SCAT

SCIENTIFIC COMPUTING ADVANCED TRAINING

Final report — ALFA Project on Scientific Computing Advanced Training (SCAT)

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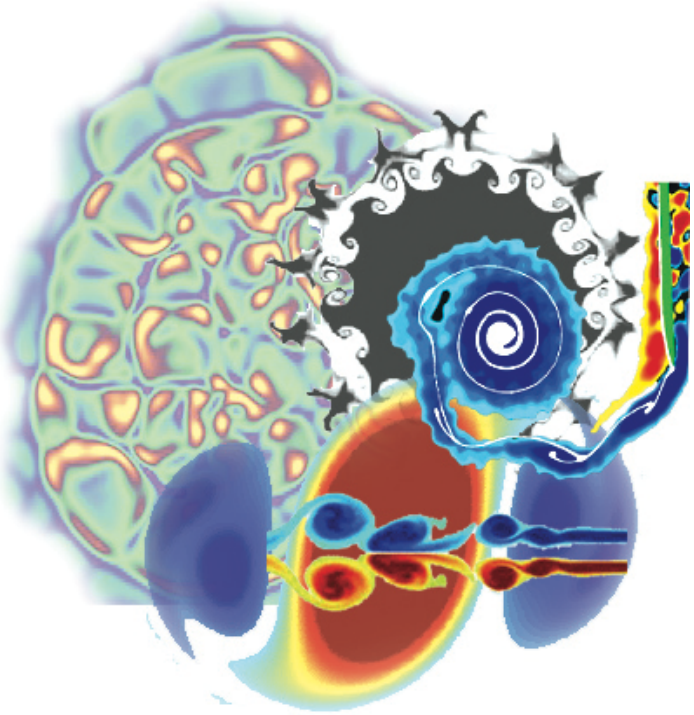
November 2009



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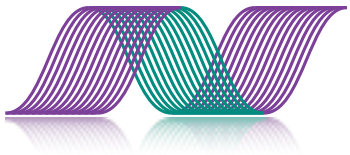

Preface

The developed world has been effectively using science and technology to drive economic progress for more than 200 years. But today, about 150 countries, mostly in the Southern Hemisphere, remain at lower levels of economic development and of personal health and wealth of their populations.

It has been recognized that developing countries need to build scientific capacity to use science and technology as an engine of economic development[1]. However, scientists in the developing world face many difficult challenges in education, resources, autonomy, access to equipment and scientific literature, and lack of role models for the young.

The European Union has consistently increased its involvement in support of scientific activity in developing countries. One predominant approach of these programs is the encouragement of international cooperation. Within this framework lies the ALFA Programme for cooperation between higher education institutions in Europe and Latin America.

ALFA —*América Latina, Formación Académica*— is a programme for the advancement of academic cooperation between the European Union and Latin America.

A project funded by EuropeAid

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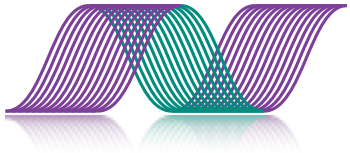
[1] See, for example, "Building Scientific Capacity", a report of the Third World Academy of Sciences, 2004. http://twas.ictp.it/publications/twas-reports/capbuildreport.pdf



Executive Summary

The SCAT project is a collaboration project among ten (10) institutions of higher learning and research, in six (6) countries of Latin America and Europe. The main actions of the project consist of a programme of mobility grants, aimed at post-graduate students or postdoctoral fellows, and a programme of international scientific meetings and courses.

This is the final report of the project. Previous interim reports were prepared in March 2007 —covering the first 14 months of activities— and January 2008. In the total 3 years and 8 months duration of the project, SCAT has awarded 31 mobility grants and organized 10 international meetings.

The project offered throughout its duration a professional and informative website, and has disseminated the various activities to the wider academic communities in the countries of the partners.

The expenditures have been checked and audited against the supporting documents and the contract. The total spending of the project amounted to 98% of the original budget of €1,342,000.

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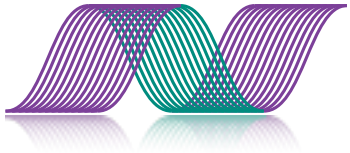

1. Introduction

Project overview

The SCAT (Scientific Computing Advanced Training) project is a collaboration project involving 10 institutions in Europe and Latin America, co-financed by the ALFA Programme of EuropeAid.

The overall objectives of the project, as detailed in the project proposal (submitted for the 10th and final round of ALFA–II in October 2004), are the following:

- Consolidate a partnership of institutions of higher education and research that provokes accelerated knowledge transfer in scientific computing technology and applications in science and engineering.
- Provide hands-on training to advanced students and post-doctoral researchers in the methods and applications of advanced computational research.
- Bring together research groups in the network partners, to develop a synergy and a common vision in the use of scientific computing in balance with analysis and experiments, for the production of high-quality research.
- Trigger initiatives for furthering advanced computational research in Latin American institutions of higher-education, and promote future student exchanges with Europe.

Key dates:

Proposal – October 2004
Start – November 2005
End – July 2009

The official project start date was 25 November 2005, and the original duration was 3 years. However, in October 2008 an extension to the project was authorised by the European Commission, and an addendum to the contract was signed. The end-date of the project was brought to July 2009, completing 3 years 8 months of activities.

One of the most important components of the SCAT project is a programme of **Grant Holder Mobility.** This programme consisted of grants awarded to advanced students—mostly from Latin America—to spend an extended period immersed in a research group of a SCAT partner institution. The grantees received a stipend of €1500 per month, plus full travel expenses, and in some cases assistance for language improvement. Thus, they were well-funded and able to dedicate full-time to training in research.

A total of of 30 young aspiring scientists were benefitted by the Mobility programme, 28 of them from Latin America. This number is 50% higher

Success

The impact on the lives of the young grant holders was greater than we ever anticipated when designing the proposal for SCAT.

than planned at the proposal stage, thanks to careful financial engineering during the project.

Another essential component of the project was a programme of **International Meetings**. A total of 10 meetings were held, in the different locations of the partner institutions. During these meetings, the project participants presented their ongoing research work, and engaged in discussions with other partners aiming at collaboration. The meetings were often enhanced with short courses for the local scientific community and students. The meetings held during this reported period are described in more detail in Section 3.

The impact of the international meetings as a means of promoting collaboration among the partners was even greater than we hoped for. As the various people engaged in discussions about their research interests, and later socialized together, lasting bonds were created. We have no doubt that there will be long-term impact generated by the networking that occurred during the SCAT meetings.

SCAT members in Barcelona for the project launch, February 2006.

Andre Nachbin and Oscar Orellana at the Barcelona Supercomputing Center.

Project partners

The SCAT project involves 10 institutions of higher learning and research. Within these institutions, there are different departments and/or laboratories that were involved, listed below.

- University of Bristol, United Kingdom (coordinating institution)
- Science and Technology Facilities Council, STFC (formerly known as Council for the Central Laboratory of the Research Councils), UK — Computational Engineering Group, & Advanced Research Computing Department at the Daresbury Laboratory
- Université de Provence (Aix-Marseille 1), Marseille, France — Institut de Recherche sur Phénomènes Hors Equilibre (IRPHE), & Institut Universitaire des Systèmes Thermiques Industrielles (IUSTI)

- Université Pierre et Marie Curie, Paris, France —Institut Jean Le Rond D'Alembert (formerly known as Laboratoire de Modélisation en Mécanique, LMM)
- Ecole Supérieure de Physique et de Chimie Industrielles, ESPCI, Paris, France —Laboratoire Ondes et Acoustique (LOA) & Laboratoire Physique et Mécanique des Milieux Hétérogènes (PMMH)
- Universitat Politécnica de Catalunya, Barcelona, Spain —Centre Tecnològic de Transferència de Calor (CTTC)
- Instituto de Matemática Pura e Aplicada (IMPA), Rio de Janeiro, Brazil
- Universidad Tecnica Federico Santa Maria: Departments of Mathematics, Informatics & Mechanical Engineering
- Universidad de Chile: Departments of Physics, Informatics & Mechanical Engineering
- Universidad Nacional Autonoma de Mexico: Instituto de Investigaciones in Matematicas Aplicadas y en Sistemas, Facultad de Estudios Superiores Cuautitlan, Instituto de Geofisica, Centro de Ciencias de la Atmosfera, Facultad de Ingenieria & Facultad de Ciencias

A group of SCAT members exploring the site of Barcelona Supercomputing Center in February 2006.

In front of 10 rue Vauquelin, Paris, the site of ESPCI and the workplace of Marie and Pierre Curie.

Success

As the various people engaged in discussions about their research interests, and later socialized together, lasting bonds were created.

In total, there are 22 groups (institutional departments or research labs) that are associated to SCAT, several of these having joined during the course of the project. The total number of people involved —either as institutional coordinator, grant holder supervisor, or short course lecturer— is 58 (see a full list in the Appendix).

Institutional coordinators

- Dr Lorena A Barba (project leader), University of Bristol
- Prof David Emerson, Daresbury Laboratory
- Prof Eduardo Wesfreid, ESPCI
- Dr Stéphane Le Dizes, IRPHE

- Dr Christophe Josserand, Université Pierre et Marie Curie
- Dr Carlos Perez-Segarra, Universitat Politéctica de Catalunya
- Prof Rodrigo Soto, Universidad de Chile
- Dr Susana Gomez, UNAM
- Prof Andre Nachbin, IMPA
- Prof Oscar Orellana, Universidad Tecnica Federico Santa Maria

A complete list of all people involved in the project is included in the Appendix.

Prof Andre Nachbin and Prof David Emerson socializing in Paris.

Group of SCAT members in a social moment in Santiago.

Throughout the project, constant efforts were made for high-visibility of the project actions, via a professionally-designed website that was actively maintained, and various press appearances. In addition, a respectable number of technical publications were produced from the research results of the collaborations of SCAT members and grant-holders. These always carried an official acknowledgment to the project and the EuropeAid funding.

Success

The new *Centro Cientifico y Tecnológico de Valparaiso* secured US$10 million in funding for 5 years. SCAT was instrumental in this achievement.

As a direct result of the SCAT project, there a number of new collaborations initiated. More importantly, SCAT laid the foundation which allowed the partners in Latin America to establish new scientific initiatives. The most impressive of these is the Scientific and Technological Center of Valparaiso (Centro Cientifico y Tecnológico de Valparaiso, CCTVal), which secured US$10 million in funding from the Chilean government for 5 years. This new project, of which one of the leaders is SCAT member Prof Luis Salinas, has three topics: High-energy physics, electronics and scientific computing. Prof Salinas ascribes a large part of their success to the standing given to them by the SCAT collaboration. More details are given in the section on Dissemination and Impact.

2. Grant Holder Mobility

Summary

In this final period of the project, two more selection rounds for mobility grants were completed, and eleven (11) grants were awarded. This has brought the total of grants awarded in the duration of the project to 31, over 50% more than was anticipated at the proposal stage.

Selection Rounds

The two additional selection rounds of this final period of the project were:

3. Deadline for applications: 15 March 2008 — The selection was carried out at the Rio de Janeiro SCAT meeting.

4. Deadline for applications: 27 October 2008 — This selection was carried out entirely online, after the SCAT meeting in Chile, in which the extension of the project was announced

Success:

During the first two periods of reporting, 17 young aspiring scientists were awarded mobility grants. Added to this final period, a total of 31 mobilities were completed.

Application Process

The process of applications was refined in previous periods of reporting, and has been kept the same. See the document *"Guideline for Applicants"* in the Appendix. In summary, the application requirements are the following:

1. Grants are intended for graduate students (MSc or PhD) or post-doctoral fellows registered at, affiliated to, or graduated from one of the network partner institutions.

2. Applicants must have at least a Bachelor of Science or equivalent degree, and a strong mathematical background.

3. Applicants must have proven English language skills, for example, by standard tests such as TOEFL, IELTS, or Melab.

4. Computer skills are required, and previous research experience desirable.

All applications are received via an online form, available on the project website. This facilitates the process for the applicant, and in addition leaves a complete electronic record of all applications received.

Preparation for Mobility

As described in previous interim reports, the SCAT coordination office circulates a guidance note for the initiation of the mobility of grant holders, titled *"General Recommendations Regarding the Registration of Grant Holders"*.

Moreover, grantees are asked to read and sign a document entitled *"Responsibilities of Grant Holders"* before their travel. This document reminds them that they have made a commitment to complete the mobility, that they are responsible for their travel arrangements, insurance and visa, and that they must acknowledge SCAT in any publications, among other things. A modification was introduced to this document in April 2007, adding a compulsory requirement for writing a final report at the end of the mobility. The full document is included in Appendix.

Identification of Grantees

Following, is a roster of all the candidates awarded a mobility grant during the period of this Interim Report. The details of their applications, and a report of each selection process, can be found in the Minutes of each selection round included in Appendix. (CVs of all grant holders are included in a CD, attached to this report.)

Name of the grantee *Abraham Ortínez*

Institution of origin Universidad Nacional Autónoma de México, Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas, IIMAS

Host institution Daresbury Laboratory, Council for the Central Laboratory of the Research Councils

Kind of training and duration Advanced Training (AT), at MSc level, 8 months

Beginning of the training period July 2008

End of the training period February 2009

Area of study Computational Fluid Dynamics (CFD): Air Quality Emissions and its integration with the Climate Science Modelling Language (CSML).

Name of the grantee *Aldo Figueroa*

Institution of origin Universidad Nacional Autónoma de México, Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas, IIMAS

Host institution Université de Provence (Aix-Marseille 1), Institut de Recherche sur les Phénomènes Hors Equilibre, IRPHE

Kind of training and duration Advanced Training (AT), at MSc level, 6 months

Beginning of the training period June 2008

End of the training period November 2008

Area of study Computational Fluid Dynamics (CFD): Mixing in oscillatory flows generated by electromagnetic forcing.

Name of the grantee *Guillermo Barrios*

Institution of origin Universidad Nacional Autónoma de México, Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas, IIMAS

Host institution Universitat Politècnica de Catalunya, Centre Tecnològic de Transferència de Calor, CTTC

Kind of training and duration Advanced Training (AT), at MSc level, 5 months

Beginning of the training period July 2008

End of the training period November 2008

Area of study Computational Fluid Dynamics (CFD).

Name of the grantee *Guillermo Cabrera*

Institution of origin Universidad Técnica Federico Santa Maria, Informática

Host institution University of Bristol, Mathematics

Kind of training and duration Advanced Training (AT), at MSc level, 7 months

Beginning of the training period May 2008

End of the training period November 2008

Area of study Computational Fluid Dynamics (CFD): Adaptative Issues in Vortex Particle Methods.

Name of the grantee *Paola Arce*

Institution of origin Universidad de Chile, Departamento de Informática

Host institution University of Bristol, Mathematics

Kind of training and duration Complementary Training (CT), at BSc level, 6 months

Beginning of the training period May 2008

End of the training period November 2008

Area of study Computational Fluid Dynamics (CFD): Simulation of cancer tumor growth using particle method.

Name of the grantee *Sergei Silva*

Institution of origin Instituto Nacional de Matemática Pura e Aplicada (IMPA)

Host institution Université Pierre et Marie Curie, Institut Jean Le Rond D'Alembert (IJLRDA)

Kind of training and duration Advanced Training (AT), at MSc level, 6 months

Beginning of the training period June 2008

End of the training period November 2008

Area of study Finance and Acoustic Modelling.

Name of the grantee *Alberto Beltrán*

Institution of origin Universidad Nacional Autónoma de México, Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas, IIMAS

Host institution Universitat Politècnica de Catalunya, Centre Tecnològic de Transferència de Calor - CTTC

Kind of training and duration Advanced Training (AT), at MSc level, 6 months

Beginning of the training period February 2009

End of the training period July 2009

Area of study Computational Fluid Dynamics (CFD): A numerical model for the heat transfer in an MHD flow

Name of the grantee *Rodrigo Demarco*

Institution of origin Universidad de Chile, Departamento de Fisica

Host institution Université de Provence (Aix-Marseille 1), Institut Universitaire des Systèmes Thermiques Industriels (IUSTI)

Kind of training and duration Advanced Training (AT), at MSc level, 7 months

Beginning of the training period January 2009

End of the training period July 2009

Area of study Computational Fluid Dynamics (CFD): Development of High Accuracy Spectral Models to Treat Radiative Heat Transfer from Flames.

Name of the grantee *Valeska Valdivia*

Institution of origin Universidad de Chile, Departamento de Fisica

Host institution Université Pierre et Marie Curie, Institut Jean Le Rond D'Alembert (IJLRDA)

Kind of training and duration Complementary Training (CT), at BSc level, 6 months

Beginning of the training period February 2009

End of the training period July 2009

Area of study Computational Fluid Dynamics (CFD): Chemoconvection: A Non Normal Approach.

Name of the grantee *Jocelyn Dunstan*

Institution of origin Universidad de Chile, Departamento de Fisica

Host institution Ecole Supérieure de Physique et de Chimie Industrielles, ESPCI

Kind of training and duration Complementary Training (CT), at BSc level, 8.33 months

Beginning of the training period September to November 2008

End of the training period January 2009, then May to July 2009

Area of study Computational Fluid Dynamics (CFD): Hydrodynamic Interaction between Swimming Bacteria.

Name of the grantee *Fernando Aguayo*

Institution of origin Universidad de Chile, Departamento de Fisica

Host institution Université de Provence (Aix-Marseille 1), Institut Universitaire des Systèmes Thermiques Industriels (IUSTI)

Kind of training and duration Advanced Training (AT), at MSc level, 7 months

Beginning of the training period January 2009

End of the training period July 2009

Area of study Computational Fluid Dynamics (CFD): Influence of the Fractal Landscape in the Forest Fire Propagation.

Name of the grantee *Jaime Zúniga*

Institution of origin Universidad de Chile - Departamento de Fisica

Host institution Ecole Supérieure de Physique et de Chimie Industrielles, ESPCI

Kind of training and duration Complementary Training (CT), at BSc level, 5 months

Beginning of the training period March 2009

End of the training period July 2009

Area of study Computational Fluid Dynamics (CFD): On the number of propagating modes of a diffusive periodic waveguide in the semi-classical limit.

Name of the grantee *Víctor Romero*

Institution of origin Universidad de Chile - Departamento de Fisica

Host institution Ecole Supérieure de Physique et de Chimie Industrielles, ESPCI

Kind of training and duration Advanced Training (AT), at BSc level, 5.37 months

Beginning of the training period March 2009

End of the training period July 2009

Area of study Computational Fluid Dynamics (CFD): Dynamics, Singularities and Geometry of Matter out of Equilibrium.

Language Improvement

Language improvement courses have been offered to all grantees as a possibility. English is the official language of the project, and it is re-

quired at the application stage that applicants have a level of proficiency in the English language which is comparable to the usual requirements of postgraduate admissions to universities in English-speaking countries. Nevertheless, in many cases there is still much to be gained from improving the language skills of the grantee.

In general, the support for language improvement has proved to be of much interest to the grant holders. For them, being highly proficient in the English language enhances their career prospects as scientists.

The following grantees have received language training courses:

- Paola Arce, 2 months Intensive English Course at the Bristol Language Centre, with a satisfactory result as she was eventually able to write her final SCAT report with a good intermediate level.
- Sergei Silva who visited Paris, who was already proficient in the English language, was granted a 15-week intensive course of French at the Alliance Française, which gave him the skills to attend seminars and lectures at the Université Pierre et Marie Curie.

Health Cover and Insurance

It is recognised that grant holders are entitled to have full health insurance during their mobility. Two kinds of insurance are offered: travel insurance, which is usually included in their fully-funded travel costs, and health insurance during their stay abroad. In the latter case, we are faced with the fact that health coverage differs from one host country to another. The following cases have been raised.

- Mobilities in the EU: The health systems in France, Spain and the UK provide a diverse range of coverage, subject to various circumstances. Above those minimum standards, and considering the transitory situation in which students are placed in during their mobility, SCAT advises grantees to take complementary health insurance. This would cover any emergency during their stay.
- Mobilities in LA: In Latin America, private health cover is advised, in general. Therefore, European grantees are counselled to buy full insurance at their home country before starting their mobility.

The cost of additional health insurance contracts is assigned to the budget line "Preparations for mobility", according to the ALFA Programme Guidelines.

Final Report and Certificate of Completion

According to the conditions of delivery of the scholarships, all grantees have submitted a final report, which is published on the project website. All SCAT grantees are awarded a Certificate of Completion once they finish their mobility period. For a sample, see Appendix.

Complete list of grant holders, for the duration of the project

The full list of grant holders in the format requested by the ALFA office is included in the Appendix.

NAME	ORIGIN	HOST
Felipe Cruz F.Cruz@bristol.ac.uk	Universidad Técnica Federico Santa Maria, Informática	University of Bristol, Mathematics
Helmut Wahanic helmutwahanik@gmail.com	Instituto Nacional de Matemática Pura e Aplicada (IMPA)	University of Bristol, Mathematics
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Thomas Séon seon@math.ubc.ca	Université Pierre et Marie Curie, Laboratoire de Modélisation en Mécanique	Universidad de Chile, Departamento de Fisica
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The total number of grant-holder months awarded was 235, which is equivalent to almost *20 graduate-student years*, overall. Therefore, it is undoubtable that not only were these young people benefitted by their experience, but the host institutions as well benefitted from the great human resource that was allocated to their labs.

In all cases, the host institutions have complied with the agreement of waiving any tuition fees and registration payment towards SCAT grantees, as required by the contract provisions, and in accordance with the agreement signed by the partners.

Success:

A total of 20 graduate-student years were funded by SCAT.

Total male: 25 (81%)
Total female: 6 (19%)

Successes of Grant Holders

In this section, we will relate some of the success stories of the young people impacted by this project. But first, we offer some indicators of success for the mobility grants program as a whole.

PROPOSED INDICATOR	SUCCESS RESULT
Approved theses by the grant-holders and degrees conferred	3 MSc obtained (F. Cruz, H. Wahanik, E. Sufan)
Number of post-graduate degrees initiated after a SCAT mobility	12 postgrad studies initiated (10 PhD) (F. Cruz, H. Wahanik, C. Torres, N. Rodriguez, E. Sufan, C. Cooper, C. Valdivia, A. Figueroa, R. Demarco, F. Aguayo, Jocelyn Dunstan, V. Romero)
Attraction of further funding for research	The mobilities have attracted further funding for 10 out of the 12 grantees listed above, ranging from Government funding, Research scholarships, Prizes and private sponsors. The other two were funded by their home institution (H. Wahanik and Aldo Figueroa)
Total number of scholarships granted	31 grants (compared with 20 grants expected at the proposal stage)
Accumulated number of months of stay abroad by the grantees	235 accumulated months of mobility (compared with 160 months expected at the proposal stage)

In almost all cases, the subsequent stories of success of the grant holders are a direct consequence of their experience during the SCAT mobility. The factors leading to this impact were diverse, but the leading ones are:

- The students often were encouraged to apply to the SCAT grant by their supervisors in their home institutions, being unsure themselves of what they wanted to do. They did not really know what doing research was all about, and were undecided about their future plans. The SCAT mobility opened their eyes to the world of scientific research, and they decided to pursue this as a career. Only a handful of cases are exceptions to this: the two European grant holders had a clear career plan, but wanted an international and cross-cultural experience; and two Latin American grantees already had a PhD degree and used the SCAT grant as a means of furthering their careers.
- Being immersed in a world-class research environment during their SCAT mobility, many grantees came in contact with well-positioned scientists who offered them mentorship, opportunities for further study, contacts, and even job opportunities.

Felipe A. Cruz

Felipe Cruz was one of the first three SCAT grantees, selected in June 2006.

After the SCAT mobility grant that took him to Bristol, UK, Felipe Cruz obtained his MSc in Informatics from his institution of origin, Universidad Técnica Federico Santa Maria in Valparaiso, Chile.

His experience during the SCAT mobility determined him to pursue a doctorate degree, and he applied for graduate studies in Bristol. His supervisor (and SCAT leader), Dr Lorena Barba, was able to secure industrial funding for his PhD studies, thanks to the excellent work that he had already carried out.

Felipe published his first peer-reviewed journal paper presenting the work initiated during his SCAT mobility and continued afterwards as a PhD student. The paper is:

> "Characterization of the accuracy of the fast multipole method in particle simulations", Felipe A Cruz, L A Barba
> *Int. J. Num. Meth. Engrg.*, Vol. 79(13):1577-1604 (2009)
> http://dx.doi.org/10.1002/nme.2611

He has presented his research in several international conferences since becoming a PhD student (see titles in the Publications section):

- 20th International Conference on Parallel Computational Fluid Dynamics, Lyon, France, 19–22 May 2008
- 8th World Congress on Computational Mechanics, WCCM8, and 5th European Congress on Computational Methods in Applied Sciences and Engineering, ECCOMAS, Venice, Italy, 30 June–4 July 2008
- 21st International Conference on Parallel Computational Fluid Dynamics, Moffett Field, California, 18–22 May 2009
- 10th National Congress on Computational Mechanics USNCCM10, Columbus, Ohio, 16–19 July 2009

Felipe Cruz is scheduled to complete his PhD in July 2009, and he has an excellent chance of a successful academic career afterwards. He has networked via conference participation, and recently submitted a second peer-reviewed article to a high-impact factor journal. He is now an equal player in the field of international research, and we have no doubt it is in great measure due to his SCAT mobility.

Helmut Wahanik

A national of Colombia, Helmut Wahanik was an MSc student at IMPA in Rio de Janeiro when he applied for a SCAT grant. After a stay of 6 months in Bristol, he returned to IMPA to start PhD studies in March

2007. Since then, he has passed his qualifying examinations at IMPA (in July 2008) and has commenced his thesis work in earnest.

Helmut's PhD thesis is entitled *"The Riemann Solution for the Injection of Supercritical Carbon Dioxide and Steam in Porous Media"*, and is supervised by Prof Dan Marchesin, Director of the Fluid Dynamics Laboratory at IMPA. This work is of timely importance. It is meant to classify solutions to the problem of injection of CO_2 in salt water aquifers, with the aim of understanding the transport and thermodynamics of CO_2 sequestration. The applications are of the highest interest for research groups in geological and environmental sciences.

The work described also involves a collaboration with Prof Hans Bruining and Ali Eftekhari at TU Delft. The initial results of the research have been presented at:

- SIAM Conference on Mathematical and Computational Issues in the Geosciences, Leipzig-Germany, 15–18 June 2009
  http://meetings.siam.org/sess/dsp_programsess.cfm?SESSIONCODE=8667
- International Conference on Non-linearities and Upscaling in Porous Media, Stuttgart University, 5–7 October 2009

Claudio Torres, selected in the third round for a SCAT grant, is now a PhD student at University of Delaware, USA

Claudio E Torres

Claudio Torres did his BSc and MSc at Universidad Técnica Federico Santa Maria, in Valparaiso. He then started his SCAT research visit to the University of Bristol, where he worked with Dr Lorena Barba for 10 months.

After completing his SCAT mobility in January 2008, Claudio started PhD studies at the University of Delaware, USA. His supervisor there, Prof Louis F Rossi, is a collaborator of Dr Lorena Barba, and he met Claudio on a visit to Bristol on September 2007. Thus, the SCAT grant placed Claudio on a path to his future academic career.

Claudio also published his first peer-reviewed journal paper with work performed during his SCAT grant. The paper is:

> "Fast radial basis function interpolation with Gaussians by localization and iteration", Claudio E Torres, L A Barba
> J. Comput. Phys., Vol. 228:4976-4999 (2009)
> http://dx.doi.org/10.1016/j.jcp.2009.03.007

After starting his PhD in Delaware, Claudio has presented his work in:

- SIAM Annual Conference, Denver, Colorado, 6–10 July 2009

An additional impact, reported in Section 4, relates to incipient new collaborations between Claudio's current supervisor, Prof Louis Rossi, and SCAT member in Chile, Prof Luis Salinas.

Luis Miguel de la Cruz

Luis Miguel is now eligible to apply for a faculty position in Mexico, thanks to his SCAT experience.

The case of Luis Miguel de la Cruz is one of two Latin American grantees who already had their PhD from their country of origin. He had managed to continue studying in his native Mexico while holding a position as Academic Technician at UNAM, in support of researchers using visualization software. He was in charge of the Visualization Department of the Directorate of Research Computing, DGSCA (Dirección General de Servicios de Cómputo Académico) from March 2004 to February 2006, while obtaining his PhD degree in Computer Science, granted in June 2005. He continued working thereafter in the same unit until he obtained the SCAT grant.

In May 2008, Luis Miguel completed a 10-month stay at Daresbury Laboratory where he worked with Prof David Emerson and his group. After his SCAT mobility (the only one which involved moving with a family with two young children), he returned to his previous post in Mexico. Upon his return, the new Director of the unit allowed him to dedicate time to continue some research activities in scientific computing. These have focused on the topic of simulation of oil reservoirs —the oil giant PEMEX is at this moment in time investing significant sums in research efforts at both universities and private companies. Luis Miguel is collaborating with a group of researchers from UNAM and the Center for Mathematics Research CIMAT to present a research project for funding by PEMEX.

Since returning to UNAM, Luis Miguel has offered invited courses and has presented his work at local events. Here are some examples:

- "Meshfree method based on radial basis functions for fluid dynamics problems", Thermofluids Laboratory Seminar, Centro de Investigaciones en Energia, CIE-UNAM, Temixco, Morelos, 19 November 2008
- "Finite volume method in the simulation of oil reservoirs", Mathematical Modeling and Computing Seminar, Instituto de Geofisica, UNAM, 12 June 2009
- Course "Solution of the convection problem using the method of finite volumes and parallel algorithms" (in Spanish), Escuela de Modelación y Métodos Numéricos: Supercómputo y aplicaciones en la industria del petróleo, CIMAT Guanajuato, 16–19 June 2009
- "Supercomputing in oil exploration", presentation at Escuela de Modelación y Métodos Numéricos: Supercómputo y aplicaciones en la industria del petróleo, CIMAT Guanajuato, 16–19 June 2009

The impact of the SCAT mobility for Luis Miguel is that he is now eligible to apply for a faculty position in Mexican universities. He is currently applying both at UNAM and UAM, and will probably learn of the outcome in a few months. Before his SCAT mobility to Daresbury Laboratory, Luis Miguel was not eligible because he lacked the required experience as a postdoctoral researcher outside of Mexico.

According to Luis Miguel, the SCAT mobility allowed him the status of a researcher in the Mexican university environment, and he fully expects this to be formalized in the near future with a new position.

César Gomez

César Gomez is the second SCAT grantee from Latin America at the post-doctoral level. He did his PhD at IMPA in Rio de Janeiro, supervised by Prof Jorge Zubelli. During his SCAT mobility, César worked with Prof Joel Frélat at the Laboratoire de Modélisation en Mécanique, Université Pierre et Marie Curie. His topic of research was computational finance.

After his research visit in Paris (ended in December 2007), César took a post-doctoral position at the Department of Mathematics and Statistics in MacMaster University, Canada. There, he worked in the financial mathematics group with Dr Matheus Grasselli. His work was related to a problem of stochastic control applied to options pricing.

César has now finished his postdoc in Canada, and is back at IMPA, working on a project of mathematical finance. Here, we quote from a note that he recently sent us:

> "My field of research is mathematical models applied to quantitative finance, considering both analytic and computational aspects. The SCAT project was a great opportunity for learning and practicing scientific computing. By the time of my SCAT grant I had some computational difficulties left by my PhD thesis end I wasn't sure how to cope with them. During my grant, among so many other things that I had the opportunity to learn, I learned of the existence of the optimal quantization algorithm which is applied in the computation of expectations of random variables and numerical integration in general. Also, I learned about some discretization methods for backward stochastic differential equations that looked like the kind of thing I was seeking and I'm still working with these methods; I also had some ideas for future research."

Natalia Rodriguez

Natalia, one of six female SCAT grantees, is now a PhD student at University of Twente, Netherlands.

One of the six female SCAT grantees, Natalia had just finished a BSc at Universidad de Chile when she started her mobility at ESPCI in August 2007. It was a huge challenge for Natalia, who did not speak a word of French, and had a hard time adapting to being away from home. Indeed, we had many notes from her supervisor in Paris, Dr Agnès Maurel, telling about the special mentoring she was providing.

SCAT approved special and intense language training in French for Natalia, which was a great help. Nevertheless, she struggled for a few months. After her 8-month mobility, however, there was a significant boost to her confidence and clarity of career goals.

Natalia applied and was accepted for PhD studies at University of Twente, where she is now studying under the supervision of Prof D. J. Schipper and Dr Marc Massen.

There is no better way to express the impact of SCAT on the life of this young woman, than to quote her own words:

> "Why Twente? Because going to Paris and studying with Agnès and Vincent confirmed my thinking that I wanted to work more intensely in science. It confirmed my wish to know more, and it gave me the tools to commence new research. So I started to look into PhD programs, and in truth I wanted something more applied, and I looked for something which would combine what I learned with Felipe, Agnès and Vicent with what I learned as a mechanical engineering student. I found the PhD program in Twente and it appealed to me, and thanks to what I learned during my stay in Paris, I felt capable of undertaking it, so I decided to apply. The following week I was to receive an email saying they wanted to interview me, and 5 months later I was starting my PhD.
>
> The impact of SCAT in my career ... well, I think it was key, that is, it changed everything. It gave me the technical knowledge, and gave me an idea of what it was to live outside Chile, without which I would have never dared to come out of the country for four years to do a PhD. "

The work of Natalia during her SCAT mobility was later prepared for publication, and accepted in a prestigious journal:

> "Interaction between elastic waves and prismatic dislocation loops", Natalia Rodriguez, Agnès Maurel, Vincent Pagneux, Fe-

lipe Barra and Fernando Lund, *Journal of Applied Physics*, Vol. 106, 054910 (2009). DOI 10.1063/1.3213338

Thus, we are certain to have made an impact in Natalia's life, sending her on a path of success and scientific discovery.

Eduardo Sufán

A final-year student of Mechanical Engineering at Universidad Técnica Federico Santa Maria, Eduardo Sufán was hosted for 10 months at Catalunya Polytechnic University in Barcelona. During that time, he worked in the area of computational fluid dynamics, gaining a basis of fundamental knowledge on the subject.

After his stay in Barcelona, Eduardo went back to Valparaiso, Chile, to finish his degree thesis in mechanical engineering, which he presented in August 2009. He decided to continue his studies at the MSc level, and has been accepted in the program on Computational Engineering at the University of Erlangen-Nuremberg, Germany. Eduardo applied and was awarded a fellowship from the Chilean government research funding entity, the Comisión Nacional de Investigación Cientifica y Tecnológica, CONICYT.

Gustavo Ramos

After completing an MSc in Computer Science at UNAM, Gustavo Ramos applied for a SCAT grant to visit Daresbury Laboratory. There, he worked with Prof David Emerson and Dr Charles Moulinec. He had a very productive 7-month stay, and his work is being prepared for publication and has been presented at conference the following conference (see title in the Publications section):

- 4th International SPHERIC SPH Workshop, École Centrale de Nantes, Nantes, France, 26-29 May 2009

On his return to Mexico, Gustavo has gone back to work at UNAM with Dr Susana Gómez, and is now focusing on numerical techniques for the characterization of oil reservoirs. He has just finished his MSc thesis, and is applying for a doctorate in high-energy physics at UNAM. The SCAT mobility was instrumental in his decision to continue in science and increased his chances by giving him confidence and an excellent MSc thesis.

Victor Romero

Born in Quito, Ecuador, but a national of Chile, Victor Romero started a SCAT mobility in September 2007 at the Laboratoire Physique et Mécanique des Milieux Hétérogènes in Paris. There, he was supervised by Dr Benoit Roman, with whom he carried out work in the area of fracture mechanics of thin sheets. The work produced some interesting results which were presented as:

> "Spiraling cracks in thin sheets", Victor Romero, Benoit Roman, Enrique Cerda. Abstract A39.00007, Session A39: Focus Session on Elasticity and Geometry of Thin Objects, APS Meeting, New Orleans, Louisiana, (March 10, 2008)
> http://meetings.aps.org/link/BAPS.2008.MAR.A39.7

The success of Victor continued with being awarded a scholarship from CONICYT in Chile, within the program *"Colegio Doctoral Franco-Chileno"*. His initial internship through the SCAT grant became a *cotutelle* of his PhD —a jointly-supervised doctoral program with a degree to be awarded by both Universidad de Chile and Université Pierre et Marie Curie. This scheme required first the signing of an agreement between the two universities, which we expect will have future impact through other collaborations.

Abraham Ortinez

Like Gustavo, Abraham went from UNAM to Daresbury Laboratory. He worked with Dr Mike Ashworth, Dr Andrew Woolf and Dr Ming Jiang. His very timely research focused on the integration of the data from air quality models with the Climate Science Modelling Language, CSML. This is a standard model developed by the Science & Technology Facilities Council (STFC) at the Rutherford Appleton Laboratory. Its goal is to obtain climate and oceanographic data and to make it available in a standardized format so that it can be shared by scientists from all over the world. Gustavo's work involved extending this framework for air pollution data.

Through the collaboration initiated by the SCAT mobility of Abraham between UNAM and STFC (Daresbury and Rutherford Labs), a cooperation agreement was formalized between the institutions, with the aim of promoting and training scientists in the use of the Climate Science Modelling Language. The funding for this training will come from the UK and Mexican governments, via bilateral accords on climate change.

Thanks to Abraham's visit to Daresbury, UNAM is the first university in Latin America to integrate the climate model and data format of CSML.

His work in Daresbury was included in the following conference presentation:

- "Sensor web enablement", Dr Andrew Woolf, Environmental e-Science and Spatial Informatics, STFC Rutherford Appleton Laboratory, Sensors & Instrumentation KTN, London, 24 September 2008

Rodrigo Demarco

Out of interest in numerical simulation, Rodrigo Demarco attended the 4th Latin American SCAT meeting in Santiago (29 Sep.–4 Oct. 2008). He was a student of Mechanical Engineering at the University of Chile at that time. In the SCAT meeting, which included several short courses, he met Dr Andrés Fuentes, who gave a research talk on "Extiction simulation of a diffusion flame established in microgravity". Rodrigo was captivated by this research, and talked to Dr Fuentes later, establishing a contact for a possible mobility grant.

In January 2009, Rodrigo started his visit to Université de Provence, as one of the last students to receive a SCAT grant. For 7 months (until the end of the SCAT project), he worked at the Institut Universitaire des Systèmes Thermiques Industrielles (IUSTI). His topic was the development of a numerical approach to study radiative heat transfer in combustion.

We quote here from Rodrigo's personal statement after he finished his SCAT mobility:

> "... during these short seven months researching at IUSTI in France, I've learned much more than I was expecting to. From the scientific point of view, I've discovered the physics of combustion and I also improved my knowledge of numerical solution methods and programming. From the personal point of view, this experience was also very important, making me grow as a person as well. This mobility grant gave me the opportunity to know a different country and culture, and make new friends despite the language barrier. Moreover, this project confirmed my interest in research and gave me the thrust and courage to start a PhD here in France in the same group at IUSTI. This PhD will be funded by IRSN and will be focused on the continuation of the work started during the SCAT mobility."[2]

As evidenced in this personal note, this is one more example in which the SCAT grant first opened the eyes of a young person to scientific research, and then opened the doors for that person to pursue their newfound ambition. Rodrigo now has full funding in France for 3 years for

[2] IRSN: L'institut de radioprotection et de sûreté nucléaire

his PhD study. This is what he added in a recent note to us about his new opportunity:

> "To obtain the possibility for the funding I had several stages of selection, ending with a presentation to an IRSN committee. In this presentation, I had to show the previous works I'd carried out (during my engineering degree and my Master's degree research), the work I was doing framed by the SCAT project and the PhD subject I was going to pursue. In this aspect the SCAT mobility helped me a lot to learn about the subject I was proposing since it was very related to the work I was already doing. Also, the SCAT mobility gave me the opportunity to see how is research abroad and reinforced my interest on it, making me decide to stay "a little longer". Therefore, I think that the project had a great impact on me since I was not thinking of pursuing a PhD at the start of the SCAT mobility and it actually made me change my mind."

Fernando Aguayo

After completing an MSc degree at Universidad de Chile, Fernando Aguayo was looking for a research opportunity, without being quite sure which field he wanted to pursue. He learned about the SCAT opportunity during the 4th Latin American meeting in Santigo, where he heard about the work being done at IUSTI, Institut Universitaire des Systèmes Thermiques Industrielles, simulating the spread of forest fires.

Fernando started his mobility to IUSTI in January 2009 and stayed for 7 months, until the end of the SCAT project. His research topic was "Influence of the fractal landscape in forest fire propagation", supervised by Prof Jean Pierre Clerc and Dr Andrés Fuentes. Here is what he had to say about his experience:

> "My stay in France has been more than rewarding, in both the academic and personal point of view. Embedded in this warm team, I have been able to study and acquire research experience, which already feels fruitful. We have developed a model using concepts adopted by the group to recreate the spread of fire. This gave me the opportunity to study several different physical and mathematical areas I barely knew before. Although forest fires at first may seem unrelated with my PhD project in quantum information, I know the theoretical and computational tools I have learned and improved here will be very useful. Not only that, but the time spent here has allowed me to meet great people and stretch my curiosity into other research fields."

Recently, Fernando has been accepted as a PhD student at the University of Nottingham, UK. He has applied and been awarded a full scholarship by *Becas Chile*, which ensures funding for his doctoral degree. The work he will carry out in Nottingham is a direct follow-up of the research he pursued in his SCAT mobility.

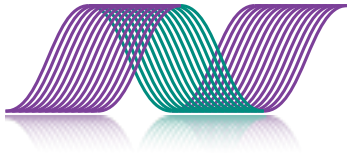
A final note about a SCAT mobility that failed

In May 2007, SCAT project leader Dr Lorena Barba and Prof Luis Salinas were invited to participate in an unprecedented event organized by the European Commission. Of all projects funded since the beginning of the ALFA Programme in 1994, only 50 were selected to participate in the Mexico Conference on "Best Practices and Results of ALFA Projects –the Future of Cooperation in Higher Education between EU and LA". During one of the open discussion sessions of this meeting, Dr Barba attempted to convey the message that one of the hardest, yet preventable, problems that grantees face is obtaining a Visa for entry to the European host country.

Indeed, several of the grantees of the SCAT project were initially denied an entry visa, despite having full funding *from the European Union* to carry out their study visits. In these cases, the SCAT coordinating office made phone calls and wrote letters to the consular authorities, and was often able to help the student overcome this hurdle.

In one case, however, the outcome was a real fiasco. SCAT grantee Ana Lilia González, from Mexico, was twice denied an entry visa to travel to the UK for a research visit to Daresbury Laboratory. Despite letters and phone calls, the consular authorities refused. Having full funding to visit the lab, she was then offered a short-term visit, so that a student visa would not be required. Short-term visitors to the UK from Mexico can enter for a maximum 6 months without a visa. The shocking conclusion to this story was that Ana Lilia was denied entry upon arrival to the UK. The border officer may have had computerized records of her previous failed attempts to obtain a student visa, and decided that there was a chance she would overstay. We don't know. What we know is that she was removed from the country and now faces the consequences of having a negative record at the UK border.

We are very sad and perturbed by this outcome, but we do not see how we could have prevented it. The only prevention we can imagine is a vigorous effort of dissemination from the EC offices to the consular authorities about the EC programmes involving overseas student visits. This would ensure that an applicant with a letter confirming a grant from the EC programme will be viewed with sufficient credibility when applying for the entry visa.



3. International Meetings and Courses

Summary

In the period reported, four more international meetings were held, completing a total of 10 events for the duration of the SCAT project. The SCAT meetings have increasingly incorporated graduate students, who present their research or attend lectures given by the SCAT members.

List of meetings for the whole project

DATE	MEETING
20–24 Feb. 2006	SCAT project launch, Barcelona.
26–30 June 2006	First European Scientific Workshop, Daresbury UK. "Advanced Computational Research"
25–29 Sept. 2006	Second European Scientific Workshop, Paris. "Mathematical Modelling and Challenges in Computational Science"
4–12 Jan. 2007	First Latin American Scientific Workshop, Chile. "Advanced Scientific Computing and Applications"
4–10 June 2007	3rd European Scientific Workshop, Marseille. "Modelling and Simulation of fluid vortices, and vortex sheets"
12–16 Nov. 2007	Second Latin American Scientific Workshop, Mexico. "Mathematical Computing for Development, Resources, Environment"
24–28 March 2008	3rd Latin American Scientific Workshop, Rio de Janeiro. "Computational and Mathematical challenges in Wells, Waves & Weather"
26–30 May 2008	4th European Meeting, Bristol UK. "Computational Science and Engineering: a truly interdisciplinary field"
29 Sep. to 4 Oct. 2008	4th Latin American Meeting, Santiago, Chile. "Developing a Vision for Advanced Computational Scientific Research in the Region"
20–24 July 2009	Final SCAT Meeting, Valparaiso, Chile. "High performance computing trends for 2010 and beyond"

Third Latin American SCAT meeting, Brazil

Held at the Instituto de Matemática Pura e Aplicada, Rio de Janeiro, in March 2008, this meeting was jointly organized by IMPA with the topic *"Computational and Mathematical Challenges in Wells, Waves & Weather"*.

Following is a list of international participants in the Third Latin American SCAT meeting in Rio de Janeiro. The program is included in the Appendix.

SCAT members

- Dr. Lorena Barba, Department of Mathematics, University of Bristol, UK
- Mr. Boris Drappier, SCAT Project Manager, University of Bristol, UK
- Dr. Rodrigo Soto, Departamento de Fisica (DFI), Universidad de Chile
- Dr. Susana Gómez, Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas (IIMAS), Universidad Nacional Autónoma de México, México
- Dr. Pierre-Yves Lagrée, Institut Jean Le Rond d'Alembert (IJLRDA), Université Pierre et Marie Curie, Paris, France
- Dr. Joël Frelat, Institut Jean Le Rond d'Alembert (IJLRDA), Université Pierre et Marie Curie
- Prof. Oscar Orellana, Departamento de Matemáticas, Universidad Técnica Federico Santa Maria, Valparaiso, Chile
- Dr. Stéphane Le Dizès, Institut de Recherche sur les Phénomènes Hors Equilibre (IRPHE), Université de Provence, Marseille, France
- Dr. Laurent Duchemin, Institut de Recherche sur les Phénomènes Hors Equilibre (IRPHE), Université de Provence.
- Dr. Assensi Oliva, Centre Tecnològic de Transferència de Calor (CTTC), Universitat Politècnica de Catalunya (UPC), Terrassa, Spain
- Dr. Manel Soria, Centre Tecnològic de Transferència de Calor (CTTC), Universitat Politècnica de Catalunya (UPC)

Local participants from IMPA

- Dr. Jorge Zubelli
- Dr. Andre Nachbin
- Dr. Markus Sarkis
- Dr. Pablo Castaneda
- Dr. Eduardo Abreu
- Dr. Glauber Silve

Participants from other local or national institutes and universities

- Dr. Clayton Lime, Universidade Federal Rural do Rio de Janeiro (UFRRJ)

- Dr. Carlos Nemer, Universidade Federal Rural do Rio de Janeiro (UFRRJ)
- Dr. Cristina Turner, Universidad de Córdoba, Córdoba, Argentina
- Dr. Hernán Gutiérrez, Universidade de São Paulo, São Paulo, Brazil
- Dr. Roberto Kraenkel, Universidade de São Paulo
- Dr. Luis Andrade, Department of Theoretical Physics, Universidade do Estado do Rio de Janeiro (UERJ), Brazil
- Prof. Saulo Oliveira, Universidade Federal do Paraná, Curitiba, Brazil

Fourth European SCAT meeting, Bristol, UK

Hosted by the coordinating institution, University of Bristol, the topic of this meeting was *"Computational Science and Engineering: a truly interdisciplinary field"*.

Following is a list of international participants in the Fourth European SCAT meeting in Bristol. The program is included in the Appendix.

SCAT members

- Dr. Lorena Barba, Department of Mathematics, University of Bristol
- Mr. Boris Drappier, SCAT Project Manager, University of Bristol
- Dr. Susana Gómez, Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas (IIMAS), Universidad Nacional Autónoma de México, México
- Dr. Lydie Staron, Institut Jean Le Rond d'Alembert (IJLRDA), Université Pierre et Marie Curie, Paris, France
- Dr. Agnès Maurel, Laboratoire Ondes et Acoustique (LOA), Ecole Supérieure de Physique et de Chimie Industrielles, Paris, France
- Prof. Oscar Orellana, Departamento de Matemáticas, Universidad Técnica Federico Santa Maria, Valparaiso, Chile
- Prof. Luis Salinas, Departamento de Informática, Universidad Técnica Federico Santa Maria
- Prof. David Emerson, Computational Science and Engineering Department, Daresbury Laboratory, United Kingdom
- Dr. Jorge Zubelli, Instituto Nacional de Matemática Pura e Aplicada, Rio de Janeiro, Brazil

Local participants from University of Bristol

- Dr. Ian Stewart, Information Services
- Dr. Richard Sessions, Department of Biochemistry

- Prof. Chris Allen, Department of Aerospace Engineering
- Dr. Steve Simpson, Department of Physics
- Dr. Joni Mujika, Department of Chemistry
- Dr. Cristina Sanz, Department of Chemistry
- Dr. Richard Lonsdale, Department of Chemistry
- Dr. Dan Lunt, Department of Geographical Sciences
- Mr. Simon Layton (student), Department of Mathematics
- Dr. Eduardo Luna-Ortiz, Imperial College, London, United Kingdom

The following SCAT grantees attended the meeting; some of them giving a talk on their research (see programme):

- Mr. Eduardo Sufán, Departamento de Mecánica, Universidad Técnica Federico Santa Maria, Valparaiso, Chile
- Miss Paola Arce, Departamento de Informática, Universidad Técnica Federico Santa Maria, Valparaiso, Chile
- Mr. Christopher Cooper, Departamento de Mecánica, Universidad Técnica Federico Santa Maria, Valparaiso, Chile
- Mr. Felipe Cruz, Departamento de Informática, Universidad Técnica Federico Santa Maria (now at University of Bristol)
- Dr. Gustavo Ramos, Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas (IIMAS), Universidad Nacional Autónoma de México, Ciudad de México, México
- Dr. Luis Delacruz, Facultad de Estudios Superiores Cuautitlán (FESC), Universidad Nacional Autónoma de México, Ciudad de México, México
- Mr. Guillermo Cabrera, Departamento de Informática, Universidad de Chile, Santiago, Chile

Fourth Latin American SCAT meeting, Santiago, Chile

Held at the University of Chile, in Santiago, in November 2008 and co-organized by the partners at the Department of Physics, this meeting was themed ont he topic *"Developing a Vision for Advanced Computational Scientific Research in the Region"*.

Following is a list of international participants in the Fourth Latin American SCAT meeting in Santiago. The program is included in the Appendix.

SCAT members

- Dr. Lorena Barba, Department of Mathematics, University of Bristol
- Prof. Stephen Wiggins, Department of Mathematics, University of Bristol
- Dr. Michal Branicki, Department of Mathematics, University of Bristol
- Mr. Boris Drappier, SCAT Project Manager, University of Bristol
- Prof. Oscar Orellana, Departamento de Matemáticas, Universidad Técnica Federico Santa Maria, Valparaiso, Chile
- Prof. Luis Salinas, Departamento de Informática, Universidad Técnica Federico Santa Maria
- Dr. Mike Ashworth, Computational Science and Engineering Department, Daresbury Laboratory, United Kingdom
- Dr. Agnès Maurel, Laboratoire Ondes et Acoustique (LOA), Ecole Supérieure de Physique et de Chimie Industrielles, Paris, France
- Dr. Benoit Roman, Physique et Mécanique des Milieux Hétérogènes (PMMH), Ecole Supérieure de Physique et de Chimie Industrielles, Paris, France
- Dr. Nicolas Vandenberghe, Institut de Recherche sur les Phénomènes Hors Equilibre (IRPHE), Université de Provence, Marseille
- Dr. Andrés Fuentes, Institut Universitaire des Systèmes Thermiques Industriels (IUSTI), Université de Provence.
- Dr. Jean-Pierre Clerc, Institut Universitaire des Systèmes Thermiques Industriels (IUSTI), Université de Provence.
- Prof. Bernard Porterie, Institut Universitaire des Systèmes Thermiques Industriels (IUSTI), Université de Provence.
- Dr. Manel Soria, Centre Tecnològic de Transferència de Calor (CTTC), Universitat Politècnica de Catalunya (UPC), Terrassa, Spain
- Dr. Maurice Rossi, Institut Jean Le Rond d'Alembert (IJLRDA), Université Pierre et Marie Curie, Paris, France
- Dr. Christophe Josserand, Institut Jean Le Rond d'Alembert (IJLRDA), Université Pierre et Marie Curie
- Dr. Lydie Staron, Institut Jean Le Rond d'Alembert (IJLRDA), Université Pierre et Marie Curie

Local participants from Universidad de Chile

- Dr. Felipe Barra, Departamento de Fisica

- Dr. Rodrigo Soto, Departamento de Fisica
- Dr. Patricio Cordero, Departamento de Fisica
- Dr. Álvaro Núñez, Departamento de Fisica
- Dr. Pablo Navarrete, Departamento de Fisica
- Dr. Sebastian González, Departamento de Fisica
- Dr. Guy Guistini, Departamento de Fisica
- Dr. Viviana Fernández, Departamento de Ingenieria Industrial (DII)
- Dr. Maria-Cecilia Rivara, Departamento de Ciencias de la Computación (DCC)

The following SCAT grantees attended the meeting:

- Dr. Fabien Ternat, Institut de Recherche sur les Phénomènes Hors Equilibre (IRPHE), Université de Provence, Marseille
- Miss Natalia Rodriguez, Departamento de Fisica, Universidad de Chile
- Mr. Leonardo Gordillo, Departamento de Fisica, Universidad de Chile

Final SCAT meeting, Valparaiso, Chile

Held at Universidad Técnica Federico Santa Maria, UTFSM, Valparaiso, Chile, in July 2008, this event received additional funding from the host university. This allowed the participation of many local students, and some students from Santiago as well. The topic of the meeting was *"High performance computing trends for 2010 and beyond"*.

Following is a list of international participants in the Final SCAT meeting in Valparaiso. The program is included in the Appendix.

SCAT members

- Dr. Rodrigo Soto, Departamento de Fisica, Universidad de Chile, Santiago, Chile
- Prof. David Emerson, Computational Science and Engineering Department, Daresbury Laboratory, United Kingdom
- Dr. Andrew Sunderland, Computational Science and Engineering Department, Daresbury Laboratory
- Dr. Charles Moulinec, Computational Science and Engineering Department, Daresbury Laboratory
- Dr. Xiaojun Gu, Computational Science and Engineering Department, Daresbury Laboratory

- Dr. Andrés Fuentes, Institut Universitaire des Systèmes Thermiques Industriels (IUSTI), Université de Provence, Marseille.
- Dr. Mario Chávez, Facultad de Ingenieria (FI), Universidad Nacional Autónoma de México, Ciudad de México, México
- Dr. Manel Soria, Centre Tecnològic de Transferència de Calor (CTTC), Universitat Politècnica de Catalunya (UPC), Terrassa, Spain
- Prof. Stéphane Zaleski, Institut Jean Le Rond d'Alembert (IJLRDA), Université Pierre et Marie Curie, Paris, France
- Dr. Joël Frelat, Institut Jean Le Rond d'Alembert (IJLRDA), Université Pierre et Marie Curie
- Dr. Lorena Barba, Department of Mathematics, University of Bristol

David Emerson, X Gu, Boris Drappier, Charles Moulinec, Raquel Pezoa, Paola Arce, Stéphane Zaleski, Mario Chávez, Andrew Sunderland, Claudia Arancibia, Oscar Orellana, Luis Salinas —on a visit to the Casablanca vineyards on a social activity for the Final SCAT meeting.

- Mr. Boris Drappier, SCAT Project Manager, University of Bristol

Local participants at UTFSM and Universidad de Chile

- Dr. Carlos Rosales, Departamento de Informática, UTFSM
- Prof. Luis Salinas, Departamento de Informática, UTFSM
- Prof. Oscar Orellana, Departamento de Matemática, UTFSM
- Prof. Andrés Olivares, Departamento de Informática, UTFSM
- Mrs. Paula Urrutia, Departamento de Fisica, Universidad de Chile
- Dr. Marcel Clerc, Departamento de Fisica, Universidad de Chile
- Dr. Rodrigo Soto, Departamento de Fisica, Universidad de Chile
- Dr. Nicolás Mujica, Departamento de Fisica, Universidad de Chile
- Dr. Felipe Barra, Departamento de Fisica, Universidad de Chile

The following SCAT grantees and other students attended the meeting:

- Mr. Felipe Cruz, Departamento de Informática, , UTFSM (now at University of Bristol)
- Miss Raquel Pezoa, Departamento de Informática, UTFSM
- Mr. Sebastián Flores, Departamento de Informática, UTFSM

- Mrs. Romina Torres, Departamento de Informática, UTFSM
- Mr. Sebastián Arancibia, Departamento de Informática, UTFSM
- Mr. Francisco Rojas, Departamento de Informática, UTFSM
- Mrs. Carolina Espinoza, Departamento de Informática, UTFSM
- Mr. Patricio Plaza, Departamento de Informática, UTFSM
- Mr. Oscar Olivares, Departamento de Informática, UTFSM
- Mr. Cristián Maureira, Departamento de Informática, UTFSM
- Mr. Gabriel Zamora, Departamento de Informática, UTFSM
- Mr. Rodrigo Fernández, Departamento de Informática, UTFSM
- Mr. Dario Canales, Departamento de Informática, UTFSM
- Mr. Jorge López, Departamento de Informática, UTFSM
- Mr. Patricio Esquivel, Departamento de Informática, UTFSM
- Mr. Juan Alfonso Reyes, Departamento de Informática, UTFSM
- Mr. Luis Andrés Sepúlveda, Departamento de Informática, UTFSM
- Mr. Cristián Sandoval, Departamento de Informática, UTFSM
- Mr. Felipe Escobar, Universidad de Viña del Mar, Viña del Mar, Chile
- Mr. Pablo Acuna, Departamento de Informática, UTFSM
- Mr. Manuel Terraza, Departamento de Informática, UTFSM
- Mr. Joe Herrera, Departamento de Informática, UTFSM
- Mrs. Pamela Clunes, Departamento de Informática, UTFSM
- Mr. Juan Manuel Zavala, Departamento de Informática, UTFSM
- Mrs. Tanya Pérez, Departamento de Informática, UTFSM
- Mr. Leonardo Gordillo, Departamento de Fisica, Universidad de Chile, Santiago, Chile
- Mr. Fabián Rudyar, Departamento de Informática, UTFSM
- Mr. Pedro Neira, Departamento de Informática, UTFSM
- Mr. Daniel Caro, Departamento de Informática, UTFSM
- Mr. César Vergara, Departamento de Informática, UTFSM
- Mr. Javier Baeza, Departamento de Fisica, Universidad de Chile, Santiago, Chile

- Mr. Nicolás Ceroni, Departamento de Informática, UTFSM
- Mr. Eduardo Vergara, Departamento de Informática, UTFSM
- Mr. Juan Justiniano, Departamento de Informática, UTFSM
- Mr. Luis Ortega, Departamento de Informática, UTFSM
- Mr. Arnaldo Gaspar, Departamento de Informática, Universidad Técnica Federico Santa Maria, Valparaiso, Chile
- Mr. Javier Olivares, Departamento de Informática, UTFSM
- Mr. Pablo Espinosa, Departamento de Informática, UTFSM
- Mr. Roberto Bonvallet, Departamento de Informática, UTFSM
- Mr. Nelson Rojas, Departamento de Informática, UTFSM
- Mr. Felipe Marchant, Departamento de Informática, UTFSM
- Mr. Charbel Chapana, Departamento de Informática, UTFSM

Short scientific visits

In addition to the international SCAT meetings, with attendees from all the partner institutions, a number of short visits were carried out in which members of the project collaborated, gave seminars and/or taught short courses. Most of these visits were funded by the institutions themselves, with occasional support from SCAT. A report of activities is included in the Appendix.

The increase in collaboration activities like these towards the end of the project is clear indication of the success of the SCAT project in its goal of promoting the collaboration among the partner institutions. Moreover, the actual scientific results of the various new collaborations is already substantial, as can be ascertained from the list of publications (see the Section on Dissemination and Impact). This impact of the project was greater than expected and will have a lasting effect on the partners, as they continue to collaborate in the future.

The short scientific visits during this reported period are:

24–28 March 2008: Dr Mario Chavez from UNAM visited Daresbury Laboratory

- Presented the seminar "On earthquake simulations: theoretical and computational approach."
- Installed a 3D parallel finite difference code for the simulation of synthetic seismograms on the supercomputers BlueGene P, HPCx, and HECToR of the Daresbury Laboratory.

- Performed test runs of the mentioned code in the 3 supercomputers.
- Obtained results with the mentioned code for the realistic 3D modeling of the 19 09 1985 Michoacan earthquake using 1024 processors of the supercomputer HECToR .

18–26 May 2008: Prof Jorge Zubelli from IMPA visited Université Pierre et Marie Curie

- Gave the seminar "On the inverse problem for structured population models" and prepared Sergei Silva's research topic with Joel Frelat.

3–26 June 2008: Dr Eric Clément from École Superieure de Physique et Chimie Industrielles visited University of Chile

- Gave the short course "Mechanics of Granular media"
- Gave a seminar on "Injection in reorganizable porous media"
- This eventually led Eric Clément to attract a grantee from DFI to ESPCI: Jocelyn Dunstan

21 June–6 July 2008: Prof Oscar Orellana from Universidad Técnica Federico Santa Maria visited UNAM

4. Gave an intensive course of one week on advanced aerodynamics, including the following topics:
   - Euler equations, irrotational and incompressible fluids, complex variable fluid dynamics
   - The vortex sheet problem and the Birkhoff-Rott equation
   - The fundamental equations of aerodynamics
   - Prandtl's classic lifting-line theory
   - Improvements on the accuracy of calculations with a modern adaptation of Pradndtl's classic lifting line theory.

   There were about 15 or 20 students per day.
5. Gave the seminar "On the circular vortex sheet problem, complexification, singularity formation and critical time".
6. Carried out research about the transmitted and reflected wave from a discontinuous potential in the Schroedinger equation.
7. Collaborated with Dr Susana Gomez

17 July 2008: Dr Lorena Barba visited Daresbury Laboratory

- Seminar on "Opportunities in petaflop computing"

2–24 September 2008: Dr Mario Chavez from UNAM visited Daresbury Laboratory

- Gave the seminar "3D synthetic seismograms of the 12-05-2008 ms 7.9 Sichuan earthquake"
- Continuing working with D. Emerson and M. Ashworth, on the optimization of 3D parallel finite difference code for the simulation of synthetic seismograms..
- To work on two papers: one about the 3D modeling of the Michoacan 1985 and the other on the Sichuan 12 05 2008 earthquakes.

11–13 November 2008: Dr Agnès Maurel from École Superieure de Physique et Chimie Industrielles visited University of Bristol

- Seminar on "Turbulence generated by vortex burst"

9–21 December 2008: Dr Agnès Maurel visited University of Chile

- Seminar on "Study of the Trapped modes in an experiments of surfaces waves"
- This eventually led Agnes Maurel to recruit a grantee from DFI, thanks to what Jaime Zúniga spent 5 months in ESPCI the next year.

10 December–7 January 2008: Dr Mario Chavez from UNAM visited Daresbury Laboratory

- Gave the seminar "3D synthetic seismograms of the 12-05-2008 ms 7.9 Sichuan earthquake – Latest results"
- This eventually led to the following results:
  - Chavez, M, Cabrera, E, Madariaga, R, Perea, N, Moulinec Ch, Emerson, D, Ashworth, M, Salazar, A, (2008), Benchmark Study of a 3D parallel code for the propagation of large subduction earthquakes, in Lecture Notes in Computer Science, LNCS 5205, Springer.
  - Chavez, M, Cabrera, E, Chen, H, Perea, N, Salazar, A, Emerson, D, Ashworth, M, Moulinec, Ch, Wu, M, y Zhao, G, (2008), 3D wave propagation modeling of the 12 05 2008 Sichuan Ms 7.9 earthquake, XIV World Conference on Earthquake Engineering, Beijing, China, CD.
  - M. Chavez, E. Cabrera, H. Chen, N. Perea, A. Salazar, D. Emerson, M. Ashworth, Ch. Moulinec, M. Wu, G. Zhao, (2008), Modeling of the 3d wave propagation of the Sichuan Ms 7.9 earthquake of 12 05 08, American Geophysical Union Fall Meeting, San Francisco, USA, CD.

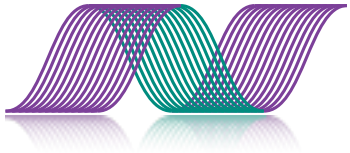
- Ashworth, M, Chavez, M, Cabrera, E, (2009), Exploiting extreme processors counts on Cray XT systems with high resolution seismic wave propagation experiments, CUG Proceedings (May 2009)

24 January–7 February 2009: Prof Rodrigo Soto visits École Superieure de Physique et Chimie Industrielles

- Seminar on "Hydrodynamic interactions in suspensions of swimming bacteria"
- Work closely with his tutee, Jocelyn Dunstan, and her local supervisor, Eric Clément, on the experimental results of the work carried out previously in Chile.

6 June–11 July 2009: Prof Rodrigo Soto visits École Superieure de Physique et Chimie Industrielles

- Finish the collaboration with his tutee, Jocelyn Dunstan, and her local supervisor, Eric Clément, on their experimental results.



8. Dissemination and Impact

Summary

Dissemination of the project has continued via the website, which regularly posts news of the grantees and their successes. Meetings have been a source of dissemination in the local academic communities, increasingly involving more participants. Additional dissemination as well as scientific impact is evidenced by a number of scientific publications. Significant impact is reported in terms of new collaborations, agreements, and new funding for important scientific initiatives.

Agreements between institutions, new funding and other impacts

UNAM-UTFSM

Although already reported previously (Report #2), we recall here that, thanks to the collaborations generated by SCAT, a general agreement of academic and cultural collaboration was signed between Universidad Nacional Autónoma de México (UNAM) and Universidad Técnica Federico Santa Maria (UTFSM), Chile). This agreement was signed on 17 January 2007 by the Rector of UTFSM and the Secretary General of UNAM. The scope of the collaborative agreement includes, for example, joint projects in both research and teaching, the exchange of academic personnel for both research and teaching and also for advisement and dialogue. It also contemplates the mobility of students at both under-graduate and post-graduate level, and the exchange of information, documentation, media and publications. The agreement is of indefinite duration. (A copy was included in the Appendix of our Report #2, January 2008.)

Centros de Innovación Tecnológica, CIT

The CITs, or Centers for Innovation in Technology, were established by Universidad Técnica Federico Santa Maria (UTFSM) in April 2008. The university built and equipped a building of over 2,000 square meters to accommodate six (6) newly created CITs. The Centers have staff specialized in the development of business initiatives together with the productive sector, who will work in coordination with the scientific staff to leverage funding for new technology initiatives with industry and business. The goal is to achieve sustainable development of the Centers for the medium and long term.

One of the Centers, is focused on scientific computing, based in great measure on the vitality created around the subject thanks to the SCAT project. The objectives of the CIT in scientific computing are as follows:

- To innovate and to create reproducible computational technologies of world class, to be applied specifically to the main economic sectors of Chile, including mining, with the aim of strengthening and adding value to the products of Chile's national economy.
- To contribute to the development of pure and applied sciences, introducing new computational methods and technologies, to the standards recognized internationally for scientific discovery through advanced computing—including world-class publications and education.
- To establish collaboration networks with public and private institutions, national and international, which are users of technologies of high-performance computing (HPC), grid computing, and scientific computing.
- To disseminate the usage of HPC, grid computing and scientific computing in enterprises and industry.
- To develop an adequate environment for scientific research and discovery, and the exchange of experiences among students, scientists, entrepreneurs and engineers.

The director of the CIT for scientific and high-performance computing is SCAT member Professor Luis Salinas.

Success

The new *Centro Científico y Tecnológico de Valparaíso* secured US$10 million in funding for 5 years. SCAT was instrumental in this achievement.

"Basal" funding for scientific centers in Chile

Universidad Técnica Federico Santa Maria (UTFSM), Chile, developed a proposal and finally won a 5-year, US$10 million funding from the Chilean government for a *Basal* technology center. This funding is to establish an institute, called the Scientific and Technological Center of Valparaiso (acronym CCTVal, in Spanish, for Centro Cientifico y Tecnológico de Valparaiso).

Only five projects in Chile were awarded the *Basal* funding, formally offered by the President of Chile, Michelle Bachelet, on September 2009. The Basal programme of Chile's CONYCIT is the most important funding effort to date in the country, immersed in the government's new strategy to strengthen scientific research and technology. The programme was created to fund centers of excellence in science and technology that must incorporate the participation of the private sector and count with international networks of collaboration.

The center created in Valparaiso consists of three groups: High-performance Computing, High-Energy Physics, and Power Electronics. According to Prof. Luis Salinas, one of the leaders of this effort (and SCAT member), the SCAT project was a substantial contributor to the university's being recognized as a leader in scientific computing, and helped satisfy one of the eligibility requirements —that of counting with a collaboration network at the international level.

Cotutelle agreement DFI-ESPCI

As mentioned in the section presenting the Successes of Grant Holders, the initial internship through the SCAT grant of Victor Romero became a *cotutelle* of his PhD. A *cotutelle* is a jointly-supervised doctoral program with a degree to be awarded two universities, one of them French. In this case, an agreement was signed by Universidad de Chile and Université Pierre et Marie Curie to award the joint degree. This agreement can now be taken advantage of by other students from Chile who are able to secure funding for carrying out part of their studies in France. In the case of Victor, this was possible by a scholarship from CONICYT.

UNAM-STFC

Through the collaboration initiated by the SCAT mobility of Abraham between UNAM and STFC (Daresbury and Rutherford Labs), a cooperation agreement was formalized between the institutions, with the aim of promoting and training scientists in the use of the Climate Science Modelling Language. The funding for this training will come from the UK and Mexican governments, via bilateral accords on climate change.

Dissemination at meetings and online

The project website has continued to offer information about the meetings organized by the SCAT project, and the successes of the grant holders. Selection rounds for grant holders have been announced in a timely manner online, and applications were also received via an online form.

The website continues to operate from an .EU domain for high visibility of the ALFA programme and the EU contribution.

See http://www.scat-alfa.eu/

Publications

A number of scientific publications were a direct result of the collaboration of the partners, and the research work of the SCAT grantees. A number of these are listed below. Several more are under preparation for publication, as the cycle for scientific publication can be one or two years.

Authors of the publications are asked to include an acknowledgement to SCAT in their papers (see some samples in the Appendix).

- Ashworth, M., M. Chavez, and E. Cabrera, Exploiting extreme processor counts on Cray XT systems with high-resolution seismic wave propagation experiments, Cray User Group, *CUG Proceedings* (2009).

- Chavez, M., E. Cabrera, R. Madariaga, N. Perea, C. Moulinec, D. Emerson, M. Ashworth, and A. Salazar, Benchmark study of a 3D parallel code for the propagation of large subduction earthquakes, in *Lecture Notes in Computer Science*, LNCS 5205, Springer (2008).

- Chavez, M., E. Cabrera, H. Chen, N. Perea, A. Salazar, D. Emerson, M. Ashworth, C. Moulinec, M. Wu, and G. Zhao, 3D wave propagation modeling of the 12 05 2008 Sichuan Ms 7.9 earthquake, *XIV World Conference on Earthquake Engineering*, Beijing, China, (2008).

- Chavez, M., E. Cabrera, H. Chen, N. Perea, A. Salazar, D. Emerson, M. Ashworth, C. Moulinec, M. Wu, and G. Zhao, Modeling of the 3d wave propagation of the Sichuan Ms 7.9 earthquake of 12 05 08, *American Geophysical Union Fall Meeting*, San Francisco, USA, (2008).

- Cruz, F. A., and L. A. Barba, Characterization of the accuracy of the fast multipole method in particle simulations, *International Journal for Numerical Methods in Engineering*, Vol. 79, No. 13, pp. 1577-1604 (2009) http://dx.doi.org/10.1002/nme.2611

- Cruz, F. A., L. A. Barba and M. G. Knepley, Fast multipole method for particle interactions: an open source parallel library component, *20th International Conference on Parallel Computational Fluid Dynamics*, Lyon, France, 19–22 May 2008.

- Cruz, F. A., and L. A. Barba, Characterisation of the FMM approximation in particle simulations, *8th World Congress on Computational Mechanics*, WCCM8, and *5th European Congress on Computational Methods in Applied Sciences and Engineering*, ECCOMAS, Venice, Italy, 30 June–4 July 2008.

- Cruz, F. A., C. Cooper, R. Yokota, and L. A. Barba, Parallel implementation of panel-free boundary conditions for the vortex particle method, *21st International Conference on Parallel Computational Fluid Dynamics*, Moffett Field, California, May 18–22, 2009.

- Cruz, F. A., and L. A. Barba, Parallelization of algorithms for heterogeneous computing systems with application to fast summation methods, *10th National Congress on Computational Mechanics* USNCCM10, Columbus, Ohio, 16–19 July 2009.

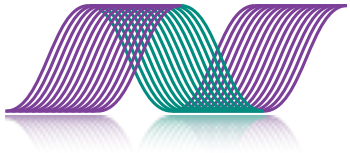
- Layton, S. K., F. A. Cruz, and L. A. Barba, Parallel fast Gauss transform in a heterogeneous computing environment, *10th National Congress on Computational Mechanics* USNCCM10, Columbus, Ohio, 16–19 July 2009.

- Ortinez, A., M. Ashworth and A. Woolf, "Air quality emissions and its integration with the Climate Science Modelling Language, CSML" (to be submitted).

- Ramos-Becerra, G., C. Moulinec, D. R. Emerson, X. J. Gu, Inlet-boundary conditions and truly incompressible SPH, 4th International

SPHERIC SPH Workshop, École Centrale de Nantes, Nantes, France, 26-29 May (2009)

- Torres, C. T., L. A. Barba, Fast radial basis function interpolation with Gaussians by localization and iteration, *Journal of Computational Physics*, Vol. 228:4976-4999 (2009)
http://dx.doi.org/10.1016/j.jcp.2009.03.007



9. Conclusions

This final report of the SCAT project covers the period from November 2007 to July 2009. This includes the extension granted by the European Commission for an additional 8 months project duration. A detailed account of the activities during the reported period is given, as well as a summary of the activities for the whole duration of the project.

In the reported period, four international meetings were held, completing a total of 10 meetings for the entire project. These meetings have rotated among the partner institutions, so that each of the 10 partners has been a host at one time. The SCAT meetings were increasingly well-attended, with the final set of them including participation of students and academic personnel in local institutions. There has also been an increased amount of additional funding available from the hosts or local sponsors, which has allowed a broader range of activities.

The SCAT project awarded at total of 31 mobility grants to 30 students and postdoctoral researchers (one student was awarded twice). The total number of months of student/postdoc support amounted to 235, which is almost 20 student-years of equivalent funding. This is considerably more than was planned at the proposal stage. The reason for this increase is that, as other actions resulted in lesser expense than anticipated (for example, by the international meetings not being attended by all the allowed SCAT members), funds were redirected to the mobility grants program. This aspect of the project was undoubtably the one which had the greatest impact for the scientific capacity of Latin America, and the lives of the young people involved in the programme.

There was only one negative circumstance associated with the mobility grants programme. In general, one of the most troublesome issues we had to deal with was the immigration barriers. For some students, it was remarkably difficult to obtain an entry visa, considering that the program is funded by the European Union. In the most dramatic case, a grantee from Mexico was denied a visa to the UK, not once but twice. This student was later invited to Daresbury Lab for a shorter visit, that would be possible with a visitor's visa (rather than student). Shockingly, this student was denied entry to the UK and sent back to Mexico.

Turning again to the positive outcomes of the project, it surpassed everyone's expectations that there was a respectable number of scientific publications that were produced either by the work of the grantees, or through the collaborations of the project partners. These publications include articles in prestigious scientific journals, as well as prominent international conferences. In many cases, the publications were the first

for the student grant holders, and opened their doors for PhD applications and other scholarship awards.

Many grant holders expressed that their SCAT mobility opened their eyes to international scientific research, and gave them the resolve to apply for PhD studies. We have 12 grantees currently in a doctoral program of study, which is a rate of about 40%. We have not confirmed with each of them how much the SCAT experience influenced their decision, but anecdotal evidence suggests that it was decisive for almost all of them.

We conclude that a program like this can have a tremendous impact on young people from Latin America who have the aptitude for scientific research, but may not have the initiative or purpose to embark in doctoral studies abroad. This is a reality very particular of the Latin American society and culture, and different, say, of what could be encountered in China or India. Latin American youngsters are still quite shielded from the opportunities abroad, and are very family-oriented. We saw how several SCAT grantees struggled the first few months to adapt to being in Europe; it was a personal challenge. Once they had stretched themselves, new realities were possible.

The fact that the SCAT mobility committed them to a short period of only 10 months abroad (rather than 4 years for a PhD), allowed many of the young grantees to embark in this adventure. They then discovered in themselves a new sense of confidence and resolve.

Many of the young SCAT grantees will return to Latin America after their PhD studies. Some perhaps will not. But even those who do not will surely maintain ties with their alma mater (like SCAT project leader Dr Barba has), and create new opportunities for international collaborations in science and education.

Thus, the goals of promoting the development of the region through scientific and technological advancement are certainly met by our project actions. We look forward to observing the impact of the SCAT initiative for years to come.

Appendices

1. Financial Reports
2. Complete list of all people involved in the project
3. Guidelines for Applicants
4. Minutes of Selection Rounds
5. General Recommendations Regarding the Registration of Grant Holders
6. Responsibilities of Grant Holders
7. Sample Certificate of Completion

8. Program of the SCAT meetings in this reporting period
9. Course Descriptions for Satellite Schools
10. Report of Activities: Short Scientific Visits

11. Survey of SCAT members
12. Sample dissemination items and evidence of impact
13. Scientific publications

14. Additional media:
    CD with files of the grant holder curriculum vitae