Next-Generation Spaceborne Precipitation Radar (PR-2) Instrument and Technology

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Global rainfall is the primary distributor of latent heat through atmospheric circulation. The recently launched Tropical Rainfall Measuring Mission satellite is dedicated to advance our understanding of tropical precipitation patterns and their implications on global climate and its change. The Precipitation Radar (PR) aboard the satellite is the first radar ever flown in space and has provided exciting, new data on the 3-D rain structures for a variety of scientific uses. However, due to the limited mission lifetime and the dynamical nature of precipitation, the TRMM PR data acquired cannot address all the issues associated with precipitation, its related processes, and the long-term climate variability. It is desirable for future rainfall measuring missions, such as NASA's planned Global Precipitation Mission (GPM) to both enhance the performance of the TRMM PR and reduce its mass. To these ends, a system concept using a dual-frequency radar with a deployable 5-meter electronically-scanned membrane antenna and real-time digital signal processing has been developed. This new system, the Second Generation Precipitation Radar (PR-2), will offer greatly enhanced capability with a fraction of the mass of the current TRMM PR. The key PR-2 advanced features include:

- A 13.6/35 GHz dual frequency radar electronics that has Doppler and dual-polarization capabilities.
- A large but light weight, dual-frequency, wide-swath scanning, deployable antenna.
- Digital chirp generation and the corresponding on-board pulse compression scheme. This will allow a significant improvement on rain signal detection without using the traditional, high-peak-power transmitters and without sacrificing the range resolution.
- Radar electronics and algorithm to adaptively scan the antenna so that more time can be spent to observe rain rather than clear air.
- Built-in flexibility on the radar parameters and timing control such that the same radar can be used by different future rain missions. This will help to reduce the overall instrument development costs.

In this paper, the PR-2 instrument design and the associated technologies will be presented.