A CubeSat network to monitor Near Earth Objects and develop space access through international collaboration

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Need

Collisions between Earth and other bodies have played an important role in the biological and climatological development of the Earth. Cretaceous–Paleogene event proves that collisions may have significant impact on biological evolution, as a result of mass extinctions brought on by global climate change. The Low (but non-negligible) probability associated to extremely high consequence of asteroid collisions makes studies of this topic worthwhile (ESA and NASA by the establishment of dedicated NEO programs).

Modern scientific methodologies associated with low financial risk of new nanosatellite technologies allow us now to develop a space-based network of instruments to monitor potentially threatening Near Earth Objects.

Mission Objectives

Humanitarian Objectives

The main objective of the NEON Project is to participate to the space situational awareness by NEO detection, providing early valuable informations for eventual mitigations. NEON will image the more interesting part of the sky with nearly real time reactivity.

Scientific Outcome

The NEON project will participate to the global effort to better understand our direct space environment by providing a high amount of information about the solar system. Indeed, studying asteroids & comets is the perfect way to know more about the origins of our solar system.

Educational Benefit

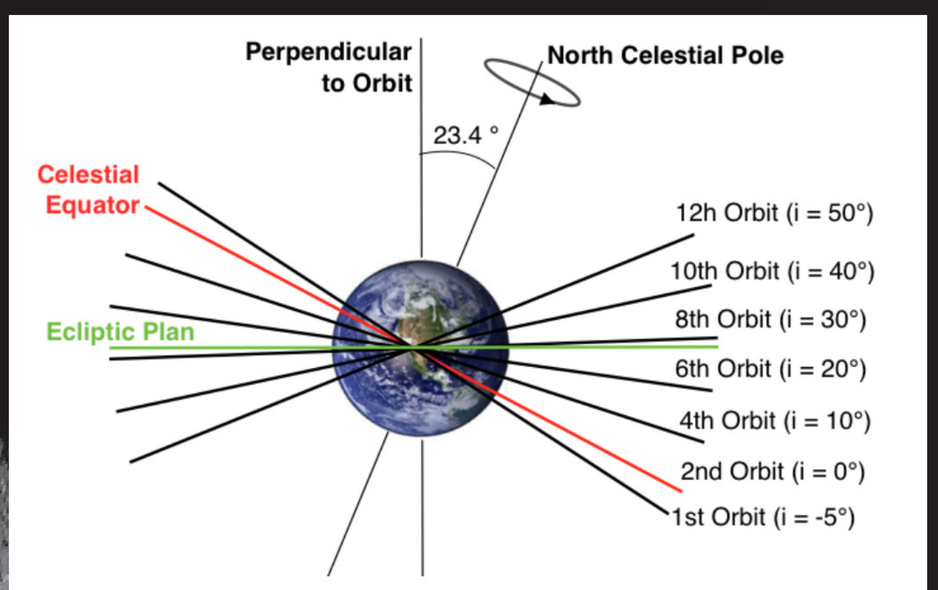
The NEON Project is the perfect way to educate aerospace engineering students through an international project with a high scientific payback. Worldwide institutions can participate for a low needed budget.

International Collaboration

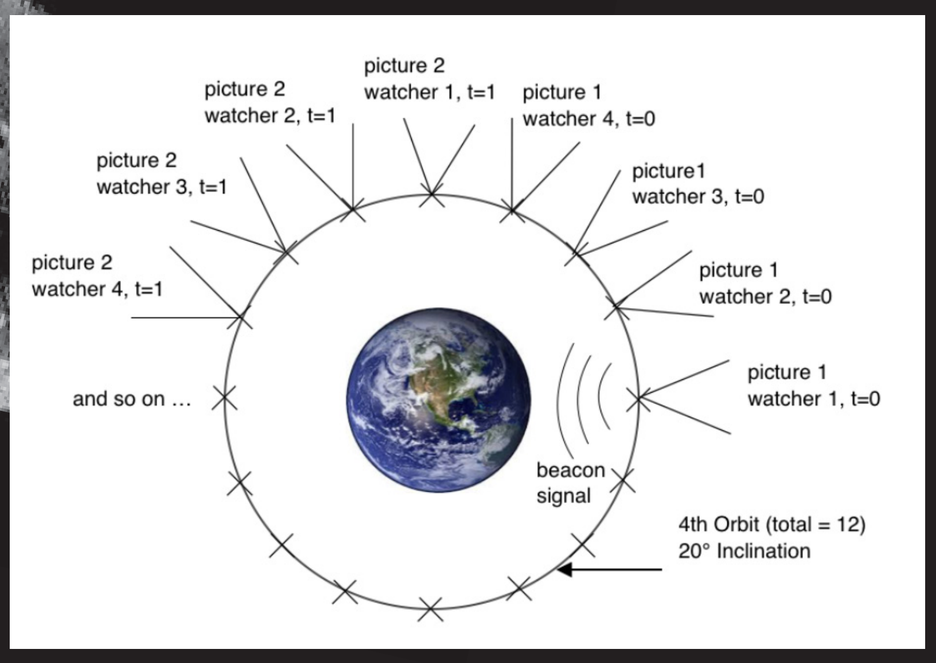
A devastating impact with Earth of a NEO would affect the whole World. As all the countries are concerned, an international collaboration is thus a very logic solution. The low financial risk allow developing countries to participate to the NEON project.

Network

The network will be uniformly distributed along 12 orbits (pearl string configurations) with different inclinations as described below:



Orbit distribution along the Celestial Equator.



Sky repartition example between 4 different Watchers.

The network goal is to monitor the sky around -30° and +30° (most probable angular position of NEO) around the ecliptic plan, to ensure humanitarian payback.

The minimal number of "watchers" is 90 according to preliminary studies, with a field of view of approximately 25 deg^2. A superior number is therefore acceptable for redundancy reasons.

Space Segment

Each "watcher" :

- is a 3U CubeSat (10x10x30cm, 4kg). The basic mechanical design is described on the right.

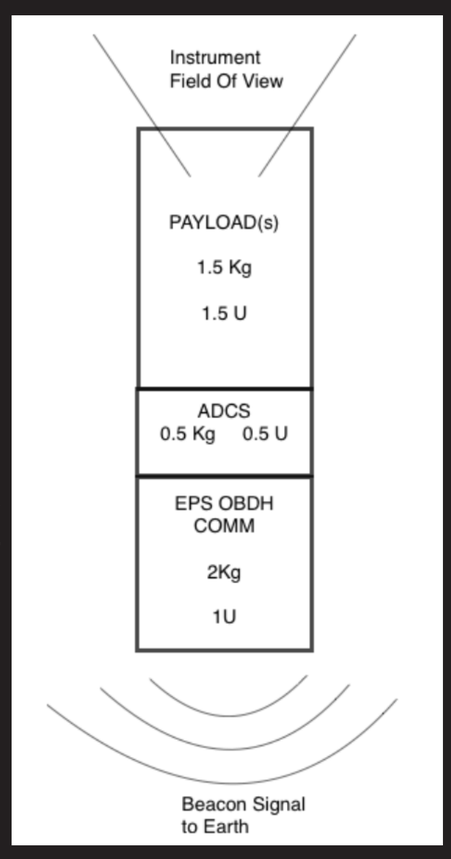
- can be composed of Components Off-The-Shelf (at the design team discretion), except for the visible imager to detect NEO, described as the "Payload", developed by the Principal Investigator Institution of the project.

- has an estimated development cost inferior to 100,000 $, reducing the financial exposure for insitutions.

- is responsible for the monitoring of 10 parts of the sky (preliminary value), and compare one picture with the last one (one orbit revolution before) to detect if something new appear on it.

- will process the payload's data to determine if NEO is detected in the field of view.

- will send a beacon signal to Earth (easily detectable by radio amateur community) to notice competent authorities.

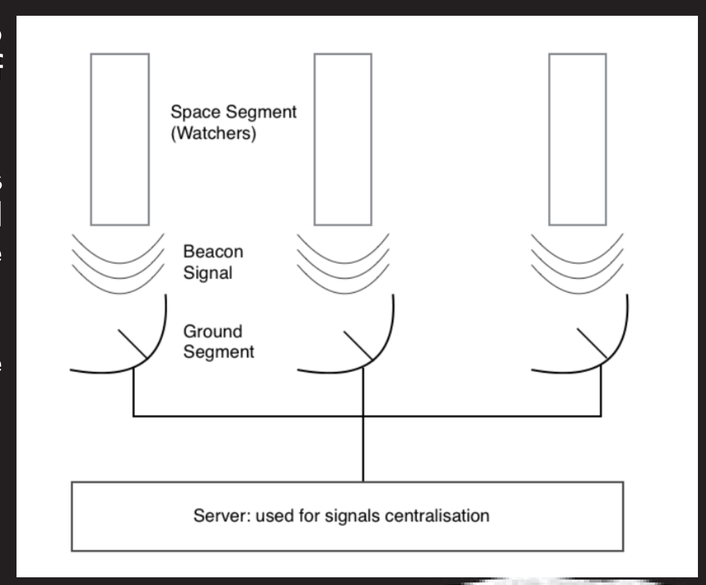


Operations

Onboard data processing is mandatory to transmit only the date, latitute & longitude of observed objects (T, L, I).

When a NEO is detected, the beacon signal is sent then detected by ground segment(s). Ground observations are then performed to confirm the notification.

Delay between picture and notification shall be inferior to 30 minutes, for efficiency purposes.



Implementation Plan

The leadership of the project is ensured by on defined institution (as the principal investigator).

Each watcher is designed, tested and integrated by a partner institution (typically a University as a pedagogical project, countries without satellite activities can then participate).

The use of the AGILE Management methodologies allow a high flexibility on the schedule described above ans is particularly suitable for a big educational project like this one.

Conceptual Design (feasibility studies, specification of needs)	Dec. 2014
Announcement of opportunity to find partners	Jan. 2015
Frozen list of partners	Jun. 2015
Engineering Models deadline (Design, Test, Integration)	Jun. 2016
Flight Models deadline (Design, Test, Integration)	Jun. 2017
Network Launch	Dec. 2018
Operation	2019 - 2021
Decommissioning	Dec. 2021