

VI. Wednesday 19 April
Meeting with General Electric
10:15-12:00
GE HQ in Boston
41 Farnsworth St, Boston

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0. AGENDA OF MEETING

10:00 Meeting the [REDACTED] of GE:

[REDACTED] ([REDACTED])

[REDACTED] ([REDACTED]).

11:00 Meeting with [REDACTED] of GE

1. STEERING BRIEF

1.1 Scene setter

On Wednesday, 19 April 2017 from 10:00 to 11:00, at GE headquarters, you will meet

- [REDACTED] ([REDACTED] - [REDACTED]),
- [REDACTED] ([REDACTED] - [REDACTED]).

From 11:00 to 12:00, at GE headquarters, you will meet

- [REDACTED] ([REDACTED])

[REDACTED]
[REDACTED]
[REDACTED] strongly believes and has immense commitment to science, fundamental research and development, training, export and global markets. [REDACTED] wants to make a difference with big data analytics (for example monitoring and analysing data from aircraft engines could easily result in 1% performance and efficiency increase, which translates to more than \$3 billion savings for the airlines).

GE's logo is: *"The Digital Industrial Company - Imagination at Work"*

[REDACTED]
General Electric Company is a global digital industrial company. The Company's products and services range from aircraft engines, power generation, oil and gas production equipment to medical imaging, financing and industrial products. Its segments include Power, (products and services related to energy production and water reuse); Renewable Energy, (renewable power sources); Oil & Gas (including liquefied natural gas and pipelines); Aviation (commercial and military aircraft engines, and integrated digital components); Healthcare (healthcare technologies in medical imaging, digital solutions, patient monitoring and diagnostics, and drug discovery); Transportation (supplier to the railroad, mining, marine, stationary power and drilling industries); Energy Connections & Lighting and Capital (financial services division).

As [REDACTED] of GE, Immelt has come under attack for leading GE towards legal tax avoidance of US federal corporate taxes. GE's tax positions have become a major item in [REDACTED] agenda. GE's local taxes in Connecticut have increased 5 times since 2011, and the state had approved yet another revised tax policy in early 2015. Immelt threatened to move GE's headquarters out of Connecticut if the state would not back away from the tax plan.

On 21 April 2016, your Head of Cabinet, Mr António Vicente and RTD.H Director Ms Clara de la Torre, met [REDACTED]. The last was accompanied by [REDACTED], [REDACTED], [REDACTED], [REDACTED] and [REDACTED].

Beside European energy branches of General Electric the Aviation branch participates with its German affiliate in a very large Horizon2020 project dealing with Aeronautical innovative combustors (see background).

1.2 Objectives

This is a courtesy meeting aiming at maintaining good relations.

- Confirming the importance of research and business relations between GE and their European-based companies (e.g. Italian AVIO, Czech Walter), as well their 43 and 57 year-old joint ventures/partnerships with French SAFRAN and German MTU respectively, in a mutual interest of Europe and the USA.

1.3 Line to take

- To state that global aviation markets and global industrial supply chain will profit from targeted R&D collaboration in energy, transport and health sectors;
- To explain the 3Os initiative and link it with the digital and data industrial transformation;
- Regarding FP9 and future Clean Sky activities, explain that despite the political uncertainties and upcoming assessments and recommendations, FP9 would be strongly oriented to be open for collaboration with the USA and GE is very welcome in that context.
- To share your views that USA-based European companies and EU-based USA companies should have a level-playing field, especially in IPR and transfer of knowledge issues;
- To share your views on the role of the European Commission in public-private collaboration on research and innovation and in particular within Clean Sky, that such collaborations go beyond research funding and create business opportunities;
- To explain that GE will have a greater role in Clean Sky 2, as following the 1st call for core partners, GE Aviation was selected. This allows GE Aviation to have a greater participation including in the decision making process.

2. SPEAKING POINTS

- As Commissioner for Research and Innovation, I want to ensure that our research funding programmes, notably Horizon 2020, and R&I policies contribute substantially to jobs, growth and investment.
- Globalisation is by nature disruptive. We are witnessing a digital transformation in the transport, energy and health businesses – all core business for both GE and H2020 research programme.
- While GE is a partner with common values and a strong presence in Europe for over 100 years, I have no doubt that we can join forces in R&D to create new products and services for the decades to come.
- We have been doing that already for more than 40 years with the CFM International, which is a joint venture between GE Aviation and SAFRAN Aircraft Engines.
- We can and we will repeat such success stories for other products and services, maintaining and even extending your strong European footprint of 84,000 people and annual revenues of €23.85 billion.
- I believe in Public-Private partnerships and EU is open for R&D and business opportunities.

3. BACKGROUND INFORMATION

3.1 CVs

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

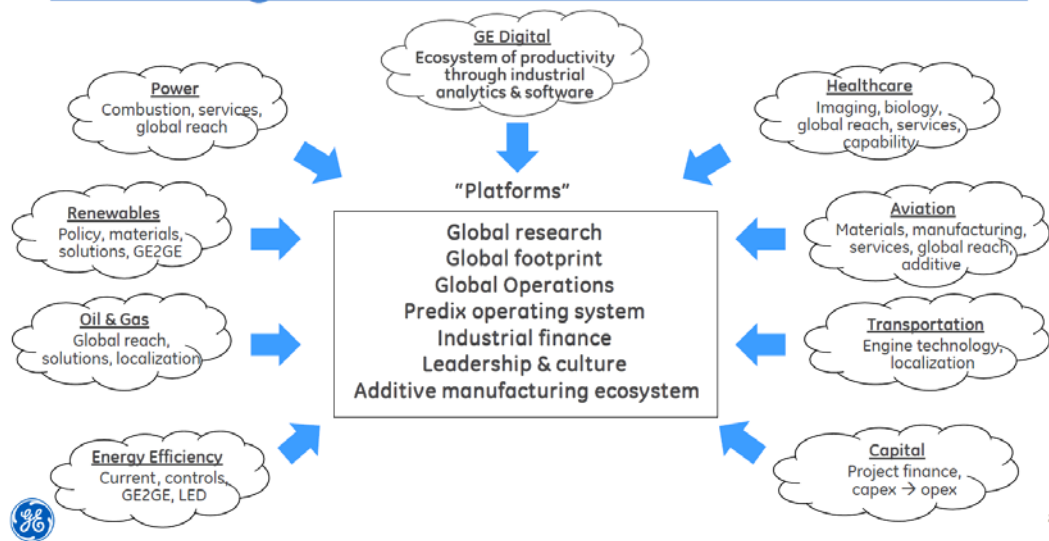
[REDACTED]

[REDACTED]

3.2 GE – Highlights & Key Figures

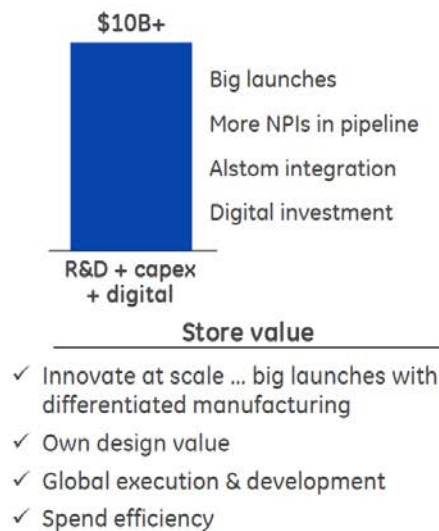
- **GE ranks 11th in the FORTUNE World's Most Admired Companies (2016).**
- GE revenues in 2016: \$123.7B, operating in 180 countries with 333K employees (125K in the USA).
- Portfolio: power, renewable energy, oil-gas, energy management, healthcare, aviation, transportation, appliances lighting, capital. GE Aviation has the highest turnover - \$26.3B or 21%.
- GE Aviation designs and produces commercial and military aircraft engines. They also provide aftermarket services to support their products. Aviation Services account for 52% of the revenues, while Equipment for 48%. GE gets more revenues from maintenance than from selling engines & equipment.
- GE built its first turbine engine in 1941. GE today has more than 42% of the world market share in commercial jet engines - 22% as Original Equipment Manufacturer (OEM) and half of the 41% share of CFM International (50-50 joint venture between GE and SAFRAN).
- GE Aviation is today mainly known from the global partnerships and ventures in the production and marketing of engines. Only one out of nine commercial engines is pure GE (destined for commercial helicopters). Their main partnerships and ventures are:
 - CFM International (50-50, GE – SAFRAN Snecma / France)
 - Engine Alliance (GE and UTC Pratt & Whitney / USA)
 - Joint venture with Honda Aero (division of Honda Motor Co., Ltd / Japan)
 - CFM Int. produced more than 28.000 engines for more than 12.000 aircraft out of which more than 8.000 are in operation. CFM56 engines family is installed in more than 50% of the Boeing and Airbus planes.
 - In 2016, CFM joint venture (GE-SAFRAN), launched the LEAP engine for the new Airbus A320 NEO and the Boeing 737 MAX aircrafts.
- GE Aviation in Europe employs more than 12,000 workers in 22 facilities and mainly accounts for aircraft systems in France, the 2008 acquisition of Walter in Czech Republic and the 2013 acquisition of Avio in Italy. Through the end of this decade, GE is investing more than \$1 billion to build Avio as a strong supplier to industrial and aviation industries – including business aviation applications like the Advanced Turboprop Engine (ATP).

Leverage the value of the GE Store



23

Technical leadership



25

GE Aviation - Research

GE Aviation heavily invests in R&D with emphasis on:

- Composite Materials (Figure 1)
- Additive Manufacturing (Figure 2)
- Digital Industry incl. Data Analytics (maintenance accounts for 52% of revenues)



Fig. 1- Composite fan blades



Fig. 2 – 3D printed sensor housing

Aviation Software and diagnostics (Predix): GE Aviation developed analytics to segment commercial fleets and provides in-depth asset condition and operational insights. Their technologies improve fault detection accuracy by 10 percentage points, eliminating unnecessary disruption to more than 1,000 commercial flights. GE got more than \$175M in customer benefits in 2015 via Predix-optimised maintenance.

- GE Global Research: GE has 10 research centres, ~3000 PhD Scientists, 3100+ patents filed in 2015, and invests \$3.5B annually.

3.3 Background on the Process for producing the Commission proposal for the next Framework Programme for Research and Innovation

The process and timeline for the producing the Commission's proposal for the next Framework Programme for Research and innovation will encompass the following steps:

- An analysis to set out the economic rationale for public R&I investments and their impact on growth and jobs has been carried out by the Commission (http://bookshop.europa.eu/is-bin/INTERSHOP.enfinity/WFS/EU-Bookshop-Site/en_GB/-/EUR/ViewPublication-Start?PublicationKey=KI0117050)
- A foresight study has been commissioned to prepare scenarios for future contexts of EU R&I policy, and to carry out a consultation with experts on possible key future developments in society, R&D practice and in technology (Delphi Survey). This study will help build scenarios that can inform our thinking on where we should be heading with FP9 (<https://ec.europa.eu/research/foresight/index.cfm>) .
- The Interim Evaluation of Horizon 2020, which will be concluded by autumn 2017, will include in-house analyses, a report from a High Level Group on maximizing the impact of EU R&I programmes and a Commission Communication in response. The HLG report is expected to include forward-looking recommendations relevant for the next framework programme. The Commission Communication (scheduled for October 2017) will present the key conclusions from the interim evaluation of Horizon 2020, it will respond to the recommendations of the High Level Group and report on the implementation of the recommendations of the High Level Expert Group on the ex-post evaluation of FP7.
- It is expected that the Commission will table its formal proposal for the post-2020 multi-annual financial framework in 2018. This will be the key juncture, where the proposed budget and broad lines of future spending programmes, including FP9, will be set out.
- An Impact Assessment will be carried out setting out the problem definition, the objectives and the policy options for the next framework programme, as well as its expected impacts for each of the policy options considered.

All the above will feed into the drafting and design of the Commission's proposal for the next framework programme. While the overall timing will depend on Commission-wide coordination, it is expected that the proposal will be tabled mid or late 2018.

3.4 Clean Sky Background

The Clean Sky JTI [<http://www.cleansky.eu/>] was created in 2008 as a public-private partnership between the European Commission and the aeronautics industry. The programme was managed by the Clean Sky Joint Undertaking.

The first Clean Sky programme:

The first research programme, Clean Sky, had a value of EUR 1.6 billion and was launched under FP7. The European Commission and industry each contribute 50% of this budget.

Clean Sky aimed to demonstrate and validate the technology breakthroughs that are necessary to make major steps towards the environmental goals sets by ACARE – Advisory Council for Aeronautics Research in Europe – the European Technology Platform for Aeronautics & Air Transport and to be reached in 2020:

- 50% reduction of CO₂ emissions through drastic reduction of fuel consumption;
- 80% reduction of NO_x (nitrogen oxide) emissions;
- 50% reduction of external noise;
- A green product life cycle: design, manufacturing, maintenance and disposal/recycling;

Clean Sky was made up of six Integrated Technology Demonstrators (ITDs):

1. Smart Fixed-Wing Aircraft - SFWA - delivers active wing technologies and new aircraft configuration for breakthrough, new products;
2. Green Regional Aircraft - GRA - delivers low-weight aircraft using smart structures, as well as low external noise configurations and the integration of technology developed in other ITDs, such as engines, energy management and new system architectures;
3. Green Rotorcraft - GRC - delivers innovative rotor blades and engine installation for noise reduction, lower airframe drag, integration of diesel engine technology and advanced electrical systems for elimination of noxious hydraulic fluids and fuel consumption reduction;
4. Sustainable and Green Engines - SAGE - designs and builds 5 engine demonstrators to integrate technologies for low noise and lightweight low pressure systems, high efficiency, low NO_x and low weight cores and novel configurations such as open rotors and intercoolers;
5. Systems for Green Operations - SGO - focuses on all-electrical aircraft equipment and systems architectures, thermal management, capabilities for 'green' trajectories

and mission and improved ground operations to give any aircraft the capability to fully exploit the benefits of Single European Sky;

6. Eco-Design - ECO - focuses on green design, production and recycling of aircraft, by optimal use of raw materials and energies.

Clean Sky had different levels of membership:

- **Leaders** – the 12 Leaders receive 50% of the funding. Two key industry players were appointed to lead each of the six ITDs for the duration of the programme. The Leaders were listed in the annex to the founding regulation¹ of the Clean Sky programme;
- **Associates** – the 71 Associates are private or public organisations were selected through open calls as permanent members of the Clean Sky JU. They committed to perform, and complete, certain essential work packages in one or more of the ITDs for the full duration of the Clean Sky programme. They receive 25% of the funding;
- **Partners** – the over 500 partners are private or public organisations participating for certain specific tasks over a limited period in the course of Clean Sky. They were selected following open Calls for Proposals issued by the JU. SMEs' participation as Partners was especially encouraged. They receive 25% of the funding.

The Clean Sky programme structure is:



¹ Council Regulation (EC) No 71/2008 of 20 December 2007 setting up the Clean Sky Joint Undertaking

The Clean Sky 2 programme:

For the second research programme under Horizon 2020, called 'Clean Sky 2', a new Clean Sky 2 Joint Undertaking was established in 2014 responsible for carrying out the activities of **both** Clean Sky programmes. The new Clean Sky 2 programme has a budget of approximately EUR 4 billion. The Commission contributes EUR 1.755 billion and industry EUR 2.2 billion.

Clean Sky 2 retains the three tiers of membership:

- **Leaders** – now 16 rather than 12, receiving 40% of funds;
- **Core Partners** – Associates have been re-named as Core Partners. So far, 133 have been selected, the fourth and final selection Call is ongoing. They receive 30% of the funding;
- **Partners** – there continue to be selected via Calls for Proposals and are not members of the JU but contribute to a specific task. To date over 200 organisations are involved. They receive 30% of the funding.

The aim of Clean Sky 2 is to integrate, demonstrate and validate the most promising technologies capable of:

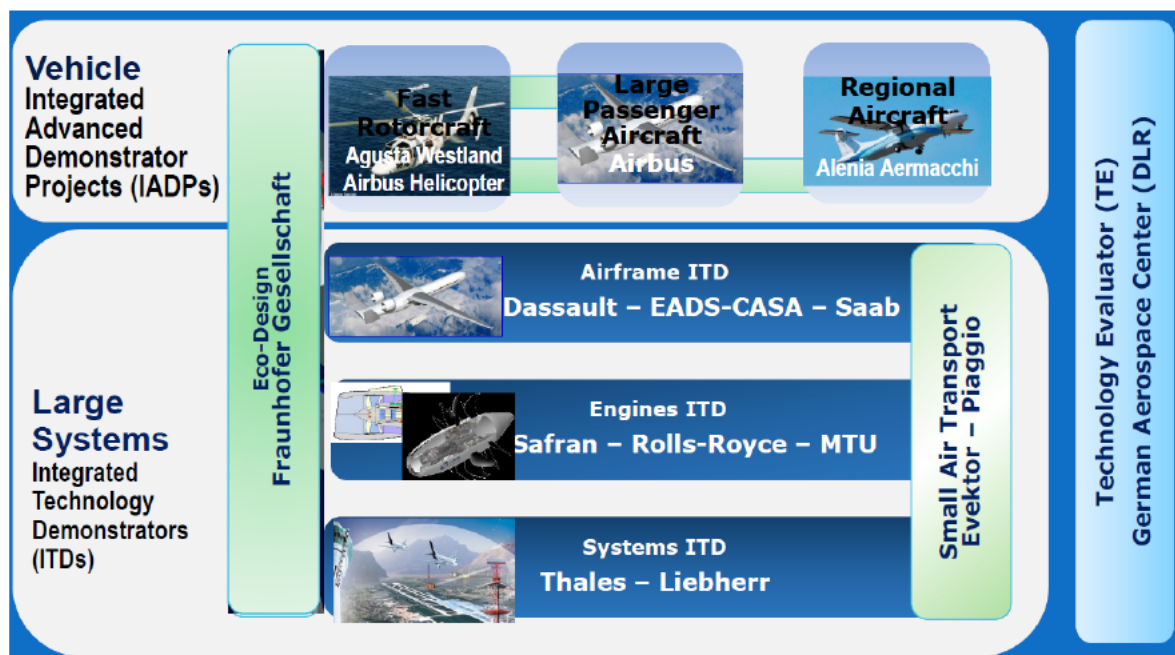
- increasing aircraft fuel efficiency and reducing CO₂ emissions by 20 to 30% compared to 'state-of-the-art' aircraft entering into service as from 2014;
- reducing aircraft NO_x emissions by 20 to 30% compared to 'state-of-the-art' aircraft entering into service as from 2014;
- reducing aircraft noise emissions levels by up to 5dB – using the recognised effective perceived noise levels decibel (EPNdB) standard – per operation compared to 'state-of-the-art' aircraft entering into service as from 2014.

These objectives follow-on from those of the Clean Sky programme, but are however more ambitious as they use a more up-to-date reference year, i.e. 2014 rather than 2000. In particular, the fuel efficiency and CO₂ emissions reduction of up to 30% will allow to overpass the average 10-15% reduction for a new generation of aircraft. This will accelerate twice the rate of improvement otherwise achievable, and could result in 'skipping a generation' of nominal development.

Based on the current market forecasts it is projected that Clean Sky 2 will impact over 75% of the fleet needing replacement from 2025 onwards and will have a crucial contribution to the achievement of the environmental and socio-economic targets of the sector: protecting the environment whilst ensuring sustainable mobility.

An additional aim of the Clean Sky 2 programme is industrial competitiveness; it aims at global leadership for European aeronautics, with a competitive supply chain, which includes academia, research bodies and SMEs.

The Clean Sky 2 programme structure:



IADP	Leaders	Focus
Large Passenger Aircraft	Airbus	Advanced engine and aircraft configurations, innovative physical integration cabin-system-structure, electrical A/C systems, and cockpit systems & avionics
Regional Aircraft	Leonardo (previously named Alenia Aermacchi)	Demonstration of, e.g. innovative wing, tail planes and flight controls technologies and wing related general and propulsion system technologies In addition, a ground demonstration of a full scale innovative fuselage and passenger cabin is foreseen
Fast Rotorcraft	Airbus Helicopters & Leonardo (previously named AgustaWestland)	Tilt-Rotor (next generation with a new architecture, e.g. to increase range and payload) and a Compound (combination of fixed wing aircraft and rotorcraft) demonstrator

ITD	Leaders	Focus
Airframe	Dassault, EADS-CASA and SAAB	Novel configurations (noise shielding, inlets...), nacelles (laminarity), wing boxes, laminar wings (extended laminarity for wider flight conditions...), fuselage shapes and structures and cabin (noise reduction, eco-friendly materials...)
Engines	MTU, Rolls-Royce and Safran	Support new aircraft opportunities post 2025, Focus on new/ improved architecture propulsion systems, e.g. the open rotor or ultra-high by-pass ratio propulsion system
Systems	Thales and Liebherr	Electrical subsystems, flight & mission management, new cockpit and interaction environment and landing systems
Transverse activities	Leaders	Focus
Technology Evaluator	German Aerospace Center (DLR)	Tool to estimate the environmental impact of the Clean Sky technologies
Eco-DESIGN	Fraunhofer Gesellschaft	Built on the progress made in the Eco-Design ITD in Clean Sky and co-ordinated across the ITDs and IADPs
Small Air Transport	Evektor, Piaggio	Will coordinate research activities related to the field of small general aviation and commuter aircraft performed in the ITDs

3.5 Background - GE participation in a large scale Aeronautic Projects

Framework Programme	H2020
Project Number	690724
Project Acronym	SOPRANO
Project Title	Soot Processes and Radiation in Aeronautical innovative combustors

Project Abstract

For decades, most of the aviation research activities have been focused on the reduction of noise and NOx and CO2 emissions. However, emissions from aircraft gas turbine engines of non-volatile PM, consisting primarily of soot particles, are of international concern today. Despite the lack of knowledge toward soot formation processes and characterization in terms of mass and size, engine manufacturers have now to deal with both gas and particles emissions. Furthermore, heat transfer understanding, that is also influenced by soot radiation, is an important matter for the improvement of the combustor's durability, as the key point when dealing with low-emissions combustor architectures is to adjust the air flow split between the injection system and the combustor's walls. The SOPRANO initiative consequently aims at providing new elements of knowledge, analysis and improved design tools, opening the way to: • Alternative designs of combustion systems for future aircrafts that will enter into service after 2025 capable of simultaneously reducing gaseous pollutants and particles, • Improved liner lifetime assessment methods. Therefore, the SOPRANO project will deliver more accurate experimental and numerical methodologies for predicting the soot emissions in academic or semi-technical combustion systems. This will contribute to enhance the comprehension of soot particles formation and their impact on heat transfer through radiation. In parallel, the durability of cooling liner materials, related to the walls air flow rate, will be addressed by heat transfer measurements and predictions. Finally, the expected contribution of SOPRANO is to apply these developments in order to determine the main promising concepts, in the framework of current low-NOx technologies, able to control the emitted soot particles in terms of mass and size over a large range of operating conditions without compromising combustor's liner durability and performance toward NOx emissions.

Number of Project Participants

17 participants

No	Country	Participant Short Name	Participant Legal Name	Participant Role	Participant Terminated	Participant SME Status	EU Financial Contribution (euro)
1	FR		SAFRAN SA	COORDINATOR	No	N	535.635,00
2	IT	GE AVIO SRL	GE AVIO SRL	PARTICIPANT	No	N	189.250,00
3	FR	CERFACS	CENTRE EUROPEEN DE RECHERCHE ET DE FORMATION AVANCEE EN CALCUL SCIENTIFIQUE	PARTICIPANT	No	N	466.750,00
4	FR	INSA Rouen	INSTITUT NATIONAL DES SCIENCES APPLIQUEES DE ROUEN	PARTICIPANT	No	N	282.750,00
5	DE	DLR	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	PARTICIPANT	No	N	1.138.700,00
6	UK	Imperial	IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE	PARTICIPANT	No	N	327.222,50
7	DE	KIT	KARLSRUHER INSTITUT FUER TECHNOLOGIE	PARTICIPANT	No	N	698.875,00
8	FR	CNRS	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	PARTICIPANT	No	N	346.175,00

			CNRS				
9	UK		LOUGHBOROUGH UNIVERSITY	PARTICIPANT	No	N	516.277,50
10	DE	MTU	MTU AERO ENGINES AG	PARTICIPANT	No	N	109.500,00
11	UK		ROLLS-ROYCE PLC	PARTICIPANT	No	N	257.000,00
12	DE		ROLLS-ROYCE DEUTSCHLAND LTD & CO KG	PARTICIPANT	No	N	255.000,00
13	FR		SAFRAN AIRCRAFT ENGINES	PARTICIPANT	No	N	140.500,00
14	FR	SAFRAN HELICOPTER ENGINES SAS	SAFRAN HELICOPTER ENGINES	PARTICIPANT	No	N	105.201,25
15	IT	UNIFI	UNIVERSITA DEGLI STUDI DI FIRENZE	PARTICIPANT	No	N	398.750,00
16	DE		GENERAL ELECTRIC DEUTSCHLAND HOLDING GMBH	PARTICIPANT	No	N	112.772,50
17	FR	ONERA	OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES	PARTICIPANT	No	N	948.951,25
Total							6.829.310,00