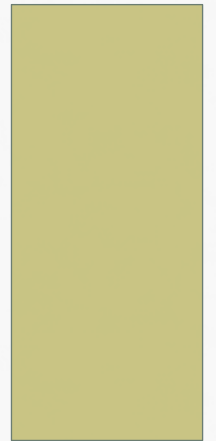
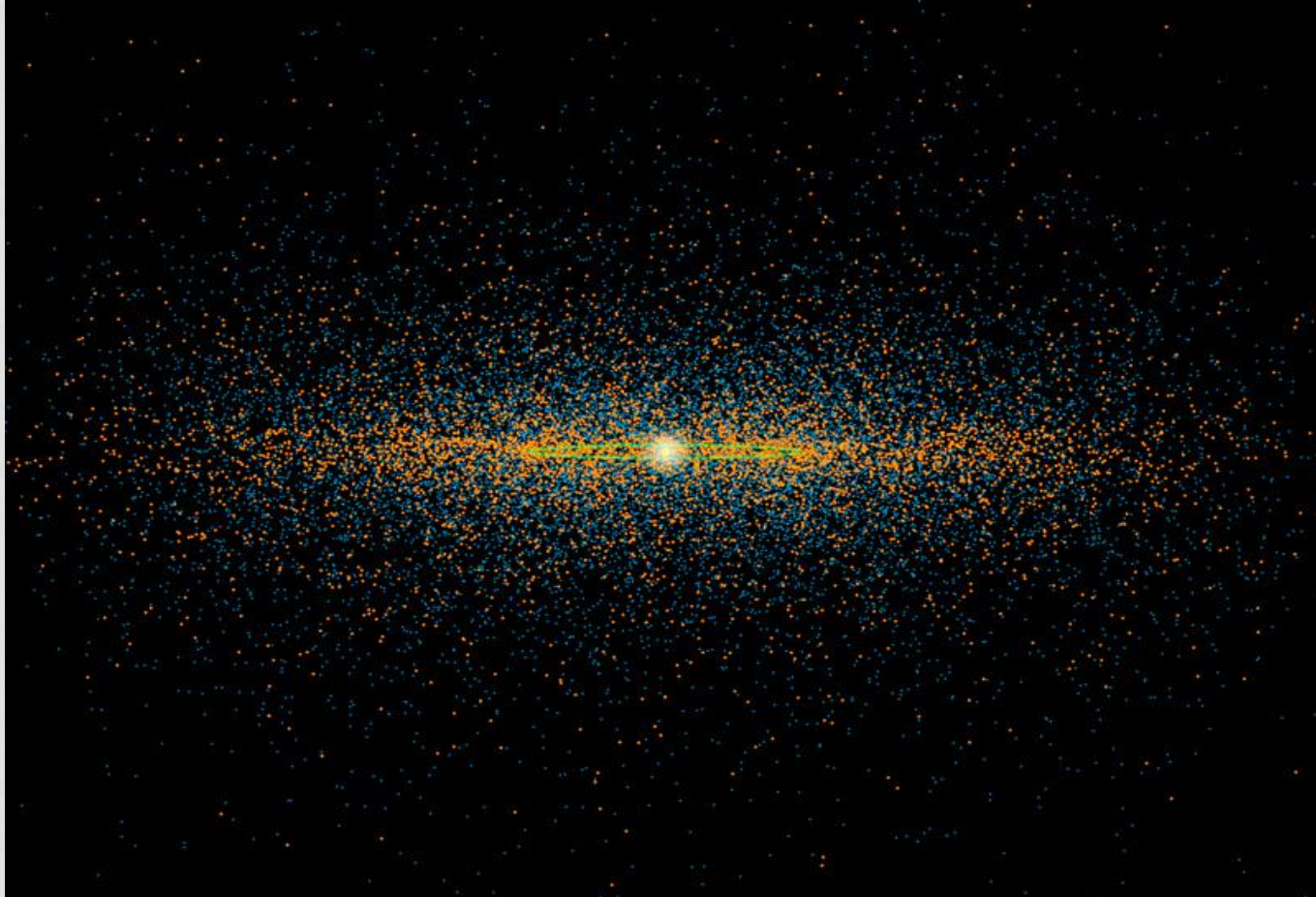


PLANETARY DEFENSE & GLOBAL GOVERNANCE

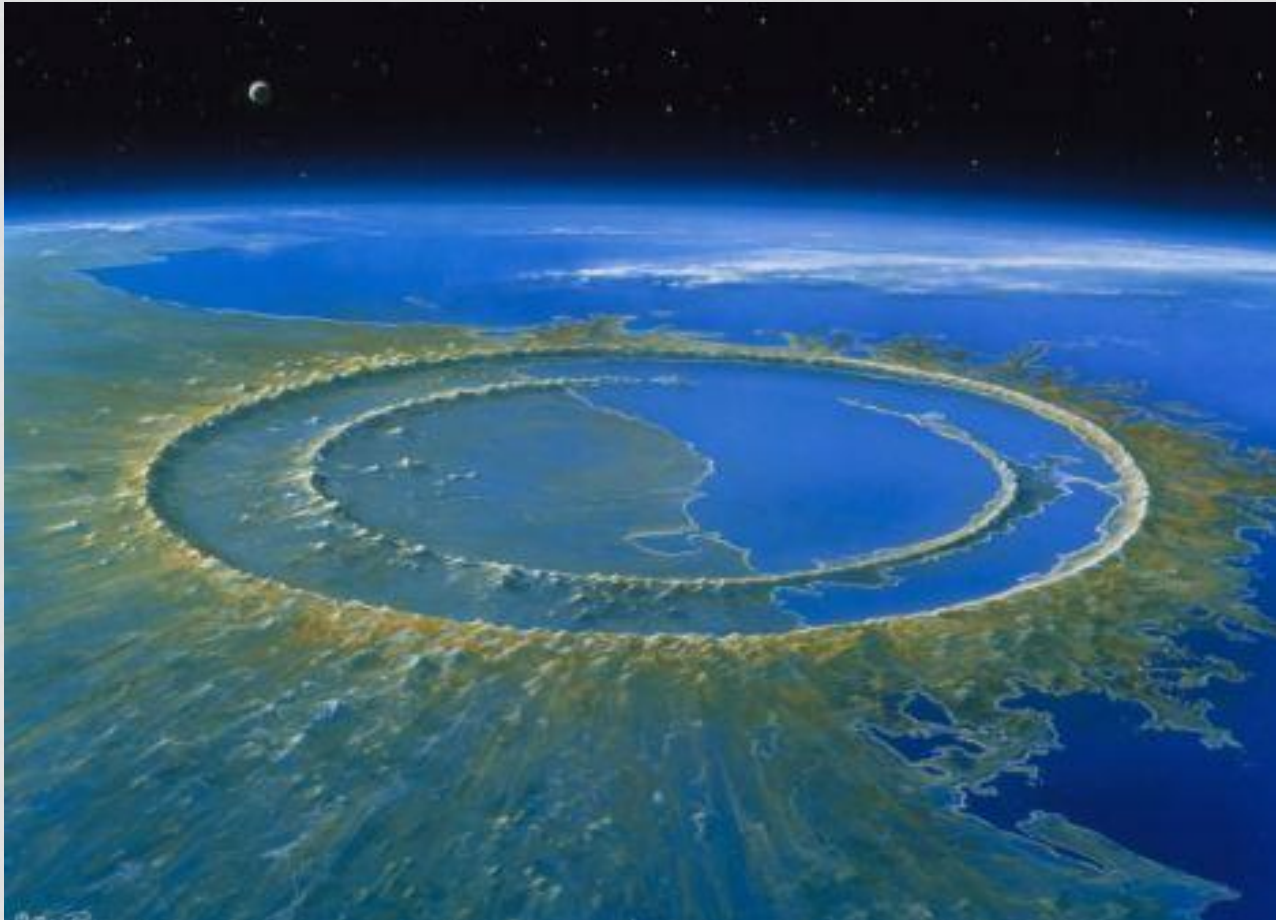
JOSEPH N. PELTON, EXECUTIVE BOARD, IAASS
MANFRED LACHS CONFERENCE, MAY 2014



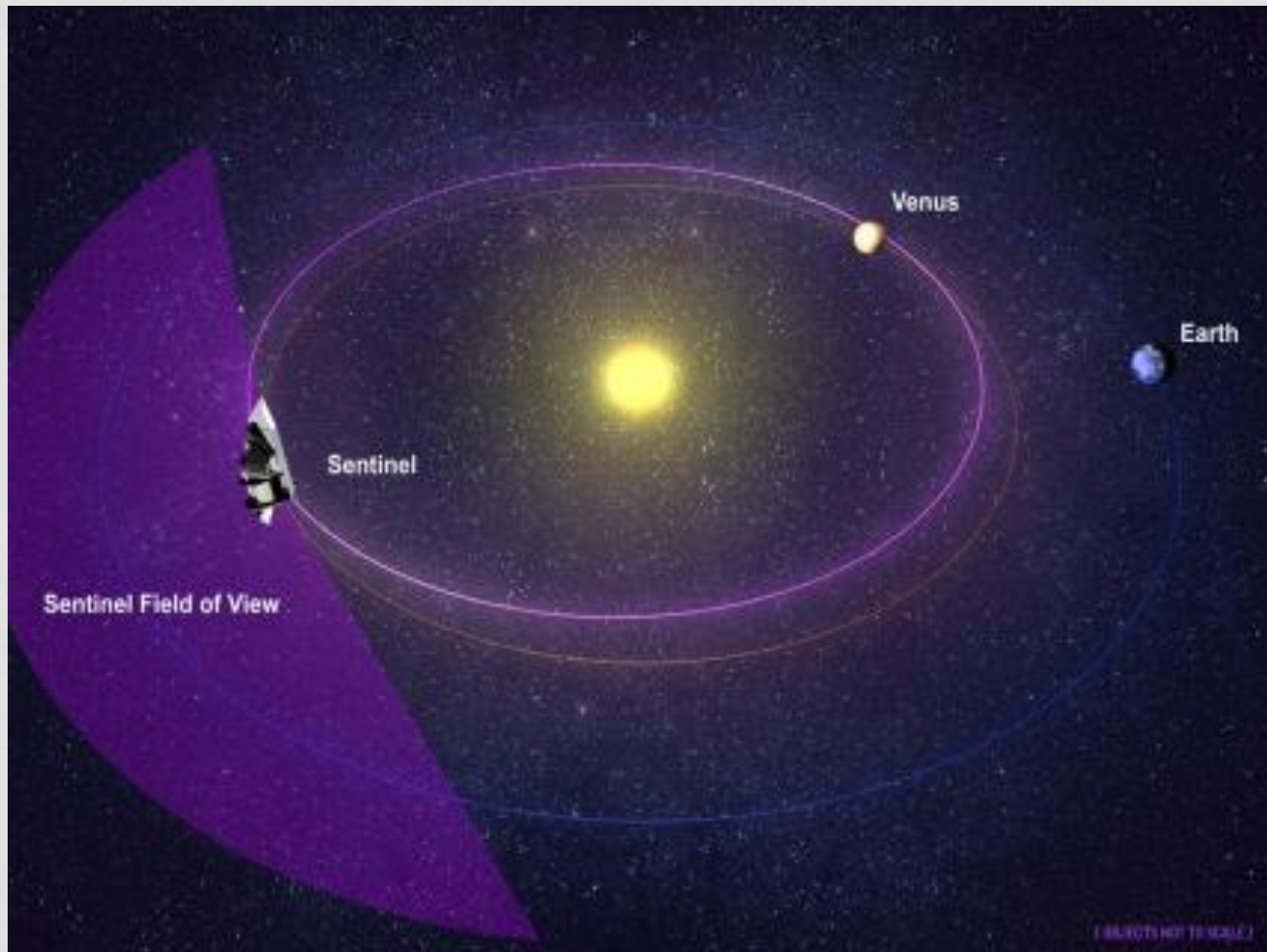
THEY ARE PERHAPS 1 MILLION CITY-KILLING ASTEROIDS (30 M OR LARGER)



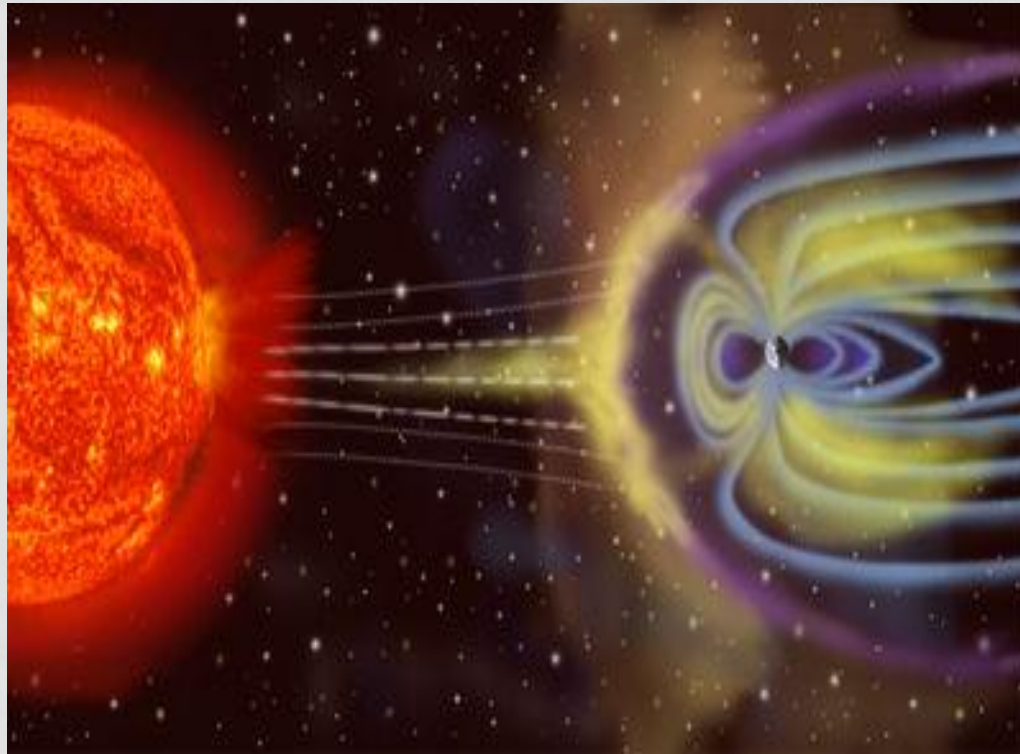
THIS IS THE RESIDUAL CRATER FROM 65
MILLION YEARS AGO – THE 5 KM
DINOSAUR-KILLING ASTEROID



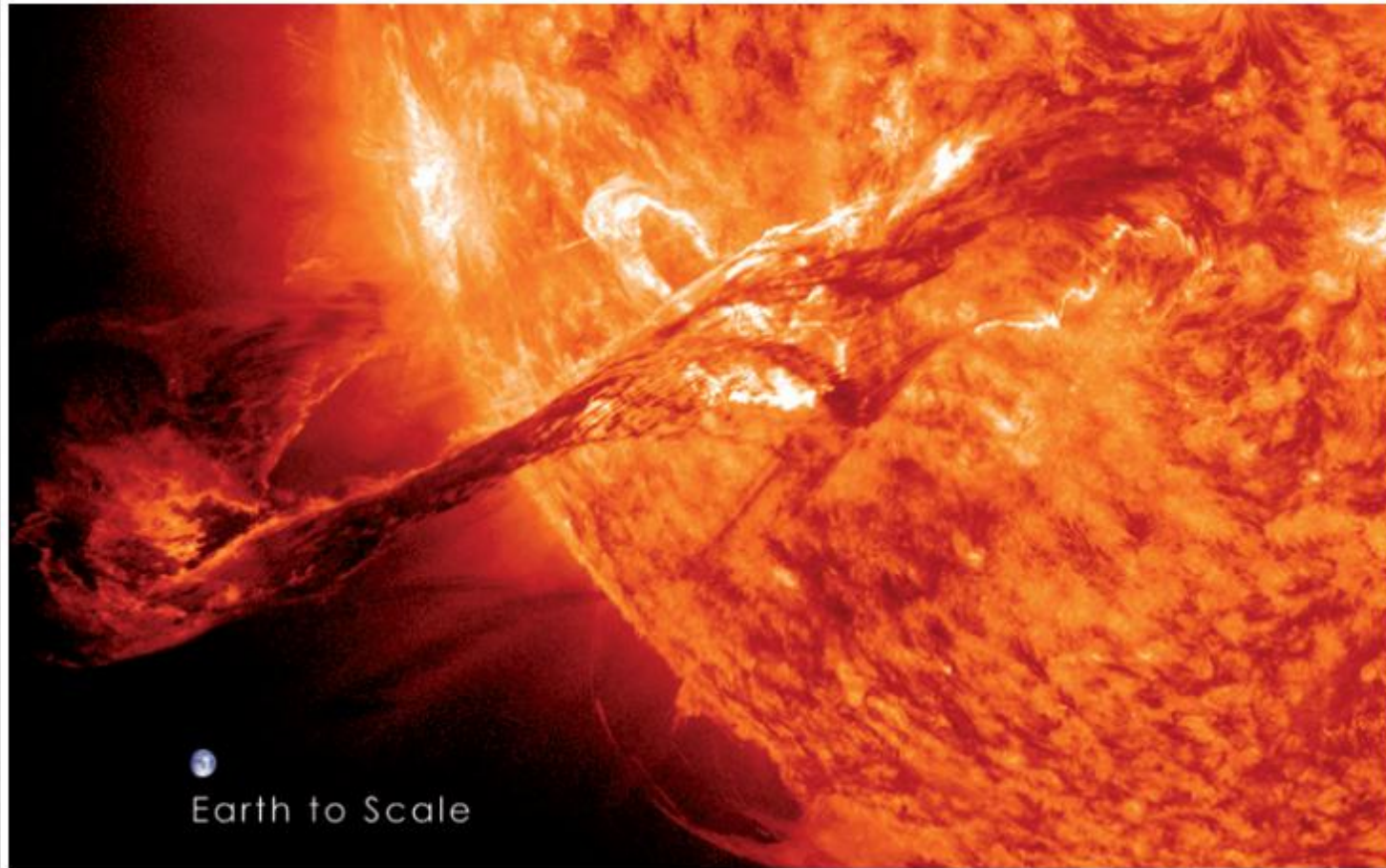
THIS IS THE SENTINEL INFRA-RED TELESCOPE TO PROVIDE 100 YR ASTEROID THREAT WARNING



SOLAR CORONAL MASS EJECTIONS COULD WIPE OUT OUR POWER GRIDS & VITAL SATELLITE INFRASTRUCTURE



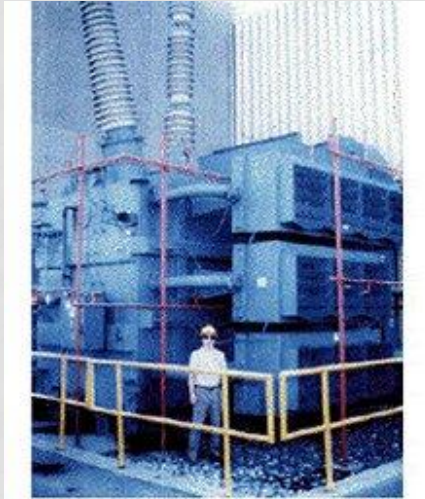
A 300,000 KM LONG FILAMENT ERUPTING FROM THE SUN



GLOBAL VULNERABILITIES TO COSMIC HAZARDS HAVE INCREASED EXPONENTIALLY

- In 1800 global population was 800 million—5% urban
- In 2014 global population is 7 billion-53% urban
- In 1800 majority of people worked in farming & mining.
- In 2014 majority of people work in service jobs in cities highly dependent on power, transport, GPS, etc.
- We are today much more vulnerable to modern infrastructure, IT, transportation systems, etc. that are key to city survival.
- A 30 meter asteroid, of which there may be a million that could hit Earth is equivalent to multiple Hiroshima bombs and for which we have no effective global response.
- A Coronal Mass Ejection could wipe out many of our satellites, and take down our power grids. The Quebec event of 1989 took out power from Chicago to Montreal. An EMP from such an event could take out the Internet, computers...

THIS SHOWS AN ELECTRICAL TRANSFORMER IN CHICAGO BEFORE AND AFTER THE SOLAR EVENT



PJM Public Service
Step Up Transformer

Severe internal damage caused by
the space storm of 13 March, 1989



A DAY WITHOUT SATELLITES

- **GPS failure alone could cripple banking (i.e. time stamping of transactions), airline travel (GPS assisted take off and landing, loss of Internet synchronization within 24 hours, etc.**
- **Loss of Meteorological satellites could create major disruptions and even loss of life in storm areas**
- **Loss of communications satellites could impact global television (Most cable tv fed by satellites), loss of credit card validation, half of world's countries connected to Internet via satellite.**
- **Defense satellites play many vital roles.**

THE POINT IS WE ARE NOT PREPARED

- Action Team 14 from Unispace is working on this issue under the auspices of the UN COPUOS
- United Nations General Assembly in 2013 voted to bring the International Asteroid Warning Network (IAWN) and the Space Mission Planning Advisory Group (SMPAG) into existence with regard to asteroid threats
- The Association of Space Explorers (ASE) created a Panel on Asteroid Threat Mitigation (PATM) whose mission is to find: “a politically acceptable, technically well grounded, and operationally effective means of coordinating a global response to an asteroid threat.”
- Others believe that only a model based on UN Peace-keeping with military and armament experts is only viable approach.

CASE OF EXTREME SOLAR EVENTS AS GLOBAL THREAT NEEDS ATTENTION

- The rising level of vulnerability is not widely recognized
- Space agencies do not have strategic mission of planetary defense identified as prime goal
- The risks of extreme solar event are not well understood and EMP and GIC vulnerabilities need to be better understood in terms of impact on critical satellites, electrical power grids, and even billions of computer processors that pervade every aspect of global society (vehicles, aircraft, computer servers, the Internet.)
- We have no backup systems for much of our modern infrastructure.
- 2012 CME event could have equaled Carrington Event

ACTION AGENDA

- **Efforts on Planetary Defense (involving asteroids, extreme solar weather, geomagnetosphere, orbital debris, etc.) need to be addresses synoptically and not piece-meal.**
- **The efforts of the International Astronomical Union (IAU), ASE, SWF, UN COPUOS/Action Team 14, IAWN, SMPAG, Minor Planet Center, solar observatories need to be more globally interconnected**
- **Efforts need to be strengthened in terms of : (a) Detecting & understanding potential cosmic threats; (b) Developing greater resilience to both asteroid and solar threats in terms of urban, infrastructure , and transportation planning; (c) Developing active mitigation and defensive strategies; (d) Creating a global response capability to recover from an asteroid strike or an extreme solar event.**

EXAMPLES OF TECHNICAL ACTIONS

- **More heavy duty circuit breakers in satellites and in critical infrastructure.**
- **Longer term decentralization of power supplies as more recyclable energy supplies are developed. Segregate District energy systems from the grid.**
- **Create Faraday Cages for critical infrastructure**
- **Backup systems to GPS/timing and space navigation satellite functionality with ground based facilities.**

EXAMPLES OF POSSIBLE INSTITUTIONAL ACTIONS

- Reverse over urbanization (now headed toward 70%)
- Create new type of UN peacekeeping unit geared to response to global disasters (whether conventional natural or cosmic hazard event),
- Move beyond initial International Asteroid Warning Network (IAWN) and Space Mission Planning Advisory Group (SMPAG) to more mature systems that are staffed and funded and closely integrated with the world's Space Agencies and global research efforts aimed at cosmic hazard mitigation and planetary defense.
- Closer collaboration between UN COPUOS and InterAgency Space mechanisms (i.e. revamped IADC to address all cosmic hazards) and integrate efforts to address asteroid/comet threats, extreme solar events, geomagnetosphere changes, and orbital debris issues.