समझौता ज्ञापन

MEMORANDUM OF UNDERSTANDING

Between

BIHAR STATE DISASTER
MANAGEMENT AUTHORITY
BIHAR

BIHAR MAUSAM SEWA KENDRA
PLANNING & DEVELOPMENT DEPARTMENT
BIHAR

AND

अंतरिक्ष उपयोग केंद्र
SPACE APPLICATIONS CENTRE
भारतीय अंतरिक्ष अनुसंधान संगठन
INDIAN SPACE RESEARCH ORGANISATION
अहमदाबाद AHMEDABAD

On

COLLABORATIVE RESEARCH IN EARTH SCIENCES

जनवरी २०२५ January 2025

This Memorandum of Understanding (hereinafter referred to as the 'MoU') is made and executed at Ahmedabad on this 11th day of January, 2025.

By and Between

Space Applications Centre, through its authorised signatory, Shri Nilesh M. Desai, Director, SAC, Ahmedabad - 380015 having headquarter located at Bengaluru (hereinafter referred to as "**SAC**" which terms or expression shall, unless excluded by or repugnant to the subject or context, mean and include its successor-in-office, administrators or permitted assignees) of the First Part;

And

Bihar State Disaster Management Authority, through its authorised signatory, Mohd. Waris Khan (IAS), Secretary, BSDMA located at Sardar Patel Bhawan, 5th Floor, D&E Block, Nehru Path, Patna – 800 023, Government of Bihar (hereinafter referred to as "**BSDMA**" which terms or expression shall, unless excluded by or repugnant to the subject or context, mean and include its successor-in-office, administrators or permitted assignees) on the Second Part;

And

Bihar Mausam Seva Kendra, through its authorised signatory, Dr. C N Prabhu, Director located at Sardar Patel Bhawan, Patna – 800 023, Government of Bihar (hereinafter referred to as "**BMSK**" which terms or expression shall, unless excluded by or repugnant to the subject or context, mean and include its successor-in-office, administrators or permitted assignees) on the Other Part;

BSDMA, BMSK and SAC are hereinafter collectively referred to as the "parties" and individually as the "party".

Preamble

Whereas, SAC is a lead R&D centre of ISRO carrying out diverse design and development activities in the field of space-borne payloads for communication satellites, optical and microwave remote sensing satellites, navigation satellites, scientific & planetary satellite payloads and associated ground applications for various ISRO missions aimed at national development;

Whereas, SAC is also involved in the design and realization of ground segment and user segment hardware, mathematical models/algorithms/techniques and software for various applications covering diverse areas of communication, navigation, land resources, meteorology, oceanography, environment monitoring and disaster management as well as space sciences;

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Whereas, SAC is continuously engaged in developing algorithms for parameter retrieval from satellite data, satellite data processing for weather applications, hydrology, geoscience and environment applications, and satellite data assimilation in the models. The conventional and satellite observations available from ISRO and other national and international agencies are used to improve model predictions. Met-ocean data visualisation and dissemination to the public is done through the MOSDAC web portal (www.mosdac.gov.in) and land-based products and applications with visualisation and analysis is available on VEDAS web portal (www.vedas.sac.gov.in).

Bihar State Disaster Management Authority (BSDMA), is a statutory body created under the provisions of the Disaster Management Act, 2005 passed by the Parliament. As per the provisions of the Act, Bihar State Disaster Management Authority has been created at the state level, located in Patna-800023. The Hon'ble Chief Minister of Bihar heads BSDMA as the Chairperson, there is a full-time Vice-Chairperson and four members. BSDMA has successfully carried out several measures focused on Disaster Risk Reduction (DRR) and mitigation. It has undertaken a lot of pioneering works in the field of policy planning and implementation, hazard-specific early warning, training and capacity building, awareness, etc with adequate and appropriate use of the latest technological tools like AI/ML, IoT, Augmented Reality, and Virtual Reality (AR-VR) etc. An innovative and unique technology-driven Multi-Hazard Early Warning Dissemination System has also been conceptualised and developed by BSDMA for communicating customised event-specific early warnings directly to individuals or groups in hazard vulnerable areas. BSDMA has been giving special emphasis on saving the lives of Children, women, and differently abled children in the state.

Bihar Mausam Sewa Kendra (BMSK), a registered Society affiliated to the Planning and Development Department, Government of Bihar, was established to provide hydro-meteorological forecasts and advisories to all the stakeholders and public in Bihar. It has developed an ICT-enabled platform for providing actionable weather services to all the Departments/Institutions engaged in monitoring and mitigating the impact of natural disasters and providing Science and Technology inputs for designing and implementing sector-specific DRR programs. The Centre has established a dense network of weather monitoring stations comprising Automatic Weather Stations (AWS) at the Block level and Automatic Rain Gauge Stations (ARG) at the Panchayath level in Bihar. The high spatial and temporal resolution weather data collected through the network is being utilized for monitoring variations in weather conditions and generating and disseminating alerts about high-impact weather events to the stakeholders. Also, the BMSK has been generating high-resolution weather forecasts and disseminating them to the end users through the "Mausam Bihar" mobile App.

The BSDMA and BMSK work in tandem to harness the potential of science and technology-driven tools and techniques for developing and executing Disaster Risk Reduction (DRR) measures in Bihar.

This MoU defines the mode and methodology of collaborative work and spells out the responsibilities of the parties.

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ARTICLE–1: OBJECTIVES OF MoU

BSDMA and BMSK recognize the importance of utilising the latest developments in earth science applications for developing accurate early warning systems on a real-time basis besides upgrading the skills of its personnel in meteorology, hydrology, geoscience, environment, etc. BSDMA and BMSK also recognise that by virtue of their focus on current technologies, SAC is an organization with 'State-of-the-art' infrastructure and a set of highly accomplished and reputed scientists. The purpose of this collaboration would be to synergise the expertise of SAC with the mandate given by the Government to the BSDMA and BMSK to optimally utilise the benefits of rapid development in Satellite Technology.

Therefore, in consideration of the mutual understanding and goodwill, SAC Ahmedabad, and BSDMA, Patna and BMSK, Patna hereby agree to sign a Memorandum of Understanding (MoU) on mutually agreed scope/terms hereinafter mentioned.

ARTICLE-2: SCOPE OF MoU

This MoU defines the broad framework of interaction and engagement of the parties (SAC, Ahmedabad, BSDMA and BMSK, Patna) and spells out the rights and responsibilities of the parties hereto. The broad scope of MoU includes the following areas but is not limited to:

1. Use of satellite data on a near real-time basis for developing and issuing Early Warnings for Hydro-Meteorological Hazard and Disaster in Bihar state.
2. To design and develop an AI/ML based framework for Weather/Flood forecasts.
3. Sharing of hydro meteorological in-situ data for development and validation of satellite-based applications.
4. Development of a flood forecasting model for natural riverine flood for selected river basins of Bihar with special emphasis on swath altimeter observations.
5. Development of a customized downscale system for urban heatwave monitoring and forecasting for selected cities in Bihar using satellite measurements.
6. Framework for air quality monitoring and forecasting by integrating remote sensing data with ground-based sensor observations of pollutants (including SPM) and other meteorological parameters.
7. Development of Digital Twin using very high-resolution satellite data (DSM, DTM, Ortho-image) for Urban flood visualization and simulation.
8. Development of a Customized Drought Monitoring Portal for Bihar on VEDAS Platform.
9. Exploring the traditional knowledge and methods of weather monitoring and forecasting.
10. Monitoring of crustal deformation and earthquake hazard potential assessment over Himalaya adjacent to Bihar state.
11. Assessment and monitoring of land degradation and demarcation of process-based vulnerability zoning.

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10. Socio-economic assessment study to measure the impact of weather forecast.
11. Specialized training and capacity building for use of space-based observations and models in different applications.

ARTICLE-3: SHARING OF FACILITIES/ RESPONSIBILITIES

SAC, BSDMA and BMSK shall encourage interactions between personnel, scientists, research fellows, and faculty members through the following arrangements: -

1. BSDMA and BMSK will share the in-situ data with SAC for satellite instrument calibration as well as the retrieval algorithms validation.
2. Operational use and validation of SAC generated earth science observations by BSDMA and BMSK.
3. Promulgating extensive use of the MOSDAC and VEDAS websites by BSDMA and BMSK for day-to-day operations and rendering frequent feedback on the utility of the products hosted/ required to be hosted.
4. A digital twin visualisation application and drought monitoring application customised to Bihar will be developed on VEDAS Portal and mirrored at BMSK.
5. Conduct short-term specialized training capsules/programs at locations mutually agreed upon.
6. Carrying out validation of earth science models derived parameters using in-situ data by BSDMA and BMSK and sharing the results between two organisations.

SAC Responsibilities

1. Design and development of framework for satellite and model-based weather and flood outlook using latest tools and technologies.
2. Development of AI/ML-based models for automatic urban feature extraction from very high-resolution satellite images.
3. Generation of 3D City Model (LOD-1) from Satellite data and its integration with weather stations and other sensors to develop a digital twin of Patna city.
4. Development of urban inundation visualisation and simulation application.
5. To develop algorithms for monitoring/ forecasting air quality using synergistic satellite and dense ground network observations of pollutants.
6. To generate riverine flood and rainfall forecasts at high spatial and temporal resolution for rainfall-driven selected flood-prone rivers of Bihar.
7. To provide high-resolution (1:12,500) wetland/water bodies maps of Bihar State.
8. Provide land degradation/desertification status maps of Bihar state (1:500K scale) and selected vulnerable districts (1:50K scale).
9. SAC will inform BSDMA and BMSK regarding any updates/changes in the model setup and data flow chain.
10. Provide training to the scientific personnel and engineers nominated by BSDMA or BMSK towards the development, operationalisation, and upgradation of models and utilisation of products developed by SAC, if need be.

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BSDMA with BMSK Responsibilities

1. Providing necessary funds, if required, for procuring suitable DSM, DTM and very high-resolution satellite data, as required for respective applications.
2. Coordination with urban local government bodies for providing GIS data on drainage and sewerage network and associated appurtenances, rain gauges in urban local bodies, soil, etc.
3. Installing and operationalising the AWS/ARG, Water Level Sensors, and any other relevant sensors at appropriate places, if needed.
4. Sharing of output from existing models used for forecasting stormwater flow in rivers, drainage channels, and stormwater drainage networks (if available).
5. Share the details of major rivers for flood forecasting along with long-term (30 years) data of river water level, discharge, bathymetry and cross section at reach scale where flood forecasting is required.
6. Share the in-situ observation of air temperature over the monitoring locations during the past years, which will be used by SAC for developing an urban heat wave prediction model and real-time observations for validation purposes.
7. Provide real-time river water level and discharge data for all the gauging sites along the rivers.
8. Conducting the river survey for the selected river reaches in synchronous with various altimeter passes to estimate river water fluxes.
9. Provide Cross-sectional and Bathymetry data for major rivers in Bihar.
10. Conducting of socio-economic survey on the ground for collecting required information from people.
11. Deputation of technical manpower at SAC for carrying out the developmental work under the scope of this MoU.

Joint Responsibilities and Coordination:

1. Deployment of river water flow and outfall discharge measurement devices.
2. Development of urban flood forecasting models as a pilot task for selected city.
3. Exploring the traditional knowledge and methods of weather monitoring and forecasting
4. Each party shall pursue its own research and operational programs that involve data from other sources.
5. Any disruption in the data and information flow from either side will be intimated to the counterpart.
6. Each party shall appropriately acknowledge the contribution of the other party while publishing the work in National/International journals or any other form.
7. Scientific Personnel of both parties shall meet periodically, at mutually convenient place, for knowledge sharing.
8. Carry out joint exercises for product evaluation.
9. Prepare and submit periodical reports (Quarterly) on the nature of work and the results achieved.
10. Nominate a single point of technical contact from SAC and BSDMA & BMSK side for communication regarding technical/operational activities under the purview of this project for

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each of the thematic components.

General

1. Any amendments to this MoU will be treated as valid and effective if made in writing with the consent of parties of this MoU.
2. Either party will not assign its responsibilities to a third party without the consent of the other parties.
3. This MoU will be in effect as long as there is no breach of responsibilities by the parties or termination by the parties on mutual consent. Parties' obligations if any, will survive even after the termination of MoU.
4. SAC forecasts are meant for research purposes along with the utilization of in-situ data. For all operational weather forecasts, IMD, Ministry of Earth Sciences and for all operational flood forecasts, CWC, Ministry of Jal Shakti are the authorised agencies in the country.

ARTICLE-4: COORDINATION

SAC and BSDMA with BMSK together will cooperate in the following areas: -

1. Operationalisation/ utilisation/ calibration of ISRO developed satellite products.
2. Participate in training programs/workshops conducted at BSDMA with BMSK and SAC.
3. Sharing data in identified areas of mutual interest.

Specific Areas of further coordination include: -

1. Ensuring satellite data products are available to BSDMA and BMSK through dedicated FTP over Internet/ leased lines.
2. SAC provides various space-based parameters to BSDMA and BMSK as described below:

ARTICLE-5: EFFECTIVE DATE AND DURATION

This MoU shall be effective from the date of signing of the MoU and valid for a period of **Three (03)** years from that day and extended further by mutual agreement which shall be in writing and signed by parties.

ARTICLE-6: PRE-CLOSURE

This MoU is signed in the interest of the nation and the mutual professional benefits of the organisations and is valid for the specified period agreed upon therein. However, in the event of any requirement to pre-close this MoU on reasons that warrant such an act, the same may be done with mutual consultations and prior intimation to the affected parties with a notice **not less than three months** in advance. The pre-closure of this MoU shall not be liable for any compensation to or from either of the parties under this MoU.

ARTICLE-7: CONFIDENTIALITY

(a) All information and documents to be exchanged pursuant to the Memorandum of Understanding will be kept confidential by the parties and will be used subject to such terms

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as each party may specify. The parties will not use the information for purposes other than that specified without the prior written consent of the other parties.

(b) All confidential information shall remain the exclusive property of the disclosing party. The parties agree that this MoU and the disclosure of the confidential information do not grant or imply any license, interest, or right to the recipient concerning any intellectual property right of the other parties.

(c) Unpublished information, whether oral, in writing, or otherwise, discovered or conceived by the scientists or technicians and exchanged under the provisions of this MoU will not be transmitted to a third party unless otherwise agreed by the parties in writing.

ARTICLE 8: AMENDMENTS

This MoU represents the understanding between SAC (ISRO) and BSDMA with BMSK in the present circumstances and supersedes any earlier understanding either oral or written hitherto concerning the subject matter of the MoU.

No amendments or modifications of the MoU shall be valid unless it is made in writing and signed by parties and specifically stating the same to be an amendment of the MoU. The modifications / changes shall become part of the MoU from the date on which they are executed unless otherwise agreed to in writing.

ARTICLE-9: FORCE MAJEURE

Force Majeure is an event for which both party parties cannot be held accountable. For events to constitute force majeure, they must be unforeseeable, external to both parties, and unavoidable. Neither party shall bear responsibility for the complete or partial non-performance of any of its obligations, if the non-performance results from such Force Majeure circumstances as Flood, Fire, Pandemic, Earthquake, and other acts of God, as well as War, Military operations, Blockade, Acts or Actions of state Authorities or any other circumstances beyond the control of the parties that might arise after the conclusion of the MoU. In the event of any dispute arising out of Force Majeure wherein any of the parties under this MoU is unable to meet the specific requirement due to reasons beyond the control of the organization, the same may be resolved on mutually agreeable terms and conditions including waiver if applicable with regard to time, space, quantity or quality of the deliverables.

ARTICLE-10: INTELLECTUAL PROPERTY AND PUBLICATIONS

10.1 General Clauses:

(a) Each party will ensure appropriate protection of Intellectual Property Rights (IPR) generated from cooperation under MoU, consistent with laws, rules, and regulations of India.

(b) In case research is carried out solely and separately by the party or the research results are obtained through the sole and separate effort of the party, the party concerned alone will apply for a grant of IPR, and once granted, the IPR will be solely owned by the party concerned.

(c) In case of research results obtained through joint activities, the grant of IPR will be sought by both parties jointly, and once granted these rights will be jointly owned by the parties. The parties shall not assign any rights and obligations arising out of the IPR generated to inventions/activities carried out under the MoU to any third party without the consent of the other party in writing.

10.2 Publication:

Any publication, document, and/or paper arising out of joint work conducted by the parties under this MoU will be jointly owned. The use of the name, logo, and/or official emblem of the parties on any publication document and/or paper will require prior permission from both parties. It may however be ensured that the official emblem and logo are not misused.

ARTICLE-11: DISPUTE SETTLEMENT MECHANISM

All disputes arising between the parties in any way connected with this MoU or regarding the interpretation of the context thereof shall be resolved amicably on mutual consultations and negotiations between the parties. If the matter remains unresolved within 30 days, the same will be referred to Hon'ble Vice Chairman, BSDMA, Govt of Bihar, Additional Chief Secretary, Planning and Development Department, Govt. of Bihar and Director SAC, ISRO whose decision will be final.

Notwithstanding, anything mentioned in the above para, the party to this MoU with written mutual consent may take recourse to any alternative dispute settlement mechanism.

ARTICLE-12: GOVERNING LAW

This MoU shall be governed as per provisions of the Indian Contract Act, of 1872 and other applicable Indian Laws.

ARTICLE-13: MISCELLANEOUS

The headings and sub-headings are inserted for convenience only and shall not affect the construction of this MoU. After this MoU has been signed, all preceding understandings/ negotiations and correspondence pertaining to it shall become null and void.

ARTICLE-14: FOCAL POINTS

The functionaries shall communicate and monitor the progress of work from time to time related to this MoU. Any notices to be given under this MoU shall be sent to the respective functionaries of either party at the address of the parties.

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Space Applications Centre (ISRO)	Bihar State Disaster Management Authority	Bihar Mausam Sewa Kendra, Govt. of Bihar
Sh. Manish Parmar Scientist/Engineer, EPSA 079 – 2691 4028 manish.parmar@sac.isro.gov.in	Sh. Ravi Anand Senior Research Officer +91 – 97984 76894 ravi@bsdma.org	Dr. Abhishek Kumar Mishra Scientific Officer +91 – 7508082367 abhishekkumar.mishra.21@gmail.com

ARTICLE-15: SIGNATURE AND SEAL

This MoU is executed in duplicate with each copy constituting an official version and having equal validity. By signing below, the parties, acting in their duly authorised capacities, agree to execute the terms of this MoU, effective from the date of signing.

In WITNESS WHEREOF the undersigned duly authorized thereto, have signed this MoU.

On behalf of

Space Applications Centre ISRO, Govt. of India	**Bihar State Disaster Management Authority, Govt. of Bihar**	**Bihar Mausam Sewa Kendra, Govt. of Bihar**
By:	By:	By:
Nilesh M. Desai	Mohd. Waris Khan (IAS)	Dr. C N Prabhu
Director, SAC	Secretary, BSDMA	Director, BMSK
Witness:	**Witness:**	**Witness:**
1. (Praveen Gupta)	1.	1.
2. (CP K Thapliyal)	2.	2.