



Embedded Training for Lead-In Fighter Training



 Air Transport Division
Training, Simulation & Operator Performance

 training@nlr.nl

 +31 88 511 31 01



What is the role that Embedded Training can play in improving efficiency and effectiveness of Lead-In Fighter Training for future fighter pilots?

The demands 4th and 5th generation of fighter aircraft (such as the Typhoon, Rafale, Raptor and Lightning II) place on pilots, together with increasing pressure on costs, are driving changes in Lead-In Fighter Training. Embedded Training offers opportunities to increase the use of Lead-In Fighter Training aircraft and reduce the reliance on operational fighter aircraft.



Embedded Training systems provide training capabilities using operational systems, subsystems or equipment together with training equipment. The embedded training system is on-board software that simulates threats and integrates them with the operational system.

Operationally, the change in fighter aircraft and tactics that is increasing the cognitive demands on fighter aircraft pilots is driving a need to modify Lead-In Fighter Training (LIFT). Embedded Training and Live Virtual Constructive training technology is increasingly available against lower costs. This is driving the consideration of Embedded Training to facilitate the downloading of training from higher cost operational fighters to lower cost (Lead-In fighter) training aircraft. Embedded Training offers the possibility to include tasks such as information handling and weapons systems handling in training aircraft at an earlier stage in the training program.

An operational push that will be fuelled with the further introduction of 5th generation fighters is the need for pilots that are primarily 'information managers'. This entails increased requirements for cognitive tasks such as information handling and weapon system handling, due to increased sensor data fusion and stealth techniques. Moreover, operations with 5th generation fighters lead to more autonomy in the wing man's role, because system capabilities (e.g. data links, radar, IR, EW, AMRAAMs) encourage loose formations.

The probable implications for the LIFT stage of training for pilot of the 4th and 5th generation aircraft, which can be enabled cost effectively through the application of Embedded Training are:

- Downloading part of Qualification Training which is currently done on an operational fighter type, to LIFT aircraft.
- Downloading part of the day-to-day operational training at the operational squadron to LIFT aircraft.
- Through the use of mission-related systems on LIFT aircraft (such as simulated radar), associated qualification training can be performed.
- Application of computer generated forces together with simulated/stimulated equipment in LIFT aircraft enables tactical training to be downloaded from the operational aircraft.
- 5th Generation fighter tasks such as "information handling" and "weapon system handling", and the autonomous wingman can be introduced earlier in the training program on LIFT aircraft.

The application of an Embedded Training System lies in the cost savings that can be achieved through downloading of training tasks. Each student hour on a LIFT aircraft costs approximately one-third of that on an operational fighter type.





When considering the current NATO syllabi, most of the gain of ET can be achieved in the Introduction to Fighter Fundamentals phase. However, most of the training in this phase is currently based on Within Visual Range fighter manoeuvres, for which the ET technologies are not readily available. This relates particularly to in-cockpit projection and display technology (e.g. HMD), and technology that resolves managing a mix of real and virtual visual features. This is an area for further research and development.

However, in future syllabi, it is expected that Training Objectives that were formerly achieved on the operational aircraft during

Qualification Training may be downloaded to LIFT phases. This will only happen when such training objectives can be realised on the LIFT aircraft, which must be enabled by ET technology implementation on the LIFT aircraft.

There is more to gain from ET during the initial training phases than during the subsequent continuation training on the operational fighter type. While initial training will remain based on the live flying experience, continuation training will increasingly be off-loaded to ground-based simulations; hence ET can have a large impact during the live flying phases of initial training.





The downloading of training from operational aircraft to LIFT aircraft offers a potential increase in training effectiveness. The transition of trainees to single-seat operational fighters (where no dual seat training aircraft are available) imposes psychological (e.g. stress) and physiological (e.g. sustained acceleration) pressures that consume the mental resources that are needed for effective skill acquisition. It is sensible to familiarize trainees with these pressures in more appropriate and less costly environments, such as the simulator and the dual-seat LIFT aircraft, which are better suited to instruction and learning. Future initial training syllabi will support a more balanced mix between simulator hours and LIFT aircraft hours, and operational fighter aircraft hours.

NLR and DutchSpace have developed ET for application in operational fighters, which have the actual sensors and weapon systems on-board through the E-CATS facility. However, where LIFT aircraft only have a subset of the real sensors (e.g. data-link, RWR, but no fire control radar) on-board, the NLR/DutchSpace approach can be extended with additional simulation capabilities, for example radar simulation.

The introduction of Embedded Training for LIFT aircraft will be focused on enabling the downloading of training from operational fighter aircraft to current and future generations of LIFT aircraft.



Please contact us for more information