UKLSL INTERNSHIP

Breadboarding of Innovative Space Surveillance and Tracking Concept

Work Breakdown

The internship was split up into five different work packages, comprising of tasks ranging from market research and project planning to mechanical and simulation analysis of a given product

Work Package 1: Market Research

The first work package consisted of a some prior reading acompanied with a slide deck which was presented detailing what was learnt about the BEAP project's previous market analysis and where the product would fit in the current market. The main objective was to figure out if BEAP would be successfull in the current market.

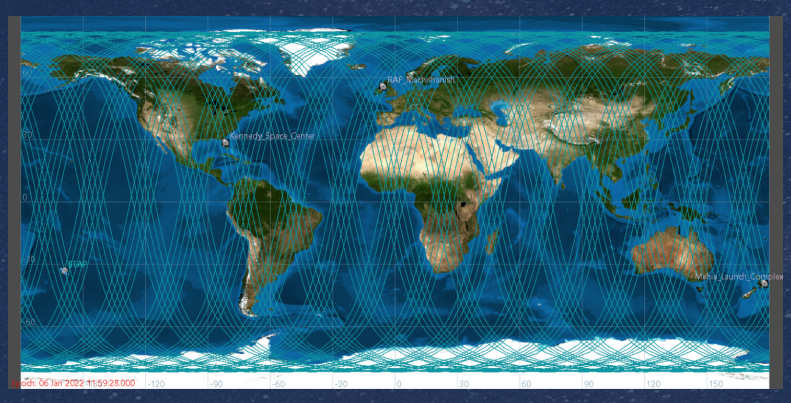
This was a great experience as I had no experience in such a specific marketing campaign and this was a valuable learning experience.

Work Package 2: Project Status Review

This work package was primarily a review of the previous work on the BEAP project. This review was carried out in particular looking into the mechanical aspects of the BEAP module which included considerations such as the structure of the module, ground station contact time, solar contact time etc. The findings were presented with a slide deck along with the first work package.

Work Package 3: Mission Simulation

Using GMAT, orbital simulations were carried out to determine the contact time between ground stations and a satellite at various orbital inclinations and altitudes to determine the usability of each ground station. This gave the line of sight contact time which was then narrowed down to a more accurate answer by taking into account the tumble rate of a launch vehicle's upper stage in orbit and calculating the visibility of the ground station using a MATLAB script. A similar process was undertaken to calculate the solar contact time and generate a power graph.



Work Package 4: Mechanical Analysis

Firstly, the environmental boundary conditions were set as requirements for the rest of the work in this work package. This led onto a material selection which resulted in Al. 7076 alloy to be chosen for the structure of the BEAP module. Once this was set, mass and volume budgets were made to inform the rest of the design moving foreward by taking into account the component selection for the current version of BEAP and the original BEAP requirements. Once the components were chosen, a CAD model was made on Solidworks which was then used for a random vibration analysis to determine if the structure would withstand the vibrations suffered during launch.

Material Requirement	Associated Material Property	Scaled Property			Weighting Factor	Weighting Scaled Property		
		Al. 7075	Al. 6082	Kevlar	Tot.	Split	Al. 7076	Al. 6068	Kevlar
Maintain Shape	Yield Strength	8.5	6.2	N/A	0.25	0.25	2.13	1.55	N/A
High Structural Integrity	Young's Modulus	7.3	7.5	9.5	0.25	0.1	0.73	0.75	0.95
	Tensile Strength	7.5	5	10		0.155	1.16	0.78	1.55
Lightweight	Density	7	8.2	9.4	0.1	0.1	0.7	0.82	0.94
Resistant to Thermal Cycling Deformation	Thermal Expansion Coefficient	8.5	8.4	N/A	0.1	0.1	0.85	0.84	N/A
Operate in Orbital Temperatures	Maximum Service Temperature	10	8.2	9.8	0.15	0.075	0.75	0.63	0.74
	Minimum Service Temperature	8.5	8.5	10		0.075	0.64	0.64	0.75
Economical	Cost per kg	9.8	10	3	0.05	0.05	0.49	0.5	0.15
Environmental Degradation	UV Radiation Resistance	10	10	3	0.1	0.1	1	1	0.3
						Total Score	8.45	7.50	5.38

Work Package 5: Test Plan

The test plan was structured to be completed towards the end of the internship as it was more important to complete work packages 3 and 4 before it. Because of the duration of the internship, this was not completely finished. However, this package required a detailed description of all the tests required before BEAP could get space heritage. To do this, an Excel spreadsheet was made in which each of the tests was detailed out explaining the test, facilities necessary, test outcomes etc. This makes it easy to keep track of the testing campaign and makes sure all the key requirements from both UKLSL and the launch provider are met.

Extra Work

UHF Patch Antenna

When looking into the communications required for the BEAP module, UHF band was one of the commonly used bands for similar applications. However, the structural requirements make it so a whip antenna cannot be used and as such a patch UHF antenna would be ideal for BEAP.

Risk Management Plan

The risk management plan is very important when it comes to space missions especially when sharing a launch provider as is the case with BEAP. Each potential risk must be mittigated and minimised before launch, to keep track of these risks, an Excel sheet was made.

Final Thoughts

I have learnt a lot during this internship, fromproject management to mission definition and analysis. My internship at UK Launch Services Ltd. has given me some real experience working in a professional environment and I am thankful for the oportunity. I learned a lot of new skills during the internship and a lot of knowledge I will carry forward.