5E2 Research Ethics Report

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My dissertation project focuses on the inter-communication of small satellites, namely CubeSats, in low earth orbit. Missions which launch multiple CubeSats may benefit greatly from their inter-communication. The project focuses on simulating communication protocols which may be used to form CubeSats networks (CSNs). The project does not deal with laboratory work or the collection of personal information. As such, this report focuses on a hypothetical research mission relating to a particular application of CSNs.

CSNs have numerous applications which raise ethical issues such as military communications, control of high-altitude drones and naval, land and aerospace vehicle tracking. This report focuses on an area which raises less obvious ethical issues, that of earth observation (EO). The chosen hypothetical CSN EO mission has two objectives: To implement a CSN capable of coordinated EO and the use of EO data to construct detailed three dimensional maps of observed locations.

CubeSats are well suited for small scale EO applications thanks largely to their low cost of development and launch [1]. Such low cost EO offers notable scientific opportunities, especially in the areas climate and environmental science [2]. CSNs are projected greatly increase the EO capability of CubeSat missions by introducing collaborative sensing [3]. Research which seeks to extend and enable CSN EO similar to that of the hypothetical mission, faces ethical issues relating to data sovereignty, data protection and espionage.

As EO techniques improve many significant space policy organizations, such as the UN Office for Outer Space Affairs (UNOOSA), have noted potential ethic and legal issues [4, 5]. Further specifying the details of the chosen hypothetical mission highlights such issues. For instance, consider an American mission, launched from the International Space Station, which uses a CSN to perform EO. During its polar orbit, the CSN collaboratively monitors Arctic and Antarctic ice formation. Their orbit also leads the CSN over London, Barcelona and Cape Town. At present there are few legal structures and effectively no preventative measures in place to restrict the CSN from collecting detailed information relating to these locations [6]. Presently it would be impossible for a third party in one of these locations to determine what, if any, data was being collected by the mission. This is a common issue with EO, when a mission observes an area in another sovereign nation the data is generally property of the nation originating the mission and not the nation, person or organization to which the land legally belongs.

Performing research in the area of CSN EO requires careful consideration of ethics and space law. Data collection and data analysis both contribute to ethical issues in this area. Whether the utility of low cost high fidelity EO mitigates the duty of the researcher to prevent the malicious use of their work is an open question. In order to address future ethical issues research may be conducted into insuring transparent EO operations and sensing in region of the electromagnetic spectrum which do not reveal sensitive information.

At present, it is clear that international space policy and law must advance in order to insure that EO can be performed without causing a rise in international tensions. It is likely that issues relating to data protection and sovereignty in other fields will inform the correct approach to the advancement of EO technology. This will be particularly important as academic, commercial and defence organizations advance towards larger and more capable EO using CSNs [7-9].

References

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