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Accelerating Missile Threat Engagement Simulations Using Personal Computer Graphics Cards

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Abstract: The 453rd Electronic Warfare Squadron supports on-going military operations by providing battlefield commanders with aircraft ingress and egress routes that minimize the risk of shoulder or ground-fired missile attacks on our aircraft. To determine these routes, the 453rd simulates engagements between ground-to-air missiles and allied aircraft to determine the probability of a successful attack. The simulations are computationally expensive, often requiring two-hours for a single 10-second missile engagement. Hundreds of simulations are needed to perform a complete risk assessment which includes evaluating the effectiveness of countermeasures such as flares, **chaff**, jammers, and missile warning systems. Thus, the need for faster simulations is acute. This research speeds up these mission critical simulations by using inexpensive commodity PC graphics cards to perform intensive image processing computations used to simulate a heat seeking missile's tracking system. The innovative techniques developed in this research reduce execution time by 33% and incorporate a user-selectable fidelity feature to perform high-fidelity simulations when required. Furthermore, these image processing computations use only 5% of the available computational capacity of the graphics cards, providing a ready source of additional computational power for future simulation enhancements. Analysts can now meet shorter suspenses with more accurate products, ultimately enhancing the safety of Air Force pilots and their weapon systems. With ongoing operations in Iraq and Afghanistan, and a growing threat at home and abroad posed by the proliferation of man-portable missiles, the speed of these simulations play an important role in protecting forces and saving lives.

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