Dual sites for the SKA radio telescope

On 25 May the Square Kilometre Array (SKA) project announced that the two contenders to host the world's largest, most sensitive, radio telescope would share the honor. Broadly, the split will be by frequency, with South Africa and its neighbors hosting the SKA's mid-frequency antennas, and Australia, partnering with New Zealand, covering low frequencies. The decision was reached by the project's other member countries: Canada, China, Italy, the Netherlands, and the UK. Notably absent from the collaboration is the US, which the project hopes will join later.

In its evaluation of the two sites, the selection committee slightly favored South Africa. But the excellence of both sites, and the multimillion-dollar precursor projects that each country had in the works, "gave rise to a desire to see if we could come up with a creative approach to use both," says John Womersley, chair of the SKA board of directors and chief executive of the Science and Technology Facilities Council, the UK funding agency for particle physics, astronomy, and large science facilities. "To our surprise, the planned way forward should deliver more science for the money, because it takes advantage of the investments already made."

The precursor arrays to be integrated into the SKA are South Africa's MeerKAT and the Australia SKA Pathfinder (ASKAP). In South Africa, the SKA will add 190 15-m dishes to MeerKAT's 64 13.5-m ones, for an array sensitive to frequencies from 450 MHz to 3 GHz. In Australia, a slew of small, low-frequency (70–450 MHz) dipole antennas (see the artist's rendering on page 26) will be installed, and 60 15-m SKA dishes will supplement ASKAP's 36 12-m ones—which will begin scientific observations by the end of this year—to serve as a survey telescope sensitive from 700 MHz to 1.8 GHz. The first phase of the SKA is scheduled to be completed by the end of this decade.

When the second phase of the SKA is completed—slated for 2023—the baseline in southern Africa will extend beyond 3000 km, with dishes in Namibia, Botswana, Zambia, Mozambique, Kenya, Ghana, Madagascar, and Mauritius. (See PHYSICS TODAY, August 2011, page 25.) Those approximately 3000 traditional dishes will be complemented with an undetermined number of flat 60-m antennas (see artist's rendering on page 26). In Australia, more low-frequency antennas will be added within the 200-km baseline configuration. The SKA is intended to help answer questions about star and galaxy formation, dark energy, gravity, the role of magnetism in the cosmos, and the search for extraterrestrial life, among other things.

The cost of the project's first phase, some 10% of the full SKA, is €350 million ($433 million). The cost of the second phase is less certain, but a running estimate is €1.5–2 billion. In terms of technology, says Womersley, "we could basically build SKA now. But we couldn't afford what it would cost. The biggest challenges are affordability and mass production." Still to be worked out are engineering details about antenna design, number, and configuration; data transport and computing; and the financial and in-kind contributions from member countries.

In building the SKA in stages, says Womersley, "we are trying to learn the lessons of other megaprojects and to

SKA ORGANIZATION/TDP/DRAO/SWINBURNE ASTRONOMY PRODUCTIONS

Aperture arrays for low (top) and middle (bottom) frequencies, to be located in Australia and South Africa, respectively, will be part of the Square Kilometre Array.

employ best practices." Specifically, he says, the project won't ask governments to "put billions on the table" until the technologies are mature. "We have also been careful to work closely with the people with the checkbooks, so they are comfortable with how the project and the decision making are progressing, and to make sure we avoid some of the problems that have affected other big projects."

It helps that in both South Africa and Australia, the SKA is a visible symbol for politics and the public. The project "is seen as an important facet for maintaining Australia's position in world astronomy," says Brian Boyle, SKA director for Australia. "For South Africa and our African partner countries, this represents a new era," says Justin Jonas, SKA South Africa's associate director of science and engineering.

The dual-site decision, Boyle and Jonas say, has one winner: Global science.

Toni Feder

NASA receives spy telescopes

Surplus instruments could mean big savings for future astrophysics missions, but not anytime soon.

The two space telescopes that the secretive National Reconnaissance Office (NRO) has given to NASA are likely to remain grounded for the foreseeable future. A satellite incorporating one of the surplus spy telescopes will cost NASA between $1 billion and $2 billion to build and launch, according to Michael Moore, acting deputy director of NASA's astrophysics division. That's money the agency doesn't expect to be able to find for years to come.

Each of the telescopes "would have cost us around $250 million," Moore told reporters on 5 June. The optical components are "essentially perfect," he said, with performance comparable to that of the *Hubble Space Telescope* but with a field of view up to 100 times greater. "We arguably could have produced these, but we didn't have the scientific drive in that particular direction," he noted.

The wide-angle feature makes the NRO telescopes well suited to become the major component of the *Wide Field Infrared Survey Telescope*. That telescope was ranked as the top-priority large space mission by the National Academies' 2010 decadal survey of the astrophysics community; its main functions are measuring dark energy and searching for exoplanets. The telescopes' "extraordinary field of view would allow you to see more supernovae, the classic way to look for dark energy," Moore said.

A long way off

If cost were no object, 2020 would be the soonest that a spacecraft built around one of the telescopes could be launched, said Moore. A more likely launch date is 2025, after funding for development of the *James Webb Space Telescope* project has been freed up and becomes available for other projects, he said.

John Mather, NASA senior project scientist for *JWST,* expressed delight with the acquisition of the twin telescopes. Having the hardware in hand "saves a lot of thinking cost," he says, and will make engineering the spacecraft a whole lot simpler. "The next challenge is to get the instrumentation built," he says. The telescopes have been stripped of cameras and other instrumentation that would have been used for reconnaissance missions.

Moore said the NRO first contacted NASA in January 2011 to offer the telescopes. Neither agency would provide a photo of the telescopes, which have been declassified and in NASA's possession since August 2011. Asked about how they happened to become available, a spokeswoman for the NRO would say only that they were "hardware that didn't meet NRO's intelligence needs."

Located at an ITT Exelis facility in Rochester, New York, each telescope features a 2.4-m-diameter main mirror, mirror support elements, and a truss structure that holds a secondary mirror. Also included are systems to maintain