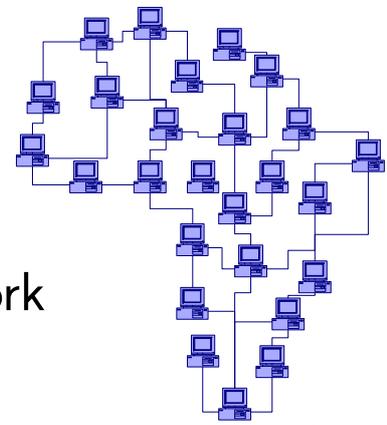


AMI-Net

African Mathematical Institutes Network



A critical need for African science

Modern science is increasingly broad in its scope, but unified in its methods. Strong quantitative skills are now a key requirement in essentially all scientific disciplines. These include the ability to analyse and model large data sets, to develop and apply computer software, to understand and apply modern technologies in innovative ways. These skills are in great demand across all sciences. They are critical to the development of a strong science base in Africa.

Modern society is also heavily dependent upon mathematics: from information technology to biotechnologies to the financial markets. There is an increasing recognition of the vital role mathematics will play in African development. Strong interest and support exist across society for initiatives to strengthen the mathematical sciences at all levels.

The problem

African scientists have traditionally faced isolation and a lack of resources. Consequences include low morale and publication rates, poor teaching quality and a profound *brain drain*. In these poor conditions, it is hard to attract the best students. There is a consequent lack of a critical mass in many fields.

The Internet offers unprecedented opportunities for gaining access to huge information resources. But most African institutions have insufficient bandwidth at astronomical prices. Where good infrastructure does exist, there is a shortage of qualified technical personnel and bandwidth is poorly managed.

Most universities run expensive proprietary software which is often slower and less secure than Free and Open Source (e.g. GNU/Linux) equivalents. This leads to dependency and undermines their ability to innovate. Many departments run pirated software.

Our proposal

AIMS is proposing to develop an African Mathematical Institutes Network (AMI-Net) across the continent. Nodes of this network will continuously engage in sharing ideas, skills, and resources for research or teaching in the mathematical sciences via the Internet. AMI-Net will connect African researchers with the global science community, encouraging international exchange visits, and nourishing collaborations. The focus of the network will be on those areas of mathematical science which are of greatest relevance to African science and development.

The AIMS model

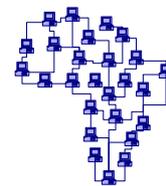
AMI-Net is proposed as a natural extension of the African Institute for Mathematical Sciences (AIMS, see www.aims.ac.za). Since its launch in September 2003 in Cape Town, South Africa, AIMS has rapidly established itself as a leading centre for postgraduate training in a broad range of mathematical sciences. AIMS operates at international standards while being cost-effective: costs per student are less than one quarter of what they are in the US or Europe. The course is heavily oversubscribed and students are among the most committed and enthusiastic worldwide. Alumni have been very successful in obtaining research and teaching placements.

AIMS and the African Mathematics Millenium Science Initiative (AMMSI), a plan to develop several leading centres for mathematics in Africa, have been recently proposed as a NEPAD Centre of Excellence by several international scientific organisations. AMI-Net will provide key infrastructure linking AIMS, AMMSI Centres, and other leading centres for mathematical sciences across the continent.

Based on its experience and proven track record AIMS is now in a prime position to expand the project.

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Impact on science in Africa

AMI-Net will create a *multiplier effect* by providing opportunities for AIMS graduates and other outstanding young African scientists. They will be able to pursue scientific careers *inside* Africa, and to contribute to mathematics and science education in their home countries.

Like AIMS, each partner institute could produce fifty skilled mathematical scientists per year. Within a few years, the proposed twenty AMI-Net institutes will annually generate a substantial number of well-educated, well-connected young African scientists and lecturers.

The AMI-Net proposal

AMI-Net is proposed as a network of partner institutes with its central hub located at AIMS. Five centres will be connected and equipped in the first two years, gradually expanding to a network of twenty centres within eight years. Funding will taper off as each node becomes self-sustainable.

A preliminary proposal with a budget estimate was prepared for the Department of Science and Technology of South Africa in 2004. It is available on request.

Funding is now sought for the development of a detailed implementation plan. An interim director will be appointed with a team of respected academics along with management and ICT experts. They will visit and assess the widely varying conditions at proposed sites to identify the specific needs, opportunities, and feasibility in each case.

An AMI-Net governing body consisting of representatives of NEPAD, senior African academics, international scientists, and the AMI-Net director will be convened. Upon completion of the site assessments, AMI-Net nodes will be selected on the basis of quality, potential, and geographical distribution.

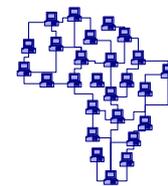
An executive team based at AIMS will oversee the project. The team will include administrative, technical staff, and content developers. Each node's operations will be monitored, and assistance will be given on continuous basis.

Candidates for AMI-Net nodes

In consultation with our partners, AMMSI, and other institutes listed below, a survey will be conducted to select sites for AMI-Net.

 **Institut de Mathématiques et de Sciences Physiques (IMSP), Porto-Novo, Benin.** IMSP is a research training centre in postgraduate mathematical sciences for all of francophone Africa. A small amount of outside funding comes primarily from the International Centre for Theoretical Physics (ICTP) in Trieste. IMSP has an outstanding record of graduating PhDs in mathematical sciences. Many are on *sandwich programmes* with overseas universities. Alumni have gone on to faculty positions across West Africa. IMSP has a small computer facility which would be greatly improved under the auspices of AMI-Net (bandwidth in Benin is amongst the most expensive in the world). With a new site and building, IMSP is in an excellent position to take advantage of the opportunities which AMI-Net offers. AIMS and IMSP already have close ties, with representatives of each serving on the advisory boards of the other. The research focus of IMSP is on mathematical modelling and computer science, as well as pure mathematics and mathematical physics. A recent innovation is a course on water resource management. *Director: Prof. J-P Ezin*

 **National Mathematical Centre (NMC), Abuja, Nigeria.** NMC is the top national centre for mathematics in Nigeria.



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NMC runs a variety of courses and research workshops each year. AIMS receives more applications from Nigeria than from any other African country, and twelve Nigerians have taken the AIMS course so far. In spite of its status within Nigeria, and the demand amongst students, the rudimentary computer facilities urgently need upgrading. NMC representatives have visited AIMS twice and are enthusiastic about joining AMI-Net. *Director: Prof. S. Ale*

 **Faculty of Sciences, University of Khartoum, Khartoum, Sudan.** The Faculty of Sciences has over 15,000 students, but only seven full PhDs on its senior staff. Representatives have visited AIMS and eleven students (including eight women) from Sudan have attended the AIMS course. Several are young university lecturers planning to return after completing their Masters and PhDs. Good computer facilities and an Internet connection have recently been installed in Khartoum, but there is a severe shortage of skilled personnel. There is great interest in the establishment of an AMI-Net node. Particular research interests include statistics and computer science. *Contact: Former Dean, Prof. M. Ishmail*

 **Mathematics Department, University of Nairobi, Nairobi, Kenya.** AIMS has strong ties with this department and there have been several exchange visits. Three Kenyan students have attended the AIMS course. The previous head of department, Professor Wandera Ojana, is also chair of the African Mathematics Millennium Science Initiative (AMMSI) writing group. In June 2004 a joint memorandum of understanding between AIMS and AMMSI

was signed, according to which both organisations will collaborate fully in developing a pan-African network of mathematical sciences institutes. The Nairobi department has research groups in a number of areas, several in association with Scandinavian scientific partners. *Contact: Prof. W. Ojana*

   **North Africa** Six North African students have attended AIMS so far, and there is strong enthusiasm for AMI-Net amongst AIMS representatives in North Africa. Establishment of a North African node will require government involvement and support. A number of possible sites will have to be explored. The Libyan government has expressed strong interest in such an institute. *AIMS representatives: Prof. F. Lahlou, Département de Physique, Université de Fez, Fez, Morocco; Prof. J. Mimouni, Institut de Physique, Université de Mentouri-Constantine, Constantine, Algeria*

Additional sites to be considered as AMI-Net nodes include the following.

 The Edward Bouchet Abdus Salam Institute, Accra, Ghana. *Prof. F.K.A. Al-lotey*

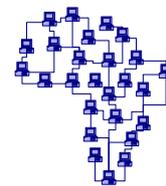
 Faculté de Sciences, Université de Kinshasha, Kinshasha, République Démocratique de Congo. *Prof. P. Badibanga*

 Departamento de Matemática e Informática, Universidade Eduardo Mondlane, Maputo, Moçambique. *Prof. P. Gerdes*

 Mathematics Department, University of Dar Es Salaam, Dar Es Salaam, Tanzania. *Prof. E. Massawe*

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 Mathematics Department, University of Botswana, Gaborone, Botswana. *Prof. E. Lungu*

 Physics Department, University of Zambia, Lusaka, Zambia. *Prof. H.V. Mweene*

 Département de Mathématique, Université d'Antananarivo, Antananarivo, Madagascar. *Prof. G. Razafimanantsoa*

Each contact person mentioned above has visited AIMS, and students from their country have taken the AIMS course. The AMI-Net concept was developed in discussion with them and they are all keen to participate in it.

Why now?

-  The New Partnership for Africa's Development (NEPAD) and the African Ministerial Committee on Science and Technology (AMCOST) are coordinating science priorities and policy on the continent.
-  The Internet provides access to vast resources and scientific data, and allows rapid, continuous communication via email and the web. Voice and video over the Internet are rapidly evolving and being deregulated. Satellite (VSAT) technology allows affordable expansion of current poor bandwidth levels.
-  Free and Open Source software is rapidly facilitating independence from expensive proprietary software, allowing for innovation and indigenous development and nurturing the ability of graduates to become entrepreneurs with affordable tools.

AMI-Net goals

-  To establish five well-connected AMI-Net (256kbps+) nodes within two years. To implement bandwidth management, and to lobby for bandwidth buying consortia.
-  To equip each centre with forty plus computers, including a full suite of Free and Open Source software, good electronic journal access, library facilities i.e. mathematics and computing textbooks. AMI-Net will also lobby for free access to scientific journals for AMI-Net researchers.
-  To run annual training courses for fifty university lecturers and system administrators in the use of Free and Open Source software for teaching and research in the mathematical sciences. In July 2005, AIMS is piloting this course, funded by a generous private donation and by the Ford Foundation.
-  Developing and distributing documentation, tutorials, and other teaching content.
-  Through seminars and research meetings, to bring visibility to African researchers and facilitate efficient continent-wide collaboration.
-  To continuously monitor the operation of each node, and to be available to advise and assist with ensuring the most effective operation of the network.
-  To increase the number of centres to twenty within eight years.

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