

**Project co-funded by the European Commission
within the Sixth Framework Programme**



PRIORITY 4 - AERONAUTICS AND SPACE

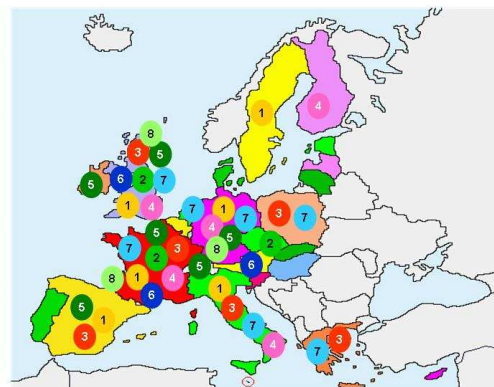
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Publishable Executive Summary

Launched in July 2006, MOET (More Open Electrical Technologies) is an Integrated Research Project co-funded by the European Commission within the 6th Framework Programme. It is based on a consortium of 62 European partners (a new partner, MOOG SARRL, having joined the Consortium in December 2007). Please see table 1 listing all members of the MOET Consortium.

The consortium represents 14 European countries. It is composed of universities, research centres and a broad range of aircraft, system and component manufacturers representing the whole supply chain (including SMEs) who are ready to set up the Power-by-Wire standard.

- Aircraft Manufacturer** 1
- Engine Manufacturer** 2
- Electrical Systems** 3
- Air/cooling systems** 4
- Actuation system** 5
- Avionics Systems** 6
- Platform Simulation** 7
- Power Electronics** 8



MOET Competence within Europe

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MOET Consortium

Type	Participant name	Country
Industrial	AIRBUS FRANCE (<i>Coordinator</i>)	FR
Industrial	AIRBUS DEUTSCHLAND	DE
Industrial	AIRBUS SPAIN	ES
Industrial	AIRBUS SAS	FR
Industrial	AIRBUS UK	GB
Industrial	ALENIA	IT
SME	ARTTIC	FR
Industrial	ARTUS	FR
Industrial	CRISA	ES
Industrial	CROUZET	FR
Industrial	DASSAULT AVIATION	FR
Research Centre	DLR	DE
SME	DYNEX	GB
Research Centre	EADS France	FR
Research Centre	EADS CRC D	DE
SME	EGIDA NET	PL
SME	EUROLOGIC	FR
Industrial	EUROCOPTER	FR
Industrial	GOODRICH ACTUATION SYSTEMS FRANCE	FR
Industrial	GOODRICH ACTUATION SYSTEMS Ltd	GB
Industrial	GOODRICH POWER SYSTEMS	GB
Industrial	HISPANO-SUIZA	FR
Industrial	LABINAL	FR
Academic	INST. NAT. POLYTECHNIQUE DE TOULOUSE	FR
Academic	INST. NAT. POLYTECHNIQUE DE GRENOBLE	FR
Industrial	LIEBHERR TOULOUSE	FR
Industrial	LIEBHERR AEROSPACE LINDENBERG	DE
Industrial	LIEBHERR- ELEKTRONIK	DE
SME	MICROTECH	PL
Industrial	MICROTURBO	FR
Industrial	MOOG IRELAND	IE
Industrial	MOOG SARL (<i>joined the consortium in Dec 2007</i>)	FR
Research Centre	NLR	NL
SME	PARAGON	GR
Industrial	PBS	CZ
SME	PCA	GB
Industrial	PUISSANCE PLUS	FR
Industrial	ROLLS-ROYCE	GB
SME	ROLLVIS SA	CH
Industrial	SAAB AB	SE
Industrial	SAGEM	FR
Industrial	AEROCONSEIL AIRCRAFT ENGINEERING	FR
SME	SEMELAB PLC	GB
Industrial	SIEMENS G	DE
Industrial	GE AVIATION SYSTEMS	GB
Industrial	SNECMA	FR
SME	INGETEAM TECHNOLOGY	SP
SME	TFE	FR
Industrial	THALES AES	FR
SME	TTTECH	AT

Type	Participant name	Country
SME	ULTRA ELECTRONICS	GB
Academic	ACADEMIC INITIATIVE FOR THE MORE ELECTRIC AIRCRAFT - University of Nottingham - University of Sheffield - University of Bristol - AIMEA - Manchester	GB
Academic	UNIVERSITY. OF CATALANA	ES
Academic	GDANSK UNIV. OF TECHNOLOGY	PL
Academic	UNIVERSITY. OF HAMBOURG	DE
Academic	UNIVERSITY OF LAPPEENRANTA	FI
Academic	UNIVERSITY. OF NAPOLI II	IT
Academic	UNIVERSITY. OF NAVARRA	ES
Academic	UNIVERSITY. OF PADOVA	IT
Academic	TECHNOLOGICAL EDUCATION. INST. OF PIRAEUS	GR
Industrial	ZODIAC-ECE	FR
Industrial	ZODIAC-INTERTECHNIQUE	FR

In line with the vision 2020 from ACARE (Advisory Council for Aeronautics Research in Europe), **MOET aims at establishing the new industrial standard for commercial aircraft electrical system design**, which will directly contribute to strengthening the competitiveness of the aeronautical industry. MOET will also contribute to reducing aircraft emissions and improving operational aircraft capacity.

Recent National and European research activities have launched more advanced approaches towards commercial aircraft on-board power system management. These benefits have also been recognised in North America where this is being given special consideration.

A step change is necessary to remove current air and hydraulic engine off-takes and further increase the electrical power generation capability. This in itself will require significant changes to current electrical generation and network techniques.

After Fly-by-wire, the Power-by-wire concept will enhance aircraft design and use by power source rationalisation and electrical power flexibility. This will be achieved by developing the necessary design principles, technologies and standards.

Over the full-project 3-year period, **the overall aims of MOET are:**

- Validate scalable electrical networks up to 1MW considering new voltages and advanced concepts including system transformation of future air, actuation and electrical systems into all electrical solutions:
- Assess the Power-by-Wire concept integration at aircraft level considering a more composite environment and the interfaces with the avionics world,
- Build a design environment aiming to design and validate standardised solutions and a coherent set of platforms open to the full supply chain, in order to develop an optimised high performance Power-by-Wire concept.

Based on the first 12 months achievements, the work performed during the second year period (July 2007 – June 2008) includes:

At the management level, The day to day activity of the core management team was as follows:

- Secured Information and document exchange and sharing between partners (the Collaborative Website, MOET documentation templates and associated guidelines)
- Risks management: maintain the risk register and the related indicator
- Resources monitoring and management: with a 3-months monitoring of persons-months consumption and 6-months monitoring of budget consumption used for the related indicator and necessary follow-up (even through Coordination Memorandum distribution) when deviation is noticed and corrective action requested.
- Deliverables management: with a weekly monitoring of Deliverables due and the related indicator and with a quality control fully performed before delivery to the European Commission.
- Dissemination and exploitation of results with support of the Exploitation Manager, the Intellectual Property Rights Team and the public website through the organisation of Steering Committee approval.
- Forum organisation: trade-off performed and presented to MOET Management Committee/Forum Organising Team approval to identify cost effective hosts

At each project review (every 3 months), indicators are presented to the MOET Management Committee and distributed to the MOET Steering Committee through the Collaborative website where registers (dissemination, knowledge, risk) and deliverables are also available.

At each technical review (every 6 months), enrollment of independent experts, provision of guidelines and necessary technical documents and recommendations follow-up were performed by the Management team. Status on project milestone reviews was also distributed to the MOET Steering Committee through the Collaborative website.

At technical level, Partners completed detailed design for hardware for the 3rd year demonstration and manufacturing started. Hardware performances verifications have been initiated on in-house test rigs, especially at Goodrich Power Systems facilities in Pitstone-Green. Detailed reports on methodologies for analysing electrical system performances have been released by Academics and, in parallel, the electrical system optimization tool prototype has been delivered by DLR to Airbus-France for evaluation by airplane electrical engineers.

The main difficulty encountered during the reporting period lead on models collection necessary for the validation and the extrapolation for the Power-by-Wire concept. This difficulty has been properly mitigated through a dedicated workshop organised at DLR in April 2008.

The work performed has resulted in the following major achievements:

- Hardware manufacturing started
- First equipment delivered to Test Rigs in Naples and Toulouse
- First assessment of airplane performance based on input data from partners: fuel burn target not yet achieved but the way forward has been identified to improve performance
- Methodologies for analysing electrical system performances have been released
- Electrical system optimization tool prototype has been delivered by DLR to Airbus-France for evaluation by airplane electrical engineers.

Considering Dissemination and Exploitation, the following activities are reported

- dissemination activities:

Dissemination activity	Date	Audience	Countries	Size of the audience	Partner responsible /involved
Polish Aero Community Presentation+ Discussions with : - the Rzeszow University of Technology - AERONET Aviation Valley	04-Jul-07	Outside the consortium	Poland	100 (including the Polish Aero Community attendees and students from U-GDA)	U-GDA
Technical meetings organised internally: M12 Technical Review	03 & 04-Jul-07	Internal to MOET	14 European Countries	35 (including Guests)	All partners
Newspaper article reporting on the 1 st Annual Review (Trokmiasto Gazeta)	5-Jul-07	Outside the consortium	Poland	280.000	U-GDA/A-F
Presentation of MOET at the TEOS 2 nd Forum	21-Jul-07	2 nd TEOS Forum	Europe and North America	50	A-F
Article in Airbus Corporate Magazine – ONE - regarding the 1 st year achievements	Feb 08	Outside the Consortium	Europe	All Airbus Employees	A-F
SAE Power Systems Conference	11-Nov-08	Outside the Consortium	Seattle, US	50	A-F
The MOET Forum	Sept 09	Outside the consortium	Europe	200 attendees	A-F/ARTTIC and Contributions from all partners

- Scientific and Technical presentations and/or publication:

Date		Type	Title	Ref:
Planned	Actual			(Journal, Conference...)
17-Sept-07	17-Sept-07	Presentation	"A Novel Tool for the Conceptual Design of Aircraft Electrical Power Systems" - Paper presented by DLR	Conference: SAE 2007 AEROTECH
19-Jun-08	19-Jun-08	Presentation	Stabilisation of a PMSM Drive System for Aerospace Applications - Paper presented by AIMEA	Conference: IEEE Power Electronics Specialists
19-Jun-08	19-Jun-08	Presentation	An Approach for Stability Analysis of Nonlinear Electrical Network using Anti-optimization - Paper presented by DLR	Conference: IEEE Power Electronic Specialists
10-Jul-08	10-Jul-08	Presentation	State-Space Average Modelling Of 18-Pulse Diode Rectifier - Paper presented by AIMEA	Conference: 3rd edition of International Conferences - from Scientific Computing to Computational Engineering

Date		Type	Title	Ref:
Planned	Actual			(Journal, Conference...)
10-Jul-08	10-Jul-08	Presentation	Stability Analysis of Electric Power Systems For 'More Electric' Aircraft- Paper presented by AIMEA	Conference: 3rd edition of International Conferences - from Scientific Computing to Computational Engineering
17-Jul-08	17-Jul-08	Presentation	Numerical Simulation of a New Cooling System for Commercial Aircrafts - Paper presented by TUHH	Conference: 12th International Refrigeration and Air Conditioning
Oct. 2008	Oct. 2008	Paper	Analytical modeling of the input admittance of an electric drive for stability analysis purposes (Partner INPT)	European Physical Journal

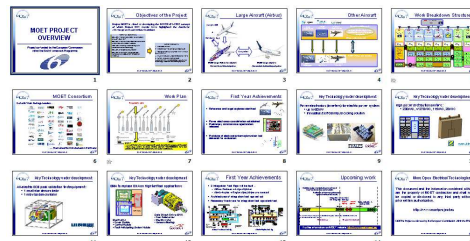
To avoid potential issues related to Intellectual Property Rights, all MOET public communications are subject to an approval by the MOET Steering Committee at least 30 calendar days before release.

Means for dissemination have also been set up and made available with:

- **the MOET Public Website :** <http://www.moetproject.eu> where regular update on project milestones and associated content have been released



- **MOET overall ppt presentations:** there are now 2 existing presentations with the MOET presentation presented at the TEOS Forum being approved as a standard overall presentation and distributed within the Consortium as it was for the initial one.



Content of this have been approved by the MSC and can be used by Partners without any further prior MSC approval

The MOET Consortium will build upon these achievements over the next reporting period, in order to focus on the following:

- Completion of detailed design, manufacturing and delivery of hardware for the 3rd year demonstration to validate the Power-by-Wire concept
- Completion of verification of hardware performances against individual test results
- Application of analytical methods for electrical network performances on typical aircraft systems
- Further development/improvement of DLR's electrical system optimization tool based on the evaluation feedback from Airbus-France
- Integration of hardware into integration test rig (Toulouse, Naples)
- System test campaign on integration test rigs (Toulouse, Naples) to address all relevant validation items as identified in the Validation & Verification Plan.
- Development of computer models of the integration test rigs (Toulouse, Naples), reconciliation with test results and extrapolation of test rig behaviour
- Analysis and interpretation of results from validation platforms against top-level objectives and Validation & Verification Plan
- Extrapolation of results from validation platforms and release of recommendations for future airplane programs
- Dissemination activities and final dissemination Forum (September 2009)

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