A. PROJECT SUMMARY

AMPATH Collaborative Research and Education Operational and Functional Support

This proposal seeks staff support in order to improve the operational and functional capabilities of the AMPATH project, an advanced networking infrastructure and international exchange point for research and education, based in Miami, Florida at Florida International University (FIU). Assistance by way of salary support under the auspice of the NSF-STI-2002 program would have a direct and significant impact for AMPATH to address the STI goal of *accelerating Research and Development in strategic technologies*. AMPATH seeks to connect at least 10 countries National or Regional Research and Education Networks (NRENS) as well as providing advanced networking connectivity to US e-Science applications and major instrumentation interests in Latin America, the Caribbean, the US and globally. A dedicated source of funding for the duration of this proposal will allow the AMPATH project team to carry out the future work plan proposed herein; directly reduce the cost-sharing requirements for its participants; and greatly assist collaborative research and information sharing between US scientific researchers, educators, using Internet based computational grids, and major research instrumentation. The proposal uses **The August, 2001 AMPATH Workshop Report**[1] prepared by a committee of US researchers, as the foundation of its funding request.

Work Plan Objectives:

- Enable and support strategic US-led projects in South and Central America, Mexico and the Caribbean
- Connect the NRENs in the AMPATH Service Area to the global R&E networking community
- Develop an outreach and dissemination program through conferences, workshops and other channels to increase awareness of AMPATH and its benefit to the global R&E networking community
- Develop a technology plan that will enable the AMPATH network to support e-Science and experimental networks

To launch the AMPATH project, Global Crossing donated 10 DS3 (45 Mbps) circuits for three year periods, staggered depending on the connection date of each NREN. Cisco Systems, Lucent Technologies and Juniper Networks donated carrier-class network equipment; and Terremark Worldwide, Inc. donated collocation space in the NAP Of The Americas. Since June 2001, the AMPATH project has connected three National Research and Education Networks in South America: REUNA[2] of Chile, RNP[3] of Brazil, and RETINA[4] of Argentina; the Academic Network of Sao Paolo, ANSP[5], which is a State-funded network; the University of Puerto Rico; the Arecibo observatory; and the Gemini-South telescope. The NRENs of Colombia, Mexico, Panama, Peru and Venezuela remain to be connected to the project. The final DS3 is to connect the R&E network of the US Virgin Islands, primarily targeted to the distributed campuses of the University of the Virgin Islands. This work has been done on a best-effort basis by the PI and Co-PI, the Chief Network Engineer and the International Coordinator for the AMPATH project. AMPATH's project goals would be much better served if several members of the project team had their time formally committed to the project by way of this proposal.

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[1] http://www.ampath.fiu.edu/workshop.htm , The workshop was sponsored by NSF Award #ANI-0123388
[2] www.reuna.cl
[3] www.rnp.br
[4] www.retina.edu.ar
[5] www.ansp.br

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1.0 Introduction and Background

This proposal seeks staff support in order to improve the operational and functional capabilities of the AMPATH project, an advanced networking infrastructure and international exchange point for research and education, based in Miami, Florida at Florida International University (FIU). Assistance by way of salary support under the auspice of the NSF-STI-2002 program would have a direct and significant impact for AMPATH to address the STI goal of *accelerating Research and Development in strategic technologies*. AMPATH seeks to connect at least 10 countries' National or Regional Research and Education Networks (NRENS), as well as providing advanced networking connectivity to US e-Science applications and major instrumentation interests in Latin America, the Caribbean, the US and globally. A dedicated source of funding for the duration of this proposal will allow the AMPATH project team to carry out the future work plan proposed herein; directly reduce the cost-sharing requirements for its participants; and greatly assist collaborative research and information sharing between US scientific researchers, educators, using Internet based computational grids, and major research instrumentation. The proposal uses **The August, 2001 AMPATH Workshop Report**[1] prepared by a committee of US researchers, as the foundation of its funding request.

1.1 The AMPATH Project

Over the last two years, FIU has developed an international, high-performance research connection point in Miami, Florida, called AMPATH (AMericasPATH). One of AMPATH's goals is to enable wide-bandwidth digital communications between the Abilene network and ten National Research and Education Networks (NRENs) in South and Central America, the Caribbean and Mexico, as well as a variety of US research programs in the region.

FIU emphasizes research as a major component of its mission and is ranked by the Carnegie Foundation for the Advancement of Teaching as a Doctoral/Research University-Extensive, the highest ranking in its classification system. FIU has more than 32,000 students, 1,100 full-time faculty, and 90,000 alumni, making it the largest university in South Florida and placing it among the nation's 25 largest colleges and universities. It is unique in that it has the highest proportion of international students and faculty of any major university in the country. FIU is a Minority Institution with the largest contingent of Hispanic students of any doctoral-granting university and awards more Bachelors degrees to Hispanics than any other school within the continental US. Its mission includes being the principal educational and research interface between the State universities and South and Central America and the Caribbean. AMPATH provides opportunities for Hispanic minority students at the University to work on the project in technology and administrative positions.

Through the High-Performance Connections Grant solicitation of NSF's ANIR division, FIU first established itself as an Abilene connecting point for South Florida in 1999. In

[1] http://www.ampath.fiu.edu/workshop.htm , The workshop was sponsored by NSF Award #ANI-0123388

addition to itself, the University now provides Internet2 connectivity to Florida Atlantic University and the University of Miami. From this base, FIU realized that South Florida – because of the number of undersea fiber cables landing on its east coast and because it possesses a rich terrestrial fiber infrastructure - is strategically positioned to become a major international exchange point (IXP) for the research and education networks in South America, Central America, Mexico and the Caribbean.

To launch the AMPATH project, Global Crossing donated 10 DS3 (45 Mbps) circuits. AMPATH is providing one of these circuits to a NREN in each of ten service-area countries for three years to connect to the AMPATH IXP in Miami for connectivity to the Abilene Internet2 high-performance research and education network. The three-year period is staggered depending on the connection date of each NREN. Cisco Systems, Lucent Technologies and Juniper Networks donated carrier-class network equipment; and Terremark Worldwide, Inc. donated collocation space in the NAP Of The Americas. Since June 2001, the AMPATH project has connected three National Research and Education Networks in South America: REUNA[2] of Chile, RNP[3] of Brazil, and RETINA[4] of Argentina; the Academic Network of Sao Paolo, ANSP[5], which is a State-funded network; the University of Puerto Rico; the Arecibo observatory; and the Gemini-South telescope. The NRENs of Colombia, Mexico, Panama, Peru and Venezuela remain to be connected to the project. The final DS3 is to connect the R&E network of the US Virgin Islands, primarily targeted to the distributed campuses of the University of the Virgin Islands.

1.2 Current Cost-Shared Funding Model

AMPATH operates through significant industry support, with participants sharing the cost of operational expenses incurred by FIU in association with the project. The major cost-shared components are administrative staff support, network engineering personnel and support, hardware maintenance, and cost-shared bandwidth for Abilene and/or STAR TAP-StarLight. Several countries in the AMPATH service area have well-developed in-place R&E network infrastructures, at the national or state levels. However, for a number of others countries, the local telecommunications infrastructure build-out (the *local loop* or *last mile*) have been an economic challenge. Some of the potential AMPATH participants are struggling to build the financial commitment to join the FIU AMPATH project, obtain the equipment and collocation space in-country, as well as build out the local infrastructure to the universities and major research instrumentation, in support of US scientific research goals.

It is critical for the cost-sharing component to be significantly lowered or eliminated to allow the AMPATH international exchange point and network to mature. By providing the international connectivity at little or no cost for the first three years, participating countries will have the incentive and financial wherewithal to develop the in-country connections to universities and research centers needed for establishing stable NRENs.

[2] www.reuna.cl
[3] www.rnp.br
[4] www.retina.edu.ar
[5] www.ansp.br

Moreover, all participants would have an opportunity to budget reasonable future costs for the international component of their circuits. Grant assistance, in the form of salary support, is being sought to offset these costs for a suitable period of time.

2.0 Proposed Work Plan

2.1 A Quick Look Back at the Last Year: June, 2001 to May, 2002

In its first year of service as an international exchange point for research and education networks, AMPATH has connected the NRENs of Argentina, Brazil, and Chile, and the academic network of Sao Paolo (ANSP); the University of Puerto Rico, the Arecibo observatory and the Gemini South telescope. This work has been done on a best-effort basis by the PI and Co-PI, the Chief Network Engineer and the International Coordinator for the AMPATH project. AMPATH's project goals would be much better served if several members of the project team had their time formally committed to the project.

2.2 Work Plan Objectives

- Enable and support strategic US-led projects in the Service Area
- Connect the NRENs in the AMPATH Service Area to the global R&E networking community
- Develop an outreach and dissemination program through conferences, workshops and other channels to increase awareness of AMPATH and its benefit to the global R&E networking community
- Develop a technology plan that will enable the AMPATH network to support e-Science and experimental networks

2.2.1 Enabling and Supporting Strategic US-led Projects in the AMPATH Service Area

2.2.1.1 Astronomy[6]

From an astronomer's perspective, many of the most scientifically interesting celestial objects are only properly viewed from south of the Equator. The Andes of northern Chile comprise one of the best locations for such observations anywhere in the Southern Hemisphere, due to its combination of proximity to the very dry Atacama Desert and favorable prevailing winds.

Thus, it is no surprise that four major US observatories have established a significant collection of world-class telescope facilities based in Chile's Fourth Region in the coastal city of La Serena. Among these US facilities are the **Gemini Observatory's southern telescope** and the **Southern Observatory for Astrophysical Research (SOAR)** on Cerro Pachón, and the **Cerro Tololo Inter-american Observatory's (CTIO)** suite of 8 telescopes. These are all NSF-funded programs managed by the Association of Universities for Research in Astronomy (AURA).

[6] Astronomy Section written in collaboration with Dr. James Kennedy

In addition, the Observatories of the **Carnegie Institution of Washington (OCIW, also known as CARSO)** are host to four additional telescopes on Cerro Las Campanas. In all, there are 14 La-Serena-based US-operated telescopes in operation or nearing completion. These range from very small special-purpose facilities to several behemoths in the 4, 6, and 8m classes.

The **Atacama Large Millimeter/sub millimeter Array radio telescopes (ALMA)** will be the world's most sensitive, highest resolution, millimeter-wavelength telescope. It will combine an angular resolution comparable to that of the Hubble Space Telescope with the sensitivity of a single antenna nearly 100 meters in diameter. ALMA will consist of no less than 64 12-meter antennas located at an elevation of 5,000 meters in Llano de Chajnantor, Chile. Fiber Optic transmission lines between the ALMA Operations Support Facility and the Chajnantor installation is planned for 2005. Remote monitoring and control of the ALMA telescope will start soon using REUNA2, AMPATH and Abilene advanced networking connectivity. Future challenges for ALMA networking are to connect four points like they are on the same local network with at least 10 Mbps and an average anticipated need for 30 Mbps and up to 300 Mbps sustained peak by 2005 to enable the high performance Internet applications that are an integral part of this undertaking. The ALMA Project is an international partnership between U.S. and European astronomy organizations to build a complete imaging telescope that will produce astronomical images at millimeter and submillimeter wavelengths. The U.S. partner is the National Science Foundation, through Associated Universities, Inc., (AUI), led by Dr. Riccardo Giacconi, and the National Radio Astronomy Observatory (NRAO).

The **National Astronomy and Ionosphere Center Arecibo Observatory (NAIC)** is located in Puerto Rico and operated by Cornell University under cooperative arrangement with the National Science Foundation; additional support is provided by the National Aeronautics and Space Administration. The Observatory provides observing time, electronics, computer, travel and logistic support to scientists from all over the world. As the site of the world's largest single-dish radio telescope, the Observatory is recognized as one of the most important national centers for research in radio astronomy, planetary radar and terrestrial aeronomy. All of these areas lend themselves to data collection that might be most economically shared with scientists via a high-performance Internet connection, such as Internet2. NAIC in conjunction with the University of Puerto Rico are currently the recipients of an NSF High Performance Connection award from NSF, and they have enabled their Internet2 connectivity through the AMPATH PoP in Miami.

The **Pierre Auger Cosmic Ray Observatory** is located near the cities of Malargue and San Rafael in Mendoza Province, Argentina. It is a major facility for forefront science in Latin America and will consist of 1,600 particle detector stations to record the arrival on earth of air "showers" caused by the most powerful particle interactions ever observed, in an attempt to track down the unknown origin of these extremely high-energy cosmic rays. The U.S. contribution to the funding for the construction of the Auger Observatory Site in Argentina is being provided equally by the U.S. Department of Energy and the National Science Foundation. Nineteen nations in total are represented in the Pierre Auger Project including Argentina, Australia, Brazil, China, France, Japan, Mexico, and the United

Kingdom. Auger Project spokesman, Dr. James Cronin said, "We have been working with agencies and governments around the world … to reach this moment. It is truly a great achievement for international scientific collaboration--for science without borders." Construction of the Pierre Auger Observatory will be complete in 2003. Auger Project collaborators plan to begin cosmic-ray observations in about 2001.
Modern astronomical facilities rely heavily on taking digitized images and two-dimensional spectroscopic fields. As the detectors that capture these fields continue to grow in format size, the amount of digital data produced has grown geometrically. The remoteness of these telescopes from their scientific constituencies leads to the need to rapidly communicate significant amounts of data to the US National Research and Education Networks including Internet2 (I2), as well as non-US NRENs. Moreover, in these times of budget limitations, the economic and productivity advantages of strategies such as remote and queue observing, further intensifies the need for such wide-bandwidth low-latency digital communications.

2.2.1.2 High Energy Nuclear Physics[7]

Experiments in high energy nuclear physics utilizing CMS datasets and the COJAC application were carried out by Professor Harvey Newman of the California Institute of Technology in Rio de Janeiro Brazil following the LISHEP Grid Workshop on February 7-8, 2002 with Co-PI Alvarez in attendance. Commenting on the link technology being developed by AMPATH, StarLight and Global Crossing to support further international collaboration with the HENP scientists in Brazil, Prof. Newman (who co-manages the network links between the US and CERN and who also leads the US CMS Collaboration[8]) said, "The development of a multifaceted VPN service based on IP/MPLS will pave the way for production use of 1-10 Gbit/sec links in support of science and engineering between South America and the US, as well as across the Atlantic between STARLIGHT and CERN in support of the LHC program over the next five years." Many spokespeople and senior representatives for Grid projects presented at this meeting http://www.lishep.uerj.brr , in person or using Caltech's VRVS state of the art collaborative system (http://vrvs.org). VRVS also was used to make the Grid Session available to participants in the US and Europe. Professor Newman noted that, "The link into the Grid Workshop is a pivotal event demonstrating inter-regional collaboration and frontier developments of Grid systems. The presence of the link has made the Grid Workshop global in character, marking appropriately the entry of South America into the community of nations developing Grids and state of the art collaborative systems, in support of leading edge research in science and engineering."

The support received from NSF grant award #ANI-0215434; ***AMPATH StarLight Rio Grid Workshop Support Request*** is providing an outstanding opportunity to help initiate a Grid effort in support of the Large Hadron Collider and other major scientific programs in Brazil—the first of its kind in the southern hemisphere. This support has provided a foundation to build on the excellent first steps Professor Alberto Santoro of Universidade do Estado do Rio de Janiero (UERJ – site of the workshop) has already taken in this

[7] HENP Section written in collaboration with Prof. Harvey Newman
[8] http://uscms.fnal.gov.

direction, including plans for a Tier1 Regional Center in Rio. These developments stand to be of great near-term benefit to the Fermilab collider program, where Professor Santoro is an important collaborator in the D0 experiment. In the longer term, the developments would strongly benefit the LHC program and the Compact Muon Solenoid (CMS) experiment (http://cmsdoc.cern.ch) in particular, through the development of the first Tier1 Regional Center in the Southern hemisphere.

2.2.1.3 Advanced International Internetworking Services

Of particular interest to our researchers is the use of a **Computational Grid** for the Americas, ***LAGRID***, in support of a testbed for integrated collaborative activities taking place in the Americas. AMPATH's PI and Co-PI are working with investigators on the HENP, iVDGL, National Virtual Observatory, and GriPhyN projects to develop AMPATH's network infrastructure to support computational grid collaborations with scientists in South America. Resources in South America that are immediate users to connect to *LAGRID* are Gemini and CTIO telescopes in Chile, and the Pierre Auger ultra high-energy cosmic ray observatory in Argentina. As the international exchange point for R&E networks between the US and Latin America, AMPATH is strategically positioned to support the Gigabit-level bandwidth requirements of *LAGRID*.

NSF funded workshops, Awards #ANI-0123388 and #ANI-0220176, have provided the means to document applications that would greatly benefit from an optical wavelength network between the US and countries in South America. The natural development of the AMPATH network would be to provide the optical wavelength network infrastructure that would support the Computational Grid for the Americas and its e-Science application requirements.

The **Access Grid** for the collaborative sharing of research and data consists of multimedia display, presentation and interaction environments, to support large-scale distributed meetings, collaborative work sessions, seminars, lectures, tutorials and training. The AMPATH International Conference focused on existing grid application developments that demand advanced network connectivity to the AMPATH service area.

VRVS service and its continuous leading edge technology development is an important component in furthering advanced e-Science application development. AMPATH has successfully used VRVS technology for enhanced communications across the AMPATH advanced networking infrastructure to facilitate collaborative scientific research workshops. AMPATH hosts the VRVS reflector and is the main entry point into the US for VRVS traffic from South and Central America and the Caribbean[9]. The AMPATH VRVS reflector is strategically located at the NAP of the Americas in Miami, to provide the best possible connectivity for VRVS traffic in and out of the Latin American region. The LISHEP-2002 conference[10] in Rio de Janeiro, Brazil, was a demonstration of the

[9] *"A Next Generation Integrated Environment for Collaborative Work Across Internets",* Newman, H.B., 2001
[10] http://www.lishep.uerj.br

capabilities of the AMPATH network to provide VRVS services for this conference and has enabled Brazilian universities, such as UERJ, to use VRVS to collaborate with Fermilab and the VRVS community.

2.2.1.4 Other e-Science Internetworking Applications[11]

A wide range of strategically-important, US-based, or US-involved, research programs are already in place in the AMPATH service area. The involvement of South America in these programs in astronomy, biology, ecology, geoscience, materials science, and physics, with others on the drawing board, marks the emergence of 21st century scientific collaborations that are truly global in scope. The success of these efforts depends on enhanced connectivity. This includes greater network bandwidth to sustain both greater data throughput, and interactivity in collaborative work. Over the next decade the need for bandwidth will dramatically increase by several orders of magnitude, as planned new programs come to fruition and currently operational programs mature.

At the highest level, some US science would be intrinsically driven outside the US by geography and/or the availability of leading-edge experimental facilities, even if no collaborations were involved at all. A broad sector of US researchers also participates with international collaborators because of the value of the collaboration itself.

2.2.1.5 Strategic US Science Interests in the South – Driven by Geography

In many science fields one can do the research within the geographical boundaries of the US. However, there are many other fields where the nature of the science and the geography of the planet demand that important aspects of the work be done in foreign countries, as referenced in the Astronomy Section above. What follows is a sampling from the ***August, 2001 AMPATH Workshop Report*** of research programs that *must* rely on operations in the south due to the nature of the science studied, in addition to astronomy already discussed above. However, in all of these programs there are indeed very powerful international collaborations as well, that exist for their own value to the science involved.

Global Warming and Ecology

The climate of the US, and the whole planet, is influenced by significant events occurring or observable rather exclusively in the South. Several speakers spoke on the need for network access to support environmental studies that must be carried out in South America. The ozone hole cannot be observed from the Northern Hemisphere. El Niño, which affects global weather on short time scales, impinges on the northwest coast of

[11] This section is paraphrased from the AMPATH Workshop Report, http://www.ampath.fiu.edu/workshop.htm, prepared by a committee of US researchers invited to act as the reporting team: Roy Armstrong, University of Puerto Rico, Marine and Atmospheric Science, Bob Bradford, NASA, Space Science, Dick Crutcher, Univ. of Illinois at Urbana Champaign, NCSA, Jim Kennedy, Gemini Observatory, Astronomy, (Committee Chair), Michael McClain, Florida International University, Environmental Science, Harvey Newman, Caltech, High Energy Physics, Surendra Saxena, Florida International University, Materials Science. It should be noted that all of the Committee members were also presenters at the conference. Each is affiliated with one or more organizations that have important scientific stakes in the success of AMPATH and AMPATH-like programs.

South America. The most dynamic areas of deforestation and associated alterations to the carbon cycle are found mainly in the Amazon basin of northern South America and affects four extensive regions in the continent: Ecuador, northern Amazonia, southeastern Brazil, and eastern Argentina. The disappearance of tropical glaciers in the Andes is an early indicator of global climate warming and a significant threat to water supplies in many arid urban settings along the Pacific coast of South America. All of these effects impact the degree of biodiversity in the affected regions, and feedback into the complex ecological system of the planet.

Whether conducted directly as US-sponsored research projects or as international collaborations based on our common dependence on the Earth's environment, the venue for gathering much of the data is South America. This fact is recognized by the current US administration, and on June 10, 2001, President Bush underlined the US commitment to collaboration in these fields. He made mention to collaborations throughout the Western Hemisphere and specifically stated that "We will work with the Inter-American Institute for Global Change Research and other institutions to better understand regional impacts of climate change."

The Inter-American Institute for Global Change Research (IAI) stimulates and funds global change research in 18 countries of the Americas. US participation in IAI began in 1992 and is realized through the specific activities of more than 30 investigators in as many US research institutions. AMPATH is in discussions with IAI Headquarters now to become the US Node for the IAI Distributed Information System, pending a successful response to a future announcement of opportunity from the NSF.

Astrobiology

Linking the Earth and space, those who study the possibilities of life on other planets, either originating in place or inserted as alien species (for example, by visits from terrestrial spacecraft), find the ecological dependencies on the Earth form a point of departure. Studies of the Earth provide a “ground truth”, from which researchers can extrapolate what might happen elsewhere. The NASA Ames Research Center has established an Ecosystem Computer Facility for the analysis of remote sensing data. With plans to develop a virtual laboratory for the analysis of remotely sensed data, Ames has focused on biological studies of South America as an analog for a cooling drying biosphere. In the process it has formed collaborations with many institutions in Puerto Rico and South America.

Atmospheric Lightning Research

Both as an atmospheric phenomenon and as a hazard to human activity, the study of lightning, why it happens – when it happens – where it happens, has many scientific and practical applications. Aside from the hazards it can have for human life, it is an enormous problem for both the electrical power and petroleum industries. It has been a subject of intensive study at sites in Northern Florida, Southern Arizona, and Colombia for decades. The 20-year-long project of the National University of Colombia is particularly interesting in that it samples the true tropical environment. The program has 11 sensors in a nation-wide network and employs sophisticated signal processing

techniques to extract meaningful information from the sensor array. It has major collaborations with MIT and Colorado State, as well as with workers in South America and Europe.

Counter Drug Research

Another example of the site of critical US interests being determined by external factors was provided by the presentation on the United Counter Drug project. In the public health realm, it is a well-known fact that a significant threat comes from the illegal use of drugs, and a significant fraction of these drugs originate in South and Central America. The UCD program is a seventeen-country collaboration establishing searchable databases to provide essential rapid-turnaround data in support of drug enforcement activities. The principal thrust of this aspect of the program is to allow multinational agencies, regardless of their language, to exchange information by searching multilingual databases.

2.2.1.6 Strategic US Science Interests in the South – Driven by Collaborations

Scientific excellence and experience know no borders. There are many areas where US strategic interests are affected primarily by the availability of talented foreign researchers pursuing similar lines of investigation, and where geography itself is of secondary importance, if at all. The High Energy and Nuclear Physics community interests are discussed separately above as they are responsible for pushing the envelope of advanced networking for collaboration.

Physical and Organic Chemistry

The University of Utah and the University of Buenos Aires are engaged in a collaboration, funded jointly by the NSF and several Argentine agencies, to model chemical shifts in complex organic crystals. The collaboration itself is rooted in special expertise available in Utah and Buenos Aires. One of the objectives of the study is to develop robust techniques to include intermolecular effects in the calculations. Subsequently these techniques will be applied to solve structural problems in biologically active compounds from marine invertebrates from the South Atlantic in collaboration with researchers in the organic chemistry group and Buenos Aires.

Remote Biological, Marine, and Atmospheric Sensing

Although somewhat influenced by geography, the University of Puerto Rico's remote sensing program represents a collaboration of a different kind – one across many disciplines. This program acquires large, generally geographically-based, data sets from remote ocean sensing devices, earth-sensing satellites, and a variety of other sources. These data are then applied to problems in oceanography, marine biology, and a variety of related fields.

Biodiversity

Another broad collaboration, based at the University of Buenos Aires and sponsored by IAI, is examining the role of biodiversity and climate in functioning ecosystems. The group is studying the interrelationships between the atmospheric composition, climate, land use, biodiversity, and the ecosystem as a whole and how that impacts on the

provision of human services. This is a global program in terms of the systems studied and it relies on collaboration between several senior scientists in six South and North American countries. Two of the participating researchers are in the United States, one in Mexico, and several more are in South America.

Materials Science

The Instituto Balseiro in Argentina is pursuing a program aimed at understanding the thermodynamic, phase stability, and transformation of complex material systems. This effort involves a broad collaboration involving research centers in Florida, France, and Sweden. It includes an important distance-learning component directed at the upper-division and graduate level.

2.2.2 Connecting NRENs in the AMPATH Service Area to the global R&E networking community

A major milestone of the AMPATH project is to connect the NRENs of Latin America and the Caribbean to the AMPATH network for connectivity to the global R&E networking community. Through Global Crossing's donation of ten (10) DS3 circuits, ten (10) NRENs from countries where Global Crossing has access can be connected to AMPATH. However, there are many countries in the Service Area where Global Crossing does not have access. Those countries, such as Ecuador, Uruguay, Paraguay, etc., if they have NRENs or research universities, can still connect to the AMPATH project either by: (1) provisioning their own circuit to the AMPATH PoP in Miami; (2) aggregating in a neighboring country that is already connected to AMPATH. FIU's AMPATH team plays a very key role in providing leadership and direction to these countries of how to get connected.

In all three (3) years of the Work Plan, the AMPATH project team would actively pursue connecting the NRENs of countries in the Service Area to the AMPATH network. In Year 1 of the work plan, most if not all of the countries serviced by Global Crossing will be connected. Building relationships with carriers (in addition to GX) that offer connectivity to these other countries is an essential step towards connecting the NRENs, (or in their absence, an academic network),of the Service Area. It is expected that this work would take place in Years 2 and 3 of this grant.

2.2.3 Outreach and Dissemination Program to Increase Awareness of AMPATH and its Benefits

As the AMPATH project team continues to connect participant NRENs from the Service Area, the AMPATH/FIUwill also need to publicize its presence and its capabilities to the rest of the world. It is expected that the AMPATH team will develop collaborative relationships with US and international researchers, as well as advanced networking professionals, which will yield a number of published works over the three years of this proposal. Increased awareness of AMPATH serves to draw new collaborative research and education applications. The Outreach program will also establish a better working relationship among all participants.

The AMPATH Outreach program will include:

- Presentations to US and International Agencies, including the Inter-American Development Bank, on the cultural impact of AMPATH
- Collaborative presentations, papers, and proposal with US and international researchers and educators detailing the activities supported and enabled by the AMPATH project
- Demonstrations of intercontinental collaborative research and applications at national and international conferences
- Workshops and Conferences to further information sharing, technological development and scientific collaboration
- Working Group meetings on specific research subjects, such as Astronomy, High Energy Nuclear Physics and Space Flight (NASA-related) Studies
- Heightened presence at global networking conferences (such as iGRID2002 and INET), demonstrating AMPATH's commitment to global collaborations in scientific research and education
- The AMPATH Registry - An online 'connections database' listing institutions in each participating NREN that are connected to the high speed network, and their research activities and interests

An important component of the program is the networking opportunities, not only to and from AMPATH, but also among the various country participants. Individuals will be encouraged to share their research ideas, any papers that are produced, workshop themes, and other aspects of their work with the entire group of participants. Such sharing will take place through the AMPATH web site.

2.2.4 Technology Plan to Enable AMPATH to Support e-Science and Experimental Networks

The AMPATH network follows a traditional SDH/SONET architecture, making it very robust and flexible for provisioning DS3 circuits, then using ATM as an overlay technology to support IP connectivity to Abilene and other Global R&E networks. AMPATH offers the following services to its members:

AMPATH Network Services
ATM and Optical Ethernet (available soon) Peering Fabrics
Intraregional peering over Layer 2 services, including IP VPNs
Ipv6: tunneled now; upgrade to native this calendar year, after Abilene
Multicast
End-to-End Performance Measurement and Monitoring
VRVS Reflector for video conferencing and remote collaboration
Flow-based and QoS-based monitoring using NetFlow tools

To support e-Science applications between the US and Latin America, AMPATH must develop its network infrastructure to support Gigabit bandwidth capacity. As a first step, AMPATH resources will be centralized in the NAP Of The Americas starting in July

2002. The physical infrastructure in the NAP will facilitate growth for the addition of optical transmission technologies AMPATH will require to offer Gigabit level service and lambda switching. AMPATH should be fully operational in the NAP by end of September 2002.

AMPATH will be adding Gigabit Ethernet as an interconnection technology and to its peering fabric, while continuing to support ATM. Carriers and service providers of the submarine cable systems to South America from the US are already offering IP-based services using MPLS. MPLS can be used to create Layer 2 or 3 VPNs between two end points. MPLS-based Layer 2 VPNs would support bilateral peering between two networks and can easily support bandwidth capacities from 1 to 10Gbps. AMPATH currently connects to the StarLight using an MPLS-based IP VPN, serving as a testbed for applications with specific bandwidth characteristics. Using MPLS-based Layer 2 VPNs, connectivity between Chicago, Miami and Brazil would enable AMPATH to connect the researchers in Brazil, as well as researchers in other countries of South America, working on bandwidth intensive computational Grid applications, such as HENP and iVDGL.

To work around the performance ceiling of optical fiber (10Gbps is the electronic limit on fiber segments), dense wave division multiplexing (DWDM) can be used to multiplex multiple 10Gbps channels over a single fiber. HENP and other e-Science applications will greatly benefit from this increase in orders of magnitude of bandwidth capacity. AMPATH will be starting a feasibility study to assess where in the Service Area Gigabit level bandwidth will be needed and how soon.

2.2.5 Milestones and Schedule

In each year of the work plan, there are three central themes that must be developed; Infrastructure, e-Science Application Support, and Outreach / Dissemination Efforts. The work plan responsibilities of the AMPATH PI, Co-PI and International Coordinator correspond with some overlap to these themes. This work plan provides evaluation criteria, which will be referred to in yearly business plan update reports to the NSF.

Year 1 Work Plan – July, 2002 through June, 2003
INFRASTRUCTURE
Ongoing: Develop relationships with more international submarine cable carriers that offer service to other countries not serviced by Global Crossing.
Ongoing: Connect the remaining NRENs or academic networks in Service Area countries where Global Crossing has a presence. Currently working with Venezuela.
Ongoing: Determine how (and to whom) better connectivity will be provided
Ongoing: Planning and overcoming turbulence in the carrier market
Jun 02 – Dec 02: Analyze and plan for instances where lambda communications will be necessary over the next 3 years and where existing or planned OCX connectivity is appropriate.
Jun 02 – Aug 02: Analyze and plan for improved or new AMPATH connectivity to other international connect points such as StarLight.
Jun 02 – Sept 02: Centralize AMPATH in the NAP Of The Americas.
Aug02 – Sept02: Upgrade Abilene connection from OC3c to OC12c.
Jun02 – Jan03: Prepare for the next AMPATH Meeting in Miami for necessary infrastructure support; video conferences with AMPATH participants and Advisory board member to plan relevant agenda items
Aug02: Evaluate recommendations made in the Valdivia Conference Report and take actions as required

Oct02 – Dec02: Formalize AMPATH Advisory Board mission and guidelines
Nov 02: Enable native Ipv6
e-SCIENCE APPLICATION SUPPORT (Grants & Acquisitions)
Ongoing: FIU/CMS HENP Outreach and Educational Initiatives working with Paul Avery and Harvey Newman, Pete Markowitz (FIU, Physics) and others to develop a work plan and funding proposal
Ongoing: Pursue resources AMPATH will need from funding agencies to fulfill its short and long term goals
Ongoing: Astronomy application advanced networking infrastructure support analysis through collaborative relationships with observatory PIs, Co-PIs and Sr. Personnel
May-Sep 02iGrid 2002 Application Demonstration in HENP with Brazil using a 622 Mbps connection through AMPATH, StarLight, and SurfNET.
June 02: Prepare addendum to NSF 96-15 CISE Minority Institutions Infrastructure Program for *Building Globally Distributed Electronic Collaborative Learning Communities* proposal
Jun02 – Jul02: Provide support as required to the Valdivia Conference Report Committee to complete and publish the conference deliverable to the NSF
OUTREACH

Ongoing:
• Assist in establishing Working Groups and Advisory Committees
  ○ Determine organization and structure, their missions, etc.
  ○ Specify fields in which WG's will be created (Astronomy WG already has a chair); other fields include: high energy physics, possibly bioinformatics, environmental studies, genome studies, education, visualization, video conferencing
• Organize external advisory committee and identify its purpose; recruit subject matter experts.
• Schedule presentations to US and International agencies, including the Inter-American Development Bank, on the cultural impact of AMPATH, to increase in-country support for NREN's.
• Determine how best to engage AMPATH in the Institute for Connectivity in the Americas, which will support educational, cultural and scientific programs that connect the hemisphere.
• Increase AMPATH presence at global networking conferences (such as INET), demonstrating AMPATH's commitment to global collaborations in scientific research and education
• Schedule demonstrations of intercontinental collaborative research and applications at national conferences, such as Internet2 Member Meetings

Jun – Oct 02 Work with FIU School of Computer Science, I2 ATLAS program, and AMPATH participants to develop and propagate the AMPATH Registry on networks, applications, educational outreach initiatives in the Service Area
Jul 02 – Oct 02: Develop business plan integrating AMPATH and the GigaPOP. AMPATH will be the international exchange point for R&E networks between the US and Latin America, as service of the GigaPOP.
Jan 03 AMPATH Workshop, Miami Florida. Planning is already underway for this event which will feature new application developments, a focus on science discipline working groups output, and active planning by AMPATH participants
Feb03 – Jun03: Develop and publish the AMPATH Annual Report
Year 2 Work Plan – July, 2003 through June, 2004
INFRASTRUCTURE
Connect to AMPATH NRENs and academic networks of countries not serviced by Global Crossing
Conduct feasibility study to extend the AMPATH network and establish peering points in Service Area countries.
Continue planning of AMPATH's development as a production network for support of science and education, as well as an experimental network serving the application requirements of researchers from the US working in the Service Area.
Oct03 – Dec03: Assess network equipment for AMPATH to develop a plan for replacement of obsolete equipment.
Mar03 – Jun03: Replace obsolete equipment as per the recommendations in the capitol equipment replacement plan
e-SCIENCE APPLICATION SUPPORT (Grants & Acquisitions)

Jul03 – Jun04 Continue development and administration of existing programs; Develop new programs based on e-Science requirements
Jul03-Jun04 Cultivate educational outreach programs with US and Service Area research institutions for student and faculty exchange aimed an increasing minority participation in science and engineering disciplines that use or could use advanced international Internetworking services.
OUTREACH
Jan/Feb03: Second AMPATH Workshop, Miami Florida.
Jul/Aug03: Second International AMPATH Conference, Rio de Janeiro, Brazil. Planning will begin for this meeting following the January '03 Workshop.
Oct03: Update AMPATH Business Plan.
Feb03 – Jun03: Develop and publish the AMPATH Annual Report.
Ongoing: Tasks as detailed in Year 1
Year 3 Work Plan – July, 2004 through June, 2005
INFRASTRUCTURE
Continue connecting to the AMPATH network NRENs and academic networks of countries not serviced by Global Crossing
Continue planning of AMPATH's development as a production network for support of science and education, as well as an experimental network serving the application requirements of researchers from the US working in the Service Area.
Oct04 – Dec04: Assess network equipment for AMPATH to develop a plan for replacement of obsolete equipment.
Mar04 – Jun04: Replace obsolete equipment as per the recommendations in the capitol equipment replacement plan
e-SCIENCE APPLICATION SUPPORT (Grants & Acquisitions)
Jul04 – Jun05 Continue development and administration of existing programs; Develop new programs based on e-Science requirements
Jul04-Jun05 Cultivate educational outreach programs with US and Service Area research institutions for student and faculty exchange aimed an increasing minority participation in science and engineering disciplines that use or could use advanced international Internetworking services.
OUTREACH
Ongoing: Tasks as detailed in Year 2; Meeting planning and administration
Oct04: Update AMPATH Business Plan
Jan/Feb04: Third AMPATH Workshop, Miami Florida.
Jul/Aug04: Third International AMPATH Conference, place TBD. Planning will begin for this meeting following the January '03 Workshop.
Feb05 – Jun05: Develop and publish the AMPATH Annual Report.
Future Planning: Determine the long-term outlook in connections to be made, interactions with other global networks, funding to be required of clients and funding agencies. Determine if AMPATH will primarily be an organization furthering U.S. science interests in the AMPATH service area or will it also play a major role in developing local science in the service area. Will it primarily serve science research or will it also serve education?

3.0 Broader Impacts

At both the AMPATH Workshop and the First AMPATH International Conference the presenters spoke of broad, in-place international collaborations. It was very clear that many of the programs not only had significant ties between their US and southern counterparts, but that there were also important scientific and operational requirements for connections to many countries in Europe and the Asia-Pacific area. Virtually all of these countries are already served by StarLight / STAR TAP and other networks.

Typical examples of US-funded programs included the International Space Station with its many partners, the Gemini Observatory with partners in Europe, Australia, and North and South America, and ALMA with partners in the US, Canada, Europe, Japan, and Chile. Funded in part by the US, the CERN/LHC collaboration has partners worldwide--AMPATH Workshop Report.

The western hemisphere science community is a partnership of people and ideas with a well-established, vigorous, collaborative multinational, hemispheric science community in the Americas, despite currently poor network access in many southern locales. With modern levels of high-performance connectivity, it is inevitable that this community will be further enabled to grow and flourish to unprecedented levels.

The AMPATH project provides a unique opportunity to explore the impact of emerging communications technologies on people of different languages, cultures, and backgrounds who are willing to work together for a common cause. By providing the essential high-speed network infrastructure, together with low latency, the network will be an enabling factor in making real-time collaborations, which were once inaccessible, available throughout the globe for scholarly research and education.

Beyond meeting the present needs of the currently connected programs such as Gemini and Arecibo, AMPATH has the potential to serve as an enabling infrastructure that will break new ground for future programs, such as Auger in Argentina and the Atacama Large Millimeter Array in Chile, that must also connect geographically dispersed communities with remote sites in real time, to fully realize their scientific goals.

The result of funding this proposal to improve the operational and functional capabilities of AMPATH on society echoes the goals of both AMPATH and StarLight/STAR TAP: "*to dissolve the international barriers to advanced scientific collaborations as a model for future seamless connectivity*." In a very real sense, it is this shared worldview that has led the many scientists and networking professionals and FIU/AMPATH to join together in this enterprise.

4.0 Conclusion

The Committee believes that AMPATH presents an unprecedented opportunity to advance both US science and world science. The NSF has played a key role in enabling research connectivity within the US, and then between the US and science programs in Europe and the Asia-Pacific. The NSF can continue the US's central role in research networking by helping to foster and nurture the AMPATH effort—AMPATH Workshop Report.

E. BIOGRAPHICAL SKETCHES

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Professional Experience:

Heidi L. Alvarez is an Associate Director at Florida International University (FIU) Technology Services, where she was responsible for working with the AMPATH principal investigator in the strategic planning and implementation of connecting high performance Research and Education (R&E) networks and US e-Science initiatives in South and Central America, Mexico and the Caribbean with US and Non-US National Research and Education Networks. She holds responsibility for researching and preparing technology grant opportunities as well as seeking out other funding sources to participate in furthering the goals of the AMPATH project and other related activities. Alvarez has served as Co-PI for AMPATH since April, 2000 and is currently PI for a project to assist in developing an advanced networking Grid connection for High Energy Nuclear Physics between Brazil, the US, and CERN.

Other appointments at Florida International University:

Assistant Director, Network Engineering and Telecommunications Florida International Alvarez performs business and project planning functions associated with AMPATH, assisting the Director with the flow of activities between existing and potential project participants, staffing issues, and other duties as required. She is also responsible for publications, web design and other dissemination activities related to the AMPATH project.

Adjunct Instructor, Freshman Composition, Academic Systems Multi-Media English: Essay Writing, and Technical Writing 1995-2000

Sr. Programmer Analyst (Temporary Appointment), Academic and Research Computing, 1998-1999. Responsible for policies and procedures in the areas of Computing Practices, Fair Use of Computer Resources, Academic and Research Computing, Electronic Messaging, Electronic Mail as Public Record, and World Wide Web resources at FIU.

Other Professional Appointments:

Chief, of Information Services, Miami-Dade Department of Solid Waste Management, 1992-1996. Responsible for directing, developing and implementing policies and procedures for applications, networking and telecommunications for the Department. Duties involved the formulation and supervision of an *Information Services Master Plan*, project management and reporting methodologies. Planned and administered of an information technology budget of between four to six million dollars annually. Position responsibilities involved supervising a professional and technical staff, business and operational applications lifecycle administration, customer support, policy and procedure formulation. Manager,

Computer Services, Miami-Dade Department of Solid Waste Management, 1989-1992
Programming Systems Supervisor, Miami-Dade Transit Agency, 1988-1989
Sr. Systems Analyst, Miami-Dade Transit Agency, 1986-1988
Systems Analyst 1, Miami-Dade Transit Agency, 1985-1986
Programmer Analyst, Jordan Marsh Department Stores, 1984-1985

Professional Preparation:
M.A. in English, Florida International University, 1999
B.S. in Education, University of Miami, 1979

Publications:
AMPATH Conference Valdivia Update, International Task Force, Spring02 I2 Members Meeting, Arlington, VA. May 6, 2002
AMPATH Scientific Applications Collaboration Update; First Int'l AMPATH Conference, Valdivia, Chile, April 10 -12, 2002
AMPATH Overview; University Technology General Meeting, FIU, April 26, 2002
AMPATH; Network of the Americas, LISHEP Grid Workshop, UERJ, Rio de Janeiro, Brazil, Feb 7-8, 2002
AMPATH Scientific Applications Overview; AMPATH Workshop, Miami, Florida August 15 – 17, 2001
AmericasPATH, STAR TAP Annual Meeting, INET 2001, Stockholm, Sweden June 5, 2001
AMPATH; International Connectivity Issues, Internet2 Fall Members Meeting, Atlanta, Georgia, October 31, 2001
Regional Aspects of Miami Crime Fiction; A Postmodern Frontier – Master's Thesis, 1999
Florida International University Information Resource Management Newsletter – Editor of the inaugural issue June 1999 and recurring article contributor.
Book Review: "Essays by Contemporary American Women," in Probable Cause, Spring, 1996.

Graduate Advisor: Kenneth E. Johnson, Assistant Vice President, FIU Academic Affairs & Associate Professor FIU English Department

Synergistic Activities:
FIU Academy for the Art of Teaching Grant Award; Innovations in Process Analysis Essay Writing
Chairperson, Miami-Dade Information Systems Policy Committee DEC Users Group
Dade County ESP Award for computer maintenance cost savings

E. Biographical Sketches

Julio E. Ibarra
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Professional Experience:
Julio E. Ibarra is Director of Grants and Acquisitions in the Florida International University Technology Services Division, where he holds responsibility for the strategic planning and development of advanced networking infrastructure and services for the University. He oversees the University's Internet and Internet2 services and the AmericasPATH (AMPATH) project, which he created in 2000. Ibarra is the administrative and technical lead of Internet and Internet2 services for the University, and is responsible for the strategic planning and development of the regional GigaPOP.

Ibarra has been active in initiatives to advance networking and Internet technologies for the State of Florida. He serves on the Governor's IT Florida Task Force subcommittee on Infrastructure and Technology Development as a subject matter expert. He is co-author of the policy recommendation for the development of a Network Access Point (NAP) in South Florida to enhance the State's eCommerce opportunities with Latin America. Mr. Ibarra is the founder and director of AMPATH: *a project to interconnect the research and education networks in South and Central America, the Caribbean and Mexico to Internet2 connected networks.* Ibarra has served as PI for AMPATH over the past two years, successfully securing in excess of $1M in active equipment and collocation space in the NAP of the Americas, and a significant donation of bandwidth (450 Mbps collectively) from a major telecommunications carrier to begin the AMPATH project.

Other appointments at Florida International University:
Director of Network Engineering and Telecommunications, 1998 - 2002
Associate Director, Department of Telecommunications, 1994 –1998
Assistant Director, University Computer Services, 1989 –1994
Systems Coordinator, University Computer Services, 1988 –1989
Systems Coordinator, Academic Computer Services, 1984 – 1988
Scientific Programmer, Academic Computer Services, 1993 – 1994
Computer Programmer II, Academic Computer Services, 1982 – 1983

Education:
M.S. in Computer Science, Florida International University, 1995
B.S. in Computer Science, Florida International University, 1983

E. Biographical Sketches

Publications:

AMPATH Project Status Report, GEANT Global Research Networking Summit, Brussels, Belgium, May 21-22, 2002

AMPATH Project Status Report; First Int'l AMPATH Conference, Valdivia, Chile, April 10 -12, 2002

AMPATH Presentation for the Joint Engineering Team, Supercomputing 2001, Denver, Colorado, November 15, 2001

AmericasPATH Presentation to the Inter-American Development Bank, Washington D.C., March 9, 2001

AmericasPATH Presentation to the Beacon Council, Miami, Florida, February 7, 2001

AmericasPATH Presentation to the Internet2 Fall Members Meeting, Atlanta, Georgia, October 31, 2000

Advanced Internet Connectivity in the Americas: AmericasPATH, RNP2 Meeting, Brazil, September 4, 2000

AmericasPATH Presentation to CANARIE/Internet2/NLANR Joint Techs Conference, University of Toronto, Canada, August 20-24, 2000

Gemini South / AMPATH Connection to Internet2 (Grant Proposal), National Science Foundation, Arlington, VA, June 23, 2000

Advanced Internet Connectivity in the Americas Proposal, Miami, Florida and San Francisco, California, March 8-9, 2000

Ibarra, Julio E. Ethernet Modeling--Simulation Tool;"Master of Science in Computer Science" Thesis (M.S.)--Florida International University, 1995.

Other Relevant Activities:

Technical Advisor for the "High Performance Connection for Florida International University," NSF Grant Proposal 9876409

Graduate Advisor(s): David Barton and John Comfort

E. Biographical Sketches

Melyssa Fratkin
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http://ampath.fiu.edu

Melyssa Fratkin is the International Development Coordinator for the AMPATH Project. She is responsible for strengthening current ties to AMPATH Participants, and establishing relationships with future members, with the goal of connecting high performance Research and Education (R&E) networks and US e-Science initiatives in South and Central America, Mexico and the Caribbean with US and Non-US National Research and Education Networks. In addition, she is responsible for orchestrating AMPATH conferences around the world, and exploring new funding opportunities for the project within the United States.

Prior to AMPATH, Melyssa worked for the Mid-Atlantic Crossroads GigaPoP Project (MAX), where she redesigned and maintained the MAX Web site, generated publicity materials, and maintained membership database and accounts receivable. The MAX project links the major Universities, non-profits and government agencies in the Washington, DC, area to the Abilene network. From 1997 to 1999, Melyssa was the Membership & Meeting Coordinator for Internet2/UCAID. In this role, she was the primary contact person for Internet2 members, as well as the point of contact for any institutions wishing to join the initiative. She was principally responsible for planning all of Internet2's conferences, workshops and council meetings, across the United States and abroad.

Before her introduction to the world of broadband networking, Melyssa was a political "junkie." She was the lead volunteer in Latino Outreach on the Clinton/Gore '96 re-election campaign, worked in event operations on the 53rd Presidential Inaugural Committee, and managed VIP relations for the Presidents' Summit for America's Future.

Melyssa is fluent in Spanish, and holds a Master of Business Administration degree in eCommerce/Marketing from the University of Maryland.

Education:
M.B.A., e-Commerce; Robert H. Smith School of Business, University of Maryland, 2001
B.A., Spanish; Rutgers University, 1994

Certificates:
Diploma of Spanish as a Foreign Language, Superior Level, conferred November, 1998

Related Activities:
Business Manager, Fratkin Associates, a Washington-based Higher Education & Technology Lobbying firm (July 2001-Present) Responsible for evaluating Administration budget proposals, to determine availability of future information technology research and development (ITRD) funding opportunities.

Salary Support Request

Florida International University (FIU) is requesting 1.4 FTEs of salary support for the AMPATH project. The 1.4 FTEs of salary support would be distributed among the following project staff members: 40% for the Principal Investigator, and Director of AMPATH, Julio Ibarra; 20% for the Co-PI, and Associate Director Heidi Alvarez; and 75% for the International Coordinator, Melyssa Fratkin. The requested salary support would greatly enable AMPATH to develop its program to support and integrate research and education activities in its Service Area[1] of strategic interest to the US, as well as demonstrate that AMPATH is an enabling infrastructure for research and education, and for the support of science applications from the US, Canada, Asia-Pacific and Europe.

While there are many other types of support that would benefit the mission and goals of AMPATH, the project team's time to develop AMPATH is of paramount importance. Funding for this grant proposal will clearly delineate the AMPATH project team's responsibilities. Network engineering support, which is a critical personnel function for AMPATH, is currently funded through operational cost-sharing with both AMPATH and the South Florida GigaPOP participants in an exemplary manner; Network Operations Center functions are through the Global Research NOC at Indiana University[2]. Recurring costs, such as equipment maintenance and replacement, are currently covered in the operational cost sharing, as well. The NSF has provided meeting support through other grant awards and the team will pursue meeting grants in the future on a case-by-case basis. The largest capital operations costs of the AMPATH project including circuits, active equipment, and collocation space have been provided through industrial affiliations. The AMPATH Workshop Report committee had this to say about the AMPATH project team:

Dedicated Individuals

The Committee was very impressed with the level of effort and, even more so, the striking success of the AMPATH team. They have put together a remarkable partnership of corporate, national and regional research-networks, academic, and research organizations to create the substance and scalable framework of the AMPATH project.

What is even more remarkable is that, while strongly encouraged by the FIU administration, these achievements have been brought about almost entirely through the effort, energy, and determination of FIU's Julio Ibarra, Heidi Alvarez, Eric Johnson, and their small support staff. They are to be commended for their extraordinary entrepreneurial success.

[1] AMPATH's Service Area is defined as South and Central America, the Caribbean and Mexico.
[2] http://noc.ampath.net/

F. BUDGET JUSTIFICATION

The Committee is very comfortable that the direction of AMPATH is in good and capable hands for the present and the future.

Principal Investigator / Director of AMPATH, Julio Ibarra, originated and leads the AMPATH project. Ibarra was directly responsible for the significant industrial partnerships that enabled AMPATH to begin in 2000 and progress as far as it has to date. He has successfully brought together a well-qualified project team with national and international participation and support, opening up new possibilities for research and education networking and collaboration. The PI has a solid advanced network engineering background, honed diplomatic skills, and a deep understanding of Latin American culture that in combination make Ibarra uniquely suited to lead AMPATH.

Co-PI / Associate Director of AMPATH, Heidi Alvarez, holds primary responsibility for matters related to funding the project. She develops and maintains relationships with world-class US and international scientists and funding program directors with research projects and collaborations in the region. The business of developing, submitting and administering grants in consideration of a variety of disciplines and collaborators falls under her purview.

The AMPATH International Development Coordinator (IDC), Melyssa Fratkin, joined the AMPATH team in the Fall of 2001, after the AMPATH Workshop. Fratkin's role as senior personnel on the project is to perform tasks over the next three years as detailed in the Work Plan in Section C. The IDC is responsible for strengthening current ties to AMPATH Participants, and establishing relationships with future members. In addition, this individual is responsible for orchestrating AMPATH conferences around the world, for which the IDC must manage the budget, contracts, and expense process in close collaboration with Co-PI Alvarez. She is uniquely qualified for this position due to her excellent knowledge of the Spanish language and culture, as well as her significant work experience with high-performance R& E networking at both the MAX GigaPOP and Internet2, as the first meeting coordinator.

If awarded, the IDC will take on additional responsibilities such as: exploring new funding opportunities for the project within the United States, and when appropriate, writing grant proposals to secure these funds; provide strategic direction and leadership by identifying new business opportunities; participating in meetings with current and potential participants; and providing ongoing support to ensure the development of solid, long-term member relationships. This will serve to increase awareness of AMPATH and enhance its benefit to the global research and education networking community.