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Space System Engineering Process to design orbit for an electromagnetic detection payload

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The objective of this work is to present the Space System Engineering process to design orbit for an electromagnetic detection payload used at the LOM Project (FINEP/ITA/LabGE) - "Development of Payloads for Receiving Electromagnetic Signals for Satellites – Phase 1". The process starts with the definition of the needs of the users considering the goals and the objectives. Questions such as "What is the mass of the payload? The frequency range desirable for surveillance? Views of the ground stations? The data collection rate desirable?" are the key investigations the first time. Also, the relevant stakeholders must be identified and their main expectations must be considered.[1], [2] Once these questions have been solved, the second step is to investigate what similar space systems could be used as the reference architecture. This stage is relevant to investigate whether the operational architecture of the current space system, adapted to the parameters identified at the beginning of the process with the stakeholders, can be applied to this new mission. The third step involves designing scenarios with language and graphics models to identify with the stakeholders if the new space system can provide the expected capabilities. The experience acquired at the LOM Project shows that an electromagnetic detection payload with a mass of less than 250 kg must applied on LEO orbit. This requirement avoids lost weak signals from transmitters located at the surface. The second requirement involves temporal resolution. In this case, the polar orbit can be more useful, unless it is desirable to monitor specific areas around the Equator, where an inclined orbit could be more interesting. The third requirement considers that signals that arrive at the front end of the payload receptor must have a minimum level of information capable of being processed and stored with the characteristics necessary for identification. This implies low orbits customized to the type of emitters that one wishes to survey.

References

[1] J. R. Wertz, et al., "Space Mission Engineering - The New SMAD.", 2011.
[2] W. J. Larson, et al., "Applied Space Systems Engineering", 2009.

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