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## SATELLITE COMMUNICATION SYSTEM FOR DISASTER RESPONSE IN BHUTAN

**Abstract**

Bhutan is considered to be highly vulnerable to multiple hazards of geophysical as well as hydrological nature. It has been observed during disasters in the past that the existing communication systems, which are terrestrial systems, are destroyed physically or overloaded rendering them useless for communication. In some places, even the terrestrial communication system is non-existent. Without communication links in times of disasters, it paralyses official response for mobilization of relief efforts to the affected areas. This research aims to propose a low cost and reliable rudimentary communication system using small satellites in times of disasters to save lives and reduce damages to properties. The system design starts from top mission level requirements and constraints, down to the subsystem level requirements. Constraints are not exclusive to technical aspects but rather a whole aspect of the country's situation as well. The proposed satellite communication system consists of various elements: launch segment, orbit, mission payload and subsystems, operations on the ground and end users. The analysis shows that a proposed mission requirement can be achieved with as few as 3 satellites each on 2 orbital planes, forming a constellation, at Low Earth Orbit (LEO). The analysis also shows that an orbit inclination deviation of 15 will have not much impact on the mission requirements, leaving a leeway to choose piggybacking launch of satellites and reduction in propulsive requirements. The end users, responsible government officials and first responders, can use portable handheld radios in the field for communication. Besides the direct benefit of the proposed system has to Bhutan in responding to disasters, the system also has very high potential in collaborating with other countries, thereby, aiding in developing technical human resource capability of the country in space industry.