## An Intro to Jet Dogfighting

Birds of Prey – Air Combat in the Jet Age uses revolutionary mechanisms to create a fun, playable game of jet dogfighting. *Birds of Prey* cleverly hides the physics, math and aerodynamics so players can concentrate on flying and fighting!

Maneuvering in Birds of Prey

The Pitch Heading Attitude Display (PHAD) represents a sphere around the aircraft. Marks on the PHAD represent the aircraft's nose, canopy top and right wing-tip. PHAD cells are thirty degrees across, and each mark must stay three away from the other two. (Any other distance bends our aircraft!)
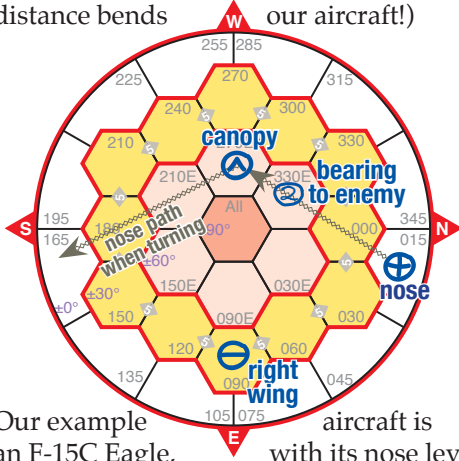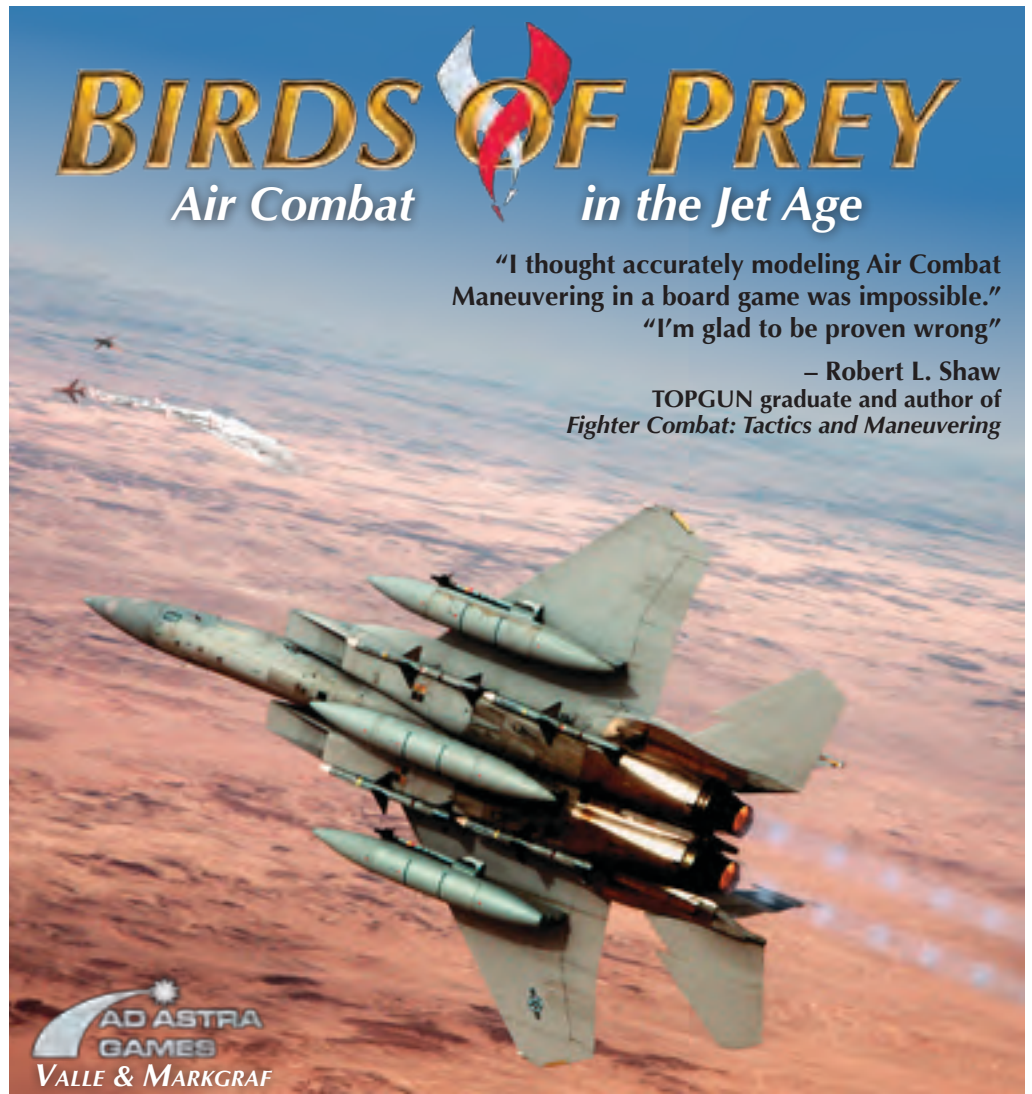
Our example aircraft is an F-15C Eagle, with its nose level and rolled to the pilot's left. Our pilot has sight of an enemy Flanker (number two), a bit above and to his left.

A turning aircraft rotates its nose and canopy marks three hexes from the right wing mark. Our pilot notices that the bearing to the enemy Flanker is along this path. If he can maneuver the nose up two cells, the Eagle may be able to engage the Flanker with its mighty Vulcan cannon.

The aircraft turns by applying G-forces to move the nose and canopy marks. Each cell moved costs six Turning Points (TP). The number of TP generated by a given Turn-G depends on the aircraft's speed. To find out how much the aircraft turns, the player uses the Turning Move Aid.

(Rolling works much like turning, though we are not using it now. When rolling, the nose mark is kept fixed and the canopy and right wing rotate around it).

BIRDS OF PREY

Air Combat in the Jet Age

"I thought accurately modeling Air Combat Maneuvering in a board game was impossible."
"I'm glad to be proven wrong"

– Robert L. Shaw
TOPGUN graduate and author of
Fighter Combat: Tactics and Maneuvering

AD ASTRA GAMES

VALLE & MARKGRAF

The Eagle's speed is 320 knots and the aircraft needs to generate twelve TP in ten ticks (the duration of a game turn) to move the nose two cells. The player draws a line from twelve TP to ten ticks, to show the desired amount of turning and duration. He next draws a line through this mark from speed 320 and finds he needs 3.0 Turn-G.
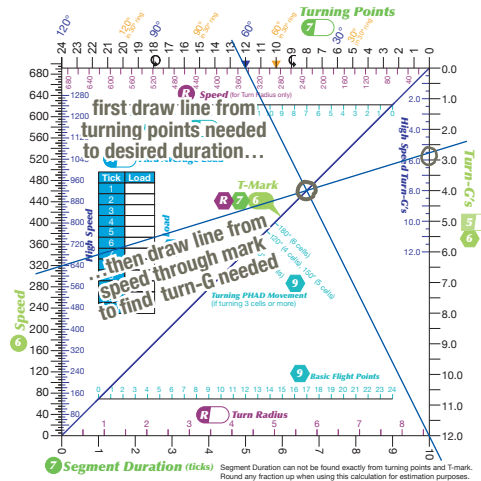
This may not seem like a lot of Turn-G, but the Eagle is relatively slow and every G risks further slowing and eventual stall! Which just goes to show… speed is life!

Flying Out a Move!

Having built a plan for maneuvering, the Eagle's player next moves the aircraft on the map. Distance flown is given in three dimensional Flight Points (FP). If flown in a horizontal plane, each FP is one hex long. A maneuver's FP depends on the duration and aircraft speed.

Our Eagle is at speed 320 in a maneuver that takes ten ticks. A quick lookup on the Speed to FP table yields eight FP.

Speed	FPs					Ticks				
	1	2	3	4	5	6	7	8	9	10
40	0	0	0	0	0	0	0	0	0	1
80	0	0	0	0	1	1	1	1	1	2
120	0	0	0	1	1	1	2	2	2	3
160	0	0	1	1	2	2	2	3	3	4
200	0	1	1	2	2	3	3	4	4	5
240	0	1	1	2	3	3	4	4	5	6
280	0	1	2	2	3	4	4	5	6	7
320	0	1	2	3	3	4	4	5	6	8
360	0	1	find FP for a 10 tick maneuver							9
400	1	2	3	4	5	6	7	8	9	10
440	1	2	3	4	5	6	7	8	9	11

Movement is converted from FP to flight on the map by using the 3D Move Aid and 2D Move Aid. Each of these operate by counting out from an orange starting hex, using the 30° wedge containing the mid point of the PHAD maneuver.

Tracing along the path of the Eagle's nose mark, we find the cell at heading 000 and pitch +30 is center-most.

Literally the Next Generation!

– David C. Isby, defense analyst and designer of *Air War*

Birds of Prey – Air Combat in the Jet Age is a revolutionary jet combat game simulating flight with unprecedented precision and engrossing play. The *Birds of Prey* flight mechanics allow freedom in three dimensions without special maneuver rules. Physics-based systems show performance differences through two simple, elegant playaids.

Birds of Prey hides complex systems in easy to use play aids and mechanics.

Color coding and subtle hints help keep the rulebook in the box during play.

Su-27S "Flanker-B" 1986
Mirage 2000C 1984
F-16C block 30 Fighting Falcon 1987
F-14A Tomcat 1973
MiG-29 9.12 "Fulcrum-A" 1983
F-15C MSIP Eagle 1986
F-5E Tiger II 1973
Lightning F.Mk.6 1966
F-8E Crusader II 1963
MiG-23MS "Flogger-E" 1974
JA 37 Jaktviggen 1980
F-18C block 25 Hornet 1987
F-4E Phantom II 1968
Mirage F1E 1978
F-4J Phantom II 1966
Mirage IIIC 1962
F-104C Starfighter 1959
MiG-21MF "Fishbed-J" 1970
MiG-19S "Farmer-C" 1956
MiG-21F-13 "Fishbed-E" 1960
MiG-17F "Fresco-C" 1953
Hunter FGA.Mk.9 1959
F-86F-1 Sabre 1952
MiG-15bis "Fagot-B" 1950

Birds of Prey
F-14A Tomcat

| Flight | 2x Pratt & Whitney TF30-P-414A afterburning turbofans | Gun |
| Wing Load | Engine | |

Birds of Prey
Mirage 2000C S5

| Flight | 1x Snecma M53-P2 afterburning turbofan | |
| Wing Load | Engine | AoA Effect | Gun |

Birds of Prey
MiG-21F-13 I-74 "Fishbed-E"

The Eagle has eight FP to fly at +30 pitch. Using the 3D Move Aid he can select any dot in a cell eight FP from the orange cell that is in between +45° and +15° pitch (this makes a 30° wide wedge).

After identifying his options, the Eagle driver selects a dot moving seven hexes and gains nine steps of altitude. Next, the hexes are used on the 2D Move Aid.

The Eagle driver chooses the cell closest to the Flanker. Using the aircraft's current position as the orange cell, the Eagle is moved equivalently on the map.

After map movement, the player updates their PHAD marks, reorients the Eagle on its tilt-block and stacking tiles and places a new bearing to the Flanker.

With the Flanker on its nose and at close range, the Eagle only has to check a chart and roll some dice to prosecute its attack.

All will end happily… with stories at the O-Club and an enemy insignia painted on the Eagle's nose!

This game is created using only unclassified, publicly available data.