MRO Strategies to Synchronize Uncertainties

By Jerome Greer Chandler

"There are known knowns. These are things that we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things that we don't know we don't know." Former Defense Secretary Donald Rumsfeld disclosed this intelligence on Feb. 12, 2002. Rumsfeld's focus was Iraq. But, as far as aviation maintenance managers are concerned, it might as well have been airplanes.

"Any way you look at them, non-routines are an unknown," says Yossi Zohar, deputy manager of Bedek Aviation Group's aircraft division. "In some cases…they become the major portion of the maintenance event."

Predicting the Unpredictable

Ironically, as aircraft become more digital, the ability to predict when a component will go down becomes more of a problem. "Mechanical equipment will tend to wear out, and failure will occur on a more predictable basis," says Marc Wilson, director of safety, quality and asset management for Morten Beyer & Agnew consultants. "Failure probability with an electronic piece of equipment is essentially random."

Certainly ACARS, the Aircraft Communications Addressing and Reporting System, has mitigated the problem since the 1990s, especially out on the line. Digital datalinks "allow the maintenance staff at a destination to plan an unscheduled event and take the required actions to potentially avoid an AOG," says Frank Martin, a principal with Seabury Aviation and Aerospace. ACARS was a quantum leap in easing the impact of "unknown unknowns," but that doesn't mean they have gone away.

Bedek models heavy checks and assigns non-routine to routine ratios, pegging its predictions to aircraft type, age and utilization. It allocates a Boeing 737NG 0.25 non-routine man-hours to each man-hour of routine work. By contrast, a Boeing 727-200 might consume two hours of non-routine work for every hour of routine maintenance.

Oliver Wyman associate partner Brian Prentice cites experience that mirrors Bedek's. "Fully half of the work done within a letter check is responding to non-routines," he says. He has worked with some operators flying aged aircraft where as much as 70% of the ultimate work package is non-routine. He also has worked with carriers fielding young fleets with 10-15%. "But, on average, 40-50% of all work done in a hangar is non-routine."

Bedek assigns an approximate non-routine/routine formula to its customer's aircraft for a couple of reasons: to help better apportion resources, and to ease friction with customers. "I plan the workload and the hangar slot, assuming that those non-routines…will apply," says Zohar.

Then there are relations with operators. He says non-routine ratios render them less contentious. Whenever it can, the MRO includes "a certain portion of non-routines…into our fixed price," says Zohar. Bedek puts 50%, perhaps more, of the non-routines into that column. He says the idea is to "move the work ahead, rather than bargaining for each hour of non-routine." The idea of negotiating a full hour to determine the price tag of an hour of labor is "absolutely illogical and worthless," maintains Zohar.

What is worthwhile is the experience gleaned from going over scores of aircraft possessing similar characteristics. That's how Bedek, and others, have traditionally planned for non-routines. "We…accumulate more and more events and learn [from] those events what will be the behavior of the next event," Zohar says.

Echoing Zohar is Philippe Rochet, executive VP of airframe services at Sabena technics. In his shops, non-routine planning is pegged to "our experience on the type of aircraft, and [the] number of aircraft." Then, it maps "the metrics applicable for managing such events."

But how they map those metrics differs decidedly. Sabena technics employs an IT package called Visual Planning, manufactured by Stilog. "We have one IT tool deployed [across] the group," says Rochet. "It's been customized to our needs" and manages both workload and workforce. "We are able to see…where we need to put more people on certain aircraft in order to meet our turnaround time," he explains. "We know exactly where are our different skills are for each type of aircraft, where our resources are."

Bedek's not as sold as some on this species of integrative IT.

"I would not regard…IT solutions [as] magic," says Zohar. "We have tried on several occasions to use the innovative IT packages that could help us in order to better plan. But, with all frankness, I cannot say that there is some crystal ball that will give me the solution. The only thing that we…do is to accumulate more and more events and learn from those events."

He's adamant in insisting there's no "mathematical model that will create for me a solution that will give me the opportunity to sit in peace, and the planning will be done by itself."

Maybe not, but that doesn't mean vendors aren't working furiously to fashion software that takes all that accumulated data, parses it and plugs it into programs that pay off.

Choreographing the Chores

"Because the [non-routine] environment is so uncertain, and there's limited capacity, the challenge in execution is really how to synchronize everything to get the aircraft turned around," says Sridhar Chandrasekaran, VP of strategic services at Realization Technologies. "This is the problem we're trying to solve: synchronizing in the face of uncertainty."

Seminal to the solution, Chandrasekaran contends, is meticulously metering workflow: preventing too many balls from bouncing about at once and "controlling the amount of work that you start, [the] work in progress," he says.

He concedes the solution "is very counterintuitive," that it even may entail a change in metrical mindsets. Measuring individual mechanics' efficiency and "keeping them busy all the time" should be subordinate to pushing metal out the hangar door.

That means putting people to work where they'll do the most good. If 50 items are open at the same instant, Chandrasekaran says Concerto will jump in and say, "'Hey guys, you can't open more than 20 [items]. More than 20, and you're going to go crazy.'"

That's why the software prioritizes. "If I'm chasing parts for three or four repairs, I still need to know what parts to chase first," he says. "If I'm a supervisor, I still need to know where to deploy my mechanics first."

This could mean chucking cherry-picking and heading for the nastiest problem on the hangar floor first. The idea is to triage: get to the potential check-killers first, from the get-go, then attack the other issues. You've only got a narrow window of opportunity before it all starts to unravel.

"If you leave [a critical] inspection…until day 15 of an 18-day check, you'll never make your target," agrees Prentice. Case-in-point: door jamb corrosion. It can take five to 10 days to repair. Fail to open the area up on day one on an older aircraft that operates in humid climes, and you're asking for trouble.

"The role of the planner and the MRO is to understand that not every inspection has the same level of risk, and to do all those inspections that have high-risk, high-impact as early in the check as possible," he says. That kind of approach results in plans that are realistic, as well as personnel, parts and capacity allocation that are attuned—synchronized, if you will—to the task at hand.

Some software hones in so tightly to that task at hand that it can construct granular estimates of what it will take to tackle a given non-routine. Mxi's Maintenix has the ability "to model non-routine estimates right against an inspection task, as opposed to an entire check," says Evan Butler-Jones, MXi's product marketing manager. While allowing a look at the big picture, its per-task perspective gives planners even more control of the process. Micro or macro, "either way that you do this," says Butler-Jones, "as the check content changes, your non-routine estimate automatically changes along with that."

And that's what the right kind of IT can bring to the hangar floor—evolving, real-time perspective. "It's not an easy thing to do manually," contends Realization Technologies' Chandrasekaran. "You need some sort of a system to tell you… how much work can be started, how much work can be going on at any one time based on the [number] of mechanics, capacity, [and] management bandwidth."

SWIFT Passage

If non-routines are troublesome on the hangar floor, they can be toxic out on the line. "What a fleet manager is always up against," says Morten Beyer & Agnew's Marc Wilson, "is that for every 10 parts they decide to place at a line station, it's always the eleventh that fails—the one that they don't have." Putting all the pieces where they need to be can be "a very, very complex game."

It's a game Dave Fischer knows well. "The biggest challenges [in non-routines] are when they occur and where they occur," says Southwest Airlines' senior director of engineering and planning.

The game at Southwest is played out on a board 68-cities big, with roughly 541 aircraft. In terms of line maintenance, the goal of the game is to make sure those 541 players transit one of Southwest's 16 total maintenance locations "typically…two or three times a day," says Fischer.

There's really no cognate for Southwest's complex point-to-point route structure. Were it a traditional hub-and-spoke carrier, hitting a maintenance location possessed of the right parts and people might be more straightforward. That's where SWIFT and SMARRT come in.

SWIFT is the Southwest Integrated Flight Tracking system, and SMARRT is the Southwest Maintenance Aircraft Routing and Recovery tool. The former is the actual routing piece; the latter the maintenance piece. Both were developed internally—SWIFT in 1996, and SMARRT in 2008. Together, they give Fischer and his colleagues a grandmaster's perspective on a constantly changing chessboard.

SMARRT helps spread the non-routine workload more efficiently over the Southwest system, compiling the all-737 fleet's "labor hour, [maintenance tasks] and requirements and automatically feeding SWIFT," says Fischer. SWIFT takes that data and makes sure the seven-threes make it to the right station at the right time. In the universe of integrated maintenance applications, these two dovetail nicely.

"Maintenance and the guy routing the aircraft all see the same thing," says Fischer. "We work with schedule planning. [We can] re-tweak our schedule and take work away [from a station], or put it in."

Manually, the task would be all but impossible. Too many airplanes; too many cities. "This puts some logic to it," says Southwest's engineering and planning chief. The system is suggestive, not determinative. While the computer does a lot of heavy lifting, the fine-tuning is human. "There are always people with oversight, making adjustments accordingly."

But, these people have a solid foundation upon which to make those adjustments. The system takes the maintenance requirements gathered by SMARRT—what sort of skills are needed for a non-routine, the man-hours entailed, the parts, whether an inspector's needed—and it feeds SWIFT. SWIFT then tells planners, "Oh, you need to be at a maintenance base…in seven days." Then, it starts routing the airplane there.

In tandem, SWIFT and SMARRT make a material difference. Consider structures. Prior to the SWIFT/SMARRT mating, Southwest aircraft were down 4,200 hours per month—a not insignificant 2% of the fleet. Material issues—O-rings, flaps and such—accounted for 1,500 hours of that. Now, that 1,500 figure has dropped to 1,100 hours. Today, Southwest's maintenance, inspections and task cards "are set up and executed in the cities where we have the materials, tools and parts to do the work," says Fischer. "We match our routine, and possible non-routine, events with the location best suited to handle [them]."

That sort of matching means reduced overtime. Fischer says line maintenance overtime used to run 11% or 12%. Now, it's 4%. "We allowed the local leader to really manage their station. They understand that. Their labor needs to match the number of hours coming into their station. They're measured on that," he says.

AA Answer

Cross-town megacompetitor American Airlines, one of the pioneers of in-house IT, “is on the verge of doing a couple of…computerization programs that will help us better forecast” non-routines in what Line Maintenance VP Ken Durst considers the critical “three- to five-day window.”

Like Southwest, American decided to develop the system itself. “Normally, when you…buy something off the shelf, you have to revise or modify it anyway,” he says. What Durst and colleagues are doing is looking at ways to complement its existing set-up, MAPS—the Maintenance Aircraft Planning System. In place for more than a year now, MAPS allows planners to “plug in routing, scheduling, and overnights,” all with the idea of matching the airplane’s needs to the station’s capabilities.

While Durst won’t go as far as Southwest in breaking down MAPS’ benefits, he does say that “it has helped substantially” in managing material and communications—things that “really get us moving the dial forward [on-non-routines].” American’s line maintenance chief says there have been significantly fewer MELs (minimum equipment list) issues, and he says American has seen “a reduction in out-of-service aircraft, delays and cancellations.”

Once again, it’s a matter of synchronicity. If it’s an MEL item, he has “10 days to get the thing fixed. And I’m looking at how many times I’m going to see this airplane at a maintenance station…and whether I have the right part in place. Because otherwise you’ve got parts chasing planes and planes chasing parts.”

Here’s what synchronicity boils down to, according to Oliver Wyman’s Prentice: “You’re seeing a lot of MROs and maintenance organizations within airlines working very closely with engineering groups and maintenance program groups to make sure that they are looking at the right things, at the right time, and in the right locations.”

Whether you’re Bedek, American or Southwest, the nature of the IT, maintains Prentice, isn’t as important as the data accumulation and the planning that precede its introduction. “It can be as simple as a shared XL spreadsheet, all the way up to an ERP system,” he says. “But if you don’t have the knowledge and the planners aligned to do the right work in the right place, no system is going to fix [your non-routines].”

Scrub-a-Dub-Dub

Do not, however, confuse system quality with the quantity of information it manages, nor over-inspection with effective inspection. Case-in-point: Oliver Wyman had a client whose actuators were breaking with alarming frequency. “Their reliability was incredibly low,” remembers Prentice. “And nobody could figure out why”—until they got out of their offices and looked at how the components were inspected.

“It took us a couple of weeks of looking through all the data,” he says. “But once you actually got out and watched them do it, it was very clear what was happening.” Mechanics were over-servicing the part, breaking off the nozzle when they pulled a lubrication look-see. Ironically, paying too much attention to the actuator killed reliability. Once the part was serviced at the proper interval, reliability rebounded.

The point: data accumulation is terrific, and the profusion of that data through the system is critical. But absent the human element, the even the subtlest system can fall flat.

It also doesn’t hurt to “de-escalate” some items in a heavy check and push them into a line environment. Oliver Wyman suggested precisely that to one client, reducing heavy check hangar work by 10%. “Some of [the work] got de-escalated into the line, into the B check,” says Prentice. “Some of it got escalated,” meaning it was performed less frequently. Some of it got tossed. Such was the fate of management directives that were no longer applicable. “Maintenance programs are like black holes,” he says. “Things go into them, but the never come out.”

Cull the clutter, track metrics that matter most, and then synchronize your efforts. Do those things and render unknown unknowns a bit less bothersome. Do those things “and when you find non-routines,” says Prentice, “that means you’re managing the aircraft well. You’re finding things that are correctable, and [you’re] able to work on them.”OM

This story appeared in Overhaul & Maintenance's *March 2010 issue*.

Photo credit: American Airlines