PLAYBOOK FOR THE FAA CERTIFICATION JOURNEY

2024

Message From Our Crew
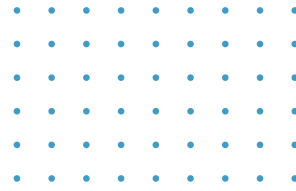
Let's Navigate Success, Together!

Certification can be arduous. We have enjoyed helping innovators and mature companies alike, navigate the Certification journey on the way to bringing state of the art and safe products to market. This guide will explain how we can help you do the same.

Understanding the Certification Journey

Let's start with the FAA Certification journey... there are a number of steps, from Working Prototype to Certified Product. Collinear Group has helped new innovators as well as established aerospace companies in each major phase of their journey. In this playbook, we will cover the major phases of the certification process and explain the defining traits of each phase, what challenges you might face along the way, and how we can help you get to the next phase.

At first glance, embarking on the multitude of steps along the FAA certification journey to bring new solutions and products to market may seem daunting or overwhelming. It may even give the impression of hindering innovation rather than fostering it. This roadmap is designed to change that narrative: FAA goals and regulations provide a safety net for innovators by regulating commercialization, not innovation.
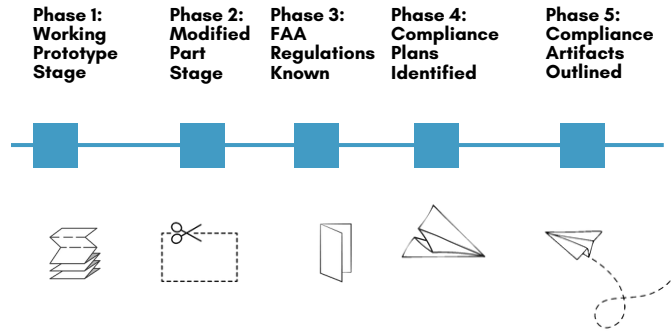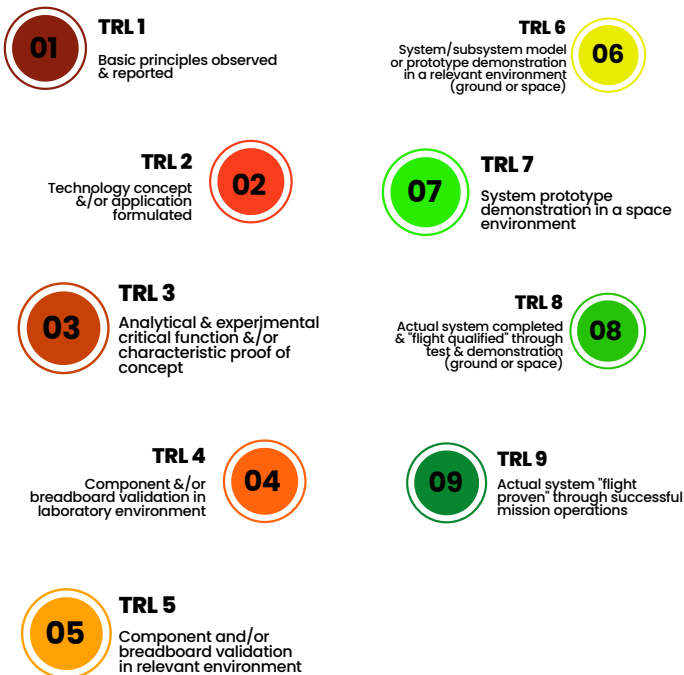
Navigating The Journey

A certified air vehicle achieves these three elements.

1) The Design is Type Certified; which means it meets all the FAA safety requirements.

2) The manufacturer of the air vehicle is authorized to produce the design that is Type Certified.

3) The operator is approved to operate the design that is Type Certified and produced by an authorized manufacturer.

Let us introduce you to our roadmap for Design Type Certification.

Phase 1: Working Prototype Stage

Phase 2: Modified Part Stage

Phase 3: FAA Regulations Known

Phase 4: Compliance Plans Identified

Phase 5: Compliance Artifacts Outlined

What are the Technology Readiness Levels (TRL) ?

01 **TRL 1**
Basic principles observed & reported

02 **TRL 2**
Technology concept &/or application formulated

03 **TRL 3**
Analytical & experimental critical function &/or characteristic proof of concept

04 **TRL 4**
Component &/or breadboard validation in laboratory environment

05 **TRL 5**
Component and/or breadboard validation in relevant environment

TRL 6 **06**
System/subsystem model or prototype demonstration in a relevant environment (ground or space)

07 **TRL 7**
System prototype demonstration in a space environment

TRL 8 **08**
Actual system completed & "flight qualified" through test & demonstration (ground or space)

09 **TRL 9**
Actual system "flight proven" through successful mission operations

TRL is a scale that was developed by NASA in the 1970s and has since evolved to determine the amount of resources that will be necessary to bring a technology to life.

The TRL measurement system is used to identify the types of projects that can progress from invention to commercialization and ultimately to wide-scale application.

A TRL rating determines how far a particular technology is from being deployed by an industry for commercial use.

01. Working Prototype

What this phase looks like:
- You are starting to approach established companies that may buy your product
- You are starting to approach investors for funding to start manufacturing plans

Challenges in this phase:
- You should have already been designing your product with Certification in mind; but probably haven't
- A prototype is not just a product missing FAA approval. Very often prototypes have to undergo design changes, sometimes significant, to meet Certification regulations.
- You don't know how to answer investor questions about Certification. How long will it take and what will it cost?

How can Collinear help:
- What you really need to do is speak with someone that is knowledgeable on your component or system about the different paths to certification. If you are developing an innovative vehicle you probably have access to a number of certification experts, but maybe you need special expertise in the area of fuels, or propulsion or batteries or avionics. Collinear can provide a high level assessment that will give you insights on:

- Likely FAA Test and Evaluation processes; 14 CFR Part 21/23/25/27/29 | SAE ARP 4754 | SAE ARP 4761 | DO-160G/178C/254
- Certification milestones and timing
- Risks impacting Cost and schedule
- Mitigation strategies
- Recommendation of Subject Matter experts that can help with mitigation strategies

- With this Certification assessment you can make better plans, speak more confidently to investors, answer questions on Certification and look at different strategies down the road.

Equal to TRL Level 5

05

TRL 5
Component and/or breadboard validation in relevant environment

02. Near Production Part Stage

You have a Production part and you may or may not have a notional idea about how to Certify it. Either way, you need a Plan agree to by the FAA for Type Certification.

What this phase looks like:
- Best case scenario, you have perfected your prototype and you are ready to make modifications based on how your product complies with the FAA regulations, so you need to identify the regulations.
- Worst case scenario, you have stable finished drawings with plans to make your product by the 1000's. And you are ready to identify each and every FAA Design regulation you must show compliance to.

Challenges in this phase:
- Let's talk Worst Case Scenario first. Why is having something ready to produce a bad thing? If you have not designed your product fully cognizant of all the applicable FAA regulations then you will probably need to change your design. Even for small modifications of previously certified parts, changes are frequently required. The use case might change, the regulations change over time and the FAA is the final arbiter of what is safe enough.
- So by comparison planning to adapt the design to meet FAA regulations better positions you for accurate planning and resourcing.
- In either case, a comprehensive list of all the applicable regulations must be agreed to with the FAA.

How can Collinear help:
- We can help you collect, assess, and document the applicable FAA regulations.

- Further, with our in house experts and partnerships with FAA designated representatives we can preview your position on the regulations before you seek FAA agreement, saving you time and money in early evaluation. Collinear can also use our Certification experience to look to similar products, components or systems that have already been FAA certified as precedence for your product.

Equal to TRL Level 7

07

TRL 7

System prototype demonstration in a space environment

03. FAA Regulations Known

In this phase you have all the FAA regulations identified, now you have to figure out how you are going to show compliance to those regulations. As the applicant you 'show' compliance to the FAA and the FAA "finds" compliance.

What this phase looks like:
- You know your product needs to 'show' how to be designed to perform its intended function, but you don't know if you do that by test, and if so, what kind of test, by analysis or by similarity.
- Maybe you might have well informed ideas about how you are going to show compliance, but you don't have an agreement with the FAA on your proposals, or they disagree on how you plan to show compliance.
- Maybe you have some agreements with the FAA on how to show compliance, but you can't reach agreement with them on some very important regulations

Challenges in this phase:
- Did you know that a single part will require several FAA specialists to approve all the regulations for even a simple product? Something as easy as a valve requires a system specialist and structural specialist a materials specialist and maybe even a software specialist depending on the design.
- This step can be overwhelming. If you have a complex product that has a number of systems, how do you divide and conquer the pieces, components and systems for each of the regulations.
- If you have software, is software its own system or is it divided up by the components it interfaces with?
- Even if you have a simple product, how do you know how it works with the air vehicle and what the relationships are?

How can Collinear help:
- We have been part of large and small Type Certificate projects, from modifications to parts, to modifications to the air vehicle called a Supplemental Type Certificate or STC. We have navigated the divide and conquer questions of how to identify all the different parts, the different regulations, all the elements of showing compliance and all the specialists that need to approve those Methods of Compliance. Can you say mega-matrix?

Equal to TRL Level 8

TRL 8

Actual system completed & "flight qualified" through test & demonstration (ground or space)

08

04.

Compliance Plans Identified

What this phase looks like:
- In this phase you have all your Compliance plans agreed to with the FAA, by component, system, technical specialty and regulation and Method of Compliance test, analysis, similarity. Now you have to create the detailed Compliance Artifacts that will capture your 'showing' evidence'

Challenges in this phase:
- Just knowing you have to test your product for say decompression at high altitude, isn't enough. What is the maximum altitude, how quickly must the decompression occur, how do you prove to the FAA you did the test correctly.
- How do you prove to the FAA the part you are testing is the part you intend to produce?
- Where do you conduct the tests? Compliance tests must be conducted at FAA recognized and approved test houses.

How can Collinear help:
- We have authored, reviewed and received approval for 1000's of Artifacts; a document containing the elements of evidence showing compliance per the compliance plan.
- Not only can we help you with the Artifacts themselves but we can create templates for you to replicate best practices and approval as you build expertise within your own organization.

Equal to TRL Level 8

TRL 8

Actual system completed & "flight qualified" through test & demonstration (ground or space)

08

05. Compliance Artifacts Outlined

The documents that show compliance are shaping up. And you are getting close to starting your tests.

What this phase looks like:
- In this phase you have all your drawings done and approved, you have part Acceptance Test Procedures or ATPs, Compliance tests defined in Qualification Test Plans or QTPs, your test part conformity has been written, your test setup conformity has been written.

Challenges in this phase:
- You don't have enough test engineers for all the tests you need to conduct. You don't have enough Designated Engineering Representatives or FAA delegates. You need people that know how to complete and document the SSAs, the test results, document test failures and discrepancies; basically how to write Qual Test Reports QTRs or QSARs, Qualification by Similarity and Analysis Report.

How can Collinear help:
- We have experienced test engineers, who have worked with many of the best testing houses to efficiently conduct and execute your tests. We know how to write QTRs and QSARS. We know how to dissect test failures to figure out if you have to retest, partially retest or perhaps not retest at all. We can create documents that consistently pass muster with the FAA and can be used as templates for your team and organization to use.

Equal to TRL Level 9

09

TRL 9

Actual system "flight proven" through successful mission operations

Factoids

How many?

The average component certification plan can have anywhere between 100 to 1000 artifacts (documents) that must be presented on drawings, QTPs, RFCs, ATPs, QTRs

Did you know?

1000

There are currently 1000 certification officers working for the FAA.

Fun Facts

- The average Certification plan takes 6 months to 12 months to approve, or revise through the FAA.

- A single FAA regulation like 25.1301a can require up to 32 tests to be conducted for compliance.

- An FAA rejected artifact can take weeks or even months to be re-reviewed by the FAA.

- There are no FAA designated representatives that cover all systems. Many cover multiple systems, also called delegations, but most innovative products cross several disciplines.

More Information
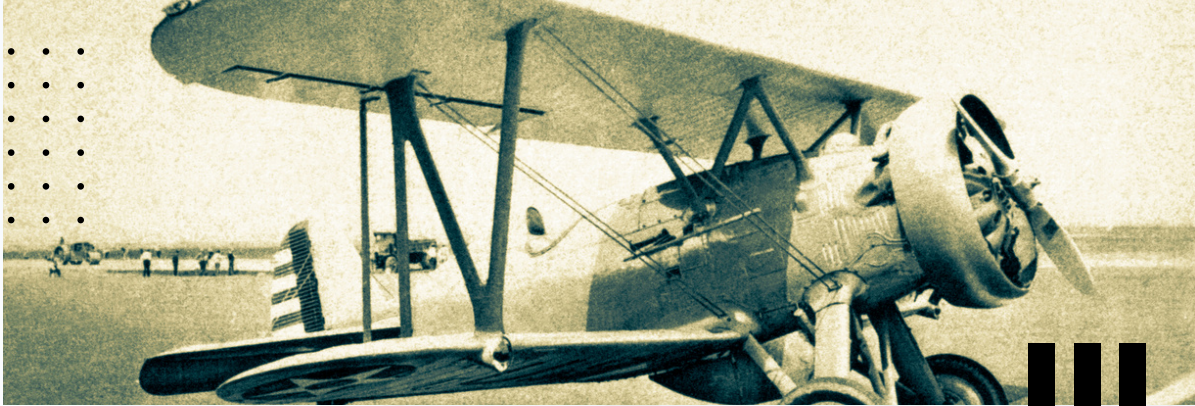
Empowering Innovation in a Complex Age

Aerospace is under highly intensified public safety and regulatory standards as a result of recent global incidents. It comes at a time of soaring innovation in commercial space, advanced air mobility, sustainability, digital infrastructure investments and growing Go To Market pressures all of which have created an unprecedented regulatory knowledge and experience gap across the industry. Collinear Group recognizes that organizations can become siloed over time. We know how to integrate and act as a catalyst, ensuring a fully cohesive approach to any problem, bridging the gaps. www.collineargroup.com

Founded in 2012, Starburst Aerospace is an innovation catalyst in the global Aerospace and Defense (A&D) industry. Combining three complementary activities—startup accelerators, strategy consulting, & ventures—they help stakeholders innovate, navigate and invest in the dynamic ecosystem. With offices in Los Angeles, Paris, Munich, Singapore, Seoul, Tel Aviv, Madrid, and Washington, D.C., the team has built a robust community with 60+ partners and a portfolio of 140+ startups while identifying all sources of innovation that will impact the aerospace value chain. Starburst's leading Flagship Accelerator program helps startups scale their business in aviation, space, and defense with access to one of the largest groups of corporate representatives, government stakeholders, and private venture investors in the world. More information about Starburst can be found at www.starburst.aero.

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