tubes were cold-drawn in four stages of 50, 45, 42 and 40 mm. It was found that it was best to anneal the tubes after 50 mm to make them ductile and attain yield strength of 60 kg/mm^2.

In the case of the reflecting panels, it was desirable to achieve a mean radial facet error of approximately 1 mm in order that the facet error had negligible effect on the overall surface deviation. However, this would have required 12 planar facets along each radial section. As this would have been unwieldy, five parabolic-shaped panels were designed to fit between every two radial tubes.

Vibration analysis tests to measure the resonant frequency of the dish showed that the stiffness of the dish needed to be increased. To do so, 12 stiffeners were installed between the central hub and alternate spokes. The stiffeners altered the system resonant frequency to 2.2 Hz and average damping ratio to 0.978 – numbers well within design requirements.

The dish has been mounted on an alt–azimuth-type mount with a slew ring bearing for the azimuth axis drive and a sector gear for the elevation axis drive. A control system was developed in-house to drive the azimuth and elevation axes in closed loops with a Linux-based PC acting as the position controller.

Current status

Photogrammetric measurements have shown that the dish works satisfactorily in the 2–3 GHz range (Figure 2). From measurements made of the surface accuracy and gravitational deformation of the dish, it is known that several panels need realignment. Researchers are working on ironing out all deficiencies to attain the design goal of making the dish functional up to 5 GHz range.

According to Uday Shankar, the assembly of one dish would take about 15 man-days. To anyone attempting a similar experiment, the recommendation is to use turn buckles to get some lift on the radial spokes and then vertical poles with shims to bend the tubes as required. With these supports one can get the outermost circumferential members in place and then release the vertical loads by removing the vertical poles one at a time. During this phase, one has to ensure that the poles remaining at any time are almost uniformly distributed. This is necessary, as the PPD configuration does not have one stable state and can relax in several stable states retaining the same perimeter.

For radio astronomers, the results are exciting. The Deep Space Network Project would require several such dish antennas and these results would be of interest to space organizations. In addition, internationally there is interest in the project from astronomers working on the Square Kilometre Array (SKA) telescope area, as the SKA would require thousands of such dish antennae.

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Crittercam – A new tool in animal-borne imaging

There have been tremendous improvements in the tools and technologies used in wildlife research. From the conventional voice recorders to satellite telemetry, from the manned underwater video cameras to unmanned microprocessor-based Crittercams – the advancement in technology has proven to be a boon to conservation science.

The Crittercam is a set of instruments containing a camera that can be attached to any wild animal to study its life in the wild. This is a tool by which we can see the world through the animal's point of view.

Although the first depth gauge was invented in the late 1800s, it was in 1964 that the first depth recorder was deployed on a Weddell Seal in Antarctica. The next step in animal-borne imagery was made possible by a microprocessor that attached a video camera housed in a submersible case (Crittercam) to a loggerhead turtle.

The Crittercam not only records video and audio data but also records information on depth, temperature and acceleration. This device combines solid data with gripping imagery and puts forth a conservation message to audiences worldwide from the animal's point of view.

The idea behind Crittercam was conceived by Greg Marshall, a marine biologist at National Geographic in 1986. During one of his diving trips in Belize, Marshall saw a shark approaching him that had a sucker fish clinging to its body. As the shark disappeared, the idea struck him that if he could put a camera in the place of the sucker fish, it would be possible to explore the shark's world without actually diving deep. He began working on a camera system that could be attached to an animal and record everything the animal saw. With small grants from the American Museum of Natural History, as a part of his experiment, a handheld camera fitted into a fibreglass case was strapped to the back of a captive loggerhead turtle. After the initial struggle, securing grant from the National Geographic Society, Marshall successfully deployed highly improved prototypes on sharks and sea turtles[1].

Over the past 20 years, Crittercams have been deployed on green turtles (*Chelonia mydas*) to study their foraging ecology in Moreton Bay, Australia[2] and to study the underwater diving, feeding and calling behaviour of blue whales[3].

The feasibility of this technology has also been tested on wild manatees[4]. The Crittercam has also been deployed on Hawaiian monk seals, humpback whales, reef sharks, etc. An Oscar winning documentary, 'March of the penguins' carried information and footage obtained from the Crittercam[5].

Although the Crittercam is not being used yet in India, it can prove to be a useful tool in addressing issues related to conservation. Since it is more successfully used on marine species, it can further add to the knowledge on species like the Olive Ridley turtles that have mass nestlings on the Gahirmatha coast, Orissa. Satellite telemetry is used to study their movement, but deployment of the Crittercam can add to this knowledge, since it records audio and video images.

At times, lack of data or insufficient data may render it difficult to assign a status to animals, based on certain parameters like population size, foraging ecology, predator pressure, migration, movement, etc. The Crittercam is certainly the answer to this problem.

Many marine species along the Indian coasts today are threatened, including the Olive Ridley turtle, green turtle, Gangetic dolphin, gharial and crocodile, which are in need of attention from conservation biologists. Data collection on these species can be augmented by use of Crittercam.

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MEETING REPORT

Grid security and management*

The Indian power sector is currently passing through an evolutionary phase and there are numerous challenges that it is facing to bring about the desired changes. The first and the foremost challenge is the adequacy of power supply. To meet the same, the Government of India has embarked on an ambitious plan to add more than 80,000 MW capacity by the end of the current Plan (i.e. end of 2012), to the existing capacity of about 141,000 MW built-up during the last five decades. Further, even after adding this large capacity, wheeling it to the distant locations to ultimately reach the end-user would be possible only if commensurate growth in the transmission sector matching with that of generation capacity addition is achieved simultaneously. In this direction, a large number of inter-state and inter-regional transmission links have been added in the recent past in different areas of the country. By virtue of this, we have been able to achieve seamless flow of power from surplus to deficit areas, thereby meeting higher demand. However, this addition of the transmission network has also brought with it a variety of operational, commercial and techno-economical issues and has thrown fresh challenges to the grid operators in the form of heavy loading of the lines, skewed load-generation pattern, etc. The above complexity and challenges emphasize the need for adopting fast and reliable grid security measures and use of modern and intelligent technologies, so that the vast network in the grid can be managed in an integrated mode of operation. In order to address these issues, a two-day workshop on 'Grid Security and Management' was organized recently. It was a well accomplished workshop attended by over 150 delegates from power utilities, industry, regulatory agencies, and academic and research institutions from different parts of the country.

Santhosh N. Hegde (Lokayukta, Government of Karnataka), while inaugurating the workshop stated that the ultimate objective of all power utilities must be to improve the electricity supply to the needy and the poor. The distribution of electricity should be taken up with the ordinary citizen in mind, with a special focus on the rural and economically weaker sections of the society. Further, he stated that the supply of electrical energy is one of the most important human requirements and there is a need to bring about improvements in all the disciplines of electricity supply, i.e. generation, transmission and distribution. He particularly emphasized on adopting ways and means to plug distribution and transmission losses.

R. P. Singh (Powergrid Corporation of India Limited (POWERGRID)) in his keynote address stated that in view of the rapid economic growth in the country, slowly the business of supply of electricity is moving away from being considered as a public service to a full fledged economic activity, leading to the establishment of open electricity market. The electricity supply industry which in the beginning was solely under the purview of government agencies is getting ready for private sector presence in a large scale in all facets of electricity supply. Entry of private entities in the power sector has been aimed at marshalling requisite investment into the sector as well as to usher in competition and improved efficiency of operation. These changes, however, have brought along with them numerous issues which were earlier non-existent. He stated that all power engineers must gear up to meet the challenges arising out of the significant role which electricity has assumed in the present conditions.

P. K. Shetty (NIAS, Bangalore and POWERGRID) emphasized that the economy in India is growing at a fast pace and electrical energy has become one of the prime movers in this process.

*A report on the two-day workshop on Grid Security and Management' organized by Powergrid Corporation of India Limited in association with Karnataka Power Transmission Corporation Limited and IEEE Power Engineering Society, Bangalore Chapter at the National Institute of Advanced Studies, Bangalore on 28 and 29 April 2008.