

Co-Orbital Convergence – Rallying Solar Sails, Small Solar-Electric Spacecraft and Nanolanders to Help Save Us from a Nasty Neighbour Soon

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and the *Fun Paper* teams 2011-2021

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Tambora 1815



Krakatau 1883



May 1858 (1858)



Hunga eruption, Jan. 15th, 2022 – ≥61 Mt_{TNT}



point of departure:

- 13¾ years to impact
- co-orbital swan dive
- coming out of the Sun

experience of natural disasters
geophysical data & research
historic observation record
global preparedness
knowledge

within scale of historic events
many surprise phenomena
modern instrumentation
globally detectable
new insights

destination for arrival:

- agile and responsive
- break away from disaster
- all powered by the Sun

We should have seen it coming much earlier – ASTEROIDFINDER/SSB – PDC'09
Space observatories to spot asteroids at low elongations many times but none were completed

locally devastating, globally interesting

Know your PHO – Multiple NEA Rendezvous with Sail to Soil & back again – PDC'17
“Now-term” solar sail technology enables rendezvous with 5 in-flight selected NEAs within 10 years with sample return

detour: 2011AG₅ – the PDC 2013 Exercise impactor imagined to hit on February 3rd, 2040

2023 PDC: a range of ranges of uncertainties

ASTEROIDSQUADS/SSB – PDC'11
Regular practice missions for responsive implementation and precision ops – congratulations DEEP IMPACT & DART!

ASTEROIDSQUADS/SSB
Send shoeboxes to explore asteroids and keep them simple – MASCOT – PDC'13
Well, that one really happened and it worked! – Thank you, HAWABUS2 & keep on going #sharp & strong!

Sail to Soil! – GOSSAMER-3 and the MASCOT Flight Spare – PDC'15
Well, that one really happened and it worked! – Thank you, HAWABUS2 & keep on going #sharp & strong!

“go fly a sail every other year” – the GOSSAMER Roadmap

exploration vehicles (to scale)

globally devastating, globally lethal

paleontology impact geology disaster management infrastructure topography prehistoric relation of events

beyond any historic scale
surprise phenomena
fragmentation spread
complex & ripple effects

displacement L₁ space weather warning buoy
from local resources made in space ready by 2050 it can be done if we see it coming now

Steinheim Basin, ≈150 m impactor, ≈3.8 km crater, ≈14.8 Ma ago, 42 km WSW of Nördlinger Ries

≈1.5 km impactor, ≈24 km crater, 14.8 Ma ago