

IAA Study Group Status Report

Responsible Commission: 3

Study Number and Title: 3.29 Strategy and Feasibility Assessment of Collision Protection from Asteroid and Comet: Concept, Technology, and Prospect

Short Study Description (repeat from Study Group Proposal):

The Study Group 3.29 will make effort to push the technologies of collision protection from concept to practice. Based on the potential concepts and strategies of collision protection, the corresponding state-of-the-art technologies such as orbit optimization and design, GNC, propulsion, and remote operation are developed, and the feasibility of different kinds of strategies will be investigated. With the consideration of present technology development, a micro and low cost collision protection mission will be proposed and designed. Furthermore, the prospect of collision protection strategy in the next 10 years will be previewed, which may lead the technology development and the international cooperation.

Progress in past six months:

- **The study team has been assembled.**

Up to now, 16 researchers from China Aerospace Science and Technology Corporation, Luna Exploration and Space Engineering Center, Beijing Institute of Technology, University of Colorado, University at Buffalo, Observatoire de Paris, and Delft University of Technology have joined the team. The team members are listed as follows:

Name	Title	Organization	Position
Weimin Bao	Prof.	China Aerospace Science and Technology Corporation	Chair/Proposer
Weiren Wu	Prof.	Luna Exploration and Space Engineering Center	Member
Pingyuan Cui	Prof.	Beijing Institute of Technology	Member
Daniel J. Scheeres	Prof.	University of Colorado	Member
John L. Crassidis	Prof.	University at Buffalo	Member
M. A. Barucci	Prof.	Observatoire de Paris	Member
M. Fulchignoni	Prof.	Observatoire de Paris	Member
Pieter Visser	Prof.	Delft University of Technology	Member
Dong Qiao	Prof.	Beijing Institute of Technology	Member
Haibin Shang	Dr.	Beijing Institute of Technology	Member
Rui Xu	Dr.	Beijing Institute of Technology	Member

Shengying Zhu	Dr.	Beijing Institute of Technology	Member
Ai Gao	Dr.	Beijing Institute of Technology	Member
Juan Dai	Dr.	Beijing Institute of Technology	Member
Yang Liu	Dr.	Beijing Institute of Technology	Member
Zhengshi Yu	Dr.	Beijing Institute of Technology	Secretary

Meanwhile, some researchers from Universities such as Tsinghua University, Beihang University also contact the secretary and ask to join the team.

- **The content of the draft report has been initiated.**

As the draft of report will be finished as soon as possible, we have initiated the content of the report, which is shown as follows.

Abstract and Executive Summary

1. Introduction/Background

- 1.1 Distributions of NEOs
- 1.2 Potential impact hazard of NEOs

2. Potential impact prediction and warning

- 2.1 Ground and space-based observations
- 2.2 Potential impact prediction
- 2.3 Impact assessment and warning

3. Strategies for impact protection

- 3.1 Strategies for short warning time
- 3.2 Strategies for short warning time

4. Migration and feasibility assessment

- 4.1 Migration capability analysis
- 4.2 Feasibility assessment

5. Technology development for small body exploration

- 5.1 NEO shape and gravity modelling
- 5.2 Orbit optimization and design
- 5.3 Guidance, navigation, and control
- 5.4 Deep space propulsion
- 5.5 Remote operation

6. Design of a low cost demonstration mission

- 6.1 Selection of target NEO
- 6.2 Scientific and technique goals
- 6.3 Transfer and scientific orbit design
- 6.4 Mission profile design
- 6.5 Spacecraft system design

7. Prospect and international cooperation

- 7.1 Prospect of NEO exploration
- 7.2 Suggestions for international cooperation

8. Conclusions

The content is still under revision, and the contribution of each team member is under discussion.

- **Arranging a symposium in January, 2018.**

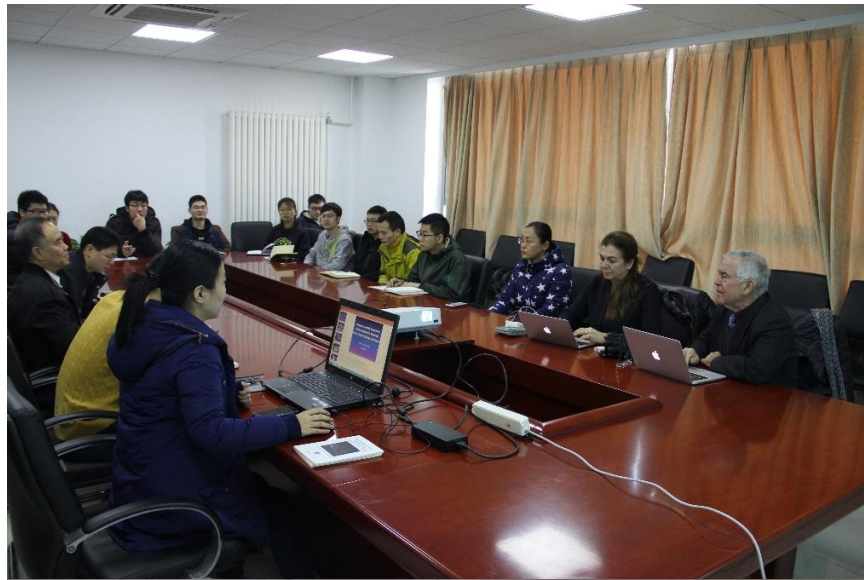
On Jan. 16th, 2018, the first IAA Study Group Symposium was held in Beijing Institute of Technology. The main objectives include introducing the IAA Study Group, discussing the research content and work plan, and introducing the main research progress on small body exploration and small body defense. The main members of the Study Group including Prof. Barucci and Prof. Fulchignoni from Observatoire de Paris, Prof. Cui, Dr. Rui Xu, Dr. Ai Gao, Dr. Juan Dai, and Dr. Yang Liu from Beijing Institute of Technology attended the Symposium. Meanwhile, Prof. Barucci and Prof. Fulchignoni also visited the Institute of Deep Space Exploration. The agenda and the photos of the IAA Study Group Symposium are as follows.

Agenda

Time: Jan. 16th, 2018 (Tuesday)

Place: School of Aerospace Engineering, Beijing Institute of Technology

Time	Meeting Content	Host
08:40-09:00	Visiting the Institute of Deep Space Exploration	Dr. Rui Xu
09:00-09:30	Introduction to the IAA Study Group SG 3.29	
09:30-10:00	Discussion about the research content and work plan	
10:00-11:00	Academic lecture on the progress of small body exploration Speaker: Prof. Barucci	
11:00-12:00	Academic lecture on the collision protection from small body Speaker: Prof. Fulchignoni	
12:00	Lunch	Meeting group



Website Study Information update: (please give any update regarding Study Group Membership, documents, Study Plan and Schedule):

Issues requiring resolution? (recommend approach):

Product Deliveries on Schedule? (If modified explain rationale):

Study Team Member Changes? (List any Study Team Members that you wish to discontinue, and provide names plus contact coordinates of any Members you wish to add on the second page of this Study Update form.) Note: Complete contact information including email, tel. and fax must be provided for all additions. Only Members with complete contact information will be listed and receive formal appointment letters from the IAA Secretariat.)

Name of person providing Study Group Status (Study Group Chair or Co-Chair):
Prof. Weimin Bao (Study Group Chair).

Status Report Date: Feb. 23rd, 2018.

Study Team Membership Changes

Effectivity Date:

Discontinue:

Name
Current email address

Add:

Name
Current email address
Tel.
Fax
Mailing address