

Environmental considerations shuttle and rocket launches

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Shuttle program

- 123 shuttle launches
- First launch in 1981
- 4-5 launches/yr
- No CO₂ release in “eco-friendly” (burning H₂ and O₂)¹
- Solid Rocket Boosters (SRB's) have big impact: hydrochloric acid forms in launch cloud¹

1 http://news.bbc.co.uk/2/hi/uk_news/magazine/4130980.stm

Shuttle program

- Caveat: if we extend our view, the environmental impacts could be greater:
 - Manufacture of shuttle & boosters/tanks
 - Manufacture of launch infrastructure
 - Maintenance and upkeep of all equipment, hardware, operations, etc. related to space program
 - For example, we need energy to manufacture hydrogen fuel cells... (TINSTAAFL)

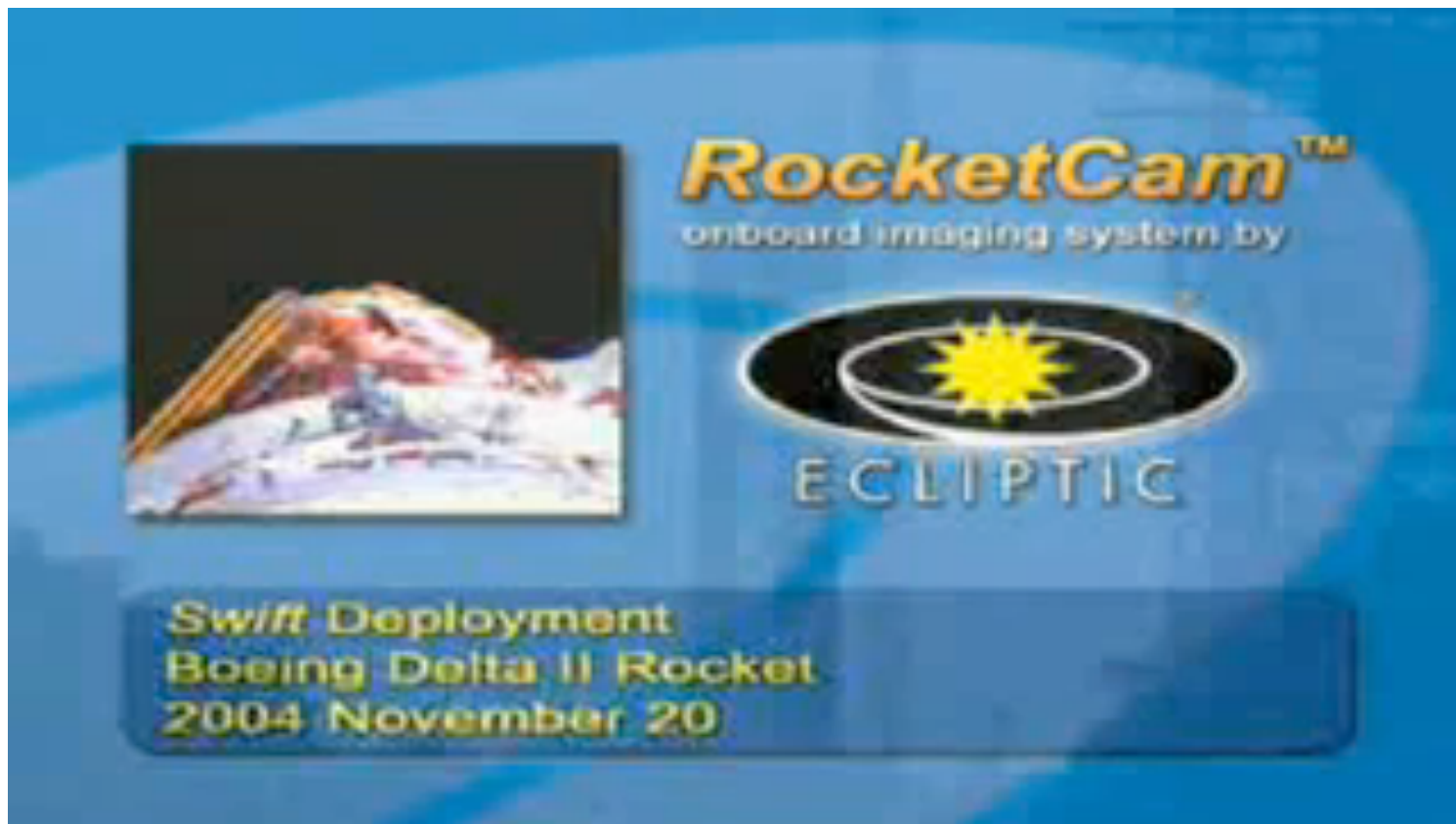
Shuttle program - decommissioning

- This Programmatic EA provides information associated with the potential environmental impacts of the transition and retirement (T&R) of NASA's Space Shuttle Program (SSP). The T&R of the SSP would consist of the disposition of both real property (land, buildings and other structures and their associated built-in systems that cannot readily be moved without changing the essential character of the real property) and personal property (all assets not classified as real property owned by, leased to, or acquired by the government). **Property disposition activities are the primary focus of this EA because this is the T&R activity with the greatest potential for environmental impacts.** The Programmatic EA approach allows NASA to assess the overall T&R activities, although some specific options are not yet sufficiently developed to assess in detail.²

[Emphasis added]

2 http://www.nasa.gov/pdf/214131main_SSP_Programmatic_EA_full.pdf

Delta II rockets



Delta II rockets

- Require ~10,000 gal of kerosene³
- 125 launches since 1989
- Presuming similar pollution from burning jet fuel and burning Delta II kerosene, the total pollution emitted by all Delta II's to date is equivalent to the pollution from roughly 22 maximum-range flights of a fully loaded 747-400 (gas mileage: 235 meters/gal)⁴
- Of course, there are a variety of other types of fuel used in the later stages of the Delta II launches, the environmental impacts of which vary:⁵
 - SRB's
 - Hypergolic Aerojet
 - ATK-Thiokol solid rocket motor

3 http://www.nasa.gov/mission_pages/swift/launch/pad.html

4 http://www.boeing.com/commercial/747family/pf/pf_400_prod.html

5 http://en.wikipedia.org/wiki/Delta_II

Final thoughts

- Despite the sometimes significant environmental impact of any given launch, there are so few launches that, in our opinion, any damage to the environment is far outweighed by the space programs' benefits to society
- The space program has created numerous spinoff technologies, including hydrogen fuel cells
- Have launched and serviced numerous missions that have inspired the public and furthered science
- Specifically, there have been missions that monitor the environment and climate change

Bibliography

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