

Memorandum of Understanding

for

Land Use / Land Cover Analysis (Third Cycle) - 2015-2016

between

Deputy Director, RSAA National
Remote Sensing Centre ISRO, Dept.
of Space, Govt. of India, Balanagar,
Hyderabad-500 037.

and

Registrar

Birla Institute of Technology, Mesra

Ranchi, Jharkhand - 835215

(Name of the authorized signatory and
address)

Signed on this day 25th of July Month, Year 2016

1. PREAMBLE

National Remote Sensing Centre, Indian Space Research Organisation (ISRO), Department of Space, Government of India in collaboration with various State, Central Government Departments and Institutions has completed first and second cycle of LULC 50 K interpretation using Resourcesat LISS III data of 2005-06 and 2011-12 respectively using NNRMS Level-III classification system on 1 : 50,000 scale.

Establishing the Natural Resources Repository (NRR) is the overall goal under NNRMS. Reliable database on the spatial spread and monitoring the dynamics of the land use/land cover is the basic prerequisite for planning and implementing various developmental activities. Apart from this, nationwide land use information becomes important from the point of view of addressing changing pattern in land use/land cover in addition to overall reporting on the nation's land use/land cover scenario.

In the current exercise, existing spatial land use/land cover database will be modified to obtain LULC for 2015-16 for the entire country. This will be used as a base layer to arrive at land use/land cover changes from 2005-06 to 2011-12 to 2015-16.

2. PARTIES

2.1 Indenting party:

National Remote Sensing Centre, Indian Space Research Organization (ISRO) under Dept. of Space, Govt. of India, Balanagar, Hyderabad hereinafter called as NRSC.

2.2 Executing party:

1. Birla Institute of Technology (Name of the Partner Institution - PI) Represented by Dr. A.P. Krishna, Registrar with its office located at BIT, Mesra Ranchi, Jharkhand

3. AUTHORISED SIGNATORIES

3.1 For and on behalf of Indenting party (NRSC):

Dr. P.G. Diwakar, Deputy Director, RSA A, NRSC, ISRO, Department of Space, Govt. of India, Balanagar, Hyderabad - 500 037, Telangana.

3.2 For and on behalf of Executing Party(PI):

Dr. A.P. Krishna, Registrar, Birla Institute of Technology (BIT), Mesra

4. FUNCTIONARIES AND CONTACT ADDRESS, PHONE, EMAIL, ETC

4.1 NRSC:

Sl. No	Name	Contact Address	Phone	Email
1	Dr.T. Ravisankar	Group Director LRUM, RSA A NRSC/ISRO, Dept. of Space, Govt. of India, Balanagar, Hyderabad - 500 037	040- 23884214	ravisankar_t@nrsc.gov.in
2	Dr G. Ravi Shankar	Head, Land Use & Cover Monitoring Division, RSA A NRSC/ISRO, Dept. of Space, Govt. of India, Balanagar, Hyderabad - 500 037	040- 23884238	ravishankar_g@nrsc.gov.in

4.2 Partner Institution

Sl. No	Name	Contact Address	Phone	Email
1.	Dr. C. Jeganathan (PI)	Department of Remote Sensing, BIT, Mesra	7763859236	jeganathanc@bitmesra.ac.in
2.	Dr.A.P. Krishna (Co-PI)	-do-	0651-2276003	apkrishna@bitmesra.ac.in
3.	Dr.V.S. Rathore (Co-PI)	-do-	0651-2276003	vsrathore@bitmesra.ac.in
4.	Ms.Richa Sharma (Co-PI)	-do-	0651-2276003	Richa_13@hotmail.com
5.	Mr. Nitish Kr. Sinha (Co-PI)	-do-	0651-2276003	nitish@bitmesra.ac.in

5. EFFECTIVE DATE AND DURATION

5.1 Commencement : This MOU will come into effect from the date of receiving the funds / Satellite data /Bhuvan login credentials.

5.2 Date of Signing :This MoU is signed on this day 25th of July.
(Month), 2016.

Memorandum of Understanding

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5.3 Duration: This MOU will be valid from the details mentioned in section 5.1 with the ending date on **October 31, 2017**.

6. SCOPE OF WORK

The scope of work under this project include updating of land use/land cover vector of 2011-12 using orthorectified three season Resourcesat LISS III data of 2015 - 16 using Bhuvan Web Geo-portal or otherwise. The activities will include Identification and depiction of areas with major changes to arrive at land use/land cover changes from 2005-06 to 2011-12 to 2015-16; preparation of report containing category-wise change statistics; spatial distribution of change and other ancillary information like ground truth point file along with ground photos etc.

7. METHODOLOGY

The land use/land cover vector layer generated from satellite data of 2011-12 will be overlaid on to the orthorectified three-season 2015-16 imagery. This vector layer will be updated by redrawing the boundary of changed areas using the vector tools provided on the Bhuvan Web Geo-portal or otherwise. The land use/land cover vector layer of 2011-12 and orthorectified satellite imagery for 2015-16 along with required legacy information will be made available through Bhuvan geoportal. 20% random sample ground checks need to be undertaken to assess change areas and to improve the accuracy of the maps.

8. DELIVERABLES AND GUIDELINES ON DATA / MAP SECURITY

8.1 Deliverables

- Seamless land use/land cover layer of 2015-16 for each of the districts in geodatabase format (.mdb and .gdb) along with statistics and cross-matrix.
- Land use/land cover change map between 2011-12 and 2015-16 along with change statistics and cross-matrix table;
- Map compositions; point layer in GIS status report for the State.
- Geo-tagged photographs especially for the LULC change areas (to be uplinked to Bhuvan through mobile application provided by NRSC).
- Administrative layer containing district boundary, district name in GIS format.
- Base layer containing major roads, railway line and drainage.
- District-wise/state-wise reports, with specific reference to information to LULC change areas.

B.I.T. Mesra

(name

of the partner Institution) will take action to provide overall security as per applicable law or as may be required to all parts of the Project during the operation phase. The data shall be utilized for the bonafide official purposes only

9. PROJECT SPECIFICATIONS

Parameter and Values for thematic / GIS Database and output for 1:50,000 Scale

A]	Thematic / Cartographic mapping standards	
	Image Registration accuracy (RMS) in meter	12
	Map Projection	Albers Equal Area
	Datum	WGS84
	Position (Planimetric) Accuracy in meter	50
	Minimum Mappable Unit (MMU) in sq. mts.	22,500
	Thematic Accuracy of Classification / Mapping	90/90
B]	GIS Database Standards	
	Spatial Framework	Seamless
	Coordinate units for precision	Meters
	Projection	Albers Equal Area
	Datum	WGS 84
	Minimum frame size for NRR	15' x 15'
	Position (Planimetric) Accuracy in meter	50

10. APPLICABLE DOCUMENTS

Product Realization Plan (Technical Manual) will be prepared by NRSC to enable guidance to the participating scientists in the projects.

11. RESPONSIBILITIES OF EACH PARTY

11.1 Responsibilities of NRSC

1. Will make available the orthorectified satellite data of 2015-16, LULC geodatabase of 2011-12 through Bhuvan.
2. Provide project realization plan (technical manual) and orientation training for the concerned scientists.
3. Provide the cost for satellite data interpretation, ground data collection, IQC/EQC and final geodatabase generation, supervise the implementation, conduct monitoring, and evaluation of the project from time to time.
4. Obtain progress reports, monitoring and evaluation reports etc. and give suitable directions for project implementation.
5. The funds for execution of the project will be released in THREE installments based on the progress of the work for each of the project.
 - The first installment amounting to 40 % of project cost would be released upon receiving the signed MoU for project execution;
 - The second installment (40 %) of the project cost will be released on receipt of Utilization Certificate for the amount released as first installment and on completion of the project.
 - The third installment will be released after submission of project deliverables and utilization certificate for the amount released during second installment.

11.2 Responsibilities of the Partner Institution

1. The partner institution (PI) will nominate a Project Manager who will be the focal point for interaction with NRSC during the course of the project. The project manager will be changed only with the consent of NRSC.
2. Identify a separate team for executing the project along with a project manager. The team members should have specialization related to the project theme.
3. The work should be executed strictly following the technical manual and maintaining high quality standards, which will be checked and certified by the internal quality team exclusively identified by the PI for quality assurance. Prior to final submission of outputs to NRSC, approval of external quality assurance team as identified by NRSC is to be obtained. The QC reports given by internal as well as external teams have to be submitted to NRSC along with the final outputs.
4. Any inaccuracies noticed during quality inspection will have to be corrected to the satisfaction of the functionaries from NRSC (as mentioned at 4.1) / Project Quality Assurance Team without any additional cost.
5. Provide monthly progress report and Utilization Certificate before the release of the installments. A consolidated Utilization Certificate for the total fund received has to be sent to NRSC.
6. NRSC at his discretion will conduct inspection of the work at working place of the Dept. /Organization / University and also carry out field inspection if required. Such inspection will be done by authorized representative(s) from NRSC at such intervals as deemed necessary for which the Dept./Organization/University should provide the transport and necessary facilities.

7. All the deliverables as specified in Clause 8.1 need to be submitted to NRSC, in the prescribed format.
8. The outputs produced by the Dept./Organization/University will be the property of NRSC (ISRO) /DOS and the property / intellectual right vests with ISRO / DOS. The partner institution shall *necessarily take prior permission before sharing the data to any agency and also duly acknowledge NRSC /DOS while publishing.*
9. The monthly progress report in the prescribed format has to be submitted to the respective functionaries at NRSC, in the first week of the following month.
10. The Project Manager is wholly responsible for smooth implementation of the project. In the event if Project Manager is not able to complete the project for what so ever reason, the institution should nominate another person as project manager and arrange for proper handing over and carrying out the unaccomplished project work for smooth functioning of the project.

12. PROJECT SCHEDULE

The detailed schedule for each of the project is given in Annexure -1

13. SCHEDULE OF PRICES

The total cost for carrying out the project is given in Annexure 2 in which fund breakup is provided for each of the activity. Details of the study area are given in Annexure-3.

14. SCHEDULE OF INSTALLATION, SUPPLY AND ACCEPTANCE TEST

- 14.1 The deliverables are to be supplied upon completion of all process steps as mentioned under Clause-7 (Methodology).

14.2 The schedule delivery period for final data for each theme need to be strictly adhered to (as per clause 5.3)

14.3 The responsibility of data accuracy checks and acceptance of the deliverables lies with NRSC.

15. CONSIDERATION

15.1 As per mutually agreed terms and conditions

16. FUNDING & TERMS AND CONDITIONS OF PAYMENT

16.1 *Funding:*

The entire project cost will funded by NRSC, Hyderabad.

16.2 *Terms and conditions of payment :*

As mentioned in Sl.No.5 of section 11.1

17. TRAINING

Orientation training program will be provided by NRSC, schedules of which will be communicated to the participating PIs.

18. WARRANTY

18.1 The contents or the information provided by the PI's to be true and realistic along with supporting ground information.

18.2 PI to guarantee the accuracy and specifications as mentioned under Clause-9 (specifications).

18.3 If any errors are brought out by the Quality team of NRSC within the project duration, the same shall be rectified by PI, if the errors are beyond the specifications.

19. PROJECT MONITORING

Partner Institution will establish a mechanism to monitor the progress under the project and will report to NRSC / ISRO on monthly basis. NRSC/ISRO will carry out periodic review of the progress of work.

20. CONFIDENTIALITY

During the tenure of the agreement and thereafter both Partners undertake on their behalf and on behalf of their employees / representatives / associates to maintain strict confidentiality and prevent disclosure thereof, of all the information and data exchanged/ generated pertaining to work under this agreement for any purposes other than in accordance with this agreement.

21. INTELLECTUAL PROPERTY RIGHTS

Partner Institution shall have to consult NRSC to commercially exploit / use the intellectual property generated in the Projects. In such an event, the fee and royalty and other terms and conditions for the commercial exploitation / use of the aid intellectual property created in the project shall be decided by NRSC, ISRO for which a separate agreement shall be entered into.

During the work envisaged under the agreement in the event of NRSC, ISRO Scientists exploring, inventing or discovering results over than the specific objectivities of the project, NRSC, ISRO and

B.I.T. Mesra (name of the Partner Institution) shall retain absolute rights on such results.

22. CHANGE IN SCOPE OF WORK

No amendment or modification of this agreement shall be valid unless the same is made in writing by both parties and their otherwise representatives and specifically stating the same to be amendment of this agreement. The modification/changes shall be effective from the date on which they are made / executed, unless otherwise agreed to.

23. MODIFICATIONS TO MOU

Any further modifications to this MoU, if required, would be through amendments with mutual consent.

24. FORCE MAJEURE

Neither party shall be held responsible for non-fulfillment of their respective obligation under the agreement due to the exigency of one or more of the unforeseen events such as but not limited to Acts of God, war, flood, earthquake, strike, lockouts, epidemics, riots, civil commotion etc. provided on the occurrence and cessation of any such events, the party affected thereby shall give a notice in writing to other party within one month of such occurrence or cessation. If the force-majeure conditions continue beyond six months, the parties shall then mutually decide about the future course of action.

25. INDEMNITY

B.I.T. Mesra
(name of the Partner Institution) shall exercise reasonable skill, care and diligence in the performance of the contract and indemnify and keep indemnified NRSC/ISRO in respect of any loss, damage or claim howsoever

arising out of or related to breach of contract, statutory duty or negligence by employees, agents or sub-contractors in relation to the performance or otherwise of the services to be provided under this contract.

26. DISPUTE RESOLUTION

26.1 In the event of any dispute or difference between the parties hereto, such disputes or differences shall be resolved amicably by mutual consultation. If such resolution is not possible, then unresolved disputes or differences will be resolved as per latest rules of Government of India on the subject.

26.2 Pending the submission of and/or decision on a dispute, the Parties shall continue to perform all of their obligations under this MOU without prejudice to final decision in regard to dispute

27. Pending the submission of and / or decision on a dispute, difference or claim or until the arbitral award is published; the parties shall continue to perform all of their obligations under this Contract without prejudice to a final adjustment in accordance with such award.

28. Jurisdiction

Any dispute arising out of the MOU or the terms shall be subject to the exclusive jurisdiction of Hyderabad only.

29. Termination: (for Cause, Convenience, and Force Majeure)

During the tenure of the agreement, either Party may terminate and nullify this Agreement/MOU by providing prior written notice of 30 days to the other party for any of the reasons - Cause/convenience/Force Majeure.

29.1 Termination for Convenience: For convenience without assigning any reason.

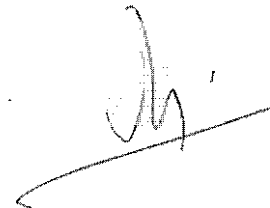
29.2 Termination for Cause: For the breach of any obligations/responsibilities/conditions of this agreement by the other party, with an opportunity to cure/rectify such a situation within thirty (30) days to the defaulting party and no remedial action is taken to the satisfaction of the aggrieved party.

29.3 Termination for Force Majeure: in the event of "Force Majeure" as defined in clause #25.0

29.4 Obligations upon Termination

Following termination or expiration of this Agreement, in addition to any other obligations existing hereunder or otherwise at law or in equity:

- a) The rights and obligations of the parties thereto shall be settled by mutual discussion; the financial settlement if any shall take into consideration not only the expenditure incurred but also the expenditure committed by the parties hereto.
- b) The agreement arrived at between the parties hereto for the utilization of the intellectual property (defined in clause #22.0) shall survive the termination of the agreement



SEAL OF PARTIES

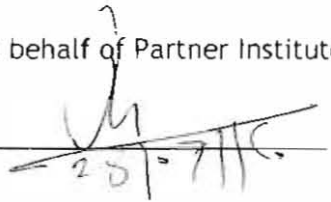
In witness whereof the parties hereto have signed this agreement on the day, month and year mentioned hereinbefore.

THE PARTIES HAVE EXECUTED THIS MEMORANDUM OF UNDERSTANDING (MOU) IN DUPLICATE ON THIS DAY OF _____ IN THE PRESENCE OF WITNESS INDICATED.

Parties

For and on behalf of Partner Institute

Signature



Name Dr. A.P. Krishna, Registrar

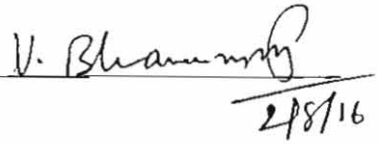
Registrar
Birla Institute of Technology
Mesra, Ranchi

Seal

For and on behalf of PARTY

For and on behalf of NRSC, ISRO,

Signature



Name V. Bhanumurthy

वी. भानुमूर्ति / V. BHANUMURTHY
उप-निदेशक, आरएसएए/Dy. Director, RSAA
राष्ट्रीय सुदूर संवेदन केन्द्र
National Remote Sensing Centre
इसरो, अन्तरिक्ष विभाग, भारत सरकार
ISRO, Dept. of Space, Govt. of India
Seal बालानगर, हैदराबाद/Balanagar, Hyderabad-500 037.

Witnesses: (Name & Address)

1. Dr. C. Jegarathnan
Professor
Department of Remote Sensing
BIT, Mesra

2. Mr. Nitish Kr. Sinha
Department of Remote Sensing
BIT, Mesra

Date: _____

Witnesses (Name & Address)

J. CHANDHA MOHAN
Sci/Engr'SS
National Remote Sensing Centre
ISRO, Dept. of Space, Govt. of India
Balanagar, Hyderabad-500 037

2. Dhiraj Kumar Belhare
Sci"sc", NRO2245

Date: _____

Land Use/Land Cover Analysis (Third Cycle) - Time Schedule

S.No.	Activity	Month
01	Signing of MoUs – Release of First installment of project fund	May, 2016
02	Hands on training	June 2016
03	LULC database creation & Internal Quality Checking (IQC)	Jun – 2016 – May 2017
04	Ground data Collection	Sept.- Dec. 2016
05	Post field interpretation, IQC & External Quality Checking	Nov.- 2016 – May 2017
06	* Ground data collection and IQC	Jan – Mar. 2017
07	Change data base organization	Jun.2017 – Aug. 2017
08	Edge matching and geodatabase finalization	July - Sept. 2017
09	Statistics and report generation and submission of data	Oct. 2017

* Ground data collection for left over areas, if any.

Budget breakup details for Partner Institutions

Name of the State: Bihar (Western Part) and UP (Eastern Part)

Sl. No.	Amount (in Rs.)
I. Bihar:	
1. Analysis cost (Manpower salary including QAS etc.)	9,18,456/-
2. GT Collection (Transport, DA etc.)	1,80,600/-
3. Digital database creation (System cost, Internet Connection, Handset, Data plan etc.)	3,67,920/-
4. Project Management	1,46,664/-
GRAND TOTAL	16,13,640/-
II. UP:	
1. Analysis cost (Manpower salary including QAS etc.)	20,11,856/-
2. GT Collection (Transport, DA etc.)	3,95,600/-
3. Digital database creation (System cost, Internet Connection, Handset, Data plan etc.)	8,05,920/-
4. Project Management	3,21,264/-
GRAND TOTAL	35,34,640/-

Details of Study Area

I. Uttar Pradesh (Eastern Part)

Sl.No.	Name of the Dist.
1	Allahabad
2	Ambedkar Nagar
3	Azamgarh
4	Bahraich
5	Ballia
6	Balrampur
7	Banda
8	Bara Banki
9	Basti
10	Chandauli
11	Chitrakoot
12	Deoria
13	Faizabad
14	Fatehpur
15	Ghazipur
16	Gonda
17	Gorakhpur
18	Hamirpur
19	Jalaun
20	Jaunpur
21	Jhansi
22	Kaushambi
23	Kushinagar
24	Lalitpur
25	Maharajganj
26	Mahoba
27	Mau
28	Mirzapur
29	Pratapgarh
30	Rae Bareli
31	Sant Kabir Nagar
32	Sant Ravi Das Nagar
33	Shravasti
34	Siddharth Nagar
35	Sonbhadra
36	Sultanpur
37	Varanasi

II. Bihar (Western Part)

Sl.No.	Name of the Dist.
1	Aurangabad
2	Bhabua
3	Bhojpur
4	Buxar
5	Darbhanga
6	Gaya
7	Gopalganj
8	Jehanabad
9	Madhubani
10	Muzaffarpur
11	Nalanda
12	Pashchim Champaran
13	Patna
14	Purba Champaran
15	Rohtas
16	Samastipur
17	Saran
18	Sheohar
19	Sitamarhi
20	Siwan
21	Vaishali