PD CM 0203


C-MMACS

**CSIR Centre for Mathematical Modelling and Computer Simulation**

# PROJECT PROPOSALS FOR 10TH FIVE YEAR PLAN PERIOD (2002-2007)

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Project Document CM 0203

March 2002
Bangalore 560 037, India

# C-MMACS Project Proposals for 10th Five Year Plan Period

## Summary for Financial Approval

| Sl. No. | Project Code | Programme Classification | Plan | |
|---|---|---|---|---|
| | | | 1st year 2002-2003 | 5 years 2002- 2007 |
| 1 | GP1 | II. 20, III. 21 | 5 | 10 |
| 2 | GP2 | II. 20, III. 1 | 7 | 9 |
| 3 | AK1 | II. 20 | 4 | 10 |
| 4 | AK2 | II. 20 | 2 | 4 |
| 5 | KM1 | II. 20 | 0 | 2 |
| 6 | KM2 | II. 20 | 0 | 2 |
| 7 | PG1 | II. 20 | 5 | 25 |
| 8 | PG2 | II. 20 | 5 | 12 |
| 9 | PG3 | II. 20 | 10 | 50 |
| 10 | PG4 | II. 20 | 5 | 15 |
| 11 | SJ1 | II. 20 | 3 | 15 |
| 12 | MKS1 | II. 20 | 2 | 10 |
| 13 | GKP1 | II. 20 | 8 | 22 |
| 14 | VAK1 | II. 20 | 0 | 19 |
| 15 | JB1 | II. 17, II. 20 | 5 | 25 |
| 16 | JB2 | II. 20 | 5 | 25 |
| 17 | IAP1 | II. 20 | 14 | 20 |
| ***Total*** | | | ***80*** | ***275*** |
| 18 | *Infrastructure renovation and refurbishment* | | 120 | 245 |
| **Total** | | | **200** | **520** |

All figures in Rs. L.

**Sub: Project Proposals for Tenth Five Year Plan (2002-2007) and for Annual Plan 2002-03**

We now understand that the plan allocations to the laboratories for 2002-2003 will be on a project basis and that we need to submit well conceived projects to secure the requisite financial approvals. That is, we now need to generate specific project proposals and seek project-wise approvals from CSIR. I have therefore sought inputs from our Scientists/Fellows using a proforma designed after very careful thought by NAL and which I think was exemplary for the immediate purpose. Although our need now is to secure the plan allocation for 2002-2003, I have asked our Scientists to project a longer-term picture for the full five years from 2002-2007. I am enclosing the consolidated picture of our inputs to CSIR. Right now, only first-cut summary proposals are indicated. We will work out these summary proposals into a more detailed statement to be submitted in due course of time.

In the last plan, a modernisation budget was not given to C-MMACS. It is therefore included in the present budget, especially as C-MMACS should be in the vanguard of any effort by CSIR to put in place a modern IT infrastructure. In fact, C-MMACS can be a mirror portal, if not the main portal, for CSIR's efforts for a Comprehensive Traditional Knowledge Digital Documentation Library (I.10 Mission Mode Programme of the Steering Committee on S&T).

C-MMACS' projections are that it will need Rs. 200L for the 1st year (2002-2003) and Rs. 520L over the 5-year period (2002-2007). After prioritisation by the task force. I think this will come down to modest amounts.

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20 Mathematical Modelling and Computer Simulation
III. 21 Developing Capabilities in Advanced Manufacturing Technology

| | | |
|---|---|---|
| ***Project Title:*** A Priori Error Analysis for Finite Element Modelling | | Project code: GP1 |
| ***Proposer*** Gangan Prathap, C-MMACS<br>Somenath Mukherjee, NAL | ***Div./ Group*** | ***Duration*** 2 years |

***Objectives : (Short term and Long term)***

Formulation of a priori error estimates for finite element computation. This will have implications for automatic and interactive mesh refinement. Function space concepts will be introduced to examine classical problems as well as pathological problems.

***Expected Results/ Applications***

Considerable efforts are being made in recent years to automate finite element methodology. This requires error estimates to be made during analysis. In this project, an attempt will be made to develop error estimates from first principles for the work-horse elements of industry standard packages.

***Deliverables/ Approximate Dates of Delivery***

1. Basic studies using orthogonal projections in function space algebra of problems in structural analysis modelling – Sep 2002
2. Extension of work to plate models based on classical and Mindlin theories – Mar 2003
3. Studies of plane stress and 3D elasticity problems – Sep 2003
4. Parallel development of adaptive codes for 1. to 3. – Sep 2002, Mar 2003, Sep 2003
5. Documentation of Findings, release of package – Mar 2004

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | 5 | 5 | | | | 10 |
| ***External*** | - | - | | | | - |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL*** Structures Division
***Other CSIR Institutions*** SERC, Chennai
***Other Indian Institution*** EACOE, Bangalore
***International Institute***

***Any other relevant information***

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|
| | | |

D:/sita/gp/project proposals_10thFiveyear plan(gp)

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20 Mathematical Modelling and Computer Simulation
III. 1 High Science and Technology for National Aerospace

***Project Title :*** Modelling of Smart Structural Systems for Aerospace Applications — Project code: GP2

| ***Proposer*** Gangan Prathap, C-MMACS<br>S Raja, NAL | ***Div./ Group*** | ***Duration*** 3 years |
|---|---|---|

***Objectives : (Short term and Long term)***

Modelling of piezoelectric devices for hybrid actuation (isotropic & shear) of smart sandwich structures to have better control of structural instabilities (vibration, flutter, dynamic instability)

***Expected Results/ Applications***

A MATLAB based toolbox, incorporating Adaptive Finite Element Analysis, for modelling piezoelectric anisotropy in smart laminated and sandwich composite structures and other piezoelectric devices

***Deliverables/ Approximate Dates of Delivery***

1. Modelling of piezoelectric sandwich systems – Mar 2003
2. Hybrid actuation modelling in laminated and sandwich structures – Mar 2003
3. Modelling piezoelectric anisotropy in smart laminated and sandwich composite structures – Mar 2004
4. Modelling of piezoelectric devices using field-consistent smart finite elements – Sep 2004
5. Dev. of NATLAB based toolbox through stages 1-4, documentation, validation – Mar 2005

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | 7 | 1 | 1 | | | 9 |
| ***External*** | 12.0 | 2 | 2 | | | 16 |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL*** Structures Division
***Other CSIR Institutions***
***Other Indian Institution***
***International Institute***

***Any other relevant information***

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|

D:/sita/gp/project proposals_10thFiveyear plan(GP2)

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20 Mathematical Modelling and Computer Simulation

***Project Title :*** Numerical Investigations of Stability, Dynamics and Morphology of Thin Liquid Films Project code: AK1

| ***Proposer :*** Anand Kumar | ***Div./ Group:*** C-MMACS | ***Duration:*** 3 years |
|---|---|---|

***Objectives : (Short term and Long term)***

We propose to develop efficient numerical methods for the large-scale simulations of the thin film morphology and dynamics. Some of the numerical issues are: I) Numerical solutions of the free boundary problem, subject to the highly nonlinear intermolecular body forces, II) The equations are rendered stiff due to the near molecular to the macroscopic length scales, III) Surface tension forces are important due to a large surface to volume ratio, IV) Real life complexities such as evaporation/condensation, slippage of (non-Newtonian) fluid on its substrate, complex rheologies and the film-substrate heterogeneities, which provide additional numerical challenges, but also opportunities in terms of the application.

***Expected Results/ Applications***

The science and technology of thin liquid films (including polymeric films) are witnessing an explosive growth worldwide due to their technological importance in areas as diverse as microelectronic, optical (e.g., displays, diffraction gratings, etc) and biomedical applications (e.g., lab-on-a-chip); nanotechnology; and coatings. The central problem in this area is to understand the stability, dynamics and morphology of thin (<100 nm) fluid films on solid substrates under the influence of a variety of antagonistic (attractive/repulsive) short and long range intermolecular interactions (forces) that come into play due to the finite (nanoscale) thickness of the film. A fundamental understanding of the free surface flows and surface deformations in thin films engendered by the interfacial forces is crucial in nano-scale patterning of soft materials including polymers by means of self-organization.

***Deliverables/ Approximate Dates of Delivery***

1. Numerical investigation of coated substrate with adsorbed layer; 1st year
2. Numerical investigation of retraction of liquid films on a homogeneous substrate, 2nd year
3. Numerical investigation of evaporating thin films, 3rd year

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | 4 | 3 | 3 | | | 10 |
| ***External*** | Planned | Planned | Planned | | | |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***
***Other CSIR Institutions***
***Other Indian Institution*** Prof. Ashutosh Sharma, Dept. of Chemical Engineering, I.I.T., Kanpur 208016
***International Institute***

***Any other relevant information***

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|
| | | |

D:/sita/gp/project proposals_10thFiveyear plan(AK1)

# Project Proposals for 10th Five Year Plan Period

## Programme: II. 20 Mathematical Modelling and Computer Simulation

| | | |
|---|---|---|
| ***Project Title*** *:* Director and Concentration Profiles in 2-Component Liquid Crystals | | Project code: AK2 |
| ***Proposer:*** Anand Kumar | ***Div./ Group:*** C-MMACS | ***Duration:*** 2 years |

***Objectives : (Short term and Long term)***

We propose to develop efficient numerical codes to solve relevant equations to understand the new structures observed.

***Expected Results/ Applications***

In the liquid crystal laboratory of Raman Research Institute, Bangalore several new director configurations have been discovered. The relevant equations governing these structures involve both director and concentration fields, and are highly nonlinear. The calculations are expected to lead to new predictions, which can be tested in the laboratory.

***Deliverables/ Approximate Dates of Delivery***

Numerical investigation to understand new observed director configurations, and possibly come up with new predictions; two year

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | 2 | 2 | | | | 4 |
| ***External*** | Nil | Nil | | | | 0 |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***
**Other CSIR Institutions**
***Other Indian Institution*** Prof. N V Madhusudana, Raman Research Institute, Bangalore
***International Institute***

***Any other relevant information***

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|
| | | |

D:/sita/gp/project proposals_10thFiveyear plan(AK2)

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20. Mathematical Modelling and Computer Simulation

***Project Title :*** Studies on moving grid methods for partial differential equations — Project code: KM1

| ***Proposer*** T R Krishna Mohan | ***Div./ Group*** C-MMACS | ***Duration*** 5 years |
|---|---|---|

***Objectives : (Short term and Long term)***

To understand the moving grid methods in the context of bioremediation models

To devise moving grid methods that can be applied with ease to given problems

To make software packages for moving grid methods that can be combined with commercially available softwares for numerical integration of partial differential equations.

***Expected Results/ Applications***

Efficient simulation software for bioremediation problems applicable to high initial contaminant concentrations

Software package for moving grid methods applicable to a wide class of problems

***Deliverables/ Approximate Dates of Delivery***

1. Published papers/reports and presentations – at regular intervals of approx. one year
2. Software for moving grid methods for partial differential equations – after 4 years
3. Software for moving grid methods that can be combined with commercially available integration packages – after 4 years

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | 0 | 0 | 2 | 0 | 0 | 2 |
| ***External*** | 0 | 0 | 0 | 3 | 3 | 6 |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***
***Other CSIR Institutions*** RRL Jorhat
***Other Indian Institution***
***International Institute***

***Any other relevant information***

Work is expected to start from 3rd year only because of absence of the investigator from C-MMACS on sabbatical from June

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|

D:/sita/gp/project proposals_10thFiveyear plan(KM1)

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20. Mathematical Modelling and Computer Similation

***Project Title :*** Studies on the role of lithospheric heterogeneities in earthquake dynamics Project code: KM2

| ***Proposer*** T R Krishna Mohan | ***Div./ Group*** C-MMACS | ***Duration*** 5 years |
|---|---|---|

***Objectives : (Short term and Long term)***

To understand the earthquake dynamics better so as to determine its predictabilities
To elucidate the role of lithospheric heterogeneities in earthquake dynamics and incorporate it in the models
To understand the concept of self-organised criticality better so as to apply it fruitfully.

***Expected Results/ Applications***

The role of lithospheric heterogeneities in shaping the earthquake statistics would be understood better
Generation of catalogue of synthetic earthquake data for use in earthquake predictability programs

***Deliverables/ Approximate Dates of Delivery***

1. Published papers/reports and presentations – at regular intervals of apprx. one year
2. Catalogues of synthetic earthquake data – from 4 years onwards
3. Simulation models for earthquakes with heterogeneities incorporated – from 4 years onwards
4. Prediction models for earthquakes – from 4 years onwards

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | 0 | 0 | 2 | 0 | 0 | 2 |
| ***External*** | 0 | 0 | 0 | 3 | 3 | 6 |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***
***Other CSIR Institutions*** NGRI (India)
***Other Indian Institution***
***International Institute*** Grenoble, (France) etc

***Any other relevant information***

Work is expected to start from 3rd year only because of absence of the investigator from C-MMACS on sabbatical from June 2002

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|

D:/sita/gp/project proposals_10thFiveyear plan(KM2)

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20 Mathematical Modelling and Computer Simulation

***Project Title :*** Modelling of intra-seasonal and inter-annual variability of land surface processes Project code: PG1

| ***Proposer*** Prashanth Goswami<br>S Himesh | ***Div./ Group*** C-MMACS | ***Duration*** 5 years |
|---|---|---|

***Objectives : (Short term and Long term)***

1. Development of Comprehensive environmental database relevant to land surface processes of select Indian river basins
2. To study evolution , intra-seasonal and inter-annual variability of soil moisture for different scenarios of rainfall and land-use pattern for different basins
3. To study the impact of atmospheric and anthropogenic stress on basin's hydrological response through coupled atmospheric –hydrological model

***Expected Results/ Applications***

Identification and quantification of the impact of significant basin specific land surface processes on basin's hydrological response

***Deliverables/ Approximate Dates of Delivery***

1. Database (2003)
2. Model to simulate basin's hydrological response with realistic basin specific surface features and processes(2005)
3. Parameter estimation and sensitivity studies over different bsins(2006)
4. Model calibration and validation(2007)

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| | ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** | |
|---|---|---|---|---|---|---|---|---|
| | ***CSIR*** | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 25.00 | |
| | ***External*** | | | | | | | |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***
***Other CSIR Institutions***
***Other Indian Institution*** NIH - Roorkee
***International Institute*** LMD France

***Any other relevant information***

This project is closely linked to Indo-French Centre on Environment &Climate ( IFCEC )Program

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|
| | | |

D:/sita/gp/project proposals_10thFiveyear plan(PG SH)

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20 Mathematical Modelling and Computer Simulation

| | | |
|---|---|---|
| ***Project Title :*** Neural Network Based Long-range Forecasts of Atmospheric and Oceanographic Processes | | Project code: PG2 |
| ***Proposer*** P Goswami<br>G K Patra | ***Div./ Group*** C-MMACS | ***Duration*** 5 years |

***Objectives : (Short term and Long term)***

To design and evaluate cognitive networks for long-range prediction of rainfall at various timescales eg., daily, weekly, monthly and annual for particular location (or sector)

To evaluate and extend the cognitive network prediction for various locations through suitable design to simulate and predict both spatial and temporal variations.

To organize the various network configurations in a hirarchical and interconnected unit to obtain a comprehensive simulation and prediction system for rainfall pattern.

***Expected Results/ Applications***

A cognitive network capable of long-range prediction of rain fall at various time scales

A Cognitive Network capable of prediction for spatial and temporal variation various locations.

A hirarchical and interconnected comprehensive simulation and prediction system for rainfall pattern

***Deliverables/ Approximate Dates of Delivery***

1. Design and evaluation of CN for sectorial mean annual rain fall (15 months)
2. Design and evaluation of CN for prediction of monthly rainfall (15 months)
3. Design and evaluation of CN for prediction of weekly rainfall (10 months)
4. Design and evaluation of CN for prediction of daily rainfall (10 months)
5. Hierarchical organization of network for different timescales. (10 months)

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| Source | 1st Year | 2nd Year | 3rd Year | 4th Year | 5th Year | Total |
|---|---|---|---|---|---|---|
| ***CSIR*** | *5* | *2* | *2* | *2* | *1* | *12* |
| ***External*** | *10* | *2* | *2* | *2* | *2* | *18* |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***
***Other CSIR Institutions***
***Other Indian Institution***
***International Institute***

***Any other relevant information***

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|
| | | |

D:/sita/gp/project proposals_10thFiveyear plan(PG2)

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20 Mathmatical Modelling and Computer Simulation

***Project Title:*** Ocean-Atmospheric Coupled Model for Climatic Variability — Project code: PG3

| ***Proposer :*** | ***Div./ Group*** | ***Duration*** |
|---|---|---|
| P Goswami<br>P Rajeevan | C-MMACS | 5 years |

***Objectives : (Short term and Long term)***

To develop Ocean-Atmospheric Coupled Model with global coverage
To simulate Ocean-Atmospheric Variability in the Tropics at different scales.

***Expected Results/ Applications***

Understanding of ocean-atmospheric variabilities at different scales.

***Deliverables/ Approximate Dates of Delivery***

1. Calibrated stand-alone model (30.3.2003)
2. Software module for Ocean-Atmospheric coupled model (30.9.2004)
3. Calibrate coupled model for tropical variabilities (30.3.2007)

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | 10 | 10 | 10 | 10 | 10 | 50 |
| ***External*** | 0 | 10 | 10 | 10 | 10 | 40 |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***
***Other CSIR Institutions*** NIO, Goa
***Other Indian Institution*** LODYC, Paris. LMD, Paris
***International Institute***

***Any other relevant information***

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|
| | | |

D:/sita/gp/project proposals_10thFiveyear plan(PG3)

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20 Mathematical Modelling and Computer Simulation

| | | |
|---|---|---|
| ***Project Title :*** Assimilation methodology for atmospheric and oceanic models | | Project code: PG4 |
| ***Proposer :*** P Goswami | ***Div./ Group*** C-MMACS | ***Duration*** 5 years |

***Objectives : (Short term and Long term)***

To develop and test evaluate algorithms for assimilations data in models of atmosphere and ocean.
Implementation and validation of assimilation methodology in a hierarchy of models.

***Expected Results/ Applications***

Algorithms for evaluation and validation of assimilation systems.

***Deliverables/ Approximate Dates of Delivery***

Algorithms for evaluation and validation of assimilation systems.

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | 5 | 5 | 3 | 1 | 1 | 15 |
| ***External*** | | 5 | 3 | 3 | 3 | 14 |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***
***Other CSIR Institutions***
***Other Indian Institution*** NCMRWF, New Delhi
***International Institute*** LMD, France

***Any other relevant information***

The external funding for the project is expected from the Indo-French Centre for Promotion of Advanced Research.

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|
| | | |

D:/sita/gp/project proposals_10thFiveyear plan(PG4)

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20 Mathematical Modelling and Computer Simulation

***Project Title :*** Analysis, Interpretation and Modelling of GPS data of Network Stations Project code: SJ1

| ***Proposer*** Sridevi Jade | ***Div./ Group*** C-MMACS | ***Duration*** 5 years |
|---|---|---|

***Objectives : (Short term and Long term)***

Modelling the dynamics of continental collision zone
Influence of GPS signal scattering on GPS stations and solutions

***Expected Results/ Applications***

Insight in to the deformation suffered by the network stations
Based on the magnitude of strain accumulation, GPS experiments can be designed for more detailed study

***Deliverables/ Approximate Dates of Delivery***

Continuous monthly solutions (posted on web).

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | 3 | 3 | 3 | 3 | 3 | 15.0 |
| ***External*** | | | | | | |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***
***Other CSIR Institutions***
***Other Indian Institution:*** Indian Institute of Astrophysics, Guhauti university, Nagaland university, Tezpur university, Aizwal university, Imphal university, IMD shillong.
International Institute

***Any other relevant information***

This would give first hand information on the displacement of the GPS network stations as a short term result and aid in modelling the dynamics as a long term result.

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|
| | | |

D:/sita/gp/project proposals_10thFiveyear plan(SJ)

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20 Mathematical Modelling and Computer Simulation

***Project Title :*** Mathematical Modelling of Marine Biogeochemical Cycles — Project code: MKS1

| ***Proposer*** M K Sharada | ***Div./ Group*** C-MMACS | ***Duration*** 5 years |
|---|---|---|

***Objectives : (Short term and Long term)***

**Long Term :**

To understand the influence of biogeochemical processes in the upper ocean on the exchange of carbon between ocean and atmosphere

To link primary productivity models with fish population dynamics models

**Short Term:**

Detailed study of the format of the satellite data obtained ffrom SeaWiFS and OCM Visualization and analysis of the satellite data and cruise data

Comparing the simulation results obtained from 0-D and 1-D models with the satellite data at a few stations in Arabian Sea and Bay of Bengal

Detailed study of contemporary 0-D, 1-D and 3-D models of biogeochemical cycles for Arabian Sea and Bay of Bengal

Study of the forcing functions and environmental conditions prevailing in the Indian ocean, required in the model simulation

To introduce modifications in the formulation of biogeochemical processes and study of the parameter sensitivity

***Expected Results/ Applications***

Understanding the significance of various biogeochemical processes that influence the primary productivity in the upper ocean

Estimation of carbon flux between atmosphere and ocean

Estimation of primary productivity, the basis source of food for fishes

***Deliverables/ Approximate Dates of Delivery***

1. Visualization of spatial and temporal variation of chlorophyll concentration obtained from Satellite data (SeaWiFS and OCM) and the numerical simulation results in the Indian Ocean
2. Development of a proper methodology for the comparison of simulation results with the observation obtained from satellite data, at a few stations in the Indian Ocean
3. Modifications in the formulation of a few of the biogeochemical processes and estimation of some of the model parameters applicable for simulations in Indian Ocean
4. Estimation of carbon flux between atmosphere and ocean and primary productivity in the Indian Ocean

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| | ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|---|
| | ***CSIR*** | 2 | 2 | 2 | 2 | 2 | 10 |
| | ***External*** | | 3 | 3 | 2 | | 8 |

***Linkages with other Institution & their nature (Pl. Specify)***

| | |
|---|---|
| ***Other Divisions of NAL*** | |
| ***Other CSIR Institutions*** | National Institute of Oceanography, Goa for procuring Cruise data |
| ***Other Indian Institution*** | Space Application Centre, Ahmedabad for procuring and understanding OCM data |
| ***International Institute*** | International JGOFS Group, SeaWiFS Data Users' Group for Inputs on Data formats, Data analysis and Modelling activities |

***Any other relevant information***

The data on chlorophyll observed by SeaWiFS is procured from NASA

The estimation of primary productivity may be an useful input for the fish population dynamics model

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|
| | | |

D:/sita/gp/project proposals_10thFiveyear plan(MKS)

# Project Proposals for 10th Five Year Plan Period

**Programme: Programme :** II. 20 Mathematical Modelling and Computer Simulation

***Project Title :*** Design, Development and Implementation of a Complete and Reliable Data Communication System over Internet using Interactive Random Key Generation Algorithm. Project code: GKP1

| ***Proposer*** G K Patra | ***Div./ Group*** C-MMACS | ***Duration*** 5 years |
|---|---|---|

***Objectives : (Short term and Long term)***

To recognize the various security threats to modern cryptographic methods and develop a secure and reliable data communication system. The proposed method based on a non-computational interactive algorithm is expected to provide confidentiality, data integrity, authentication and non-repudiation. In addition, it will provide secure shell for remote application and secure protocols for financial transactions such as E-commerce. This will provide a complete secure solution to all forms of threats by an unknown adversary, which will be achieved by vigrous tests and analysis at each stage of development. This method will be implemented for all available operating systems and made compatible to all available communication protocols. A Graphical User Interface (GUI) will be developed for easy user access to the complex system, and will have options for user to choose its own parameters such as security level and encryption method.

***Expected Results/ Applications***

A complete and reliable security package, to prevent and detect cheating and other malicious activities during communication of secret data over public channel.

Secure information exchange for secret vital information of military and diplomatic uses.

Secure cash transactions using secure communication protocols (E-Commerce).

Secure shell to prevent unauthurized hacking and intrusion.

Graphical User Interface (GUI) for easy user access to the complesx system.

***Deliverables/ Approximate Dates of Delivery***

1. Design of Threat Models and analyse the existing modern cryptographic methods using the Threat Models. (12 months)
2. Development of an Interactive Random Key Generation Algorithm (IRKG). (8 months)
3. Implementation and Analysis of IRKG Algorithm in a networked environment. (12 months)
4. Design of a secure shell for authentication and prevention from intrusion. (10 months)
5. Development of secure communication protocols for on-line financial transaction. (10 months)
6. Graphical User Interface (GUI) and development of complete software package. (8 months)

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| | ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** | |
|---|---|---|---|---|---|---|---|---|
| | ***CSIR*** | 8 | 3 | 3 | 4 | 4 | 22 | |
| | ***External*** | | | | | | | |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***
***Other CSIR Institutions***
***Other Indian Institution***
***International Institute***

***Any other relevant information***

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|
| | | |

D:/sita/gp/project proposals_10thFiveyear plan(GKP1)

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20 Mathematical Modelling and Computer Simulation

***Project Title:*** Advanced Study on Design, Implementation and Performance Evaluation Issued of Automatic Network Intrusion Detection Systems (NIDS) — Project code: VAK1

| ***Proposer*** V Anil Kumar | ***Div./ Group*** C-MMACS | ***Duration*** 5 years |
|---|---|---|

***Objectives : (Short term and Long term)***

Identify various possible intrusion attempts targeted to different layers of TCP/IP Communication Suite.

Generatation of Synthetic Intrusion Packets (SIP) to perform behavior analysis of TCP/IP module.

Implementation of high-speed on-line data collection system.

To extract the features of attack and represent it in the form of compact attack signature which can be handled easily and processed faster using algorithms implemented as computer software.

To identify and implement suitable independent algorithm or combination of algorithms to distinguish network intrusion attempts from normal network events using attack signatures extracted in step 4.

To carry out the performance evaluation (both on-line and off-line) of the proposed Intrusion Detection System. Quantify the detection rate and false alarm rate of the system using ROC (Receiver Operation Characteristics) curves, and compare the results with DARPA Intrusion Detection Standards.

***Expected Results/ Applications***

Thorough understanding of major issues involved in design, implementation and performance evaluation of NIDS. 2) A software tool capable of automatically detecting intrusion attempts to computer networks. 3) A set of well defined intrusion packets, and techniques to extract and represent their signature in the form of compact attack symptoms. 4) Output of the behaviour analysis of different implementation of TCP/IP communication protocol while they are under attack with SIP.

***Deliverables/ Approximate Dates of Delivery***

1. Identification of possible intrusion attempts to TCP/IP based Computer Networks. (At the end of 12 months)
2. Generation of Synthetic Intrusion Packets(SIP) for behavior analysis of TCP/IP. (At the end of 24 months)
3. Implementation of on-line data collection system for high speed network. (At the end of 36 months)
4. Signature extraction and representation of intrusion packets. (At the end of 42 months)
5. Implementation of Intrusion detection algorithm. (At the end of 54 months)
6. On-line and off-line performance evaluation of the detection system according to the DARPA intrusion detection guidelines, and detailed research report containing the complete summary of the research output and observation. (at the end of 60 months)

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | | | 9.0 | 6.0 | 4.0 | 19.0 |
| ***External*** | | | | | | |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***

***Other CSIR Institutions***

***Other Indian Institution*** Electrical Engineering Department, IIT Bombay (Prof. D Manjunath)

***International Institute*** Possibilities of collaboration with Fraunhofer Institue for open Communication system, (FOKUS), Berlin will be explored while the proposer is in FOKUS as DAAD fellow.

***Any other relevant information***

The work will be started from November 2002 at Fraunhofer Institute for Open Communication System (FOKUS), Berlin, Germany, the institute where the project proposer will be on deputation as DAAD fellow. There is no financial requirement to carry out this work for the first two years. The work will be continued at C-MMACS and the approximate financial requirement for the 3rd, 4th and 5th years are mentioned.

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|

D:/sita/gp/project proposals_10thFiveyear plan

# Project Proposals for 10th Five Year Plan Period

**Programme:** II.17 Drug target development using in–silico biology
II. 20 Mathematical Modelling and Computer Simulation

| | | |
|---|---|---|
| ***Project Title :*** Studies of nonlinear dynamical phenomena in biological physics | | Project code: JB1 |
| ***Proposer*** Janaki Balakrishnan | ***Div./ Group*** C-MMACS | ***Duration*** 5 years |

***Objectives : (Short term and Long term)***

To develop simple models to understand complex biological process

***Expected Results/ Applications***

Knowledge of mechanisms involved in biological phenomena at the cellular & molecular level; better insight into the protein folding problem, transport phenomena in & across cells. Applications: pharmaceutical industry, drug delivery, use in medical technology.

***Deliverables/ Approximate Dates of Delivery***

1. Transport phenomena - 2003
2. Estimations of global parameters describing the energy landscape of a foldable protein - 2004
3. Estimations of the free energy of a protein - 2005
4. Others spread over till - 2007

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | 5 | 5 | 6 | 5 | 4 | 25 |
| ***External*** | | | | | | |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***

***Other CSIR Institutions***

***Other Indian Institution*** IISc.: Dept of Physics, Molecular Biophysics Unit; National Centre for Biological Studies (NCBS), Bangalore

***International Institute*** University of Massachusetts, Amherst (Dept. of Polymer Science & Engg., Dept of Physics), USA; Max Planck Institutes, Dresden, Leipzig, Germany; Los Alamos National Laboratory, New Mexico, USA.

***Any other relevant information***

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|
| | | |

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20 Mathematical Modelling and Computer Simulation

***Project Title :*** Studies of nonlinear dynamical phenomena — Project code: JB2

| ***Proposer*** Janaki Balakrishnan | ***Div./ Group*** C-MMACS | ***Duration*** 5 years |
|---|---|---|

***Objectives : (Short term and Long term)***

To understand the mechanisms of different observed non-linear phenomena in materials & to predict properties of use & relevance to industry.

***Expected Results/ Applications***

Knowledge of certain instability mechanisms in materials can help in the prediction & control of their degradation, ageing & breakdown under certain conditions. Applications: In industry & defence.

***Deliverables/ Approximate Dates of Delivery***

1. Studies on effects of strong electromagnetic fields on dielectric & other materials, & their breakdown properties -- 2003.
2. Studies on physics of interfaces between materials – 2004.
3. Other problems such as instability phenomena such as the acoustoelectric effects – spread over till 2007.
4.
5.

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | 5 | 5 | 6 | 5 | 4 | 25 |
| ***External*** | | | | | | |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***

***Other CSIR Institutions***

***Other Indian Institution*** IISc.: Dept. of High Voltage Engg., Inorganic & Physical Chemistry Unit, Dept. of Chemical Engg., Dept. of Physics.

***International Institute*** University of Massachusetts, Amherst (Dept. of Polymer Science & Engg., Dept of Physics), USA; Max Planck Institutes, Dresden, Leipzig, Germany; Los Alamos National Laboratory, New Mexico, USA; Univ. of California, San Diego, USA.

***Any other relevant information***

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|

D:/sita/gp/project proposals_10thFiveyear plan(JB2)

# Project Proposals for 10th Five-Year Plan Period

**Programme:** II. 20 Mathematical Modelling and Computer Simulation

***Project Title :*** Site-Specific Seismic Microzonation of Bangalore City by 2-D modelling of SH and P-SV waves — Project code : IAP1

| ***Proposer*** Imtiyaz Ahmed Parvez<br>Sridevi Jade | *Div./ Group* ***C-MMACS*** | ***Duration*** 3 years |
|---|---|---|

***Objectives : (Short term and Long term)***

Preparation of detailed site-specific Microzonation map of Bangalore City, numerically modelled or directly measured, notably the peak ground acceleration, velocity and other ground parameters like site amplification for seismic resistant designs of structures and infrastructure facilities.

***Expected Results/ Applications***

Seismic ground motion along several 2-d sub-surface geological cross-sections in terms peak ground acceleration, velocity and response spectra ratio (amplification) at different frequency levels will be presented. The results will help to those earthquake and civil engineers who wish to undertake comprehensive and detailed studies of earthquake hazard and risk mitigation.

***Deliverables/ Approximate Dates of Delivery***

1. Collection of geotechnical sub-surface data, hiring man power and buying Sun work station (first six months)
2. Drilling bore holes to those regions where data is not available with the help of Private/Govt. organisation (next six months)
3. Preparation of seismic inputs (next six months)
4. Numerical modelling and computer simulation of seismic waveforms (next one year)
5. Preparation of final Microzonation map of Bangalore city (last six months)

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | 14.00 | 3.00 | 3.00 | | | 20.00 |
| ***External*** | | | | | | |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL*** Nil
***Other CSIR Institutions*** Nil
***Other Indian Institution*** Drought Monitoring Cell of Karnataka Govt. & Dept. of Civil Eng., IISc, Bangalore.
***International Institute:*** There will be collaboration with The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy.

***Any other relevant information***

Bangalore is a fast growing megacity of India and is on seismic risk as well. A moderate earthquake of magnitude 6.0 occurred in February 1900 in Coimbatore just 35 km from Bangalore which created a lot of damages in the city. Very recently the city has experienced a minor tremor of magnitude 4.3 on January 29th, 2001 which was enough to disturb the local authorities and media. In brief, this is the high time to go for earthquake preparedness and a detailed microzoantion m ap of Bangalore city is necessary to assess the seismic hazard and risk.

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|
| | | |

D:\sita/gp/project proposals_10thFiveyear plan(IAP1)

# Project Proposals for 10th Five Year Plan Period

**Programme:** II. 20 Mathematical Modelling and Computer Simulation

***Project Title :*** Setting up of a modern IT infrastructure at C-MMACS high performance computing centre — Project code: RPT1

| ***Proposer*** | ***Div./ Group*** | ***Duration*** |
|---|---|---|
| R P Thangavelu<br>V Anil Kumar<br>G K Patra | C-MMACS | 5 years |

***Objectives : (Short term and Long term)***

To provide state-of-the-art computing, data storage and communication resources for ocean, atmosphere, climate, environment and lithosphere modelling.

***Expected Results/ Applications***

The existing high performance computing facility consisting of a 16 CPU SGI Origin 3400 server will be augmented with state-of-the-art multiterabyte storage server, high speed WAN connectivity (2 Mbps / 8 Mbps).

***Deliverables/ Approximate Dates of Delivery***

1. To setup a 2 Mbps dedicated WAN connectivity. (Dec 2002)
2. To identify and install a fault tolerant storage server with 5 TB capacity and appropriate Tape library (June 2003)
3. Replacement of the existing 100KVA UPS (installed in 1989) with 2x100KVA UPS systems in a fault tolerant mode. (March 2003)
4. Upgrading the 2 Mbps WAN link to 8 Mbps. (March 2004)
5. Upgrading the storage server to 10 TB capacity. (June 2005)

***First Estimate of Costs (Year wise for the duration of the project) – Rs L (round fig.s)***

| ***Source*** | ***1st Year*** | ***2nd Year*** | ***3rd Year*** | ***4th Year*** | ***5th Year*** | ***Total*** |
|---|---|---|---|---|---|---|
| ***CSIR*** | 120 | 50 | 25 | 25 | 25 | 245 |
| ***External*** | 0 | 40 | 0 | 50 | 0 | 90 |

***Linkages with other Institution & their nature (Pl. Specify)***

***Other Divisions of NAL***
***Other CSIR Institutions*** All other CSIR Labs
***Other Indian Institution*** INDOMOD Partners
***International Institute***

***Any other relevant information***

External funds are expected from Department of Ocean Development (DOD)

| ***Signatures*** | ***Proposer*** | ***HOD*** |
|---|---|---|
| | | |

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