SCIENCE & DIPLOMACY

A quarterly publication from the AAAS Center for Science Diplomacy

Fernando Quevedo, "The Importance of International Research Institutions for Science Diplomacy," *Science & Diplomacy*, Vol. 2, No. 3 (September 2013*). http://www.sciencediplomacy.org/perspective/2013/importance-international-research-institutions-for-science-diplomacy.

*The complete issue will be posted in September 2013.

The Importance of International Research Institutions for Science Diplomacy

Fernando Quevedo

ONE of the major scientific discoveries of the past decades was announced on July 4, 2012. On this day, the world learned of the discovery of a new fundamental particle that may be the long-sought Higgs particle, the only component of the standard model of particle physics yet to be discovered. This was a great triumph for science and could mark a turning point in our most basic understanding of nature and the early universe.

That this momentous announcement coincided with the U.S. Independence Day, a turning point for world history, is somewhat serendipitous, but helps to remind us of the importance that science had for the U.S. founding fathers. (On July 4, 1776, Thomas Jefferson was simultaneously running a meteorological experiment as part of his systematic measure of climate.)

More importantly, the July 4th Higgs announcement is a prime example of effective international science diplomacy. The Higgs particle was discovered at the European Organization for Nuclear Research (CERN), an organization formed to build the foundations for European science after World War II by bringing together former adversaries. Besides strong partnerships within Europe, CERN also includes participation of scientists from the United States and many other countries. CERN illustrates the importance of science and international research institutions in uniting nations to pursue a single noble goal.

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Along with CERN, the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy, is one of the oldest international research institutions. It also exemplifies how international research institutions can play an important role in bridging the world's political and developmental divides by focusing on large-scale scientific challenges that require collaboration between countries.

After decades of operation, both ICTP and CERN have proven that their well-defined missions and strict emphasis on maintaining the highest international scientific standards create a successful and sustainable formula that strengthens scientific ties and ensures continuous support from funding sources. As the divides of the twentieth century heal and new ones emerge or reemerge, these large multinational institutions have had to adapt to the geopolitical and developmental realities of the twenty-first century by expanding their scientific and geographical reach. With more countries practicing and investing in science, these institutions have needed to include, and in fact take advantage of, growing scientific communities. ICTP and CERN can draw from these Cold War lessons—a mission based on high quality and ambitious science, politically neutral siting of the physical facilities, and an inclusive organizational management and membership structure—to serve as models for new or future research institutions.

The vision of ICTP's founders, most notably Nobel laureate Abdus Salam, was to create an institution with a truly global nature at a time when the world was divided by the Cold War. The founders chose Trieste because of its great cultural diversity, which flows from its rich history—the city oscillated between the Austro-Hungarian Empire, Italy, and the former Yugoslavia and for a brief period was a free independent state under the United Nations after World War II. Its key location on the border between Western and Eastern Europe during the Cold War made it strategic for an international organization. Exhibiting what may be one of the earliest examples of science diplomacy success, ICTP in the 1960s was essentially the only place in the West where scientists from both sides of the Iron Curtain could meet and share their scientific results and knowledge of physics and mathematics.

While ICTP has kept pace with the research in physics and mathematics, it has since broadened its research activities to include applied subjects that have more direct and relatively shorter-term effects on society and are of particular importance to developing countries, such as climate change, telecommunications (promoting the knowledge and use of low-cost wireless networking), and high performance computing (helping developing countries extend their computing power for research). The center has also identified research areas for future expansion—such as energy and sustainability, quantitative biology, and computing sciences—which are of timely importance, especially for developing countries, and which complement the center's current research efforts.

Whatever the research subjects, ICTP brings together scientists from literally all over the world. Since its beginning in 1964, the center has received visitors from more than 185 countries. These scientists regularly get together, teach each other, start collaborations, learn about each other's cultures, and share their views

not only about science but about other subjects including politics, religion, art, music, and food. In a world with many divides, whether it is east and west or north and south, ICTP is one of the few places that offers a possibility of dialogue among civilizations (of diverse and sometimes contrasting views and opinions). Like CERN, ICTP operates under the belief that science is a truly international activity; it transcends cultural, religious, national, and ethnic differences among its practitioners, unifying in a particular way all of mankind.

In this vein, ICTP continues to expand its geographic reach. ICTP aspires to assist science policy makers and scientists in developed, emerging, and the least developed countries through the creation of regional centers of excellence and active scientific networks. In addition, the center's Training and Research in Italian Laboratories (TRIL) program brings thousands of developing world scientists and engineers to train in more than four hundred Italian laboratories, with clear benefits to both the hosting institutes and the TRIL participants. This is allowing ICTP to have an even greater impact in the scientific landscape of developing countries. Furthermore, ICTP has a research group working in the same CERN experiment that discovered the Higgs-like particle, strengthening its ties with CERN and allowing more scientists from developing countries to get involved in the world's biggest laboratory.

The many programs offered at ICTP to support scientists from developing countries provide a holistic and sustainable approach to the goal of reducing the scientific gap between industrialized and developing countries. Contrary to most efforts on international cooperation that usually address only near-term issues without a clear follow-up strategy, ICTP creates strong ties with its visitors that are maintained throughout their whole career.

ICTP has also been able to create a sustainable network of scientists worldwide, providing a multiplier factor that enhances the impact of the organization's work to fulfill its mission. ICTP staff scientists have a unique and fulfilling career that comprises not only educating students and supporting the center's many visitors from developing countries, but also traveling, often to all corners of Africa, Latin America, and Asia. These scientists organize activities, lecture, and open links with the local communities, their governments and diplomatic sectors, while at the same time maintaining the highest standards of their own research.

CERN scientists also share many of these duties because of the increasing international impact and reach of the laboratory. CERN's initiatives to expand to non-European countries have taken a few different directions. First, it has been able to involve non-member states in the construction of its experiments as well as in scientific collaborations, which now include members from many countries on all continents. It has been organizing schools, such as the CERN Latin American school on accelerator physics and, more recently, it has joined ICTP and other institutions to organize African schools in fundamental physics. At these schools, local scientists and students can attend lectures on subjects as diverse

as early universe cosmology, the physics and engineering aspects of accelerators, data analysis, and medical applications. CERN has also played a leading role in initiatives to have networks of scientists from developing countries join one of its experiments, such as the former European Union project known as HELEN (High-Energy Physics Latin-American-European Network).

CERN and ICTP share many goals and have been involved in several joint efforts. One remarkable example is their common support for SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East), which is being built in Allan, Jordan, with member states that include Bahrain, Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, and the Palestinian Authority. SESAME will be the major experimental facility in the Middle East with many applications including material sciences and biology. In this way science is opening bridges of collaboration among countries in a conflicting political region.

CERN's history of bringing together international scientists also serves as a model for current and planned international experimental facilities such as the International Linear Collider; Iter in France; the Square Kilometer Array (SKA), which will be mostly based in South Africa and neighboring countries; and ANDES (Agua Negra Deep Experiment Site) in South America. In particular, SKA will be the world's biggest radio telescope, which will not only bring much needed scientific activity to the region, but also benefits for the local community deriving from being involved in a world-class effort. ANDES may play a similar role in South America as a truly Latin American big experimental project.

Other countries, such as Brazil, India, and China, are now in a position to host international scientific centers and support the development of science in neighboring countries. In 2011 the ICTP-SAIFR (South American Institute for Fundamental Research) opened in São Paulo, Brazil, with the goal of promoting science in the region following the ICTP model. Similar institutions are being planned for other key areas of the world to strengthen scientific collaboration within a given region and with the rest of the world.

Clearly, CERN and ICTP are key role models of international science diplomacy. For CERN, the results—which would not have been possible without bringing together the world's best physicists and engineers across political divides—have included the possible discovery of an important missing piece to the Standard Model puzzle as well as the creation of the World Wide Web, a tool so ubiquitous today that few can imagine a life without it. ICTP's successes are more subtle but no less important: the building of solid, sustainable science foundations in less-advantaged parts of the world to ensure that budding scientists, no matter what the economic and political situation of their native countries, have the opportunity to nurture their ambitions in an environment conducive to the highest levels of scientific knowledge and discovery.

Working through the universal language of science, both have demonstrated the importance of a global approach to address the challenges of our time. They

probably represent the best examples of how international scientific institutions can play a crucial role in uniting countries and cultures with the goal of benefiting not just a single country or region, but the world as a whole.

The right to pursue science, like the rights declared more than two hundred years ago by America's founding fathers, should be universal, regardless of a country's economic or technological status. The global nature of science makes this possible. This is science diplomacy at its best. SD