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INTEGRATED SMALLSATS AND UNMANNED VEHICLES FOR NETWORKING IN REMOTE
LOCATIONS

Abstract

The lack of infrastructures in maritime and Arctic regions has a strong impact on many operations, such as the retrieval of scientific data. Nowadays, data logged during these operations must either be collected by manned missions or transmitted over existing satellite links. Unfortunately, both methods face challenges regarding availability, as well energy and link budget constraints.

When considering the throughput of existing satellite links, the effective amount of data that can be transmitted is limited by the links' throughput, periodicity and economic cost. Consequently, it is a common practice to visit research sites in order to manually collect data recorded over extensive time periods, usually spanning from several months to years. However, manual collection of research data, in particular in harsh maritime environments, poses a risk to crews and also incurs significant costs.

In order to overcome current communication limitations, the use of small satellites and unmanned vehicles for remote and in-situ sensing has been proposed by several authors. This is motivated by the growing availability of small satellite platforms as well as by the foreseen increase in launch availability, enabling the creation of novel dedicated small satellite missions. Constellations or swarms of small satellites, such as CubeSats, can work together with other unmanned vehicles and play a key role in integrated communication systems.

Unmanned vehicles can act as relay nodes or as data-mules. The relay node can be used when a vehicle or small satellite is simultaneously in communication-range with research sites and supporting infrastructures, such as other relay nodes. Alternatively, data-mules may also cover regions outside the range of existing infrastructures and reach distant research sites where data is being gathered. In the area of destination, data-mules collect and store data, delivering in when returning to a supporting infrastructure.

In this paper, we propose an integrated network, consisting of a combination of dedicated small satellite systems and unmanned vehicles to help in scientific data retrieval in remote locations. The main contribution consists in addressing the communication challenges of heterogeneous unmanned platforms and how they can support different scenarios and experiments. The proposed approach is defined and described in a testbed suitable for a selected set of maritime scenarios.