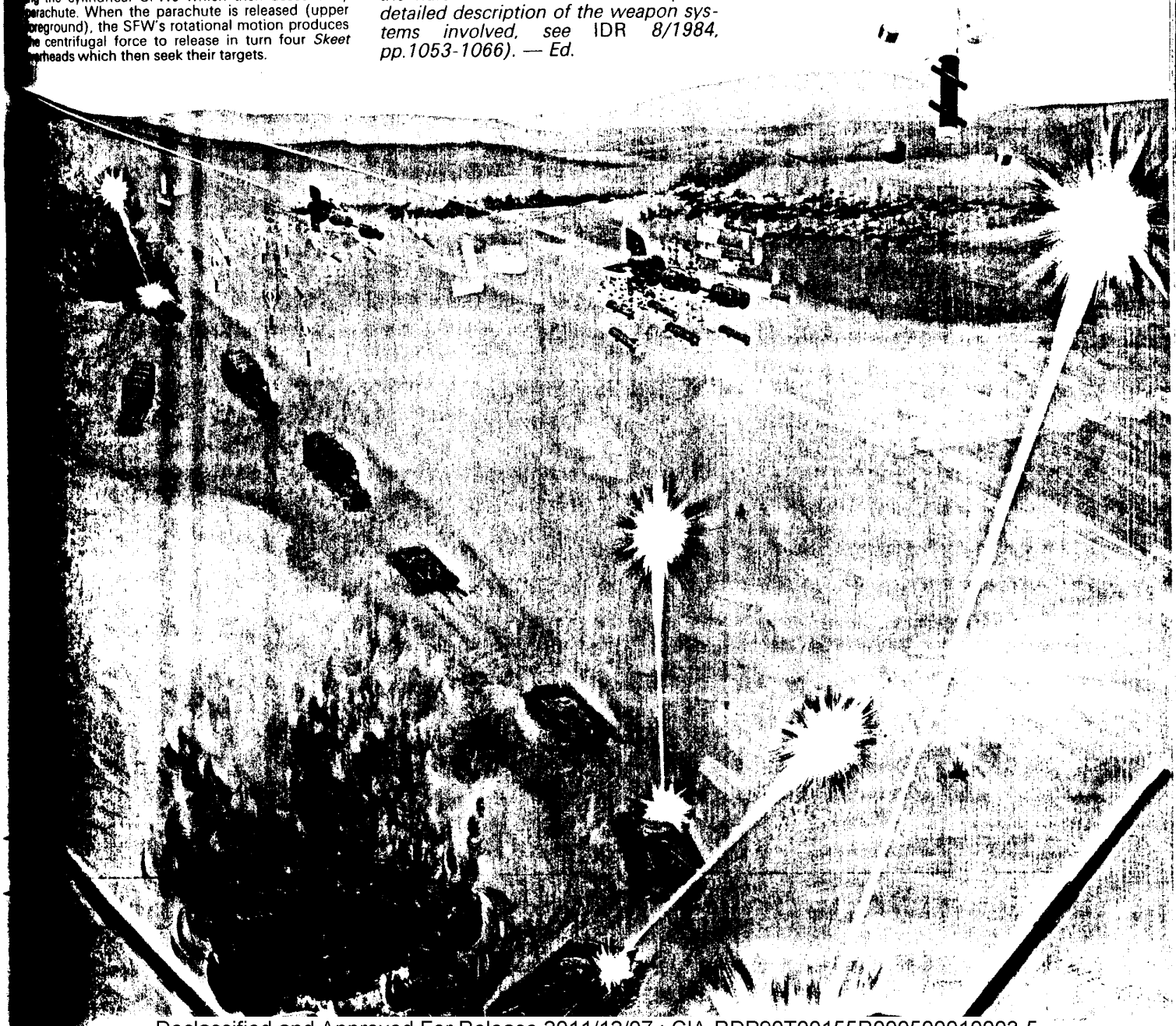
Emerging Technology for Conventional Deterrence

by Dr James A. Tegnelia

Strengthening NATO's conventional capabilities has been a continuing Reagan administration priority. Presented as a way to prevent the nuclear escalation of a military conflict, it relies on the development of so-called "emerging technologies" to produce conventional weapon systems which will provide a deterrent to a non-nuclear Soviet attack. The US has already adopted the AirLand Battle doctrine to exploit these technologies and now NATO has adopted the "follow-on-forces attack" (FOFA) concept which can apply these technologies to extend the battlefield towards the enemy rear. The two are said to be compatible, but not identical. The AirLand doctrine pertains to US world-wide commitments. FOFA overlaps with it only as concerns the deep battle in Europe. In the following article Dr James Tegnelia, US Assistant Under-Secretary of Defense for Conventional Initiatives, explains the rationale behind the new US strategy, the structural changes involved and the status of the hardware connected with it (for a detailed description of the weapon systems involved, see IDR *8/1984, pp.1053-1066). — Ed.*

▼ An artist's impression of a tank battle using sensor-fuzed weapons (SFW) presently under development for the US Air Force. Here Tactical Munition Dispensers (TMD) delivered by aircraft are unloading the cylindrical SFWs which then descend by parachute. When the parachute is released (upper foreground), the SFW's rotational motion produces the centrifugal force to release in turn four *Skeet* warheads which then seek their targets.



The threat

One basic fact concerning the threat to NATO, which has not changed since the alliance was formed, is that, in all phases of conventional warfare, the Warsaw Pact possesses numerical superiority. To overcome this disadvantage, deterrence was provided primarily by US nuclear forces. Later, this approach was changed to a strategy of "flexible response" with deterrence maintained by a combination of nuclear weapons and by high quality conven-

tional forces. In the 1960s, when this strategy was adopted, NATO enjoyed qualitative superiority in all components and, with nuclear weapons, overall force superiority.

Today these NATO advantages have all but disappeared. The Soviets have, at a minimum, attained strategic parity, while gaining numerical theatre nuclear superiority. They have increased their conventional lead by improving the quality of their ground and air forces.

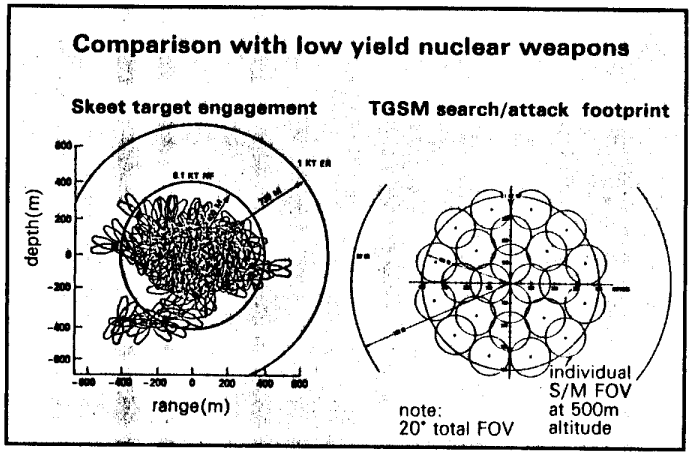
These considerable qualitative improvements include improved ground forces in every category, improved aircraft and advances in tactical missiles. These, together with alarming developments in Soviet small munitions, air defense, and chemical warfare capabilities, negate any edge previously held by NATO. Shorter Soviet system-development times and accelerated deployment of increasingly sophisticated weapon systems, new operational concepts such as the operational manoeuvre group (OMG) and organizational changes, such as the linking of air-support and air-defense missions, are examples of new Warsaw Pact strengths. Under these conditions, and bearing in mind that NATO as a defensive alliance will have to fight outnumbered if attacked, a credible conventional deterrence requires a strategy which overcomes the Pact's numerical superiority on the battlefield by employing new sensors, weapons and munitions incorporating emerging Western technologies.

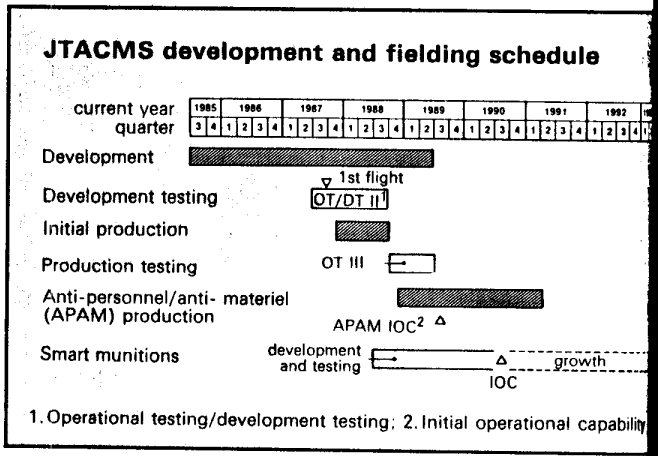
There is little argument amongst analysts that the Soviet Union prefers to achieve its objectives without resorting to war. Equally obvious is the Soviet desire to avoid nuclear war, or at least to restrict the use of nuclear weapons to the lowest possible level. What is relatively new, however, is the Soviet belief that a conventional attack against a nuclear-armed adversary such as NATO could remain a conventional war.

If US/NATO nuclear forces can, as the Soviets believe, be neutralized, the Soviet Union would have the advantage in a short, conventional-only battle [illegible] Europe. The structure and nature [illegible] Soviet military power have been geare[d] to achieving a high level of confiden[ce] in such a conventional offensive. [In] July of 1982 Minister of Defen[se] Dmitrii Ustinov explained:

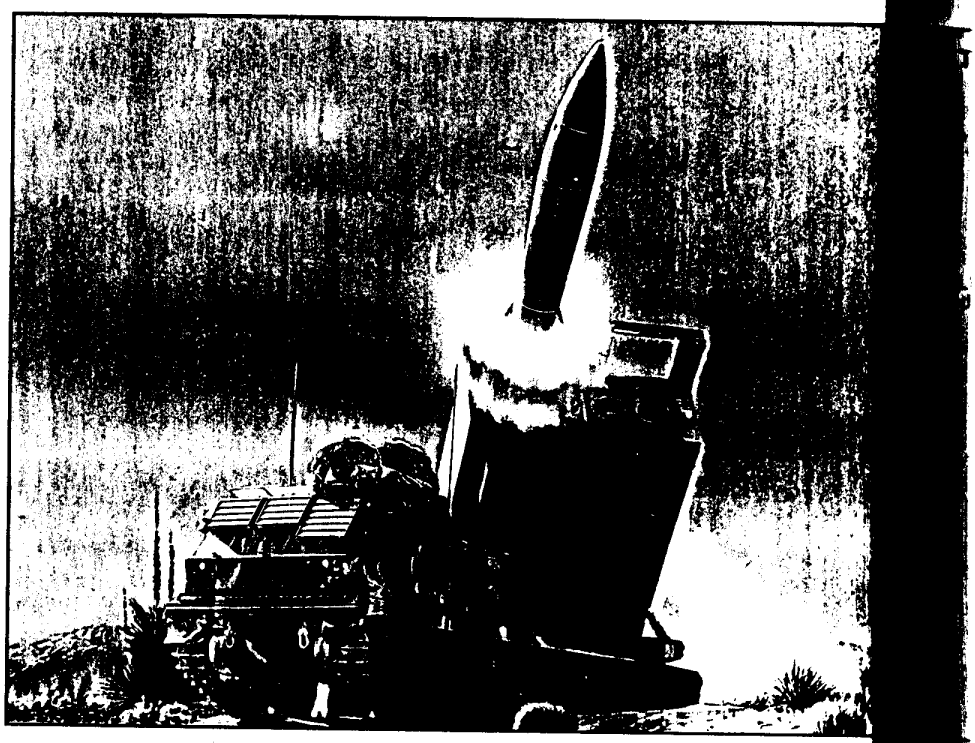
"...this means that now, in the prepar[a]tion of the armed forces, even more a[t]tention will be devoted to the task [of] preventing the development of a mi[li]tary conflict into a nuclear one; a[nd] those tasks, in all their diversity, a[re] becoming an unalterable part of [the] military activities....This establishes a[n] even stricter framework for the traini[ng] of troops and staffs, for the dete[r]mination of the mix of weapons, and [for] the obligation of still tighter control [so] as to exclude non-sanctioned launch [of] nuclear weapons, from tactical up [to] strategic."

The Soviets have designed their o[f]fensive around a concept for rapid a[nd] deep penetration on the ground [by] highly mobile and numerically super[ior] forces. The early application of air su[p]

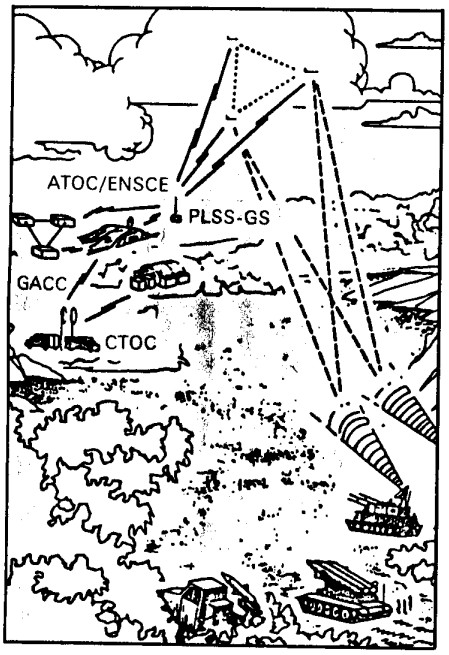




▲ The diagram shows that against certain targets "smart" submunitions can be as effective as low-yield nuclear weapons in hitting a hard-armoured target and cause less lateral damage. On the left, the *Skeet* engagement is compared to that of a 0.1kiloton fission weapon and a 1kiloton enhanced radiation warhead (neutron bomb). Based on a MLRS missile load this represents, however, a greater number of *Skeets* than that demonstrated in *Assault Breaker*. At right is an illustrative TGSM footprint for the same area. The current MLRS program involves less submunitions than *Assault Breaker* and will use hit-to-kill TGSMs.

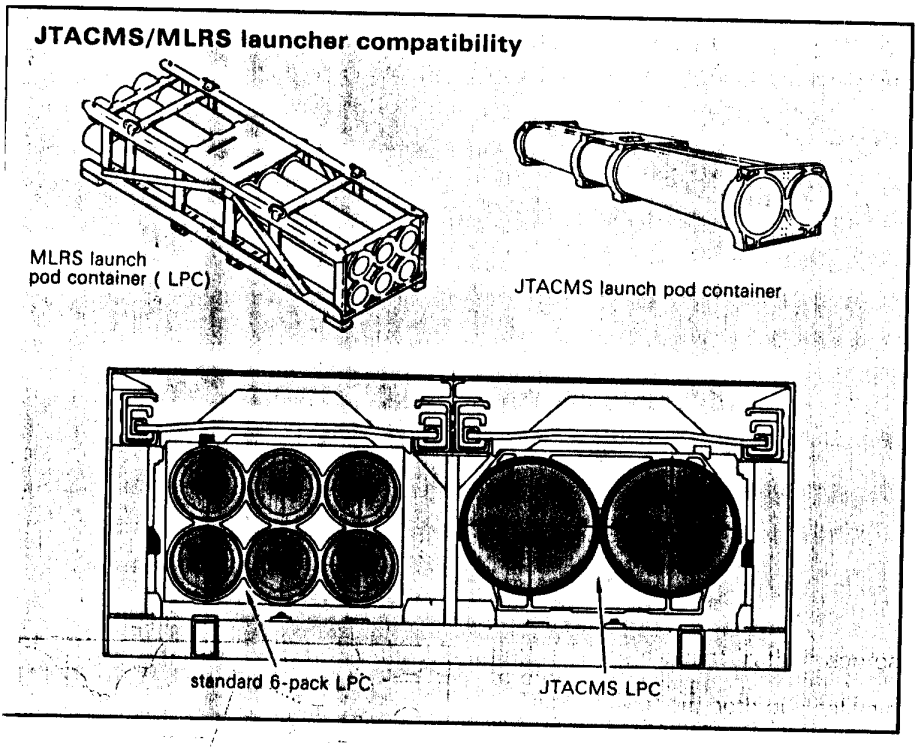


►► The Army has chosen the MLRS launcher for its surface- launched JTACMS and has a pre-RFP out to industry for a missile which must be compatible with the MLRS launcher. This early artist's impression shows a missile similar to a T-22 fired from an MLRS launcher. In all probability the two pod containers would not be side by side in the same launcher as shown, (see drawing at right) but the basic system would be dual capable with individually configured canisters.



▲ The airborne Precision Location Strike System (PLSS) offers an improved capability for locating ground emitters. Data is transmitted through the ground station (GS) to the Airborne Tactical Operations Center (ATOC). Enemy Situation Correlation Element (ENSCE, the Air Force version of the Joint Tactical Fusion Program), the Ground Attack Control Capability (GACC) and the Core Tactical Operation Center (CTOC). PLSS has the potential for real time target location cueing.

◀ The approximate US DoD schedule for the Joint Tactical Missile System (JTACMS).



port is a key element in their approach to ground attack.

Tactical aviation, both qualitative and quantitative, has been improved accordingly. Similarly, the greater range and accuracy of the tactical ballistic missiles, the SS-21, SS-22, and SS-23, have led to the Warsaw Pact being able to strike against NATO deep targets and have enhanced the Soviet potential for the suppression of NATO's air and nuclear assets. Supporting these options, Soviet electronic warfare is designed to introduce critical delays or confusion into NATO C^3 systems which have been carefully studied for vulnerabilities.

The Soviets have made major adjustments in order to achieve by conventional means what they have previously sought to achieve with nuclear weapons. By rapid ground operations, supported by air and tactical missiles the Soviets would concentrate numerically superior forces at critical points, echeloned in depth, to ensure penetration and a sustained advance into the NATO rear areas.

Rapid ground operations

The Soviets have developed the weapons to support these fast manoeuvre elements. Their modern forces have the BMP, improved tanks, self-propelled artillery, and helicopters for command and control, reconnaissance, fire support, and greatly increased mobility of the air-assault component of the force. Moreover, the Soviets now have the fighters, fighter-bombers, and transport aircraft to protect and support their force and to deliver airborne forces for early seizure of primary objectives.

The latest trend in Soviet military thought gives full recognition to the potential of new conventional weapons. Former Chief of Staff Nikolai Ogarkov recently observed: "...rapid changes in conventional means of destruction make many types of weapons global, and permit the sharp increase (at least by an order of magnitude) in destruction... so as to approach in effectiveness weapons of mass destruction. The sharp increase in the combat range of conventional weapons makes it possible for the whole of a country's territory...to become involved immediately in active combat actions."

Soviet air and anti-air operations

An air operation against NATO's air-defense system in Central Europe would employ penetration corridors to reduce aircraft losses.

An air operation, involving massed strikes on the first days of battle, would be accompanied by use of electronic jamming to "blind" NATO air-defense radars and associated communications in order to facilitate the subsequent destruction of NATO air-defense systems by missiles and aircraft. For mobile targets, such as aircraft, which could not be accurately located, tactical air communications with controllers would be jammed. Other targets such as air-defense batteries would be designated for simultaneous jamming and destruction.

Artillery and tactical ballistic missiles armed with improved conventional munitions would initiate the strategic operation and, to the extent that weapon inventories allowed, the Soviets would initially strike an enemy's air defenses and airfields with means other than aircraft.

NATO's response

A deterrent based primarily on a nuclear response has disappeared and probably cannot be realized again.

Is there then any possibility of achieving a conventional force capability to match that of the Warsaw Pact? This would consist of matching the Warsaw Pact gun for gun and tank for tank, requiring, of course, more expenditure on conventional weapon systems and ammunition. Even more serious would be the requirement for a greater number of uniformed personnel, signifying not only more men in arms, but many more US troops in Europe and, given demographic indicators, a return to the draft.

Another option might be to increase the rapidity with which NATO could reinforce its forward defenses. As far as the US is concerned, this would require some increase in uniformed personnel and means for rapidly moving people and equipment to Europe after warning of an attack. Vast amounts of air lift, involving substantial costs, would be needed in addition to much improved air defenses to ensure access to points

of debarkation in Europe and the survivability of air-transported equipment and troops.

Still another option is a NATO offensive strategy. The Warsaw Pact conventional threat could be deterred by the threat of a NATO conventional counter-attack. This suggestion cannot be taken seriously because of the large forces required and the most fundamental point: NATO is a defensive alliance. As such, it is committed to a forward defense in Europe, with sufficient capability to counter-attack only to regain lost territory following a Warsaw Pact attack.

The only viable conventional option is to equip existing NATO forces with modern weapons; weapons which are more effective for all parts of the concurrent echelon battle, i.e. they must be effective for the central battle and for the attack on follow-on forces. This combination of forces is what gives the Soviets their numerical edge.

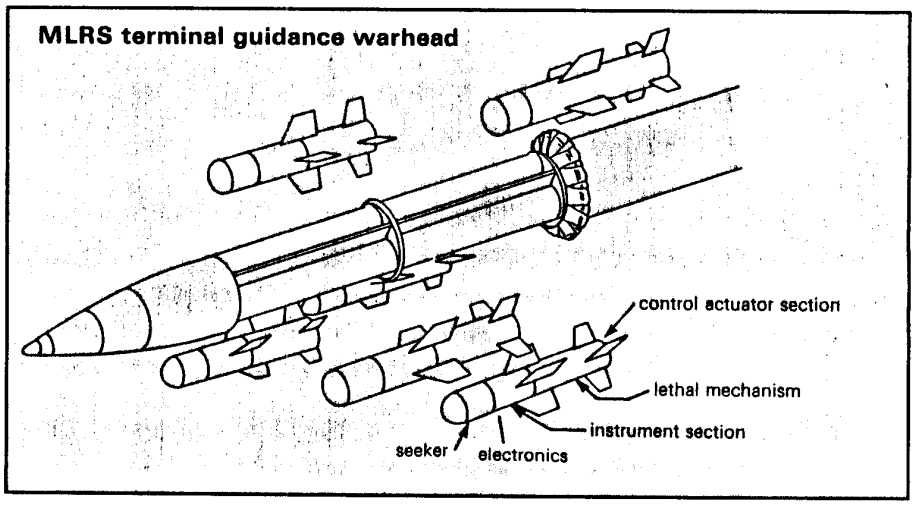
NATO's technological opportunities

Enhanced deterrence from conventional forces in the last part of this century is attainable by putting to use the West's greatest asset, the ability to exploit high technology.

It is true that a great amount of modernization has been taking place. New tanks have appeared in NATO forces, better communications exist, and vehicles, helicopters, aircraft and other weaponry have been added to the inventory. Although these improvements will continue, they will not in themselves redress the imbalance of conventional forces. No matter how good and well equipped NATO forces are, they still stand to be overwhelmed by numerically superior Warsaw Pact forces.

The answer to this problem is partly operational and partly technological. New technologies can improve the capabilities of our forces. Today we have in hand the means for a new dramatic breakthrough in the course of warfare through the exploitation of the microprocessor or chip. The chip gives us the capability to improve our systems greatly. It provides new capabilities for airborne radar and other sensors allowing the acquisition of targets at great ranges with high degrees of resolution. It enables the processing and transmission of intelligence and targeting data with unprecedented speed and efficiency, giving commanders considerable flexibility in battlefield management. It leads to terminally guided submunitions which can increase warhead lethality. In sum, modern electronic systems enable the ground commander to observe and influence the battle at close and stand-off ranges; ranges well into the enemy rear. It brings depth to the battlefield and can enhance the effectiveness of those forces engaged in the close-in battle.

Giving depth to the battlefield means NATO commanders can have the ability accurately to attack Soviet ground forces at ranges from a few to several hundred kilometres; modern weapons can destroy, disrupt and delay forces moving to contact. They can also be used to attack command and control nodes, transportation choke points, airfields and other vital targets. These weapons can be launched either from aircraft or by ground systems.



▲ Technical features of the MLRS TGW

With the ability to attack deep and effectively, NATO forces can, for the first time, offset the numerical superiority of the Warsaw Pact by conducting the echelon battle concurrently with the front-line battle. If NATO can disrupt or delay follow-on forces, it can influence the time and place of their commitment and their combat power. The objective would be to deny the enemy the initiative by undermining his tactical plans and denying him the opportunity to mass at critical points. This can be done by attacking follow-on manoeuvre elements and by going after critical targets whose destruction would impede those elements. In this way NATO forces in direct contact would be facing a level of enemy force against which they could survive and ultimately prevail.

There are critics who maintain that Soviet tactics are changing, that there will be no force echelonment by Pact armies, and that deep-attack tactics are therefore, ineffective. Soviet tactics are in fact changing. The use of operational manoeuvre groups is one example. The Soviets, however, can only bring so much combat power to bear at the front at one time no matter which tactics are applied. In the Soviet rear there are just so many roads, so many bridges, so much bivouac room and so many airfields. Some type of echelonment, some type of follow-on force movement will be necessary to commit such large forces to battle. There will be targets that are vulnerable under any tactical plan.

US AirLand Battle

The United States Army and Air Force are presently engaged in developing joint doctrine designed to exploit these new technologies. In May 1984, the Chiefs of Staff of the US Army and Air Force in a 34-point agreement set the following goal: To provide operational commanders an integrated, capable and flexible air-land battle force for use against an enemy aggressor.

The AirLand Battle concept which is the focus of this new doctrine holds three basic tenets. First, the close battle must be fought and won. The close battle is the traditional battle between manoeuvre forces, supported by air assets and other indirect fire weapons. This battle follows the doctrine of forward defense, denying enemy penetration and holding at the political borders. The second part of the AirLand Battle is the rear battle. In this phase operational commanders seek to protect their rear areas from enemy air and other interdictive forces thereby enabling support of the close battle. The third part of the concept is the deep battle. In this phase, the battle is taken to the enemy's rear by air-launched and ground-launched weapons to engage, destroy and disrupt follow-on forces and other targets previously described.

Pursuant to the new US doctrine, Army and Air Force would jointly fight in all three parts of the AirLand Battle at the same time, making maximum use of available combat power. The US AirLand Battle doctrine, developed for world-wide use, is fully compatible with the concept of "follow-on forces attack" (FOFA) embraced by NATO.

High technology now offers the Army a new role directly in the deep battle. Current doctrine sees the Army influencing the battlefield by deep attacks with air support out to distances approaching 100 kilometres. For the first time, the ground commander will have the capability simultaneously to engage forces in contact as well as follow-on echelons.

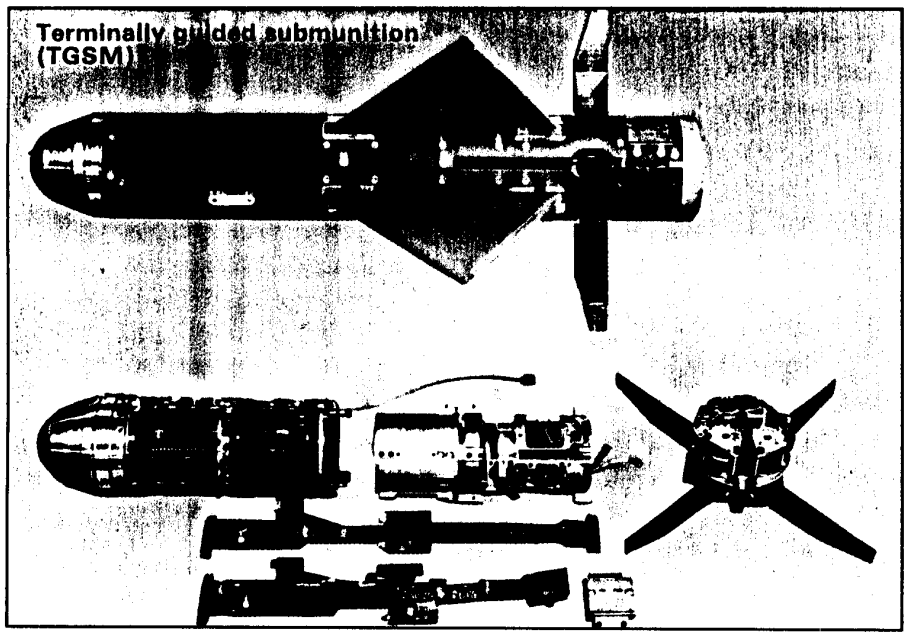
Studies done by the US Army reveal that for the close-in battle, high densities of ground forces will occur on D-Day; they will also occur out to a distance of about 100 kilometres. By D+36 hours, a maximum target density will occur at about 50 kilometres from the FLOT within range of both Army and

Air Force assets. Knowing this will allow for the joint management of the battle and the most efficient use of force capabilities to fight the deep battle. If we can manage an air battle from an AWACS with targets moving at the speed of sound, we should certainly be able to do the same with ground targets moving at 60 kilometres per hour.

AirLand Battle summary

AirLand Battle can be characterized by the following features:

1. An enlargement of the battle space.
2. An emphasis on shared sensors and inter-operability of command and control.
3. Establishment of the requirement for stand-off weapons.



▲ The General Dynamics TGSM used in *Assault Breaker* had infrared guidance. The currently funded TGW for MLRS will use millimetre-wave sensor technology (see *IDR* 2/1985, pp.255-257).

4. Joint doctrine, tactics, training and testing.

Technical Requirements

● *Surveillance:* NATO must detect enemy force deployments and determine intent as early as possible. NATO must be able to assess the situation and, in particular, to determine enemy vulnerabilities. At all stages both classical intelligence means and theatre-level reconnaissance, surveillance and target acquisition sensors will be used to determine the assessment of the situation as well as the location and classification of important targets.

Targets must be classified and tracked in near real time, i.e. with lag times measured in the order of a few minutes. In most cases it will not be necessary to track each target individually. While high value or critical node targets should be detected and located as precisely as possible, manoeuvre units or moving targets should be aggregated into groups or clusters, such as companies and battalions, appropriate for the engaging weapon. Accurate assessment of the enemy situation and the precise location of second echelon targets requires that information from many sensors and sources be available.

The most important new sensors are:

1. Synthetic aperture radars mounted on high altitude aircraft such as the TR-1.

2. Precision emitter-location systems such as the Precision Location and Strike System (PLSS), also carried by high altitude platforms.

3. Moving Target Indicator radars, such as JSTARS, carried on board a C-18 aircraft.

● *Data fusion:* Information from these sensors is correlated at fusion centres that combine all information and provide situation reports and projections to the commander and to his planning staff. With this information, the commander identifies groups of targets for attack by all his available air and ground assets.

● *Weapons systems:* The delivery of weapons or weapon systems to the target is the third important function of deep attack systems. The term "weapon" can refer to a missile that delivers munitions to the target, or it might mean an aircraft that delivers a missile containing submunitions. The systems must be flexible, survivable, and responsive. Flexibility is necessary so that they can be employed in the various theatres in which US forces operate.

Clearly the equipment must be able to survive enemy attack, given numerically inferior forces. In general, survivability can be achieved with weapon-delivery platforms which have stand-off capability. Survivability can also be achieved with platforms and weapons that can operate over enemy territory.

These systems must also be able to deal with short-warning attacks and time-sensitive targets. The Pact forces will attack rapidly and then exploitation units will move quickly to take advantage of the situation. Therefore, all of the functions described above must be capable of being performed quickly and the equipment for "follow-on forces attack" must be closely integrated on the battlefield.

Weapons now in development, such as the MLRS-TGW, can destroy an armoured company in a variety of deployments, from a few to tens of kilometres from the FLOT. Other weapons, such as the Joint Tactical Missile System (JTACMS), will be able to attack a wide variety of targets out to about 100 kilometres.

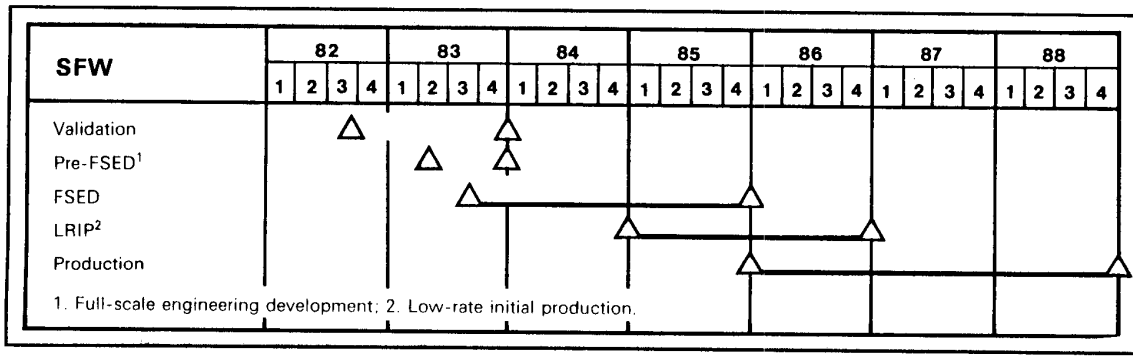
Status of technologies

● *Surveillance:* The TR-1 high altitude tactical reconnaissance aircraft is in production, and first units have been deployed in the European theatre equipped with passive electronic intercept sensors. The advanced synthetic aperture radar for the TR-1 has been successfully developed and demonstrated and is entering production. This long range high resolution radar can detect and classify fixed targets in near real time.

The Joint Surveillance and Target Attack Radar System (JSTARS) radar combines the synthetic aperture, fixed target indication and MTI modes with a weapons guidance mode. These techniques have been demonstrated by two different contractors as part of the US *Pave Mover* program. In tests at White Sands, mounted on an F-111 aircraft, it was demonstrated to have the capability to detect and track armoured vehicle targets in all modes. In tests as part of the *Assault Breaker* program, the weapons guidance mode with missiles and aircraft was also demonstrated. The JSTARS Army and Air Force program to develop an operational system will begin this spring.

● *Data fusion:* The Battlefield Exploitation and Target Acquisition (BETA) system is being tested in Europe; BETA correlates and fuses information from diverse sensors as required for locating echeloned targets. To provide a permanent operational capability, the BETA technology is being incorporated into the Joint Tactical Fusion Program (JTFP). The Army and the Air Force have agreed to the requirements for JTFP and are in the process of combining the Army All Source Analysis System (ASAS) and the Air Force Enemy Situation Correlation Element (ENSCE) programs to develop the operational system.

To facilitate the command and control function in the Air Force, the architecture of the Ground Attack Control Capability (GACC) concept, based on



The Air Force has contracted for the operational development of the Avco Systems sensor-fuzed weapon (SFW) which is now in full-scale engineering development (see *IDR* 8/1984, p.1061), and is said to be in a phase of "technological maturation." Its approximate development schedule is shown in the chart.

existing developmental equipment, has been established. This will make it possible to track and engage time-sensitive targets. The GACC is analogous to the Command and Reporting Center (CRC) presently in operation for controlling interceptors and fighters.

The US Tactical Air Command has developed an operational concept for the GACC which provides the capability to: a) integrate sensor data for attacks against targets in the enemy rear area; b) determine the most effective means of attack; c) draw upon assigned and available resources to attack the targets and d) control the attacks against those targets. The basic structural interface between the Army and the Air Force will be preserved. The Air Force is currently pursuing "modular control equipment " required to build the command and control capability necessary for second echelon attack in coordination with the Army.

● *Weapons delivery:* The technology for weapon delivery systems is mature and has been demonstrated. One system is the JTACMS to be initiated this spring. JTACMS can be surface-launched from a mobile transporter-erector launcher, the MLRS launcher having been chosen for this system.

The technology for precision guidance of such missiles is available and has been demonstrated. Low cost, high precision inertial navigation systems were incorporated into early missiles and flown as part of the demonstration program at the White Sands missile range. The basic navigation systems for ballistic or cruise missiles can be augmented by external means such as JSTARS radar, PLSS or GPS.

For cruise missile delivery systems, a terminal seeker can also augment the inertial navigation system. For some targets, such as hardened fixed installations, precision terminal guidance is important. Terminal seekers are in production for both the US Air Force *Maverick* missile and the GBU-15 glide bomb program. Both man-in-the-loop visual and autonomous imaging infrared seekers are used in these applications.

A wide range of submunition candidates exist, from cluster bomblets to precision terminally guided submunitions. Area bomblets already in the field can be very effective when delivered accurately against many types of targets. Sensor-fuzed munitions, for example, warheads such as SADRAM and *Skeet* fuzed by relatively inexpensive sensors are in development. Sensor-fuzed munitions, accurately delivered, are extremely effective against any target type. These can be dispensed from a variety of air or surface-delivered munition carriers. The most mature submunition concept which has been demonstrated is the autonomous hit-to-kill submunition. Such terminally guided submunitions, after being dispensed from the carrier vehicle, select an individual target within their field of view and manoeuvre to engage these targets selectively.

The terminally guided submunitions, as well as the sensor-fuzed munitions, can employ a number of different autonomous target acquisition techniques including infrared and millimetre wave radars. System engineering factors for employment from a particular dispenser or munition may dictate the submunition field of view or potential countermeasure susceptibility, but the technical capacity is already in hand to make such system-design trade-offs. The technologies involved in these submunitions can also be applied to a wide variety of weapon systems. For example, munitions based on this technology can be launched from any one of many candidate platforms ranging from mortars to cannon or rocket artillery (MLRS), as well as long range missiles (JTACMS) or from aircraft dispensers.

● *Summary of status:* The status of the technologies that form the basis of these new conventional capabilities are as follows:

a) The military concept has been developed and is technically and operationally feasible.

b) The sensors and sensor platforms required to detect, identify, and track echeloned manoeuvre units at short and long range are either in production or under development.

c) Battlefield correlation and fusion of multi-sensor information is being demonstrated in Europe.

d) Air-launched and ground-launched missiles for delivery of weapons to targets in any echelon have been demonstrated and are under development for production in five years or less.

e) Unguided submunitions for large area engagement and destruction of unarmoured and lightly armoured targets are in production in Europe and in the US.

f) Smart submunitions of various kinds have been demonstrated and are either in engineering development or ready for engineering development.

g) Technology for submunition lethality is sufficient for the near term threat, and can be improved to match the evolution of the threat.

Conclusion

There remains the question of whether all these new developments can indeed be funded by NATO members. Although costs of individual systems may be high, all of our studies indicate that resultant savings in conventional ammunition, force structure and logistics assets over the long term will make them affordable. In the report, *Strengthening Conventional Deterrence in Europe* issued by the European Security Study group (ESECS) in 1983, it was estimated that all of the systems described would be developed for Central Europe for about $10 billion.* We estimate that the program cost, including procurement, would be between $20 and $30 billion. This would represent a total NATO cost, stretching over a decade or more.

Modern weapons technologies, including microelectronics, provide us with the potential for improving our conventional forces, thereby affording a higher degree of conventional deterrence.

A few modern conventional weapons can be as effective as one small nuclear weapon. This reality produces the enhanced deterrence. These weapons have been successfully tested and will be deployed to our operational forces before the close of this decade.

The United States military establishment will continue to seek exploitation of the new technologies and will acquire the resulting weaponry. It will do little good for the United States to pursue these new technologies unilaterally. Therefore, multi-national programs such as MLRS-TGW have been established, and the US looks forward to establishing others. ✦✦

* The European Security Study (ESECS), *Strengthening Conventional Deterrence in Europe*, MacMillan Press, London, 1983. The ESECS Steering Group's report considered this estimate, which was contained in a supporting paper, to be a *"minimum"* . The group itself advanced the figure of $20 billion as a median estimate, p.30. – Ed.