

Proposal for Forming an IAA Study Group SG 3.29

Title of Study:

Strategy and Feasibility Assessment of Collision Protection from Asteroid and Comet: Concept, Technology, and Prospect

Proposer(s):

Weimin Bao

Primary IAA Commission Preference: COMMISSION 3 Space Technology & System Development

Secondary IAA Commission Interests: COMMISSION 4 Space Systems Operations & Utilization

Members of Study Team

Chair(s): Prof. Weimin Bao (China)

Secretary: TBD

Other Members:

China: Prof. Weiren Wu, Prof. Pingyuan Cui, Prof. Dong Qiao, Dr. Haibin Shang, Dr. Rui Xu, Dr. Shengying Zhu, Dr. Ai Gao, Dr. Zhengshi Yu, Dr. Juan Dai, Dr. Yang Liu

USA: Prof. Daniel J. Scheeres, Prof. John L. Crassidis

France: Prof. M. A. Barucci, Prof. M. Fulchignoni

Netherland: Prof. Pieter Visser

Short Description of Scope of Study

Protecting the Earth from probable collision of asteroid and comet is one of the main purpose of the small body exploration. Although the threat of asteroid and comet to the Earth has been analyzed and the potential protection concept has been proposed, the detailed technologies and the feasibility assessment are not investigated thoroughly. This proposal 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 are investigated. With the consideration of present technology development, a micro and low cost collision protection mission is proposed and designed. Furthermore, the prospect of collision protection strategy in the next 10 years is previewed, which may lead the technology development and the international cooperation.

Overall Goal:

Advancing the new technologies for collision protection from asteroid and comet, as well as investigating the feasibility of different potential strategies. Leading the trend of technology development for the potential collision protection strategy in the near future. Based on the progress of study group, an international research team on small body exploration will also be built, which will further increase the international cooperation.

Intermediate Goals:

- Systematically improve and perfect the potential collision protection concepts such as gravity trailer, solar sail drag, kinetic impact, and nuclear explosion.
- Build the feasibility assessment model of each strategy based on the orbit divergent capability, early warning time, and potential cost.
- Identify and develop the underlying key technologies such as orbit optimization and design, guidance, navigation, and control.
- Initiate an international cooperation frame for collision protection from asteroid and comet.

Methodology:

- Proposing an international study group, drafting a detailed objective and timeline of the study.
- Assigning individual responsibility for the study report.
- Holding seminar and symposium regularly in order to discuss the progress and gather data to write the report.
- Attending the annual International Astronautical Congress or the IAA Spring meeting to improve the communication.
- Monitoring and supervising the progress of study for the study report.

Time Line:

- Assemble the study team: Dec. 2017
- Draft outline of report: Dec. 2018
- First draft of report: Dec. 2019
- Final report: Jun. 2020

Final Product (Report, Publication, etc.):

Publishable report which will be distributed to the International Space Community

Target Community:

International space community, related universities

Support Needed:

Conference and workshop opportunities

Potential Sponsors:

CNSA CASC CEA