



## Real Time – Military Style

In the military, we are often concerned with real-time programming. A typical scenario would be an attack aircraft approaching its target. The onboard radar-warning receiver is reporting the ground-based search radar that is painting the aircraft from several kilometers away. As the target nears, another radar pops up with the signature sweep of tracking radar. The search was successful and another stage of the game begins. The attacker becomes a target.

On the aircraft, the electronic signatures speak of launch mode, and then launch. A digital signal processor analyzes the signature, and decisions are made in real time. Is the missile radar guided? What frequency is it using? What is the power level? How many are there? From which direction is it approaching? How fast is it approaching? How is it being guided? Is the radar on board the missile, or is it ground-based and passing guidance information to the missile via a communications channel? What frequency is the communication channel? Is the missile using infrared seeking? The electronic brains put together a counter measures plan and send command signals to activate the jammers and expend the flares if they are needed.

First comes the boost phase; the missile comes to life and gets its speed up to intercept the attacker. Usually there is no guidance available at this time. The electronics and hydraulics are activated. The internal brain comes to life.

In the second phase, the missile is up to speed and being vectored to its target by the target tracking radar. Like a teenager, it quickly develops its own field of view and sets out to prove itself. Modern missiles, like modern teenagers, are smart. Onboard processors are sifting through incoming data streams looking for counter measures from its quarry so it can apply counter-counter measures. It compares its electronic signatures with the sun to make sure it isn't tracking the sun. If it is, it goes back into search mode to reacquire the target. It

might compute the track path and filter out the vertical velocity, then compare it to the acceleration of gravity to make sure it is not tracking a free-falling flare. If it is, it needs to re-acquire the target.

The aircraft counter measures are pumping out electromagnetic energy and flares to create false targets and misinformation about angle or range. However, is it working? Occasionally the silicon brains have to do a look-through to see if the foe is still in pursuit. If so, they have to make another decision. Can they handle it themselves? Should they pop another flair and hope the distraction is long enough to cause a miss? Is it time to warn the pilot and tell him to get us out of here? What would R2D2 do? Unlike a human heart, the clock-ticks of the onboard processors remain steady. Real-time decisions are made as to whether the missile has taken the bait, or if it has seen through the spoof and another tactic needs to be applied.

Back and forth they go, counter measures versus counter-counter measures. The last phase of this scenario is called the endgame. Here it will be decided who has the best technology or tactics. Sometimes good tactics can counter good technology. Yet fast processors, fast algorithms, and efficient code play an important part in the final decision. Good pilot training is essential. It all happens in real time.

However, was

it real or simulated? It seems like cutting-edge software is mostly developed for the military or the gaming industry. We seem to oscillate between trying to amuse ourselves or kill ourselves, and with some of the games on the market today, well, we won't go there.

For example, here are some games (well, OK, the first are the titles that we should have, followed by the real titles). Seems to fit well with the Department of Defense (DoD) mindset, right?

- "Finding Demo." ("Finding Nemo.")
- "Madder 'n Hell 2004." (Madden NFL 2004.)
- "Freaky Flyers." (No kidding – this is a real title from Midway.)

It seems to follow that advances in technology in the real world translate quickly to advances in simulation technology, which also mirrors gaming technology. In a few years, we are going to have the first generation of pilots and warfighters in the DoD that was raised on state-of-the-art warfighting simulations. I wonder if they will find the Joint Strike Fighter a letdown?

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