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WhiteKnightTwo and SpaceShipTwo: A Comparison of Aircraft & Reusable Spacecraft Maintenance Regulations and Procedures

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Abstract

As many show their passion and many more continue to pursue their dreams in aviation. Simultaneously, the space industry shows limitless possibilities as increasing numbers of adventurists pursue personal interests. However, there is a gap in knowledge about regulations and maintenance practices that shepherds the fast-growing and innovative space industry. While more people may be familiar with aviation regulations, little is known about the regulations and maintenance requirements that govern reusable commercial spacecraft, particularly those that involve ferrying space tourists.

Research Questions

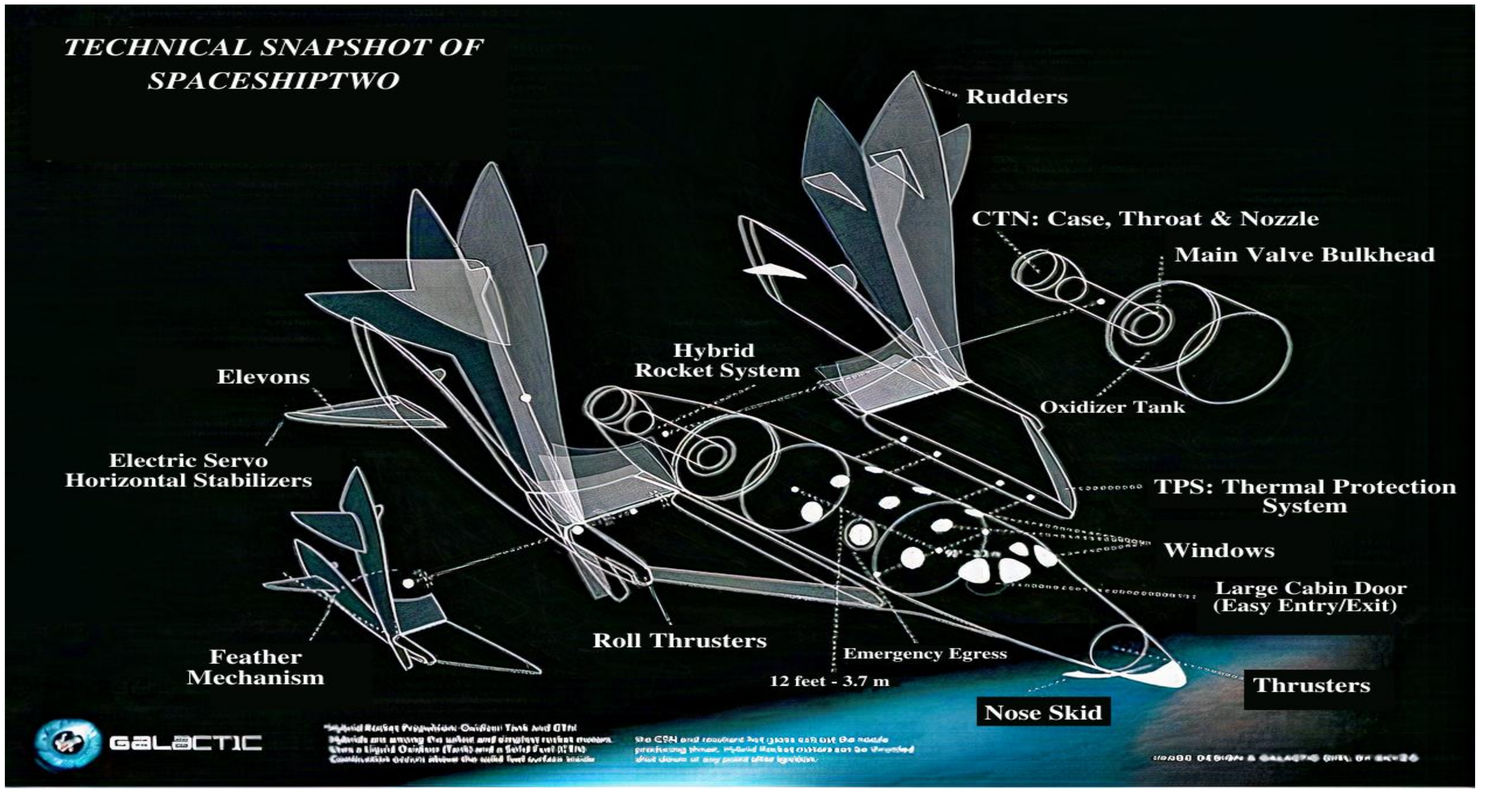
- What are the similarities & differences between aviation & space maintenance requirements?
- How do maintenance standards and federal regulations affect safety & advancement of space travel?
- What new regulations and guidelines are in place to ensure safety in space travel?
- What role does the Federal Aviation Administration (FAA) play in commercial aviation as compared to commercial space operations?

Research Method

- Using published Codes of Federal Regulations (CFR) pertaining to both aircrafts and spacecrafts to draw comparisons.
- Interviewing subject matter experts to obtain accurate and up to date information on current practices in the aviation & space industry.
- Drawing comparisons using information attained from credible sources.

Regulations

- 14 Code of Federal Regulation (CFR) Part 400 - Aeronautics & Space.
- 14 CFR Part 91 - General Operations & Flight Rules.
- 14 CFR Part 25 - Airworthiness standard: Transport Category Airplanes.
- 14 CFR Part 121 - Operations requirement for domestic, flag & supplemental operations.
- 14 CFR Part 43 - Maintenance, Preventive Maintenance, Rebuilding, & Alteration.



General Aviation & Commercial Aircrafts	WhiteKnightTwo	SpaceShipTwo
Aircrafts undergo several certification requirements before they are put to service. (Type, Production and Airworthiness certification)	Experimental aircrafts are not subjected to the same rigorous and extensive testing requirements like non-experimental aircrafts.	Has a dynamic inspection criteria & more rigorous flight tests and qualification process.
Maintenance & Inspection procedures are developed by the manufacturer. An operator may develop a customized progressive inspection plan and put into use upon approval.	Virgin Galactic (Manufacturer and Operator) develops its maintenance & inspection plans.	Virgin Galactic (Manufacturer and Operator) develops its maintenance & inspection plans.
Customized progressive inspection plans do not require yearly re-certification.	Maintenance & Inspection plan is re-certified yearly, by FAA safety inspectors.	Maintenance & Inspection plan is re-certified yearly, by FAA safety inspectors.
Aircrafts are required to undergo an annual inspection every year. Additional inspection requirements if used for hire or compensation (100-hr inspections)	Experimental aircrafts are also subjected to annual inspections, which is phased out into smaller inspections. (Pre-flight & post-flight inspections)	Engineering team develops engineering requests (ER) containing maintenance instructions which are carried out by A&P technicians..
Certain components require an inspection or a replacement at certain flight cycles or time intervals as mandated by the manufacturer. (Inspection for continued airworthiness)	Has flight cycle inspections: Engine undergoes maintenance & inspections after 10 and 30 flight cycles.	Life limited parts on the propulsion system (RocketMotorTwo) are replaced at certain flight cycles. (CTN – R&R after every flight) (Main Oxidizer Tank – R&R after 40 flight cycles)
Pilots note discrepancies on aircraft log-books.	Event-triggered Inspections are conducted upon any off-nominal.	Event-triggered Inspections are conducted upon any off-nominal
FAA oversight is performed at almost levels of an aircraft operator. Annual reports are not required.	FAA Oversight & Audits is performed at the leadership level. Annual reports are required.	FAA Oversight & Audits is performed at leadership level. Annual reports are required.

Limitations

- Confidentiality and protection of proprietary information. Nondisclosure agreements (NDA) hinder subject matter experts from sharing information regarding the reusable launch vehicles.
- Variance between aerospace regulations and aviation regulations.
- Lack of previous research in the research area.

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