of the Combustion Agreement (provided that they are based on the same research project).

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IEA Combustion Agreement

A Collaborative Task on Sprays in Combustion

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IEA Combustion Agreement ExCo



Implementing Agreement for Energy Conservation and Emissions Reduction in Combustion

Belgium, Canada, Finland, Italy, Japan, Korea,
Norway, Sweden, Switzerland UK, USA (China
and Russia interested in participating)

Chair 2009: Gurpreet Singh, USA
Vice Chair 2009: Bernt Gustafsson, Sweden
Operating Agent: Dennis Siebers, USA
ExCo Secretary: Bob Gallagher, USA

Sprays in Combustion, Organization from April 1, 2009

Chair: Martti Larmi, Finland

Co-chair: Yasuo Moriyoshi, Japan

Technical Committee:

Martti Larmi, Finland

Yasuo Moriyoshi, Japan

Gerardo Valentino, Italy

Research Manager/ Technical Coordinator

Dr. Ossi Kaario, TKK, Finland

Program plan approved by Finland, Italy,
Japan, Switzerland and UK.

Focus in 2009

The main focus of the Collaborative Task is on **engine sprays**, including compression ignition engines, spark ignition engines and new engine combustion concepts, as well. Also sprays of advanced fuels are included and basic spray phenomena studies are accepted. Other combustion related spray studies can be accepted as subprojects too.

Sprays play a major role in **air/fuel mixing**. Therefore the role of the sprays in combustion is very important. The improved performance of internal combustion engines and emission reduction are the ultimate goals of the spray studies. The collaborative task will have sub-projects on computational and experimental research. The aim is to **increase the understanding of spray physics** and also **promote collaboration** between experimental and computational research.

- **Administrative framework existing**

Collaborative Task Benefits

1. Networking, Discussions
2. Bringing Experimentalists and Simulation Experts together
3. Learning from each other

Fuel Spray Work Shop in Detroit in Connection with the Annual SAE World Congress

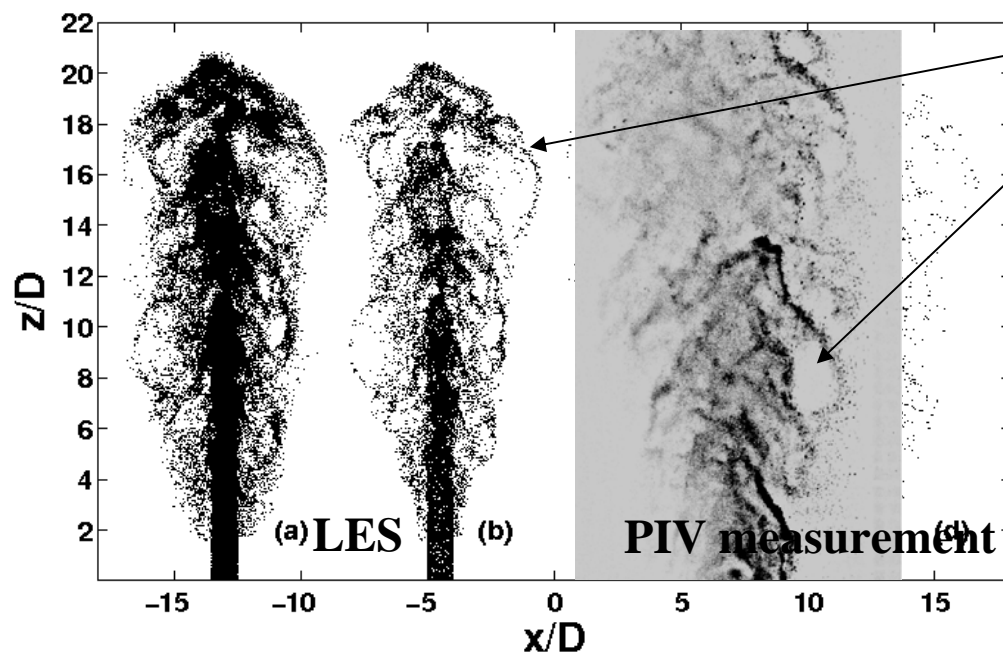
- Arranged in 2007, 2008 and 2009
- 14 to 20 delegates from countries
- Japan, Korea, USA, Italy, Sweden and Finland

Fuel Spray Work Shop April 18, 2009 in Detroit

- 1. “Study of Diesel Spray Primary Breakup using Ultrafast X-Ray Phase-Contrast Imaging”, Jian Gao, Won-Geun Lee, and Rolf D. Reitz from the Engine Research Centre, University of Wisconsin-Madison, and Zun-Ping Liu, Jin Wang from the Advance Photon Source, Argonne National Laboratory, USA
- 2. “Progress of spray formation and ambient gas flow in the high-pressure swirl spray”, Yoshiyuki Kobayashi, Tsuneaki Ishima, Gunma University, and Tomio Obokata, Tokyo Denki University, Japan
- 3. “Modeling sub-grid scale mixing of vapor in diesel sprays using jet theory”, Neerav Abani and Rolf D. Reitz, Engine Research Centre, University of Wisconsin-Madison, USA
- 4. “A Comparison of RANS and LES Models for Non-Evaporating Sprays using OpenFoam”, Yejun Gong and Franz X. Tanner, Michigan Technological University, USA
- 5. “Effect of Nozzle Orifice Geometry on Diesel Spray and Combustion Characteristics”, Som, Sibendu, Anita I. Ramirez, and Suresh K. Aggarwal, Department of Mechanical and Industrial Engineering, University of Illinois at Chicago, USA
- 6. “Experimental Studies of the Spray-Wall Interaction of Diesel Sprays”, Alf-Hugo Magnusson, Sven Andersson, and Ingemar Denbratt, Chalmers, Sweden
- 7. “Diesel Spray Visualization”, Harri Hillamo, Ville Vuorinen, Ossi Kaario, and Martti Larmi, TKK Helsinki University of Technology, Finland

Example of contribution to others

1. Spray physics experimental data (inner structure)
2. Spray experimental data with different nozzles
3. Spray simulation data with LES. Especially drop gas face interaction (inner structure)



preferential
concentration

LES Reproduces the PIV-
like Spray Structure
(Hillamo & Vuorinen, TKK,
2009)

Collaborative Task on “Sprays in Combustion”

Plans 2009–2010

- Sub-project approval and documentation
- TLM-meeting session in Canada
- Fuel Spray Work Shop in Detroit 2010

Paper from technical presentations

- Extended abstract
- Typically 1–5 pages
- Submit to Dr. Bob Gallagher