Should the payload owners take responsibility for payload review declarations to the FAA?

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Some definitions & basic information

- **Payload**: an "object that a person undertakes to place in outer space by means of a launch vehicle or reentry vehicle" - 51 USC § 50902(13)). **Payload determination**: every payload must obtain a payload determination by the Federal Aviation Administration (FAA), Office of Commercial Space Transportation (FAA/AST).
- The FAA does not perform a review when the payload is "owned or operated by the US government," or if is subject to regulation by FCC or NOAA. See § 415.53 (14 CFR § 415.53 - Payloads not subject to review.)
- **When? And by whom?** The payload review is normally done as part of a launch or reentry authorization but it does not need to be done then. It could be done:
  - as part of a license application review
  - or may be requested by a payload owner or operator in advance of or apart from a license application. **§ 415.57 Payload review.**

Some definitions & basic information

- The FAA reviews the payload under the following aspects:

  "Public health and safety

  Safety of property

  U.S. national security

  Foreign policy interests

  International obligations of the United States".

- AST, Commercial Space transportation, *FAA's Payload Authority & Planetary Protection*, available at https://www.nationalacademies.org/documents/embed/link/LF2255DA3DD1C41C0A42D3BEF0989ACAECE3053A6A9B/file/D4E77F0D5B30602CFC9C59B80102C04E3165AA933DA6?noSaveAs=1

FAA's payload review

- FAA's review is cursory:

  "FAA gets to stop a launch if the FAA finds that the launch or reentry would jeopardize the public health and safety, safety of property, or national security or foreign policy interest of the United States. **51 U.S.C. 50904(c)**. The FAA does not, however, get to tell payload operators what to do about their payloads."

  Laura Montgomery, *No Tardigrades Here,* available here https://groundbasedspacematters.com/index.php/2019/08/22/no-tardigrades-here/).

FAA's payload review

From a 1997, House Committee Report:

"The original Act intended that a launch ends, as far as the launch vehicle's payload is concerned, once the launch vehicle places the payload in Earth orbit or in the planned trajectory in outer space."

Which information does the FAA receive?

§ 415.59 Information requirements for payload review.

(a) A person requesting review of a particular payload or payload class shall identify the following:

- **(1)** Payload name;
- **(2)** Payload class;
- **(3)** Physical dimensions and weight of the payload;
- **(4)** Payload owner and operator, if different from the person requesting payload review;
- **(5)** Orbital parameters for parking, transfer and final orbits;
- **(6)** Hazardous materials, as defined in § 401.5 of this chapter, and radioactive materials, and the amounts of each;
- **(7)** Intended payload operations during the life of the payload; and
- **(8)** Delivery point in flight at which the payload will no longer be under the licensee's control.

FAA's payload review

- (Perhaps beyond the federal mandate?) the FAA requires additional information:
- "A key informational element is the payload's intended use in space. It may be necessary to request additional information to address specific issues such as planned orbits that could threaten important orbiting objects such as ISS, ability to take photographs of national security assets, planetary protection, and the use of nuclear materials..."

  AST, Commercial Space transportation, *FAA's Payload Authority & Planetary Protection*, vailable at https://www.nationalacademies.org/documents/embed/link/LF2255DA3DD1C41C0A42D3BEF0989ACAECE3053A6A9B/file/D4E77F0D5B30602CFC9C59B80102C04E3165AA933DA6?noSaveAs=1

FAA's payload review

- The FAA relies on the declarant and assumes the declaration is accurate, complete, and in good faith.
- The launch licensee has a duty of accuracy for the whole application (including the payload determination).
- But … when the declarant is unaware of the precise content of the payload?

An increasing problem

- Launches are more and more frequent: in the US alone, the FAA has licensed 532 launches since 1989 (https://www.faa.gov/data_research/commercial_space_data/). In 2022 Space X alone launched "61 orbital missions" (https://www.space.com/spacex-celebrates-2022-61-launches)
- Rockets are larger and contain multiple payloads (SpaceX holds the record of 143) and sometimes a payload within a payload.

The messy business of the “tardigrades”

- In February 2019 the Israeli private lunar lander Beresheet (built by Israel Aerospace Industries (IAI) and operated by SpaceIL) malfunctioned and crashed on the Moon.
- Beresheet travelled as a secondary payload on a SpaceX Falcon 9.
- Inside the Beresheet was the “Lunar Library”, a miniature database owned by the nonprofit Arch Mission Foundation, containing hundreds of thousands of bits of information and human DNA.
- At the last moment, the Arch Mission Foundation decided to add thousands of tardigrades in epoxy, to the archive. It is uncontested that nobody else knew.
- Also known as “water bear”, tardigrades are extremely resilient creatures, known to survive to extreme conditions, including the space vacuum

More on the Beresheet mission here: https://davidson.weizmann.ac.il/en/online/sciencepanorama/what-happened-beresheet. See also” https://www.thespacereview.com/article/3783/1

The messy business of the “tardigrades” debunked

- SpaceIL - and not the Arch Mission Foundation - filed for payload review and determination with the FAA.
- SpaceIL (operator) was unaware of the tardigrades.
- SpaceX (launch licensee) was also unaware of the tardigrades.
- The FAA opened an investigation against SpaceIL and SpaceX but at the end issued no sanctions.
- The tardigrades are a telltale of a situation in which nobody faced responsibility.

The messy business of the "tardigrades" debunked

- The SpaceIL payload determination is available.
- Unsurprisingly, "[t]here's no mention of tardigrades." (Laura Montgomery, *No Tardigrades Here,* available here https://groundbasedspacematters.com/index.php/2019/08/22/no-tardigrades-here/).
- It is likely the tardigrades did not breach the nonbinding COSPAR Planetary Protection Guidelines because the Moon is category II under COSPAR so forward contamination is not a problem. However, it could be quite different if a payload containing tardigrades would head to Mars.

Planetary Protection policy

COSPAR (NGO established in 1958)

- Divides space missions into 5 categories, depending on the target and need of protection.
- Requirements for the mission are different depending on the category: No requirements for Category I missions; only documentation for Category II missions; starting from Category III, more documents + a procedure in place.

- Recently Moon missions divided into:
- Category Iia: all missions to the surface of the Moon except certain areas.
- Category IIb “Permanently Shadowed Regions (PSRs) and the lunar poles” (requires more documentation (organic inventory)

Policy available at https://cosparhq.cnes.fr/assets/uploads/2019/12/PPPolicyDecember-2017.pdf

NASA Planetary Protection Independent Review Board (PPIRB), REPORT TO NASA/SMD -- FINAL REPORT (2019)

The Moon is currently classified Category II—of "significant interest to origins of life questions but with "low risk" that contamination will compromise future science. In general, however, scientific interest in the Moon is not focused on the origin of life or its building blocks. Other than locations where ice is known to exist near the lunar poles (which could remain Category II), most locations on and inside the Moon are not relevant to questions of the chemical evolution leading to or the origin of life itself." at 13.

The PPIRB Report invited NASA to reconsider: "how much of the Martian surface and subsurface could be Category II versus IV" Id. at 13.

- Available at https://www.nasa.gov/sites/default/files/atoms/files/planetary_protection_board_report_20191018.pdf

NASA Planetary Protection Independent Review Board (PPIRB), REPORT TO NASA/SMD -- FINAL REPORT (2019)

- The Report invited NASA to distinguish between
- "(i) high priority astrobiology zone, i.e., regions considered to be of high scientific priority for identifying extinct or extant life, and
- (ii) human exploration zones, i.e., regions where the larger amounts of biological contamination inevitably associated with human exploration missions, as compared to robotic scientific missions, will be acceptable." id.
- in the case of smaller objects like "comets, asteroids, Kuiper Belt Objects), the Report invited NASA "to categorize everything as category I … to simplify missions …" Because even if a contamination happens in one [asteroid] … there are myriad to choose from that will not have been previously visited by robotic probes" for planning experiment on origin of life. Id.
- the Report also pointed out that "some experiments that have been conducted have shown that "the survival and amplification of terrestrial biota are unlikely on the Martian surface, which would support classification of much of the Martian surface as Category II." Id. at 14.

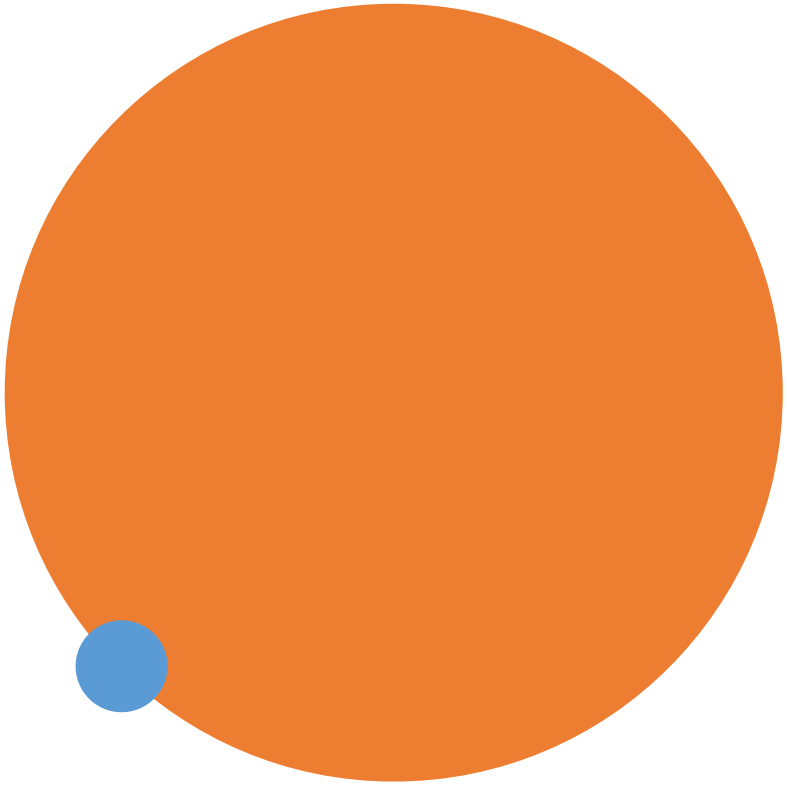
NASA Planetary Protection Independent Review Board (PPIRB), REPORT TO NASA/SMD -- FINAL REPORT (2019)

- Other findings:

"It is impractical for launch providers or satellite hosts to definitively determine the biological content of every payload. Biological materials intentionally added by a bad actor are especially challenging for launch providers to monitor or report, as they can be further obscured by falsified verification or inaccurate documentation." Id. at 12.

Re Beresheet: "By the Moon's Category II PP designation, it is likely that a payload license would have been readily granted had the bioload been self-reported; however, the lack of such reporting created new issues relating to launch licensing." Id.

"Breaches of PP reporting or other requirements should be handled via sanctions that hold the root perpetrator accountable, rather than increasing the verification and regulatory burden on all actors." Id.



- My analysis will focus on the problem of forward contamination. "Forward contamination": "transport of Earth-based microbes to other celestial bodies"(as opposed to "Backward contamination": "possibility that extraterrestrial microbial life returned by a space mission could propagate on Earth.")

New Report Addresses Limiting Interplanetary Contamination During Human Missions, available at https://www.nasa.gov/feature/new-report-addresses-limiting-interplanetary-contamination-during-human-missions

Query

- As said, **§ 415.57(a) (Payload review)** provides that "A payload review may be conducted as part of a license application review or may be requested by a payload owner or operator in advance of or apart from a license application"
- I suggest that the applicant for the payload review must be the payload owner OR anyway that a Payload declaration by the payload owner must be filed with the payload review application.

Pro argument

- Why?
- The declaration to the Government must be done by the party best suited to be **knowledgeable.**
- This requirement would maximize the possibility the Government receives an accurate declaration.

OR

- that there is a responsible party for knowingly and willfully presenting false information.
- As a consequence, the risk of forward contamination is diminished.

Consequence of false statement

18 U.S.C. § 1001 ("Statements or entries generally") punishes whoever

- "in any matter within the jurisdiction of the executive, legislative, or judicial branch of the Government of the United States
- knowingly and willfully
- **(1)**falsifies, conceals, or covers up by any trick, scheme, or device a material fact;
- **(2)**makes any materially false, fictitious, or fraudulent statement or representation; or
- **(3)**makes or uses any false writing or document knowing the same to contain any materially false, fictitious, or fraudulent statement or entry." 18 USC §1001(a).

Consequence of false statement

- Broad application
- While it does "not apply to a party to a judicial proceeding, or that party's counsel, for statements, representations, writings or documents submitted by such party or counsel to a judge or magistrate in that proceeding" and there are limitations to the application of the statute "with respect to any matter within the jurisdiction of the legislative branch," the statute does not contain other exceptions. 18 USC §1001(b) and (c)
- *United States v. Rodriguez-Rios*, 14 F.3d 1040, 1044 (5th Cir. 1994), SCOTUS overruled the exculpatory exception ("a generally negative and exculpatory response made by a subject of a criminal investigation in reply to questions directed to him by investigating officers is not a crime under § 1001." *United States v. Krause,* 507 F.2d 113, 117 (5th Cir.1975).

Consequence of false statement

Penalties:

"shall be fined under this title, imprisoned not more than 5 years or, if the offense involves international or domestic terrorism (as defined in section 2331), imprisoned not more than 8 years, or both. If the matter relates to an offense under chapter 109A, 109B, 110, or 117, or section 1591, then the term of imprisonment imposed under this section shall be not more than 8 years. 18 USC §1001(a)."

Other questions

- Is it appropriate to have a set of guidelines related, for example, to planetary protection?
- Not sure if we should go much beyond requiring compliance with COSPAR. PPIRB Report seems to go towards a simplification of requirements.
- Lastly, could a bond be imposed?

Cons argument: Would it be burdensome to the industry if payload owners would take responsibility for payload declarations?

- Could multiple declarations by the several payload owners complicate the procedure? Maybe. But as space opens up to novel commercial activities which will reach out well beyond Earth orbit, the current procedure is inadequate to protect from forward contamination.
- Making sure that the Government receives accurate information or is able to identify a responsible party is paramount.
- The answer to the question whether the payload owners should take responsibility for payload declarations is affected by the the issue of whether this should be part of a new Mission Authorization or “Enhanced payload review” (under the FAA or under Dept. of Commerce.)