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NASA Space Apps Challenge - Noida 2025

ADDRESS REAL-WORLD CHALLENGES ON EARTH & IN SPACE

(04th & 05th October 2025)



Team Details

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- c. Problem Statement: Meteor Madness**

Asteroid Impactor-2025: Preparing for Planetary Defence

A comprehensive response framework for near-Earth asteroid threats, integrating NASA surveillance data with geological impact modelling to enable informed decision-making and effective mitigation strategies.



The Impactor-2025 Threat Assessment

Current Status

Impactor-2025 represents a newly identified near-Earth asteroid with potential Earth-crossing trajectory. Initial observations indicate significant size and velocity parameters requiring immediate comprehensive analysis.

The asteroid's discovery triggers established planetary defence protocols, demanding rapid integration of observational data with impact consequence modelling systems.



Critical Data Integration Challenge

NASA Datasets

Comprehensive asteroid catalogues, orbital mechanics data, and real-time tracking information from ground-based and space-based observation networks.

USGS Geological Data

Surface composition maps, population density information, and geological vulnerability assessments crucial for impact consequence modelling.

Integration Gap

Current systems operate in isolation, preventing comprehensive risk assessment and limiting effective decision-making capabilities for stakeholders.

Preparing for the Unthinkable

Ready. Informed. Protected.

The Impactor-2025 visualisation tool transforms complex scientific data into actionable intelligence, empowering decision-makers with the knowledge needed to protect our planet. Through integrated data systems and advanced simulation capabilities, we can face asteroid threats with confidence and preparedness.

The future of planetary defence depends on the tools we build today.



Impact Consequence Modelling Framework



Blast Effects

Airburst and ground impact energy calculations, thermal radiation patterns, and overpressure wave propagation models.



Seismic Impact

Ground motion predictions, structural vulnerability assessments, and secondary earthquake risk evaluation.



Key Stakeholder Requirements

Emergency Managers

Evacuation planning tools, resource allocation guidance, and real-time decision support systems for coordinated emergency response operations.

Policymakers

Risk communication frameworks, budget justification data, and policy recommendation engines based on scientific evidence and impact projections.

Defence Scientists

Technical analysis platforms, deflection mission planning tools, and collaborative research environments for rapid scientific response.

Public Stakeholders

Accessible risk communication, educational resources, and transparent information sharing to maintain public trust and preparedness.



Mitigation Strategy Evaluation Matrix

1 Early Detection Phase

Enhanced observation networks, trajectory refinement, and initial risk assessment protocols.

2 Deflection Window

Kinetic impactor missions, gravity tractor deployment, and nuclear deflection option evaluation.

3 Civil Defence Preparation

Evacuation planning, infrastructure hardening, and emergency resource pre-positioning strategies.

4 Post-Impact Response

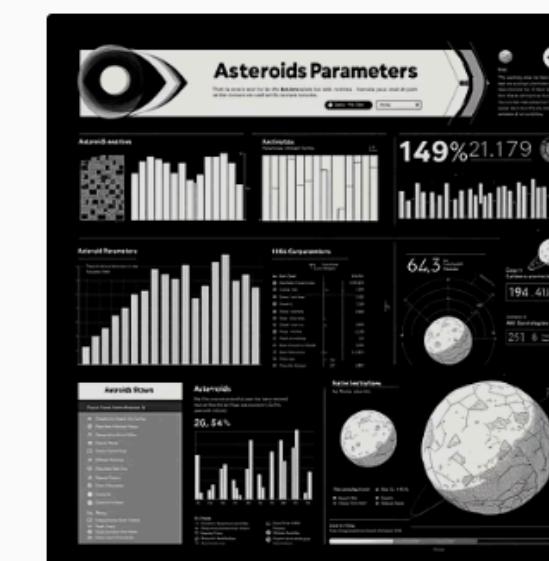
Search and rescue coordination, medical response systems, and recovery operation frameworks.

Interactive Simulation Capabilities

User Interface Features

- Dynamic asteroid parameter adjustment
- Real-time impact visualisation
- Comparative mitigation analysis
- Multi-stakeholder dashboard views

The system enables users to modify key variables and immediately observe resulting changes in impact predictions and mitigation effectiveness.



Implementation Timeline & Critical Milestones



Phase 1: Data Integration



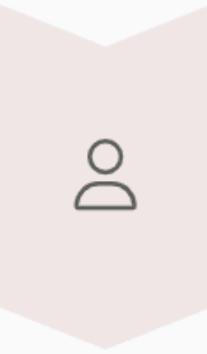
Establish secure connections between NASA and USGS databases, develop standardised data formats, and create unified access protocols.



Phase 2: Simulation Engine



Build comprehensive impact modelling algorithms, validate against historical data, and implement real-time processing capabilities.



Phase 3: User Interface



Develop stakeholder-specific interfaces, implement visualisation tools, and establish training programmes for system users.

Each phase requires approximately 6-8 months for full implementation, with continuous testing and stakeholder feedback integration throughout the development process.



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Thank you!

