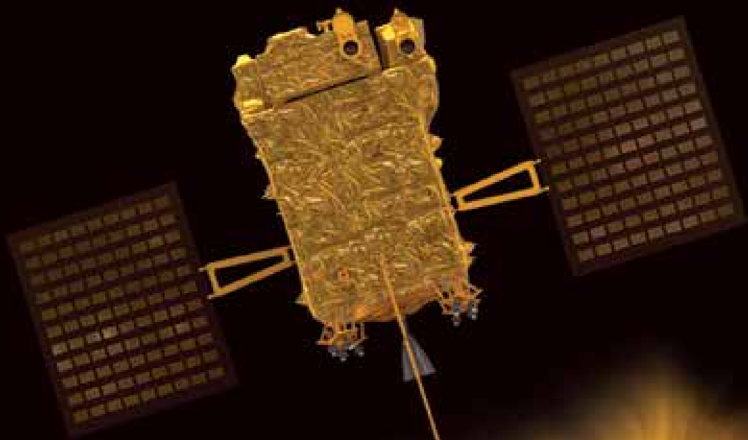
ADITYA-L1 MISSION

The first Indian space-based observatory-class solar mission to unlock the mysteries of the Sun



Distance

1.5 million kilometres

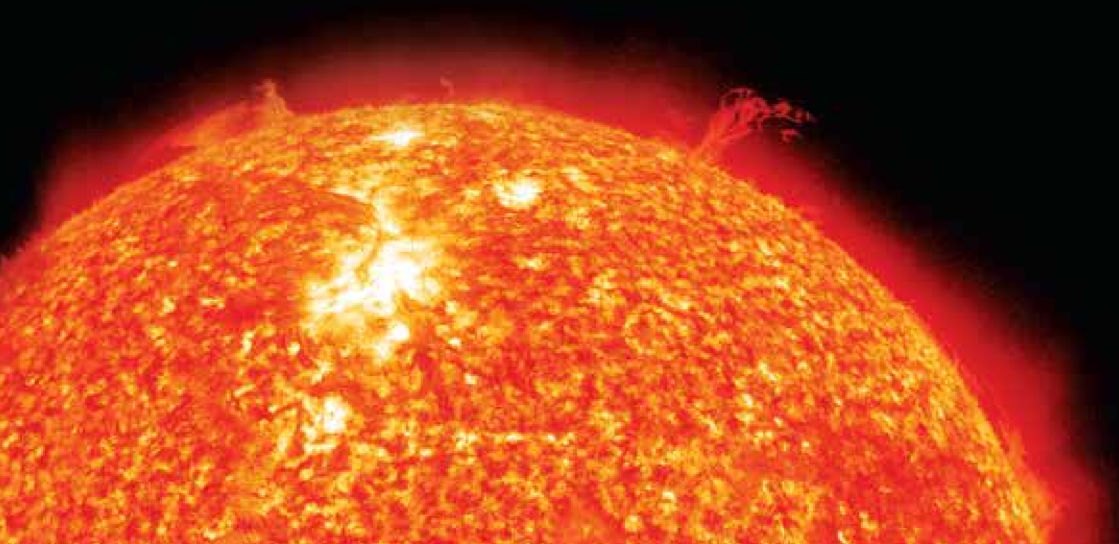
from the Earth, about 4 times farther than the Moon

Spacecraft

Space-based, observatory-class solar probe

Aditya-L1 is the first space-based observatory-class Indian solar mission to study the Sun. The spacecraft is planned to be placed in a halo orbit around the Lagrangian point 1 (L1) of the Sun-Earth system, which is about 1.5 million km from the Earth. A satellite placed in the halo orbit around the L1 point has the major advantage of continuously viewing the Sun without any occultation/eclipse. This will provide a greater advantage of observing the solar activities continuously.
The spacecraft will carry seven payloads to observe the photosphere, chromosphere, and the outermost layers of the Sun (the corona) using electromagnetic and particle detectors. Using the special vantage point of L1, four payloads will directly view the Sun and the remaining three payloads will carry out in-situ studies of particles and fields at the Lagrange point L1.

The suit of Aditya L1 payloads are expected to provide most crucial information to understand the problems of coronal heating, Coronal Mass Ejection, pre-flare and flare activities, and their characteristics, dynamics of space weather, study of the propagation of particles, fields in the interplanetary medium, etc.

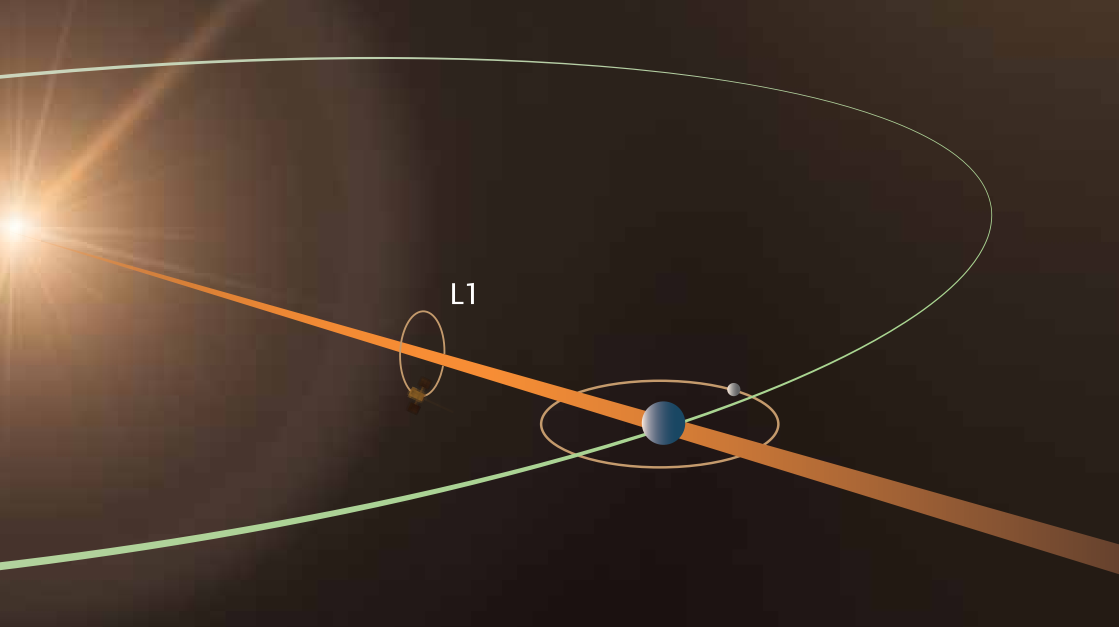


The Spacecraft

Lagrange Points

For a two-body gravitational system, the Lagrange Points are the positions in space where a small object tends to stay, if put there. These points in space for a two-body system such as Sun and Earth can be used by the spacecraft to remain at these positions with reduced fuel consumption.

Technically at Lagrange point, the gravitational pull of the two large bodies equals the necessary centripetal force required for a small object to move with them. For two-body gravitational systems, there are total five Lagrange points, denoted as L1, L2, L3, L4, and L5. The Lagrange point L1 lies between Sun-Earth line. The distance of L1 from Earth is approximately 1% of the Earth-Sun distance.



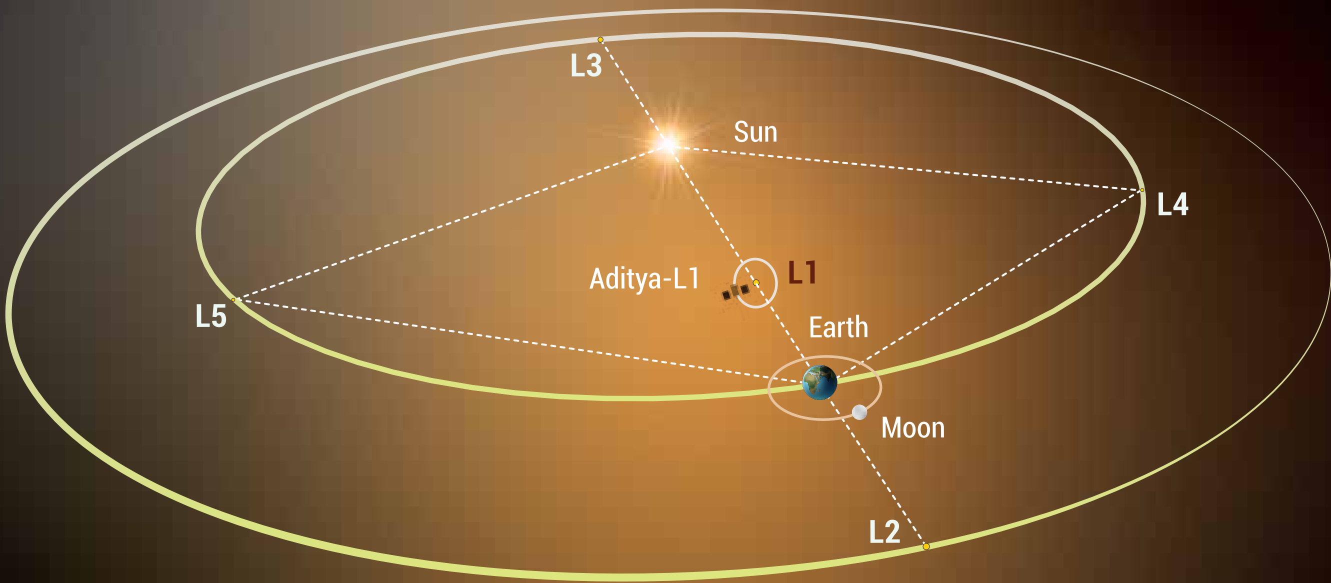
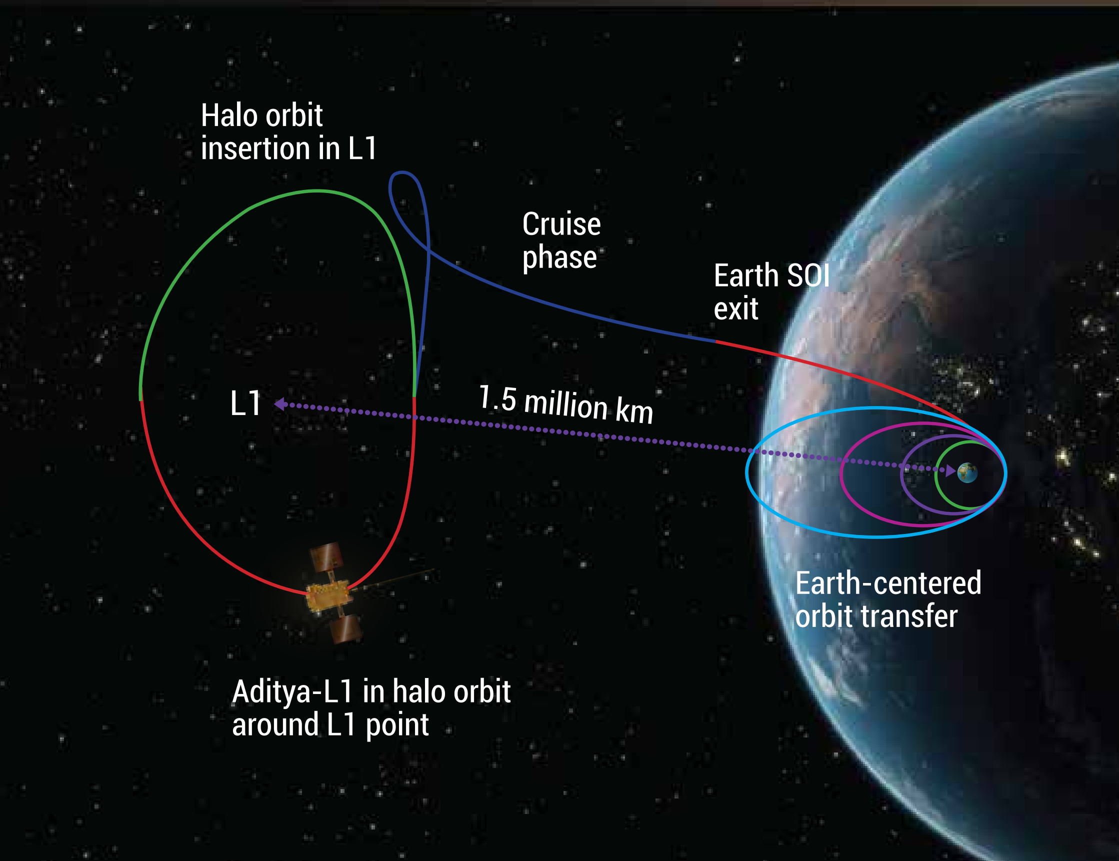


Illustration of all five Lagrange points of Sun-Earth system. Aditya-L1 will be placed around Largrange point 1

Trajectory to L1

The Aditya-L1 mission will be launched by ISRO's PSLV XL rocket from Satish Dhawan Space Centre SHAR (SDSC-SHAR), Sriharikota. Initially, the spacecraft will be placed in a Low Earth Orbit. Subsequently, the orbit will be made more elliptical and later the spacecraft will be launched towards the Lagrange point (L1) by using onboard propulsion.

As the spacecraft travels towards L1, it will exit the Earths' gravitational Sphere of Influence (SOI). After exit from SOI, the cruise phase will start and subsequently the spacecraft will be injected into a large halo orbit around L1. The total travel time from launch to L1 would take about four months for Aditya-L1. The Trajectory of Aditya-L1 mission is shown in the figure below.



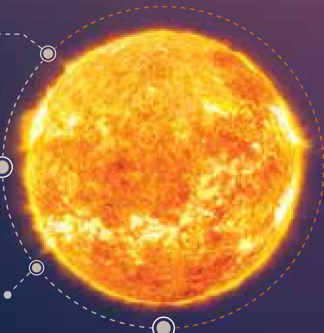
Major Science Objectives

GET A DEEPER UNDERSTANDING OF THE SUN

- Coronal heating and solar wind acceleration
- Coupling and dynamics of the solar atmosphere
- Solar wind distribution and temperature anisotropy
- Initiation of Coronal Mass Ejection (CME), flares, and near-earth space weather

Uniqueness of Aditya-L1

- First-time spatially resolved solar disk in the near UV band
- CME dynamics close to the solar disk (~from 1.05 solar radius) thereby providing information in the acceleration regime of CME, which is not observed consistently
- Onboard intelligence to detect CMEs and solar flares for optimised observations and data volume
- Directional and energy anisotropy of solar wind using multi-direction observations



Science Payloads

The spacecraft carries seven scientific payloads for systematic study of the Sun. All payloads are indigenously developed in collaboration with various ISRO Centres.

VELC

Visible Emission Line Coronagraph is designed to study solar corona and dynamics of coronal mass ejections. The payload is developed by **Indian Institute of Astrophysics**, Bengaluru in close collaboration with ISRO.

SUIT

Solar Ultra-violet Imaging Telescope to image the Solar Photosphere and Chromosphere in near Ultra-violet (UV) and, to measure the solar irradiance variations in near UV. The payload is developed by **Inter University Centre for Astronomy and Astrophysics**, Pune in close collaboration with ISRO.

SoLEXS

HEL1OS

Solar Low Energy X-ray Spectrometer and **High Energy L1 Orbiting X-ray Spectrometer** are designed to study the X-ray flares from the Sun over a wide X-ray energy range. Both these payloads are developed at **U R Rao Satellite Centre**, Bengaluru.

ASPEX

PAPA

Aditya Solar wind Particle EXperiment and **Plasma Analyser Package for Aditya** payloads are designed to study the solar wind and energetic ions, as well as their energy distribution. ASPEX is developed at **Physical Research Laboratory**, Ahmedabad. PAPA is developed at **Space Physics Laboratory, Vikram Sarabhai Space Centre**, Thiruvananthapuram.

MAG

Magnetometer payload is capable of measuring interplanetary magnetic fields at the L1 point. The payload is developed at **Laboratory for Electro Optics Systems**, Bengaluru.

VELC Payload wrapped in multi-layer insulation

VELC is the prime payload onboard Aditya-L1, designed as a reflective coronagraph with a multi-slit spectrograph.

SUIT Payload

SUIT is a UV telescope to image the solar disk in the near ultra-violet wavelength range.

SoLEXS Payload

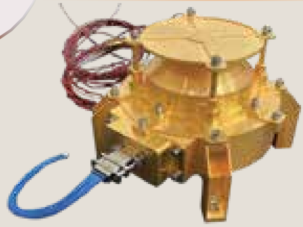
SoLEXS is a soft X-ray spectrometer onboard Aditya-L1. The payload is designed to measure the solar soft X-ray flux to study solar flares.

HEL1OS Payload

HEL1OS is a hard X-ray spectrometer designed to study solar flares in the high energy X-rays.

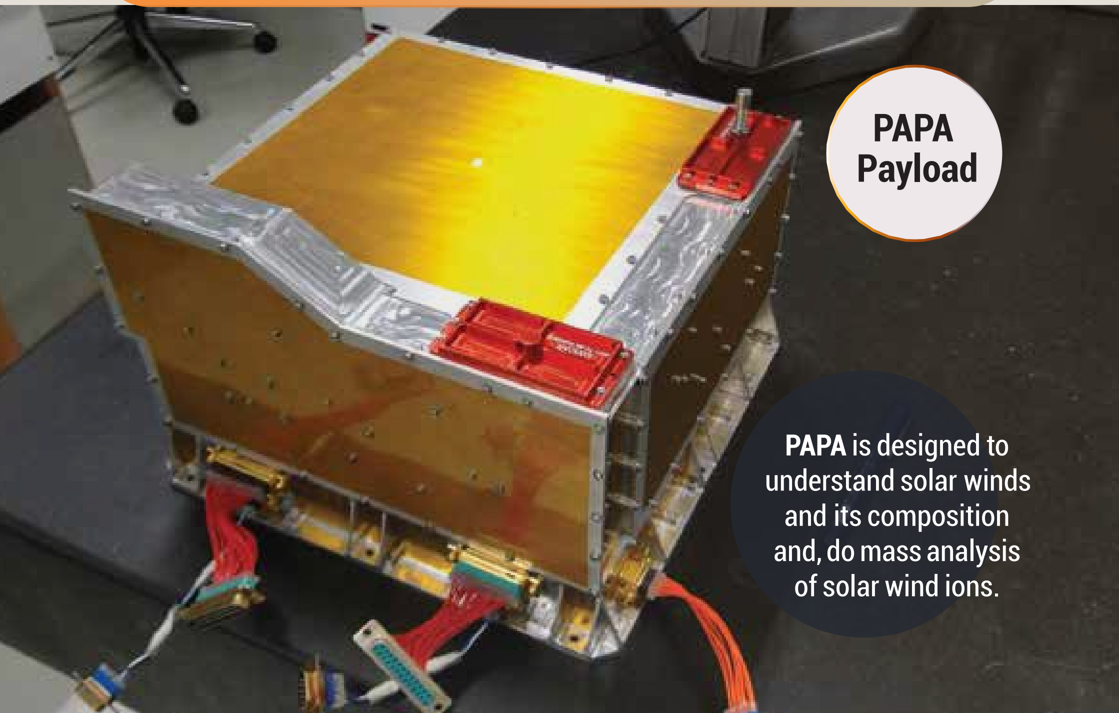
ASPEX Payload

The **ASPEX** payload comprises 2 subsystems: **SWIS** and **STEPS**



SWIS (Solar Wind Ion Spectrometer) is a low-energy spectrometer that is designed to measure the proton and alpha particles of the solar wind.

STEPS (Suprathermal and Energetic Particle Spectrometer) is a high-energy spectrometer that is designed to measure high-energy ions of the solar wind.

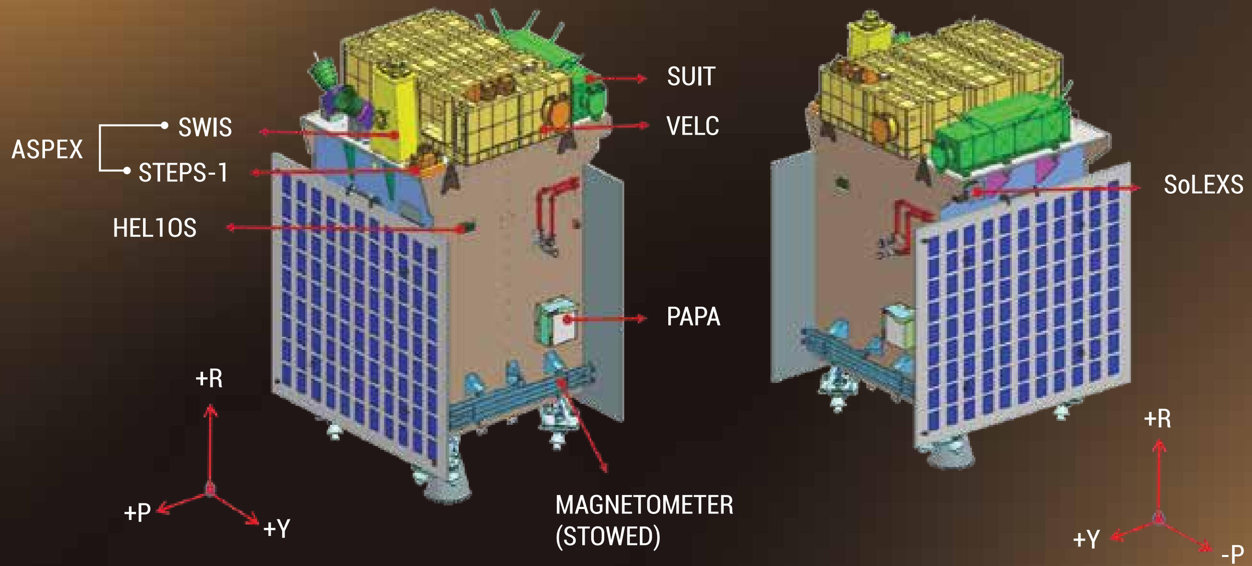


PAPA Payload

PAPA is designed to understand solar winds and its composition and, do mass analysis of solar wind ions.

Aditya-L1 Payloads On The Spacecraft

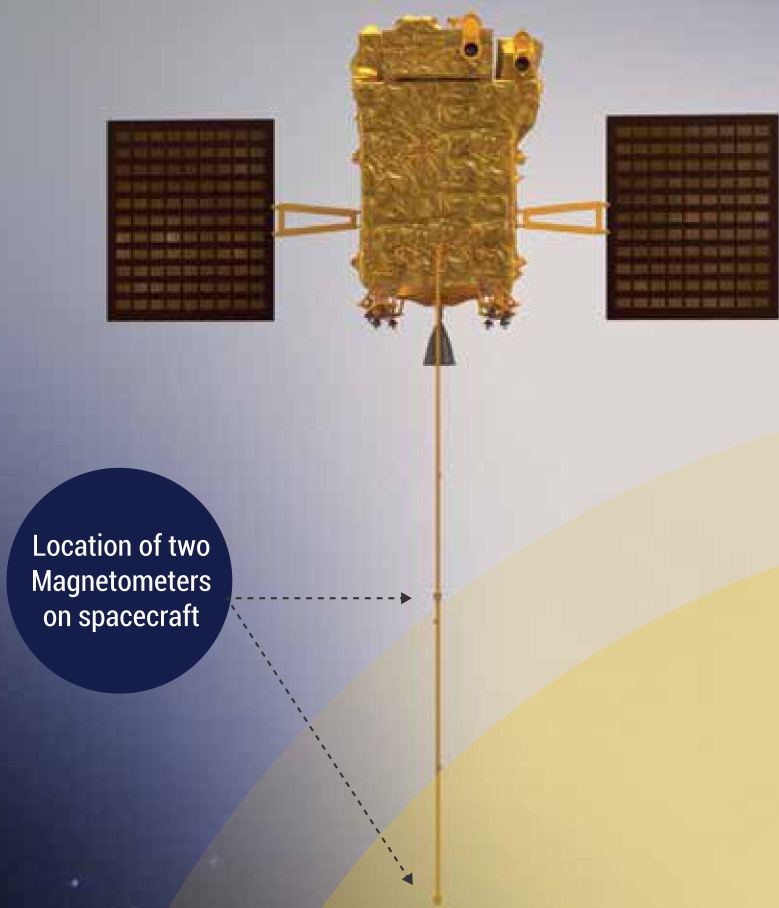
The location of all seven payloads—VELC, SUIT, SoLEXS, HEL1OS, ASPEX, PAPA and MAG are shown in the figure below.



R, P, and Y indicate the Raw, Pitch, and Roll axis of the spacecraft.

Magnetometer (MAG) onboard Aditya-L1 is meant to measure the low intensity interplanetary magnetic field in space. It has two sets of Magnetic Sensors: one at the tip of a 6 meter deployable boom, and the other in the middle of the boom, 3 meters away from the spacecraft.

MAG Payload



ADITYA-L1

To be launched by

PSLV XL

Indian Space Research Organisation
Department of Space, Government of India
Antariksh Bhavan, New BEL Road, Bengaluru-560094, India