UPDATED AIR POWER RULES PROJECT

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Aims

This project aims to produce updated and rewritten rules for *Air Power*.

Context

At the time of writing, there are several sets of rules available:

– The original rules were published in 1987 in *Air Superiority* and *Air Strike* and extended by *Desert Falcons* and *Eagles of the Gulf*. I understand that a limited number of copies of *Air Superiority* are still available. Nevertheless, these rules are considered obsolete.

– The first-edition *Air Power* rules, with official errata, were published in 1992 in *The Speed of Heat*. There are two sets of errata: one page provided with *The Speed of Heat* and four pages published in *Air Power Journal* #24. Again, I understand that a very limited number of copies are still available.

– There were several proposals for second-edition rules outlined by J.D. Webster mainly in *Air Power Journal* during the 1990s.

– Malcolm Pipes published a set of second-edition *Air Power* rules in 2022. These are available at the airpower email group site. The current text is labeled "v2.4".

Rationale

There is already a set of second-edition rules. Why is the project necessary?

– The second-edition rules do not fully incorporate previous errata, in particular Felix Hack's errata published by JD Webster in *Air Power Journal* 36, and have certain errors.

– Where they incorporate errata, it is often inserted literally rather than changing the text to include the sense of the errata.

– There is no traceability. Changes have been made, but there is no way to see what changed or why.

– There are no internal hyperlinks for cross-references.

– Many of the diagrams have not been fixed.

– I think it would be helpful to incorporate diagrams and tables into the text (and also have them on the play-aid sheets). With printed rules, this separation reduced costs and, to a large degree, was more convenient. When viewed on the screen, these considerations are different.

– The text needs copy editing and could benefit from being rewritten or perhaps reorganized.

– There are few examples or explanations. Indeed, there is little effort to distinguish examples or explanations in the original text.

– The text still refers to pilots, crew, and players using masculine pronouns. That was understandable when the first-edition rules were written, but nevertheless it needs correcting.

Versions

So how do we get there from here? I propose to produce a set of intermediate versions of the rules, each with carefully defined and documented changes. The final intermediate version will contain all rules changes. The last step will be to rewrite and reorganized the final intermediate version to produce a new version.

I use "versions" to distinguish my efforts from the other "editions." Since the versions are a work in progress, they will be distinguished by date.

There are several versions of the rules and play aids, each based on the previous one.

– Version 1A corresponds to the original first-edition rules without the official errata.

– Version 1B incorporates the errata from authoritative sources, including the published errata, statements by J.D. Webster, and Felix Hack's article in *Air Power Journal* 36.

– Version 1C has corrected and redrawn diagrams and incorporates these into the body of the text in addition to the play aid sheets.

– Version 2A incorporates second-edition changes from *Air Power Journal*, email messages from JD Webster, and Malcolm Pipe's second-edition rules. Not all changes have been adopted since some seem to have issues.

– Version 2B has additional minor non-authoritative changes to cover aspects missing from version 2A. This version is in collaboration with Carl Smeaton.

– Version 3A has major non-authoritative changes. Again, this version is in collaboration with Carl Smeaton.

– Version 3B is a rewrite. Certain rules have been rewritten for clarity and conciseness. Parts of the text have been reorganized. However, the meaning of the version 3B rules should be the same as the 3A rules.

Having multiple versions allow us to more easily review changes. For example, the changes in 1B and 2A come from authoritative sources, but the changes in 2B and 3A are from non-authoritative sources.

Which version should you use?

– If you wish to play with second-edition rules with changes only from authoritative sources, I would suggest using version 2A. However, you will miss out on the minor, but non-authoritative, additions in version 2B that cover aspects missing from version 2A.

– If you wish to play with second-edition rules and are prepared to accept non-authoritative minor additions, I would suggest using version 2B.

– I use version 3A/3B, as I consider it has significant improvements over 2B. However, these changes are neither minor nor authoritative.

Products

I produce two PDF files for each version, one showing the changes with respect to the previous version (which aids in understanding the origin of the changes and evolution of the rules) and one clean version (which is suitable for actual play).

Rules Changes

This section describes the rules changes between different versions.

Version 1B

Version 1B is an update to the text of version 1A according to errata from authoritative sources. There are changes to the sense of some rules compared to version 1A, but the changes to the text are minimal. It incorporates the following errata:

– **Change: 1B-credits.**

Additions to the credits.

– **Change: 1B-tsoh-errata.**

All changes in the single sheet of errata included with *The Speed of Heat*.

– **Change: 1B-apj-22-damage-tables.**

The optional advanced damage tables from APJ 22.

– **Change: 1B-original-play-aids.**

All changes to the rules to agree with the original play aids.

– **Change: 1B-apj-23-errata.**

All changes in the four sheets of errata published in APJ 23.

– **Change: 1B-apj-24-play-aids.**

All changes in the revised play aids published in APJ 24.

– **Change: 1B-apj-36-errata.**

All changes in Felix Hack's list of errata published in APJ 36, except for the change to sustained turning being assessed per 30 degrees of facing change, which was later clarified as a second-edition change.

– **Change: 1B-apj-10-qa.**

– **Change: 1B-apj-20-qa.**

– **Change: 1B-apj-21-qa.**

– **Change: 1B-apj-22-qa.**

– **Change: 1B-apj-23-qa.**

– **Change: 1B-apj-25-qa.**

– **Change: 1B-apj-26-qa.**

– **Change: 1B-apj-27-qa.**

– **Change: 1B-apj-28-qa.**

– **Change: 1B-apj-30-qa.**

– **Change: 1B-apj-34-qa.**

– **Change: 1B-apj-35-qa.**

– **Change: 1B-apj-37-qa.**

– **Change: 1B-apj-38-qa.**

– **Change: 1B-apj-39-qa.**

Changes and clarifications from JD Webster's Q&A articles in *Air Power Journal* 10, 20, 21, 22, 23, 25, 26, 27, 28, 30, 34, 35, 37, 38, and 39.

– **Change: 1B-tailing.**

A correction to the rule on tailing following an email message by JD Webster to the airpower group.

– **Change: 1B-missile-launch-speed.**

A missile's start speed on its first game turn of flight is based on the launching aircraft's start speed on the game turn of launch. This was confirmed by Tony Valle in an email message to the airpower group.

– **Change: 1A-identifying-at-night.**

Identifying an aircraft at night requires matching its position, facing, and speed. This appears in the v1 sheets, but not in the v1 rules.

Version 1C

Version 1C incorporates the following changes. There should be no changes to the sense of the rules compared to version 1B.

– **Change: 1C-credits.**

Additions to the credits.

– **Change: 1C-figures.**

All figures have been redrawn.

Figures 2 (the game map), 6 (level flight), 11 (angle-off on a hex-side) have been corrected according to the comments in corresponding the errata incorporated in 1B. Figure 12 (SSGT) now shows a range of 6 hexes. Figure 12 (Genie scatter) now shows the scatter for a Genie centered on a hex and pointing to a hex corner.

All figures have been incorporated into the body of the rules. Certain figures also continue to appear in the play aids.

Reference to figures now follow the pattern "Figure 1" rather than "Angle-Off Diagrams".

– **Change: 1C-tables.**

All tables have been incorporated into the body of the rules and also appear in the play aids.

Reference to tables now follow the pattern "Table 1" rather than "IRM Seeker Head Table".

– **Change: 1C-cover.**

The cover features a USN photograph of an A-7A. This appears to have been the inspiration for the line drawing on the cover of the *The Speed of Heat* rules.

Version 2A

Version 2A incorporates the following changes. There are changes to the sense of the rules compared to version 1C, but these changes come from authoritative sources. The changes to the text are minimal.

– **Change: 2A-credits.**

Additions to the credits.

– **Change: 2A-adc.**

The first-edition F-4B/C ADC is replaced with the second-edition F-4F ADC from *Air Power Journal* 44. Also, an appendix gives instructions for converting ADCs from first-edition to second-edition.

– **Change: 2A-idle.**

An aircraft that selects idle power no longer has its start speed reduced. Instead, the aircraft incurs DPs for normal power plus the additional DPs listed in the ADC. This change is taken from the Origins rules in *Air Power Journal* 39, 41, 44, and 53 and the v2.4 rules.

– **Change: 2A-spbr.**

Similarly, an aircraft that uses speedbrakes no longer loses FPs. Instead, the aircraft incurs DPs up to the value shown in the ADC. If the aircraft is supersonic, the maximum is increased by 1 DP. This change is taken from the Origins rules in *Air Power Journal* 39, 41, 44, and 53 and the v2.4 rules.

– **Change: 2A-fp-to-dp.**

The conversion factor from FPs to DPs for the new idle power and speedbrake rules is 2. This change appears in the Origins rules in *Air Power Journal* 41 and the v2.4 rules.

– **Change: 2A-supersonic-flame-out.**

An aircraft that selects idle or military power at supersonic speeds automatically and immediately suffers a flame-out. This change appears the 1995 GEnie post by JD Webster and the v2.4 rules.

– **Change: 2A-cruise.**

The cruise speed in the ADC is for CL configuration and is 0.5 less for 1/2 configuration and 1.0 less for DT configuration. This change was initially suggested by Guy Acala in *Air Power Journal* 24, and appears in the Origins rules in *Air Power Journal* 44 and 53 and the v2.4 rules.

– **Change: 2A-snap.**

Aircraft and missiles can no longer execute snap turns. This change appears in the 1995 GEnie post by JD Webster, the Origins rules in *Air Power Journal* 41, and the v2.4 rules.

– **Change: 2A-sustained.**

Sustained turning penalties are now assessed per 30 degrees of facing change for second and subsequent facing changes. This change was included by Felix Hack in the errata in *Air Power Journal* 36 but was clarified as applying to 2nd edition rules by JD Webster in the *Air Power Journal* 38 QA. It was included in the Origins rules in *Air Power Journal* 39, 44, and 53 and the v2.4 rules.

For aircraft with low and high bleed rates, the sustained turning penalties are 0.5 and 1.5 DP. This change was included in the "Props against Jets" article in *Air Power Journal* 32 and the Origins rules *Air Power Journal* 39, 44, and 53 and the v2.4 rules.

– **Change: 2A-zoom-climbs.**

The deceleration for zoom climbs (and sustained climbs that gain more than the CC) is now always 1.0 DP per level. See the 1995 GEnie post by JD Webster, the Origins rules in *Air Power Journal* 44 and 53, and the v2.4 rules.

– **Change: 2A-vertical-climbs.**

The deceleration for vertical climbs is now always 1.5 DP per level. See the 1995 GEnie post by JD Webster, the Origins rules in *Air Power Journal* 44 and 53, and the v2.4 rules.

– **Change: 2A-super-climbs.**

Aircraft with a CC of 6.0 or more in a ZC or SC can use one of their VFPs to climb three levels. This change appeared in the 1995 GEnie post by JD Webster and the v2.4 rules.

– **Change: 2A-steep-dives.**

The acceleration for steep dives is now always 1.0 AP per level. This change appeared in the 1995 GEnie post by JD Webster, the Origins rules in *Air Power Journal* 44 and 53, and the v2.4 rules.

– **Change: 2A-unloaded-dives.**

The unloaded dives rule is changed to follow the Origins rules in *Air Power Journal* 44 and 53 and the v2.4 rules.

The proposed wording is not completely clear, and in an attempt to state the rule more clearly, it is extended to note that the VFPs are unloaded, too.

Two things seem unsatisfactory. First, with this rule, unloaded dives do not give any advantage over steep dives in terms of acceleration of horizontal distance. Indeed, a steep dive is better since one VFP can lose two altitude levels, whereas in an unloaded dive, each VFP can only lose one altitude level. Second, the rule appears to state that unloaded dives are a form of level

flight, in which case other rules need modifying (e.g., an aircraft cannot recover from a vertical dive into an unloaded dive, and unloaded dives do not count as diving for barrel rolls). If unloaded dives are a form of level flight, treating them separately from diving flight would probably be better.

– **Change: 2A-missile-sighting.**

The sighting rules are changed so that attempts to sight missiles come before attempts to sight aircraft, and the modifiers are changed. This change appeared in the Origins rules in *Air Power Journal* 44 and 53.

The Origins rules mention that missiles launched from sighted aircraft are no longer sighted, but I can't find this in the original rules.

– **Change: 2A-irsts-c.**

IRSTS-C, from the v2.4 rules, is added.

– **Change: 2A-advantage.**

An aircraft in a vertical climb may disadvantage aircraft at the same level or lower. This change appeared in the Origins rules in *Air Power Journal* 39, 41, 44, and 53 and the v2.4 rules.

– **Change: 2A-tailing.**

Complete a sentence in the rule on tailing: No more than three aircraft *may be part of a multi-aircraft tailing*. This change appeared in the v2.4 rules.

– **Change: 2A-roll-preparatory-fps.**

Lag and displacement rolls now require preparatory FPs equal to 1/3 of the aircraft's speed (rounded down). The preparatory FPs may be HFPs or VFPs. These change appeared in the 1995 GEnie post by JD Webster and the v2.4 rules.

– **Change: 2A-missile-launch-modifiers.**

The modifiers for being a combat hero and tactics master are now cumulative (i.e., a pilot who is both gets a −2 modifier). This change appeared in the tables for the v2.4 rules.

– **Change: 2A-missile-launch-failure.**

The missile launch rules are changed so that if the launch roll fails by exactly one and is not an unmodified ten, the missile fails to launch but remains on the rail and can be used in the future. This change appeared in the Origins rules in *Air Power Journal* 39, 31, 44 and 53.

– **Change: 2A-missile-flight.**

Air-to-air missiles always move before their target. This change appeared in the Origins rules in *Air Power Journal* 44 and 53.

– **Change: 2A-missile-attacks.**

Missile attacks occur when the missile has the same position and altitude as the target or when it has the same altitude, at least one FP left in its proportional move, and the target is one of the seven positions immediately

in front of the missile. This change appeared in the Origins rules in *Air Power Journal* 44 and 53.

– **Change: 2A-missile-speed.**

The missile speed attenuation factors are changed. In all cases, they now increase or stay the same with time, which makes physical sense. These changes appeared in the v2.4 tables.

– **Change: 2A-ew-coverage.**

RWR-A now detects air-to-air target illumination, not air-to-air locks. RWR-B can no longer detect VF FCR. These changes appear in the v2.4 tables.

The rule for pylon drag (suggested originally by Mark Bovankovich in *Air Power Journal* 18 and adopted in the Origins rules in *Air Power Journal* 41, 44, and 53) is not incorporated simply because applying it uniformly would require extensive research and modifications to almost all ADCs.

Version 2B

Version 2B contains nonauthoritative minor changes, normally to clarify existing rules. These changes have been developed in collaboration with Carl Smeaton.

– **Change: 2B-credits.**

Additions to the credits.

– **Change: 2B-missile-counters.**

I have explicitly stated that each missile counter represents a single missile.

– **Change: 2B-directions.**

ENE, ESE, WSW, and WNW are used in preference to NE, SE, SW, and NW. The original directions fall evenly between two 30° facings, whereas the new ones are unambiguously closer to one.

– **Change: 2B-stacking.**

Collisions are only possible if the aircraft are at the same altitude. They are also possible if four or more aircraft are stacked at the same altitude, even if they are in a close formation.

– **Change: 2B-collisions.**

Potential collisions from head-on attacks are resolved after the attack. Other collisions are resolved at the end of the flight phase.

– **Change: 2B-range.**

I have written a rule to clarify how to calculate range when counters are on hex sides. The new rule gives the correct result, for example, when two counters are on hex sides on the opposite sides of a hex.

– **Change: 2B-closeness.**

I have defined closeness in terms of range. This is important since it is possible to define closeness in other terms, for example, taking into account half hexes and odd altitude level differences.

– **Change: 2B-fractions.**

Explicitly, the fractions table is used for:

– Determining the number of HFPs and VFPs required by a given flight type.

– Engine thrust.

– SSGT requirements

– Aiming requirements and modifiers

The values in the table are explained (round to nearest unless one half). In all other cases, the conventional mathematical meaning is used.

– **Change: 2B-fractions-of-half.**

We sometimes need to take 1/3 or 2/3 of 0.5 in order to determine the reduced thrust at high altitude. I have added appropriate entries to the fractions table.

– **Change: 2B-ground-fac-marking.**

The text of the original rules states that ground FACs mark targets in the AAA planning phase. This phase does not exist. The extended sequence of play indicates that this occurs during the visual sighting phase. I have changed the text of the rules to match this.

– **Change: 2B-ra-speed-limits.**

RA aircraft at their maximum or dive speed, as appropriate, may only carry forward 1.0 APs.

– **Change: 2B-military.**

Aircraft can select 0.0 APs when using military power. This gives no acceleration, but allows them to maintain a steady speed above cruise speed

– **Change: 2B-propeller-aircraft.**

I've added rules for the HT and FT settings. The only difference is the fuel consumption. I've also noted that propeller aircraft never suffer flame outs.

– **Change: 2B-raa-fp-carry.**

RAA aircraft can carry up to 1.0 APs.

– **Change: 2B-when-supersonic.**

Purposes other than turns or maneuvers, an aircraft is supersonic if its speed is greater than or equal to the M1 speed in the altitude band in which it started the game turn.

– **Change: 2B-stall-recovery.**

Aircraft recover from a stall to a wings-level attitude.

– **Change: 2B-departures.**

Aircraft lose any carried APs or DPs when they recover from departure.

– **Change: 2B-relights.**

Relights attempts can happen on any three game turns after a flame-out (not the first three game turns). The count is reset for each flame-out.

– **Change: 2B-idle-after-relight.**

A relit engine is considered to be in idle power. This is important if the engine does not have RPR and AB is selected on the next game turn.

– **Change: 2B-pssm-maneuvering-departures.**

A PSSM aircraft that is supersonic and is carrying a prohibited turn suffers a maneuvering departure. This follows the consensus on the Air Power mailing list.

– **Change: 2B-low.**

The low altitude band extends down to level 0, to account for aircraft at level 0 in TFF.

– **Change: 2B-steep-climb.**

An SC must use at least one VFP.

– **Change: 2B-unloaded-dives.**

The UD rules in version 2A gives no advantage over an SD. I have changed the rule so that all FPs are HFPs, one altitude level is lost if half of the FPs are spent unloaded, and two if all are spent unloaded. This gives one additional HFP over an otherwise similar SD.

– **Change: 2B-free-descent.**

After a VC, an aircraft in level flight must expend 1/3 of its FPs (not speed) before taking a free descent. This is for consistency with other similar limits on flight, which are in terms of FPs.

– **Change: 2B-half-vfps.**

The rules in section 8.4 on half VFPs seem to be incompatible with the rules in 5.4. Perhaps they are left over from when speedbrakes eliminated FPs? I have deleted this rule.

– **Change: 2B-recovery.**

I have changed the rules for recovery for ET turns to be that the aircraft must not turn at the ET rate and must not prepare for or execute rolling maneuvers. This allows slides and eliminates the potentially confusing reference to being wings level.

– **Change: 2B-vertical-attacks.**

If an aircraft has not yet moved, use its flight type from the previous turn for determining the vertical attack modifier.

– **Change: 2B-same-hex-or-hex-side.**

All references to the "same hex" in gun attacks have been changed to the "same hex or hex-side".

– **Change: 2B-head-on-attacks.**

I have changed the rule for head-on attacks to include all the prerequisites except sighting. (If you are being fired at, you will probably notice.) A head-on attack and any response are resolved simultaneously. If the target has not moved, its flight type from the previous game turn is used to determine vertical limits and same-location vertical modifiers.

– **Change: 2B-angle-off-on-hex-side.**

I have changed the angle-off diagram for an aircraft on a hex side so that the boundaries between the arcs radiate from the aircraft. The previous version makes sense in the context of the Genie scatter diagram, where one wants the lines to trace valid locations, but not for simply determining geometry.

– **Change: 2B-rocket-restrictions.**

I have applied the errata to the restrictions to rocket attacks on aircraft at different altitudes to those applied to gun attacks ("An aircraft *in level flight* may fire at a target in another hex only if it is at the same altitude level or at an adjacent altitude level").

– **Change: 2B-rocket-modifiers.**

The TSOH sheets say all gun attack modifiers apply to rocket attacks, but the TSOH rules after APJ 23 errata exclude snapshots (obviously) and damage. I am going to include damage, for simplicity.

– **Change: 2B-optional-damage-tables.**

The actual damage (and not the cumulative damage) is used to determine the appropriate section of the optional damage table.

– **Change: 2B-damage-control-restrictions.**

The only climbing flight allowed during damage control is an SC without AB. The only diving flight allowed during damage control is a SD without AB and at most 2 VFPs

– **Change: 2B-sighting-higher.**

The TSOH errata are slightly inconsistent on whether the rule that four levels of altitude count as one hex of range when sighting a higher target applies just to aircraft (page 2) or also to missiles (page 3) and whether it only applies in daylight (page 2) or all of the time. I assume it applies to both aircraft and missiles, but only in daylight.

– **Change: 2B-sighting-and-other-detections.**

The version 1A rules give a −1 modifier for a RWR detection, but not other types of detections. In 2B this is changed to be a −1 modifier for any type of detection or lock-on.

– **Change: 2B-sighting-and-hud.**

The version 1A rules give a −1 modifier for an IRSTS lock-on and HUD interface technology, but not for a radar lock-on. In 2B this is changed to be a −1 modifier for any type of lock-on with HUD interface technology.

– **Change: 2B-sighting-and-engaging-missiles.**

The TSOH rules give requirements for engaging missiles include the missile being sighted (a) by the target when the missile starts its move or (b) by a friendly aircraft when the defender starts its move. However, the decision to engage or not occurs in the aircraft decisions phase, not the flight phase. I have changed both requirements to be "in the aircraft decisions phase."

– **Change: 2B-sighting-and-pre-emption.**

The sighting restrictions in the original rules state that a defender can preempt a moving aircraft if both are sighted by a third aircraft at the start of the *defender's* movement. I have changed this to the start of the *attacker's* movement.

– **Change: 2B-padlocking-ground-units.**

Aircraft can padlock ground units.

– **Change: 2B-vas-identification.**

VAS can only be used for identification in the 180°+ arc.

– **Change: 2B-vas-and-padlocks.**

If VAS is used, then the pilot may not padlock, but other crew members can still padlock.

– **Change: 2B-irsts-c.**

IRSTS-C may attempt to lock on to any six detected targets, not just the closest. IRSTS-C allows IR Uncage on tracked targets, like IRSTS-B.

– **Change: 2B-irsts.**

IRSTS detections are lost if any lock-on succeeds (i.e., IRSTS does not have a capability similar to TWS.) IRSTS detections and lock-ons are maintained provided the target satisfies the arc and range requirements at the start of the radar phase and, for single pilot aircraft, provided the pilot does not use radar.

– **Change: 2B-same-location-advantage.**

Change 1B-apj-23-errata added that aircraft "in the same hex" do not have any effect on the other's advantage. I have changed "hex" to "map location" to include hex sides.

– **Change: 2B-declaring-preemptions.**

The rule on preemptions has been rewritten to make it clear that an aircraft can preempt a moving aircraft before each FP, including the first.

– **Change: 2B-no-double-preemptions.**

Add text to explicitly state that a preempting aircraft may not itself be preempted. There is no point, since a preempting aircraft cannot make gun attacks, but making this statement is clearer.

– **Change: 2B-limited-arcs.**

I changed the limited arcs to be consistent with each other. See the discussion in the airpower.io group starting on 28 February 2024.

– **Change: 2B-maneuver-consecutive.**

I have added a statement that FPs for maneuvers must be consecutive.

– **Change: 2B-maneuver-carry.**

I have added a statement that preparatory FPs for maneuvers can be carried from one turn to the next.

– **Change: 2B-additional-HFPs-for-slides.**

I have added the statement that additional preparatory FPs for slides must be HFPs.

– **Change: 2B-slides-VFPs.**

I have added that the use of a VFP implicitly aborts a slide maneuver.

– **Change: 2B-roll-hfp-cost.**

All displacement and lag rolls cost 1 HFP to execute.

This is not a change in the rules per se; in the first-edition rules displacement and lag rolls cost 1 HFP to execute. However, the v2.4 rules state that the FP cost is specified on the ADC and the first-edition ADCs of some aircraft, including the F-14, indicate that the cost of 1.5 HFPs. This doesn't fit well into more modern rules that assume that whole FPs are expended. These ADCs should be modified to give a cost of 1.0 HFPs.

– **Change: 2B-viff-vertical-pitch.**

I have added that when a VIFF vertical pitch is used to enter a vertical dive from a vertical climb, all the HFPs must be used before any VFPs. This parallels the requirement for using a HRD to enter a vertical dive from a zoom or sustained climb.

– **Change: 2B-missile-launch-modifiers.**

In the missile launch modifier table, I have changed the launch modifier for a critically damaged aircraft from +2 to +3 to match the damage tables.

– **Change: 2B-launch-restrictions.**

I have changed the restriction on missile launches from "firing guns during its last FP" to "firing guns or rockets after its last FP."

– **Change: 2B-follow-up-missiles.**

I have slightly changed how the FPs regained by a follow-on missile are assigned. I have stated that they are added to the initial complete proportional segments rather than the initial proportional segments. This is relevant when the missile has a life of only one game turn; we do not want an additional FP added to the incomplete proportional moves with the launch delay.

– **Change: 2B-missile-launch-speed.**

The aircraft speed used to determine a missile's initial speed is its end speed on the turn of launch.

– **Change: 2B-slower-missile.**

If the missile is slower than the aircraft, in each proportional move the missile moves 1 FP and the aircraft moves 1 or more FPs. Calculate the number of FPs for the aircraft in the same way as for a missile when the missile is faster.

– **Change: 2B-missile-power-modifier.**

If a free aircraft under attack by an IRM selects idle power and fails the roll, it uses the modifier for normal power (i.e., +0). A free aircraft under attack by an IRM can select normal power and automatically gain the corresponding modifier. If an aircraft was using idle power at the moment it became the target of an IRM and continues to use idle power until the missile attacks, then it gains the +1 modifier for idle power even if it does not engage the missile.

– **Change: 2B-uncaged-lock-up.**

The roll to determine whether an uncaged IRM lock-up succeeds is made after declaring missile launches. If all declared launches fail, as usual one additional launch may be attempted.

– **Change: 2B-irm-vertical-fov.**

I have added that the vertical limits for the limited, 180°+, and 150°+ arcs are used according to the horizontal field-of-view.

– **Change: 2B-irm-envelopes.**

The rules on out-of-envelope IRM launches state that type A seekers may be launched at "large" targets, but I have changed this to "not large" targets (those with a visibility of less than 10), as this makes more sense from the context.

– **Change: 2B-radar-requirements.**

I have changed the requirement for radar work from "made an air-to-air gun attack" to "made an air-to-air gun or rocket attack".

– **Change: 2B-limited-look-down.**

In the first edition rules, are two incompatible statements on the capabilities of radar with of limited lookdown. Section 16.3 states that they can potentially detect aircraft from levels 5 to 10 from above provided the target is closer to the radar than to the ground. Section 16.4 states that they can do this from levels 2 to 10. I have adopted the latter.

– **Change: 2B-declaring-special-radar-modes.**

I have changed the text that states that boresight and auto-track modes are declared "when an aircraft begins its flight" to "in the aircraft decisions phase" (following the expanded sequence of play).

– **Change: 2B-auto-track-selection.**

I have added that a visually sighted aircraft may be selected for detection in auto-track mode of a 7− (in accordance with the charts). If the roll fails, no detection occurs.

– 2B-multiple-dds If an aircraft has two or more DDS systems (e.g., one integrated and the other in a pod), each can have their own DDS program and any combination of them can be turned on or off each game turn, provided other requirements are met.

– **Change: 2B-flight-type-disorientation.**

I have changed the moment at which disorientation is determined for risky flight types from the end of the game turn to the end of flight. This allows disorientation to interfere with missile launches and radar work.

– **Change: 2B-disorientation-fbw-modifier.**

The FBW modifier for recovering from departed flight should not apply to disoriented flight.

–   **Change: 2B-gloc-bail-out.**

Some propeller-driven fighters can ET and hence cause GLOC, but do not have ejection seats. I have added that a crew member suffering GLOC cannot bail out.

–   **Change: 2B-undamaged-egress.**

GLOC or disoriented flight may cause a crew to attempt to egress an undamaged aircraft. I have treated an undamaged aircraft the same as an aircraft with L or 2L damage.

–   **Change: 2B-ajms.**

The AJM rating (not the BJM rating) is used for jamming rolls with AJMs.

–   **Change: 2B-infrared-jammers.**

I have added a rule on infrared jammers. These appear as external stores in *The Speed of Heat*.

–   **Change: 2B-merging-cloud-layers.**

Two dense layers that overlap or are adjacent are merged. A stratus layer that overlaps with a dense layer (but not one that is adjacent) is ignored.

–   **Change: 2B-stratus.**

Aircraft and ground units may not visually sight, use VAS, use IRSTS, use TV/IR Optics, use Night IR sights, launch IRMs (even with radar assist), launch IR SAMs, launch or track OG/LG SAMs, use laser designators, or use laser spots on targets on the opposite side of stratus cloud layers. Also, the requirements on IRM and IR SAM tracking concerning stratus cloud layers apply only at the end of the missile's proportional move and also apply to OG/LG SAMs.

–   **Change: 2B-generating-night-conditions.**

I have added a simple means to determine randomly if a scenario occurs at night. Stating this explicitly in the scenario notes is probably a more satisfactory approach.

–   **Change: 2B-aaa-sun-clutter.**

AAA units stacked with an FCR or with an integrated W-type FCR are not penalized for firing when in the Sun clutter of their target.

–   **Change: 2B-contrails-at-night.**

Missiles, as well as aircraft, that are contrailing and below the highest cloud layer can also be sighted to a range of 6. In both cases, sighting is automatic.

–   **Change: 2B-tvir-optics.**

Haze does not reduce the sighting range for TV/IR optics or OPs. They may be used during the day (to see through haze) and at night.

–   **Change: 2B-radar-bombing.**

The navigation range (or half the air-to-air search range) is used for the detection range. The attack range (or half the air-to-air tracking range) is used for the tracking range. I have added a procedure for lock-ons. I have added that a radar cannot simultaneously be used in the air-to-ground mode and air-to-air mode, and detections

and tracks are lost when it switches from one mode to the other. Furthermore, I apply the same restrictions to the use of air-to-ground radar as air-to-air radar in normal mode (e.g., pilot-only aircraft cannot search if they used an HT or more).

Version 3A

Version 3A contains unauthoritative major changes. Again, these changes have been developed in collaboration with Carl Smeaton.

–   **Change: 3A-credits.**

Additions to the credits.

–   **Change: 3A-fp-stages.**

The various actions that can occur around the expenditure of an FP now have a defined order in terms of "FP Stages".

–   **Change: 3A-same-hex-arcs.**

For gun attacks (and for horizontal arcs in general), the arc at the same location is the same as if the attacker were to be moved backwards one hex.

–   **Change: 3A-missile-attack-arcs.**

The arc for missile attacks is determined at the moment the missile attack is declared. Border-line cases are resolved by first considering the arc into which the faster element is moving and second by choosing the wider arc, the one closer to the 120° arc. (The previous rule made no mention of considering the faster element and required the arc that favors the defender. The wider arc and the arc that favors the defender are only different for E, I, and M seekers on the 150°/180° border and E, I, and BR seekers on the 120°/150° border.)

–   **Change: 3A-missile-launch-envelope-arcs.**

When determining the arc for missile launch envelopes, border-line cases are resolved by first considering the arc into which the faster element is moving and second by choosing the wider arc, the one closer to the 120° arc. This is the same procedure as for missile attacks.

–   **Change: 3A-irm-launch-arcs.**

When determining the arc for IRM launch requirements, border-line cases are resolved by first considering the arc into which the faster element is moving and second by choosing the wider arc, the one closer to the 120° arc. This is the same procedure as for missile attacks.

–   **Change: 3A-combined-arcs.**

The advanced rule on vertical limits is replaced by an adaptation of Tony Valle's proposal in APJ 39. The phrase "combined arc" is used, as these limits are no longer simply vertical limits in addition to the horizontal ones, as for sufficiently large flight slopes the limits can become purely vertical.

–   **Change: 3A-AP-carry-at-speed-limits.**

Aircraft whose speed is equal to their maximum speed or maximum dive speed carry no APs forward. Aircraft that suffer a speed fade-back or whose speed it reduced to their dive speed carry neither APs not DPs forward.

– **Change: 3A-speedbrakes.**

DPs from speedbrakes must be chosen at the start of flight, just like APs from engine thrust.

– **Change: 3A-turn-drag.**

Each turn now gives DPs when it is declared. Sustained turns and the additional drag for more than one turn per game turn are gone.

The turn drag given by ADCs for earlier versions of these rules can be updated as follows: take half of the old turn drag and add 0.5 for normal aircraft, 0.25 for aircraft with the low bleed rate (LBR) property, or 0.75 for aircraft with the high bleed rate (HBR) property. This is equivalent to averaging the old turn drag over two turns.

Subsonic EZ turns still have zero drag, since at most speeds an aircraft can only execute at most one per game turn and so would not accrue the old penalty for sustained turns.

We average the old DPs per game turn for supersonic turns over two turns.

– **Change: 3A-multiple-turns.**

Note that multiple turns acquire turn drag for each facing change of 30° and that additional FPs can be expended before the first facing change.

– **Change: 3A-slide-drag.**

Each slide gives no DPs. The additional drag for more than one slide per game turn is gone.

– **Change: 3A-slide-banking.**

Aircraft have to be appropriately banked for a slide, is banked during the slide, and can come out banked in the sense of the slide or wings-level.

– **Change: 3A-multiple-slides.**

An aircraft my declare more than one slide in a game turn, but must spend at least 4 FPs between executing a slide and declaring the next slide. There is no speed limit on this.

If sufficient preparatory FPs are carried in, at least 9 FPs are required to execute two slides: 1 FP to execute the first; 4 FP of delay; 3 FP of supersonic preparatory FPs; 1 FP to execute the second. If no preparatory FPs are carried in, at least 12 FPs are required.

In the original rules, only two slides were allowed. With this new rule, if the aircraft is extremely fast, it can potentially execute three. If sufficient preparatory FPs are carried in, at least 17 FPs are required to execute three slides: 1 FP to execute the first; 4 FP of delay; 3 FP of supersonic preparatory FPs; 1 FP to execute the second; 4 FP of delay; 3 FP of supersonic preparatory

FPs; 1 FP to execute the third. If no preparatory FPs are carried in, at least 20 FPs are required.

– **Change: 3A-roll-drag.**

Each displacement, lag, or vertical roll now gives the DPs in the ADC when it is declared. The additional drag for more than one roll per game turn is gone.

The roll drag on the ADC is not changed from previous version. This is somewhat inconsistent with the approach taken for turns, were we average the old turn drag over two turns, and for supersonic rolls, where we average the old roll drag over two rolls. However, roll drags are typically close to 1.0, so the difference is small.

We average the old DPs per game turn for supersonic rolls over two rolls.

– **Change: 3A-vertical-attacks.**

The +1 same-location vertical attack modifier also applies if the attacker is in level flight and the target is climbing or diving.

– **Change: 3A-head-on-attacks.**

A non-moving target may declare a head-on attack even if the moving aircraft does not.

– **Change: 3A-searcher.**

The searcher is designated by the player and need not be the closest aircraft. The +2 modifier applies if the target is in the restricted arc of the searcher, not all participating aircraft.

– **Change: 3A-multi-crew-searchers.**

A searcher may use the crew quality modifiers for any crew member who is conscious and not disoriented (i.e., it may use the modifiers for the highest quality crew member). Provided at least two crew members are conscious and not disoriented, it may also use the multi-crew modifier.

– **Change: 3A-missile-targets-declare-flight.**

The target of a missile declares its flight type, power settings, and speedbrake settings before the missile's first proportional move.

– **Change: 3A-fps-for-proportional-moves.**

The proportional moves of a missile and its target are based on the number of FPs each has and not on their speeds.

– **Change: 3A-follow-on-missiles.**

Follow-on missiles now skip whole proportional moves rather than FPs.

– **Change: 3A-missile-fp-stages.**

The various actions that can occur around the expenditure of an FP by a missile now have a defined order in terms of "Missile FP Stages".

– **Change: 3A-missile-tracking.**

The missile tracking requirements (on arcs and range to the target) must be satisfied after each of the missile's

proportional moves. They do not have to be satisfied after each of the aircraft's proportional moves or at the end of each game turn.

– **Change: 3A-missile-attacks.**

The missile attack rules are changed slightly.

A missile attacks in a missile attack stage associated with either one of its FPs or one of its targets.

A missile can attack either by being at the same hex or hex-side and altitude as the target or by having the target in one of the six positions around the position in front of it, having an FP remaining, and having the target either at the same altitude or, if it can execute a free descent, one altitude below.

If a missile can attack in its next FP by moving to the position and altitude of the target, it must do so. This means that if it can attack with an HD, it cannot use H and then D. This prevents missiles from drawing out moves to gain more time to turn. It also replaced the previous rule that if the target was immediately in front of the missile, it would declare an attack but does so in a way that allows a missile to complete a turn.

– **Change: 3A-continuing-to-engage.**

If an aircraft engaged a missile in the previous game turn, it may continue to do so on the current game turn even if the missile has become unsighted.

– **Change: 3A-combat-hero-squadrons.**

The −1 modifier to initiative when a combat hero is lost now applies to all aircraft in their squadron, not just their formation.

Version 3B

Version 3B is a rewrite of version 3A and is incomplete.