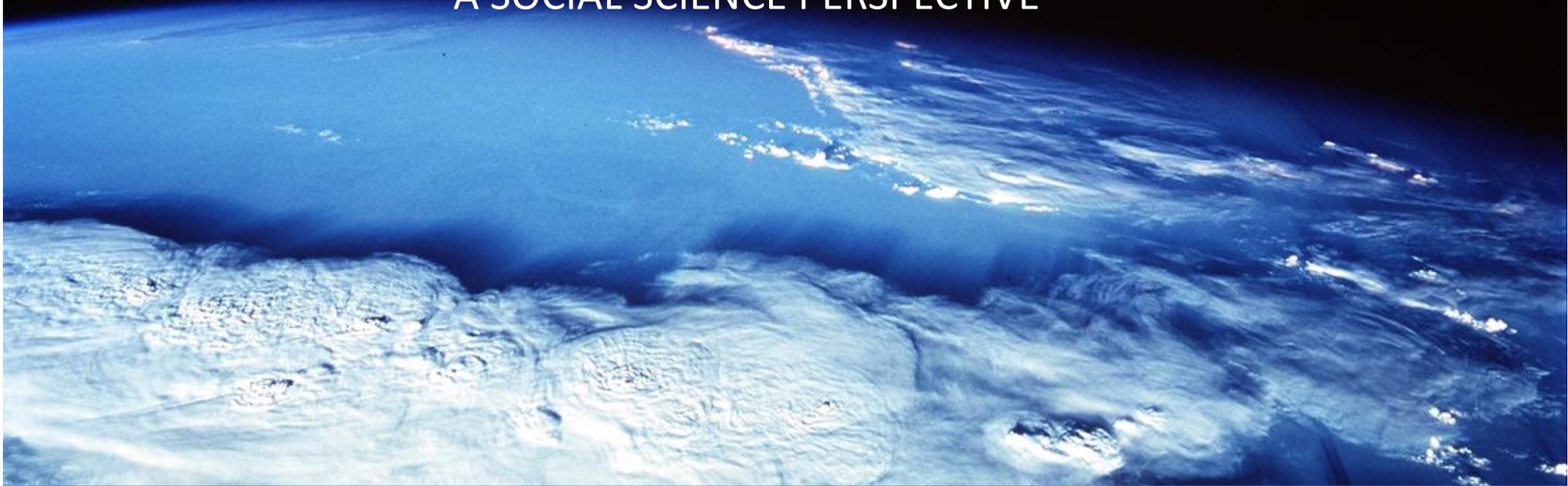




# PLANETARY DEFENSE IN THE CLASSROOM

## A SOCIAL SCIENCE PERSPECTIVE

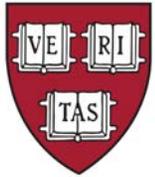


**Alissa J. Haddaji,**

**Harvard Business School, SMPAG Ah-Hoc Legal Working Group Coordinator, [ahaddaji@hbs.edu](mailto:ahaddaji@hbs.edu),**

**6<sup>th</sup> IAA Planetary Defense Conference, College Park, Maryland, USA, May 2<sup>nd</sup> 2019**

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# Table of Contents

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- I. Resources & Goals**
- II. Current efforts at Harvard**
- III. Lessons Learned**
- IV. Conclusion/ Next steps**

# RESOURCES & GOALS

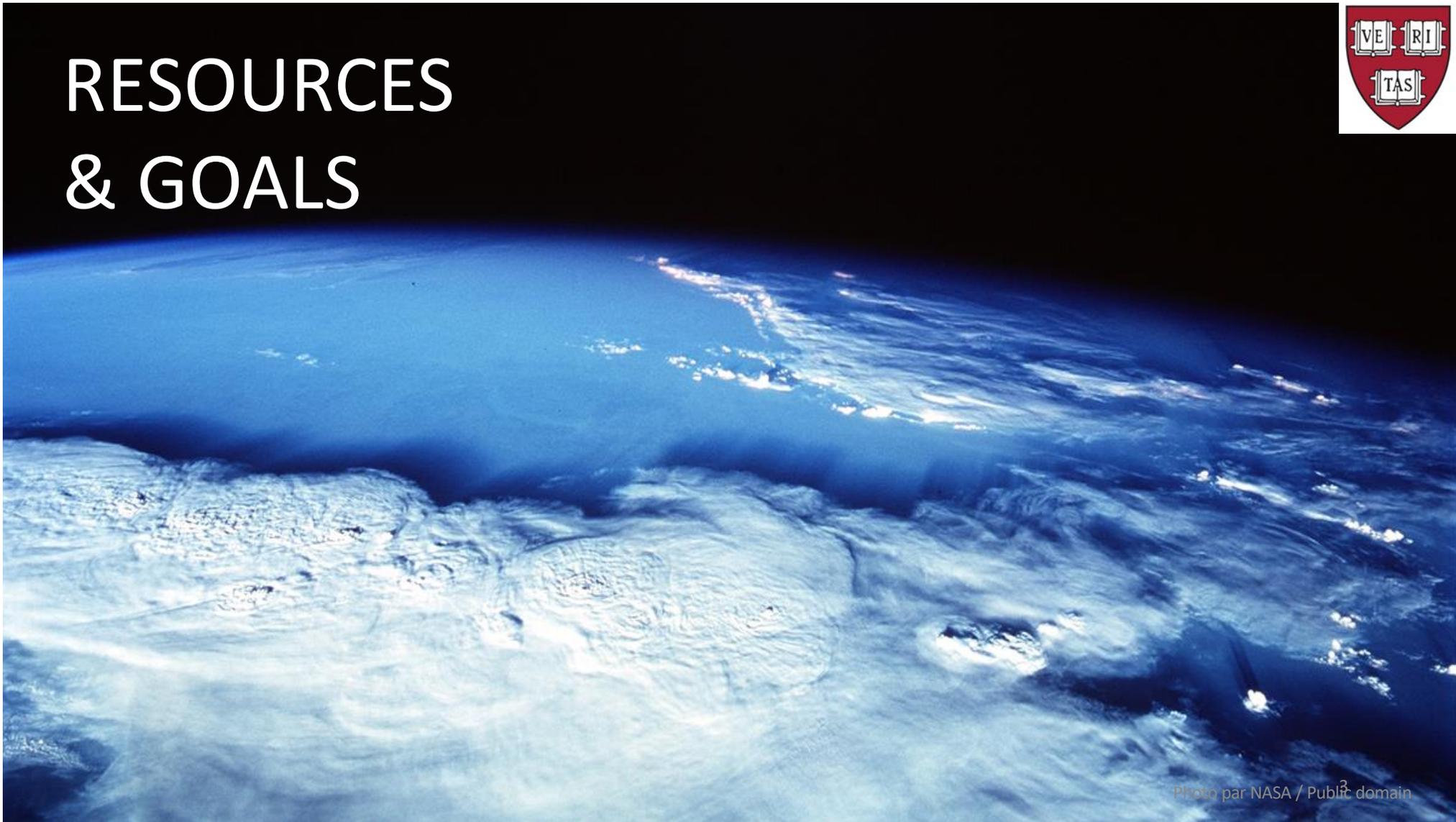
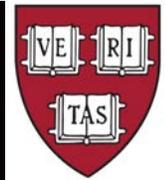
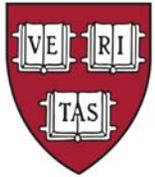


Photo par NASA / Public domain

## Thank you to:

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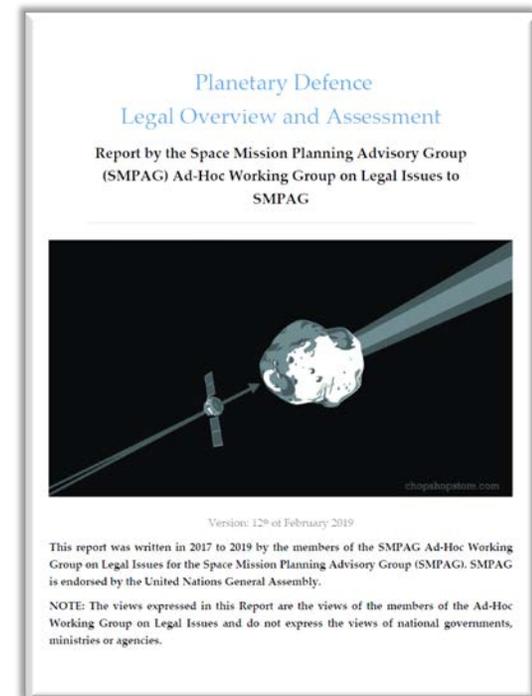
- ❑ Lindley Johnson, Gerhard Drolshagen, Line Drube, Daniel Mazanek, Rudolf Albrecht, and all members of SMPAG and SMPAG Ad-Hoc Legal Working Group
- ❑ Bill Ailor, Paul Chodas, Brent Barbee and all PDC organizers
- ❑ Bruce Betts, Nahum Melamed, Andy Riukin, Martin Elvis...
- ❑ Gerhard Sonnert (Harvard)

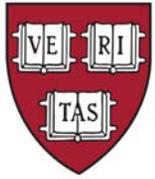


# Resources

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- ❑ **4th PDC simulation**
- ❑ **New app**
- ❑ **Legal report with a dedicated chapter on the scenario**
- ❑ **+ all of you!**
  
- ❑ **DART & Apophis: great examples to teach PD in the classroom**





## Pedagogic Goals (1/2)

---

- ❑ **Outreaching through Education (not only movies)**
- ❑ **Making Planetary Defense a “normal” problem to think about. Reducing the shock factor/panic through educating those who will become the next space engineers, scientists but also decision makers, economists, lawyers and journalists covering the story.**
- ❑ **Preparing a new and needed workforce from STEM and Non-STEM backgrounds: law, policy, ethics, business, economics, design, art, communication, marketing etc.**



## Pedagogic Goals (2/2)

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- ❑ **Jim Bridenstine: Importance of training for the technical risks and political risks.**
- ❑ **Exploring how risk perception impacts risk management**
- ❑ **Increasing awareness of the field of Planetary Defense: what it is; why it is important; why it should matter to them; the existing PD structures (IAWN, SMPAG, PD Offices etc.);**
- ❑ **Engaging students/building their curiosity;**
- ❑ **Developing team work**
- ❑ **Practicing decision-making during an emergency situation and with limited data (getting the students used to this discomfort)**

# CURRENT EFFORTS AT HARVARD

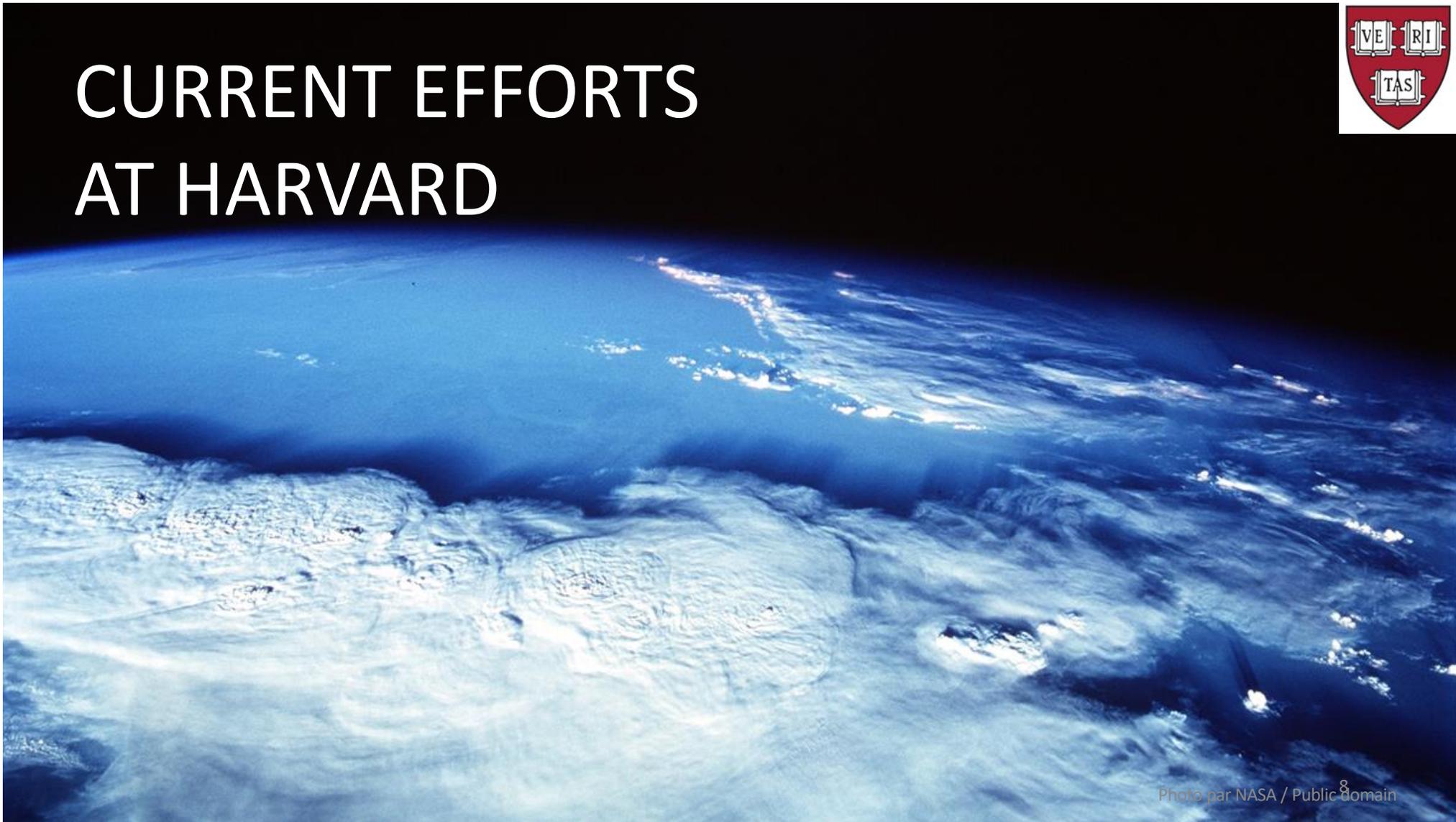
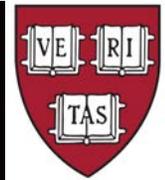


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# The Harvard Space Consortium & Space Night

**SPACE NIGHT AT HARVARD**

5:00 – 5:15 PM **OPENING REMARKS**  
Alissa J. Haddaji (HBS)

5:15 – 5:45 PM **LECTURE 1: Mars, MOXIE and MIT**  
Astronaut Jeffrey Hoffman (MIT)

5:50 – 6:20 PM **LECTURE 2: 20 Years with NASA's Chandra X-ray Observatory, From First Light to Virtual Reality**  
Professor Kim Kowal (FAS)

**LIGHTNING TALKS (180")**

6:30 – 7:10 PM **HARVARD/MIT SPACE CURRICULUM**

- Astrophysics – Bernhard Bonert (FAS)
- Space Economics – Matthew Weisner (HBS)
- Space History – Matthew Bieracki (FAS)
- Space Medicine – Ting Wu (HMS)
- Space Mining – Martin Elvis (FAS)
- Space Science and Engineering – Robin Wordworth (SEAS)
- Space Studies – Alissa J. Haddaji (HES)
- Space at the MIT Media Lab – Daniele Wood and Arja Elblin (MIT Media Lab)
- Space at the MIT Museum – Debbie Douglas (MIT Museum)
- Space at Framingham State – Irene Porro (Framingham State University)

7:15 – 7:55 PM **WORKING IN THE PRIVATE SPACE SECTOR**

- Richard DaBallo (Virgin Orbit)
- Mike French (Bryce Technologies)
- Michelle Hanson (Univ. of Mississippi)
- Vasanthan Lakshmi (Boeing)
- Dan Menius (Analytical Space)
- Ben Roberts (Moon Express)
- Barret Schlegelmilch (Blue Origin)
- Jana Staudemire (Space Tango)
- Gabe Swiney (US Department of State)

8:00 – 8:30 PM **GRADUATE/UNDERGRADUATE HARVARD/MIT SPACE STUDENT GROUPS**

- Beth Baccouche (Harvard STARR)
- Jesse Burbank (HLS SEALS)
- Manwei Chan (MIT SEES)
- Jenny Collins (MIT Sloan AstroLab)
- Kylin Lucas (HBS Heraldo)
- Erin McLean (HSS NASA SUITS)
- Hoy Nguyen (HMS)
- Amir Siraj (Harvard SEES)
- Audrey Walsh (Ivy Space Coalition)

8:30 – 9:30 PM **MEET AND GREET!**

**HARVARD UNIVERSITY**

SPACE NIGHT AT HARVARD is sponsored by the Harvard Provost Office.

**SPACE NIGHT AT HARVARD**

**MONDAY, Apr. 22<sup>nd</sup>**

**5:00 – 9:30 PM**

**AUSTIN HALL 100 (North)**  
1515 Massachusetts Ave  
Cambridge, MA

Free and open to all

With guest lectures by Astronaut Jeffrey Hoffman and Professor Kim Kowal

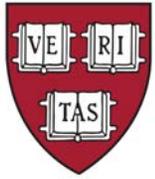
Featuring a meet-and-greet with representatives from:



**HARVARD UNIVERSITY**

SPACE NIGHT AT HARVARD is sponsored by the Harvard Provost Office.





# Astrosociology

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- ❑ **Harvard College Astrosociology Class (2017-):**
  - **ASTRON 5: Astrosociology (Fall semesters)**
  - **ASTR S-20: Astronomy and Society (Harvard Summer School)**
  
- ❑ **Sociology: Analyzing group dynamics**
- ❑ **Astrosociology: The study of the interrelationship between space-related phenomena and human society. Course based on group exercises + topics: space history & philosophy; science fiction & space exploration; SETI Institute; **Cosmic threats.****



## PDC Scenario 2017

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- ❑ **2hrs Experiment: focusing on the PDC 2017 “world leaders”**
- ❑ **In the Fall 2018 class**
- ❑ **With 20 Harvard undergraduate students: 8 freshmen, 4 sophomores, 4 juniors, and 4 seniors.**
- ❑ **3 rounds (early warning, confirmed impact, mission results)**



## Method

---

- ❑ **(ahead of the workshop) An introductory lecture on Planetary Defense (UNOOSA, COPUOS, IWAN, SMPAG, NEO observation, mitigation methods, etc.) and on sociology of risk perception**
- ❑ **Students are asked to pick a country and represent it**
- ❑ **Random reporters (engaged all students, kept the session's dynamics)**

# LESSONS LEARNED

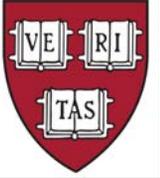
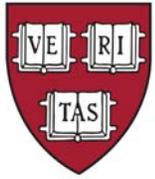


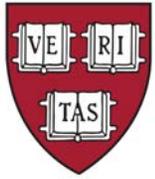
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## General outcomes

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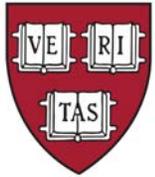
- ❑ **Very engaged students, data curious and creative responses (mass evacuation, sanctuary cities, invasion, press kept in the dark etc.)**
- ❑ **The “rogue agent” (will it always occur?)**
- ❑ **Long-term objective: Data-collection to compare with other classrooms in the US and internationally. Will we find cultural behavior differences in the way decisions are made?**



## What to improve (1/2)

---

- ❑ **Making it a game/ building simple academic material / use dice**
- ❑ **Planning for time (3 to 4hr-workshop)**
- ❑ **Much like the PDC Table Topic Exercise: giving specific options**
- ❑ **Teaming up (!) to:**
  - **Answer all their questions (ex: how fast did the asteroid rotate? What was the observability window? What are the launch limitations? etc.) + Provide missing data (setting a budget per country/ the economic impact of the destruction, etc.)**



## What to improve (2/2)

---

- ❑ **Assigning countries at random: incentives to learn about a national space program they might not know anything about; Avoiding too much imbalance;**
- ❑ **Planning 2 to 3 different scenarios with 1) one country; 2) a continent; 3) the entire world at risk.**

# CONCLUSION/NEXT STEPS

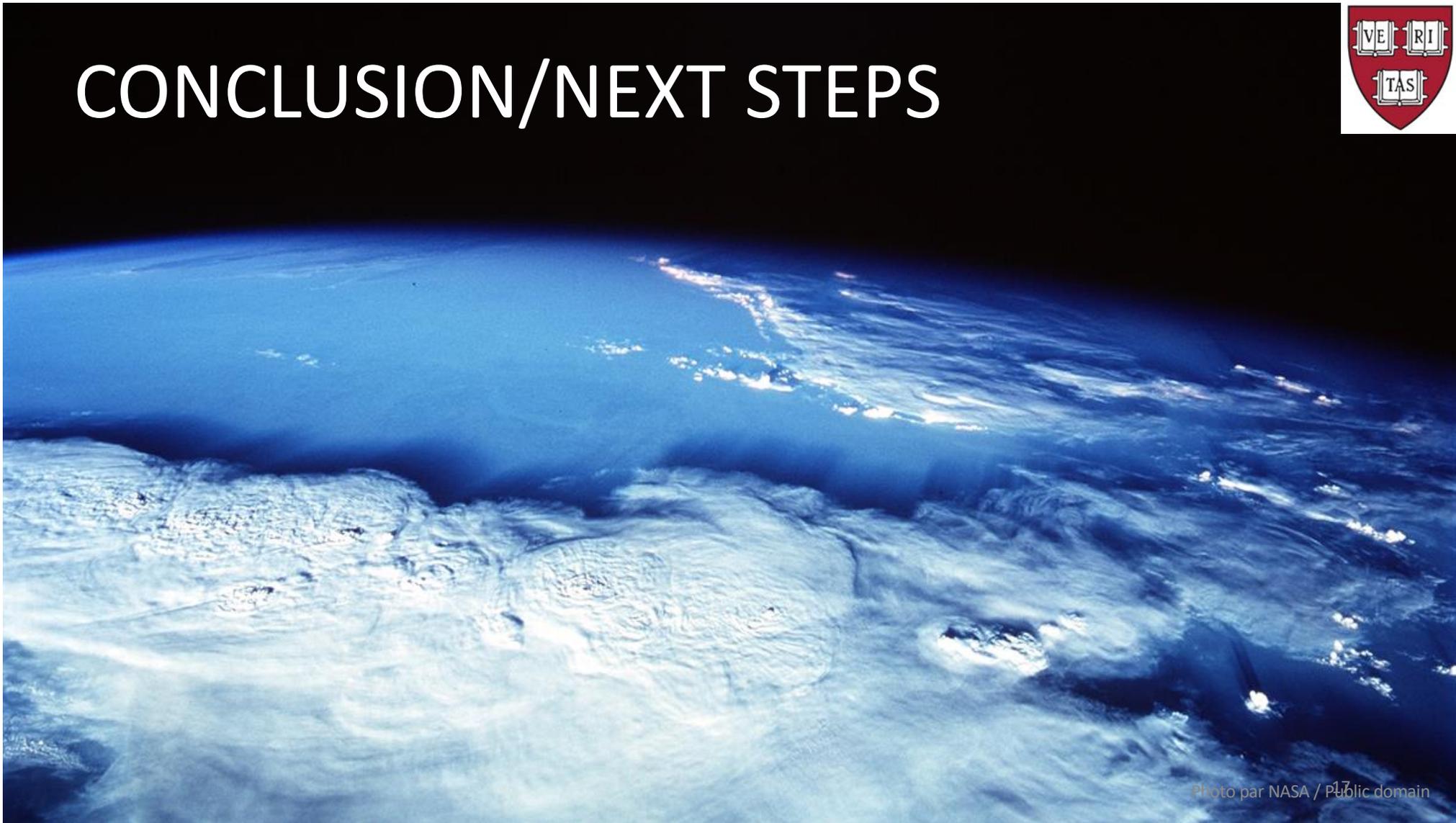
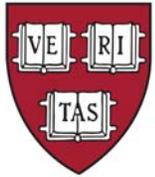


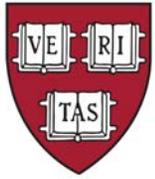
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## Conclusion

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- ❑ **A very engaging (and fun!) transdisciplinary and informative exercise involving a wide range of knowledge: Science, Technology, Engineering, Law, History, Sociology, Ethics etc.**
- ❑ **Adaptable in all types of classrooms, for all age brackets**
- ❑ **A good way for transdisciplinary/transdepartment efforts and for university departments to connect/ be less siloed**
- ❑ **Partner with other universities (Harvard/MIT crossregistration and co-teaching)**

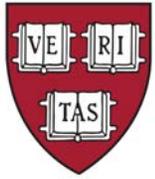


## Next steps (1/2)

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### **This Year (2019)**

- ❑ Improving the exercise through collaborations: Let us know if you are interested! ([ahaddaji@hbs.edu](mailto:ahaddaji@hbs.edu))**
- ❑ Harvard Summer & Fall Astrosociology course**
- ❑ ISU (General workshop + Expert workshop focused on PD Space Law and Policy)**



## Next steps (2/2)

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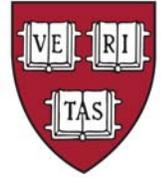
### **MID TERM**

- Building easy to use academic material based on existing resources (The Aerospace Corporation app; the Planetary Society educational videos from the KickAsteroid Project; from those in the room and online who have been conducting similar activities)**

### **LONG TERM**

- A coordinated effort on Asteroid Day (June 30th) 2020 and/or in parallel to PDC in schools in the US and around the world ?**
- Involving the public, using this material for citizen science exercises?**

**Thank you!  
Any questions?**



**Alissa J. Haddaji,  
Harvard Business School, SMPAG Ah-Hoc Legal Working Group Coordinator, [ahaddaji@hbs.edu](mailto:ahaddaji@hbs.edu),  
6<sup>th</sup> IAA Planetary Defense Conference, College Park, Maryland, USA, May 2<sup>nd</sup> 2019**

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