

## 6<sup>th</sup> IAASS Conference

### Global Precipitation Measurement (GPM) Safety Inhibit Timeline Tool

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The Global Precipitation Measurement (GPM) Observatory is a joint mission under the partnership by National Aeronautics and Space Administration (NASA) and the Japan Aerospace Exploration Agency (JAXA), Japan. The NASA Goddard Space Flight Center (GSFC) has the lead management responsibility for NASA on GPM. The GPM program will measure precipitation on a global basis with sufficient quality, Earth coverage, and sampling to improve prediction of the Earth's climate, weather, and specific components of the global water cycle.

As part of the development process, NASA built the spacecraft (built in-house at GSFC) and provided one instrument (GPM Microwave Imager (GMI) developed by Ball Aerospace) JAXA provided the launch vehicle (H2-A by MHI) and provided one instrument (Dual-Frequency Precipitation Radar (DPR) developed by NTSpace). Each instrument developer provided a safety assessment which was incorporated into the NASA GPM Safety Hazard Assessment.

Inhibit design was reviewed for hazardous subsystems which included the High Gain Antenna System (HGAS) deployment, solar array deployment, transmitter turn on, propulsion system release, GMI deployment, and DPR radar turn on. The safety inhibits for these listed hazards are controlled by software. GPM developed a "pathfinder" approach for reviewing software that controls the electrical inhibits. This is one of the first GSFC in-house programs that extensively used software controls. The GPM safety team developed a methodology to document software safety as part of the standard hazard report. As part of this process a new tool "safety inhibit timeline" was created for management of inhibits and their controls during spacecraft buildup and testing during I&T at GSFC and at the Range in Japan. In addition to understanding inhibits and controls during I&T the tool allows the safety analyst to better communicate with others the changes in inhibit states with each phase of hardware and software testing. The tool was very useful for communicating compliance with safety requirements especially when working with a foreign partner.

Lessons learned from participating in the GPM phase 0/1 and the phase 2 safety reviews held at Tsukuba, Japan, JAXA facility will be discussed. The JAXA safety process and the challenges of ITAR will also be addressed.