

# WHEN THE STARS CAME OUT

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The James Webb Space Telescope Mirror is seen during a media unveiling at NASA's Goddard Space Flight Center at Greenbelt, Maryland. | Photo Credit: REUTERS

The dominant narrative these days across much of the world is, as Ayn Rand said about her novel *The Fountainhead*, the story of 'individualism versus collectivism, not in politics, but in man's soul'. In India, we too celebrate such individualism where heroic individuals, through their will power, strategic vision, perseverance and unique personal qualities, lift society up by its bootstraps and, like Nietzsche's superman, and create a new moral order. This new social order will, ostensibly, enjoy a higher level of human creativity and human freedom. In this narrative, individualism has built the modern world.

This is, however, only half the story. While Elon Musk, Jeff Bezos, Stephen Schwarzman, N.R. Narayana Murthy, Mukesh Ambani have made a significant difference as individuals, as also countless others who have passed away, there is another perspective that is equally significant but has rarely been celebrated. Obscured by the dominant narrative, this other account applauds the contribution of groups. Working together in collaborations, such groups, through sharing and cooperation, produce outcomes that are no less beneficial for society. In this story, there are no supermen just worker bees.

The making of the \$9.7 billion [James Webb telescope](#) is one such story. One of the most significant technological achievements of the last few years, that involved construction, transportation, [launching](#), alignment, and deployment in deep space, the James Webb Space Telescope (JWST) is a project that marked twenty plus years of continuous collaboration between many teams. Its successful placement in deep space is a defining moment in humankind's history of reaching for the stars. Another journey into 'man's soul' has just begun.

There are four aspects in this other narrative, that are complementary to, and not competitive with, that of the superman. These are, the ambitions of the project; how it was put together; the technologies involved; and its implications for human society. Taken together, they constitute an illustrative case of the collective production of a common good.

The James Webb telescope was imagined by its initiators as the coming together of many cutting-edge technologies. It was planned to enable humanity to peer deeper into space and to look further back in time. The telescope will give us new knowledge about the origins of the universe. Because it is essentially an Infra-red spectrum telescope, as compared to the Hubble which worked largely in the UV and visible light range, it will allow us to stare into the beginnings of the 'cosmic dawn', a period 250 million years after the big bang when light began to break through the cloud of mist and the first stars and galaxies began to form. The JWST will take us back about 150 million years further than Hubble, closer to when it all began.

The project seeks to understand how galaxies form and evolve. It will look for evidence of dark matter, study exoplanets, capture images of planets in our solar system, and other such cosmic curiosities. This knowledge will impact not just the physical sciences but also the humanities and social sciences as we attempt to understand our own place in the universe and ask those perennial questions such as: Is there other life in the universe? Will it look like us and, more worrying, will it look for us? What is the relation between 'chance' and 'necessity', to use Jacques Monod's thesis, in the emergence of life? In this ambition, the JWST belongs to the classical tradition of scientific inquiry: the pursuit of fundamental curiosity untouched by special

interests.

The CEO of Northrop Grumman, an aerospace and defence company and the primary contractor of the project, has gone on record to announce that because of the delays and production lapses, the company would only book profits after the successful deployment of the telescope.

If the ambition of the project was to understand the origin of the universe, and our place in it, the execution of the project was a stellar product of collective endeavour. Although there were many remarkable individuals who led the various groups in the project, the emphasis throughout was on its accomplishment by teams who worked together to fabricate the instruments, make the telescope parts, design the cooling systems, etc. This new collective, comprising of free scientists and engineers, collaborated with the single purpose of producing, launching, and placing, at the chosen Lagrange point (a point where the Earth's and Sun's gravitational forces are balanced), a telescope that was lighter than Hubble but had a mirror six times larger. Compared to Hubble's location 550 km from the Earth, JWST was located 1.5 million km away. All its parts had, therefore, to work the first time around. There were no second chances. Recent reports from NASA inform us that the deployment and aligning of the mammoth telescope is proceeding well and may even 'exceed expectations'. The launch of the satellite, on 25 December 2021, was a joint project of NASA, the European Space Agency, the Canadian Space Agency and involved many universities, organisations, and companies across 14 countries.

Further, the science and technology that was deployed should be toasted as a tribute to human ingenuity. Eighteen hexagonal beryllium mirrors first had to be folded to fit the available space in the Ariane rocket and then unfolded, in deep space, to make a single mirror with nanometric precision. One of the instruments, for example, has 2,50,000 individually-controlled shutters to ensure that the illumination of only the narrow portion of the sky being observed is possible. The JWST teams built and installed a Near Infra-Red spectrograph, a Near Infra-Red camera, a slitless spectrograph and, after technical difficulties, a Mid Infra-red instrument because, unlike the other instruments that need to be cooled to 40 K, it needs to be cooled to 7 K. At great cost the successful cryocooler was finally engineered.

These collaborative achievements have produced a sophisticated scientific infrastructure for exploring space and for opening the door to new scientific knowledge. It has created a new 'knowledge commons'. Administered by the Space Telescope Science Institute (STSI), which has a charter and a website that places in the public domain all relevant information, and that invites scientists from across the world to submit projects, JWST, through the process of commoning, is on the threshold of producing a huge knowledge commons. The 'heroic collective' thereby shares space with the 'heroic individual'. Hubble gave us mind blowing pictures of the infinite sky, such as the Lagoon nebula. JWST will give us pictures of the heavens that Isaac Asimov only imagined in his brilliant science fiction short story *Nightfall* when the stars came out.

*(Peter Ronald deSouza is the DD Kosambi Visiting Professor at Goa University)*

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