

Report of the 33rd IAA/IISL Scientific Legal Roundtable, Global Cooperation in Planetary Defence

Co-Chairs: Alan Harris, Yu Takeuchi
Rapporteur: Nicola Rohner

The Secretary General of the IAA and the president of the IISL gave short welcoming speeches. They both appreciated the long lasting cooperation between the IAA and IISL. The roundtable activities are listed in the jubilee brochure which was prepared after the 30th joint roundtable. Further they encouraged the participants to give recommendations to IAA and IISL, especially for the next asteroid conference 2019 in Washington.

Co-chair Alan Harris introduced the roundtable topic with a clear and very helpful overview of what asteroids are, where they come from, what we can learn from them about the universe, the solar system and the development of life. Furthermore, he pointed out that asteroids may provide future generations with sources of raw materials for activities in space. On the other hand, while asteroid impacts on earth can destroy large areas, technologies are available today to deflect or destroy an asteroid to protect humankind. All these aspects have legal implications. To initiate the later panel discussion (after all presentations) he put the following questions up for discussion:

- Does a technically competent nation or group of nations have an obligation or responsibility to act, even if predicted ground zero is not in their territory?
- An abortive attempt to deflect could move ground zero from one country to another – who is liable for malfunction or failure?
- Is the use of nuclear explosives in space for emergency deflection and tests justifiable?
- If it is not possible to move ground zero completely off the Earth but only to displace it from one region to another, how do we decide to minimize loss of life and damage to infrastructure (i.e. who should “take the hit”)?
- What role should the UN and the Security Council play?

In the next presentation Claudio Maccone pointed out that the possible impact of an asteroid is a number one problem of mankind as we do not know when it will happen. NASA detected about 300,000 asteroids in our solar system. The ones with high probability of collision with the earth must be observed by astronomers or automatic systems. In case of a predicted collision (known years before impact) a space mission is sent out, takes pictures of the asteroid to learn about the shape, mass, surface of it before deflection. Especially nuclear instruments need a precise knowledge of the asteroid. Deflection is preferable to destruction. For this maneuver Cl. Maccone strongly promotes the use of nuclear weapons especially for the bigger asteroids. Nuclear interceptors can deflect NEOs of smaller size (100-500m) with two years or more time before impact and larger NEO's with five or more years before impact. Actual launch vehicles show sufficient performance to enable the development of a near term categorization and mitigation architecture. The military must be involved. However, international legal contracts need much more time than the technical preparation. Therefore he appeals for more intense efforts to develop the urgent legal framework.

The first speaker from the legal side, Sergio Marchisio, began his speech with a historic legal overview. Since 1995 the UN adopted a series of non-legally binding recommendations warning the international community of the potential threat by NEOs. The awareness of the member states of a possible threat was raised. Mechanisms have then been established to improve the international coordination. The asteroid population has been monitored. In 2013 the International Asteroid Warning Network (IAWN) and the Space Mission Planning Advisory Group (SMPAG) were set up to aim at building an international response mechanism to the NEO-impact threat, and finally in 2016 a SMPAG Ad Hoc Legal Working Group was established to work on recommendations (please see aspects of the presentation of Irmgard Marboe below). Afterwards S. Marchisio gave examples of which laws could apply in case planetary defence is necessary (primarily the Outer Space Treaty and the Charter of the UN; for details please see his full paper in the IAC proceedings). As the impact is a natural disaster, other provisions like remote sensing are not usable. Up to now only a few states are working on this topic (i.e. the US in its strategy). Therefore it is important and urgent to promote and advance this topic globally.

The next speaker Yoshiaki Kinoshita presented scientific as well as legal aspects of planetary defence. He started with the current international asteroid mission Hayabusa II, which landed four instruments with its lander MASCOT on the asteroid Ryugu only some hours before his talk! Ryugu is a near-Earth asteroid, which means it could pose a threat to Earth and investigations of its physical properties could inform future planetary defence activities. On 3rd October 2018 MASCOT separated from the Japanese

Hayabusa2 spacecraft and landed on Ryugu approximately 20 minutes later. (*Note:* MASCOT was operational for over 17 hours, during which it collected data from the asteroid's surface). This is a very successful and impressive example of international cooperation (here JAXA; CNES, DLR). Further it demonstrated that the surface of an asteroid can turn out to be very different to what was expected on the basis of Earth-based observations.

Afterwards he talked about responsibilities to protect mankind. International cooperation is essential while national unity in space must be respected. Each state is responsible for taking care of victims of natural disasters; affected states have the first responsibility. On the premise of that responsibility, he highlighted the questions we are confronting: If the affected state does not have the ability to protect their people, who should take action? Is international law applicable?

In the last presentation Irmgard Marboe reported from the recently prepared draft document of recommendations from the SMPAG Ad Hoc Legal Working Group. The main purpose of this group is to advise SMPAG with regard to legal aspects of near-Earth object (NEO) threat mitigation. The scope of work includes the description of the existing legal context relevant to the work of SMPAG, to identify, formulate and prioritize relevant legal questions and issues requiring clarification with regard to planetary defence and to suggest, where necessary, possible ways forward to deal with legal questions and issues. First findings will be presented to SMPAG before the end of 2018 and will be presented at the Planetary Defence Conference in May 2019 (held in the US). The membership in the SMPAG WG is open to agencies, states can be observers.

After giving the overview of the SMPAG WG she presented some preliminary thoughts about the first findings. They consider the aspects of the obligation to inform and to act, the legality of planetary defence methods, the responsibility, liability, and the actual decision bodies and processes. In all cases the draft document describes the particular existing legal basis and its applicability. Her main point for the discussion is how to overcome the absence of a multilateral body dedicated to planetary defence and the likelihood of the UN taking the lead role in that respect.

In these five presentations the speakers raised numerous technical and legal (and moral) aspects for the following panel discussion which varied from the morally and legally difficult issue of the use of nuclear devices to the probability of impact and the responsibility to act.

Roughly described the technical challenges are:

- to improve the detection of smaller bodies,
- to investigate an object's physical properties before planning deflection, while the big and longer term legal challenge is
- to develop a global policy on public information strategies, preparation of and decision-making on the appropriate missions in an organized fashion, and adaption of the law wherever necessary and possible

The main recommendations out of the discussion were:

- **Further scientific research, especially on-site of the asteroid, before deflection** must be done as it is extremely important to have an accurate knowledge of parameters such as the shape, density, structure, composition, of an asteroid to facilitate an effective response in an emergency situation.
- A **space telescope** would be very helpful to further explore and characterize the population of NEOs
- It is not appropriate to have deflection hardware stationed permanently in space as a significantly hazardous asteroid could be detected years before impact and in that case the latest technology should be applied
- Investigate what kind of space exploration missions will most effectively contribute to planetary protection
- **A multilateral legal approach is preferred** because smaller states may not have the technical means to protect themselves from an impact.
- **Establish an international fund**
- **Set up a commission as a decision-making body**
- The decision making process for planetary protection should also be implemented in **national decision making systems**
- Raise the **awareness** of a possible threat especially in the young population (school level) and among decision makers