

APPENDICES

APPENDIX A. CAMPAIGN BACKGROUNDS

DESERT STORM

Following the territorial invasion of Kuwait in November 1990, the UN Security Council authorizes the use of force to contain Iraq. The resulting buildup of forces on the Saudi-Iraqi border is dominated by 400,000 U.S. troops and coined Operation Desert Shield. Repeated warnings and an ultimatum from the UN go unheeded, and Saddam Hussein's gathering of forces along Saudi Arabia's border continues. Confrontation with Iraq seems inevitable, and on 17 January, 1991, the standoff is finally broken as coalition forces deliver stiff retribution. The Persian Gulf marks the combat debut for many weapon platforms, but most importantly, it becomes the proving ground for the F-15E Strike Eagle as a dual-role fighter.

The 335th and 336th Tactical Fighter Squadrons enter Saudi Arabia in early August 1990, flying sorties from the newly constructed Al Kharj airbase until the cease-fire on 28 February, 1991. Together, these units account for nearly 11 million pounds of ordnance. Each Strike Eagle's payload includes 24,000 pounds of external stores — Paveway II laser-guided bombs, Combined-Effect Munitions, Mk82 and Mk84 unguided bombs, AIM-9 Sidewinders and AIM-7 Sparrows. Because the F-15E is rushed to combat before fully completing development, few USAF Strike Eagles have the coveted AAQ-14 LANTIRN targeting pods for delivering guided munitions. Despite this, F-15Es still achieve most of their strategic missions, and by the end of the war, nearly all F-15Es have the AAQ-14.

While A-10s and F-16s pound tactical targets on clear days, the F-15Es strike around the clock in any weather, eliminating many of Iraq's most impenetrable targets. Facing concentrated AAA fire and SAMs, some pilots opt for medium-to-high loft approaches to avoid the hellish barrage below. Others dare the minimum-altitude flight for which the F-15E was designed, skimming the desert at 100 feet to thwart enemy radars and SAMs.

Initial missions concentrate the F-15E's firepower on ground-based SCUDs aimed at nearby Israel. SCUD-hunting attacks become standard fare for Strike Eagle pilots, who work in pairs alongside the Synthetic Aperture Radar-capable E-8A J-STARS. Later, the F-15E is adapted to "tank-plinking" (attacking armoured vehicles with laser-guided bombs) and "road recce" (striking fixed interdiction targets, such as bridges and roads). Several F-15Es operate in unexpected capacities, providing on-the-spot air support for ground units in trouble. One F-15E from the 335th even tallies an air-to-air kill against an enemy helicopter using a laser-designated bomb. No air-to-air F-15E losses are incurred, although two F-15Es and aircrews are lost to ground fire.

The F-15E then becomes a favored delivery tool for the Air Force, and is capable of precision, night-time attacks in hostile airspace. Pound-for-pound, it out-performs any other dual-role fighter in existence. Desert Storm marks the evolution of the F-15 from strictly an air-to-air machine to a dual-role fighter, and its accomplishments remain a menacing reminder to those who dare to oppose it.

IRAN

Despite a shaky peace, the turn of the century has not brought much change to the Gulf region. Most Arab states still harbor a strong anti-American sentiment, and Turkey, Jordan and Saudi Arabia have fallen under conservative rule. Intense pressure from Islamic religious leaders has compelled even these key U.S. allies to question an American presence in their territory.

To further complicate matters, the American military has been impaired by a reduction in force. U.S. bases in the Middle East have been closed or forcibly relocated to remote deserts, reflecting the mindset of a “smaller, smarter military.” For the first time, the U.S. military finds itself in the highly vulnerable position of being unable to support dual conflicts.

In contrast to the fading U.S. presence, Iran has now become a very real threat to Gulf security. Obscured by the limelight of U.S.-Iraqi and U.S.-North Korean tensions, Iran has spent five years bolstering its military forces with aircraft, naval vessels and technical expertise. Increasingly offensive training exercises remain unchecked due to a lack of a watchdog force.

The region grows more susceptible to conflict after world attention is drawn to the far east, where border conflicts break out along the de-militarized zone (DMZ) between North and South Korea. The increasingly brash incursions are viewed as North Korea’s desperate attempt to right its falling communist regime. Viewing this delicate situation as a preamble to war, U.S. and other allied military forces deploy to the area. Most units transfer from the Middle East, where a regional conflict is considered highly possible, but not imminent.

Iran seizes this opportunity in an alarming string of events and flexes its military might — first Iran’s president is assassinated; then, the government is overthrown by conservative clerics that proclaim the Iranian military to be “the sword of God.” Arab fears that Iran might use its new political position to invade its ill-armed neighbors turn out to be valid when Iran seizes the disputed islands of Abu Musa, Tunb and Sirri — strategically located at the mouth of the Gulf.

Diplomatic attempts by the United Arab Emirates fail, and several U.S.-flagged ships are attacked directly by missiles and indirectly by mines littering the Strait of Hormuz. Iran deploys its fleet of Kilo submarines and issues a string of threats describing armed, chemically tipped “Scud-B” missiles. In response, U.S. military forces in the region are placed on red alert, and a USAF squadron is deployed. Facing a lack of carrier support, F-15s comprise the major air arm in the region and must provide initial front-line support to oust Iran from its newly acquired position.

APPENDIX B. ACRONYMS AND ABBREVIATIONS

A/A	Air-to-Air
AAA	Anti-Aircraft Artillery.
AB	Afterburner capability; also Air Base
ACM	Air Combat Maneuvers.
ACQ	Acquisition
ADC	Air Data Computer
ADI	Attitude Director Indicator
A/G	Air-to-Ground
AGL	Above Ground Level
ALT	Altitude
AMRAAM	Advanced Medium-Range Air-to-Air Missile.
AoA	Angle of Attack.
A/P	Auto Pilot
ARMT	Armament
ASE	Allowable Steering Error
ASL	Above Sea Level.
AUTO	Automatic, an A/G weapons delivery mode.
AWACS	Airborne Warning And Control System.
AZ	Azimuth
BARO	Barometric
B-Hot	Black-hot FLIR polarity
BIT	Built-In Test
BRG	Bearing
BRST	Boresight
BRT	Brightness
BST	Boresight
BVR	Beyond Visual Range
CAP	Combat Air Patrol
CAS	Close Air Support
CBU	Cluster Bomb Unit

CC	Central Computer
CDIP	Continuously Displayed Impact Point.
CDES	Continuous Designation
CFT	Conformal Fuel Tank
CMD	Countermeasures Dispenser. Also Command
COMM	Communication
CONT	Contrast. Also Continuous
DCL	Declutter
DIL	Displayed Impact Line
DTWS	Designated Track While Scan
DW	Display Window
ECM	Electronic Countermeasures.
EL	Elevation
EMIS LMT	Emissions Limit
ESL	Elevation Steering Line.
EWWS	Electronic Warfare Warning Set
FAC	Forward Air Controller
FCC	Flight Control Computer
FCP	Front Cockpit
FLIR	Forward-Looking Infrared
FOV	Field of View
G	Gravity Force
GBU	Guided Bomb Unit. Also known as a Smart Bomb.
GCI	Ground Control Intercepts
GDS	Gun Director Sight
H/C	Hot/Cold
HDTWS	High Data Rate Track-While-Scan
HOB	Height of Burst
HOTAS	Hands On Throttle and Stick
HPRF	High Pulse Repetition Frequency
HRM	High Resolution Map
HSI	Horizontal Situation Indicator
HUD	Head-Up Display

Hz	Hertz, Cycles Per Second
ICS	Internal Countermeasures Set
IFF	Identification Friend or Foe
ILS	Instrument Landing System
IND	Indirect
INST	Instrument
INTVL	Interval
IR	Infrared
JETT	Jettison
JSTARS	Joint Surveillance Target Attack Radar System
KTAS	True Airspeed in Knots
KTO	Kuwait Theater of Operations
LAE	Lead Angle Error
LANTIRN	Low Altitude Navigation and Targeting, Infrared, for Night
LAW	Low Altitude Warning
LCFT	Left Conformal Fuel Tank
LCOS	Lead-Computing Optical Sight
LGB	Laser-Guided Bomb
LOS	Line of Sight
LPRF	Low Pulse Repetition Frequency
LR BST	Long Range Boresight
LSG	Losing
M	Menu
MAN	Manual
MAR	Missile Active Range
MAX	Maximum
MPD	Multi-Purpose Display
MPCD	Multi-Page Color Display
MPRF	Medium Pulse Repetition Frequency
MRM	Medium-Range Missile. E.g., AIM-7, AIM-120.
NAV	Navigation
NAVFLIR	Navigational FLIR
NDTWS	Non-Designated Track-While-Scan

N-F	Navigation FLIR
NFOV	Narrow Field of View
NOE	Nap-of-Earth
NM	Nautical Mile
NORM	Normal
OBST	Obstacle
PACS	Programmable Armament Control Set
PB	Pushbutton
PDT	Primary Designated Target
PGM	Precision Guided Munitions
RCS	Radar Cross Section
ROE	Rules of Engagement
PROG	Program
QTY	Quantity
RALT	Radar Altimeter
RBL	Radar Boresight Line
RBM	Real Beam Map
RCFT	Right Conformal Fuel Tank
RCP	Rear Cockpit
RDR	Radar
RDY	Ready
RGH	Range Gated High
RAERO	Maximum Aerodynamic Range
RMIN	Minimum Range
RNG	Ranging or Range
ROPT	Optimum Range
RP MPL	Ripple Multiple
RP SGL	Ripple Single
RTR	Range Turn and Run
RWR	Radar Warning Receiver
RWS	Range While Search
RWS-H	Range While Search – High
RWS-I	Range While Search – Interleaved

RWSM	Range While Search – Medium
SAM	Surface-to-Air Missile
SARH	Semi-Active Radar Homing
SEAD	Suppression of Enemy Air Defense
SP	Sequence Point
SRM	Short-Range Missile. E.g., AIM-9.
SS	Supersearch
STBY	Standby
STT	Single Target Track
T	True Airspeed
TACAN	Tactical Aid to Navigation
TAS	True Airspeed
TCN	TACAN
TD	Target Designator
TERM	Terminal
TEWS	Tactical Electronic Warfare System
TF	Terrain Following
TFR	Terrain-Following Radar
TGT	Target
TOF	Time of Flight
TOT	Time on Target
TPULL	Time-to-Pull
TREL	Time-to-Release
TSD	Tactical Situation Display
TTA	Time to Active
TTI	Time to Impact
TTGT	Time-to-Target
TWS	Track While Scan
UFC	Up Front Controls
UNC	Uncage
VCTR	Vector Scan
VSI	Vertical Speed Indicator
WSO	Weapons Systems Officer

APPENDIX C.

GLOSSARY OF TERMS

Active. A radar missile currently using a self-guidance system to locate its target.

Airfoil. Curved wing or blade surface designed to produce lift when air passes over it.

Airframe. Basic construction of the aircraft (doors, landing gear, seats, cabin, etc.).

Angels. Altitude in thousands of feet. "Angels ten" indicates 10,000 feet of altitude.

Angle of Attack (AoA). Aerodynamic angle formed between the chord of an airfoil and the direction of the relative wind.

Aspect Angle. Angle from which a target is viewed – the number multiplied by 10. "9R" means a view of the target's right wing from a 90° angle.

Attitude Director Indicator. Shows attitude of airplane relative to horizon.

Azimuth. Indicates a position on a horizontal plane surrounding your aircraft.

Bandit. Confirmed enemy aircraft.

Barometric Altitude. Altitude above sea level, calculated from air pressure data.

Barrage Fire. Anti-aircraft fire that "floods" an area with ammunition rather than trying to specifically target and hit an aircraft.

Bent. An informative call indicating the identified equipment is inoperative.

Bingo. When your aircraft has just enough fuel to get back to base and land.

Blind. An informative call indicating loss of visual contact with friendly aircraft.

Bogey. Unidentified aircraft (radar or visual contact).

Bogey Dope. A request for target information from GCI/AWACS

Bracket. Fighter element attack geometry which places aircraft on opposing sides of the target either laterally or vertically.

Break (Up/Down/Right/Left). A directive call to perform an immediate maximum performance defensive turn in the direction indicated.

Buddy Spike (position/azimuth/altitude). An informative call indicating reception of friendly AI RWR.

Bullseye. Code word for a specific reference point from which the position of target aircraft are determined.

Chaff. Strips of metal film released to confuse and decoy radar-guided weapons.

Chord. Imaginary line that passes through the leading and trailing edges of an airfoil. See "Angle of Attack."

Closing. Range to the bandit/bogey/target is decreasing.

Closure. Relative velocity of one aircraft in relation to another.

Corner Speed/Velocity. Minimum airspeed at which the maximum allowable aircraft G is generated. I.e., speed at which an aircraft can turn the sharpest, given current altitude and attitude.

Designate. Use of aircraft systems to identify a ground objective/aircraft as a target for weapons employment.

Drag. Force that counteracts an object in motion through the air, such as air resistance.

Echelon. A call conveying groups/contacts/formation with wingmen placed 45° behind the leader's wingline.

Egress. The outbound (exit) portion of an A/G attack profile.

Element. A flight of two aircraft.

Flare. A pyrotechnic device dispensed to defeat IR missiles.

Frag. Fragmentary range and duration of an ordnance.

Furball. A turning fight involving multiple aircraft.

Guns. Air-to-Air or Air-to-Surface gunshot.

Heater. A slang term for an IR missile.

Hot. Air-to-Air: a GCI informative call that the target is heading toward the fighters. Intercept geometry which positions the fighters in front of the target. The leg of a CAP heading toward the anticipated threats. Air-to-Ground: ordnance employment is authorized, anticipated, or completed.

Hung. A/A or A/G weapon launch/release commanded, but the ordnance remained on the aircraft.

Indicated Airspeed. The speed you would be traveling (given engine performance) at sea level in still air. An aircraft flying at the same true airspeed will show different indicated airspeeds at different altitudes and under different wind conditions.

Ingress. The inbound (entry) portion of an A/G attack profile.

Interleaved. Radar search mode alternating medium and high PRF waveforms.

Initial Point. The location where aircraft turn to directly approach their target – the steer point just prior to a target point.

Jammer. Electronic countermeasure that emits microwaves to distort/confuse enemy radarscopes.

Knot. Measure of speed equal to one nautical mile per hour. (See Nautical Mile.)

Lag Pursuit. Refers to pointing an aircraft's nose just behind an enemy's flight path during a turn.

Lead Pursuit. Refers to pointing an aircraft's nose just ahead of an enemy's flight path during a turn.

Mach. Speed of sound at sea level (760ft/s) used to measure rapid flight (Mach 1, Mach 2, etc.).

Mach Ratio. The ratio of your aircraft's speed to the speed of sound at the same altitude.

Mark-20. Canister bomb containing smaller bombs; used against armored targets.

Mark-82. 500-lb. general-purpose bomb.

Mark-84. 2000-lb. general-purpose bomb.

MiG. Common nickname for the Soviet designed fighter aircraft.

Mil Power. Maximum aircraft power, not using afterburner.

Nautical Mile. Aeronautical measurement of distance equal to 6,076ft.

Ordnance. Military weapons – including expendable armament, such as missiles and ammunition.

Padlocked. An informative call indicating the aircrew cannot take their eyes off the target without a significant risk of losing tally.

Patch Map. Radar image used for targeting.

Pickle. Act of pressing weapon release button.

Pipper. Visual aiming designator that appears on the HUD.

Point of Impact. Point along the leading edge of an airfoil where the air separates and flows over the top and bottom of the airfoil.

Radar Altitude. Altitude above ground level (AGL), in feet, calculated from terrain-following radar returns.

Radar Signature. Measure of an aircraft's visibility to radar; also called its radar cross section (RCS).

Rockeye. See Mark-20.

Roland. (French) Surface-to-Air missile; effective at low altitudes.

SAM ring. A circle designating the outer range of a SAM's threat to overhead aircraft.

Sanitize. A directive call to clear an assigned area with the radar searching for additional threats.

Scissors. Defensive maneuvering utilizing a succession of turn reversals attempting to achieve an offensive posture following an attacker's overshoot.

Scramble. Launch the aircraft as soon as possible.

Scud. Tactical surface-to-surface ballistic missile, medium-range, modified and used by Iraq.

Semi-Active. A missile/bomb guidance system where the missile receiver homes in on radiation/reflection from the target that has been sent by a source other than the missile itself. I.e., an aircraft (usually) bounces radar off the target, and the missile homes in on the target.

Sequence Points. A set of geographical points to be overflown, including steer points, initial points, and target points. Also known as Waypoints.

Sidewinder. An AIM-9 IR missile

Sparrow. An AIM-7 semi-active radar missile.

Stall. “Loss of lift” condition that occurs when the angle of attack is too steep or airspeed is too low for the airfoil to provide any lift. During a stall, the normally streamlined flow of air over the airfoil is disrupted.

Straight Flush. Acquisition radar unit for SA-6 Surface-to-Air missiles.

Tally. An informative call conveying visual contact with the bandit, the opposite of “No Joy.”

Tankplink. Attack armored vehicles using laser-guided bombs.

Target Point. A steer point at which a pilot releases weapons.

Trailer. The last aircraft in a formation.

Triple-A. Unguided, ground-to-air gunfire (12.7 - 100mm).

True Airspeed. Velocity relative to the ground, taking into account additions and subtractions to your indicated airspeed due to altitude, temperature, wind direction and speed, side slippage, etc.

Turn Rate. Number of degrees per second a particular aircraft can turn. The higher the rate, the faster the turn.

Turn Radius. Radial distance required to complete a turn. The smaller the radius, the tighter the turn.

Weapon Envelope. Effective area of attack for a weapon. Enemies within this envelope are vulnerable to fire from the weapon.

Wilco. Will comply.

Wild Weasel. Aircraft (F-4Gs in Gulf War) that take out SAM sites in preparation for strike attacks.

APPENDIX D.

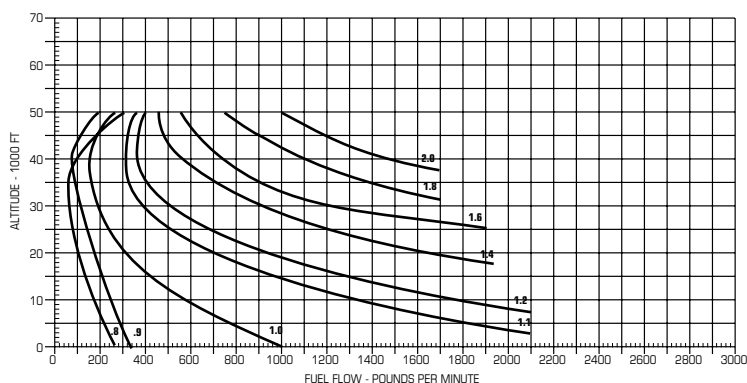
F-15E FUEL FLOW

The Strike Eagle in *Jane's F-15* has a realistic fuel consumption model.

Having an idea of how long your aircraft can stay airborne before needing to refuel is crucial both in flying longer missions and in designing them.

The chart below can be summarized by two basic concepts: the faster an F-15 flies, the more fuel it uses; the higher an F-15 flies the less fuel it uses.

Note: This chart does not apply to afterburner usage, which has a significantly higher fuel consumption.



Number to the right of curved line indicates Mach number.

APPENDIX E.

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