The Heart of Weapon Systems Availability

James Davis ■ William F. Conroy III

TO START WITH AND TO KEEP THINGS SIMPLE, WE'LL DEFINE AVAILABILITY AS A MEASURE of a weapon system's readiness to perform its mission. In terms of aircraft readiness, a metric often used for availability is mission-capable (MC) rate.

It is important to understand that three basic elements drive a weapon system's availability. These are reliability, maintainability and supportability (RMS). We like to make the analogy that availability is akin to wins in baseball. In other words, it is the desired result and not the function. Continuing the baseball comparison, reliability would equate to hitting, maintainability to pitching, and supportability to fielding. Baseball fans would agree that all three components are important to winning, and the same can be said for the relationship of RMS to availability.

Let's stay with baseball for a bit and pretend we are the owners of a brand new baseball team. Our goal is pretty simple—win baseball games. Well, first we could go out and buy hitting. There are certainly

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Davis *has been assigned to Defense Acquisition University (DAU) as Department Chair for Logistics in the Mid-Atlantic Region for more than 7 years. He earlier was the Commanding Officer of the Navy Supply Corps School and served in various capacities such as Comptroller, Community Manager and Senior Assignment Detailer.* **Conroy** *has been assigned since 2005 to the DAU Mid-Atlantic Region as Professor of Life Cycle Logistics, and of Production, Quality and Manufacturing.*

great hitters out in the market and buying some sluggers to drive in runs sounds like a great way to improve our chances at winning games. Next, we could buy some pitching to help decrease the number of runs scored against us … again with our end result in mind—win baseball games. Finally, we would need to address the area of defense and go out to buy some solid fielders, again, to reduce the number of runs scored against us and ultimately help us win more games.

So, this baseball business is pretty simple. Buy hitting, pitching and fielding abilities and you win ball games. But what if the hitters you purchased don't perform as expected? Rather than drive in 100 runs in a season, your star slugger falters to 50 runs batted in. Do you win as many games? Probably not. I say probably not, because we operate in a real-world environment so there would be some level of deviation. But, ultimately, we wouldn't be surprised by a losing season.

OK, so a pretty miserable first season has come to a close, and now it's the off season. We have some decisions to make. We can either stay the way we are (with probably the same miserable outcome); we can go out and get new hitters who have shown more promise; or we can make adjustments to our pitching and fielding. Now, there may be some adjustments we need to make to our pitching and fielding, but the one thing we do know is that our hitting isn't meeting our needs. So what do we do? We get rid of our poor hitters and replace them with better hitters. Assuming our pitching and fielding continue to serve us well, we should be set for a great upcoming season.

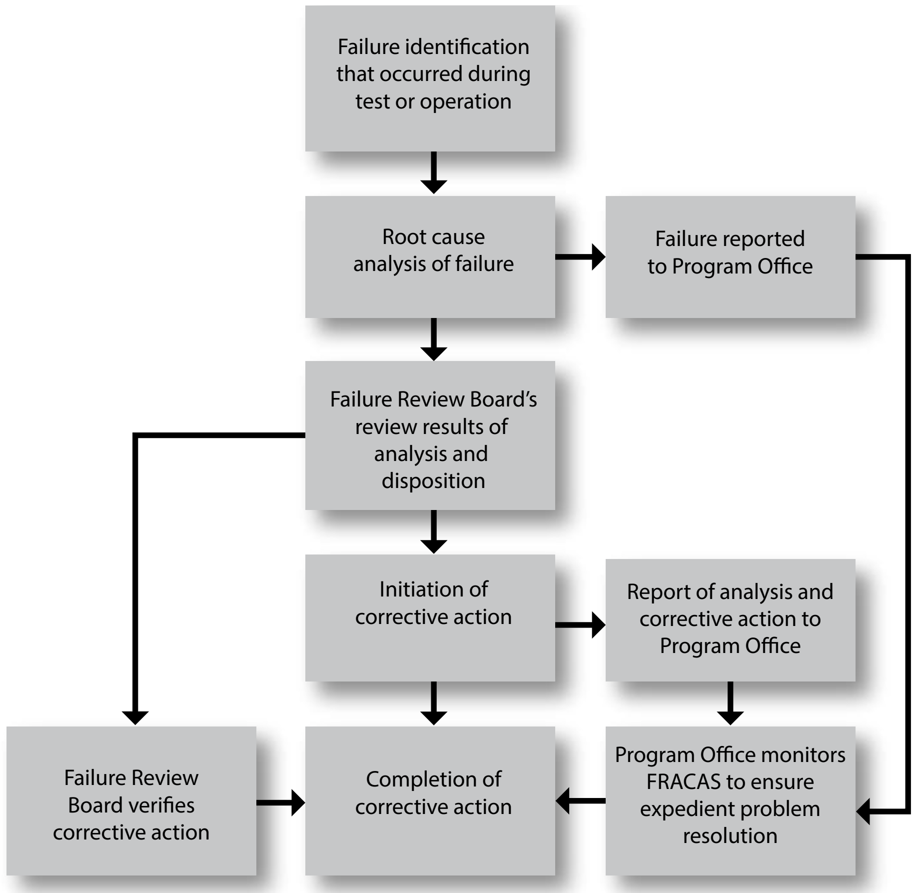
It sounds pretty easy—right? The same analogy can be applied to the availability of our weapons systems. In other words, if our issue with weapon system availability is the reliability of the components, then why don't we improve the reliability? Instead, we have a tendency to look at only the "nondesign" component of availability—namely, supportability and specifically, we tend to look at the supply support element of the product support package. How many times have we heard "If we only had more spares"? And sometimes that's true. We might not have enough spares (or for our baseball analogy, enough good fielders). But the fact is, changing the number of spares will not change the reliability of the system, and we will most likely still come up short in our availability.

So, if we're saying the problem is reliability, then why don't we fix the reliability? For clarification purposes, we are not saying the shortfall in availability of your weapon system is due to less than planned reliability. What we are saying is that in order to fix a shortfall in your availability, you must first understand what component (reliability, maintainability or supportability) of availability is causing your issue and also appreciate that there may be multiple components that do not meet expectations.

We must also understand the impact reliability plays on supportability. Reliability has one of the greatest influences on the development of the product support strategy and thereby the product support elements that we procure in support of the weapon system availability. Component failure rates drive our provisioning process, level of repair decisions, technical data procurement, etc. To put it in more basic terms, we understand that during the provisioning process, failure rates will determine if we even assign a national stock number to an item. If an item isn't expected to fail, there is no need to go past a part number assignment. However, if that item does fail, then you are a long way from obtaining a new spare. The same logic applies for the level of repair. If an item is expected to be highly reliable, then the level of repair analysis and subsequent supply, maintenance and recoverability (code recommendation will be for two levels of repair rather than establishment of a third level of repair (intermediate level capability). Again, if the failure rates fall short of prediction, we will run into availability challenges.

Nothing said so far should come as a revelation. It's a pretty basic model and we readily admit that there are a myriad of other factors that drive a weapon system's availability (OPTEMPO [operations tempo], environment, age, etc.). The point we want to drive home is that when we face an availability shortfall, we need to look at all three fundamental components of availability (RMS) and then take the most practical steps to resolve the shortfall. Notice that we didn't say we need to fix the component that exhibits the shortfall. For instance, it might be impractical to "fix" a reliability shortfall. We might not be able to improve the reliability of the design and will just have to live with the "new normal" of the failure rate. However, we then have to return to our supportability analysis process and refresh our input data in order to reevaluate the product support strategy and subsequent Integrated Product Support element investments required to meet our availability needs. This sounds simple enough, but unfortunately, there is a tendency to just buy more spares and try to solve the availability shortfall without the analysis. Buying more spares could help. Although, we would be a procurement lead-time away from having the new spares and would certainly not be optimizing your product support package.

Figure 1. A Basic FRACAS Procedure



Figuring on FRACAS

Talk about a cool acronym—FRACAS, for Failure Reporting Analysis and Corrective Action System. Not only is its acronym cool, it is also a fantastic system in helping to resolve availability shortfalls. Unfortunately, there are many folks out there who have never heard of FRACAS—and that is because their program doesn't employ a FRACAS.

First, let's start with some background about FRACAS. It has its roots with the U.S. Navy and specifically with the Naval Air Systems Command (NAVAIR). The concept developed into Military Standard (MIL-STD)-2155 dated July 24, 1985, and was made available for use by all departments and agencies of the Department of Defense. MIL-STD-2155 transitioned to Military Handbook (MIL-HDBK)-2155 in 1995. There was no change to the narrative, just that the information was now guidance and not directive. As noted in the MIL-HDBK, FRACAS is a disciplined and aggressive system and is considered an essential element in the early and sustained achievement of both reliability and maintainability (Figure 1).

MIL-HDBK-2155 emphasizes a couple of key points: (1) FRACAS needs to be a disciplined system and include the life cycle's sustainment period and (2) the program must take action to correct the root cause of the failure.

Let's break that down further:

Disciplined System

MIL-HDBK-2155 defines FRACAS as a disciplined and aggressive closed loop Failure Reporting, Analysis and Corrective Action System that is considered an essential element in the early and sustained achievement of the reliability and maintainability potential inherent in military systems. From this definition, we can focus on a couple of key words. FRACAS is disciplined and aggressive. In other words, we need to have a well-defined process by which we are capturing the failures and investigating the failure data and providing recommended corrective action. We also must have a robust process that is expedient and doesn't measure the response time in years. Speed is a virtue and extremely important to taking the corrective actions and achieving the desired weapon system availability throughout the life cycle.

Taking Action on the Data

FRACAS is a closed-loop system that not only captures the failure data, but then also generates corrective action on the failure data. The effectiveness of the FRACAS is predicated on the level of accuracy and thoroughness of the failure data. More specifically, the data should reveal who discovered the failure, what failed, where it failed, when it failed and how future failures could be prevented. This is easier said than done as a great deal of effort is needed on collecting and analyzing data to even start recommending corrective actions. Sometimes we are lucky and the recommendation can be as simple as a change in procedures, or it might involve correcting an earlier design change. We can recall one time when a reliability engineering change added a grounding strap to a power supply. The grounding strap significantly improved the reliability of the units. Unfortunately, we still experienced failures. Upon analyzing the data, we determined that only the first 25 units still were failing. As it turned out, the engineering change only addressed units 26 and higher. The first 25 were inadvertently left off the change. Data were collected, analysis performed and corrective action (place grounding straps on first 25 units) taken. Sometimes it can be that simple.

Summary and Conclusion

We readily admit that there are limitations in developing a robust FRACAS. It's one thing to sit behind a desk and write about all the things we should be doing. It's another thing to be out there doing them and dealing with the speed and intensity of operations and the intense competition for resources, time, money and manpower.

What we suggest is to take a moment to step back and capture the root cause issues and not just try to treat the symptoms. Yes, it's hard. If we have a hole in an aircraft, the immediate reaction is to get a new spare to fill the hole and maybe look at ways to make the depot more efficient to providing those spares. But, in relation to the baseball analogy introduced earlier, wouldn't it be nice if we also went after the underlying causes to our availability shortfalls and did the analysis on the three components of reliability (hitting), maintainability (pitching) and supportability (fielding) and then adjusted our product support strategy (roster) accordingly? We need to appreciate that the answer to our availability might not be to buy more spare parts or fix repairable parts faster … the problem just might be a little more complex than that.

The authors can be contacted at **james.davis@dau.mil** *and* **william.conroy@dau.mil**.