



# Error Management Systems Australia

***Red Flag***®

A Risk Management System

# Testing

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# Testing for EM Fitness

## The Case for Testing

There is no doubt that the personal quality involved in the majority of pilot error accidents can be detected through test. However, until recently, the idea has only been implemented by air forces (and some airlines). The Wombat is one test that will reveal the presence of the problem. It is useful, in the development of the argument (that Wombat is a part of the remedy for hazard factors), to describe how Wombat achieves a risk factor appraisal.

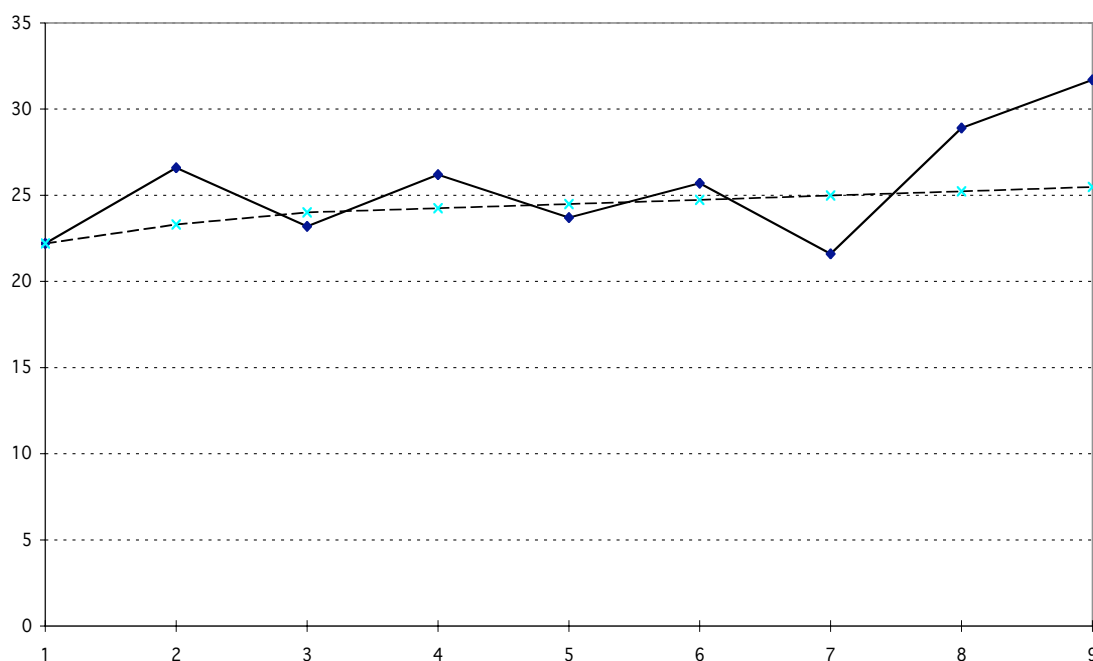
## The Wombat

The Wombat measures cognitive performance of a particular nature – the mental mechanisms (cognitive skills) that manage a pilot's Situation Awareness and comprehension. The two are not the same thing, though interdependent. A pilot might have a strong Situation Awareness information scan (Time Management), but be poorly interpreting what he or she sees – eg, a visual illusion (Information processing). Good SA relies on accurate comprehension as well as rapid information assimilation. The Wombat measures both.

The test takes place over two-and-a-half hours. After a 50 minute introduction, the test subject performs tasks over a fixed 90 minute period. Performance is recorded as a score at each ten-minute interval. The following chart is a typical Wombat score profile.

*(I should note before going on that most users of Wombat-type tests in pilot selection processes only use the overall total score. This is a crude and unsatisfactory approach – and unfair and discriminatory to the test subject – as will become obvious as you read on.)*

## Subject #1



*The unbroken line joins score points. The dotted line is a 'standard learning curve'.*

This test subject's commencing score is 22.5. He's gets off to a good start and finishes strongly – excellent signs in a current or intending pilot.<sup>2</sup>

Performance after the first ten minutes is, essentially, a measure of latent or natural talent for this type of task challenge (but only in a person who has not had exposure to SA-type training, such as learning to fly, or playing computer games. That sort of background tends to improve score results.). As the competencies being measured are the same underlying skills that provide a pilot's (or anyone else) *Situation Awareness* (Time Management, Information Processing are the sub-skills), Wombat is assessing *situation awareness competence*, over time, and under stress

Loss of situation awareness is by far the main cause of accidents (aviation or other). A strong performance on the Wombat thus marks an individual as possessing *defences against accident-causing error, in and related to flight*.

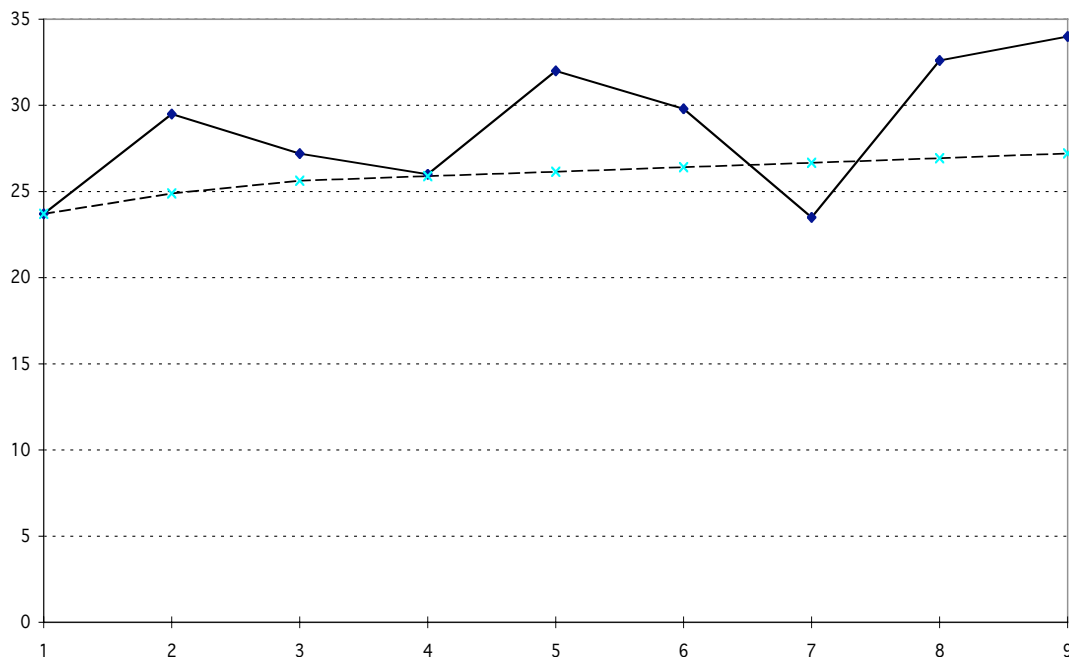
Having said that, it is important to stress that a lesser score performance can be overcome through diligent training, *provided the right learning opportunities are offered*.

*The standard learning curve profile is the most common experience in the majority of Wombat tests. That is, a score may not be very high, but the overall shape of the attainment profile follows the same basic skill-improvement plateau pattern, as seen on the diagram.*

### Other Score Profiles

As you would expect, there is a fair bit of variety in Wombat score profiles.

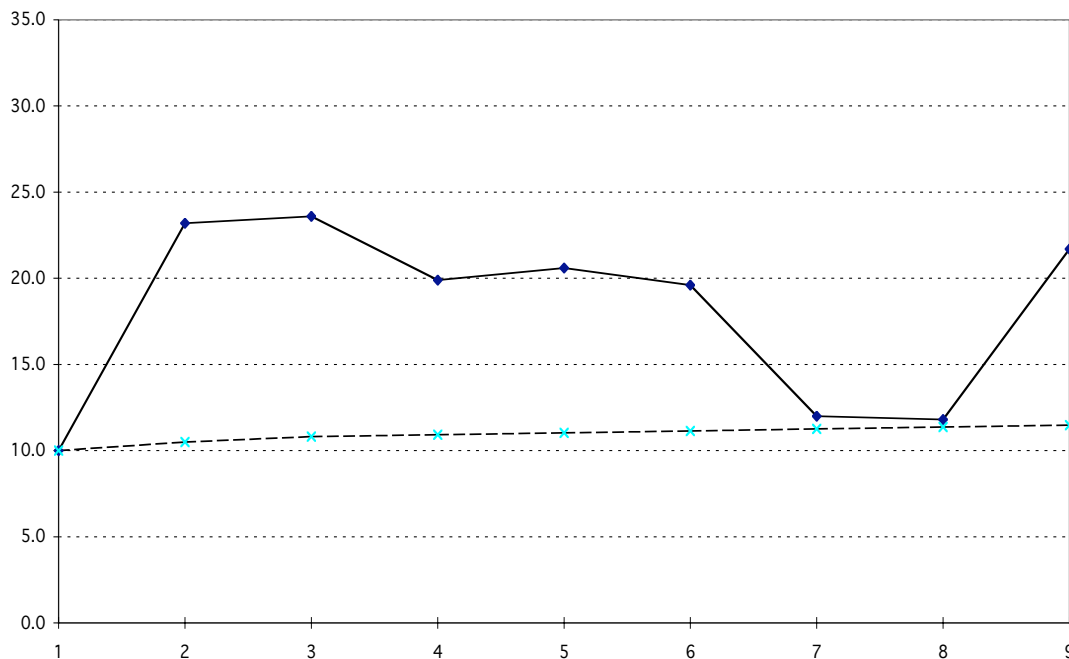
### Subject #2



Subject #2's is another good score; a strong start, sound SA maintenance throughout, and an especially strong finish. Not all start so well, though the final score is in the same ballpark.

<sup>2</sup> Readers who are familiar with Wombat might wonder at the scale of the 'Y' axis. I have used the score as at the end of each ten-minute period, as opposed to total or predicted total score.

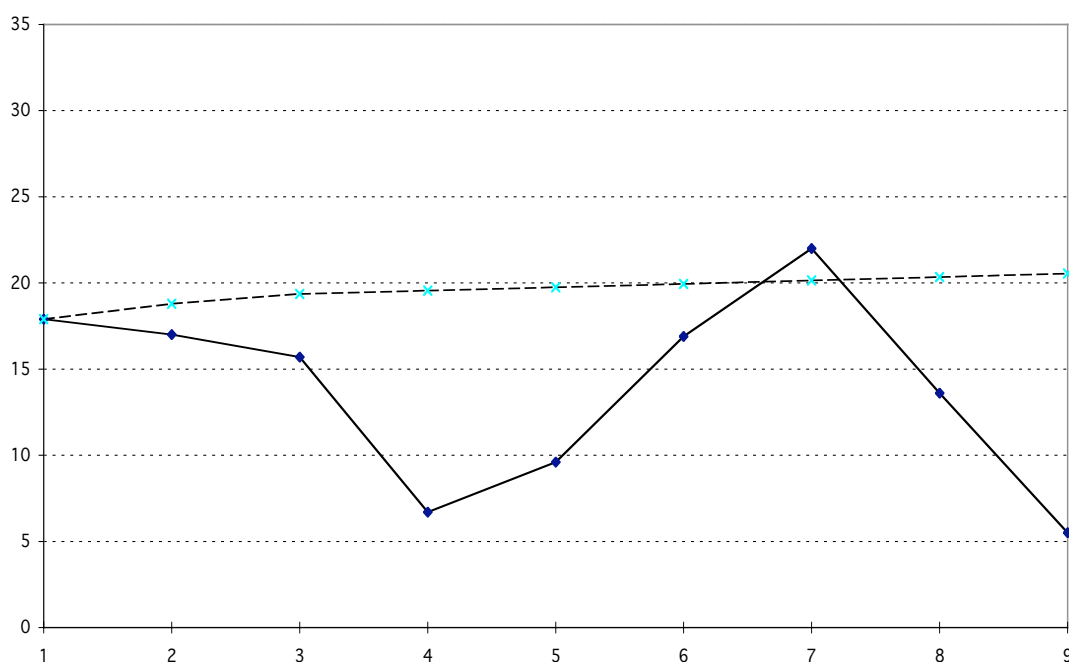
### Subject #3



This pilot (they're all trained pilots) overcomes a latent difficulty – ie, he's not a 'natural' – shows good enough performance, including a downturn from which he recovers. The overall score is within the 'acceptable' range for most airline recruiters who use Wombat.

*Not all pilots are so dedicated and diligent. This chart is from a current airline pilot.*

### Subject #4



This pilot has a position in an air carrier and, frankly, he did not care about the test at all. It is a weakish beginning – and that’s the level of SA competence he daily brings to passenger carrying. The drop in performance at the 30-minute mark was due to lack of concentration. He began to recover, but collapsed again through insufficient tenacity – no ‘Tiger’.

This is a poor result for a very experienced pilot. More significant, he thought he’d done OK. Pilots such as this need the rude awakening they can get from a properly debriefed Wombat session. On the other hand, no one should be subject to that form of frank disclosure except they know of the existence and nature – and certainty of effect – of remediation training.

*As noted earlier there should be concern about the ‘adaptation’ factor introducing higher likelihood of pilots making errors of judgement. How Wombat detects that syndrome is thus of interest.*

### Detecting that Pathogen

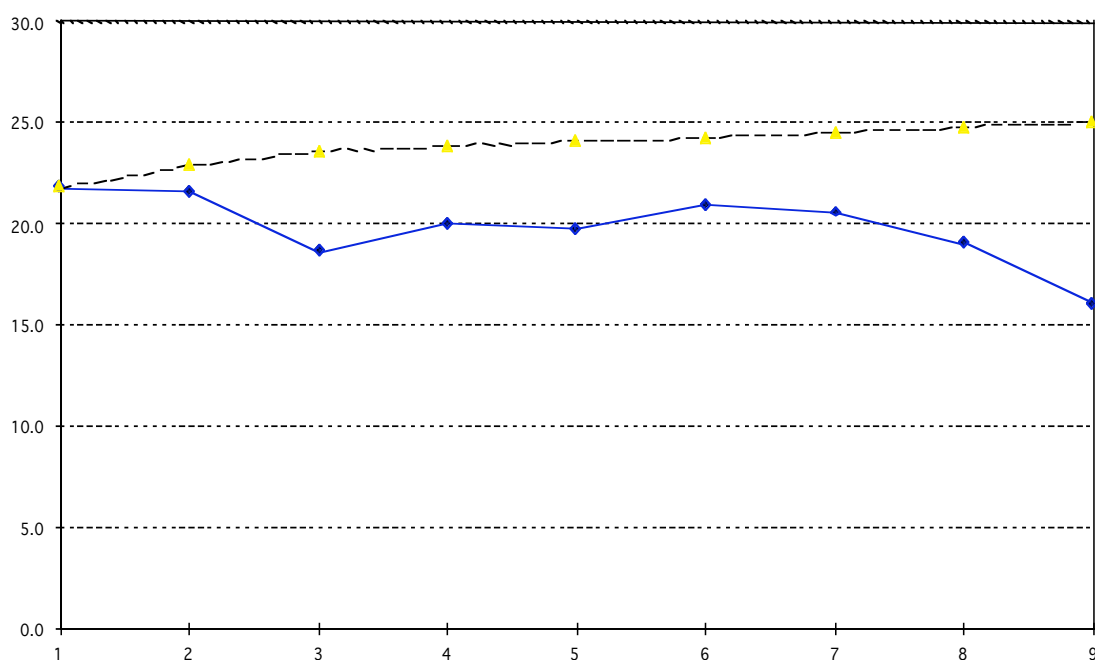
The Wombat sets task challenges that are not unduly difficult. They are not flight- or culture-specific. (High-skill non-pilots such as first grade footballers score about the same as pilots.) The tasks are *representative* of flight – challenging the cognitive processes through which Situation Awareness is secured and maintained. Accordingly, the test is a fair and reasonable challenge to any pilot, whether practising or intending.

The test does impose pressure. For these reasons, it is accurately described as appraising, not only as the pilot’s ability to maintain Situation Awareness, but his or her being able to do that *under stress*. In the first two charts the test subjects continued to improve through the test, demonstrating stamina under increasing pressure. Less robust subjects fare less well.

*Situation Awareness breakdown under pressure is, arguably, the most dangerous of all of the negative attributes in the catalogue of human factors in flight. It is a virulent pathogen – and prominently evident at work in many crashes.*

The following chart shows a case where breakdown in situation awareness kicks in – due to the stress factor – and is not recovered throughout the test.

### Subject #5



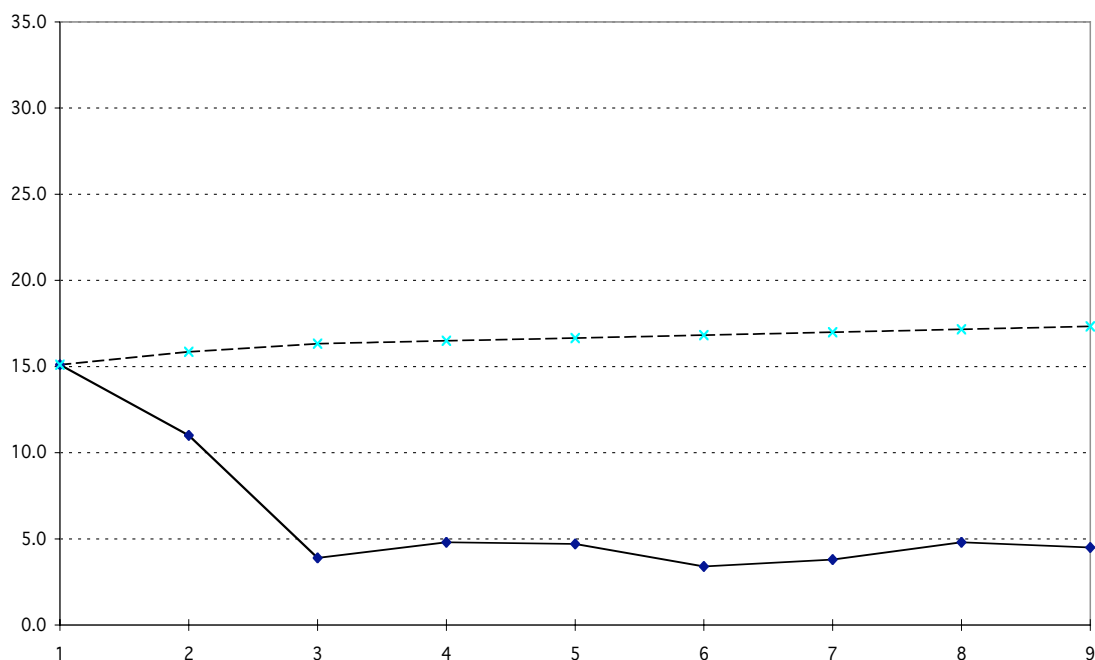
This is not a poor performance. (It starts at about the same innate score level as Subjects #1 and #2). But the pilot would have done better had the collapse not occurred. Given his result after ten minutes, he clearly has the potential for a higher score – or stronger SA competence. As before, the learning curve line on the chart shows the normal expectation that performance will improve – even though only slightly – throughout the test. As stated earlier, most test results conform to that standard learning curve profile ‘shape’. This profile is fairly unusual.

More important, a breakdown in Situation Awareness such as this, in real flying, could represent a hazard. Characteristics of SA attenuation will include poor communication, and consequently degraded crew coordination, as well as erroneous interpretation of the ‘real world picture’ – such as the QF-1 skipper’s unduly optimistic reading of the true situation.

It might be argued that Subject #5’s loss in performance was not great (though it got worse towards the end as the stress factor intensified). On the other hand, the pressure imposed by a Wombat test, on terra firma, is nothing like that associated with flight, say, in a thunderstorm at night. We need to know if pilots have high levels of SA management resilience.

I chose Subject #5’s performance as the first example of decline in SA competence, as though it may not be major, it must be grounds for concern. Also, being relatively minor, it is easily reversed through training. On the other hand, I have seen more troubling results. For example, the next test profile. Once more, it is from a senior practising RPT pilot. He could be flying you next time you travel):

## **Subject #6**



This is clearly a gross loss of situation awareness – and, again, the pilot was wholly unaware of it. The result is a serious safety concern – total loss of SA competence. In a crew, the subject, under pressure, would have withdrawn altogether from communication, though stubbornly remaining in command, while having no idea of the true state of affairs he was flying in and into. (Too many RPT and other accidents show this pattern of behaviour.)

The “learnability” factor is established in the following account from my earliest days on the trail of tests for the error-prone.

### **The World’s Most Uncoordinated Man**

Years after the day in question, Rob Lee became Director of BASI – the Bureau of Air Safety Investigation. He did the job so well it was taken from him, but that’s another story. A PhD in psychology, Rob had spent, before the BASI appointment, many years in research into human factors phenomena that impact on flight – those endlessly fascinating concepts that feed aviation’s never-waning allure and makes addicts of all right-thinking people.

At the time, back in the 70s, I’m on a job looking into flying training. Rob is doing research at a nearby university. We’d done some accident investigation together. So I’m not surprised to get a call from him to come down and check out a device he thought of interest.

To spread the wealth, I collect colleagues A and B. We set off. A is a fellow pilot. B, a man fascinated by aviation, is working on design of part-task trainers and pilot aptitude testing. He offers to drive, as his car is close by. We accept. Big mistake. At the first roundabout, A and I realise ... *this bloke is so uncoordinated ... he can only do one thing at a time*. While he’s pushing the clutch in ... *steering stops! Gulp! Clench!* Clutch fully depressed ... there’s a snap correction ... and guidance is briefly resumed. It stops soon enough ... *while the gear stick is being moved*. Progress around the circle is a series of straight legs and sharp turns. And on it goes, each individual action getting exclusive attention for its duration. Terrifying.

We arrive at the uni hot and sweaty ... on a cool day. Rob takes us to his baby. It’s a computer-based tracking task device. What is different is that, till now, tracking challenges have been ‘single channel’ – one ‘joystick’, one moving target to chase. This beast has two of each – the first dual-tracking system. Rob is unsure whether it presents insurmountable skill demands ... or not? If not, could it be used to measure pilot aptitude? It certainly looks to be an unrealisable task challenge. But you can also see its possibilities as a pilot-potential test.

The pessimistic, gut-feeling, prognosis is soon confirmed. B, the part-task trainer man, had sat down and engaged the machine. His tracking is dreadful, the cursors zig and zag, zipping past and around the targets. The score read-out never goes above 5%. Clearly, it’s beyond human ability. End of story. Rob’s a tad downcast ... until A steps up and has a go. The little dots move, he repositions the cursors, wiggles the controls, follows the targets, scores 85% right away, gets better. Maybe it can be used. My go suggests there is something in a positive outlook. (Both A and I had an advantage; recent practice – in the name of scientific research only, mind – in computer-based tracking challenges. It helped.)

The drive back confirms that the *World’s Most Uncoordinated Man* is at the wheel.

Nearly two decades later, B gets in touch. After many years of trials, he has perfected a pilot-potential battery of tests that includes the dual-target tracking challenge. I go over to take a look ... and inwardly scoff at his offer to demonstrate. Hmmph. Him! The *World’s Most Uncoordinated Man*. I’ve seen him make a total hash of the task.

Then he sits down and ... a miracle! It’s like a virtuoso at the grand piano, Yehudi Menuhim on the violin! The targets move around, at random, the toughest challenge (unpredictable). But he tracks unerringly. The controls move with sure precision. Readout – 95%! It dawns on me. He’s been doing this through 15 years of trials – hour after hour of practice. He’s become an automaton in these tasks.

And at that instant, any vestige of doubt as to the efficacy of EM skill training evaporates.

He drives me back to my accommodation. It’s still a manual car – but he’s a different driver. Coordinated. *Smooth!*