



MOVES IN ENGLISH edited by Charles Vasey

ALL ABOUT AIR WAR

by Gray Boak

Air War has been amazingly popular — and, with the Update, still seems to sell well over here. For this reason, and the very nature of the game, I asked Gray Boak for the article that follows. Gray used to write fine articles on various air-games in my magazine, *Perfidious Albion* (advtd.), based on his job which is “something” at British Aerospace where they make Tornados. The result is, I hope you will agree, both challenging and interesting. Dave Isby, who was visiting over here to take in Farnborough Air Show, attached his comments. I am sorely tempted to dig my old set out and once more climb into the gleaming cockpit of my Sabre, and head out to duel with MiG’s. Can we hope that the following discussion may lead to *Air War II*?

— CHV

The arrival of the Revised Edition provides a welcome opportunity to study *Air War* again. Criticising the game is rather akin to criticising the Spitfire in 1940 — it may not be perfect, but it is the best we have got. Yet not even the Spitfire achieved perfection. Could it have better guns? Could it fly further? Could it carry bombs? Some of these changes were brought about, but other proved unattainable for the basic design.

So what could have been done with *Air War*? Minor niggling little changes tend to be open to opinion — or alternate data sources. For example, my Tornados carry ARM’s. Major changes can be plugged into the rules as they stand, such as my later suggestions for the Turn Modes. Even so, there are major flaws so firmly embedded in the game mechanics to require a disproportionate amount of work to improve, and it is better to wait for another game to appear. I feel that the climb rules are the worst offenders here.

To the contents of the expansion. There are three new manoeuvres: Diving Vertical Roll, Climbing Vertical Roll, and Horizontal Break. The Air-to-Ground rules have some very welcome extensions — those bombs do fall forward — and there are 14 new aircraft types: Hunter, Meteor, Harrier, Lightning, Mirage F, Draken, Viggen, A-6, F-100, F-104, F-106, F-8, Su-15, and MiG-19/F9. This last should be F-6bis or even A-5, but one problem with modern games is that fresh information will keep appearing! Special rules are provided for the F-8, F-4, Kfir, Foxbat, and Harrier. Fourteen specific historical scenarios are new, and two generalised scenario-types. In addition, you get rules for air-launched cruise missiles, nuclear-armed Air-to-Air missiles, and extra details for ECM warfare. The Addenda are

basically those published in *MOVES*, but there are some additions, omissions, and changes.

How does the game work with all these changes? Is everything on the hexes now crystal-clear, with no room left for improvement?

Two tanks sit, one on each side of a small bridge. Some 3000 feet above them, two F-5E fighters orbit lazily. Let us not be too precise just where we are geographically, for two Harriers at 250 feet are about to shatter this rustic scene. Both carry Sidewinders to match F-5’s, but whereas one carries 2 x 1000 lb bombs, the other has two Matra rocket pods. This one opens the action by ripple-firing both pods at the second tank, and turning away towards the F-5’s.

As the other heads towards the bridge, the F-5’s split, one diving to cut across the bomber whilst the second accelerates to a head-on pass with the rocketeer. They are face-to-face, cannons twinkling, then shoot past each other. The bombs fall towards the bridge, then the Harrier jinks left and right, the F-5 slides in front of him for a point-blank high-angle-off shot and one F-5 is blown to pieces.

One bomb falls wide, 2000 feet from the bridge, the other slap on target. The bombing Harrier heads for home. The surviving F-5 has banked to the right, hoping for a rear attack on this Harrier, but the rocketeer has hauled his nose up and around, swivelled his nozzles down and whipped around to his left. The Harrier staggers in the sky, speed almost all gone, but the F-5 is well placed for a Sidewinder. He twists to the right and the missile flashes past his side, but he has crossed the nose of the accelerating Harrier, and two Adens score again!

250 feet is the lowest altitude allowed in the game — RAF Harriers would be at 50 feet dodging around and amongst the terrain. Such detail would be difficult to handle without more work than is desirable — perhaps we should press for transparent hex-sheets so they can be overlaid on an Ordnance Survey map? *Air War* is, as always seemingly, an air-to-air game where all the air-to-ground rules have been added as an afterthought. This is understandable, but it does lead to some curious simplifications.

There is no finesse in the Scatter of Munitions rules. Whether from 50 feet or 50,000, the bombs scatter to the same extent. In the last scenario, note the amazing achievement of having one bomb hit and

another miss by 2000 feet. Perhaps I am misinterpreting the rules, and should count the two bombs as one attack, thus either hit or miss, but not both. Mea Culpa. The reader may well wonder just what I am talking about, as there is no Scatter of Munitions Table provided. I used the play-test version, and append it to this article.

MUNITION SCATTER DISTANCE TABLE

DIE	ACCURACY MULTIPLE				
	½	1	2	3	4
1	1	1	1	1	1
2	1	1	1	1	2
3	1	1	2	2	2
4	1	1	2	3	3
5	1	2	2	3	4
6	2	2	3	4	4
7	2	3	4	4	5
8	3	3	5	5	5
9	3	4	5	6	6

Modifications:

If the range (in hexes) from the release hex to the target’s hex is over 30 hexes (6 hexes for rockets), add 1 to the die roll.

If the range is over 60 hexes (9 for rockets), add 2 to the die roll.

If the range is over 90 hexes (12 for rockets), add 3 to the die roll.

However, my one 1000 lb bomb only gained a probability of 4 for the bridge’s destruction. What is this bridge, the Paul Doumer? I was imagining something a little smaller. Surely a better measure would be a totting-up of hits; e.g., a small bridge requires a single hit of 1000 lb or two of 500 lb, a medium requires a grand total of 4000 lb worth of hits....and so on.

I was not pleased with the rocket attack, either. There is no differentiation between rocket pods, so that a pod with 4 Zunis counts the same as a Matra pod with 17 smaller rockets. Yet a rocket attack can hit four targets in one hex — that’s purty fancy shootin’ with your four Zunis, pardner. Air-to-Air unguided missiles are allowed one “attack” for every eight missiles, which might have been a useful rule to carry across to the Matras, giving two attacks per pod. By

analogy, this would permit two possible hits from a 4-Zuni pod.

No allowance is made for carrying armour-piercing rather than high-explosive heads, and there is no spotting modifier to simulate the bright flashes of rocket launching, a +7 modifier? Whilst we are on the subject, one Lightning option is for the fitting of retractable rocket pods in the nose. [Never used! -DCI]

Of course, the F-5 player really blew his defense. He should have been a lot higher, allowing him to Split-S onto the tail of the Harriers as they try to escape. Given such limited warning he could not possibly have intercepted the intruders before their strike. (And I should hope not! The entire scenario was set up in order to play the bombing rules.) It is just as well that he chose F-5's; had he chosen Skyhawks, he would have discovered that SPI had omitted the cannon type from their revised gunnery tables. I append that, too.

Cannon Type J						
2x20mm Mk 12 (Skyhawk)						
FIRST DIE	SECOND DIE					
	1	2	3	4	5	6
1	E	1	1	1	1	1
2	1	Ef	1	2f	2	2f
3	2	2	E	2	2	2
4	3	3f	3	Ef	3	3f
5	3	3	3	4	E	4
6	4	4f	4	4f	4	Ef

It is not the fault of the F-5 player that there are no psychological rules in the game. No one ever breaks away from a head-on pass, no one is ever put off his bombing aim by worrying about the presence of enemy fighters. There is room for some useful extension of the Ace/Novice/Turkey rules.

The head-on pass was useful to demonstrate the VIFFing (not VFFing) rules, in this case **104.42: Pitch and Roll**. Note that VIFF does kill movement, and quite rightly, but does not cost Movement Points in the turn used. I should really have hit him with that Sidewinder, but it all worked out in the end. It does seem to me that the standard Harrier (non-VIFFing) is rather too good at turning, the original being less renowned than other aircraft in the game with similar Turn Modes. I would increase the Harrier by one throughout and see what happens then. Discover the need for VIFFing!

However, VIFFing is hardly the magnet for Heat-Seeking Missiles that it appears in the game. Harriers do not have reheat, and hence should never count as High Heat-Emission Signatures. Abandon the first part of Case **104.46**. Indeed, in trials against the Skyhawks around Beaufort, it was found that the AV-8A was more difficult to pick up on the Sidewinder's seeker. In turning manoeuvres, the exhausts were shielded by the wing, and the "cold" blast from the front

nozzles were covering up the "hot" blast from the rear ones. Thus, a Skyhawk's tailpipe could be picked up with the Harrier some (say) 45° "behind and up" whereas you had to be "behind and below" the Harrier to register. This can be codified as follows:

"The Harrier counts as having a Low Heat Emission Signature to an attacking aircraft which can see a partial or total upper plan view of the Harrier."

Harriers are fun to play with, particularly as they are quite accurately treated in the Munitions Characteristics Table, otherwise a bundle of laughs. A CF-104 with 41 x 1000 lb bombs is surely a misprint crying out for a caricaturist, the Viggen's inaccuracy with napalm equally misprinted, but why should the Harrier, A-6E, (B-1!), and Viggens be superior with bomblets? Why are certain aircraft without ground-attack sensors rated highly? [Bomb systems or good weapons platforms. —DCI]

This last question is easy to answer, and draws attention to a consistent bias in the game. The "certain aircraft" are those terrible twins, the F-14 and F-15. That these are excellent in their specific roles is generally agreed (not without certain qualification...), but this does not make them all-round marvels. Certainly the low wing-loading and total lack of appropriate avionics make the F-15 in particular a real pig in Air-to-Ground work. Reduce those over-rated values. More generally, Russian aircraft are automatically inferior to their US counterparts, and somewhat curious in themselves, a MiG-17 being more accurate than either a -15 or -21. A MiG-27 is suitably accurate (did that admittance hurt?), yet a Flogger-D is feeble. Sorry folks; even on your charts they are *the same aircraft*. Russian aircraft never carry napalm, presumably in accordance with some Geneva Convention that the West ignores?

Further, why cannot the Tornado carry ARM's? It is not Russian. Incidentally, Tornado also has a Laser Target Designator, and as L'Armee de l'Air Jaguars have one, it is a pretty safe bet that ground-attack Mirages will do shortly, if not already. Swing-wing Su-17's, not included in the game but readily modifiable, also do and we can reasonably assume all 1980 fighter-bombers will have it as an option. Ditto flares, chaff, etc. — the "etc." being the interesting part. Enough of this; back to the glorious knights of the air....

 The Starfighters were at 35,000 feet when they saw the two Harriers at eleven o'clock, heading away some thousand feet below. The lead Harrier had already seen the enemy, and as the F-104's dived down, he turned his formation into them. His number two failed to see the first F-104 as it shot past him, abandoning its spoiled pass, but the second Starfighter was given a good Sidewinder shot. The Harrier rolled towards the attacker and VIFFed to swing its tail away, but the Sidewinder homed on the jet plume and its proximity fuse took care of the rest.

The lead Harrier had followed the first Starfighter into its dive and managed a Sidewinder shot, but by diving hard and doing a

diving vertical roll, the enemy escaped. The second F-104 had failed to obtain another firing position so unloaded and headed to join the leader. The Harrier VIFFed, pitched down and swung into an ideal firing position — but the missile hung up.

A very educational game. Good tactics by the Starfighters, but luck was definitely on their side. The unsighted Harrier could have managed a missile shot at the overshooting lead, and a misfire is bad luck in any language. However, the first Harrier shot was avoided because of a gap in the rules.

The Starfighter was diving steeply, with a Sidewinder following him down. He did a Diving Vertical Roll, thus rotating his rear three arcs away from the missile, resulting in the missile being unable to track. Obvious on the board, but visualize it in three dimensions. Going straight down, his jet plume is pointing straight up. If he rotates 180°, so what? A missile diving on him will still keep tracking. Tracking cones vary depending upon whether the missile is climbing or diving (**14.16**) and it seems to me that the rear cone of the aircraft, which the heat-seekers home on, should be considered in a parallel way, pointing up when the aircraft points down.

This will introduce another complication, namely that some missiles require a "blue-sky view" in order to work. Randy Cunningham may fire a Sidewinder at a truck in North Vietnam (and how cost-effective is that a way of waging war?) yet Red Flag Aggressors suffer surprise kills because of needing to see "blue sky" and forgetting their target's pal a few miles aft.

I suggest separating early missiles from modern ones — the early ones need to be fired at a target on the same level or above, the later ones can be fired downwards. This will be true for Radar-Homers as well as Heat-Seekers. How to define "on the same level" more precisely may be a problem: should a difference of one level be enough? I would say yes, but if you want a more relaxed requirement, then how about this: draw a straight line between attacker and target, allowing for height drop, extend this line until it hits the ground. If the range to the ground is greater than that which the missiles may travel in the game, then the missile can be fired at the target.

Flying the F-104 against the Harrier does point out a curious anomaly in the acceleration tables, in that the Harrier is far superior. First thoughts were to improve the F-104, yet compared to other aircraft in the game, it seems less unreasonable. It still should be improved, perhaps by adding 1 for all altitudes, increasing 1/2 to 1. The Harrier remains the fastest accelerating unre-heated aircraft in the game, flattering if justifiable. But bear in mind the astonishingly low values given to the Lightning. Far too low: treat as the Starfighter and add 1, taken from the over-rated Super Sabre.

More generally, the Acceleration Tables fail to allow for the great difference between re-heat on and re-heat off, largely because

the Throttle Setting subsumes two different activities, the engine acceleration and the aircraft's "True Movement through the Air," Movement Allowance being the horizontal component of this "True Movement." In combat, it is considered a good idea to "set the throttle to the firewall and leave it there" (let us not worry for the moment just where the firewall is on a jet fighter), but even so, re-heat is switched on or off as required; e.g., to remove obvious smoke trails from Phantoms, but re-heat-on time is kept to a minimum because of excessive fuel consumption. It is fair to add that few games of *Air War* ever last sufficient time to make fuel use significant, and no doubt this was well considered in the design stage.

Fighting at the higher altitudes of the second game, the difference in turning capability was noticeable. The Starfighter was noticeably pathetic — believably so. The Harrier was little changed from the lower level, and this is certainly wrong. *Air War* was criticised because the aircraft turned too fast, a criticism with which I heartily concur, at least in part. To correct this, the Turn Mode/Point Translation Table has been changed. The two best modes, 1 and 2, have disappeared. The new 1 is the old 3, 2 the old 4, and so on. This is undoubtedly the easiest answer, needing the least work, for there is thus no need to renumber every Performance Chart.

Unfortunately, this correction is totally misfounded. (It is worth pointing out here that many Performance Charts were modified anyway. Mistitling was corrected, and extra variants added. The buyer is still left to add 2 to "Game-Turns in climb before making Immelmann" on every Performance Chart. Personally, I just add one.) The major flaw with the turn mode was not that of overall values, but the lack of adequate variation with altitude. The variations with Mach Number has been caught quite well, but too many aircraft turn just as well at HI altitudes as at LO. Remember that aircraft have no sustained turn rate at their maximum altitude — all their thrust and aerodynamics are going into keeping it up!

Compare the turn modes for Harrier and Starfighter at Movement Allowance 4:

	LO	ML	MH	HI
Harrier	2	2	3	3
F-104	6	8	9	12

The Starfighter is believable; indeed, with the revision, even pessimistic. My original idea for correcting Turn Modes was to add 1 for ML, 2 for MH, and 3 for HI, making the Harrier (remember early comments):

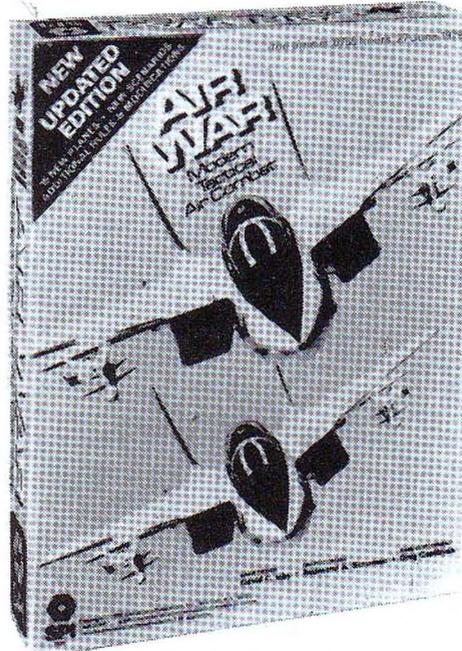
3	4	6	7
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but the Starfighter would be devastated by such a rule applied to the revision.

The new modes are undeniably too low; the F-4 was well matched, at sea level, by the original LO levels. I suggest varying the values by using the *old* table at LO, the new one (old +2) at MH, an intermediate at ML, and a (new +1) at HI. This returns the low-level game to its original, faster pace.

Beware! A few aircraft are already quite well matched for altitude variations, namely F-104, Su-19, and MiG-25. Others seem a little "half and half," e.g., F-105, A-7, F-111, and Su-7. Use your own judgement there. I suggest adding 1 to ML and MH, and 2 for HI for these.

The surviving problem with the Turn Modes is inherent in the system, rather than the numbers plugged into it. The player must sacrifice Movement Points for Turning, and when steadily turning, this does severe damage to a realistic simulation. Consider two aircraft with Movement Allowance 10, Turn Mode 10. One moves straight ahead, the other turns as hard as possible. After one game-turn, both are still pointing in the same direction, but they are now 2500 feet apart; one has covered twice the ground of the other. This can be very useful in the game for carrying out an overshoot, but it does seem exaggerated. How to correct this without major game re-design, I cannot say.



Two Foxbats crossed the border, high and fast, one rapidly outpacing the other. Ground Control passed the word to the Phantom CAP, sitting on their perch over the "sensitive" industrial site. One Phantom clawed for local altitude, the other raced away towards the border. Cockpit warning lights flashed as radar beams searched, crossed, flickered, seeking an elusive contact for a firm lock-on.

The lead Foxbat swept past 'way overhead, flying a gentle curve over the site as the Phantom struggled upwards, rolling as he climbed to keep the Foxbat in contact, but impotent through lack of height. The second Phantom was closer as the recce Foxbat rushed back across the border, but his missiles lacked both range and speed.

That evening, as sensor records were displayed at the United Nations, two F-15's flew into the forward base.

The problem with playing *Foxbat and Phantom* (what a great name for a game!) is

that the Foxbat player can sit so high and so fast that the Phantom just cannot play; from his ceiling, his missiles cannot reach the elevated MiG. This does not make for a good dogfight, but *Air War* aficionados will have recognised the Photo-Reconnaissance scenario, shorn of a few irrelevant — for my purpose — fighters. This would make a good solo scenario, with the lone recce Foxbat flying an optimum path, and various Western fighters/tactics being tried against it.

Three days later the F-15's had their turn. They did manage several missile shots (none successful) and tangled with the escorting fighter Foxbat. Improved tactics would give the F-15's a very good chance. On this level (pun intended) *Air War* is both (superficially) a good simulation and an enjoyable game — if you happen to like long drawn-out games decided by a few die rolls in the final turns, and heaven help you if you did something wrong 20 turns back.

Minor points first: the Phantoms were carrying Shafrirs and early Sparrows. I was surprised to learn that both were credited with the same range. No way! Shafrir is listed with the late Sidewinder, all credited with an extended range. Whatever the improvements to the Shafrir's seeker, it is normally regarded as a slot-range missile, at times, quoted as even shorter-ranged than the early Sidewinder. I would suggest reducing the "Turns in Flight" for the improved Sidewinder from 6 to 4, and the Shafrir to 2. Any larger makes an unreasonable comparison with the Sparrow, early and late. Perhaps the Sparrow should be extended, certainly so according to some sources, but missile performances are notoriously difficult to find, unreliable, and dependent on many other factors.

When doing steep climbs, particularly Vertical Rolls, remember my comments about Tracking Cones and rear Heat areas. The climb rules, particularly the steeper ones, are where *Air War* moves particularly far away from aircraft behaviour.

The basic flaw in the mechanics is a failure to differentiate between two very different ways of gaining height. Conventional aircraft climb at a constant speed by using the difference between (a) the power required to maintain level flight at that speed, and (b) the thrust available at the desired engine setting. This occurs with the aircraft attitude more or less level, and increasing not with climb rate, but with altitude. Alternatively, the aircraft can "zoom" by pulling its nose up, increasing attitude, and trading velocity for altitude by flying a more or less constant energy curve.

The game presents aircraft climbing in series of arcs, Type I, II, and III climbs being progressively steeper, gaining more height at the expense of speed-over-ground, if not speed-through-the-air. This is a compromise between the two kinds of climb, and it creaks. When aircraft such as the F-15 are introduced, with their very high thrust-to-weight ratio, the game has even more problems. These types can stand on their tail and accelerate vertically upwards, at least at low level.

At low and medium altitudes, the game is little damaged by this basic problem, but cannot represent genuine fighter tactics at high altitudes, where the zoom is most commonly used. At all levels of combat, a fighter may desire to gain altitude in return for losing speed. Witness the yo-yo manoeuvre, not particularly well represented in the game. At high levels, for interception, this desire can become paramount. A fighter flying at high speed and high altitude, near its ceiling, can move outside the normal limits of its flight envelope by zooming. As its speed falls, it can reach an altitude considerably above the service ceiling. It will continue to gain altitude at the expense of speed until it reaches such a low speed that it no longer has the control power to maintain a stable position, whereupon it must dive to regain its normal flight envelope. This allows an interceptor to launch its missiles at an overflying bomber (or recce-type) beyond its normal reach.

The technique is also used to capture world records for altitudes and time-to-height. Hence the exaggerated figures often quoted in reference sources for such aircraft as F-15, F-104, F-4, or Foxbat, all aircraft credited with ceilings well above their true service ceilings. As a rough guide, a 1960's fighter will reach 65,000 feet (e.g., F-4), 1970's fighter 75,000 feet (F-15). Count the F-104 as a better-than-average 1960's and the Foxbat as just plain superb.

Zoom techniques are not only used to achieve high altitudes beyond the flight envelope, but also to reach speeds lower than normal minimums. Much research and development work is currently being done on "post-stall manoeuvring," and the current F-18 problems show that answers are far from certain. The game has taken some of this into account; it would take a brave man to lay down the law here.

Nonetheless, some form of zoom rule is required. I suggest using the following rules only for high altitude games, particularly bomber/recce intercepts:

Prerequisite:

The aircraft must be in the best possible Type III Climb. Each turn spent in a zoom the aircraft loses 1 Throttle Setting Point and gains a number of levels. The maximum number of levels possible to gain is equal to twice the Throttle Setting minus twice the number of turns in the zoom. The Movement Allowance is set at that appropriate for the best Type III Climb at the aircraft's Throttle Setting. The aircraft can continue zooming until reaching its minimum Movement Allowance, but once moving above the normal ceiling, the aircraft must either continue zooming or dive to regain the normal ceiling.

Postrequisite:

The aircraft is placed in a Type I Dive. The following turn it must enter a Type II Dive, and the third turn a Type III Dive. All following turns must be spent in the steepest possible Type III dive. On the turn after reaching the normal ceiling, normal rules apply for recovery from dives.

I hope these rules better represent aircraft behaviour, but admit that they are far from perfect. Ideally a set of rules should be produced to accurately represent not only zooms but yo-yo's as well, but the confusion

between Throttle Setting and True Movement hinders all attempts to improvement. To fully "correct" the Climb rules would require major re-writing, as Dave Isby is well aware. Witness the discussion as to whether an aircraft can or cannot accelerate in a climb, as to whether Movement Allowances are completely restored as aircraft reduce from Climb-III to Climb-II, and so on.

Less importantly, many aircraft acceleration tables show a good variation with altitude, but some are much less satisfactory, falling off too much transonically and low-supersonically. These aircraft would run out of fuel long before reaching their maximum speeds (incidentally a problem often associated with the MiG-21, a fighter about which much rubbish has been written!). Many of the early supersonic types have an acceleration "island," where at high altitudes the acceleration capability actually increases above Mach 1 before reducing to zero at the boundaries of the envelope. And for "acceleration" we can also read "climb rate" or even "turn rate," the parameters being intimately connected. Until this physical linkage is paralleled in the game information and rules, *Air War* will inadequately simulate fighter conflict.

It is still the best we have.

ENTER THE ISBY

After reading Gray Boak's article, I wanted to play *Air War*. If combat in the game can be like the battles Gray described, then I did something right back in 1976 when I designed the game.

Gray was a great help in the design of the *Update*, and knows much more about flight and how aircraft behave in the air than I do — I am a lawyer by trade, not an aeronautical engineer. His praise is thus the better received, his criticisms often on target, but I crave your attention to let me explain why I made certain decisions in the design of *Air War*.

The climb system (which incorporates the angles of climb into the different levels of the Type I, II, III system) and the turn system (which incorporated both rate and radius of turn into one turn mode) were attempts to keep the game system simple. At that I succeeded; read rules pages 3 through 16 and you're up and in action. But the compromises I made to achieve this level of simplicity were really, with hindsight, not the best way to achieve my objective. The simplest way in these situations, I have since found, is to present the game as close to reality as possible. The player thus only has to know reality to know the game. *Air War* would actually be a simpler game if abstractions made in the name of simplicity had not been made — and let that be a caution to game designers who tread in the highly technical fields of 20th Century combat.

Any *Air War* replacement should also use a co-ordinate system of representing position, similar to *BattleFleet Mars*, rather than the distortions of hexagons and altitude levels. (I should point out that Redmond Simonsen suggested this before the original *Air War* took shape on paper, but I did not

then realise that, coupled with a separate display to show fine gradations in heading, it was obviously the best way.) It should also deal with knots rather than movement points, "G" forces rather than turn modes, and angle of attack units rather than climb types, the specific rather than the general.

The aircraft performance figures were, of necessity, estimates in many cases. I only had thorough performance envelope figures or "Dash-One" manuals for a few of the many aircraft included. Anyone out there got a spare Backfire flight manual lying around the *dacha*? The degree of information is directly proportional to the accuracy of each aircraft's charts, and my impressions of how each aircraft should perform.

A few other points Gray reaches: sorry for not differentiating air-to-ground rockets. They are supposed to be standard US 2.75" FFAR pods. There just was not room for another chart. Much of my information on VIFFing comes from conversation with USMC aircrew. (The "heat seeking magnet" bit also came from the Marines, obviously not the chaps who flew the tests Gray mentioned.) Bridges can be altered to taste and scenario. I was thinking of something along the lines of the Paul Doumer, the Thanh Hoa, or the Ludendorff bridges. (If you have read this far, I assume you know where they all are.) MiG-17's are apparently more stable low altitude weapons platforms than any other pre-Flogger MiG. Even without VIFF, Harriers have a large SEP (Specific Excess Power) and an extremely good horsepower/weight ratio. Hence good acceleration and manoeuvrability.

In a field where the good is often ignored and the second-rate exalted, I can understand *Air War* drawing flak that no one would bother to direct at other efforts. *Air War* is the best we have, or are likely to see for the near future. I learned much when doing the game, and the next one will be better. I shall give you all this caveat. I cannot include all the data on all the world's aircraft, rocket pods, ECM pods, bridges, ejection seats, etc., without compiling and printing reference tables the size of several *Janes* annuals. Perhaps *Air War* cannot fully simulate modern fighter combat, but to do that you need a multi-million dollar computerized system, such as the one the USAF uses for development purposes. Granted that the state of the art is always expanding, and that improvements are always to be hoped for, but you should not ask a game design to do too much, for this can be as fatal as asking an aircraft design to do too much. An F-15 cannot deliver bombs with the accuracy of a Tornado, nor a Harrier speed through the cold skies of the upper air, contrails streaming, the way a recce Foxbat can. No one expects one airplane to be all things at all times. No one should expect that of a game either, even one as complete, exciting, and admittedly flawed as *Air War*.

(One additional omission deserves correction. Su-15 Flagon-E's use the MiG-25 Foxbat entry on the effects of jamming table. Earlier Su-15 versions use the Su-19 Fencer entry.) ■■