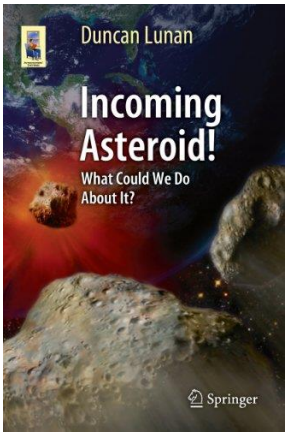
Book Review

Incoming Asteroid!

What Could We Do About It?



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> *Much new technology will be needed to counter comets from the outer solar system as the threat to Mars from Comet McNaught and the sheer size of Comet Swift-Tuttle both demonstrate. But for the moment it seems we can count ourselves lucky - perhaps luckier than we deserve.*
> *(Incoming Asteroid! D. Lunan, Springer 20014, ISBN 978-1-4614-8748-7)*

Intrigued by listening to ESA's 24hr global "Asteroid Day" webcast on 30th June 2017 about "Astronauts and (space) Rock Stars", I decided to take a deeper look into this fascinating subject which at one day might determine the fate of mankind.
A lot of the discussions centered around the worldwide Near Earth Objects (NEO) detection project. At the end of the webcast Lindley Johnson, NASA's NEO Defense Officer explained NASA's pro-active stance in case a threatening object would come our way: First, a notification process informing the public would be started, secondly, refinement of the information about the object's orbit, structure and size together with one or more counteractions to deflect the orbit, e.g., using kinetic impact or gravity assist methods would be announced. However, the key would be to "find'em early". Currently "there is nothing to worry about to lay awake at night" (Lindley Johnson). More information can be found on NASA's relevant web-pages [1]

Searching the internet I found the brilliant and profound book by Duncan Lunan, "Incoming Asteroid!" dealing with the dinosaur extinction event (Chicxulub impactor at Yucatan 65 Mio years B.C), the Halley comet and its early sightings, Noah's Ark and the and its possible connection with an asteroid induced tsunami (the Flood?), the more recent Tunguska and Cheljabinsk asteroid strikes, it brings us up to the year 2014 describing and putting it in perspective with everything ever thought, done, speculated, written and researched about Asteroids and their influence on our lives. The book also covers the technical means which have been developed worldwide since the beginning of the space age and their relevance to avoid asteroid collisions with Earth. But the author does not stop there, he also looks into all human related "legal" political and ethical aspects e.g., prohibiting nuclear weapons in space – even in case of an impending wipeout of mankind by an asteroid (?), or what to do if an approaching asteroid might be used by a "mad" politician to extinguish his foes or even mankind?
The book is based on the research activities of the author D. Lunan (Author BIS and ASTRA member) and his colleague John Braithwaite (Expert in optics and electronics, last maker of Telescopes in Scottland and Technical Supervisor of the Glasgow Parks Department Astronomy Project) since 1969 and their lifelong contributions to the British Interplanetary Society (BIS) and the Association in Scotland To Research into Astronautics (ASTRA) [2]. The authors literally address all technical,

political and humanitarian aspects of how to detect, follow and counteract any dangerous NEO (Near Earth Object) and do not hesitate to point out shortcomings or suggesting improvements which still could be done technically and politically – all laced with a spike of dry British humor: “What is the more immediate danger – a global starvation or asteroid impacts? Put it this way – if something a mile across hit the Pacific twenty minutes ago we aren’t going to finish our cups of coffee” (Lunan, Braithwaite).

The book contains a lot of technical explanations, assessments, calculations, demonstrations taking all significant Earth impact events and their results into account, but does not shy away from respecting knowledge based science fiction speculations from famous authors like Asimov, Arthur C. Clark, Carl Sagan and many others.

Of course, the asteroids as “low hanging fruits of the Universe” (Asteroid Day quotation) are also discussed: “they are the only objects coming to us, offering opportunities to investigate and exploit them”, as a couple of industrial start-up companies for asteroid mining in the USA try to do already. But as it was said during the Asteroid Day discussions also: there are good guys (asteroids) and bad ones.
The main purpose of the book “Incoming Asteroid!” is how to deal with the “bad guys”.

The additional value of the book consists of the fact that the author not only states hard facts and theoretical speculations but also tried from the very early beginning of his career to actively support and influence the asteroid deflection strategies.
For that purpose a fictional asteroid called “Goldilocks” composed of as many as suitable real features like origin, orbit, size, shape, spin, gravity, composition etc., of known asteroids and comets was defined and used to exercise various “real-threat” scenarios and to discuss them whether they would work or what in addition would be needed - and as a consequence, identifying technologies which could be developed for this purpose, i.e., a team of renowned scientists, astrophysicists and technicians was invited to analyze and develop strategies for every eventuality in workshops, conferences and publications.

Tools at Hand
As mentioned above, chapter 4 (Tools at Hand) provides an excellent and up to date (2014) summary of worldwide developed and available launch vehicles since the beginning of military rocket development after 1945.

Threats
Asteroid Bennu is currently considered to be the most dangerous known asteroid with a 1:1,800 chance of impacting Earth in the late 22nd century, particularly in the year 2188. These observations motivated NASA to initiate the first exploratory mission to a Potentially Hazardous Asteroid (PHA) and this mission is well worth doing it for that reason alone. This mission is called Osiris-Rex, was launched Sept 8, 2016 and will rendezvous with Bennu in 2018 to “touch” it and try to collect 2 ounces of small rocks and dust and return the samples to Earth by 2023. [3]

Goldilocks
On 18th September 2002 two extraordinary things happened. Lord Sainsbury, Minister for Science and Innovation from 1998 and 2006 launched the report of the UK government's Near Earth Objects task force at a press conference in London. The report verified the impact threat to the UK and made 14 substantive recommendations for government action. Secondly, nobody laughed at him (Jay Tate lecture abstract, Charterhouse 2011).

A set of modified recommendations was put before the whole Committee on the Peaceful Uses of Outer Space at its 56th session from June 12th to 21st 2013. The proposal was agreed to be sent to the UN general assembly in October 2013 for review and adoption. At its 7th meeting on February 22nd 2013 the working group adopted to presented report. After all what's been said about what needs to be done what isn't being done and what should be done if the crisis comes upon us, it has to be said that these are excellent developments but it took a long time (D. Lunan).

In 2013, for the Goldilocks scenario it was assumed that whatever agency might emerge as being tasked with the prime responsibility for deflecting Goldilocks would already have a very broad suite of resources but decisions would have to be taken quickly. As Braithwaite summed it up, government decisions have to have academic imprimatur for credibility but for action government would have to hand over to a contractor. As Bill Ramsay (ASTRA Council Member and President: "What would we do if we knew there was to be an impact in ten years time?") stressed, "money will be no object, cooperation will be total and human space capabilities worldwide will be greatly extended by the time it's over."
In 1998 Jay Tate (Director, UK Spaceguard Centre) [4] predicted that there might be a two track program with the United States as lead nation and an international cooperation under IAU (International Astronomical Union) and COSPAR (Committee on Space Research) guidance, technologies might be radically different but ultimately they would be subsumed into a US program under international banner.

By contrast it was slightly shocking to hear Rusty Schweickart (Apollo 9 Astronaut) declare at the 2013 Planetary Defense Conference that if faced with an actual threat, spacefaring nations were likely to take unilateral and possibly conflicting actions. If there would be a "corridor of threat" (the asteroid's projected impact uncertainty) sometimes called the incoming "red line" extending across the face of Earth from the most likely impact point, every nation might try to protect its own territory and might try to push the object over into somebody else's territory.

Deflection means
The Goldilocks scenario assumes three strike opportunities in ten years (3.33 years apart) and the author describes, discusses and provides a thorough performance analysis of the risks and possible modifications and chances for success for the worldwide available and technically feasible "arsenal" for each of the escalating options: (1) deflection by solar power: SOLARIS in combination with flexible mirrors, asteroid burner etc. (2) manned mission(s): MADMAN (Modular Asteroid Deflection Mission Ejector Node), gravity traction and/or and as last resort (3) nuclear deflection.
In a final chapter Lunan describes possible effects and consequences for the surviving population of a "Goldilocks" strike after all the above has partially or totally failed.

Duncan Lunan's Conclusion.
We have demonstrated that with existing space capabilities and the recreation of past ones a 1-km rock asteroid could be deflected given 10 years warning and there are a number of ways in which to do it. If solar sail technology continues to develop, if the SLS (Space Launch System of NASA) development comes to fruition and if NERVA (Nuclear Engine for Rocket Vehicle Application) or more advanced systems becomes available for lunar and planetary missions by 2020 we should be able to say that the means to do it are in hand. And we have seen that even if an impactor couldn't be stopped there are ways to improve dramatically on the loss of human life that currently would be unavoidable.

It is astonishing that the book "Incoming Asteroid" has not made it yet on the non-fiction books bestseller list, because this is a subject that might influence every soul on this planet – and possibly

has more severe consequences for mankind then the current “hot topics” like climate change, depletion of natural resources or global starvation. The book also makes you even more aware of how fragile and vulnerable our precious little planet is and that it is somehow mere coincidence that we as mankind succeeded and have come so far, as Lunan says “…perhaps we have been luckier than we deserve”.
And at that point the book leads into philosophical, ethical and metaphysical realms making us aware of our luck, and informs about the means we have to make it last i.e., what can be done and what not.
For me, the book served as an eye-opener for how dependent our existence from such little regarded phenomena like asteroids, comets or meteorites is.
All the projects enhancing and improving NEO defense deserve highest priority!

As mentioned above, the book is thoroughly researched, with beautiful historical pictures and spectacular high-res Earth and satellite produced images of comets and asteroids and their marks they left on Earth. The references for each chapter are exhaustive and the index reads like a “who is who” of space explorers and scientists.

Epilogue
June 30, 2017: “The first-ever mission to demonstrate an asteroid deflection technique for planetary defense – the Double Asteroid Reflection Test (DART) – is moving from concept development to preliminary design phase, following NASA’s approval on June 23, 2017” [5]

References

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