dishes of 1 km) which will be spread over 1,000-km distances, the government embarked on a precursor radio astronomy program, which is now coming to fruition.

The African nations preparing the proposal for the SKA have worked on it since 2003, with about 100 young scientists and engineers working on the proposal in the Cape Town office. Fanaroff is especially proud that 300 grants for studies and five university research chairs have been created in South Africa through this proposal preparation process. There have been 25 Ph.D.'s and 52 Masters degrees granted, on the basis of research done on the project. And astronomy is now being taught in Botswana, Ghana, Kenya, Mozambique, Madagascar, Mauritius, and Zambia.

Most important, Fanaroff believes, is that the project has "raised the science and technology profile" in South Africa, and also in Europe and other countries," which now see "that Africa can do cutting edge science and technology."

Africa's only competitors for hosting the SKA project are Australia and New Zealand. The decision on which site will be chosen will come early next year. Fanaroff was asked in a Congress session, what if Africa is not chosen for the SKA? And how could he justify the amount of money that will have to be spent?

We will complete MeerKAT, he replied, and "do world-class science for 50 years" using that facility. "We will do remarkable science" by also expanding the use of other telescopes in Africa, and "we will play a leading role in SKA, no matter where it is built."

"There are short-term problems" in Africa, he responded, "but we can't limit ourselves" to those. Astronomy is "inherently a very exciting subject. We are creating the cadre who are transforming the way Africa sees itself, and is seen around the world."

INTERVIEW: NALEDI PANDOR

South Africa in Space: Ending 'Afro-Pessimism'

South African Minister of Science and Technology, Naledi Pandor, is a passionate supporter of scientific and technological progress for her country. She is the former Minister of Education of South Africa, and a Member of the National Executive Committee of the African National Congress. Since 1994, she has been a Member of Parliament. Minister Pandor received degrees, and furthered her education, at the University of Botswana and Swaziland, the University of London, Bryn Mawr, the Kennedy School of Government, and the University of Stellenbosch. She is responsible for a sweeping array of scientific programs, for which she is an ardent proponent.

In order to educate the Parliament, which must approve federal program budgets, the Ministry prepared a pamphlet, explaining the importance of South Africa's radio astronomy projects, and why it is bidding to host the Square Kilometer Array (SKA).

With scientific advancement as a leading edge, the Minister is dedicated to the education of both citizens and policymakers, and expresses the optimism that South Africa will continue to lead the continent into the space age.

Pandor, who addressed the Congress of the International Astronautical Federation, in Cape Town Oct. 3-7, 2011, was interviewed by Marsha Freeman and William Jones. Here are excerpts.

21st Century: It was very clear from your statements at the Congress, that the government of South Africa has made a very serious commitment for space technology and development, and, of course, you have a country that faces many challenges, such as in education and employment. Could you tell us why you think that the space program is important for South Africa?

Pandor: Well, we need to go back a little bit. When South Africa achieved democracy in 1994, I think the country had to reflect on what it needed to do. And at the time, the new government was aware that we had a fairly strong scientific base. But I think it believed that it must focus on the socio-economic development issues, and therefore tended primarily to highlight education, health, issues of equity. Those were paramount, I think, in the mind of the South African populace at that time.

And so while we were really fortunate that Mr. [Nelson] Mandela's government established a Department of Science and Technology in 1994, the problem was somewhat that it was merged with another department. So we had something called Arts, Science, and Technology, then. And given the socio-economic concerns, arts and culture tended to dominate the discourse of that department.

But our scientists, I think, were very strong, in that they worked to formulate a strategy for the country. They did a foresight study like the decadal review by the National Academy of Sciences that you have in the United States, and set out a research and development strategy which was adopted by government in 1996, and continues to influence a great deal of the work we even do up to now. So I think that phase assisted the African National Congress to continue to have an interest and an objective of investing in science and technology.

Between the period between 1996, up to 2004, we continued with that conjoined department; but as matters developed, it became clear that science was of such importance that it needed its own department, it needed its own budget, and it needed a much more definitive strategy which would highlight what had been done in 1996, lift it out, and really begin to tie into new developments that had

emerged in that period of eight or so years.

A Department of Science and Technology

So in 2004, after the elections, the ANC decided to establish a stand-alone Department of Science and Technology. So we're a new department as a stand-alone, although it existed since '96. That new department was charged with determining a new innovation policy for South Africa. Building on the research and development strategy but drawing on what had been learnt since democracy.

In 2007, they put before the Government a 10-year innovation plan with five key focus areas identified. Now in the plan, they indicated that we've been clearly all right, as to investing in fundamental scientific research and development activity. So our scientists have been receiving grants, and while not enough, monies have been flowing; our science councils have been productive. On the basic science level, we're all right.

William Jones/EIRNS

William Jones/EIRNS

South Africa is fostering science and technology capabilities at the same time that it is trying to push forward socio-economic development. Khayalitsha (shown here), is a Cape Town informal settlement with more than 1.5 million residents. While hundreds of thousands of new homes, with electricity and water, are being built each year, the influx of refugees from neighboring countries has made eliminating these squatter villages more difficult. Below: new Khayalitsha housing.

But we had problems with respect to human capital, and we're really not doing as well as we should with respect to innovation. We're producing basic scientific outcomes, but were not converting them into a product that can be commercialized. We didn't have the institutional base for that, and we're not investing. The private sector is traditionally not venture-capital-oriented in this country, so the Government decided we had to do something. Hence, a 10-year innovation plan for science and technology, which identified five key focus areas which you hear us all talking about.

The first is space science and astronomy: very, very important, because they realized there are opportunities there, but also, we have capabilities in South Africa. The second is biotechnology, and that linked into our whole problem of the disease burden in South Africa and in Africa, and a very productive health sciences academic contingent in South Africa.

As you know, the first heart transplant was carried out here, so our human and health sciences faculties tend to be quite, quite productive. So biotechnology is the second area.

The third area was energy, because the Government was concerned that we were not doing enough for renewables, that we're too reliant on fossil-based energy sources, and thus, we're contributing to all the horrible gases in the atmosphere, and needed to change the way we resource energy.

The fourth area was climate change. And there, they call it actually global change, but the primary focus is climate change, to look at what technologies should we develop in order to understand what is happening to the world better, from a Southern, rather than a global perspective. And then the global view would be linking into other sciences, and really developing our geo-spatial understanding of the world and our ability to monitor climate change and learn from other systems. And then also to improve the search with respect to the southern oceans and understanding the southern currents much better than we do up to this point. So global change is a fourth dimension.

The fifth one, which, I must admit I am one of the people who added, was the human and social dynamics. Because in discussing the plan, some of us became concerned that there was potential to neglect the humanities and the social sciences, and given a society in transition, it was absolutely imperative that we understand what is happening with society, and are able to support a change in society and communities to grapple and cope with change. Plus, you want poetry, literature, and so on. So human and social dynamics is the fifth area.

Now embedded in those finally, is really ensuring sufficient resources for those areas without neglecting the other areas scientists want to pursue. But these would be kind of where we want to see focussed, ensured resources. Two, making sure we have the human capital, because without the people, you're not going to do the science you want to do, so your Masters degrees and Ph.D.'s are very important to us, post-graduate study. And third, making sure we have the institutional structures to give us these areas that we want to focus on. So the universities must have appropriate facilities, the science councils must have infrastructure.

So we're looking within these five areas: How do you ensure, how do we position ourselves in a way that allows us to continue to do basic science, produce the right human capital, be innovative, and actually build alliances with the private sector that support innovation. And

University of Cape Town

Tshwane University

UNESCO

South Africa has 23 universities with 820,000 students enrolled, 50,000 of them from other African countries. Here, the University of Cape Town, founded in 1829; Tshwane University of Technology, founded in 2003; and a group of students at Tshwane University.

that essentially in a very brief outline, is the agenda of the Government at this time.

South Africa's Role in the Continent

21st Century: You also have a very broad view in terms, I think, of what South Africa's role is for the whole continent.

Pandor: Absolutely! Africa is central for us, because, you know, we believe that you cannot have an island of development in a sea of underdevelopmental poverty. And so we've worked very hard to ensure as we initiate our programs that we do so with the African continent. We have 23 universities in South Africa. At the moment, we have around 820,000 young people registered, so we are almost bursting at the seams. And what's intriguing is that of that number, around 50,000 are from other African countries. So we've become a resource for the continent.

I think it is tough for us. We are worried about success rates in higher education, but we have some universities that are pretty good quality, and about 7 out of the 23 are research-intensive. We want to build much more capacity, but we have a committed Government, and fortunately, we are getting support, never enough money, but we are always fighting for more. This week, I was having big fights with my colleague in Finance, but I think we do get resources and we're able to deploy them.

21st Century: One of the most remarkable projects that you are now in a tough fight with Australia for, is the Square Kilometer Array. It's a very impressive project itself, but also the fact that you made it a joint project with a number of other countries on the continent is very impressive. How do you see that as kind of a driver? What impact do you see it having if you get the program?

Pandor: You know, one of the things that we wanted to do is to change the way the world sees Africa. We tend to view the continent as a place of awful problems—famine, disease, war—and not as a knowledge region of the world. Now we're trying to change our character into one where we are associated with an iconic research facility that draws researchers into Africa to carry out high-level research work. That, we believe, would fundamentally alter the way that the world sees us.

Because they will come to countries on the continent for a very different purpose. So we regard the Square Kilometer Array and the fact of the African partnership as part of this alteration of the perception of Afro-pessimism that we have in Africa. But also it would mean a massive boost to human capital development because it involves so many areas of technological and scientific activity.

Just two weeks ago, I was in Washington, and I was speaking to all the top corporations in the information-communications-technology (ICT) domain—your Ciscos, your IBM, Honeywell—briefing them on the opportunities offered by SKA, and it was incredible. Here's an African minister talking to the top executives of the major world ICT companies, saying please come to South Africa and see what opportunities you could derive from the Square Kilometer Array, and assist us in ensuring that we have the best programming, the best systems analysis, the best data management facility for this important project. And we told them that, even if—the Lord forbid—we don't get the SKA, we are committed to the demonstrated telescope MeerKAT, which in itself will be a significant research facility.

And it was great! They were all excited. They all wanted to be part of it. We have agreements with IBM already. We have agreements with Nokia, with Intel—so there's a lot of excitement. And this excitement: It begins with South Africa, but then it must look at Mozambique; it must look at Zambia, Namibia, Ghana, Botswana. All the partners to this

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The first few dishes of the Karoo Array Telescope, or MeerKAT, is a symbol of what Minister Pandor called "the alteration of the perception of Afro-pessimism that we have in Africa." It will mean a "massive boost to human capital development," she said.

new development are all the various sides of our program.

I've found a bit of money in my budget to start helping Mozambique to build a radio astronomy observatory. And we hope we'll do the same with Zambia; we're doing so with Ghana as well.

Inspired by Eleanor Roosevelt

21st Century: When Nigeria launched its two satellites a week or so ago, one of the ways that the press covered it was to say that Nigeria is now winning the "African space race." But all of the South African speakers at the Cape Town Congress have stressed international cooperation.

One project under development is the African Resources Monitoring Constellation. Dr. Malinga, who had a press conference in Johannesburg before the IAC conference started, said that the next South African satellite, Sumbandila-2, which will be South Africa's contribution to the Constellation, would be developed. Has that been approved?

Pandor: Not yet. No, they're still working on it, but we've agreed that that's the direction we're going. And we'll look at what they've produced, their plan, and I hope by the end of this year we will have an indication what the needs are, what the timelines are, and what resources are required.

21st Century: I have to say that an inspiring thing about South Africa is the leading role of women here.

Pandor: We all draw on the U.S. We all talk about Eleanor Roosevelt and the contributions she made to the empowerment of women. We never forget that we wouldn't have the Universal Charter of Human Rights were it not for her. A great woman. So we draw inspiration. And that's what we would like America to go back to—to be the country that inspires us.

INTERVIEW: DR. SANDILE MALINGA

Space in South Africa: A Change in Paradigm

Dr. Sandile Malinga is the first chief executive officer of the recently established South African National Space Agency (SANSA). He is a space physicist, who earned a doctorate from Rhodes University. In 2002, he joined the University of Natal and later became the Dean's Assistant at the University KwaZulu-Natal, responsible for student academic support programs.

In 2007, Dr. Malinga joined the leadership of the Hermanus Magnetic Observatory, now SANSA Space Science. He is a member of the South African Council for Space Affairs, and serves on numerous scientific committees. Dr. Malinga is dedicated to bringing young people into science and technology, a commitment which he says is inspired by his three young children; and he sees his responsibility not only to his nation, but to all of Africa.

Dr. Malinga was interviewed by Marsha Freeman on, Oct. 6, during the International Astronautical Congress, in Cape Town.

21st Century: You gave a briefing for the press in Johannesburg about a week ago, prior to the Congress, in which you mentioned that you hoped to start a project next year to build an operational Earth-observation satellite; that Sumbandila was a prototype, not designed to be operational. Why have you put this forward? People would ask, wouldn't it be cheaper and faster to just go to a foreign commercial company and buy a satellite?