PEAK OF FLIGHT NEWSLETTER

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7 Common Mistakes People Make When Attempting A Level 1 Certification

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APOGEE COMPONENTS

PEAK OF FLIGHT

7 Common Mistakes People Make When Attempting A Level 1 Certification

By Tim Van Milligan

I would wager that we here at Apogee have helped more people to achieve their high-power certifications than anyone else in America. Because of the sheer number of people that come to us, I would also wager that we've been involved in more of the certification attempts that go bad for rocketeers. It isn't something we brag about because that really means that we've failed them too. We didn't give them the necessary guidance that they may have needed to become successful.

In this article, I'll give you my opinions on what are the seven most common mistakes people make when attempting a Level 1 or Level 2 certification flights. Hopefully it will help reduce the number of failed certification flights in the future.

Figure 1: Experienced rocketeers take their time prepping their high powered rocket for flight.

Mistake #1 - Lack of a Safety Mindset

In reality, all the failed certification attempts come down to this mistake. It is a mindset, not a process.

What we see here at Apogee is that most people think that the purpose of the Level 1 High Power Certification is to obtain a license to buy larger rocket motors. Yes, that is somewhat true. But the reality is that the NAR and Tripoli set up the certification process as a "course in rocketry safety."

If all you think high-power certification is for is to buy motors, you've missed the point.

We (and I'm talking for Apogee Components and I'll speak for the NAR and Tripoli too) want you to get your certification so that you can fly bigger rockets. We all think you'll have a lot more fun. But because of the legal/litigious situation we are in, we want you to do it safely. If one person does something stupid, the government could step in and regulate us out of business. JUST ONE PERSON. That's all it takes — just one stupid person!

I remember a couple of visits over the twenty-something years I've been in business when the FBI and the BATFE have both come knocking on my door to ask me if I knew about "such-and-such" incident. I don't like those conversations, because it shows how close we are to having Congress step in and put on more regulations. It is like what is currently going on with the RC drone industry. We don't want that in our industry. We have enough regulations already.

The certification process is primarily concerned with your knowledge of rocketry safety. Period!

Once you grasp that, most of the other common mistakes people make go away.

Mistake #2 - Lack of Experience

How do you learn about safety? Do you read about it in a book or a newsletter article? If that is the case, you're setting yourself up for a higher risk of failure.

I fully believe that business proverb that goes: "The person with the experience is never at a disadvantage against the person with head-knowledge."

What this means is that the person that has launched over 100 low power rockets is going

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You can subscribe to receive this e-zine FREE at the Apogee Components website **www.ApogeeComponents.com**, or by clicking the link here Newsletter Sign-Up

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to have insights that a person who justs reads "how to do it" our web site will never have. As great as the Apogee website is at providing information, you have actually go out and build and fly a lot of rockets to know "the why."

"The why" is the reason to do something. For example, when the instructions for the rocket kit say to "let the glue dry before proceeding", there is a reason behind it. I'm thinking of the Advanced Construction Video (https://www.apogeerockets.com/Advanced_Construction_videos/Rocketry_Video_229) where I decided to skip that particular step in order to make the video go faster. "The why" was that if glue is wet, then it acts as a lubricant and parts can slip and move out of position when you attempt the next step. And that is exactly what happened in the video. It took longer to fix the mistake than it would have if I had just allowed the glue to dry.

Figure 2: Failure occurs when you rush. As this video shows, knowing "why" steps are necessary prevents errors..

One reason why I make the Advanced Construction Videos (https://www.apogeerockets.com/Advanced_Construction_Videos/all) is because there are techniques that I've learned by experience that will help you make better rockets. For example, it isn't the type of glue that is the most important thing when gluing on fins. What is more important is how you apply the glue - that is a "technique". You don't pick up that up in written kit instructions - you learn it from experience.

Unfortunately, without significant rocketry experience, we don't know the reason processes are written down. Therefore when time is short and a decision has to be made, we ignore the written processes and make our own shortcuts. But we don't know from past experience that the shortcut you're making is going to cause a failure.

Because of this I'm always concerned when a modeler contacts me and says he just got started in rocketry in the last few months, and now wants to know how to go about getting his L1 certification. The reason for my concern is that I know he doesn't have a lot of experience and therefore his risk of failure is significantly higher. I really hate those conversations where I feel obligated to try to nudge them to step back and slow down the process. They don't want to hear that it takes launching a hundred rockets to get to the point where you know where shortcuts can be made.

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Mistake #3 - Doing Things on the Cheap

High power rocketry is more expensive then small rockets. That goes without explanation. So I understand the need to minimize the price of your hobby. I am the same way. But there is a point where you are trying to squeeze so much money out of a rocket flight that it significantly increases the risk of failure.

One of the most common things that people do to save money on a high power flight is to use a smaller rocket kit. We are asked all the time "what is the cheapest rocket that I can get that will fly an H motor?"

The answer to that, of course, is the "smallest" rocket. Why? Because the price of the rocket is proportional to it size. Small rockets are less costly as a bigger one.

However, using a small rocket introduces a lot of risk to the certification process. A smaller inexpensive rocket is usually less strong and less durable compared to a bigger one. And the modeler usually doesn't have the experience to know what things can be done to make the rocket strong enough to handle a high power rocket motor.

Figure 3: Success comes from a focus on safety.

Yes… People have taken a small rocket and strengthened it to the point where it is capable of flying successfully on a H size motor. But those people have a lot of experience and they know how to beef it up, and where to concentrate their efforts.

The next question from the person that is looking for a cheap rocket is "how do I beef it up and make it stronger?"

That is a great question. But at this point we've already told them that we don't really recommend that particular small rocket for certification. So what do you think is going to happen?

From my perspective, they have already ignored my advice to get a different rocket. So what is going through my head is this question: "what makes you think they'll NOW start listening to your advice on making it stronger?" You're right… they're going to take more shortcuts in the future.

Apogee will answer their question, of course. That is what we do here at Apogee. We'll point them to various articles in our previous newsletters and our videos on how to improve their rockets. We do want to see them succeed. But we're not surprised when they tell us that they are making a second attempt at their L1 certification because they failed on the first try. Small rockets carry a higher risk in high

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power rocketry unless you have a lot of experience and you know what you're doing.

Mistake #4 - Making Things Too Complicated

This is not related to cost, but you can make a flight overly complex.

The most common thing we see in this area is when a customer wants to add dual deployment to their Level 1 Certification attempt.

We don't even have to ask the question about their experience level, because we already know the answer.

If the customer wants to add dual deployment, we know that they've never done dual deployment before.

The advantage of dual deployment is that the rocket comes down closer to the pad so you won't have to walk as far to retrieve it. I'm all for that. And since it is closer to the pad, it minimizes the chances that the rocket will get lost. You don't get certified if you can't bring the rocket back, right? So I'm for that too.

Despite the cool advantages, dual deployment is very complex, because you have to add more components to the rocket to allow for the ejection of a second parachute. For starters, you have to add an electronics bay (called the E-bay "**Figure 4**"), plus all the wiring and extra ejection charges. Just learning how a particular dual deployment altimeter works requires a lot of extra study and experimentation.

Whenever you add complexity to a rocket, you increase the risk that things can go wrong. This article is about minimizing the risk so that you maximize your chances of success. Therefore, it is our recommendation that you don't add dual deployment to either your L1 or L2 certification attempt even though it does have great advantages.

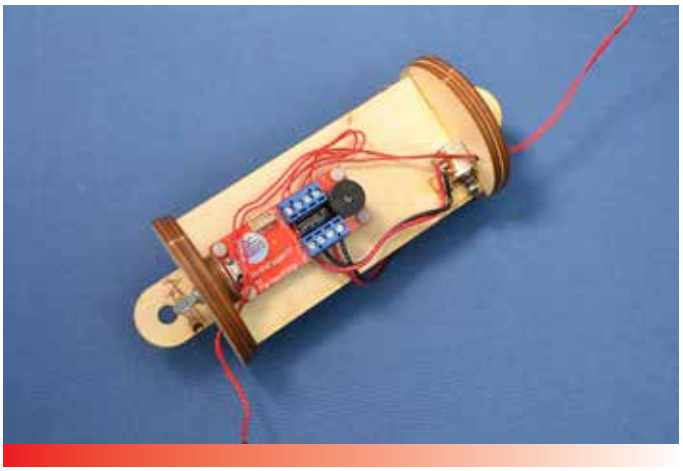

Figure 4: Adding electronics increases the complexity of the flight.

Furthermore, you might also consider leaving the Chute Release (https://www.apogeerockets.com/Electronics-Payloads/Dual-Deployment/Chute-Release) on the ground too. While it is a very cool device for mimicking the dual deployment process, there is the extra step of attaching it to the rocket around the parachute. While it seems simplistic, I can tell you that there is a chance of fouling the parachute in the flight. That happened recently on an L1 flight attempt that I was the witness for at a recent launch.

For one flight, you can walk a little bit further, can't you?

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I'd also say to even avoid using reloadable motors and use the Disposable Motors System (https://www.apogeerockets.com/Rocket_Motors/AeroTech_Motors/38mm_Motors_Single_Use). With a reload motor, you still have to go through the assembly of the motor, and while it isn't too hard, it adds more steps to the preparation of the rocket (**Figure 5**). Simplify, simplify, simplify. There will be plenty of time to do more complex things later. You don't need to do them all at once.

Figure 5: A single use motor simplifies the flight.

Mistake #5 - Trying for too much versatility

Somewhat related to both being too cheap on the flight and making it too complex is adding too much versatility to the launch. We see this all the time, when the customer comes to us and says: "I want to use the same rocket to get both my Level 1 and Level 2 certifications."

I hate hearing this question because the failure rate is high for this modeler.

This is definitely the novice rocketeer. We know it, because they don't see much difference between an L1 type rocket versus an L2 rocket. And I understand how they came to this conclusion, because on the surface, both rockets look the same. They can even be of similar size.

But they haven't taken the time to think about this question: "If it is just a difference in size, why even have L2 certification?"

They just don't have the experience to know the differences between the two types of flights. So they want one rocket that can do both tasks.

From my perspective, if the rocket can do both missions, it is optimized for neither.

A rocket that is optimized for success in an L1 flight is going to go way too high on an L2 attempt. So the rocketeer says to himself, "I'll add dual deployment to the rocket so that it doesn't drift too far on the J-size motor."

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Therefore, he makes the mistake of adding extra complexity on the L2 flight attempt. Notice as stated above, that I said not to add dual-deployment to either a L1 or L2 attempt. I hate being redundant and repeating myself, but I have to point this out again because I do want the modeler to succeed. So to repeat myself, you should avoid using electronics on your L2 certification flight too.

There will be time after you get certified for you to gain the experience using electronics. You DON'T have to do it all in one flight. It would be like NASA trying to go send men to the moon in 1959 instead of 1969 after they had learned all the skills they needed for success.

When I tell you that it is best to get two different rockets, one for the L1 attempt and another for the L2 attempt, it isn't for me to make extra money selling more rockets. I say this from experience, and it will save you money in the long run. If you fail your L2 attempt, you will spend far more money than you would have if you had spent a little more and been successful.

And more importantly, I'm doing it from a "safety" point of view. If you fail in the attempt, it means you weren't safe. Somebody could have gotten hurt. And that keeps me awake at night, because you put "versatility" ahead of, and being more valuable than "safety." To be frank, you're not the person that I feel has the best interests of the hobby in mind.

Mistake #6 - Too Much Power

An H-motor is an H-motor, right?

This mistake makes itself known when a person calls us and asks "What H motors are available?" They think "I might as well make do with what is available, rather than what would be right for the rocket." This mistake is really about "improper motor selection."

New people to model rocketry don't truly understand the difference between an H399 (https://www.apogeerockets.com/Rocket_Motors/Cesaroni_Propellant_Kits/29mm_Motors/6-Grain_Motors/Cesaroni_P29-6G_White_Thunder_H399) and an H42 (https://www.apogeerockets.com/Rocket_Motors/Cesaroni_Propellant_Kits/29mm_Motors/4-Grain_Motors/Cesaroni_P29-4G_Mellow_H42). They think that since they're both H's, they must have similar performance.

But the H399 is going to rip the fins off their rocket, and the H42 might have too little thrust and then weathercock and end up landing a mile away upwind.

The essence of the mistake is again not enough experience in rocketry to appreciate the difference in thrust of the two motors. I can tell you – and I will tell new people – about how much thrust an H399 motor has, and that it tends to shred models that aren't built to withstand the higher forces. But until you see it with your own eyes and hear the difference in the blast of the rocket as it takes off, you just can't appreciate the raw power.

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Most often, newbies make the mistake of choosing a motor that is too powerful rather than one with too low of thrust. That is why I titled this mistake as being one of too much power rather than incorrect motor selection.

The general attitude I sense from the modelers that make this mistake is: "whether I succeed or whether I fail, the flight will be spectacular!" So what is more important to them is not safety, but putting on a good show for the audience.

I don't know how to change this attitude, because I fully understand where it comes from. Behind the attitude is a desire to have your flight stand out so that other people remember it. I'm embarrassed to say it, but when I fly bigger rockets I want this too. However, I will suggest that they choose a more appropriate motor based on the rocket they are flying.

Mistake #7 - Rushing The Process

The customer will say to us: "I need the motor to arrive by this weekend, because that is when I'm doing my L1 flight."

That phrase is a big tip-off that the modeler is in a rush. The problem with being in a rush is that it creates more pressure and stress on the modeler. And when you're under stress, and this has been proven by research studies, is that you discount the negative consequences of your decisions. In other words, you ignore all the bad things that could happen and you assume that everything will go right. The result: you take greater risks.

Figure 6: Spend time building your rocket, ensuring accuracy over urgency.

You'll say things like: "I'll glue on the fins with 5-minute epoxy when I get to the field. They'll be rock-hard by the time I make the flight."

Yea… that situation actually happens. And it is a disaster just waiting to happen.

Being under a time crunch is not the ideal situation for going after a high power certification, because we want to be extra cognizant of the risks involved. We need to

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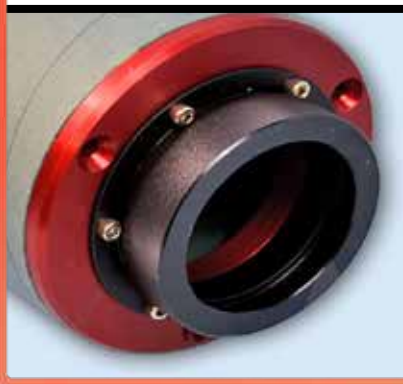

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build in extra time for those last minute problems. You have to assume problems will come up. That is why you make up step-by-step procedures for prepping the rocket. And you practice them before you get to the field.

But in the grand scheme of things, you have to ask yourself: "Will the world come to an end if I don't fly the rocket this weekend?" If the answer is anything other than "No," then something is wrong with the situation. I've actually heard modelers say: "If I don't do it this weekend, I'll have to wait an entire year because the farmer that owns the field will have planted his crops."

Really… what is the problem of waiting another year? You can't fly another high-power rocket on that field anyway, so what is the urgency? In the meantime, you can gain extra experience building and flying smaller rockets and learning more about how to select the proper rocket engines for high powered vehicles.

There will always be self-inflicted pressure on the modeler to fly a certification flight. They want the pressure to go away, and the only way they feel to relieve the pressure is to fly the rocket. Just get it done.

But that is not the best situation to be in. And that is why the certification witness is an indispensable part of the process. They have to be coach and also the voice of reason. I've seen many witnesses in action, and I have to say I'm very proud of all of them. They do a great job calming the rocketeer down and letting them know that they aren't a failure if everything doesn't go as planned. They've been in the same situation themselves, just like I'll be the first to tell you that I didn't get my L1 certification on my first attempt.

The important thing is to learn from the mistakes, and make sure that they don't happen again. That is what experience is all about.

Conclusion

As you read this article, I hope you didn't feel too let down that I didn't give you answers like: "Nose cone separation" as being among the seven most common mistake people make. Yes, those things happen.

Figure 7: If you don't rush through your preparation process you are much more likely to have a successful certification.

But the preventable mistakes happened before the flight was made. The most common mistakes are a result of decisions prior to the flight. They don't happen on the launch range. They actually happen in the grey-matter between the ears of the rocketeer.

Most importantly, they are preventable with a change in attitude. So I want to conclude this article saying that if you are going for any high-power certification, then you need to pause and ex-

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amine your reasons for wanting the certification.

I'm not telling you that a certification isn't worth it. I think it is a worthy objective. And in fact, I'm in the front row of your fan club hoping that you do succeed. I just want you to put things into perspective and realize that certification is not the end-all/be-all of rocketry. Remember, high power certification is really a safety course to designed to perpetuate the hobby of rocketry. It isn't just for permission to buy big motors and for bragging rights, although that is cool too. When everyone is flying safely, the government tends to leave us alone and doesn't add additional regulations. That is how we assure that rocketry will be around for others to enjoy too.

In conclusion, I want you to think about this question: "What are you going to do next, after you have your high-power certification?" Tell us on our Facebook page or tweet us with the hashtag: **#AfterHPRcertification**. We'd love to know what your rocketry plans are.

Additional Resources:

Video: "Introduction to High Power Rocket Level 1 Certification."
https://www.apogeerockets.com/Advanced_Construction_Videos/Rocketry_Video_60

About The Author:

Tim Van Milligan (a.k.a. "Mr. Rocket") is a real rocket scientist who likes helping out other rocketeers. He is an avid rocketry competitor, and is Level 3 high power certified. He is often asked what is the biggest rocket he's ever launched. His answer is that before he started writing articles and books about rocketry, he worked on the Delta II rocket that launched satellites into orbit. He has a B.S. in Aeronautical Engineering from Embry-Riddle Aeronautical University in Daytona Beach, Florida, and has worked toward an M.S. in Space Technology from the Florida Institute of Technology in Melbourne, Florida. Currently, he is the owner of Apogee Components (http://www.apogeerockets.com) and also the author of the books: Model Rocket Design and Construction,69 Simple Science Fair Projects with Model Rockets: Aeronautics and publisher of the "Peak-of-Flight Newsletter", a FREE e-zine newsletter about model rockets. You can email him by using the contact form at: https://www.apogeerockets.com/Contact.