DIA, DEOGHAR IAS ACADEMY

Daily News Feed

D.N.F

04.08.2025

Sabaijor Complex, Near Jamunajor Pul, Castair Town
Deoghar, Mob:-9162500508

How will railway to Sairang help in regional connectivity?

How will it boost the Act East policy? What is the status of projects to link the northeast with Southeast Asia?

Rahul Karmakar

The story so far:

The Indian Railways recently commissioned the new 51.38 km track to Sairang, 18 km short of Mizoram's capital Aizawl. It raises hopes for India's ambitious Act East Policy which envisages rail and road links with Southeast Asia.

When did the Mizoram project start?

Mizoram had 1.5 km of metre gauge railway track connecting Bairabi in the State's Kolasib district to Assam's Silchar before the gauge conversion project, sanctioned in 2000, was undertaken. The extension of this project to Sairang, which entailed laying a 51.38 km track, began in 2008-09, but the progress was slow due to inclement weather, a difficult and landslide-prone terrain, manpower shortage, and issues with transporting construction materials. The project was part of the Indian Railways' plan in the early 2010s to connect all the northeastern State capitals to the country's rail network, although the Sairang railway station is 18 km short of Mizoram's capital, Aizawl. The Bairabi-Sairang section, which received safety clearance in June 2025 and awaits formal inauguration, has 48 tunnels with a total length of 12.85 km and 142 bridges. The project cost more than ₹5,020 crore and the lives of 18 workers when the bridge with the tallest pier collapsed during construction in August 2023.

What is its significance?

Landlocked Mizoram's fastest access to the rest of the country is through air travel. The Aizawl-Silchar highway, also via Sairang, is the second-fastest option that consumes at least five hours. Trains, including a proposed Rajdhani Express, from the Sairang railhead will slash this travel time to 1.5 hours and the cost of transportation considerably. Railway officials say the biggest gain for the State will be in tourism, trade, and transportation of goods, reducing the dependence on trucks to a large extent. They said the Sairang railhead is strategic vis-a-vis the Act East Policy, envisaging rail and road connectivity to improve trade with the Association of Southeast Asian Nations (ASEAN) and other East Asian countries, deepen diplomatic engagements, and build stronger security cooperation. Sairang is also expected to be vital for transhipment of goods from the India-funded Sittwe Port in Myanmar.

What is the Act East Policy?

The Act East Policy, announced by Prime Minister Narendra Modi in 2014, was a more ambitious version of the Look East Policy initiated during the Congress government in 1991 with the key objective of transforming the northeastern region into India's gateway to the ASEAN bloc. Official data show that the Centre increased the budgetary allocations for the region by 300% from ₹36,108 crore during the 2014-15 fiscal to more than ₹1,00,000 crore during 2024-25. More than 10,000 km of highways and 800 km of railway tracks were built, eight new airports established, and several inland waterway projects undertaken during this period. Vital to linking Southeast Asia by rail are the 82.5 km Dimapur-Zubza (near Kohima) project in Nagaland, the Imphal-Moreh plan in Manipur, and the Asian Highway 1 from Assam to Moreh via Kohima and Imphal. While the Nagaland project is on track, the ethnic conflict in Manipur has affected the proposed railway line between Imphal and Moreh.

The connectivity projects to link the northeast with Southeast Asia have not progressed beyond India's borders due to the unrest in India's neighbourhood. The Act East Policy ran into the civil war in Myanmar following a military coup in February 2021, followed by the fall of the Sheikh Hasina government in Bangladesh in August 2024. The Agartala-Akhaura railway project, which would have provided Tripura faster access to Kolkata through Bangladesh and connectivity to the Chittagong Port, has been stalled. The biggest setback has been the delay of the ₹2,904 crore Kaladan Multi-Modal Transit Transport Project in Myanmar, which would have reduced the distance between Mizoram and Kolkata by 1,000 km.

THE GIST

- The project was part of the Indian Railways' plan in the early 2010s to connect all the northeastern State capitals to the country's rail network, although the Sairang railway station is 18 km short of Mizoram's capital, Aizawl.
- The Act East Policy, announced by Prime Minister Narendra Modi in 2014, had the key objective of transforming the northeastern region into India's gateway to the ASEAN bloc.
- The connectivity projects to link the northeast with Southeast Asia have not progressed beyond India's borders due to the unrest in India's neighbourhood.

How does the World Bank classify countries by income?

The World Bank's income groups are widely used in global data. This article explains how they are defined and updated

DATA POINT

Bertha Rohenkohl
Pablo Arriagada

When people talk about countries as 'rich' or 'poor', they can mean many different things. But for researchers and policymakers, it helps to have a way to compare countries by income using clear criteria. One widely used approach is the World Bank's income classification system, which places countries into four groups: low, lower-middle, upper-middle, and high-income countries.

Every year, the World Bank assigns each country to an income group based on its gross national income (GNI) per capita. GNI per capita is a measure of the average income of a country's residents, including income that is earned abroad. Since countries report GNI in their local currencies, the World Bank converts these figures into U.S. dollars using exchange rates. It then places countries in one of four income groups based on specific thresholds. **Maps 1** and **2** show how countries were classified by income in 2014 and 2024.

The income thresholds that separate groups were first set in the late 1980s when this classification system was introduced. At that time, these were aligned with the World Bank's policies for lending money to countries. The Bank used average incomes to determine which countries were eligible for concessional loans.

This threshold for receiving such loans became the boundary between low-income and middle-income countries. The Bank then added two more thresholds to allow for further distinctions. These were chosen based on the distribution of country incomes at the time, rather than on lending rules.

Today, the thresholds are no longer linked to the Bank's operations, but they have been updated yearly to account for inflation. This adjustment is based on a measure of global inflation.

This means that the classification is *absolute*. Countries are put into groups according to predetermined thresholds, and a country's placement depends only on its GNI per capita, not on how it stacks up relative to other countries. The thresholds for the latest income groups are (in U.S. dollars): low income: $1,135 or less; lower-middle income: $1,136 to $4,495; upper-middle income: $4,496 to $13,935; high income: More than $13,935.

If a country's GNI per capita crosses a threshold, it moves into a new income group in the following update. Because GNI per capita changes over time, and thresholds are revised annually, countries can move between income groups over time. These movements may reflect real changes in income, shifts in exchange rates, or updates to population data.

In the long run, most countries have moved up the income ladder as their economies have grown. However, countries can also move down – and some have, particularly in periods of war and economic crisis. Two examples are Syria and Yemen, which went from low-middle income to low income in 2017.

When we hear that there are four income groups, we might imagine that the world's population is evenly divided across them, with around 25% of people living in each. But this isn't the case. Again, these groups are defined based on *absolute* thresholds, not relative cut-offs that change based on other countries' progress.

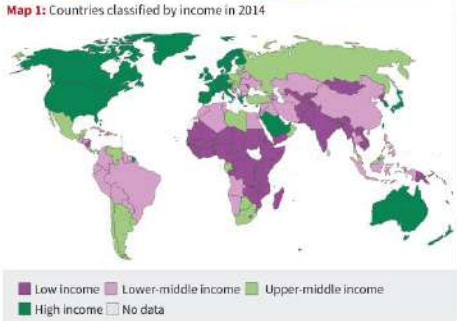
In 2004, 37% of the population lived in low-income countries. Today, that share has fallen to less than 10%. In the same period, the share of upper-middle income countries increased from less than 10% to 35%. You can see this change in **Charts 3, 4 and 5**.

Bertha Rohenkohl is Research and Data Economics Lead and Pablo Arriagada is Data Scientist at Our World in Data

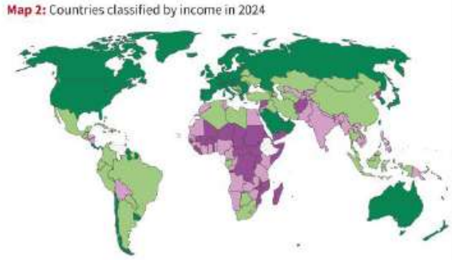
Income thresholds

The data for the charts were sourced from Our World in Data's story titled "How does the World Bank classify countries by income?"

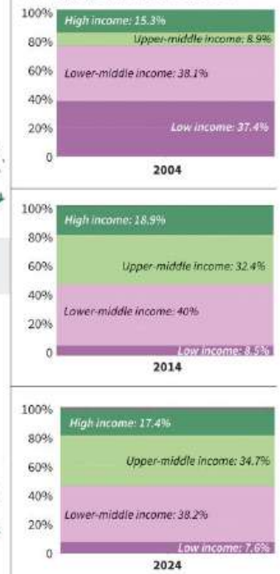
Map 1: Countries classified by income in 2014



Map 2: Countries classified by income in 2024



Charts 3, 4 and 5: Share of population by income group in 2004, 2014 and 2024



Another slip up by India in the trade pact with the U.K.

Biswajit Dhar

is former Professor of Economics at the Jawaharlal Nehru University

K.M. Gopakumar

is Senior Researcher and Legal Adviser, Third World Network

The India-United Kingdom Comprehensive Economic and Trade Agreement (CETA) raises several questions regarding India's commitments in the CETA's intellectual property chapter (Chapter 13). A problematic article in this chapter is Article 13.6, "Understandings Regarding TRIPS and Public Health Measures", in particular its first paragraph: "The Parties recognise the preferable and optimal route to promote and ensure access to medicines is through voluntary mechanisms, such as voluntary licensing which may include technology transfer on mutually agreed terms" (http://bit.ly/46zLEzj).

India's agreeing to this provision would result in dilution of its position on two critical issues. First, India consistently backed the use of compulsory licensing as opposed to voluntary licensing, to address high prices of patented medicines. Second, India argued that advanced countries must transfer technologies to developing countries on "favourable terms", for their industrialisation, and also for reducing their carbon footprints.

Issue of pricing

High prices of patented medicines are a serious anomaly of the patent system, due to excessive rent-seeking by patentees. Compulsory licensing of patented medicines can vastly improve the affordability of high-priced medicines by facilitating the production of such medicines. This was experienced following the grant of compulsory licence to Natco Pharma in 2012 for producing an anti-cancer medicine, sorafenib tosylate. The price came down to less than ₹8,800 for a month's treatment, from the ₹2,80,428 charged by the owner of the patent on the medicine, Bayer Corporation (http://bit.ly/4lVTc4l).

For remedying such instances of excessive rent-seeking, India's law-makers included compulsory licensing as a key safeguard while amending the Patents Act to make it compatible with the World Trade Organization's (WTO) Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). Both Houses of the Parliament unanimously adopted this legislation after a Joint Parliamentary Committee had carefully considered its provisions (http://bit.ly/4l7Z1uh).

There is a dilution of India's backing of the more effective compulsory licensing to address the high prices of patented medicines

Grant of compulsory licence

India's TRIPS-consistent Patents Act allows grant of compulsory licence to anyone interested in producing a patented product in India, three years after the grant of a patent. This licence can be granted if: reasonable requirements of the public with respect to the patented invention are not satisfied; or the patented invention is not available to the public at reasonably affordable price, or the patented invention is not "worked" in the territory of India, implying, it has not been commercially exploited in the country (http://bit.ly/4lTSBjI).

Patent rules monitor "working" requirement and, accordingly, patentees must submit the working status of their inventions. They had to do so annually until this requirement was diluted through India's FTA with the European Free Trade Association, with India agreeing that the periodicity of reporting "shall not be less than 3 years" (http://bit.ly/4o4NCxU). This dilution, has now been reinforced through the CETA, and it takes away an important ground for issuing compulsory licences.

By backing voluntary licensing to address the problem of access to medicines, India has, de facto, given up its position as a strong votary of compulsory licensing in the WTO. A coalition of developing countries, including India earned the right to issue compulsory licences through the Doha Declaration on the TRIPS Agreement and Public Health in 2001, despite strident opposition from advanced countries. The Declaration emphasised, "each Member has the right to grant compulsory licences and the freedom to determine the grounds upon which such licences are granted" (http://bit.ly/3IUwjiW).

Voluntary licences cannot ensure access to affordable medicines due to the weak bargaining position of domestic companies in developing countries *vis-à-vis* dominant pharmaceutical corporations. Médecins Sans Frontières (MSF), a medical humanitarian organisation, observed that using the terms of voluntary licences, pharmaceutical corporations can set various limitations, including to control the supply of active pharmaceutical ingredients, besides imposing restrictions on licensees. Therefore, options for getting affordable access are compromised when voluntary licences are used (http://bit.ly/3U0j6aQ). The MSF's observations were proven when Cipla produced the anti-COVID drug, remdesivir, in India under a voluntary licence from Gilead Sciences, the owner of the patent on the medicine. The price of remdesivir fixed by Cipla for India was, in purchasing power terms, higher than that Gilead had charged in the United States.

India's demand will be affected

The CETA undermines India's demand for technology transfer "on favourable terms" in several multilateral forums. This demand was first made through the United Nations General Assembly Resolution on the New International Economic Order (NIEO) in 1974. A key aspect of the NIEO was the call for facilitated technology transfer from advanced to developing countries to promote the industrialisation efforts of the developing countries (http://bit.ly/41ejRRl). However, despite their best efforts, little progress was seen regarding technology transfer.

The disappointment of developing countries was reflected in India's Fourth Biennial Update Report to the United Nations Framework Convention on Climate Change in 2024: "Despite substantial national efforts and investments, barriers like slow international technology transfer and intellectual property rights (IPR) hinder the rapid adoption of [climate friendly] technologies" (http://bit.ly/3H1lTfU).

As India has compromised its long-held position that technology transfer to developing countries must be on "favourable terms", its demand for climate-friendly technologies from advanced countries could lose its sting.

The 'right to repair' must include 'right to remember'

Kinnari Gatare

is a researcher in Human Computer Interaction (HCI) and a former UX Design Consultant, National Programme on Technology Enhanced Learning (NPTEL), Indian Institute of Technology Madras

In May 2025, the Indian government took a significant step toward promoting sustainable electronics. It accepted a report proposing a Repairability Index for mobile phones and appliances, ranking products based on ease of repair, spare part access, and software support. New e-waste policies now include minimum payments to incentivise formal recycling. These are timely moves.

But as India takes steps toward making repair a consumer right, we must also treat it as a cultural and intellectual resource – a form of knowledge that deserves preservation and support. India's digital and Artificial Intelligence (AI) policy landscape is evolving rapidly. Initiatives such as Digital Public Infrastructure (DPI) and the National Strategy on Artificial Intelligence (NSAI) emphasise innovation, data-driven governance and economic efficiency. Yet, the systems that quietly sustain everyday life – especially the informal repair and maintenance economy – remain largely invisible in digital and policy frameworks.

In an age of cloud backups and algorithmic processing, it is easy to forget the value of knowledge that cannot be codified. Much of India's repair expertise lives in muscle memory, quiet observation, and years of hands-on improvisation. This tacit knowledge is vital to India's material resilience. From mobile fixers in Delhi's Karol Bagh to appliance technicians in Chennai's Ritchie Street, repairers keep devices working well past their planned obsolescence. "If we don't fix it, who will?" says a mobile repairer in Ritchie Street. "People throw things out. But we see what can be made new." Their tools may be modest and their workshops discreet, but their work reflects deep ingenuity. They restore devices not by consulting manuals, but by diagnosing faults through sensory cues, reusing components, and adapting creatively to constraints. Yet, this ecosystem is gradually eroding. As product designs become less repairable and consumer habits shift toward disposability, informal repairers find themselves increasingly locked out of markets, of skilling programmes, and of policy attention. What risks being lost is not only economic opportunity but also a vast, undocumented reservoir of knowledge that has long supported India's technological resilience.

Why tacit knowledge matters

"I learnt by watching my uncle," says an appliance repairer in Bhopal. "He never explained with words. He just showed me once, and expected me to try. That's how we pass it on." Tacit knowledge refers to forms of skill and intuition that are difficult to formalise. In India's repair economy, this expertise is typically passed down through mentorship, observation, and repetition – not through formal training or certification. It is inherently adaptive and context-sensitive, qualities that structured digital systems, including AI, often struggle to replicate. As AI advances, it increasingly draws on insights shaped by this kind of labour. However, mechanisms to acknowledge or equitably involve the contributors of this knowledge are still evolving. The result is a growing imbalance: AI systems continue to improve, while the communities enabling that learning often remain unrecognised. Globally, the Right to Repair movement has gained momentum. The European Union recently introduced rules requiring manufacturers to provide access to spare parts and repair documentation. In India, the Department of Consumer Affairs launched a Right to Repair framework in 2022, followed by a national portal in 2023 covering electronics, automobiles, and farm equipment. Meanwhile, the United Nations Sustainable Development Goal 12 promotes repair as part of responsible consumption. India now has the opportunity to lead by recognising repair not just as a service but also as a form of knowledge work.

As India invests in AI infrastructure and digital public goods, it must align these ambitions with the ground realities of repair and an established culture of innovation and frugality

The blind spot in India's digital policy

In 2021-22, India generated over 1.6 million tonnes of e-waste, becoming the world's third-largest producer. The E-Waste (Management) Rules, 2022 introduced Extended Producer Responsibility (EPR) – a principle that makes manufacturers responsible for post-use product management. However, while these rules encourage recycling, they make only a passing mention of repair as a preventive strategy. National skilling programmes such as the Pradhan Mantri Kaushal Vikas Yojana (PMKVY) focus on short-term certifications for formal industrial roles. Repair work, which requires improvisation, diagnostic skill and creative reuse does not easily fit this framework. Similarly, the National Education Policy (NEP) 2020 celebrates Indian knowledge traditions and experiential learning but offers little guidance on how to support or transmit hands-on repair expertise. Campaigns such as Mission LiFE (LiFEStyle For Environment) promote repair and reuse, but complementary efforts are needed to support the workers who make such sustainability practices possible. While policies now champion circularity, they risk leaving behind the very workforce whose skills make it real.

As sustainability becomes a national priority, policymakers and technologists are reconsidering how we design, discard, and extend the life of everyday products. One emerging idea in research is 'unmaking' – the process of taking apart, repairing or repurposing devices after their first use, revealing design flaws and opportunities for reuse. Breakdowns and repairs are not failures; they are feedback loops and sources of practical insight. A discarded circuit board can become a teaching tool. A salvaged phone part can restore someone's access to work or school. A broken appliance can be repaired and reused. Informal repairers perform this work daily. Their labour sits at the centre of the circular economy, where reuse is not an afterthought but a design principle. Recognising them as stewards of sustainability – not marginal figures – can reshape how we think about environmental and digital innovation alike.

AI-enabled solutions for repair justice

India's culture of *jugaad* and frugality long pre-dates today's tech-forward policies. Repairers have always adapted across devices and decades, with minimal support. As the country invests in AI infrastructure and digital public goods, it must align these ambitions with the ground realities of repair. Most modern gadgets are built for compactness and control, not repair. According to a 2023 iFixit global report, only 23% of smartphones sold in Asia are easily repairable due to design constraints. To change this, design norms and procurement policies must include repairability from the start. To make technology genuinely sustainable, public policy must consider not only how products are manufactured and used but also how they break down, are repaired, and find new life. A shift toward designing for "unmaking", where disassembly and repair are anticipated from the outset, should inform both hardware standards and AI-integrated systems.

This transition will require coordinated institutional action. The Ministry of Electronics and Information Technology can embed repairability criteria into AI and procurement policies. The Department of Consumer Affairs could expand the Right to Repair framework to include product classification and community involvement. Platforms such as e-Shram, under the Ministry of Labour and Employment, can formally recognise informal repairers and connect them to social protection and skill-building schemes. The Ministry of Skill Development and Entrepreneurship can consider training programmes to account for the tacit, diagnostic nature of repair work, which does not conform to standardised industrial templates. To support this, decision trees can help codify typical repair pathways, while Large Language Models can capture, summarise, and translate tacit repair narratives into structured, shareable knowledge, enabling broader learning without stripping local context or expertise.

Supporting this ecosystem is not merely a question of intellectual property or technical efficiency. It is about valuing the quiet, embodied labour that sustains our digital and material lives – an essential step toward a just, repair-ready technological future. As philosopher Michael Polanyi observed, "We know more than we can tell." By choosing to remember what cannot be digitised, we preserve the human wisdom essential to a meaningful technological future.

A colourised scanning electron micrograph of a T cell. NIAID

Scientists use AI-designed proteins to generate immune cells

Rahul Karmakar

A team of Harvard scientists has used artificial intelligence (AI), in the form of AI-designed proteins, to generate large numbers of immune cells and enhance immunity against diseases ranging from cancer to viral infections, a new research paper published in *Cell* said.

The scientists engineered a synthetic activator of a key cellular pathway called Notch signalling, which plays a crucial role in cellular differentiation and is essential for transforming human immune progenitors into T cells. Notch signalling is a cell-to-cell communication system vital for various developmental processes and tissue homeostasis in multicellular organisms. Homeostasis is the body's way of keeping everything balanced and stable, despite what is happening around it.

"In response to viral infections or cancer, the body requires a higher production of T cells to mount an effective immune defence. However, this process depends on the activation of the Notch signalling pathway, for which no effective molecular activators have been available," Rubul Mout from Assam, the principal scientist of the study, said.

Associated with the Harvard Stem Cell Institute and the Stem Cell & Regenerative Biology Program at Boston Children's Hospital, he is one of 24 scientists involved in the collaborative effort. They include George Daley, the Dean of Harvard Medical School, and Nobel laureate David Baker.

The body needs more T cells to deal with viral infections or cancer. This process depends on activation of Notch signalling pathways, for which no molecular activators have been available

Improved method

According to the study, an earlier method of activating Notch signalling in laboratory settings by immobilising Notch ligands on tissue culture dishes is not applicable for therapeutic use in humans. The quest for a viable, soluble activator of Notch signalling that could work in vivo (inside a living body) made the team develop a library of custom-designed soluble Notch agonists and systematically test their ability to activate the Notch pathway and support T cell development and function.

AI-driven protein design technologies, an innovation that contributed to Dr. Baker receiving the 2024 Nobel Prize in Chemistry along with Demis Hassabis and John Jumper, were used to address the challenge.

Using the agonists, the researchers demonstrated the large-scale generation of T cells in a laboratory bioreactor, an important advancement given the growing demand for T cell production in hospitals worldwide for Chimeric Antigen Receptor (CAR) T cell-based cancer immunotherapies.

Furthermore, when the agonists were injected into mice during vaccination, the animals displayed significantly improved T cell responses, indicating an enhanced immune response. The treatment resulted in increased production of memory T cells, which are crucial for the long-term impact of vaccines."Being able to activate Notch signalling opens up tremendous opportunities in immunotherapy, vaccine development, and immune cell regeneration," Dr. Mout said.

(rahul.karmakar@thehindu.co.in)

'Anything that moves, NISAR will see with unprecedented fidelity'

A conversation with Karen St. Germain, director of the Earth Science Division at NASA's Science Mission Directorate, on the 'extraordinary new capability' NISAR represents for ISRO and NASA; a satellite that has been 11 years in the making has implications for the study of other planets too

INTERVIEW

Karen St. Germain

Vasudevan Mukunth
Kunal Shankar

On July 31, ISRO launched the NASA-ISRO Synthetic Aperture Radar (NISAR) satellite, a flagship earth observation mission jointly developed by the two space agencies. It's the first satellite to use radars of two frequencies to monitor the earth's surface. NISAR will enhance climate resilience, agricultural monitoring, and disaster response. To discuss the milestone, **Vasudevan Mukunth** and **Kunal Shankar** spoke to **Karen St. Germain**, director of the Earth Science Division at the Science Mission Directorate at NASA, to understand the mission's science goals. To watch the full interview, visit *newsth.live/nisarscience*.

Karen St. Germain

ILLUSTRATION: SOUMYADIP SINHA

Vasudevan Mukunth: Karen, thank you so much for joining us today. Can you give us a few examples of scientific studies that are possible with NISAR, but haven't been possible so far with the existing crop of earth observation satellites?

Karen St. Germain: Absolutely, and it's great to be with you. The way to think about NISAR is that it will see anything that has structure to it that moves, that changes its position at a scale of less than a centimetre over an area about half of a tennis court. When I say anything that has structure: it could be forest, it could be buildings, it could be glaciers, mountains, land. Anything that moves, we'll see at an unprecedented level of fidelity.

What that means is we will be able to see the slight bulging that happens before a volcano erupts. We'll be able to see the land becoming unstable before a landslide. We'll be able to see building shifts after an earthquake or any other sort of event. When a forest gets cut down, we'll be able to see that. Anything that changes, we'll be able to see, and that's an extraordinary new capability for us.

Kunal Shankar: After the launch, NISAR will start its 90-day commissioning phase. In this phase, do you foresee any challenges with calibration, especially with cross-band calibration?

Karen St. Germain: There are a number of different aspects to the calibration. Largely the ISRO team will focus on calibrating the S-band radar and the NASA team will focus on calibrating the L-band radar. They don't really get cross-calibrated, but each one will look at its own special targets.

Now, what do I mean by a target? It's something we call a corner reflector and it is exactly what it sounds like. It's a corner, just like the corner of a room. And it has a special feature, which is that when a pulse of energy hits it from any direction, it reflects back in exactly the same direction. So we use these targets to calibrate independently each of the instruments. And then the only other thing we really have to pay special attention to is the alignment, the pointing. Are they pointing in the same place on the ground? And for that, we'll use the data itself. So the data itself will identify features and we'll align those features from each radar.

Kunal Shankar: Speaking of costs, there's a lot of interest about the commercial aspect and the applications aspect of NISAR. Could you just tell us a bit about the kind of interest that it has generated?

Karen St. Germain: Actually, let me take a step back and talk about earth observation data in general because understanding the earth – the surface, the atmosphere, and the changes large and small that can have impacts on communities and businesses, that's become an enormous area of interest. In fact, NASA's been collecting data on the earth system for more than 60 years now. And we find that about three quarters of our Fortune 100 companies are drawing something out of that earth observation archive. We also find that about 75% of our users, and we have more than 5 million users, are coming from .com addresses. So we are talking about agriculture producers, the insurance industry, the finance industry, the transportation industry. And that's before you even get to things like disaster response. So we have a tremendous interest in general.

For NISAR specifically, we know that NISAR will produce data that can directly benefit agriculture, also risk assessment – everything from natural hazards like earthquakes and volcanoes, which are both issues in the US but also things like wildfire risk because NISAR will be able to characterise how much fuel is in our wildlands. So that's dry fuel that is burnable. There are all these application areas. One of the things that we do that we're really excited about is any time we launch a new mission, we have an Early Adopters program. These are people out there who anticipate what NISAR might do for them in their business. We don't require that they tell us a lot about what they intend to do. But right now for NISAR, we have at least 200 of these Early Adopters. Once the data start to roll out and the excitement builds, we expect it to take off from there.

Vasudevan Mukunth: Can you say why NISAR took 11 years to build? Were there any particularly difficult engineering challenges that you had to overcome first?

Karen St. Germain: Yeah, absolutely. First, it's an enormously complex system, with many dozens of subassemblies that had to be designed. Of course, to make these two radars work together and operate through a single reflector, there's a lot of design work that had to happen up front. So it was challenging to begin with. And then we had a couple of other particular challenges. This one happened right as I was starting my job: COVID hit. So think about an integrated engineering team already separated by time zones and distance and now having to work through a global pandemic. A lot of this work also had to happen in person. We had people who had to travel at the height of COVID, and had to leave their families. Remember that the waves of COVID hit differently in the US and India. We had people on both teams sometimes come down with COVID when they were in the opposite country, so we had to take care of one another's teams. Then we had to develop entirely new protocols for how people could work together in a space and remain healthy. That was a big one.

More recently, this reflector is enormous, it's about a 40-foot deployable reflector. And when we were in India integrating and we were testing in the thermal vacuum, we saw some data that worried us. We were really afraid that there may be too much of a thermal load on that reflector before it gets deployed, and it might overheat. If it did that, it could challenge the structural integrity. Of course, when you've got a deployable antenna, if it doesn't stay taut, it doesn't reflect the way you want it to. So we ended up de-mating that reflector, bringing it back home, applying a reflective coating so the sun couldn't cause it to overheat, on the struts (not on the reflector surface itself). Then we had to ship it back and reintegrate. So we had a couple of technical challenges, which we expect when you're doing something as difficult as this.

Vasudevan Mukunth: Both the L-band and the S-band radars use the same reflector. Since S-band has a shorter wavelength than the L-band, does this create any trade-offs in either L-band or S-band performance?

Karen St. Germain: It doesn't. And the reason for that is because this is a synthetic aperture radar. It creates its spatial resolution as it moves along. Each radar is taking snapshots as it moves along. You know, to get this kind of centimeter level fidelity and the kind of spatial resolution we're achieving, if you were to use a solid antenna, it would have to be five miles long. Just like when you're talking about a camera, if you want to be able to get high fidelity, you need a big lens. Same idea. But we can't deploy an antenna that big. So what we do is we build up image after image after image to get that resolution. And because of this technique, it's actually independent of wavelength. It works the same for S- and for L-bands. The only thing that's a little different is because the antenna feeds for the L-band and the S-band can't physically occupy the same space, they have to be next to each other and that means there's a slight difference in the way their pulses reflect off the antenna. There's that positioning difference, and that we can correct for.

A view of NISAR before the chamber door was closed ahead of its thermal vacuum testing at the Jet Propulsion Laboratory, California, January 4, 2022. NASA

Vasudevan Mukunth: Could you tell us a little bit more about that slight difference?

Karen St. Germain: It's the way a reflector works. You would ideally want to put the feed at the focal point of the reflector. But when you have two feeds, you can't do that. So they're slightly offset. That means they illuminate the reflector just slightly differently. The alignment is just a little bit different. The team optimised the design to minimize that difference and to make it so that they could correct it in post-processing.

Kunal Shankar: How do NASA and JPL's radar systems for planetary exploration feed into and evolve from their earth observation systems?

Karen St. Germain: Once you have expertise in a technology, you can use it in many, many ways.

And this is often the case in NASA between earth science and planetary science. One of us will develop a new technology or advance a new technology and then it can be used very broadly. So absolutely! And we love that kind of interplay. I love seeing earth science technologies make it into planetary missions.

That's one aspect. The other thing is what we learn from NISAR on earth can inform what we understand about other planets. There are lots of ways that we interact across disciplines.

One of the things that NISAR is going to tell us about is what's going on underneath the crust of the surface because we'll be able to see these very small motions that you and I don't experience daily, right? We can't sense these. But NISAR will, and it will allow us to advance our models about how the interior of planets work. And those kinds of models are the same models we use when we try to understand how a planet like Mars works.

(kunal.shankar@thehindu.co.in)
(mukunth.v@thehindu.co.in)

140 people of PVTGs, Nicobari tribe to join Andaman Police

A total of 140 people from Nicobari tribe and Particularly Vulnerable Tribal Groups (PVTGs) will join the Andaman and Nicobar Police as part of their gradual integration in Port Blair, a senior officer said. "The PVTGs, which include Onge, Great Andamanese, Nicobari, will join as Home Guard Volunteers," the officer said. Director General of Police, Andaman and Nicobar Islands, Hargobinder Singh Dhaliwal said, "A total of 132 Nicobari candidates, including 41 females, three Great Andamanese, including one female and five Onge, are now part of our police family." Integration is also noticed among other PVTGs such as Shompens and Jarawas (Ang). PTI

INBRIEF

Gajapayana, symbolic march of elephants, to be held today

With just weeks to go for the grand Mysuru Dasara festival, the stage is set for the launch of *Gajapayana*, the traditional but symbolic march of the elephants from the forest to the city, on Monday. The flagging-off will take place at Veeranahosahalli on the fringes of Nagarahole Tiger Reserve. Forest Minister Eshwar B. Khandre, officials of the Forest Department, and others will take part in the event.