



भारत सरकार / Government of India  
परमाणु ऊर्जा विभाग / Department of Atomic Energy  
आर&डी- Iअनुभाग / R&D-I Section

अणुशक्ति भवन/ Anushakti Bhavan  
छ.शि.म. मार्ग / C.S.M. Marg,  
मुंबई / Mumbai - 400 001.

संदर्भ सं/ Ref No.3/6/2012/RRCAT/R&D-I/ 9957

जुलाई/July 03 2018  
Aug

**OFFICE MEMORANDUM**

विषय/Subject: XII Plan (R&D Sector) Project of RRCAT viz. "R&D Activities for High Energy Proton Linac based Spallation Neutron Source" (PIC No.XII-R&D-CAT-4.08-0400).

=====  
Ref: DAE OM No. 3/6/2012/RRCAT/R&D-I/12874 dated 14.12.2012


The undersigned is directed to refer to RRCAT Note No. PLSCD/2017/SCJ dated 19.06.2017 on the captioned subject and to convey the sanction of the President for the following:-

- Downward revision of cost estimate of the XII Plan (R&D Sector) Project of RRCAT viz. "R&D Activities for High Energy Proton Linac based Spallation Neutron Source from Rs 130 crores ( Rupees one hundred and thirty crore only) to Rs 81.00 ( Rupees eighty one crore only) as per the details annexed to this Office Memorandum; and
- Extension of completion date of the project from 31.3.2018 to 31.3.2019.

2. The expenditure is debitable to the following Head of Account:

Major Head	:	5401	-	Capital Outlay on Atomic Energy Research
Minor Head	:	00 206	-	Raja Ramanna Centre for Advanced Technology
Sub-Head	:	72	-	R&D Activities for High Energy Proton Linac based Spallation Neutron Source
Grant number for 2018-19	:	4	-	Atomic Energy

3. This issues with the approval of the Committee chaired by Secretary, DAE in terms of DAE OM No. 7/1(13)/2014-Budget/16391 date 26.12.2014.

  
03.08.2018  
(वाई. कमलाकर/ Y.Kamalakar)

अवर सचिव-भारत सरकार /

Under Secretary to the Government of India

☎ (022) 2286 2541

Director,  
Raja Ramanna Centre for Advanced Technology,  
Indore - 452 013.

संदर्भ सं/ Ref No.3/6/2012/RRCAT/R&D-I/9957

जुलाई/July 03 2018  
Aug.

Copy :

Audit:

1. Dy. Director, Office of Principal Director of Audit, Scientific Departments, Anushakti Bhavan, Mumbai- 400 001.

Department of Atomic Energy, Mumbai:

1. Head, CISD
2. Dr. T. Sakuntala, Member Secretary, IWG (R&D Sector)
3. Budget & Planning Officer

Raja Ramanna Centre for Advanced Technology (RRCAT), Indore-452 013:

1. Shri S.C. Joshi, DS & Director, Proton Accelerator Group.
2. Joint Controller [F&A]

**Specialist Group**

1. Convenor of the Specialist Group-SG-11- 'Laser and Acceleratory Technology'

*Yve*  
08.08.2018

((वाई. कमलाकर/ Y.Kamalakar)

अवर सचिव-भारत सरकार /

Under Secretary to the Government of India

☎ (022) 2286 2541

Copy for sanction folder (XII Plan Projects of RRCAT)

XII Plan (R&D Sector) Project of RRCAT viz. "R&D Activities for High Energy Proton Linac based Spallation Neutron Source" (PIC No.XII-R&D-CAT-4.08-0400).

**I. Details of the project cost:**

Sr No	Object Head	Original Sanction cost (in lakhs)	Revised cost of the project (in lakhs)
1	Salaries	261.00	52.00
2	Domestic Travel Expenses	44.00	18.63
3	Foreign Travel Expenses	55.00	0.25
4	Office expenses	43.00	31.19
5	Supplies & Materials	7283.00	3960.00
6	PP&SS	79.00	0.00
7	Motor Vehicle	15.00	6.00
8	Machinery & Equipment	3220.00	2070.00
9	Major Works	2000.00	1961.93
	<b>TOTAL</b>	<b>13000.00</b>	<b>8100.00</b>


**II. Scheduled date of completion of the project:**

- a) Original : 31.03.2018  
b) Revised: 31.03.2019

Note: i) The revised schedule of Major Milestone is given at **Annex-I**.  
ii) The revised schedule of Machinery & Equipment, Supplies & Materials, Major Works are given at **Annex- II**.

**III PROJECT CO-ORDINATOR:**

Shri S C Joshi, DS& Director, PAG, PLSCD, RRCAT, Indore- 452 013.

  
03.08.2018

((वाई. कमलाकर/ Y.Kamalakar)

अवर सचिव-भारत सरकार /

Under Secretary to the Government of India

☎ (022) 2286 2541

(Annex-1)

Revised Milestones:

No	Quarter	Outcome of the project	Cumulative Physical target (%)
1.	Jan – Mar 2018	<ul style="list-style-type: none"><li>• Testing of five-cell 650 MHz SCRF cavity</li><li>• Development of slit, harp and scanning mechanism for emittance monitor for LEBT.</li></ul>	78
2.	Apr – Jun 2018	<ul style="list-style-type: none"><li>• Fabrication of Horizontal Test Stand (HTS) cryostat.</li><li>• Development of Faraday Cup, Wire scanner and slit &amp; Faraday-cup for characterization of H- Ion source.</li></ul>	85
3.	Jul – Sep 2018	<ul style="list-style-type: none"><li>• Assembly and commissioning of HTS facility</li></ul>	90
4.	Oct – Dec 2018	<ul style="list-style-type: none"><li>• Development of Low Level RF control system.</li><li>• Fabrication of 325 MHz Radio Frequency Quadrupole</li></ul>	95
5.	Jan – Mar 2019	<ul style="list-style-type: none"><li>• Assembly of 325 MHz Radio Frequency Quadrupole.</li><li>• Installation and commissioning of cleanrooms for development of SCRF cavities</li></ul>	100

(Annex - II)

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## Revised schedule for Machinery and Equipments :

Sr. No	Name of the item	Cost of the item (in Lakhs)	Expenditure till Mar-19 (in Lakhs)	Delivery period
1.	SOFTWARE FOR PCB DESIGN WITH FPGA-PCB SYSTEM PLANNER	19.74	19.74	20-Jan-18
2.	CONTROLLER FOR PXIe SYSTEM	17.98	17.98	28-Feb-18
3.	Langmuir Probe with two Probe Head	17.55	17.55	08-May-18
4.	HYDRAULICALLY ACTUATED DIAPHRAGM PUMP	13.98	13.98	10-Feb-18
5.	Dry Compact Multi-stage roots three phase pumps	11.69	11.69	23-Mar-18
6.	Ducts of Direct Current Filtered Cathodic Vacuum ARC	11.23	11.23	23-Jul-17
7.	PULSED FIBER LASER SYSTEM	9.62	9.62	09-Feb-18
8.	ROTARY SERVO DRIVE AND MOTOR SET FOR 15 KW ELECTRON BEAM	7.58	7.58	05-May-18
9.	RESIDUAL GAS ANALYSER AND ACCESSORIES	6.02	6.02	08-May-18
10.	SIGNAL GENERATOR	4.72	4.72	25-Mar-18
11.	ELECTRIC OPERATED PALLET TRUCK	4.56	4.56	19-Feb-18
12.	DETECTOR	4.22	4.22	13-Apr-18
13.	SUPPLY OF MEASURING INSTRUMENTS. APPROVED MAKE MITUTOYO TESA	3.94	3.94	09-Jun-18
14.	Desktop Computers	3.67	3.67	01-Apr-18
15.	FABRICATION, INSTALLATION AND COMMISSIONING OF A STRUCTURE	2.89	2.89	14-Nov-17
16.	DESKTOP PC	2.86	2.86	04-Apr-18
17.	LABORATORY TOOLS	2.69	2.69	15-Feb-18
18.	CONSUMABLES AND SPARE FOR XEROX PHOTOCOPIER MACHINE WC 133	1.89	1.89	19-Jan-18
19.	DC POWER SUPPLIES	1.84	1.84	19-Oct-17
20.	LCD PROJECTOR	1.52	1.52	04-Apr-18
21.	Tri Scroll 300 Pump Tip Seal Set	1.12	1.12	06-Jan-18
22.	Desktop Workstation, Standard PC, Monitor and A4 Size Laser	0.59	0.59	27-Feb-18
23.	Miscellaneous items	3.77	3.77	
24.	6-1/8 ELA Flanged Flexible Line	35.78	34.10	Material recd.
25.	FOUR PORT VECTOR NETWORK ANALYZERS WITH ACCESSORIES	29.82	29.82	Material recd.
26.	COUNTER BALANCED STACKER	14.81	14.81	Material recd.
27.	WET SCRUBBER UNIT	14.80	14.80	Material recd.
28.	Turbo-Molecular Pumping Station (TMPS) with essential access	14.39	11.99	Material recd.
29.	LAPTOP COMPUTER WITH PRE-INSTALLED OPERATING SYSTEM	11.87	11.87	Material recd.
30.	350 KW CHILLER UNIT	47.20	0.05	Material recd.
31.	Electrochemical Type Toxic Gas Sensor & Multi Channel Gas Monitor	7.06	7.06	Material recd.

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Sr. No	Name of the item	Cost of the item (in Lakhs)	Expenditure till Mar-19 (in Lakhs)	Delivery period
32.	THREE PHASE AC CONTROLLER FOR HV DC SUPPLY AND SPARES	6.34	6.34	Material recd.
33.	FOUR CHANNEL DIGITAL ELECTROMETER	6.05	5.80	Material recd.
34.	WATER COOLER CUM PURIFIERS	5.29	5.29	Material recd.
35.	MASS FLOW CONTROLLER AND ITS COMPATIBLE ACCESSORIES WITH	4.59	4.59	Material recd.
36.	DC SERVOAMPLIFIER	4.39	4.39	Material recd.
37.	Vector Network Analyzer	19.91	3.89	Material recd.
38.	Cryo Pump with Compressor and Accessories	15.03	3.18	Material recd.
39.	Item No. 14. Alternate Model Nos	15.92	1.59	Material recd.
40.	HYDRAULIC HAND OPERATED FLOOR CRANE	1.57	1.57	Material recd.
41.	Lightweight Portable Inverter Based TIG Welding Machine	1.48	1.48	Material recd.
42.	USB AVERAGE MICROWAVE POWER SENSOR	15.13	1.44	Material recd.
43.	CONSUMABLES FOR TOFSIMS5	1.42	1.42	Material recd.
44.	High Voltage Discharge Generator with accessories	11.71	1.17	Material recd.
45.	5 TON SINGLE GIRDER TYPE EOT CRANE	11.53	1.15	Material recd.
46.	CERVAC CTR 100 DN16KF CDG 1000Torr	7.63	1.05	Material recd.
47.	CENTRIFUGAL PUMP	0.80	0.80	Material recd.
48.	DESKTOP PC	6.43	0.64	Material recd.
49.	PORTABLE INSULATION TESTER	6.72	0.61	Material recd.
50.	THERMAL IMAGER	4.96	0.50	Material recd.
51.	Tektronix/MDO4104C, MDO4MSO Mixed Signal Oscilloscopes	8.66	0.43	Material recd.
52.	TEKTRONIX DPO7254C	14.40	0.19	Material recd.
53.	MECHANIZED FLOOR CLEANING MACHINE	1.78	0.18	Material recd.
	<b>Total</b>		<b>337.87</b>	

**Revised schedule for Supplies and Materials :**

Sr. No	Name of the item	Cost of the item (in Lakhs)	Expenditure till Mar-19 (in Lakhs)	Delivery period
1.	Fabrication of Horizontal Test Cryostats (with Feedcan)	344.98	344.98	06-Jul-18
2.	ASSEMBLED CABINETS FOR RF AMPLIFIER	105.20	105.20	28-Mar-18
3.	FABRICATION OF RIGID LINE COMPONENTS	31.81	31.81	28-Dec-17

Sr. No	Name of the item	Cost of the item (in Lakhs)	Expenditure till Mar-19 (in Lakhs)	Delivery period
4.	ULTRA HIGH VACUUM COMPATIBLE MULTIPIN FEED-THROUGH	18.27	18.27	15-Mar-18
5.	VIEWING PORTS AND CF FLANGES	14.35	14.35	10-May-18
6.	RF WIDE BAND AMPLIFIER COMPONENTS FOR 1 kW (2 TO 50 MHz)	14.33	14.33	28-Feb-18
7.	Embedded Control and Monitoring Software Suite with vision	14.25	14.25	15-Apr-18
8.	ASSEMBLY & SUPPLY OF RF CIRCUITS	12.01	12.01	19-Apr-18
9.	RF CIRCULATOR	11.74	11.74	19-Apr-18
10.	ANSYS Finite Element Analysis Academic Software	11.04	11.04	22-Feb-18
11.	Fabrication, Testing and Supply of Experimental Liquid Nitro	10.14	10.14	28-May-18
12.	RIGID COAXIAL LINE SECTIONS	9.60	9.60	15-Feb-18
13.	Single Crystal NDYAG Laser Rod	7.86	7.86	05-Oct-17
14.	WIDE BAND RF AMPLIFIER AND MAGNETIC COMPONENTS	7.85	7.85	02-May-18
15.	UPGRADATION OF ANSYS HFSS FEA SOFTWARE	6.61	6.61	17-May-18
16.	Software Development	5.76	5.76	23-Jan-18
17.	Fabrication and supply of Alumina cone shaped tube	4.92	4.92	10-Jan-18
18.	FABRICATION AND SUPPLY OF COMPONENTS OF STRIPLINE - BPM	4.67	4.67	05-Jun-18
19.	STANDARD CON-FLAT FLANGES	4.67	4.67	06-May-18
20.	HIGH VOLTAGE NON INDUCTIVE BULK CERAMIC RESISTORS	4.50	4.50	20-Sep-17
21.	Bursting Disks	4.29	4.29	28-Jun-18
22.	BALL - SCREW AND ACCESSORIES	4.27	4.27	22-Jan-18
23.	Fabrication and Supply of Titanium Adaptor Ring for FP end	3.99	3.99	28-Jan-18
24.	RF LDMOS	3.66	3.66	11-Jun-18
25.	Fabrication and supply of parts of strip - line type BPM	3.57	3.57	30-Mar-18
26.	FLANGE MOUNT RESISTORS & TERMINATION	2.95	2.95	12-Mar-18
27.	Motorized Translation Stages	2.90	2.90	09-Apr-18
28.	Tube Fittings, Instrument Plug and Flow Metering Valves	2.83	2.83	26-Feb-18
29.	2 MHz CURRENT TRANSFORMER	2.70	2.70	09-Jun-18
30.	FABRICATION OF VACUUM CHAMBER WITH STAND & BLANK FLANGES	2.47	2.47	23-Apr-18
31.	HIGH POWER LOW DENSITY FOAM COAXIAL CABLE	2.36	2.36	18-Apr-18
32.	RF SPLITTERS, DIRECTIONAL COUPLER AND FILTER	2.17	2.17	23-Mar-18
33.	SUPPLY OF S5316L STAINLESS STEEL ROUND BARS	2.07	2.07	23-Jan-18

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Sr. No	Name of the item	Cost of the item (in Lakhs)	Expenditure till Mar-19 (in Lakhs)	Delivery period
34.	FABRICATION OF UHV COMPATIBLE RECTANGULAR CHAMBER	2.07	2.07	02-Mar-18
35.	Motorized Translation Stages	1.88	1.88	09-Jun-18
36.	HIGH THERMAL CONDUCTIVITY CERAMIC CYLINDRICAL SHAPED TUBE	1.79	1.79	15-Mar-18
37.	VALVES, FILTERS, GAUGES	1.57	1.57	28-Jan-18
38.	SYSTEM ON CHIP (SOC) BOARD ALONG WITH ADC-DAC ADAPTER MODULE	1.39	1.39	15-Apr-18
39.	HIGH THERMAL CONDUCTIVITY CERAMIC CYLINDRICAL SHAPED TUBE	1.27	1.27	01-May-18
40.	H.V.LDHMW POLYETHYLENE DIELECTRIC SHIELDED CABLES	1.13	1.13	01-Jul-18
41.	FABRICATION AND SUPPLY OF COMPONENTS OF EQUATOR WELDING FIX	1.11	1.11	01-May-18
42.	1000 uF Electrolytic Capacitors	1.01	1.01	01-Apr-18
43.	PASSIVE COMPONENTS AND ICs	0.67	0.67	08-Mar-18
44.	SET OF TUBING TOOLS	0.64	0.64	24-Feb-18
45.	TRIMMER CAPACITORS	0.41	0.41	21-Feb-18
46.	Miscellaneous items	6.64	6.64	
47.	THREE - DIMENSIONAL ELECTROMAGNETIC SOFTWARE SUIT	18.97	18.97	Material recd.
48.	PXI EXPRESS 8 SLOT 3U CHASSIS WITH CONTROLLER AND CARDS	17.53	17.53	Material recd.
49.	HIGH VOLTAGE FLOATING DC POWER SUPPLY	16.37	16.37	Material recd.
50.	SUPPLY, ELECTION, COMMISSIONING AND TESTING OF COMPRESSED	15.00	15.00	Material recd.
51.	ALUMINIUM ALLOY 7075 RECTANGULAR PLATE	14.96	14.96	Material recd.
52.	ALUMINUM PLATE FIN HEAT EXCHANGER	79.58	13.95	Material recd.
53.	Base Band Transceiver	13.88	13.88	Material recd.
54.	FABRICATION OF RF COMPONENTS	12.37	12.37	Material recd.
55.	Altair Hyperworks Finite Element Analysis Software Academic	11.80	11.80	Material recd.
56.	SIMUFACT WELDING UNIVERSITY BUNDLE SOFTWARE	9.91	9.91	Material recd.
57.	REAL-TIME CONTRILLER WITH RECONFIGURABLE FPGA	9.57	9.57	Material recd.
58.	PTC CRED UNIVERSITY PLUS ACADEMIC LAB PACK SOFTWARE	9.26	9.26	Material recd.
59.	TUNGSTEN CATHODE, CATHODE WINDOW WITH O-RING, LENS FOR COLIME	7.21	7.21	Material recd.
60.	Supply, Installation, Testing of Compressed Air Pipe Line network	6.64	6.64	Material recd.
61.	PTFE INSULATEDMULMULTI CORE SHIELDED CABLE HAVING MULTIPLE	6.34	6.34	Material recd.



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Sr. No	Name of the item	Cost of the item (in Lakhs)	Expenditure till Mar-19 (in Lakhs)	Delivery period
62.	Beam Profiler System Compatible with Gig E Interfacing	5.98	5.98	Material recd.
63.	ALUMINIUM ALLOY STRUTS WITH ACCESSORIES	4.30	4.30	Material recd.
64.	RESISTIVE ELEMENT FOR RF LOAD	3.72	3.72	Material recd.
65.	FABRICATION AND SUPPLY OF C-TURNER ASSEMBLY	3.60	3.60	Material recd.
66.	Tool Pre-Setter (Tool measuring machine)	25.16	3.55	Material recd.
67.	SS TANKS & ITS COMPONENTS	3.21	3.21	Material recd.
68.	FABRICATION & SUPPLY OF TITANIUM BELLOWS FOR HB 650 MHZ CAVI	14.93	3.00	Material recd.
69.	HIGH PURITY WATER TREATMENT PLANT	31.78	2.96	Material recd.
70.	High RRR Niobium (RRR300) material	2.41	2.73	Material recd.
71.	Programmable Regulated LV DC Power Supplies	11.58	2.09	Material recd.
72.	Computer Chairs	1.96	1.96	Material recd.
73.	PXI EXPRESS 18 SLOT 3U CHASSIS WITH CONTROLLER & CARDS	19.52	1.95	Material recd.
74.	PXI COMPLIANT FPGA & DATA ACQUISITION CARDS	19.51	1.95	Material recd.
75.	SPARE HARDWARE FOR 15 KW ELECTRON BEAM WELDING MACHINE	19.46	1.95	Material recd.
76.	DC POWER SUPPLIES	1.90	1.90	Material recd.
77.	LAB MATERIAL HANDLING EQUIPMENT	1.42	1.42	Material recd.
78.	-4kVDC, 125 WATTS H V POWER SUPPLY MODULE (HVPS)	1.06	1.06	Material recd.
79.	ACRYLIC 5 - CELL CAVITY	1.04	1.04	Material recd.
80.	RIDGED WAVEGUIDE WR-284	0.97	0.97	Material recd.
81.	INSULATING OIL BREAKDOWN VOLTAGE TESTER	0.85	0.85	Material recd.
82.	CARTRIDGE	0.81	0.81	Material recd.
83.	CONTROLLER BOARD INTEGRATED CIRCUITS (IC)	0.77	0.77	Material recd.
84.	AUTOCAD MECHANICAL SOFTWARE	5.20	0.75	Material recd.
85.	CF 361 A HP 508 A CYAN LASERJET TONER CARTRIDGE	0.74	0.74	Material recd.
86.	AUTOCAD LT COMMERCIAL SOFTWARE	4.68	0.64	Material recd.
87.	PRINTER CARTRIDGES	0.61	0.61	Material recd.
88.	ACIDS AND CHEMICALS	0.58	0.58	Material recd.
89.	TONER CARTRIDGE FOR XEROX WORK CENTRE	0.52	0.52	Material recd.
90.	PROGRAMMABLE DC POWER SUPPLIES	3.46	0.52	Material recd.
91.	YZ TRANSLATION STAGES	0.47	0.47	Material recd.
92.	Burst Disk-Positive Pressure Relief	3.19	0.37	Material recd.
93.	SAFETY RELIEF VALVES	5.58	0.37	Material recd.
94.	RECIRCULATING WATER COOLING SYSTEM	3.57	0.36	Material recd.

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Sr. No	Name of the item	Cost of the item (in Lakhs)	Expenditure till Mar-19 (in Lakhs)	Delivery period
95.	Titanium Tube	0.35	0.35	Material recd.
96.	SPARES FOR HELIUM GAS RECOVERY COMPRESSOR	12.98	0.33	Material recd.
97.	DC Power Supply	2.78	0.27	Material recd.
98.	CORONA RESISTANT KAPTON FILM	2.69	0.27	Material recd.
99.	niobium-titanium material in forged disk form	14.54	0.22	Material recd.
100.	RF CONNECTORS & ADAPTORS	2.15	0.21	Material recd.
101.	CONTROLLER BOARD INTEGRATED CIRCUITS (IC)	0.15	0.16	Material recd.
	<b>Total</b>		<b>949.64</b>	

Revised schedule for Major Works :

Sr. No	Name of the item	Cost of the item (in Lakhs)	Expenditure Till Mar-19 (in Lakhs)	Delivery period
1.	Electrification of Cavity testing facility extension at RRCAT, Indore. [MW]	20.29	20.29	30-July-18
	<b>Total</b>	<b>20.29</b>	<b>20.29</b>	

**BY FAX**

Government of India  
Department of Atomic Energy  
R&D-I Section

Anushakti Bhavan,  
C.S.M. Marg,  
Mumbai- 400 001.  
☎ (022) 2286 2762  
e-mail – rd1@dae.gov.in

No.3/8/2012/RRCAT/R&D-I/12740

December 12, 2012

**OFFICE MEMORANDUM**

Subject: XII Plan (R&D Sector) Project of RRCAT viz. "Enhancement of Indus Synchrotron user facility" (PIC No.XII-R&D-CAT-5.06-0100).  
=====

The undersigned is directed to refer to RRCAT Note No.RRCAT/PCC/MSO/2012/231 dated 11.7.2012 and subsequent e-mails on the captioned subject and to convey the sanction of the President to an expenditure not exceeding Rs.117.00 crore (Rupees one hundred and seventeen crore only) with Foreign Exchange (FE) component of Rs.79.00 crore (Rupees seventy nine crore only) on the XII Plan (R&D Sector) Project of Raja Ramanna Centre for Advanced Technology (RRCAT), Indore titled "Enhancement of Indus Synchrotron user facility" as per the details annexed to this Office Memorandum.

2. The expenditure is debitable to :

Major Head	:	5401	-	Capital Outlay on Atomic Energy Research
Minor Head	:	00 206	-	Raja Ramanna Centre for Advanced Technology
Sub-Head	:	61	-	Enhancement of Indus Synchrotron User Facility
Grant number for 2012-13	:	4	-	Atomic Energy

3. This issues with the approval of Atomic Energy Commission.

*Smt. Saroja Gopal*  
(Smt. Saroja Gopal)

Under Secretary to the Government of India  
☎ (022) 2282 5303 / 2541

Director,  
Raja Ramanna Centre for Advanced Technology,  
Indore – 452 013.

: 2 :

No.3/8/2012/RRCAT/R&D-II/12740

December / 2 , 2012.

Copy :

Audit:

1. Dy. Director, Office of Principal Director of Audit, Scientific Departments, Anushakti Bhavan, Mumbai- 400 001.

Department of Atomic Energy. Mumbai:


1. Head, MSG
2. Dr. T. Sakuntala, Member Secretary, IWG (R&D Sector)
3. Officer on Special Duty (Budget)
4. Officer on Special Duty (R&D-II)

Raja Ramanna Centre for Advanced Technology (RRCAT), Indore-452 013:.

1. Dr. S.K. Deb, SO/H, ISUD and Plan Project Co-ordinator
2. Dr.(Smt.) M.S. Oak, SO/G & Head, Planning and Co-ordination Cell – with a request to ensure necessary compliance to the instructions contained in the office order No. 03/2011/2887 dated 16.3.2011 issued by Secretary, DAE and sent to all Head of Units regarding monitoring progress of Plan Projects of DAE.
3. Joint Controller [F&A]

Specialist Group

1. Convenor of the Specialist Group-SG-11- 'Laser and Acceleratory Technology'

  
(Smt. Saroja Gopal)  
Under Secretary to the Government of India  
☎ (022) 2282 5303 / 2541

Copy for sanction folder (XII Plan Projects of RRCAT)

XII Plan (R&D Sector) Project of RRCAT viz. "Enhancement of Indus Synchrotron user facility" (PIC No.XII-R&D-CAT-5.06-0100).

## I. Details of the project cost :

(Rs. in crore)

Sr.No	Object Head	Estimated cost (FE component)		
		XII Plan	XIII Plan	Total
1	Machinery & Equipment	84.73	1.40	86.13 (72.76)
2	Supplies & Materials	23.84	1.64	25.48 (6.24)
3	Major Works			
	a) Civil Works	1.00	0.00	1.00
4	Salaries	2.19	0.86	3.05
5	Domestic Travel	0.35	0.05	0.40
6	Foreign Travel	0.31	0.04	0.35
7	Office Expenses	0.25	0.01	0.26
8	Motor Vehicle	0.33	0.00	0.33
	<b>TOTAL :</b>	<b>113.00</b>	<b>4.00</b>	<b>117.00</b> <b>(79.00)</b>

## II Manpower:

Sl. No.	Post	No. of Post
1	Scientific	05
2.	Technical	19
3.	Auxiliary	03
4.	Administrative	02
	<b>Total:</b>	<b>29</b>

**Note: 1. Separate sanction of the Department is required for creation of the above posts.**

**2. Proposal for creation of posts shall be sent to DAE within three months of the sanction.**

III. Scheduled date of completion of the project : **March 2018.**

**Note :** The schedule of Major Milestones, Machinery & Equipment, Supplies & Materials and Major work are given at Annexure - I, Annexure-II and Annexure-III respectively.

IV. **PROJECT COORDINATOR:**

Dr. S.K. Deb, SO/H, ISUD, RRCAT, Indore - 452 013.

*Smt. Saroja Gopal*  
31/12/2012  
(Smt. Saroja Gopal)

Under Secretary to the Government of India

**ANNEXURE-I**

DAE OM No.3/8/2012/RRCAT/R&amp;D-I/

December , 2012.

XII Plan (R&D Sector) Project of RRCAT viz. "Enhancement of Indus Synchrotron user facility" (PIC No.XII-R&D-CAT-5.06-0100).

**Major Milestones**

No.	Year & Quarter	Major Milestones Falling in the Quarter	Financial Target (Rs in Cr)
1.	2012-13 / Q1 (Apr-Jun 2012)	Nil	8.00
2.	2012-13 / Q2 (Jul-Sep 2012)	Nil	
3.	2012-13 / Q3 (Oct-Dec 2012)	<ul style="list-style-type: none"> <li>• Optical design and Ray Tracing of the beamline for engineering applications</li> <li>• Renew of the license of ADF software</li> <li>• Installation of Si(111) crystal pair in the ADXRD beamline</li> </ul>	
4.	2012-13 / Q4 (Jan-Mar 2013)	<ul style="list-style-type: none"> <li>• Optical design and Ray Tracing of the ARPES beamline</li> <li>• Procurement of sputter ion pumps with power supplies for new frontends</li> </ul>	
5.	2013-14 / Q1 (Apr-Jun 2013)	<ul style="list-style-type: none"> <li>• Procurement of Titanium sublimation pump with power supplies</li> </ul>	30.00
6.	2013-14 / Q2 (Jul-Sep 2013)	<ul style="list-style-type: none"> <li>• Procurement of UHV valves, shutters and other UHV components for FEs</li> </ul>	
7.	2013-14 / Q3 (Oct-Dec 2013)	<ul style="list-style-type: none"> <li>• Setup of material synthesis facilities (Bulk and thin films),</li> <li>• Procurement of AFM system</li> <li>• Fabrication of refractive X-ray lens and their testing on Indus-2</li> </ul>	
8.	2013-14 / Q4 (Jan-Mar 2014)	<ul style="list-style-type: none"> <li>• Installation of two bending magnet front-ends</li> <li>• Installation and Commissioning of reflectometer for Soft X-Ray reflectivity beamline</li> </ul>	
9.	2014-15 / Q1 (Apr-Jun 2014)	<ul style="list-style-type: none"> <li>• Installation of the laser scanning microscope</li> <li>• Optical design and Ray Tracing of the XMCD beamline</li> </ul>	
10.	2014-15 / Q2 (Jul-Sep 2014)	<ul style="list-style-type: none"> <li>• Setup of facilities for the single crystal diffraction at the ADXRD beamline</li> <li>• Installation of the powder XRD system</li> <li>• Procurement of the mirrors for the ARPES beamline</li> </ul>	

11.	2014-15 / Q3 (Oct-Dec 2014)	<ul style="list-style-type: none"> <li>• Procurement of the high field, low temperature setup for electrical and magnetic properties measurements</li> <li>• Development of ferroelectric and magnetic thin film characterization Lab</li> <li>• Procurement of experimental station and other vacuum chambers, mirror systems, detectors etc. for engineering applications beamline</li> </ul>	
12.	2014-15 / Q4 (Jan-Mar 2015)	<ul style="list-style-type: none"> <li>• Installation of two planer undulator front-ends</li> <li>• Procurement of ARPES Experimental station for the ARPES beamline</li> <li>• Installation of Laser pattern generator and double side mask aligner</li> <li>• Procurement of the double crystal monochromator mirror mounts and mirrors for the beamline for engineering applications</li> </ul>	
13.	2015-16 / Q1 (Apr-Jun 2015)	<ul style="list-style-type: none"> <li>• Procurement of other vacuum chambers mirror mounting stages etc. for the ARPES beamline</li> <li>• Procurement of the monochromator for the ARPES beamline</li> </ul>	
14.	2015-16 / Q2 (Jul-Sep 2015)	<ul style="list-style-type: none"> <li>• Installation of front-end for the wavelength shifter</li> <li>• Validation and commissioning of white light interferometer and confocal profilometer</li> <li>• Installation and commissioning of Long Trace Profiler</li> </ul>	24.00
15.	2015-16 / Q3 (Oct-Dec 2015)	<ul style="list-style-type: none"> <li>• Design and procurement of detector setup for soft X-Ray beamline</li> <li>• Commissioning of the double multilayer monochromator</li> </ul>	
16.	2015-16 / Q4 (Jan-Mar 2016)	<ul style="list-style-type: none"> <li>• Mechanical assembly of the ARPES beamline, experimental station installation and alignment and the installation of the hutches</li> <li>• Fabrication of photomask of critical dimension ~ 5µm</li> <li>• Performance testing of masks on Indus-2 X-ray Lithography Beamline</li> </ul>	
17.	2016-17 / Q1 (Apr-Jun 2016)	<ul style="list-style-type: none"> <li>• Procurement of the monochromator for the XMCD beamline</li> <li>• Installation of EDS &amp; Low temperature holder on existing TEM</li> </ul>	16.00

18.	2016-17 / Q2 (Jul-Sep 2016)	<ul style="list-style-type: none"> <li>• Setup of the Raman measurement system</li> <li>• Up gradation of e-beam and Ion beam deposition system</li> </ul>	
19.	2016-17 / Q3 (Oct-Dec 2016)	<ul style="list-style-type: none"> <li>• Mechanical assembly of the beamline, experimental station installation and alignment and the installation of the hutches for the beamline for engineering applications</li> <li>• Installation of order sorter for soft X-Ray beamline</li> </ul>	
20.	2016-17 / Q4 (Jan-Mar 2017)	<ul style="list-style-type: none"> <li>• Installation of one undulator front-end</li> <li>• Fabrication of diffractive x-ray optics structures using direct write techniques and DRIE system</li> <li>• Upgradation of the XRF microprobe beamline with focusing mirror optics and detectors</li> <li>• Procurement of focusing mirrors for XMCD beamline</li> </ul>	
21	2017-18 / Q1 (Apr-Jun 2017)	<ul style="list-style-type: none"> <li>• Test experiments on the beamline for engineering applications</li> </ul>	4.00
22	2017-18 / Q2 (Jul-Sep 2017)	<ul style="list-style-type: none"> <li>• Assembly of the XMCD beamline components and the installation of hutch</li> </ul>	
23	2017-18 / Q3 (Oct-Dec 2017)	<ul style="list-style-type: none"> <li>• Mechanical assembly of the XMCD, experimental station installation and alignment</li> </ul>	
24	2017-18 / Q4 (Jan-Mar)	<ul style="list-style-type: none"> <li>• Test experiments on XMCD beamline</li> </ul>	



DAE OM No.3/8/2012/IRRCAT/R&amp;D-VI

XII Plan (R&amp;D Sector) Project of RRCAAT viz. "Enhancement of Indus Synchrotron user facility" (PIC No. XII-R&amp;D-CAT-5.06-0100).

**Schedule of Machinery & Equipment (M&E):**

Sr. No.	Item Description	Estimated Cost (Lakhs)	Scheduled date of Indenting (mm/yy)	Likely date of delivery (mm/yy)	Phasing of Expenditure (Rs in Lakhs)						Import Yes / No	
					1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year	XIII Plan		
1	Mirror mounting systems for the pre and post focusing mirrors for Soft X-Ray beamline	275	Already indented	Jan-14	275							Yes
2	Mirror mounting systems for the pre and post focusing mirrors for Angle resolved PES beamline	250	Apr -13	Mar-15	250					250		Yes
3	Mirror mounting systems for the pre and post focusing mirrors for XMCD beamline	250	Jan-15	Jan-17						250		Yes
4	PES experimental stage	600	July-12	Feb-16	500		100					Yes
5	Soft X-Ray monochromator for ARPES beamline	500	July-13	Dec-16			450		50			Yes
6	Soft X-Ray monochromator for MCD beamline	500	July-14	Oct-17					450		50	Yes
7	UHV valves and Fast shutters	370	May -12	Aug-15	200						170	Yes
8	Double crystal Monochromator for beamline for engineering applications	350	Apr -13	July-15			300		50			Yes

: 2 :

9	Experimental Station for engineering applications beamline	300	Apr -13	May-15		250	50			Yes
10	Soft X-Ray Reflectometer	270	Already indented	Nov-13	270					Yes
11	Sputter-Ion Pumps with power supplies	250	Already indented	Mar-15	140	110				No
12	High field, low temperature electrical and magnetic properties measurement setup	250	Dec-12	May-15		200	50			Yes
13	Mechanism for order sorter	250	June-13	June-16			200	50		Yes
14	Mirrors for beamline for engineering applications	150	July-13	Mar-15		150				Yes
15	Powder XRD system	135	Dec-12	Sep-14		135				Yes
16	Atomic Force Microscope for optics testing	130	June-12	Dec-13	130					Yes
17	X-Ray CCD for ADXRD beamline	150	Dec-12	Jul-14		150				Yes
18	Double side mask aligner	120	July-13	Mar-15		120				Yes
19	Other components costing less than 100 Lakhs	3512.5			342	967	546.5	347	90	Mixed
	<b>Total</b>	<b>8612.5</b>			<b>482</b>	<b>3132</b>	<b>1616.5</b>	<b>1147</b>	<b>140</b>	

DAE OM No.3/8/2012/RRCAT/R&amp;D-I/

XII Plan (R&amp;D Sector) Project of RRCAT viz. "Enhancement of Indus Synchrotron user facility" (PIC No.XII-R&amp;D-CAT-5.06-0100).

**Schedule of Supplies & Materials (S&M):**

Sr. No.	Item Description	Estimated Cost (Lakhs)	Scheduled date of indenting (mm/yy)	Likely date of delivery (mm/yy)	Phasing of Expenditure (Rs in Lakhs)					Import Yes / No
					1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year	
1	Water-cooled shutters	150	June -12	May-16	15	85		50		No
2	Hutches for beamlines	120	June-12	Feb-18	30			45		No
3	Residual Gas Analyzers with control units	100	Aug-12	Aug-16		60		40		Yes
4	Other components costing less than 100 Lakhs	2177.5			229	699	275.5	539	316	Mixed
	<b>Total</b>	<b>2547.5</b>			<b>274</b>	<b>844</b>	<b>275.5</b>	<b>674</b>	<b>316</b>	<b>164</b>

**Schedule of Major Works (MW) :**

No.	Item Description	Estimated Cost (Lakhs)	Scheduled date of indenting (mm/yy)	Likely completion date (mm/yy)	Phasing of Expenditure (Rs in Lakhs)					Remarks
					1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year	
1	Upgradation of clean room	40	Aug-12	Mar-14	25	15				
2	Utilities for the labs in users building	37	June-15	Mar-17		2	10	10	15	
3	Partition of rooms for making labs	23	June-15	Mar-16		3	10	10		
	<b>Total</b>	<b>100</b>			<b>25</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>15</b>	<b>0</b>

53

Government of India  
Department of Atomic Energy  
R&D-I Section

BY FAX

Anushakti Bhavan,  
C.S.M. Marg,  
Mumbai- 400 001.  
☎ (022) 2286 2762  
e-mail – rd1@dae.gov.in

No.3/2/2013/RRCAT/R&amp;D-I/8/08

June 27, 2013

OFFICE MEMORANDUM

Subject: XII Plan (R&D Sector) project of RRCAT "Infra-red Free Electron Laser Based Beam Lines and their Applications in Materials Research" (PIC No.XII-R&D-CAT-4.08-0200)

\*\*\*\*\*

The undersigned is directed to refer to RRCAT Note No.RRCAT/PCC/MSO/2012/XII-Plan/490 dated 5.12.2012 and subsequent e-mail dated 18.4.2013 on the captioned subject and to convey the sanction of the President to an expenditure not exceeding ₹ 45 crore (Rupees forty five crore only) with Foreign Exchange (FE) component of ₹ 31.40 crore (Rupees thirty one crore forty lakh only) on the XII Plan (R&D Sector) project of Raja Ramanna Centre for Advanced Technology (RRCAT), Indore titled "Infra-red Free Electron Laser Based Beam Lines and their Applications in Materials Research" as per the details annexed to this Office Memorandum.

2. The expenditure is debitable to :

Major Head	:	5401	-	Capital Outlay on Atomic Energy Research
Minor Head	:	00 206	-	Raja Ramanna Centre for Advanced Technology
Sub-Head	:	55	-	Infra-red Free Electron Laser Based Beam Lines and their Applications In Materials Research
Grant number for 2013-14	:	4	-	Atomic Energy

3. This issues with the approval of Member for Finance, AEC as conveyed vide Note No. JS(F)/RRCAT//20/53 dated 21.6.2013.

(Saroja Gopal)

Under Secretary to the Government of India  
☎ (022) 2282 5303

Director,  
Raja Ramanna Centre for Advanced Technology,  
Indore – 452 013.

: 2 :

No.3/2/2013/RRCAT/R&amp;D-II/8108

June 27, 2013.

Copy :Audit:

1. Dy. Director, Office of Principal Director of Audit, Scientific Departments, Anushakti Bhavan, Mumbai- 400 001.

Finance :

1. Director (Finance).

Department of Atomic Energy, Mumbai:

1. Head, MSG
2. Dr. T. Sakuntala, Member Secretary, IWG (R&D Sector)
3. Officer on Special Duty (Budget)
4. Under Secretary (R&D-II)

Raja Ramanna Centre for Advanced Technology (RRCAT), Indore-452 013:.

1. Dr. S.B. Roy, SO/H & Head, Materials & Advanced Accelerator Sciences Division and Plan Project Co-ordinator
2. ✓ Dr.(Smt.) M.S. Oak, SO/G & Head, Planning and Co-ordination Cell – with a request to ensure necessary compliance to the instructions contained in the Office Order No. 03/2011/2887 dated 16.3.2011 issued by Secretary, DAE regarding monitoring progress of Plan Projects of DAE.
3. Joint Controller [F&A]

Specialist Group

1. Convenor of the Specialist Group-SG-11 – 'Laser & Accelerator Technology'.

  
(Saroja Gopal)

Under Secretary to the Government of India  
☎ (022) 2282 5303

Copy for sanction folder (XII Plan Projects of RRCAT)

: 3 :

DAE OM No.3/2/2013/RRCAT/R&amp;D-I/ 8108

June 27, 2013.

XII Plan (R&D Sector) Project of RRCAT "Infra-red Free Electron Laser Based Beam Lines and their Applications in Materials Research" (PIC No.XII-R&D-CAT-4.08-0200)

## I. Details of the project cost :

(₹ in Crore)

Sr. No	Object Head	Estimated cost		
		XII Plan	XIII Plan	Total
1.	Machinery & Equipment	11.56	12.55	24.11 (22.30)
2.	Supplies & Materials	9.01	3.63	12.64 (9.10)
3.	Major Works			
	(a) Civil works	4.08	1.74	5.82
	(b) Electrical works	0.50	0.74	1.24
	(c) Mechanical works	0.48	0.00	0.48
4.	Domestic Travel	0.24	0.04	0.28
5.	Foreign Travel	0.26	0.08	0.34
6.	Office Expenses	0.08	0.01	0.09
	Total	28.21	18.79	45.00 (31.40)

II. Scheduled date of completion of the project : 31<sup>st</sup> March 2019.

Note : The schedule of Major Milestones, Machinery & Equipment, Supplies & Materials and Major works are given at Annex-I and Annex-II respectively.

III. PROJECT COORDINATOR:

Dr. S.B. Roy, SO/H & Head, Materials & Advanced Accelerator Sciences Division and Plan project Co-ordinator



(Saroja Gopal)

Under Secretary to the Government of India

Annex-IMajor Milestones

No.	Year & Quarter	Major Milestones Falling in the Quarter	Financial Target (Rs In Cr)
1.	2012-13 / Q1 (Apr-Jun 2012)	• Finalization of specifications and raising indents for the magneto-optical cryostats for FEL and laboratory based THz spectroscopy.	0.00
2.	2012-13 / Q2 (Jul-Sep 2012)	• Finalization of specifications and raising indents for optical tables for the FEL and laboratory based set-up for THz Spectroscopy.	
3.	2012-13 / Q3 (Oct-Dec 2012)	• Finalization of specifications and raising indents for non-magnetic X-ray diffractometer.	
4.	2012-13 / Q4 (Jan-Mar 2013)	• Finalization of specifications for klystron pulse modulator.	
5.	2013-14 / Q1 (Apr-Jun 2013)	• Design of high power RF system for IR-FEL.	4.46
6.	2013-14 / Q2 (Jul-Sep 2013)	• Finalization of specifications and raising indents for high power microwave line components.	
7.	2013-14 / Q3 (Oct-Dec 2013)	• Finalization of specifications and raising indent for magnet-cryostat system for XRD studies at low temperatures (5 K – 300 K) and in high magnetic fields (up to 50 kOe).	
8.	2013-14 / Q4 (Jan-Mar 2014)	• Testing of electron beam diagnostic systems on experimental beamline. • Raising indent for klystron pulse modulator.	
9.	2014-15 / Q1 (Apr-Jun 2014)	• Finalization of specifications and raising indent for the cryostat for Ultrasonic Resonance Spectroscopy.	5.54
10.	2014-15 / Q2 (Jul-Sep 2014)		
11.	2014-15 / Q3 (Oct-Dec 2014)	• Finalization of specifications and raising indent for the femtosecond laser and spectrometer for laboratory based THz spectroscopy.	
12.	2014-15 / Q4 (Jan-Mar 2015)	• Finalization of specifications and raising indent for thermionic electron gun.	
13.	2015-16 / Q1 (Apr-Jun 2015)	• Installation and commissioning of klystron pulse modulator.	6.01
14.	2015-16 / Q2 (Jul-Sep 2015)	• Installation and commissioning of the magneto-optical cryostats for FEL and laboratory based THz spectroscopy.	
15.	2015-16 / Q3 (Oct-Dec 2015)	• Installation and commissioning of high power microwave line.	
16.	2015-16 / Q4 (Jan-Mar 2016)	• Finalization of specifications and raising indent for the spectrometer and other equipments for FEL based THz spectroscopy.	
17.	2016-17 / Q1 (Apr-Jun 2016)	• Designing of the probes and sample fixtures required for Ultrasonic Resonance Spectroscopy.	10.2
18.	2016-17 / Q2 (Jul-Sep 2016)	• Initiation of the process toward the commissioning of IRFEL beam lines for multiple users.	
19.	2016-17 / Q3 (Oct-Dec 2016)	• Installation and commissioning of the cryostat for Ultrasonic Resonance Spectroscopy.	

Signature  
12/10/2013

20.	2016-17 / Q4 (Jan-Mar 2017)	<ul style="list-style-type: none"> <li>Development of infrastructure including users' building for IR FEL-based experiment users.</li> <li>Installation and commissioning of the non-magnetic X-ray diffractometer.</li> </ul>	
21.	2017-18/Q1 (Apr-Jun 2017)	<ul style="list-style-type: none"> <li>up for XRD studies at low temperatures (5 K – 300 K) and in high magnetic fields (up to 50 kOe).</li> <li>Commissioning of IRFEL beam lines for users.</li> </ul>	
22.	2017-18/Q2 (Jul-Sep 2017)	<ul style="list-style-type: none"> <li>Establishment of the experimental set-up for Ultrasonic Resonance Spectroscopy.</li> </ul>	11.00
23.	2017-18/Q3 (Oct-Dec 2017)	<ul style="list-style-type: none"> <li>Installation and commissioning of the Spectrometer and femtosecond Laser for the Laboratory based set-up for THz Spectroscopy.</li> </ul>	
24.	2017-18/Q4 (Jan-Mar 2018)	<ul style="list-style-type: none"> <li>Installation and commissioning of thermionic electron gun for IR-FEL upgrade</li> </ul>	
25.	2018-19/Q1 (Apr-Jun 2018)	<ul style="list-style-type: none"> <li>Establishment of Laboratory based set-up for THz Spectroscopy at temperatures from 5 to 300 K and in fields up to 70 kOe.</li> </ul>	
26.	2018-19/Q2 (Jul-Sep 2018)		7.79
27.	2018-19/Q3 (Oct-Dec 2018)	<ul style="list-style-type: none"> <li>Commissioning of IR-FEL at higher average powers</li> </ul>	
28.	2018-19/Q4 (Jan-Mar 2019)	<ul style="list-style-type: none"> <li>Establishment of FEL based set-up for IR-THz Spectroscopy at temperatures from 5 to 300 K and in magnetic fields up to 70 kOe,</li> </ul>	

*Handwritten signature and date: 27/11/2013*



Annex-IISchedule of Machinery & Equipment (M&E) (₹ In Lakhs):

No	Item Description	Estimated Cost (Lakhs)	Scheduled date of indenting (mmmm/yyyy)	Likely date of delivery (mmmm/yyyy)	Phasing of Expenditure (Rs in Lakhs)						Import Yes / No		
					1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>m</sup> Year	6 <sup>th</sup> Year XIII Plan		7 <sup>th</sup> year XIII plan	
1	Magneto-optical cryostats for THz Spectroscopy	275	June 2012	April 2015		275						Yes	
2	Thermionic electron gun	291	Mar 2015	Jan 2018					291			Yes	
3	Non-magnetic X-ray diffractometer (XRD)	211	Oct 2012	Sept 2016					211			Yes	
4	Magnet cryostat system for XRD	232	Dec 2013	Jan 2016					212	20		Yes	
5	Femtosecond laser and spectrometer for laboratory based THz spectroscopy	211	Dec 2014	June 2017						211		Yes	
6	Cryostat for Ultrasonic Resonance Spectroscopy	105	April 2014	May 2016					95	10		Yes	
7	Spectrometer and other equipments for FEL based THz spectroscopy	406	Mar 2016	Oct 2018							406	Yes	
8	Pre-buncher RF source	189	Mar 2016	Dec 2018							189	Yes	
9	Miscellaneous	491	April 2012	March 2018			158	14	96	103	25	Both	
	<b>Total</b>	<b>2411</b>				<b>0</b>	<b>95</b>	<b>158</b>	<b>289</b>	<b>614</b>	<b>635</b>	<b>620</b>	

27/06/2013  


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**BY FAX**

Government of India  
Department of Atomic Energy  
R&D-I Section

Anushakti Bhavan,  
C.S.M. Marg,  
Mumbai- 400 001.  
☎ (022) 2286 2762  
e-mail – rd1@dae.gov.in

No.3/7/2012/RRCAT/R&D-I/13029

December 17, 2012

**OFFICE MEMORANDUM**

Subject: XII Plan (R&D Sector) Project of RRCAT viz. "High Power Lasers and laser-plasma interaction in high density and ultra-high intensity regimes" (PIC No.XII-R&D-CAT-4.09-0200).  
=====

The undersigned is directed to refer to RRCAT Note No.RRCAT/PCC/MSO/2012/231 dated 11.7.2012 and subsequent e-mails on the captioned subject and to convey the sanction of the President to an expenditure not exceeding Rs.94.00 crore (Rupees Ninety four crore only) with Foreign Exchange (FE) component of Rs.69.89 crore (Rupees sixty nine crore eighty nine lakhs only) on the XII Plan (R&D Sector) Project of Raja Ramanna Centre for Advanced Technology (RRCAT), Indore titled "High Power Lasers and laser-plasma interaction in high density and ultra-high intensity regimes" as per the details annexed to this Office Memorandum.

2. The expenditure is debitable to :

Major Head	:	5401	-	Capital Outlay on Atomic Energy Research
Minor Head	:	00 206	-	Raja Ramanna Centre for Advanced Technology
Sub-Head	:	58	-	High Power Lasers and Laser-Plasma Interaction in High Density and Ultra High Intensity Regimes.
Grant number for 2012-13	:	4	-	Atomic Energy

3. This issues with the approval of Atomic Energy Commission.

  
(Smt. Saroja Gopal)

Under Secretary to the Government of India  
☎ (022) 2282 5303 / 2541

Director,  
Raja Ramanna Centre for Advanced Technology,  
Indore – 452 013.

: 2 :

No.3/7/2012/RRCAT/R&D-II/13029

December 17, 2012.

Copy :

Audit:

1. Dy. Director, Office of Principal Director of Audit, Scientific Departments, Anushakti Bhavan, Mumbai- 400 001.

Department of Atomic Energy, Mumbai:

1. Head, MSG
2. Dr. T. Sakuntala, Member Secretary, IWG (R&D Sector)
3. Officer on Special Duty (Budget)
4. Officer on Special Duty(R&D-II)

Raja Ramanna Centre for Advanced Technology (RRCAT), Indore-452 013:.

1. Dr. Prasad A. Naik, SO/H & Head, LPD and Plan Project Co-ordinator
- ✓ 2. Dr.(Smt.) M.S. Oak, SO/G & Head, Planning and Co-ordination Cell – with a request to ensure necessary compliance to the instructions contained in the office order No. 03/2011/2887 dated 16.3.2011 issued by Secretary, DAE and sent to all Head of Units regarding monitoring progress of Plan Projects of DAE.
3. Joint Controller [F&A]

Specialist Group

1. Convenor of the Specialist Group-SG-11- 'Laser and Acceleratory Technology'

(Smt. Saroja Gopal)

Under Secretary to the Government of India

☎ (022) 2282 5303 / 2541

Copy for sanction folder (XII Plan Projects of RRCAT)

XII Plan Project of RRCAT viz. "High Power Lasers and laser-plasma interaction in high density and ultra-high intensity regimes" (PIC No.XII-R&D-CAT-4.09-0200).

I. Details of the project cost :

(Rs. in crore)

Sr.No	Object Head	Estimated cost (FE component)		
		XII Plan	XIII Plan	Total
1	Machinery & Equipment	64.61	1.30	65.91 (54.89)
2	Supplies & Materials	13.77	5.13	18.90 (15.00)
3	Major Works			
	a) Civil Works	5.80	0.00	5.80
	b) Electrical & ACVE	1.20	0.00	1.20
4	Salaries	1.13	0.43	1.56
5	Domestic Travel	0.19	0.06	0.25
6	Foreign Travel	0.12	0.04	0.16
7	Office Expenses	0.11	0.04	0.15
8	Motor Vehicle	0.07	0.00	0.07
	<b>TOTAL :</b>	<b>87.00</b>	<b>7.00</b>	<b>94.00</b> <b>(69.89)</b>

II Manpower:

Posts	Total No. of posts	Pay Band and Grade Pay
Scientific Officer/C	4	15600-39100 with Grade Pay Rs.5400/-
Scientific Assistant/B	6	9300-34800 with Grade Pay Rs.4200/-
Technician/B	1	5200-20200 with Grade Pay Rs.2000/-
Attendants'A'	3	5200-20200 with Grade pay Rs.1800/-
DC	1	5200 - 20200 with Grade pay Rs.2400/-
<b>TOTAL</b>	<b>15</b>	

**Note: 1.** Separate sanction of the Department is required for creation of the above posts.

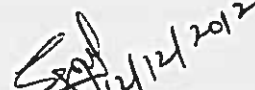
**2.** Proposal for creation of posts shall be sent to DAE within three months of the sanction.

III. Scheduled date of completion of the project : March 2018.

**Note :** The schedule of Major Milestones, Machinery & Equipment, Supplies & Materials and Major work are given at Annexure - I, Annexure-II, Annexure-III and Annexure-IV respectively.

IV. **PROJECT COORDINATOR:**

Dr. Prasad A. Naik, SO/H & Head, LPD, RRCAT, Indore - 452 013.

  
(Saroja Gopal)

Under Secretary to the Government of India

**ANNEXURE-I**

DAE OM No.3/7/2012/RRCAT/R&amp;D-I/

December , 2012

XII Plan Project of RRCAT viz. "High Power Lasers and laser-plasma interaction in high density and ultra-high intensity regimes" (PIC No.XII-R&D-CAT-4.09-0200).

**Major Milestones**

No.	Year & Quarter	Major Milestones Falling in the Quarter	Financial Target (Rs in Cr)
1.	2012-13 / Q1 (Apr-Jun 2012)	<ul style="list-style-type: none"> <li>Collecting details about PW laser</li> </ul>	3.00
2.	2012-13 / Q2 (Jul-Sep 2012)	<ul style="list-style-type: none"> <li>Finalization of the building plan</li> </ul>	
3.	2012-13 / Q3 (Oct-Dec 2012)	<ul style="list-style-type: none"> <li>Design and fabrication of involute reflectors</li> </ul>	
4.	2012-13 / Q4 (Jan-Mar 2013)	<ul style="list-style-type: none"> <li>Technology for anti reflection coating of laser rods and disks of various sizes</li> <li>Design of compact high power multi-pass amplifier</li> <li>Design of mechanical housing of PEPC</li> </ul>	
5.	2013-14 / Q1 (Apr-Jun 2013)	<ul style="list-style-type: none"> <li>Time resolved x-ray diffraction based shock studies</li> <li>Mechanical design of 2x2 array amplifiers</li> </ul>	12.00
6.	2013-14 / Q2 (Jul-Sep 2013)	<ul style="list-style-type: none"> <li>Setting up of 10 kHz regenerative amplifier, preamplifier and compressor</li> <li>Use of involute reflectors in rod amplifier and its characterization</li> </ul>	
7.	2013-14 / Q3 (Oct-Dec 2013)	<ul style="list-style-type: none"> <li>Fabrication and testing of High resolution electron beam energy spectrograph</li> <li>Procurement of diode bars and other accessories for high rep rate amplifiers</li> </ul>	
8.	2013-14 / Q4 (Jan-Mar 2014)	<ul style="list-style-type: none"> <li>Design of high rep rate OPA</li> <li>Fabrication of PEPC</li> </ul>	
9.	2014-15 / Q1 (Apr-Jun 2014)	<ul style="list-style-type: none"> <li>Upgradation of computer simulation lab</li> </ul>	
10.	2014-15 / Q2 (Jul-Sep 2014)	<ul style="list-style-type: none"> <li>Fabrication of 2x2 array amplifier prototype</li> <li>Fabrication of the multi-pass amplifier</li> </ul>	18.00
11.	2014-15 / Q3 (Oct-Dec 2014)	<ul style="list-style-type: none"> <li>Offline studies on rep-rate optical parametric amplifier to achieve stability of output</li> <li>Setting up a particle-in-cell code for simulations</li> </ul>	
12.	2014-15 / Q4 (Jan-Mar 2015)	<ul style="list-style-type: none"> <li>Construction of laboratory building with clean room and radiation shielding</li> <li>Fabrication and testing of vacuum compressor chamber for the PW laser</li> <li>Anti reflection coating of indigenous rods</li> </ul>	
13.	2015-16 / Q1 (Apr-Jun 2015)	<ul style="list-style-type: none"> <li>Testing and characterization of the multi-pass amplifier</li> <li>Fabrication of the high rep rate amplifier prototype</li> </ul>	
14.	2015-16 / Q2 (Jul-Sep 2015)	<ul style="list-style-type: none"> <li>Testing and characterization of the high rep rate amplifier</li> </ul>	43.00
15.	2015-16 / Q3 (Oct-Dec 2015)	<ul style="list-style-type: none"> <li>Increasing the high rep rate of the OPA part of the 50 TW laser</li> </ul>	

16.	2015-16 / Q4 (Jan-Mar 2016)	<ul style="list-style-type: none"> <li>• Installation of the front end of the 1 PW laser system</li> <li>• Setting up of PW laser beam delivery system for all the plasma chambers</li> <li>• Testing of indigenously developed Nd:glass rods (off-line))</li> </ul>	
17.	2016-17 / Q1 (Apr-Jun 2016)	<ul style="list-style-type: none"> <li>• Installation of the amplifiers of the PW laser system .</li> <li>• Testing and characterization of PEPC</li> <li>• Development of diagnostics of short pulse laser</li> <li>• Fabrication and testing of VISAR system</li> </ul>	11.00
18.	2016-17 / Q2 (Jul-Sep 2016)	<ul style="list-style-type: none"> <li>• Studies on ultra- short high intensity laser guiding in capillary plasmas and self guiding</li> <li>• Setting up of attosecond pulse measurement diagnostics</li> <li>• Laser driven neutron generation studies</li> </ul>	
19.	2016-17 / Q3 (Oct-Dec 2016)	<ul style="list-style-type: none"> <li>• Studies on Betatron radiation, Smith Purcell, and THz radiation using electron beam</li> <li>• Studies on attosecond pulse generation, few cycle pulse generation</li> <li>• Studies of x-ray generation from capillary discharge plasma</li> </ul>	
20.	2016-17 / Q4 (Jan-Mar 2017)	<ul style="list-style-type: none"> <li>• Laser based electron acceleration studies</li> <li>• Studies on proton acceleration and high energy ion generation from thin foils</li> <li>• Studies on laser driven (<math>\gamma, n</math>) and photo fission in plasmas</li> </ul>	
21.	2017-18 / Q1 (Apr-Jun 2016)	<ul style="list-style-type: none"> <li>• Studies on MG magnetic field by interferometry / chirped pulse probe</li> <li>• Studies on transient collisional excitation and recombination laser scheme.</li> </ul>	7.00
22.	2017-18 / Q2 (Jul-Sep 2016)	<ul style="list-style-type: none"> <li>• Studies on hard x-ray source based on inverse Compton scattering of the laser from high energy electron beam</li> <li>• Initial studies on isochoric heating</li> </ul>	
23.	2017-18 / Q3 (Oct-Dec 2016)	<ul style="list-style-type: none"> <li>• Replacement of rods in Arm A with indigenous rods and gain characterization</li> <li>• Generation of intense shocks for equation of state studies with Arm A</li> </ul>	
24.	2017-18 / Q4 (Jan-Mar 2017)	<ul style="list-style-type: none"> <li>• Study on intense black body emission from hohlraum cavities of gold and mix-Z targets using Arm A</li> <li>• Use of the Arm B for carrying out neutron generation and other studies</li> <li>• Experiments with the 1 PW laser beam</li> </ul>	

DAE OM No.3/7/2012/RRCAT/R&amp;D-II

XII Plan Project of RRCAT viz. "High Power Lasers and laser-plasma interaction in high density and ultra-high intensity regimes" (PIC No.XII-R&amp;D-CAT-4.09-0200).

**Schedule of Machinery & Equipment (M&E)**

No	Item Description	Estimated Cost (Lakhs)	Scheduled date of Indenting	Likely date of delivery	Phasing of Expenditure (Rs in Lakhs)					Import Yes / No	
					1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year		XIII Plan
1	Intensified and high resolution CCD cameras, ICTs	50	Aug-12 to Jan-15	Mar-13 to Mar-17	15	10	15	0	0	10	Yes
2	High bandwidth oscilloscopes, sub-ns probe	65	Jun-12	Mar-14	15	10	40	0	0	0	Yes
3	Miscellaneous electronics, optical and mechanical equipments	30	Dec-12 to Dec-17	Mar-13 to Dec-17	5	5	5	5	5	5	Yes
4	Marx Generator / Blumlein	20	Jan-13	Oct-14	10	0	10	0	0	0	No
5	Air conditioning and clean room equipments	20	Apr-14 to Apr-15	Jun-14 to Jul-15	0	5	15	0	0	0	No
6	Integrating sphere	10	Jun-12	Oct-13	10	0	0	0	0	0	Yes
7	Fast gated ICCD cameras	40	Jun-12	Oct-13	0	0	40	0	0	0	Yes
8	Adaptive optics and deformable mirrors for wave front correction	90	Jun-12 to Oct-15	Jan-14 to May-15	25	25	40	0	0	0	Yes
9	Large size permanent dipole and quadrupole magnets	25	Jan-13 to Mar-15	Apr-13 to Jun-16	0	10	0	15	0	0	Yes
10	Bolometer and spectrometer for THz radiation energy measurement	30	Dec-12 to May-16	Mar-13 to Aug-16	20	0	0	10	0	0	Yes
11	Fast solenoid and needle valves and pressure sensors	10	Feb-13 to Feb-17	May-13 to Mar-18	0	2	2	2	2	2	Yes
12	Radiation area monitors	15	Jan-15	Jul-16	0	0	15	0	0	0	No
13	High energy x-rays and gamma ray detectors	35	Jan-13 to Jan-14	May-14 to May-15	0	20	15	0	0	0	No
14	Fast Micro Channel Plate (MCP) detectors	50	Dec-12 to Aug-14	Apr-13 to Dec-16	0	20	20	0	10	0	Yes
15	High vacuum pumps (TMP & SIP)	50	Jan-13 to July-14	Apr-14 to Dec-15	0	25	25	0	0	0	Yes
16	10 kHz regenerative amplifier, preamplifier, and compressor	150	Aug-12	Apr-14	0	140	10	0	0	0	Yes
17	Simulation codes and computer software tools	35	Jun-12 to May-14	May-13 to Aug-15	0	25	10	0	0	0	Yes

18	Direct and indirect x-ray CCD camera	90	Jan-13 to May-14	May-13 to Oct-15	0	45	45	0	0	0	Yes
19	Gated PMT's	10	Jan-13 to May-14	May-13 to Oct-15	0	5	5	0	0	0	Yes
20	Optical microscope	10	Dec-12	Apr-14	0	10	0	0	0	0	No
21	Precision stepper motors and controllers	20	Apr-12 to Jan-17	Jul-13 to Mar-18	5	0	5	0	5	5	No
22	Vacuum compatible DC actuators	25	Apr-12 to Jan-17	Jul-13 to Mar-18	0	5	5	5	5	5	Yes
23	Motorized 5-axis goniometer	40	Dec-12	Apr-14	5	5	30	0	0	0	No
24	Laser power and energy meters for the Ti:sa laser	12	Apr-15 to Jan-16	Jul-15 to May-17	0	0	5	5	2	0	Yes
25	CCD based laser profile monitors	13	Jun-12 to Nov-16	Apr-13 to Feb-18	2	2	2	2	2	3	Yes
26	Cryostat	50	Jan-16 to May-17	May-16 to Oct-17	0	0	0	0	20	30	Yes
27	Personal and simulation lab Computers	50	Jun-12 to Dec-16	May-13 to Mar-18	6	5	24	5	5	5	No
28	Misc. vacuum equipments	25	Dec-12 to Dec-15	Mar-13 to Mar-18	5	5	5	5	0	5	No
29	Purchase of front end for the PW laser system	1400	Jun-12	Sep-16	0	104	496	760	40	0	Yes
30	Procurement of the Ti:sa amplifiers for the PW laser system	1700	Dec-12	Sep-17	0	0	100	1300	300	0	Yes
31	Purchase of second harmonic pump lasers for the PW laser system	1800	Dec-12	Sep-17	0	0	0	1500	300	0	Yes
32	Energy/power meters/ spectrographs/ photodiodes/ CCDs for glass laser	85	July 12 to July 17	upto Dec-17	10	10	20	25	10	10	Yes
33	High rep rate pump laser for OPA	90	Jul-15	Dec-17	5	70	5	0	0	10	Yes
34	Oscilloscopes -various types	120	Jul-12 to July 16	Dec12 to Dec 17	25	19.7	10.5	30	19.8	15	Yes
35	Vibration isolation tables	30	Jul-12	Feb-15	0	10	10	5	0	5	No
36	Microscopes	20	Jul-13	Mar-15	0	0	20	0	0	0	No
37	S-20 Streak camera/ framing camera	180	Jun-12	Jul-14	0	30	120	0	10	20	Yes
38	Single longitudinal mode laser for VISAR	25	Jul-12	Oct-14	15	5	5	0	0	0	Yes
39	10-30 GHz data acqu. cards for VISAR	30	Jul-12	Mar-14	15	10	5	0	0	0	Yes
40	Sol-gel coating facility for rods	40	Jul-12	Dec-14	15	10	5	0	10	0	No
	<b>Total</b>	<b>6590 lakhs</b>			<b>208</b>	<b>647.7</b>	<b>1184.5</b>	<b>3674</b>	<b>745.8</b>	<b>130</b>	



DAE OM No.3/7/2012/RRCAT/R&amp;D-I/

December , 2012

XII Plan Project of RRCAT viz. "High Power Lasers and laser-plasma interaction in high density and ultra-high intensity regimes" (PIC No.XII-R&D-CAT-4.09-0200).

### Schedule of Supplies & Materials (S&M)

No	Item Description	Estimated Cost (Lakhs)	Scheduled date of Indenting	Likely date of delivery	Phasing of Expenditure (Rs in Lakhs)						Import Yes / No
					1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year	XIII Plan	
1	Harmonic converters and non-linear crystals for second harmonic conversion	9	Feb-13 to Dec-17	May-13 to Mar-18	0	3	2	1	1	2	Both, local & imported
2	Large size polarizers, mirrors, beam splitters, lenses, windows, Faraday rotators, Electro-optic crystals	30	Feb-13 to Dec-17	May-13 to Mar-18	0	10	0	10	0	10	Yes
3	Toroidal gratings, crystal monochromator, and x-ray crystals	40	Jan-13 to Jul-15	May-13 to Nov-15	0	20	0	20	0	0	Yes
4	Stretcher and compressor gratings for Ti:Sa lasers	80	Jan-14 to Feb-16	May-14 to Jun-17	0	0	40	0	20	20	Yes
5	Vacuum pumps, gate valves, and gauges	26	Jun-12 to Dec-17	May-13 to Mar-18	0	6	5	5	5	5	Both local & imported
6	Vacuum compressor chamber and plasma interaction chamber for PW laser	35	Feb-14 to May-16	Jun-14 to Sep-16	0	0	20	15	0	0	No
7	Large size optics for Ti:sapphire lasers	50	Jun-12 to Oct-17	May-13 to Feb-18	15	0	10	10	0	15	Yes
8	Spare parts for Ti-sapphire laser systems	108	Jun-12 to Oct-17	May-13 to Feb-18	20	0	20	20	20	28	Yes
9	Focussing optics for PW laser, achromatic lenses, and off-axis parabolic mirrors	60	Jan-13 to Dec-17	May-13 to Mar-18	0	20	0	20	0	20	Yes
10	Mechanical tables for laser-heads	30	Apr-14 to Nov-15	Aug-14 to Feb-16	0	0	15	15	0	0	No
11	Laser beam line accessories and turning chambers	31	Jan-13 to Dec-15	Aug-13 to Feb-16	0	6	20	15	0	0	No
12	Fast scintillator detectors for high energy x-rays, and neutrons	20	Jan-13 to May-15	May-13 to Sep-15	0	10	0	10	0	0	Both local & imported
13	Particle detectors	10	Jan-13 to May-15	May-13 to Sep-15	0	5	0	5	0	0	Yes

14	Zone plates, capillary optics, and XUV optics	55	Jan-13 to May-15	May-13 to Sep-15	0	30	0	25	0	0	Yes
15	Radiation shielding materials	2	Apr-13	Mar-14	0	2	0	0	0	0	No
16	Metal plates	30	Jan-13 to Apr-15	May-13 to Sep-15	0	15	15	0	0	0	No
17	H. V. insulating material	9	Jun-12 to Dec-16	May-13 to Mar-17	2	2	2	2	1	0	No
18	Misc. Chemicals, and gases	5	Jun-12 to Dec-16	May-13 to Mar-17	1	1	1	1	1	0	No
19	Miscellaneous electronic, optical, mechanical components	10	Jun-12 to Dec-16	Apr-13 to Mar-16	2	2	2	2	2	0	Both local & imported
20	Miscellaneous spares for the 150 TW laser	225	Dec-14 to Mar-17	Apr-15 to Mar-18	0	0	0	0	45	170	Yes
21	Miscellaneous accessories related to the 150 TW laser	275	Dec-14 to Mar-17	Apr-15 to Mar-18	0	0	0	0	52	223	Yes
22	Opto-mechanical mounts	40	Jun-12 to Dec-16	July 13 to Dec-16	5	10	10	10	5	0	Both local & imported
23	HV switches	40	Dec 13	Dec 15	0	10	10	10	10	0	Yes
24	Data Acquisition cards	10	July 13 to July 15	Dec 13 to Dec 15	0	5	5	0	0	0	Both local & imported
25	Flash Lamps	70	Jul-12	Dec-17	5	15	15	20	10	5	No
26	Diode pump modules	60	Jul-12	Jul-15	0	25	30	5	0	0	Yes
27	Optical components	90	Jun12 to Dec.16	Mar 13 to Mar 17	5	25	20	20	20	0	Both local & imported
28	Crystal optics	40	Aug 13 to Dec 16	Dec. 13 to Mar 17	0	10	10	10	5	5	Yes
29	Faraday rotator/ isolator	40	Nov. 12 to Nov. 16	Mar 13 to Mar 17	0	10	10	10	5	5	Yes
30	Nd:glass discs	190	Dec. 12 to Dec. 16	Mar 13 to Mar 17	0	20	25	75	65	5	Yes
31	Laser rods	50	Jun 12 to Dec. 16	Mar 13 to Mar 17	5	15	15	15	0	0	No
32	Gratings ( Compressor + stretcher )	90	Oct. 12 to Oct. 16	Feb. 13 to Feb. 17	0	35	30	25	0	0	Yes
33	Amplifier mechanical housing and tables	30	Sept. 12 to Sept 6	Jan. 13 to Jan 17	0	10	10	10	0	0	No
	<b>Total</b>	<b>1890 lakhs</b>			<b>60</b>	<b>322</b>	<b>342</b>	<b>386</b>	<b>267</b>	<b>513</b>	

**ANNEXURE-IV**

DAE OM No.3/7/2012/RRCAT/R&D-II

December , 2012

XII Plan Project of RRCAT viz. "High Power Lasers and laser-plasma interaction in high density and ultra-high intensity regimes" (PIC No.XII-R&D-CAT-4.09-0200).

**Schedule of Major Works (MW)**

Sr. No.	Item Description	Estimated Cost (Lakhs)	Scheduled date of Indenting	Likely completion date	Phasing of Expenditure (Rs in Lakhs)						Remarks
					1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year	XIII Plan	
1	Construction of 1,850 sq. m, with 336 sq.m clean room area (Class <100,000) with 1m thick concrete shielding for the 324 sq.m. radiation area	700	Jan-13	Oct-14	30	210	240	195	25	0	
	<b>Total (MW)</b>	<b>700</b>			<b>30</b>	<b>210</b>	<b>240</b>	<b>195</b>	<b>25</b>	<b>0</b>	

BY FAX

Government of India  
Department of Atomic Energy  
R&D-I Section

Anushakti Bhavan,  
C.S.M. Marg,  
Mumbai- 400 001.  
(022) 2286 2762  
e-mail-rd1@dae.gov.in

No.3/3/2013/RRCAT/R&D-I/ 7568

June 13, 2013

**OFFICE MEMORANDUM**

Subject: XII Plan (R&D Sector) project of RRCAT "Biomedical and Societal Applications of Lasers and Laser Based Instruments" (PIC No.XII-R&D-CAT-5.10-0100)

\*\*\*\*\*

The undersigned is directed to refer to RRCAT Note No. RRCAT/PCC/MSO/2012/XII-Plan/490 dated 5.12.2012 on the captioned subject and to convey the sanction of the President to incur an expenditure not exceeding ₹ 45 crore (Rupees Forty five crore only) with Foreign Exchange (FE) component of ₹ 32.80 crore (Rupees Thirty two crore and eighty lakhs only) on the XII Plan (R&D Sector) project of Raja Ramanna Centre for Advanced Technology (RRCAT), Indore titled 'Biomedical and Societal Applications of Lasers and Laser Based Instruments' as per the details annexed to this Office Memorandum.

2. The expenditure is debitable to :

Major Head	:	5401	-	Capital Outlay on Atomic Energy Research
Minor Head	:	00 206	-	Raja Ramanna Centre for Advanced Technology
Sub-Head	:	63	-	Biomedical and Societal Applications of Lasers and Laser Based Instruments
Grant number for 2013-14	:	4	-	Atomic Energy

3. This issues with the concurrence of Member for Finance, AEC as conveyed vide Note No. JS(F)/RRCAT/II/20 dated 4.6.2013.

(Saroja Gopal)

Under Secretary to the Government of India

(022) 2282 5303

Director,  
Raja Ramanna Centre for Advanced Technology,  
Indore-452 013.

: 2 :

No.3/3/2013/RRCAT/R&D-I/-1568

June 13, 2013.

Copy :

Audit:

1. Dy. Director, Office of Principal Director of Audit, Scientific Departments, Anushakti Bhavan, Mumbai- 400 001.

Finance

1. Director (Finance)

Department of Atomic Energy, Mumbai:


1. Head, MSG
2. Dr. T. Sakuntala, Member Secretary, IWG (R&D Sector)
3. Officer on Special Duty (Budget)
4. Under Secretary (R&D-II)

Raja Ramanna Centre for Advanced Technology (RRCAT), Indore-452 013:.

1. Dr. P.K. Gupta, DS & Head, LBAID and Project Co-ordinator
2. Dr.(Smt.) M.S. Oak, SO/G & Head, Planning and Co-ordination Cell – with a request to ensure necessary compliance to the instructions contained in the Office Order No. 03/2011/2887 dated 16.3.2011 issued by Secretary, DAE regarding monitoring progress of Plan Projects of DAE.
3. Joint Controller [F&A]

Specialist Group

1. Convenor-SG-11 "Laser & Accelerator Technology".

  
(Saroja Gopal)

Under Secretary to the Government of India  
☎ (022) 2282 5303

Copy for sanction folder (XII Plan Projects of RRCAT)

No.3/3/2013/RRCAT/R&amp;D-II/1568

June 13, 2013.

XII Plan (R&D Sector) Project of RRCAT "Biomedical and Societal Applications of Lasers and Laser Based Instruments" (PIC No.XII-R&D-CAT-5.10-0100)

I. Details of the project cost :

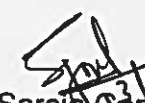
Sr. No	Object Head	Estimated cost (Rs. in crore)
		Total
1.	Machinery & Equipment	34.90 (27.10)
2.	Supplies & Materials	8.60 (5.70)
3.	Major Works	
	(a) Civil works	0.74
	(b) Electrical & AEVE	0.20
	(c) Mechanical works	0.06
4.	Domestic Travel	0.20
5.	Foreign Travel	0.20
6.	Office Expenses	0.10
	Total	45.00 (32.80)

II. Scheduled date of completion of the project : 31<sup>st</sup> March 2017.

Note : The schedule of Major Milestones, Machinery & Equipment, Supplies & Materials and Major works are given at Annex – I and Annex-II respectively.

III. PROJECT COORDINATOR:

Dr. P.K. Gupta, DS & Head, LBAID and Project Co-ordinator

  
(Saroja Gopal)

Under Secretary to the Government of India

Major Milestones

No.	Year & Quarter	Major Milestones Falling in the Quarter	Financial Target (Rs in Cr)
1.	2012-13 / Q1 (Apr-Jun 2012)	<ul style="list-style-type: none"> <li>None</li> </ul>	0.25
2.	2012-13 / Q2 (Jul-Sep 2012)	<ul style="list-style-type: none"> <li>None</li> </ul>	
3.	2012-13 / Q3 (Oct-Dec 2012)	<ul style="list-style-type: none"> <li>Development of a prototype LED based combined fluorescence and diffuses reflectance spectroscopic system for use at hospitals for cancer diagnosis.</li> </ul>	
4.	2012-13 / Q4 (Jan-Mar 2013)	<ul style="list-style-type: none"> <li>Fabrication of fiber tethered laser triangulation probe.</li> <li>Development of a prototype Doppler Optical Coherence Tomography (OCT) setup for studies on noninvasive monitoring of the healing of wounds.</li> </ul>	
5.	2013-14 / Q1 (Apr-Jun 2013)	<ul style="list-style-type: none"> <li>Synthesis of metal complex of chlorophyll derivative for use as X-ray- activated photo-sensitizer.</li> <li>Establishment of animal model of diabetic wound.</li> <li>Development of experimental set-up for recording Surface Enhanced Raman Spectroscopy (SERS) from optically trapped cells.</li> </ul>	8.65
6.	2013-14 / Q2 (Jul-Sep 2013)	<ul style="list-style-type: none"> <li>Development of experimental set up for polarimetric imaging of micro-circulation in wounds and initiation of studies on its use on noninvasive monitoring of the healing of wounds.</li> </ul>	
7.	2013-14 / Q3 (Oct-Dec 2013)	<ul style="list-style-type: none"> <li>Development of a system for fluorescence imaging of cutaneous wounds.</li> <li>Development of an OCT probe for in-vivo imaging of oral cavity.</li> <li>Development of a portable fluorescence/diffuse reflectance imaging device for large area (~few cm<sup>2</sup>) scanning of tissue.</li> </ul>	
8.	2013-14 / Q4 (Jan-Mar 2014)	<ul style="list-style-type: none"> <li>Integration of super continuum source with Near field Scanning Optical Microscope (NSOM) for near field coupling to resonant modes of micro and nano structures.</li> </ul>	
9.	2014-15 / Q1 (Apr-Jun 2014)	<ul style="list-style-type: none"> <li>Completion of experiments on uptake and photo-toxicity of metal complexes of chlorophyll derivative in cancer cells</li> </ul>	16.10
10.	2014-15 / Q2 (Jul-Sep 2014)	<ul style="list-style-type: none"> <li>Procurement and installation of laser scanning confocal fluorescence microscopy.</li> </ul>	
11.	2014-15 / Q3 (Oct-Dec 2014)	<ul style="list-style-type: none"> <li>Development of a prototype Liquid Crystal Tunable Filter (LCTF) based spectral imaging system for biomedical diagnostic applications.</li> </ul>	
12.	2014-15 / Q4 (Jan-Mar 2015)	<ul style="list-style-type: none"> <li>Development of a Photo Acoustic Tomography set up for imaging of small animals.</li> </ul>	
13.	2015-16 / Q1 (Apr-Jun 2015)	<ul style="list-style-type: none"> <li>Integration of independent excitation laser source to the Raman optical tweezers set-up.</li> <li>Demonstration of waveguide writing in fused silica with the fs micromachining system.</li> </ul>	14.75

Spd  
13/06/2013

## Schedule of Machine &amp; Equipments (M &amp; E):

Sr. No.	Item Description	Estimated Cost (Crores)	Scheduled date of Indenting (mm/yyyy)	Likely date of delivery (mm/yyyy)	Phasing of Expenditure (Rs in Lakhs)					Import Yes / No	
					1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year		
1.	Ion beam figuring system	4.00	Sep/ 2012	Jun/ 2014			3.70	0.30		Yes	
2.	Sputter coater (SiO2/SiN)	2.00	Jun/ 2014	Dec/ 2015				1.80	0.20	Yes	
3.	Confocal fluorescence microscope with laser source	2.00	Sep/ 2012	Dec/ 2014			1.80	0.20		Yes	
4.	Femtosecond laser (15W) for Micromachining	1.80	May/ 2012	Aug/ 2013			1.60		0.20	Yes	
5.	Stylus profiler for asphere metrology	1.30	May/ 2015	Jan/ 2016				1.20	0.10	Yes	
6.	X Y air bearing stages	1.00	Jan/ 2013	Sep/ 2013			0.80	0.20		Yes	
7.	Optical microscope for Raman optical tweezers with separate trapping and Raman laser coupling facility.	0.75	Jul/ 2012	Jul/ 2013		0.75				Yes	
8.	Inverted fluorescence microscope	0.50	Sep/ 2013	Sep/ 2014			0.50			Yes	
9.	Spectrofluorometer with accessories	0.60	Dec/ 2012	Mar/ 2014		0.60				Yes	
10.	XeF2 etcher	0.55	Sep/ 2011	Sep/ 2013		0.00	0.55			Yes	
11.	Laser and light sources (Super continuum source, single mode lasers for Raman spectroscopy, multi-wavelength LED systems etc.) Swept source, pico second diode lasers etc.	3.50	Feb/ 2012	Jun/ 2016		0.00	0.80	1.20	1.20	0.30	Both local & imported

Sgt  
12/06/2013



	PCB inspection system, RF signal generator,																		
18.	Air bearing Micro-lathe, Air bearing spindles, manual lathe, manual milling machine, pneumatic press, diaphragm pumps and turbo molecular Pumps	2.00	Mar/ 2013	Dec/ 2016	0.00	0.30	0.50	0.80	0.40										Both local & imported
19.	Precision air bearing micro-Milling machine, micro wire EDM, Miscellaneous items including software upgrades	1.60	Jan/ 2013	Dec/ 2016	0.00	0.20	0.50	0.70	0.20										Both local & imported
<b>Total</b>		<b>34.90</b>			<b>0.10</b>	<b>6.50</b>	<b>13.90</b>	<b>11.20</b>	<b>3.20</b>										

  
 13/06/2010

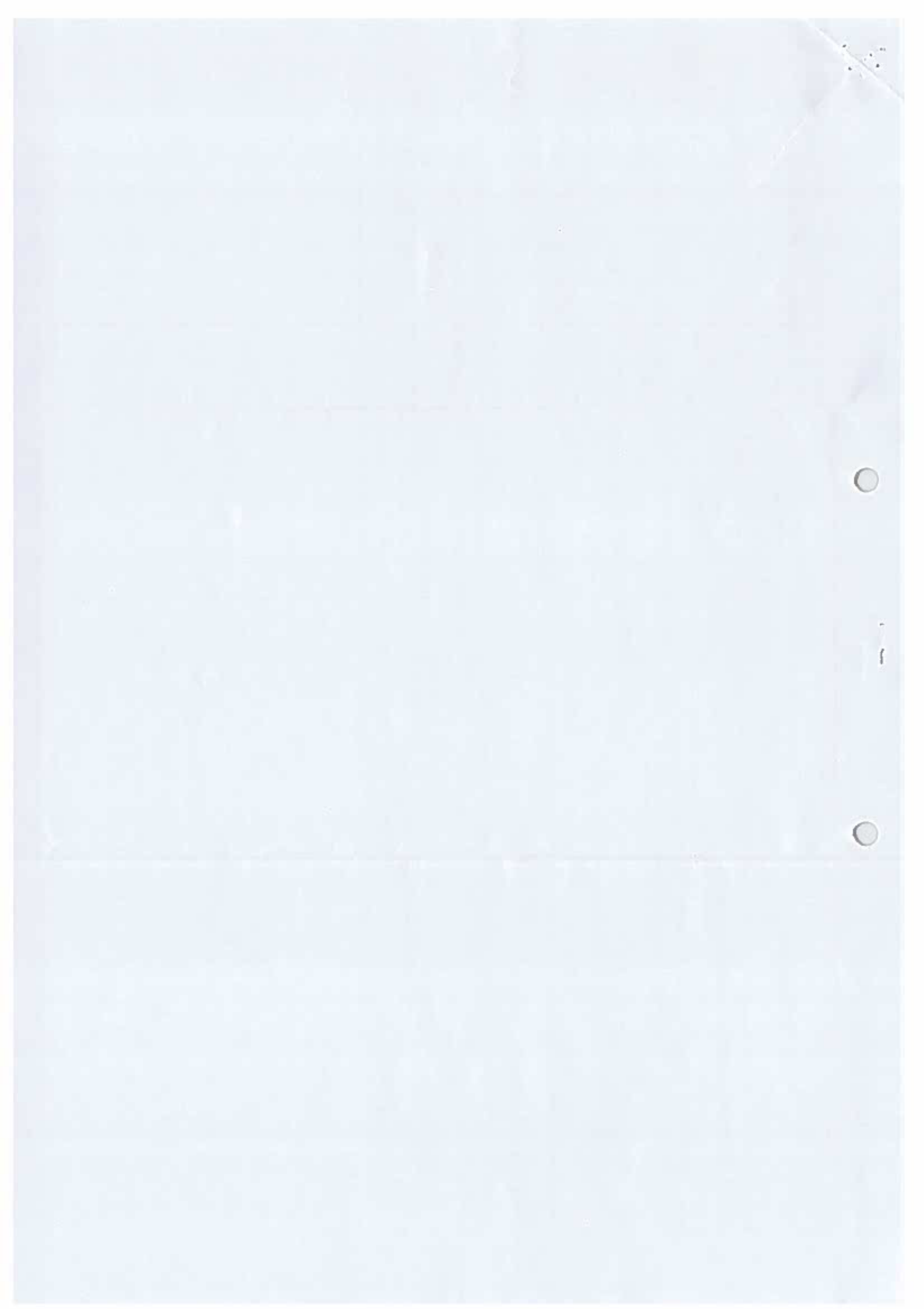
**Schedule of Major Works (MW) :**

No.	Item Description	Estimated Cost (Crores)	Scheduled date of Indenting (mm/yyyy)	Likely date of delivery (mm/yyyy)	Phasing of Expenditure (Rs in Lakhs)					Remarks	
					1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year		XIII Plan
1	Civil (Interferometer foundation and other preparations)	0.74	Apr/ 2012	Sept/ 2015	0.00	0.15	0.15	0.29	0.15	-	
2	Aluminium partitioning, clean room maintenance electrical & AC upgrades and maintenance etc.	0.20	May/ 2012	Feb/ 2015	0.00	0.08	0.10	0.02	0.00	-	
3	Misc	0.06	Apr/ 2013	Mar/ 2017	0.00	0.02	0.01	0.01	0.02	-	
	<b>Total</b>	<b>1.00</b>			<b>0.00</b>	<b>0.25</b>	<b>0.26</b>	<b>0.32</b>	<b>0.17</b>	<b>-</b>	

**Schedule of Consultancy : NA**

Sr. No.	Item Description	Estimated Cost (Crores)	Scheduled date of Indenting (mm/yyyy)	Likely completion date (mm/yyyy)	Phasing of Expenditure (Rs in Lakhs)					Remarks	
					1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	5 <sup>th</sup> Year		XIII Plan
1	Nil	Nil									
	<b>Total</b>	<b>Nil</b>									

*Signature*  
13/06/12



Government of India  
Department of Atomic Energy  
R&D-I Section

Anushakti Bhavan,  
C.S.M. Marg,  
Mumbai- 400 001.  
☎ (022) 2286 2762  
e-mail – [rd1@dae.gov.in](mailto:rd1@dae.gov.in)

Subject: Grant of time extension for completion of the XII Plan (R&D Sector) project of RRCAT "Biomedical and Societal Applications of Lasers and Laser based Instruments" .  
=====

Ref : DAE OM No. 3/3/2013/RRCAT/R&D-I/7568 dated 13.6.2013.

\*\*\*

Reference is invited to RRCAT Note dated 11.1.2017 and subsequent e-mail dated 3.2.2017, 28.2.2017, 10.3.2017, 30.3.2017, 1.5.2017 and 26.7.2017 on the captioned subject.

2. The competent authority in the Department has approved the extension of completion date from 31.3.2017 to 31.3.2018 of the XII Plan (R&D Sector) project of RRCAT "Biomedical and Societal Applications of Lasers and Laser based Instruments" sanctioned vide DAE OM No. 3/3/2013/RRCAT/R&D-I/7568 dated 13.6.2013, within the sanctioned cost of the project and without any change in the scope and objectives of the project.

3. This issues with the approval of Secretary, DAE and concurrence of Internal Financial Adviser, DAE in terms of delegated powers issued vide DAE OM No. 7/1(13)/2014-Budget/16391 dated 26.12.2014. .



(Sriram S.)  
Under Secretary (R&D-I)

RRCAT (Dr. P.A. Naik, Director), Indore.

DAE ID Note No. 3/3/2013/RRCAT/R&D-I/ 10763

August 11, 2017

- Copy to : 1. Dr. T. Sakuntala, Member Secretary, IWG (R&D Sector), DAE  
2. Dr. Rama Chari, Head, Planning & Co-ordination Cell, RRCAT.  
3. BPO, DAE  
4. JC(F&A), RRCAT.

**BY FAX**

Government of India  
Department of Atomic Energy  
R&D-I Section

Anushakti Bhavan,  
C.S.M. Marg,  
Mumbai- 400 001.  
☎ (022) 2286 2762  
e-mail – rd1@dae.gov.in

No.3/4/2013/RRCAT/R&D-I/ 6870

May 28, 2013

**OFFICE MEMORANDUM**

Subject: XII Plan (R&D Sector) project of RRCAT "Development and Applications of Advanced Lasers" (PIC No.XII-R&D-CAT-4.09-0100)

\*\*\*\*\*

The undersigned is directed to refer to RRCAT Note No. RRCAT/PCC/MSO/2012/XII-Plan/490 dated 5.12.2012 on the captioned subject and to convey the sanction of the President to an expenditure not exceeding ₹ 72 crore (Rupees seventy two crore only) with Foreign Exchange (FE) component of ₹ 46.13 crore (Rupees forty six crore thirteen lakh only) on the XII Plan (R&D Sector) project of Raja Ramanna Centre for Advanced Technology (RRCAT), Indore titled "Development and Applications of Advanced Lasers" as per the details annexed to this Office Memorandum.

2. The expenditure is debitable to :

Major Head	:	5401	-	Capital Outlay on Atomic Energy Research
Minor Head	:	00 206	-	Raja Ramanna Centre for Advanced Technology
Sub-Head	:	57	-	Development and Applications of Advanced Lasers
Grant number for 2013-14	:	4	-	Atomic Energy

3. This issues with the concurrence of Member for Finance, AEC as conveyed vide Note No. JS(F)/RRCAT/I/20 dated 22.5.2013.

*S. Gopal*  
(Saroja Gopal)

Under Secretary to the Government of India  
☎ (022) 2282 5303

Director,  
Raja Ramanna Centre for Advanced Technology,  
Indore – 452 013.

: 2 :

No.3/4/2013/RRCAT/R&D-II 6870

May 28, 2013.

Copy :

Audit:

1. Dy. Director, Office of Principal Director of Audit, Scientific Departments, Anushakti Bhavan, Mumbai- 400 001.

Finance

1. Director (Finance)

Department of Atomic Energy, Mumbai:

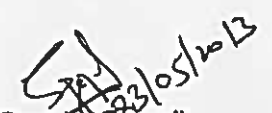
1. Head, MSG
2. Dr. T. Sakuntala, Member Secretary, IWG (R&D Sector)
3. Officer on Special Duty (Budget)
4. Under Secretary (R&D-II)

Raja Ramanna Centre for Advanced Technology (RRCAT), Indore-452 013:.

1. Dr. S.M. Oak, Outstanding Scientist and Head, Solid State Laser Division and Plan project Co-ordinator
2. Dr.(Smt.) M.S. Oak, SO/G & Head, Planning and Co-ordination Cell – with a request to ensure necessary compliance to the instructions contained in the Office Order No. 03/2011/2887 dated 16.3.2011 issued by Secretary, DAE regarding monitoring progress of Plan Projects of DAE.
3. Joint Controller [F&A]

Specialist Group

1. Convenor-SG-11 "Laser & Accelerator Technology".

  
(Saroja Gopal)

Under Secretary to the Government of India  
☎ (022) 2282 5303

Copy for sanction folder (XII Plan Projects of RRCAT)

**ANNEX-I**


DAE OM No.3/4/2013/RRCAT/R&amp;D-II 6870

May 28, 2013.

**XII Plan (R&D Sector) Project of RRCAT "Development and Applications of Advanced Lasers" (PIC No.XII-R&D-CAT-4.09-0100)****I. Details of the project cost :**

(₹ in crore)

Sr. No	Object Head	Estimated cost		
		XII Plan	XIII Plan	Total
1.	Machinery & Equipment	26.52	16.33	42.85 (33.40)
2.	Supplies & Materials	19.77	7.22	26.99 (12.40)
3.	Major Works			
	(a) Civil works	0.34	0.04	0.38
	(b) Electrical & ACVE	0.13	0.03	0.16
	(c) Mechanical works	0.11	0.03	0.14
4.	Domestic Travel	0.38	0.15	0.53
5.	Foreign Travel	0.27	0.06	0.33 (0.33)
6.	Office Expenses	0.42	0.12	0.54
7.	Consultancy	0.06	0.02	0.08
	<b>Total</b>	<b>48.00</b>	<b>24.00</b>	<b>72.00</b> <b>(46.13)</b>

**II. Scheduled date of completion of the project : 31<sup>st</sup> March 2019.****III. PROJECT COORDINATOR:**Dr. S.M. Oak, Outstanding Scientist and Head, Solid State Laser Division,  
RRCAT and Plan project Co-ordinator  
(Saroja Gopal)  
23/05/2013

Under Secretary to the Government of India





62

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Government of India  
Department of Atomic Energy  
R&D-I Section

Anushakti Bhavan,  
C.S.M. Marg,  
Mumbai- 400 001.  
☎ (022) 2286 2762  
e-mail – rd1@dae.gov.in

No.3/1/2013/RRCAT/R&D-II 6148

May 10, 2013

OFFICE MEMORANDUM

Subject: XII Plan (R&D Sector) project of RRCAT "Research and Development of Laser Materials Photonic Nano-materials Processing" (PIC No.XII-R&D-CAT-5.09-0100)  
\*\*\*\*\*

The undersigned is directed to refer to RRCAT Note No.RRCAT/PCC/MSO/2012/XII-Plan/492 dated 7.12.2012 on the captioned subject and to convey the sanction of the President to an expenditure not exceeding ₹ 55 crore (Rupees fifty five crore only) with Foreign Exchange (FE) component of ₹ 38.95 crore (Rupees thirty eight crore ninety five lakh only) on the XII Plan (R&D Sector) project of Raja Ramanna Centre for Advanced Technology (RRCAT), Indore titled "Research and Development of Laser Materials Photonic Nano-materials Processing" as per the details annexed to this Office Memorandum.

2. The expenditure is debitable to :

Major Head	:	5401	-	Capital Outlay on Atomic Energy Research
Minor Head	:	00 206	-	Raja Ramanna Centre for Advanced Technology
Sub-Head	:	62	-	Research and Development of Laser Materials Photonic Nano-materials Processing
Grant number for 2013-14	:	4	-	Atomic Energy

3. This issues with the approval of Member for Finance, AEC.

  
(Saroja Gopal)

Under Secretary to the Government of India  
☎ (022) 2282 5303

Director,  
Raja Ramanna Centre for Advanced Technology,  
Indore – 452 013.

No.3/1/2013/RRCAT/R&D-II 6148

May 16, 2013.

Copy :

Audit:

1. Dy. Director, Office of Principal Director of Audit, Scientific Departments, Anushakti Bhavan, Mumbai- 400 001.

Department of Atomic Energy, Mumbai:

1. Head, MSG
2. Dr. T. Sakuntala, Member Secretary, IWG (R&D Sector)
3. Officer on Special Duty (Budget)
4. Under Secretary (R&D-II)

Raja Ramanna Centre for Advanced Technology (RRCAT), Indore-452 013:.

1. Dr. L.M. Kukreja, Head, Laser Material Processing Division and Plan project Co-ordinator
- ✓ 2. Dr.(Smt.) M.S. Oak, SO/G & Head, Planning and Co-ordination Cell – with a request to ensure necessary compliance to the instructions contained in the Office Order No. 03/2011/2887 dated 16.3.2011 issued by Secretary, DAE regarding monitoring progress of Plan Projects of DAE.
3. Joint Controller [F&A]

Specialist Group

1. Prof. Milan K. Sanyal, Director, SINP, Kolkata & Convenor of the Specialist Group-SG-14 – 'Materials Science and Technology'.

  
(Saroja Gopal)

Under Secretary to the Government of India  
☎ (022) 2282 5303

Copy for sanction folder (XII Plan Projects of RRCAT)

**ANNEX-I**

DAE OM No.3/1/2013/RRCAT/R&D-II 6/48

May 10, 2013.

**XII Plan (R&D Sector) Project of RRCAT "Research and Development of Laser Materials Photonic Nano-materials Processing" (PIC No.XII-R&D-CAT-5.09-0100)**

**I. Details of the project cost :**

(₹ in Crore)

Sr. No	Object Head	Estimated cost (FE)		
		XII Plan	XIII Plan	Total
1.	Machinery & Equipment	21.70	19.75	41.45 (36.10)
2.	Supplies & Materials	7.90	3.25	11.15 (2.85)
3.	Major Works	2.05	0.00	2.05
4.	Domestic Travel	0.17	0.00	0.17
5.	Foreign Travel	0.14	0.00	0.14
6.	Office Expenses	0.04	0.00	0.04
	<b>Total</b>	<b>32.00</b>	<b>23.00</b>	<b>55.00</b> <b>(38.95)</b>

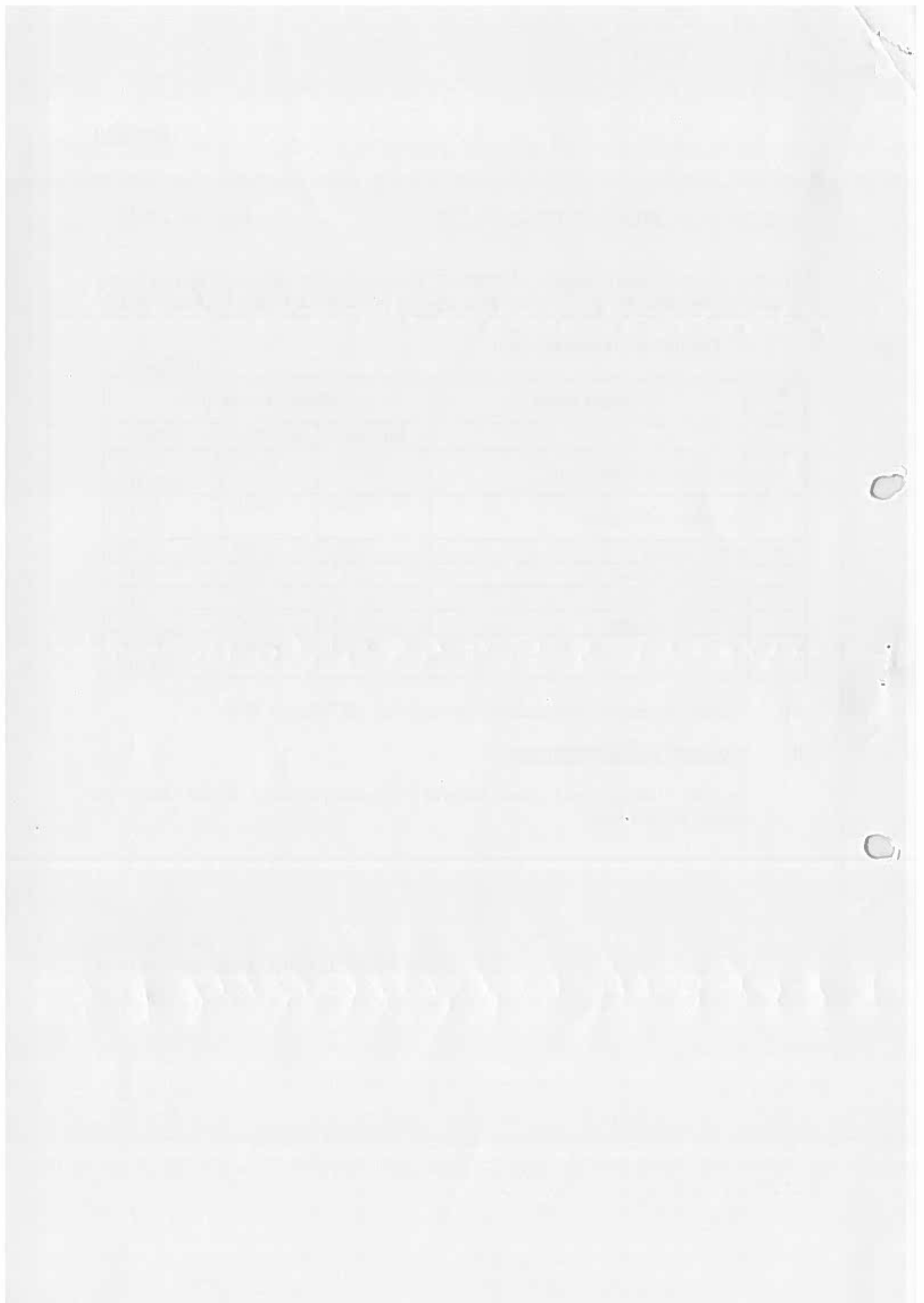
II. Scheduled date of completion of the project : 31<sup>st</sup> March 2019.

III. **PROJECT COORDINATOR:**

Dr. L.M. Kukreja, Head, Laser Material Processing Division, RRCAT and Plan project Co-ordinator

  
(Saroja Gopal)

Under Secretary to the Government of India



Government of India  
Department of Atomic Energy  
R&D-I Section

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No.3/1/2017/RRCAT/R&D-I/ 8983

July 6 , 2017

**OFFICE MEMORANDUM**

Subject: Project (R&D Sector) of RRCAT titled "Technology Development and Capacity Building for Gravitational Wave Detection" at an estimated cost of Rs.74 crore.

=====

The undersigned is directed to refer to RRCAT e-mail dated 1.3.2017, Note No. RRCAT/DPR\_GWD/1 dated 13.4.2017, e-mail dated 21.4.2017 and 22.5.2017 on the captioned subject and to convey the sanction of the President to an expenditure not exceeding Rs.74.00 crore (Rupees seventy four crore only) for the Project (R&D Sector) of Raja Ramanna Centre for Advanced Technology (RRCAT), Indore titled "Technology Development and Capacity Building for Gravitational Wave Detection" as per the details annexed to this Office Memorandum.

2. The expenditure is debitable to :

Major Head	:	5401	-	Capital Outlay on Atomic Energy Research
Minor Head	:	00 206	-	Raja Ramanna Centre for Advanced Technology
Detailed Head	:	72	-	Advance Technology for laser
Grant number for 2017-18	:	4	-	Atomic Energy

3. This issues with the approval of Secretary, DAE and concurrence of Internal Financial Advisor in terms of delegation of powers issued vide DAE OM No. 7/1(13)/2014-Budget/16391 dated 26.12.2014.



(Sriram S.)

Under Secretary to the Government of India  
☎ (022) 2282 5303

Director,  
Raja Ramanna Centre for Advanced Technology,  
Indore – 452 013.

: 2 :

No.3/1/2017/RRCAT/R&D-II 8983

July 6, 2017.

Copy :

Audit:

1. Dy. Director, Office of Principal Director of Audit, Scientific Departments, Anushakti Bhavan, Mumbai- 400 001.

Department of Atomic Energy, Mumbai:

1. Head, ICPD
2. Dr. T. Sakuntala, Member Secretary, IWG (R&D Sector)
3. Head, MSG
4. Budget & Planning Officer (Budget)

Raja Ramanna Centre for Advanced Technology (RRCAT), Indore-452 013:

1. Dr. Sendhil Raja, SO/G, ALOD
2. Dr.(Smt.) Rama Chari, Head, Planning and Co-ordination Division – with a request to ensure necessary compliance to the instructions contained in the Office Order No. 03/2011/2887 dated 16.3.2011 issued by Secretary, DAE and sent to all Head of Units regarding monitoring progress of Plan Projects of DAE.
3. Joint Controller [F&A]



(Sriram S.)

Under Secretary to the Government of India  
☎ (022) 2282 5303

Copy for sanction folder

**Project (R&D Sector) of RRCAT "Technology Development and  
Capacity Building for Gravitational Wave Detection**

**I. Details of the project cost :**

**(Rs. in Crore)**

<b>S. No</b>	<b>Object Head</b>	<b>Estimated Cost</b>
1.	Machinery & Equipment	26.80 (FE - 8.40)
2.	Supplies & Materials	13.60 (FE - 3.60)
3.	Major Works	20.00
	(a) Civil Works 13.50	
	(b) Electrical and ACVE 6.50	
4.	Domestic Travel	00.40
5.	Foreign Travel	00.90 (FE - 0.50)
6.	Office Expenses	00.40
7.	Consultancy	1.30
8.	Other Capital Expenditure	9.20
9.	Public Outreach	1.40
	<b>Total:</b>	<b>74.00</b> <b>(FE - 12.50)</b>

**II. Scheduled date of completion of the project : 31<sup>st</sup> March 2020.**

**Note : The schedule of Major Milestones and Schedule of Machinery & Equipment, Supplies & Materials, Major Works, Consultancy and Other Capital expenditure are given at Annex-I & Annex-II respectively.**

**III. PROJECT COORDINATOR:**

Dr. Prasad A. Naik, Director, RRCAT



(Sriram S.)

Under Secretary to the Government of India

## ANNEX-I

### Major Milestones

No.	Year & Quarter	Major Milestones falling in the Quarter	Financial Target (Rs in Cr)
1.	2017-18/Q2 (Jul-Sep 2017)	Completion of the optical design of the 10 m prototype interferometer (RRCAT)	15.25
2.	2017-18/Q4 (Jan-March 2018)	Outgassing measurement system for sample coupons of steel (IPR)	
3.	2018-19/Q1 (Apr-Jun 2018)	Completion of out-gassing measurement setup (IPR)	
4.	2018-19/Q2 (Jul-Sep 2018)	10 W narrow-linewidth laser for the prototype interferometer (RRCAT)	32.25
5.	2018-19/Q3 (Oct-Dec 2018)	Isolation platform for the 10 m prototype interferometer (RRCAT)	
6.	2019-20/Q1 (Apr-Jun 2019)	Upgradation of tier-2 Data centre (IUCAA)	
7.	2019-20/Q2 (Jul-Sep 2019)	Fabrication of optics for the 10 m prototype interferometer (RRCAT)	
8.	2019-20/Q3 (Oct-Dec 2019)	Data acquisition system development and test facility (IPR)	26.5
		EPICS based control system for the 10 m prototype (RRCAT+IPR)	
9.	2019-20/Q4 (Jan-March 2020)	Prototype fabrication of BSC and HAM chambers (IPR)	
		10 m prototype interferometer commissioning (RRCAT)	

Note: (a) Any particular quarter may have more than one milestone or none.





ANNEX - II**Schedule of Machinery & Equipment (M&E) :**

No.	Item Description	Estimated Cost (Lakhs)	Scheduled date of In- denting	Likely date of delivery	Phasing of Expendi- ture (Rs in Lakhs)			Import
					1 <sup>st</sup> Year2 017-1 8	2 <sup>nd</sup> Year2 018-1 9	3 <sup>rd</sup> Year 2019- 20	
1	Broadband Seismometers	120	July 2017	Dec 2017	100	20	-	No
2	Ion pumps, TMP based Vacuum pumping system	50	June 2017	Mar 2020	30	20	-	Yes
3	Cryo-equipment	25	May 2017	Dec 2019	4	21	-	No
4	BSC & HAM Chamber	1060	Sep 2017	Mar 2020	6	104	950	No
5	Baking ovens, outgassing measurement system	100	July 2017	Feb 2020	20	30	50	No
6	Controls hardware (PLC, PXIe, industrial computers, etc)	60	May 2017	Sep 2018	20	40	-	Partly
7	Differential GPS based measurement system	70	Jul 2017	May 2018	-	70	-	Yes
8	HEPA Fan-filter Units	85	Jul 2017	May 2018	-	85	-	Yes
9	HPC Hardware	280	Jan 2017	Mar 2020	240	40	-	No
10	18" Zygo	500	July 2017	Jul 2019	-	450	50	Yes
11	Clean tables & tents	30	May 2017	Dec 2019	30	-	-	No
12	Fiber drawing and welding system	120	June 2017	Sep 2019	40	80	-	Yes
13	Software Tools (Solid-Works, Ansys, Apex, Comsol and CATIA V6)	90	May 2017	Dec 2019	40	50	-	No
14	Miscellaneous equipment costing less than 50 lakhs	90	May 2017	Mar 2019	50	40	-	No
<b>Total</b>		<b>2680</b>			<b>580</b>	<b>1050</b>	<b>1050</b>	

Mins

**Schedule of Supplies & Materials (S&M) :**

No.	Item Description	Estimated Cost (Lakhs)	Scheduled date of Indenting	Likely date of delivery	Phasing of Expenditure (Rs in Lakhs)			Import
					1 <sup>st</sup> Year2 017-18	2 <sup>nd</sup> Year2 018-19	3 <sup>rd</sup> Year 2019-20	
1	Pump diodes	200	July 2017	Feb 2020	80	120	-	Yes
2	Aluminium 6061 extrusions	150	May 2017	Sep 2018	50	100		No
3	SS 304 & 316 sheets & plates	200	May 2017	Dec 2018		200		No
4	Fused silica blanks and pre-forms	80	June 2017	Dec 2017	80			Yes
5	Clean room consumables	90	May 2017	Mar 2020	30	60	-	No
6	High purity chemicals, first contact protection spray, etc	40	Apr 2017	Mar 2020	10	20	10	No
7	Ultra pure gases (He, N, calibrated leaks, etc)	120	Apr 2017	Mar 2020	20	60	40	No
8	Optical components, viewports, etc.	80	Apr 2017	Mar 2020	10	50	20	Yes
9	Electronics components, cards, etc.	200	Apr 2017	Mar 2020	60	110	30	No
10	Miscellaneous materials costing less than 50 lakhs	200	Apr 2017	Mar 2020	20	180	-	No
<b>Total</b>		<b>1360</b>			<b>360</b>	<b>900</b>	<b>100</b>	

**Schedule of Major Works (MW) :**

No.	Item Description	Estimated Cost (Lakhs)	Scheduled date of Indenting	Likely completion date	Phasing of Expenditure (Rs in Lakhs)			Re- marks
					1 <sup>st</sup> Year 2017-18	2 <sup>nd</sup> Year 2018-19	3 <sup>rd</sup> Year 2019-20	
1	Land	-	-	-	-	-	-	
2	b) Civil Works	1350	May 2017	Dec 2019	100	700	550	
3	c) Electrical & ACVE	650	May 2017	Mar 2020		100	550	
4	d) Mechanical Works							
<b>Total</b>		<b>2000</b>			<b>100</b>	<b>800</b>	<b>1100</b>	

**Schedule of Consultancy & other Capital expenditures:**

Sr. No.	Item Description	Estimated Cost (Lakhs)	Scheduled date of In- denting	Likely completion date	Phasing of Expenditure (Rs in Lakhs)			Remarks
					1 <sup>st</sup> Year 2017-18	2 <sup>nd</sup> Year 2018-19	3 <sup>rd</sup> Year 2019-20	
1	Science R&D HRD	920	April 2017	Mar 2020	320	300	300	
2	Fellowship Fee (LSC)	130	April 2017	Mar 2020	35	45	50	
3	Public Outreach	140	April 2017	Mar 2020	50	40	50	
	<b>Total</b>	<b>1190</b>			<b>405</b>	<b>385</b>	<b>400</b>	

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भारत सरकार Government of India  
परमाणु ऊर्जा विभाग Department of Atomic Energy  
आर एंड डी- I अनुभाग R&D-I Section

अणुशक्ति भवन Anushakti Bhavan  
छ.शि.म. मार्ग C.S.M. Marg,  
मुंबई Mumbai - 400 001.

संदर्भ सं/ Ref No.3/1/2018/RRCAT/R&D-I/15061

दिसंबर December 3 2018

**कार्यालय आदेश OFFICE MEMORANDUM**

विषय: आरआरकेट के "उच्च ऊर्जा के लिए प्रौद्योगिकी प्रदर्शक" नामक परियोजना(पीआईसी सं. आरआरआर 3002) (विज्ञान स्कीम 9- डायरेक्टेड रिसर्च)

Subject: RRCAT project titled "Technology Demonstrator for High Energy Laser" (PIC No. RRR 3002)(Vision Scheme 9- Directed Research)

अधोहस्ताक्षरी को उपर्युक्त विषय पर दिनांक 29.5.2018 को ई-मेल द्वारा प्राप्त आरआरकेट के प्रस्ताव को देखने और आरआरकेट के "उच्च ऊर्जा के लिए प्रौद्योगिकी प्रदर्शक" नामक परियोजना पर अधिकतम रु. 72.0 करोड़ (रुपये बहत्तर करोड़ केवल) के व्यय की सक्षम प्राधिकारी की मंजूरी को इस कार्यालय आदेश में संलग्न विवरण के अनुसार भेजने का निदेश प्राप्त हुआ है।

The undersigned is directed to refer to RRCAT proposal received vide email dated 29.5.2018 on the captioned subject and to convey the sanction of Competent Authority to an expenditure not exceeding Rs 72.0 crore (Rupees Seventy two crore only) on RRCAT project titled "Technology Demonstrator for High Energy Laser" as per the details annexed to this Office Memorandum.

2. इस व्यय को निम्नलिखित लेखा शीर्ष में डाला जाए:

The expenditure is debitable to the following Head of Account:

प्रमुख शीर्ष Major Head	:	5401	-	परमाणु ऊर्जा अनुसंधान पर पूंजी परिव्यय Capital Outlay on Atomic Energy Research
लघुशीर्ष Minor Head	:	00 206	-	राजा रमन्ना प्रगत प्रौद्योगिकी केंद्र Raja Ramanna Centre for Advanced Technology
उप-शीर्ष Sub-Head	:	72	-	लेज़र के लिए प्रगत प्रौद्योगिकी Advanced Technology for Laser
2018-19 के लिए अनुदान सं. Grant number for 2018-19	:	4	-	परमाणु ऊर्जा Atomic Energy
परियोजना के लिए यूआईडी कोड UID Code of the project	:	-	-	आरआरआर 2023 RRR 2023


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3. इसे दिनांक 26.12.2014 के कार्यालय आदेश सं. 7/1(13)/2014-बजट/16391 के अनुसार आंतरिक वित्तीय सलाहकार, पऊवि के रूप में संयुक्त सचिव (एएंडए) के परामर्श से सचिव, पऊवि के अनुमोदन से जारी किया जाता है।

This issues with the approval of Secretary, DAE in consultation with JS(A&A) as IFA, DAE in terms of DAE OM No. 7/1(13)/2014-Budget/16391 date 26.12.2014.

  
21/12/18

(वाई. कमलाकर Y.Kamalakar)

अवर सचिव-भारत सरकार

Under Secretary to the Government of India

(022) 2286 2541

निदेशक Director,

राजा रमन्ना प्रगत प्रौद्योगिकी केंद्र

Raja Ramanna Centre for Advanced Technology,

इंदौर Indore - 452 013.

संदर्भ सं/ Ref No.3/1/2018/RRCAT/R&D-II/15061

दिसंबर December 3 2018

**प्रतिलिपि Copy :**

**परमाणु ऊर्जा विभाग , मुंबई**

**Department of Atomic Energy, Mumbai:**

1. मुख्य लेखा नियंत्रक CCA
2. प्रमुख, सीआईएसडी Head, CISD
2. सदस्य सचिव, पीएसी Member Secretary, PAC
3. बजट एवं योजना अधिकारी Budget & Planning Officer
4. संयुक्त नियंत्रक (एफएंडए), आईआईडब्ल्यू JC(F&A),IIW

**राजा रमन्ना प्रगत प्रौद्योगिकी केंद्र (आरआरकेट), इंदौर-452 013**

**Raja Ramanna Centre for Advanced Technology (RRCAT), Indore-452 013:**

1. श्री ए. एस.जोशी, प्रगत लेज़र एवं ऑप्टिक्स प्रभाग  
Shri A S Joshi, Head, Advanced Laser & Optics Division
2. डॉ. सेंधिल राजा एस, एसओ/जी, प्रगत लेज़र एवं ऑप्टिक्स प्रभाग  
Dr.Sendhil Raja S, SO/G, Advanced Laser & Optics Division
3. श्री एस. वी. नाखे, निदेशक, लेज़र समूह  
Shri S V Nakhe, Director, Laser Group
4. उप लेखा नियंत्रक  
Deputy Controller of Accounts

**लेखा परीक्षा Audit:**

1. उप निदेशक, प्रधान लेखा परीक्षक निदेशक का कार्यालय, वैज्ञानिक विभाग, अणुशक्ति भवन, मुंबई-400 001  
Dy. Director, Office of Principal Director of Audit, Scientific Departments, Anushakti Bhavan, Mumbai- 400 001.



(वाई. कमलाकर Y.Kamalakar)

अवर सचिव-भारत सरकार

Under Secretary to the Government of India

☎ (022) 2286 2541

**मंजूरी फ़ोल्डर की प्रति Copy for sanction folder**

संदर्भ सं/ Ref No.3/1/2018/RRCAT/R&amp;D-II/ 150 61

दिसंबर December 3 2018

आरआरकेट के "उच्च ऊर्जा लेज़र के लिए प्रौद्योगिकी प्रदर्शक" नामक परियोजना  
RRCAT project titled "Technology Demonstrator for High Energy Laser"

- I. परियोजना लागत का विवरण  
Details of the project cost:

(₹ लाखों में in lakhs)

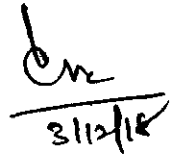
क्र.सं. S No.	मद शीर्ष Object Head	अनुमानित लागत Estimated Cost
1	मशीनरी एवं उपस्कर Machinery & Equipment	3400
2	आपूर्ति और सामग्री Supplies & Materials	3150
3	प्रमुख कार्य Major Works	535
4	घरेलू यात्रा Domestic Travel	52
5	कार्यालय व्यय Office Exp	13
6	परामर्श कार्य Consultancy	50
	कुल Total	7200

- II इस परियोजना को पूरा करने की निर्धारित तारीख : 31.03.2021  
Scheduled date of completion of the project: 31.03.2021

नोट: संलग्नक I से V में मशीनरी एवं उपस्करों, आपूर्ति एवं सामग्री, प्रमुख कार्य, परामर्श एवं अन्य पूंजी व्यय तथा प्रमुख माइल स्टोन्स की अनुसूची दी गई है।

Note: The schedule of Machinery & Equipments, Supplies & Materials, Major Works, Consultancy & Other Capital Expenditure; and Major Milestones are given at Annex I to V

- III परियोजना संयोजक Project Co-ordinator  
श्री ए. एस. जोशी, प्रमुख, प्रगत लेज़र और ऑप्टिक्स प्रभाग  
Shri A S Joshi, Head, Advanced Laser & Optics Division.



(वाई. कमलाकर Y.Kamalakar)

अवर सचिव-भारत सरकार

Under Secretary to the Government of India

☎ (022) 2286 2541

**Schedule of Machinery & Equipments (M & E):**

No.	Item Description	Estimated Cost (Lakhs)	Scheduled date of Indenting	Likely date of delivery	Phasing of Expenditure (Rs in Lakhs)			Import
					1 <sup>st</sup> Year 2018-19	2 <sup>nd</sup> Year 2019-20	3 <sup>rd</sup> Year 2020-21	
1	Diode pump gain modules for pre-amplifiers	370	Sep 2018 - Jan 2019	Apr 2019 - Dec 2019	280	90	-	Yes
2	Clean room compatible diffusion bonding furnace (1600 °C)	350	Oct 2018	Dec 2019	-	300	50	No
3	High precision Wire Bonder	260	Jul 2018	Mar 2019	235	25	-	No
4	Double side lap optics polishing machines (500 mm dia)	250	Aug 2018	Mar 2019	225	25	-	No
5	Small size double side lap optics polishing machine (100 mm dia)	150	Apr 2018	Nov 2019	-	120	30	No
6	High precision PCB prototyping system	120	Jun 2018	Feb 2019	100	20	-	No
7	PECVD for mixed oxide coating	80	July 2018	Dec 2019	-	70	10	Yes
8	Refractometer for Optical glass	60	Sep 2018	Jan 2020	-	60	-	Yes
9	Semi automatic optics lapping machine	50	Jun 2018	Mar 2019	50	-	-	Yes
10	Finished Optics cleaning facility	50	Jun 2018	Feb 2019	50	-	-	No
11	Arbitrary waveform generator	45	Jul 2018	Mar 2019	45	-	-	No
12	Electro-optic Systems	300	Aug 2018 to Dec 2019	Feb 2019 to Sep 2020	165	105	30	Partly
13	Imaging and diagnostics Equipment	210	July 2018 to May 2019	May 2019 to Jan 2020	125	85	-	Partly
14	Electronics equipment	195	May 2018 to Jun 2019	Jan 2019 to Feb 2020	95	100	-	Partly
15	Vacuum Equipment	110	May 2018 to Nov 2018	Jan 2019 to Sep 2019	30	80	-	Partly
16	Softwares	180	July 2018 to Sep 2019	Feb 2019 to Jan 2020	60	120	-	No
17	Clean room equipments and accessories	150	Aug 2018 to Sep 2019	Jan 2019 to Jan 2020	15	135	-	No
18	Upgradation of Optical coating facility	180	Jun 2018 to Jun 2019	Jan 2019 to Aug 2020	60	80	40	Partly
19	Miscellaneous Equipments	290	Apr 2019 to May 2019	May 2019 to Oct 2020	65	185	40	Partly
20	Total	3400			1600	1600	200	

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**Schedule of Supplies & Materials (S&M) :**

No.	Item Description	Estimated Cost (Lakhs)	Scheduled date of Indenting	Likely date of delivery	Phasing of Expenditure (Rs in Lakhs)			Import
					1 <sup>st</sup> Year 2018-19	2 <sup>nd</sup> Year 2019-20	3 <sup>rd</sup> Year 2020-21	
1	Laser and electro-optic materials	360	Sep 2018 to Nov 2019	Mar 2019 to Oct 2020	55	140	165	Partly
2	Ultra high purity Fused silica blanks	220	Nov 2018	Aug 2019		200	20	No
3	High power spatial light modulators (SLM)	190	May 2018 to Dec 2019	Jan 2019 to Nov 2020	30	80	80	No
4	Optical glasses	125	Jun 2018 to Sep 2019	Dec 2018 to Aug 2020	20	65	40	No
5	Flashlamps	110	Oct 2018 to Aug 2019	Mar 2019 to May 2020	20	30	60	No
6	High homogeneity optical glass	100	Nov 2018	Dec 2018	-	100	-	No
7	Airbearings stages and spindles	90	Jun 2018	July 2019	-	90	-	No
8	Large aperture gratings	60	Aug 2018	Mar 2019	60	-	-	Yes
9	HV Energy storage Capacitors	50	Jun 2018	Dec 2019	25	25	-	No
10	Optical components:	200	Jul 2018 to Dec 2019	Jan 2019 to Mar 2020	85	115	-	No
11	Disc amplifier mechanical assembly and involute reflectors	200	Aug 2018 to Jan 2019	Dec 2018 to Nov 2020	50	130	20	No
12	Opto- mechanical components	280	Jul 2018 to Oct 2018	Jan 2019 to Jun 2020	30	185	65	No
13	Chemicals and gases	155	Sep 2018 to Nov 2018	Feb 2019 to Dec 2020	40	70	45	No
14	Opto-electronic components	245	Sep 2018 to Nov 2018	Feb 2019 to Dec 2020	100	120	25	No
15	Workshop consumables	200	Sep 2018 to Nov 2018	Feb 2019 to Dec 2020	55	95	50	No
16	Coating materials and Spares for optical coating facilities	55	Apr 2018 to July 2019	Jan 2019 to Apr 2020	30	10	15	Yes
17	High voltage and electrical components	140	Sep 2018 to May 2018	Mar 2019 to Jan 2020	60	45	35	No
18	Low voltage Components	90	Aug 2018 to Aug 2019	Jan 2019 to Sep 2019	60	30		No
19	Miscellaneous items,	280	Aug 2018 to Aug 2020	Jan 2019 to Dec 2020	80	170	30	No
	<b>Total</b>	<b>3150</b>			<b>800</b>	<b>1700</b>	<b>650</b>	

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Annex - III

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**Schedule of Major Works (MW) :**

No.	Item Description	Estimated Cost (Lakhs)	Scheduled date of Indenting	Likely completion date	Phasing of Expenditure (Rs in Lakhs)			Remarks
					1 <sup>st</sup> Year 2018-19	2 <sup>nd</sup> Year 2019-20	3 <sup>rd</sup> Year 2020-21	
1	Land	-	-	-	-	-	-	
2	b) Civil Works	355	May 2018	Dec 2019	145	180	30	
3	c) Electrical & ACVE	100	Jun 2018	May 2020	-	40	60	
4	d) Mechanical Works	80	Oct 2018	Apr 2020	-	50	30	
	<b>Total</b>	<b>535</b>			<b>145</b>	<b>270</b>	<b>120</b>	

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Annex - IV

**Schedule of Consultancy & other Capital expenditures:**

Sr. No.	Item Description	Estimated Cost (Lakhs)	Scheduled date of Indenting	Likely completion date	Phasing of Expenditure (Rs in Lakhs)			Remarks
					1 <sup>st</sup> Year 2018-19	2 <sup>nd</sup> Year 2019-20	3 <sup>rd</sup> Year 2020-21	
1	Consultancy	50	Aug 2018	Mar 2020	50	-	-	
2	Other capital expenditure	-			-	-	-	
	<b>Total</b>	<b>50</b>			<b>50</b>	-	-	

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**Major Milestones**

No	Year & Quarter	Major Milestones falling in the Quarter	Financial Target (Rs in Cr)
1	2018-19 (Apr-Jun 2018)	Development of front end laser oscillator and fiber beam splitters to generate multiple beams	26
2	2018-19 (Jul-Sep 2018)	Gain characterisation of pre-amplifier stage of the front end	
3	2018-19 (Oct-Dec 2018)	Gain characterization of four disc amplifier module	
4	2018-19 (Jan-Mar 2019)	Test bench setup of the one beam of 100 mm aperture with with small signal single pass gain $\geq 3$ . Engineering design of the laser system and optical layout of the 16 beams	
5	2019-20 (Apr-Jun 2019)	Assembly of various sub-systems(fiber oscillator, pulse shaper, pre-amplifiers, SLM shapers) of the front end	36
6	2019-20 (Jul-Sep 2019)	Assembly of various sub-systems (disc amplifiers , power supply, VSF, wavefront sensor) of the main amplifier	
7	2019-20 (Oct-Dec 2019)	Optimization and characterisation of the front end of the laser system	
8	2019-20 (Jan-March 2020)	Optimization of disc amplifier and its coupling to the front end Completion of the development of capacitor banks and pre-ionization circuit for disc amplifiers of two beams	
9	2020-21 (Apr-Jun 2020)	Assembly of two beams of the laser system delivering 1 kilojoule, 3 nanosecond (each beamlet of 500 J at 1054 nm)	10
10	2020-21 (Jul-Sep 2020)	Characterisation of laser output parameters; energy, pulse width, beam profile, etc. of the two beam laser system	
11	2020-21 (Oct-Dec 2020)	Integration of the laser system and its control system with the experimental chamber and experimental control system	
12	2020-21 (Jan-Mar 2021)	Carry out Initial laser shock experiments with planar targets	

Note : a) Any particular quarter may have more than one milestone or none.

b) Extend the table similarly to cover XIII Plan period, if the project is going beyond XII Plan

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31-11-18