DEFENCE

- ***Trends:*** Increasing dependence on sophisticated assets for communication, positioning, surveillance, attack detection, radar. Many space-based. Effects similar to civil but more critical.
- ***Parameters:*** Space particle fluxes, ionospheric total electron content, maximum usable frequency, scintillation indices.
- ***Long term variations:*** cosmic-ray modulation, trapped protons and electrons, ionospheric parameters.
- ***Short term variations:*** solar particle events, outer belt electrons (deep dielectric charging), geomagnetic tail energetic plasmas (surface charging), ionospheric disturbances.

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- ***Man-made variations:*** A space weather system can monitor man-made influences, whether hostile or benign,eg :
  - high altitude nuclear explosions can pump the radiation belts (eg Starfish in 1962 led to loss of spacecraft and confused belt modelling);
  - space reactor power sources produce background in gamma-ray astronomy;
  - VLF waves can precipitate electrons;
  - high power transmitters can modify the ionosphere.
- ***Economics:***
  - losses during conflict situations can be catastrophic;
  - an attack on the civilian infrastructure would have major influence on the world economy;
  - USAF have a major space weather programme which proved extremely important during operation Desert Storm;
  - USAF-sponsored analysis (Fennell et al., Aerospace Corporation) of 300 significant anomalies and 6 losses showed major importance of spacecraft charging and single event effects;
  - "…know the ground, know the weather; your victory will then be total."