Frank Graefe

The Multirole Capability of the EUROFIGHTER Weapon System

The EUROFIGHTER weapon system has meanwhile been operated in the Luftwaffe (German Air Force) for more than six years, with training flights and flight operations in missions having so far been restricted to the air-to-air role. Training flight operations with the EUROFIGHTER weapon system were started in the Luftwaffe in April 2004 with 73rd Fighter Wing "Steinhoff", the central EUROFIGHTER training unit. Two years later operational flights began in July 2006 with 74th Fighter Wing, the first EUROFIGHTER operational wing of the Luftwaffe. There, the EUROFIGHTER has been employed in the air defence role within the scope of the NATO alert/scramble section since June 2008 to ensure the integrity of the airspace over southern Germany. The beginning of flight operations in 31st Fighter Bomber Wing "Boelke" on 16 December 2009 marked another important milestone. In that unit, the EUROFIGHTER will, in the medium term, be employed in the Luftwaffe for the first time in the air-to-ground role. According to present planning the 71st Fighter Wing "Richthofen" and, as the last one of five units, the 33rd Fighter Bomber Wing are going to be converted to the EUROFIGHTER as of 2012. In the five wings to be converted the EUROFIGHER weapon system will then have replaced the MiG-29 and F-4F PHANTOM aircraft in the air defence role as well as most of the TORNADO fleet in the air attack role. At the time of the EUROFIGHTER's introduction the main effort was, conditioned by the program, focused on the air-to-air role. In future, the EUROFIGHTER is planned to be employed in multirole missions with all wings, i.e. both in the air-to-air and in the air-to ground roles.

EUROFIGHTER Program

On 26 November 1997, the German Bundestag (Lower House of Parliament) has approved the acquisition of 180 EUROFIGHTER aircraft. The delivery of the 180 aircraft will be affected in three batches, which can be individually requested for delivery, with the respective further development occurring in several stages. The 1st batch comprises 33 aircraft for Germany. Originally, it included 44 aircraft of which eleven were handed over to the export customer of Austria. Instead, the Luftwaffe will receive eleven more modern, multirole-capable EUROFIGHTER of the 2nd batch with improved functionalities. By this transaction, Austria received its EUROFIGHTERs much quicker and at lower costs. The 1st batch was delivered by March 2008. The 1st batch is planned for an employment in the air-to-air role and to that end it is capable of being employed with the advanced medium range air-to-air guided missile AMRAAM AIM-120B and with the modern air-to-air guided short-range missile

Landing of the first EUROFIGHTER with 31st Fighter Bomber Wing "Boelcke" at Noervenich AB on 16 December 2009. Photo: Bjoern Trotzki

IRIS-T (Infra-Red Imaging System-Tail/Thrust Vector Controlled) as the successor for the AIM-9L. In contrast to the Luftwaffe, the British Royal Air Fore (RAF) has, as a special national solution, already created a first basic air-to-ground employment capability for their EUROFIGHTERs of the 1st batch. This so-called AUSTERE solution allows the employment of the ENHANCED PAVEWAY II (Enh PW II) in connection with the POD-LDP LITENING III laser designator. Following a seven-week test phase in Arizona and Nevada in spring 2008 and the participation in exercise GREEN FLAG WEST with up to ten EUROFIGHTERs and more than 60 bomb drops of Enh PW II and unguided bombs, the RAF has officially declared the multirole capability and the capability for an employment in the close air support role for its EUROFIGHTERs of the 1st batch.

The EUROFIGHTER was originally designed as a pure fighter aircraft in reaction to the threat posed by the Warsaw Pact at that time. With the advancement to a multirole-capable combat aircraft the EUROFIGHTER partner nations have adapted themselves to the changing security parameters and changed operational challenges of modern conflict scenarios and decided on getting an efficiently employable weapon system which can be flexibly and easily used in several operational roles at the same time. The multirole capability is coordinated by four nations and introduced into the Luftwaffe in two stages in 2012 and 2016. The internationally contractual designation for the first phase of the role adaptation is called PHASE 1 ENHANCEMENTS (P1E); the German quota of that is tagged Role Adaptation 1st Stage. In 2004 the German Bundestag has, concomitantly with the request for delivery of the 2nd batch, made the decision concerning the further development of the multirole capability of the EUROFIGHTEER within the scope of the role adaptation. The German Bundestag agreed to the development of the 1st stage of the role adaptation on 29 March 2007. Consequently, the EUROFIGHTERs of the 2nd and 3rd batches are going to be designed for the multirole-capable employment in the air-to-air and air-to-ground roles. On 31 July 2009, the procurement of the 3A sub-batch was ordered by the EUROFIGHTER nations; as to the 3B sub-batch a decision is said to be made by May 2011.

Capabilities in the Air-to-Air Role

Although the main emphasis of the further development of the EUROFIGHTER is presently placed on the integration of air-to-ground capabilities, the air-to-air armament is also intended to be adapted to the requirements of modern air warfare scenarios. As most of the conflicts of the recent past have shown, a favorable air situation, air superiority or, at best, air supremacy is the basic prerequisite for the employment of all armed forces. This precondition applied to both the conflicts in former Yugoslavia and for the Iraq wars. To be able to efficiently act in air-to-air scenarios it is, on the one hand, necessary to use radar-guided missiles with longer ranges than those of the enemy and, on the other hand, jam-resistant and agile guided missiles for close air combat (dog fights) at visual range.

The integration of the AMRAAM AIM-120B air-to-air radar-guided missile of U.S. production, which was introduced into the Luftwaffe for the F-4F PHANTOM weapon system already, was part of the main development contract for EUROFIGHTERs and is possible to be utilized for all batches since 2004. However, due to their age the AMRAAM in the inventory of the Luftwaffe will no longer be possible to be supplied as from the middle of the current decade and need to be replaced in order to ensure the standoff capability in the air-to-air role. Planned for the EUROFIGHTERs of the 2nd batch is therefore the integration and procurement of the METEOR medium range air-to-air radar-guided missile of European production (development by six nations – Great

EUROFIGHTER of 74th Fighter Wing at Neuburg/Danube. Photo: Bjoern Trotzki

Britain, France, Germany, Sweden, Spain, and Italy). In comparison with AMRAAM the METEOR missile is primarily convincing by its ramjet engine which allows it to cover longer distances and to travel them much faster than comparable missiles. With that the effectiveness of the mission of the friendly forces is being clearly increased. The ramjet engine additionally enhances the agility of the guided missile against defensive maneuvers of the enemy – especially in the final stage of the engagement process. The so-called "No Escape Zone" (the distance from which an enemy combat aircraft cannot escape by conducting defensive flight maneuvers) will be enlarged by that. The active seeker-head of the METEOR allows the EUROFIGHTER to break away early after the firing and to evade the enemy threat posed by air-to-air guided missiles. In addition, the METEOR will have capabilities, which will clearly improve the effectiveness of the mission in combine with the EUROFIGHTER. The so-called "Third-Party-Targeting" describes the capability to trace and detect target data by third parties (e.g. another combat aircraft or AWACS) and to transmit them via a network to the firing aircraft, which can then launch the guided missile without own radar information. This option is operationally expedient, if the target information is not available in the own combat aircraft (e.g. because of the flight direction) or if the own combat aircraft is not to be detected by radar emissions. The Third-Party-Data-Link allows the METEOR to receive the target information during the flight from an aircraft other than that of the firing one. The firing aircraft could thus break away faster in order to evade the enemy threat. The operational advantages of the METEOR missile have generated interest with numerous potential export customers (among others in Saudi Arabia, India, United

EUROFIGHTER Test Aircraft IPA 4 of the Spanish AF Equipped with the METEOR Air-to-Air Radar Guided Missile.
Photo: Eurofighter Typhoon

IRIS-T Guided Missile Mounted on a German EUROFIGHTER. Photo: Diehl

Arab Emirates). The development of the METEOR and its integration into the EUROFIGHTER are dealt with in two separate contracts. Due to difficulties in the provision of a EUROFIGHTER the METEOR development was effected on British TORNADO and Swedish GRIPEN aircraft. The challenge for the EUROFIGHTER nations is now to bring the separate developments and integration together again.

As for close air combat at visual ranges, all EUROFIGHTERs beginning from the 1st batch have the capability for an employment of the 27mm internal gun, the AIM-9L short-range air-to-air guided missiles, and the modern IRIS-T. The IRIS-T has an efficient seeker-head, a large oblique angle, high agility through optimized aerodynamics, and thrust vector control as well as a high antijamming capability against deception measures in the electrooptical field. With the available and future-planned air-to-air armament the EUROFIGHTER is well equipped for missions in the air-to-air role; there is no further demand for action.

Capabilities in the Air-to-Ground Role

The capability for an effective engagement of a broad target spectrum is ensured by the integration of suitable air-to-ground armament. The effect against military targets must be possible to be achieved by minimizing friendly losses (inter alia by standoff capability) and avoidance of unintended (collateral) damages (inter alia by precision capability). A loading with different effectors for a mission allows to successfully engage several diverse targets per sortie with one mission-optimized weapon mix. The integration of an all-weather-capable precision armament for short ranges will be realized with the 1st stage of the role adaptation. According to the present state of planning the standoff capability is going to be achieved with the 2nd stage.

In the first stage it is intended to integrate as of 2012 the GUIDED BOMB UNIT (GBU)-48 (formerly designated eG-BU-16) as all-weather-capable precision armament for combating ground targets at short ranges. The GBU-48 consists of an MK 83 effector (450 kg with an explosive mass of 202 kg), which is already available in the Luftwaffe; an Enh PW II guided system with dual mode (GPS-assisted inertial navigation and laser), and an FMU-152 A/B bomb igniter/fuse. The Enh PW II guided system is modularly designed and consists of a guidance and control unit at the head of the weapon, a wing assembly at the rear end as well as of an integrated terrain clearance sensor. The GPS-assisted inertial navigation allows the Enh PW II guided system the precise and effector-oriented engagement of stationary (fixed) ground targets in all weather conditions and at any time of the day. With the laser seeker-head it is also possible to combat moving targets.

The LASER DESIGNATOR POD LITENING (LDP) III, which has already been introduced for the TORNADO aircraft, will be integrated as an electrooptical laser designator for marking ground targets. Targets are also possible to be marked by other aircraft and by ground-based forces. The LDP also provides the possibility to acquire targets from medium altitudes, to visually identify them, and to determine their coordinates – also in cooperation with ground-based forces – in order to reduce the danger of a false target acquisition. When dropped from the EUROFIGHTER the GBU-48 travels by means of inertial and GPS navigation to the programmed target coordinates. If the laser seeker-head acquires in its final approach a target marked by a laser, it will then take over the control of the effector and guides it into the designated target. Should the laser seeker-head not acquire or even lose its target designation, the system will use the GPS target coordinates programmed in the mission planning or in the cockpit and guide the weapon into the target by applying that data.

In the past it was possible to a very limited extent only to employ weapons against the planned target with the fuse setting chosen on

EUROFIGHTER IPA 3 in a Test Flight with 4 x Paveway II, 4 x AMRAAM Air-to-Air Guided Missiles, 2 x IRIS-T Air-to-Air Guided Missiles, and 3 x 1,000 Liter External Tanks – All from EADS Manching Test Ground. Photo: Eurofighter Typhoon

the ground prior to the launch. The defined effect was thus not possible to be flexibly adapted to sudden changes of the situation. With the introduction of modern weapons like the GBU-48 the number of the potential attack parameters (speed, angle of impact, delay, etc.) has increased as well. A modern bomb fuse like the FMU-152 A/B allows igniting the charge (munition payload) in conditions, which are variably programmable during the flight (ignition time, delaying time, terrain clearance, etc.) With the possibility of free programmability of the weapons in flight, the operational flexibility and the target-adapted effect are being considerably improved. The EUROFIGHTER can carry up to six GBU-48 bombs under its wings. When equipped with six GBU-48 it is not possible to mount additional fuel tanks under the wings, however. Following the introduction of the GBU-48 the EUROFIGHTER weapon system will, for the first time, achieve the capability to be used for air-to-ground engagement.

The integration of the GBU-48 is the result of the coordination of the four EUROFIGHTER partner nations. This weapon will also be introduced by Spain and Italy – which will lead to an economical sharing of the integration costs – whereas Great Britain has decided in favor of the PW IV within the scope of the P1E. The finalization of the integration of the GBU-48 into the EUROFIGHTER is expected in 2011; after the operational testing and the release for operational use, the GBU-48 will be available to the Luftwaffe as of 2013. Following the necessary training of the crews, the respective conversion of the EUROFIGHTER, and the procurement of the armament, a mission module with the capability to be used for air-to-ground engagement with the EUROFIGHTER will be available as of 2014.

With the orientation towards most likely missions, an employment within the scope of close air support is gaining in significance for the EUROFIGHTER, too. To that end the Luftwaffe plans with a modification of the GBU-48 to introduce as of 2014 the TROJAN IMPROVED PENETRATOR (TIP), which combines an amplified penetration performance with simultaneously clearly reduced explosive power. By this adjusted target effect and the resultant minimization of collateral damages, the TIP is optimized for an employment in close air support in the immediate proximity to friendly or allied ground forces and in urban terrain. Moreover, the TIP would be capable of successfully engage even hardened point targets with its penetrator. The applicability of this TIP potential is presently being examined within the scope of a study. The external design as well as the mechanical and aerodynamic characteristics of the original MK 83 bomb body is being preserved in this modification; additional cost-incurring adaptations of the original integration into the EUROFIGHTER would thus not be necessary. With different variants of the TIP tailored to the intended scalable effect in the target it is possible to enhance the operational options.

Contracts for an integration or procurement of additional effectors for the air-to-ground capability of the Luftwaffe EUROFIGHTERs going beyond the 1st stage of the role adaptation have not been concluded yet. The integration of additional air-to-ground weapons has to be weighed in an all-embracing overall consideration against the capabilities of other platforms, including future unmanned aircraft, and must be coordinated by the four participating nations. For Germany it is essential to study and examine the air-to-ground standoff capability as well as the employment of the EUROFIGHTER in manned reconnaissance with the integration of a reconnaissance pod. The four EUROFIGHTER partner nations have so far not agreed yet on the weapons to be integrated in the 2nd stage of the role adaptation. For the 2nd stage/batch to be delivered in 2016, Spain plans the integra-

In-Flight Refueling of EUROFIGHTER. Photo: Eurofighter Typhoon

tion of a SMALL DIAMETER BOMB with a small effector and a medium range, which might also be of interest for the Luftwaffe. Great Britain is planning with the STORM SHADOW long-range standoff missile and the BRIMSTONE, which is optimized for the employment in close air support. According to present planning Germany is pursuing the integration of the TAURUS long-range modular standoff weapon of which a total of 600 missiles have already been procured and which are presently employed with the TORNADO aircraft. To be able to evaluate the impact of an integration of the TAURUS on the flight control system of the EUROFIGHTER, successful wind tunnel testing has already been conducted.

In addition to the procurement of the weapons described above it is necessary to also adapt the overall system EUROFIGHTER to the challenges of air-to-ground employment. This includes on the one hand the data transmission between aircraft and ground-based forces. For close air support missions both the forces on the ground and in the air are dependent on a quick and error-free exchange of information. In addition to voice communication with its inherent risk of non-intelligibility or misinterpretation one resorts increasingly to radio-based transmission of digitized data (DIGITAL AIDED CLOSE AIR SUPPORT – DACAS). The technical implementation of several options for the EUROFIGHTER weapon system is currently under review. One possibility to transmit text data is the use of an IMPROVED DATA MODEM (IDM). Another possibility for an improvement of the close air support capability of the EUROFIGHTER is the FULL MOTION VIDEO (FMV) functionality of the LDP, which allows video data transmission in near real time to respectively equipped ground receiver stations such as REMOTELY-OPERATED VIDEO-ENHANCED RECEIVER (ROVER).

On the other hand, radar – being the most important sensor of the EUROFIGHTER – must also be adapted to the challenges of modern scenarios. Most of the sophisticated combat aircraft on the world market are equipped with ELECTRONICALLY-SCANNING (E-SCAN) radar. E-SCAN radar offers numerous advantages for the air-to-ground engagement, e.g. larger angle coverage, the detection and tracking of moving targets (GROUND MOVING TARGET INDICATOR – GMT) and the capability to provide two-dimensional images of a terrain sector with a resolution down to the decimeter-wavelength range (SYNTHETIC APERTURE RADAR – SAR). Due to their similarity to photographic pictures these presentations are easy to interpret. They can be obtained independent of the distance in nearly all weather conditions and at night.

The radar data gained in this way can also be fed into the intelligence pool. Just as much could E-SCAN radar be additionally employed for jamming the enemy air defence. A special advantage of the E-SCAN radar for the multirole capability of the EUROFIGHTER is the possibility that the air-to-ground and the air-to-air roles can be used simultaneously. In the air-to-air field the E-SCAN also offers many advantages, such as a higher acquisition range, the potential for multi-target engagement, a higher stability and reliability, an integrated identification capability, an improved resolution to combat targets with small signatures, and an upgraded protection function against enemy jamming measures.

Multirole-Capable Employment

With the aforementioned air-to-air and air-to-ground armament the EUROFIGHTER replaces in its different employment modes several combat aircraft types, which in their specific mission spectrum were restricted to their respective employment role. This allows a significant reduction of the Bundeswehr combat aircraft fleet. With the introduction of the GBU-48 the EUROFIGHTER will, for the first time, be enabled to conduct air-to-ground operations; and as of 2014 it will thus be also capable of supporting ground forces in operations in effective, precise, effect-oriented and rapid ways – also over long distances – within the scope of close air support. In the medium term the EUROFIGHTER will thus become the mainstay for air attacks. In future, all EUROFIGHTER wings will be capable of conducting multirole missions. A prerequisite for that is the information superiority, which will be ensured by the integration of the EUROFIGHTER into a system for network enabled warfare (NEW). In operational terms, the multirole capability in connection with modern sensors, avionics, and the aerodynamic flight performances of the EUROFIGHTER offers a high flexibility in missions, since it can shift between several employment modes during the flight and thus fly simultaneously escorts against enemy interceptors in air-to-ground missions. This results in economies with the forces needed for the accomplishment of the mission; mission contingents are possible to be reduced and the economy and efficiency in missions increase. Additional economical advantages evolve in the fields of technical-logistical support and training.

By taking account of the already available capabilities it must be the goal to further develop the multirole capability in international coordination within the scope of the 2nd stage of the role adaptation, e.g. with the employment in manned imaging reconnaissance by use of the RECCE LITE reconnaissance pod already introduced for the TORNADO aircraft which delivers digitized reconnaissance results in near real time. This would allow the EUROFIGHTER to simultaneously make target and post strike analyses of the mission during an air-to-ground employment and thus to economize on additional reconnaissance forces. ■

By LTC (GE AF) ***Frank Graefe****, Assistant Chief of Branch, Air Staff.*