Mentor's Statement

On *FAROS*: Simulation and Analysis of Satellite Communication Networks

Dr Nick Koukoufilippas
Research Mentor, Horizon Academic Research Program
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I had the pleasure of mentoring Athanasia Nikolova through the Horizon Academic Research Program, supervising the design, implementation, and writing of *FAROS* over fifteen sessions. The brief was a demanding one: to take a sprawling vision of space communications and turn it into a single, testable piece of computational research.

How we worked. I provided scaffold notebooks rather than finished code, deliberately leaving gaps for Nasia to fill: coordinate transformations, orbital geometry, the inter-satellite link graph, the routing, and the visualisations. She completed them quickly and well, and more than once returned with extensions I had not suggested. Our sessions were a steady exchange between her ideas and the discipline needed to test them, and the responsibility for the work was always hers.

What I found most interesting. Nasia's first instinct, faced with almost any problem, was to ask "Can we make this bigger?" The early versions of *FAROS* reached for Moon and Mars links, optical and quantum communication, and fully autonomous interplanetary networks. The most valuable work we did together was not adding to that list but subtracting from it: narrowing a vast ambition into a focused study of how constellation design affects latency, hop count, and link quality. What I will remember is the moment the abstraction became concrete, when a sketch of "backbones in orbit" turned into a working three-dimensional constellation routing data along a shortest path computed with Dijkstra's algorithm. Holding both the grand picture and the working implementation in mind at once, at fifteen, is rare.

Why the research matters. *FAROS* sits on a genuinely live question. As low-Earth orbit fills with mega-constellations, how to route traffic and manage latency across many satellites, and whether higher relay layers help, is an active engineering problem. Nasia's simulation does not settle it, and was never meant to. Its value is twofold. It integrates orbital mechanics, link-budget physics, and graph routing into one coherent working system, well beyond what is usually attempted at her level; and it gave her the full arc of research, from question to code to figures to revision. The more visionary elements of her thinking remain speculative and rightly belong to future work, but the instinct behind them, that infrastructure questions in space are worth taking seriously now, is sound.

Potential. Considerable. Nasia combines fluent programming, real mathematical appetite, and an unusual willingness to revise her work until it is right. Her growth in scientific writing and in scoping a problem over these months has been substantial. With continued development of rigour and precision, she has a clear path towards serious work in aerospace engineering, space systems, or applied physics. *FAROS* is, in her own words, only the beginning, and a strong one.