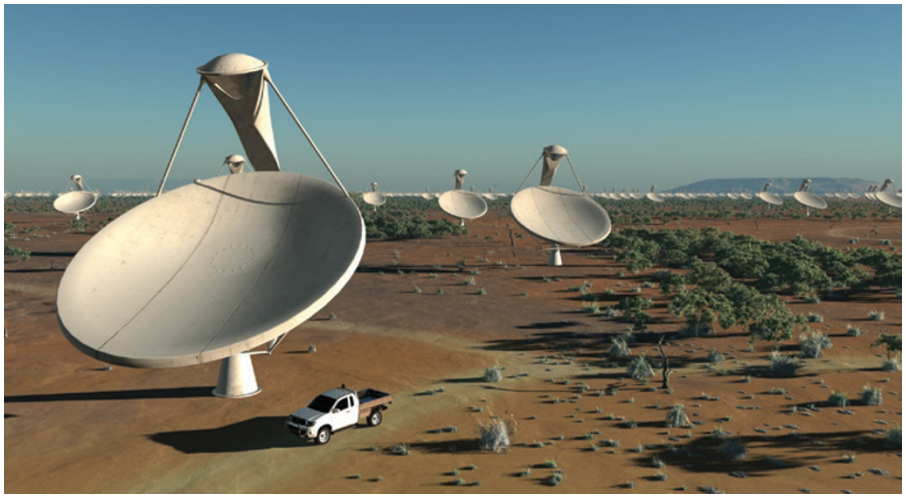

SKA ORG./TDP/DRAO/SWINBURNE ASTRONOMY PRODUCTIONS

Artist's impression of part of the Square Kilometre Array, which will be sited in South Africa and Australia.

The United States must rejoin the SKA

Plans for the radio-telescope array must be firmed up to help Americans get back on board and ensure its success, say **Anthony J. Beasley** and **Ethan J. Schreier**.

The world's most powerful astronomical instrument is currently being built in South Africa and Australia. A growing consortium of countries, soon to be marshalled by incoming director-general Phil Diamond, is laying the foundation for some unique science. When it comes online next decade, the Square Kilometre Array (SKA) will observe diffuse hydrogen ionized by the first stars and galaxies, use pulsars to explore general relativity, and detect the imprints of dark energy on the distribution of matter in the Universe.

There is one country notable by its absence in this endeavour: the United States. And its absence threatens to hinder the SKA's pursuit of its scientific goals. After nearly 20 years of participation, US astronomers last year dropped out of the SKA collaboration as the result of disillusionment with the project's planning process and budget pressure from the National Science Foundation (NSF).

This cannot be allowed to continue: the United States must eventually rejoin the SKA. We call on the NSF to plan for a US role in the SKA, and we urge the SKA consortium and Phil Diamond to review the programme's goals and produce a realistic plan for achieving them.

In late 2011, the NSF ceased to fund any US participation in SKA development. This blow could be compounded if the NSF adopts its panel's recommendation to stop supporting — and so potentially close — the Green Bank Telescope and the Very Long Baseline Array (VLBA), both state-of-the-art and cost-effective telescopes with which SKA technologies could be evaluated.

Our experience in building large telescopes on the ground and in space leads us to believe that these decisions are short-sighted. They leave US astronomers and engineers unable to contribute to the SKA design or to participate in its science. The global astronomy community will press ahead without the United States. But without US scientific and technical input, and the ability to test SKA technologies at our facilities, the array's development will be slowed down by many years.

A lack of clarity on technical details and costs were the main criticisms of the SKA in the US astronomy community's 2010 decadal survey (go.nature.com/4qyqle), which considered the project scientifically exciting but only partly defined. We agree. Satisfying all the telescope's ambitious goals will require several different types of technology (such as receiving dishes, dipoles and tiles) and the consortium has yet to decide how to adapt and integrate them. Participation of US astronomers will be crucial in the firming up of those plans.

The scientific community recognizes that seed funding and development work towards the next generation of facilities is important, and that gaps in funding only add cost and delay. The NSF should continue to support the operation of existing radio-astronomy facilities in the United States, maintaining core capabilities that will also be necessary as test-beds for SKA technology in the coming decade. The US$10 million to $15 million per year needed to retain Green Bank and the VLBA is small relative to the billions already invested in US radio astronomy, which draws upon one-third of the NSF's annual $230 million astronomy budget.

THE WAY FORWARD

NSF funding for SKA development should be re-established. Even low initial levels (around $100,000 per year) would support planning activities, travel to meetings and some basic technology research. US facilities and university astronomy groups should together develop a strategy for participating in SKA planning and prototyping. By 2015, the United States should rejoin the SKA as a full partner.

In the next 1–2 years, Phil Diamond and the consortium should decide the technical requirements for the SKA (including frequency range, field of view, angular resolution and sensitivity), and should clearly define the technology developments necessary for a realizable instrument. This will be tricky because the ambitious goals of the SKA hinge on continual 'Moore's law' improvements in digital technologies.

Components available now will be obsolete by the time the telescope comes online, so a gradual updating process needs to be worked into the plan. Planners must project what technologies will become available in the next decade, and pick those that are feasible within a reasonable funding envelope.

Progress must be synchronized with projections of funding, so that partner contributions can be integrated steadily. To maintain project momentum, detailed design and development efforts should be paced and not completed long before construction money becomes available.

With US involvement and careful planning, the global radio-astronomy community can drive an evolutionary path towards the SKA, one that builds on current investments while enabling major discoveries as we advance. ■

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CORRECTION

The article 'Beyond the Higgs' (*Nature* **488,** 581–582; 2012) located the RENO experiment in Seoul instead of Yonggwang.