Integrity - Service - Excellence

USAF Ejection Experience

Thru 1 Feb 2016

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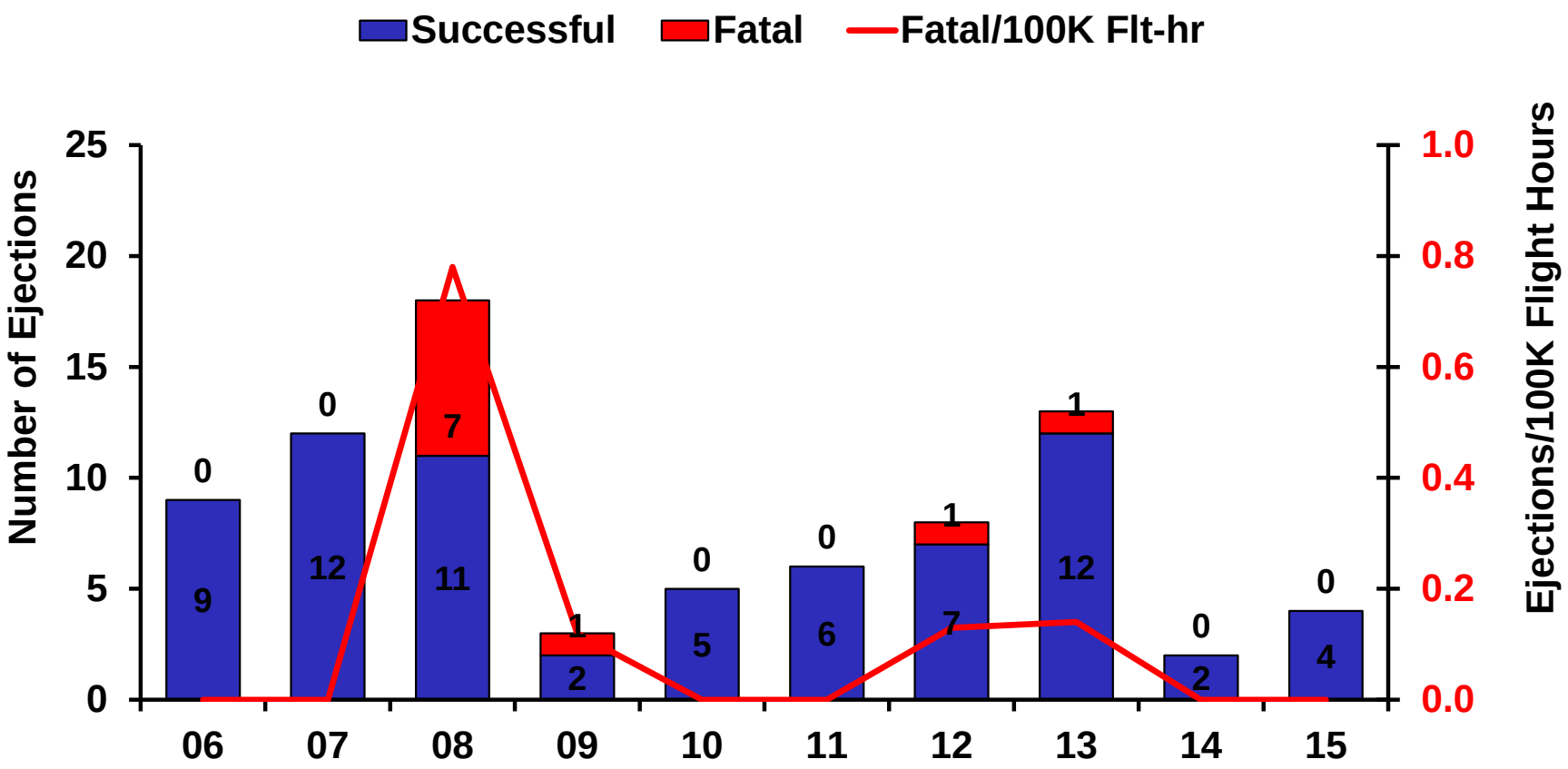
Outline

- USAF Aircraft Mishap Statistics
- USAF Ejections Statistics
- FY13/14/15/16 Ejection Details
- Ejection Concerns

All USAF Ejections
FY 06 – FY 15

	Total	Survived	Rate	Fatal	Rate
F-35	0	0	N/A	0	N/A
F-16	26	25	96%	1	4%
F-15	17	15	88%	2	12%
F-22	2	1	50%	1	50%
A-10	3	3	100%	0	0%
B-1	4	4	100%	0	0%
B-2	2	2	100%	0	0%
B-52	2	0	0%	2	100%
T-38	12	8	67%	4	33%
T-6	9	9	100%	0	0%
U-2	0	0	N/A	0	N/A
F-4	3	3	100%	0	0%
	80	70	88%	10	12%

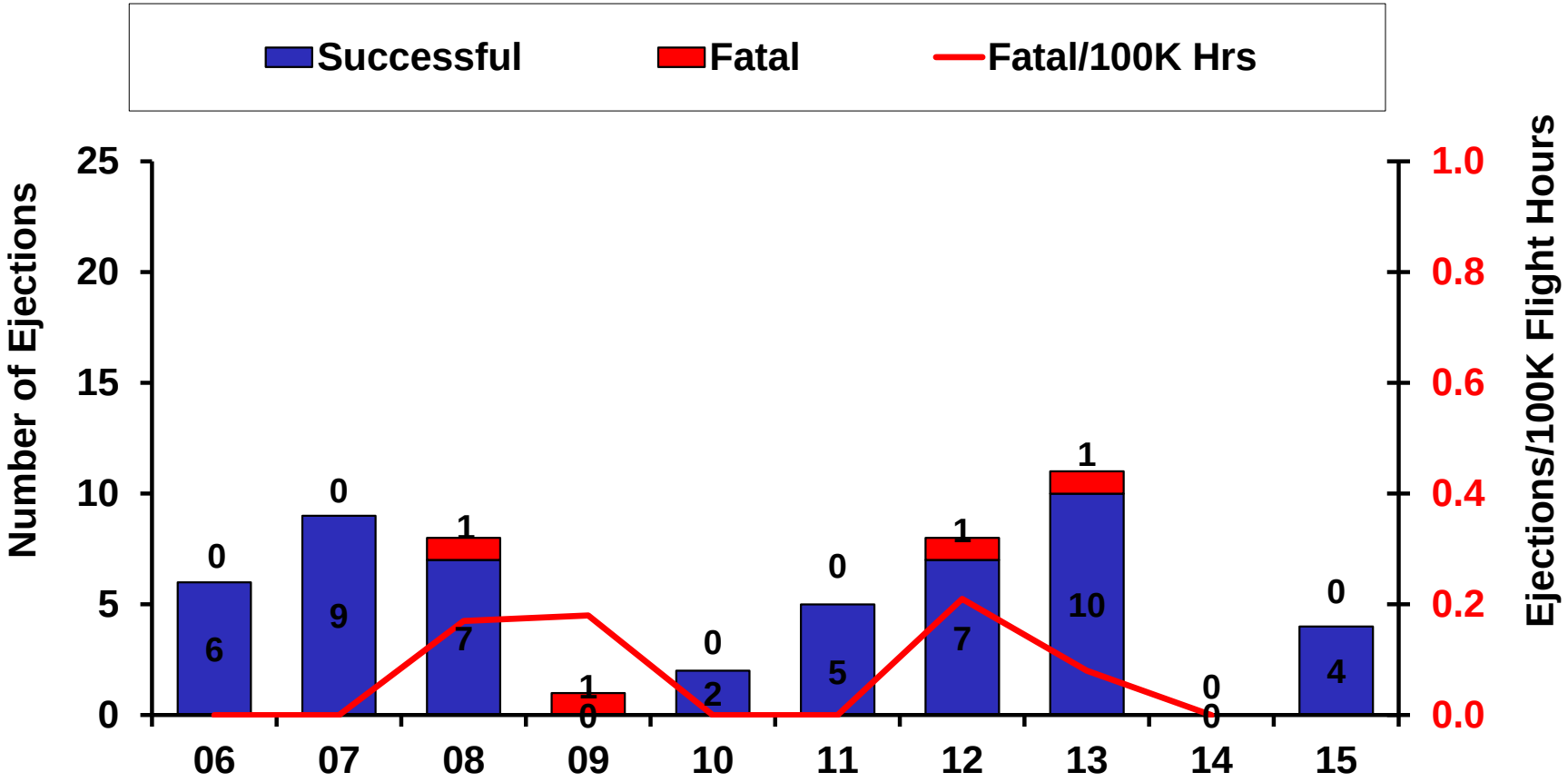
All USAF Ejections
FY 06 – FY 15



	Ejections / Rate	Fatal / Rate
10-Year (FY 06-15):	80 / 0.96	10 / 0.12

ACES II Aircraft Ejections

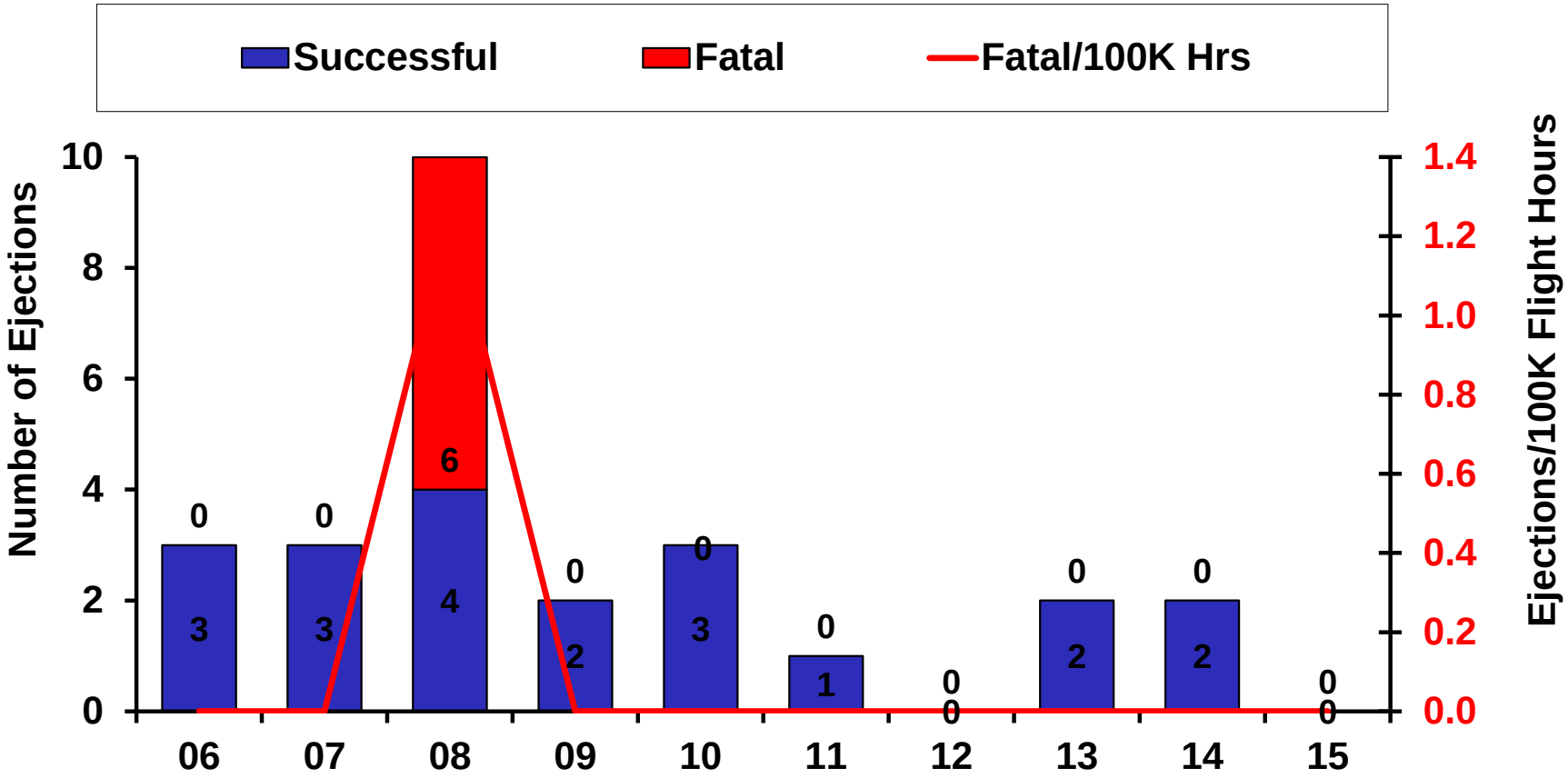
FY 06 – FY 15



	Ejections / Rate	Fatal / Rate
Lifetime (thru FY15):	472 / 2.02	41 / 0.18
10-Year (FY 06 - 15):	54 / 1.04	4 / 0.08

Non ACES Aircraft Ejections

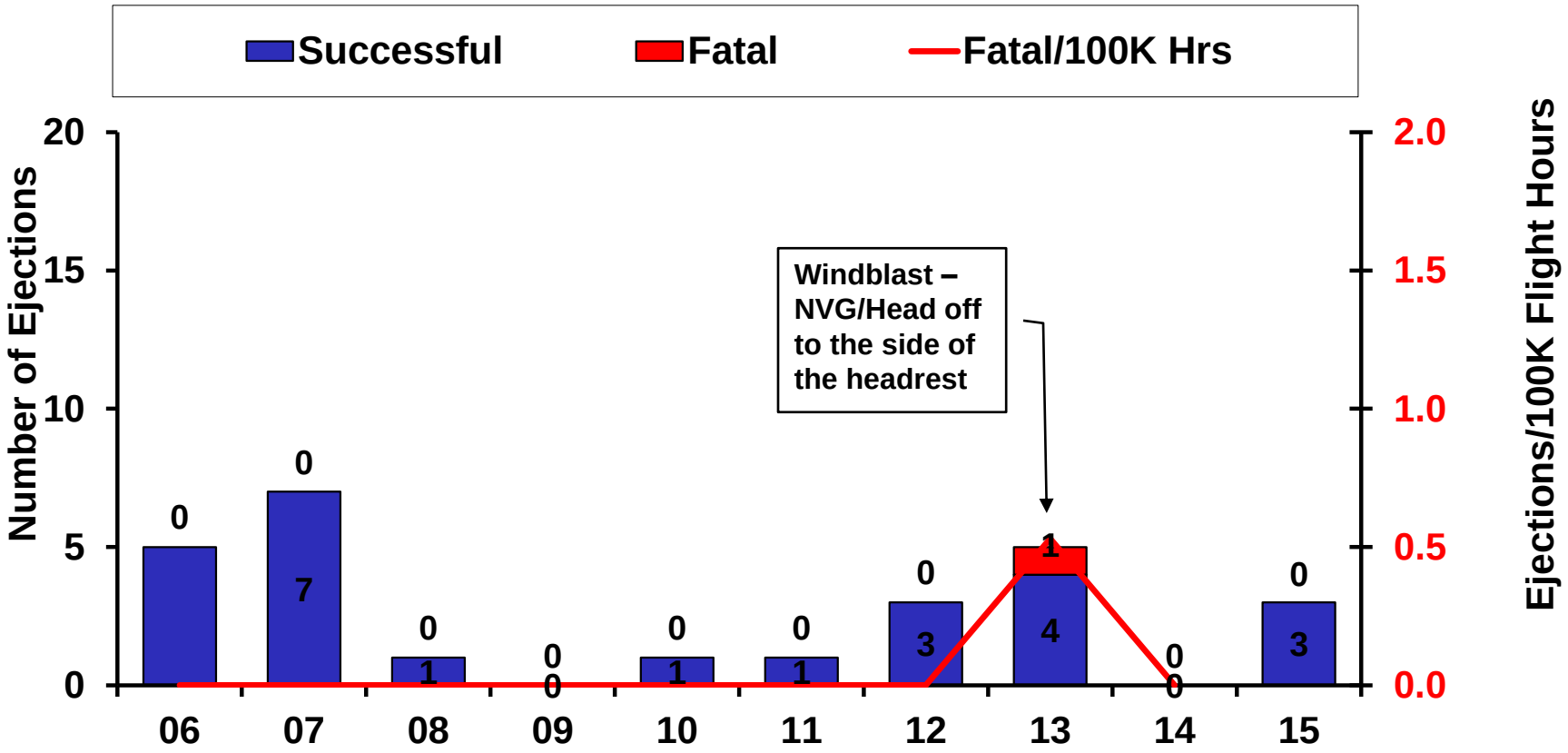
FY 06 – FY 15



	Ejections / Rate	Fatal / Rate
10-Year (FY 06 - 15):	26 / 0.82	6 / 0.19

F-16 Aircraft Ejections

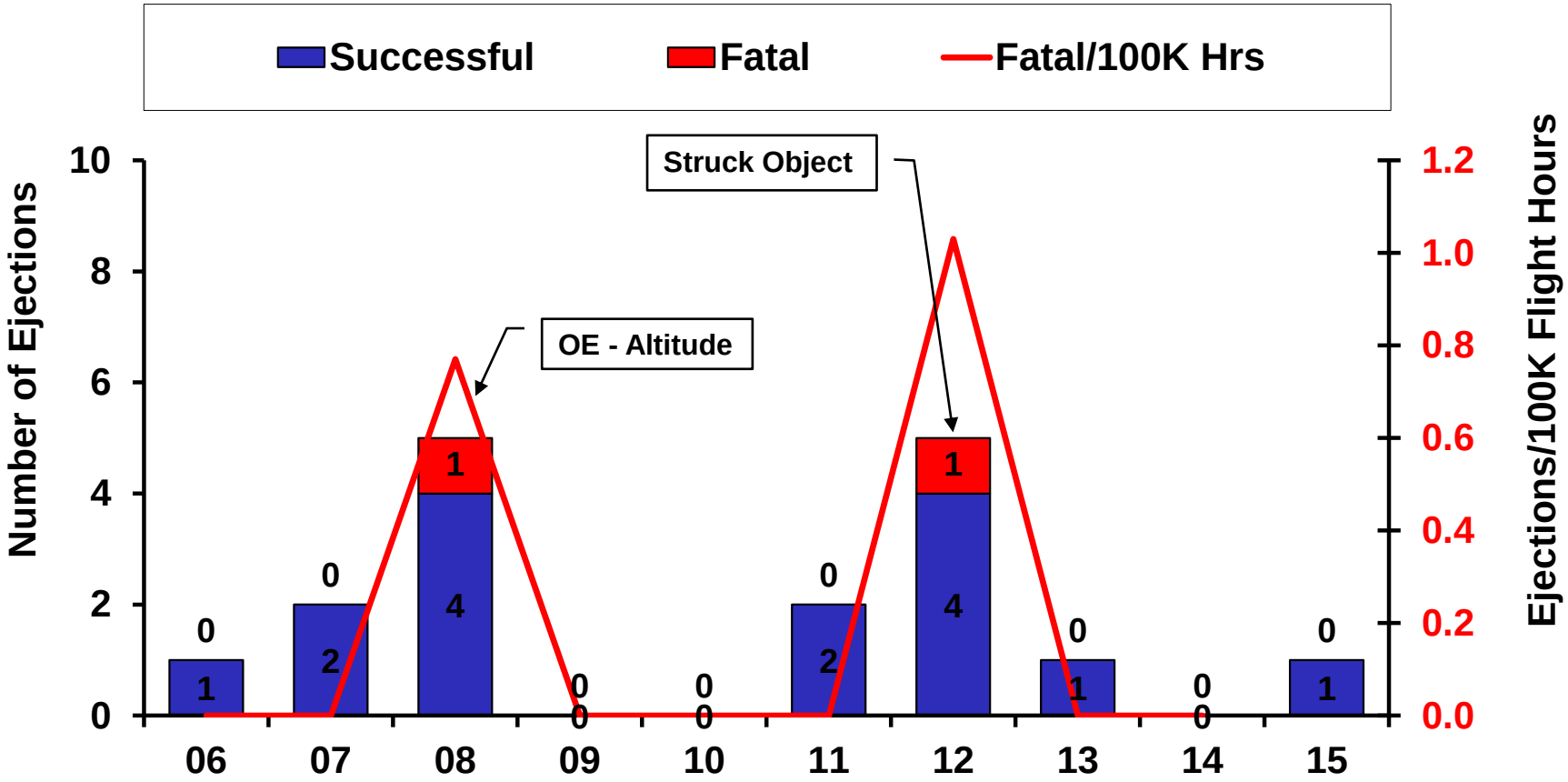
FY 06 – FY 15



	Ejections / Rate	Fatal / Rate
Lifetime (Aug 78 – FY15):	297 / 2.83	21 / 0.20
10-Year (FY 06 - 15):	26 / 1.06	1 / 0.04

F-15 Aircraft Ejections

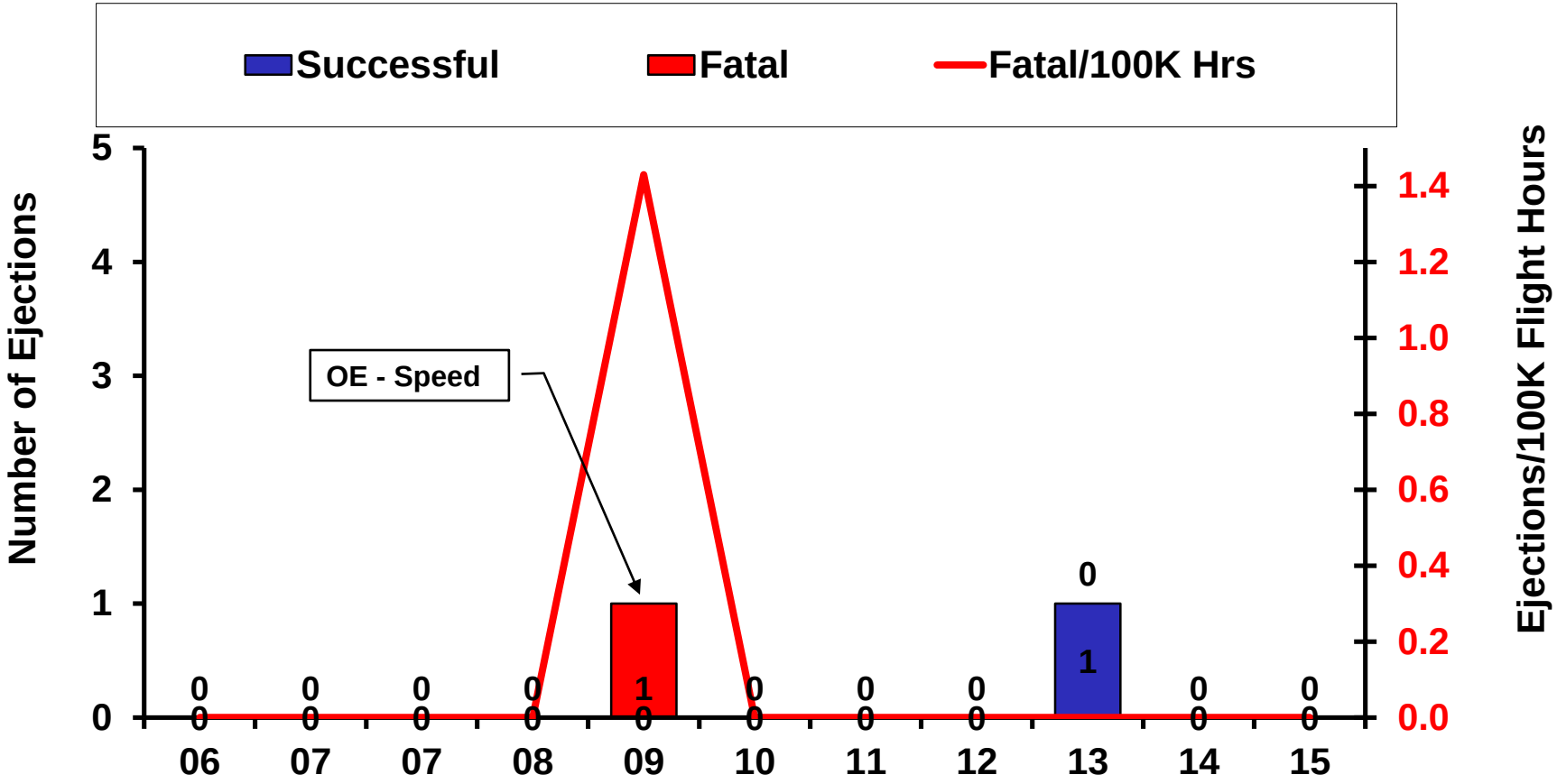
FY 06 – FY 15



	Ejections / Rate	Fatal / Rate
Lifetime (Aug 78 – FY15):	89 / 1.42	8 / 0.13
10-Year (FY06 - FY15):	17 / 1.40	2 / 0.16

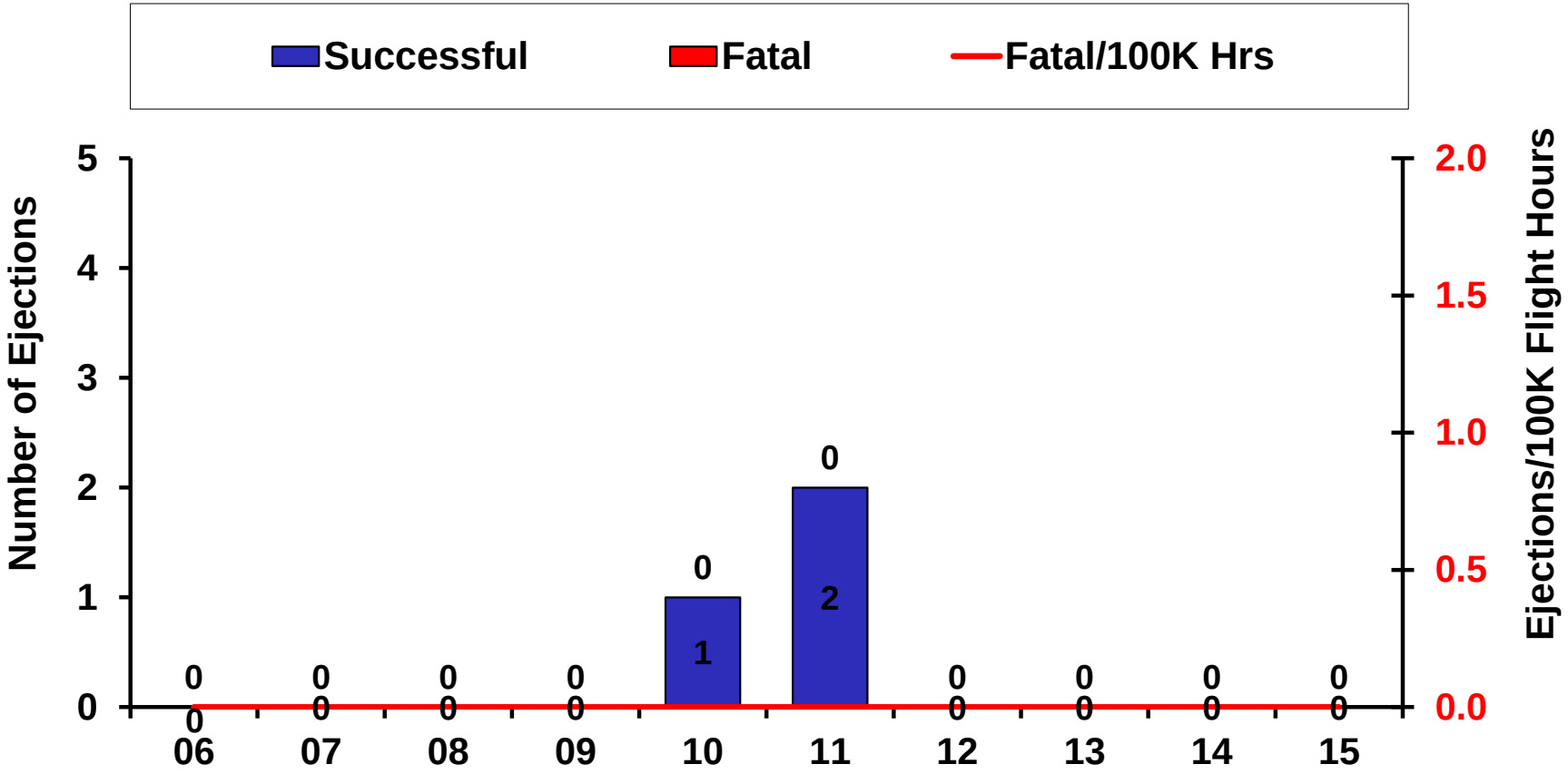
F-22 Aircraft Ejections

FY 06 – FY 15



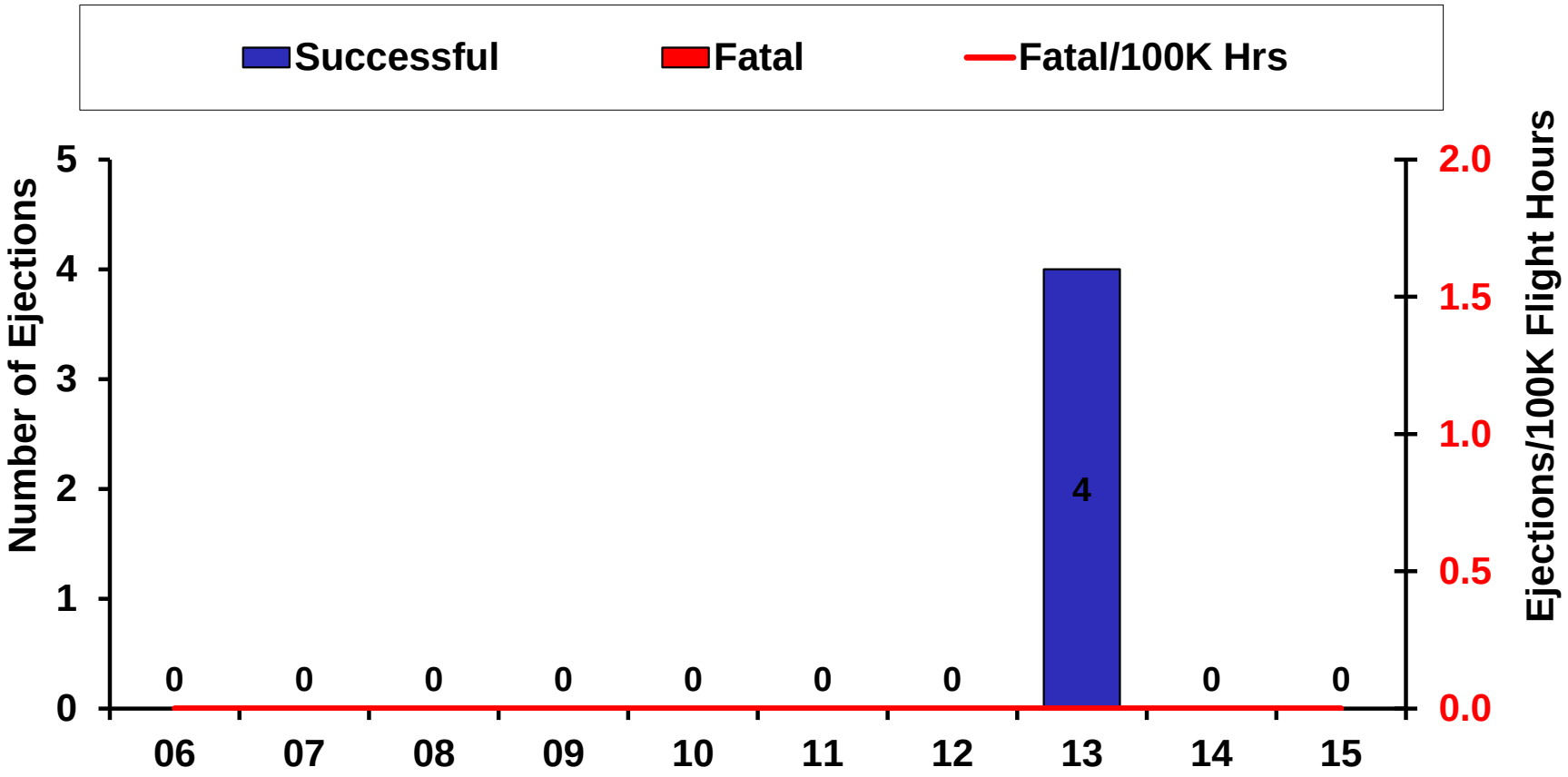
	Ejections / Rate	Fatal / Rate
Lifetime (FY02 – FY15):	3 / 1.34	1 / 0.45
10-Year (FY06 - FY15):	2 / 0.92	1 / 0.46

A-10 Aircraft Ejections
FY 06 – FY 15



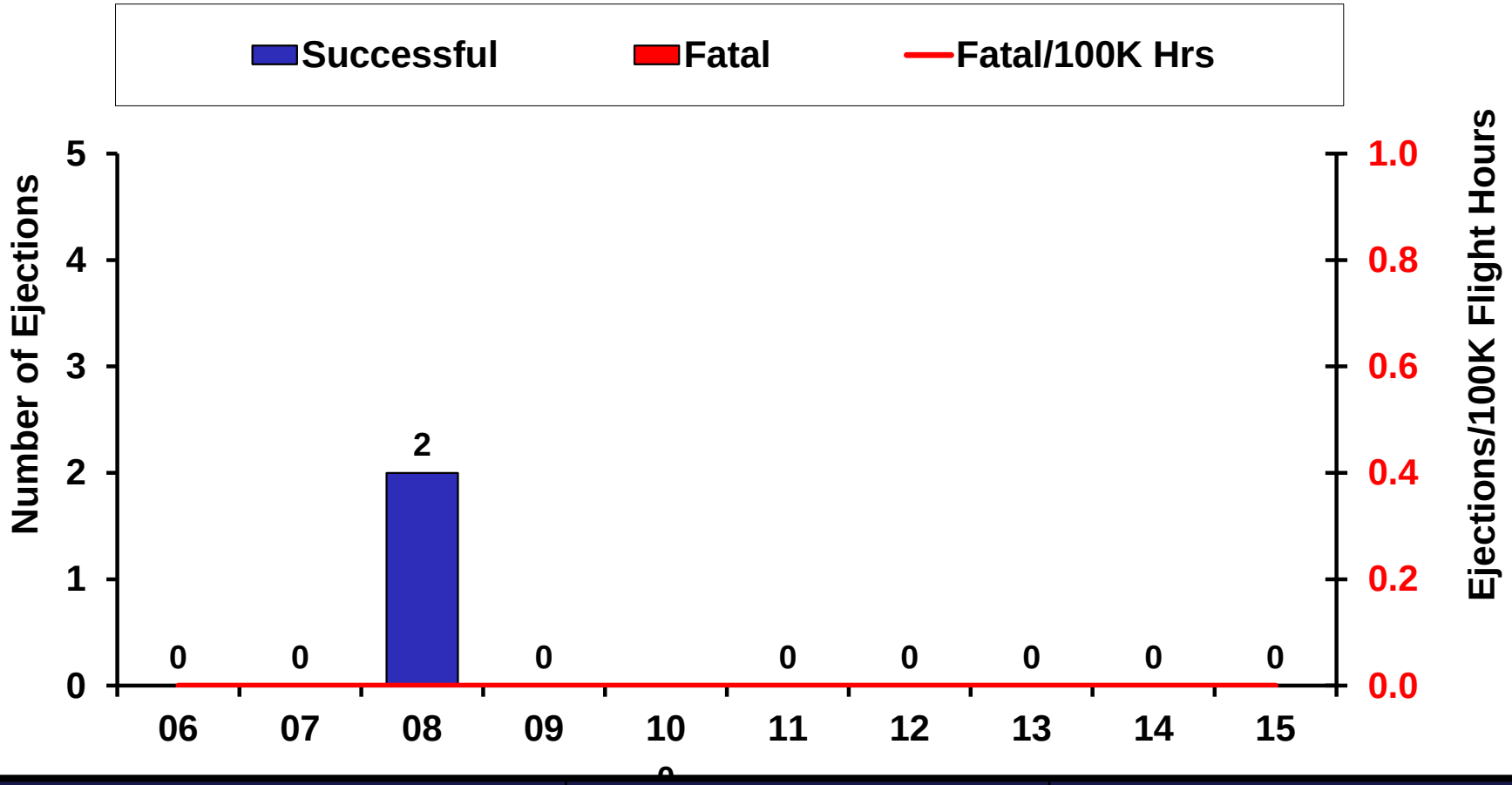
	Ejection/Rate	Fatal / Rate
Lifetime (Aug 78 – FY15):	55 / 1.04	10 / 0.19
10-Year (FY06 - FY15):	3 / 0.31	0 / 0.00

B-1 Aircraft Ejections
FY 06 – FY 15



	Ejections / Rate	Fatal / Rate
Lifetime (CY84 thru FY15):	24 / 3.44	1 / 0.14
10-Year (FY06 - FY15):	4 / 1.72	0 / 0.00

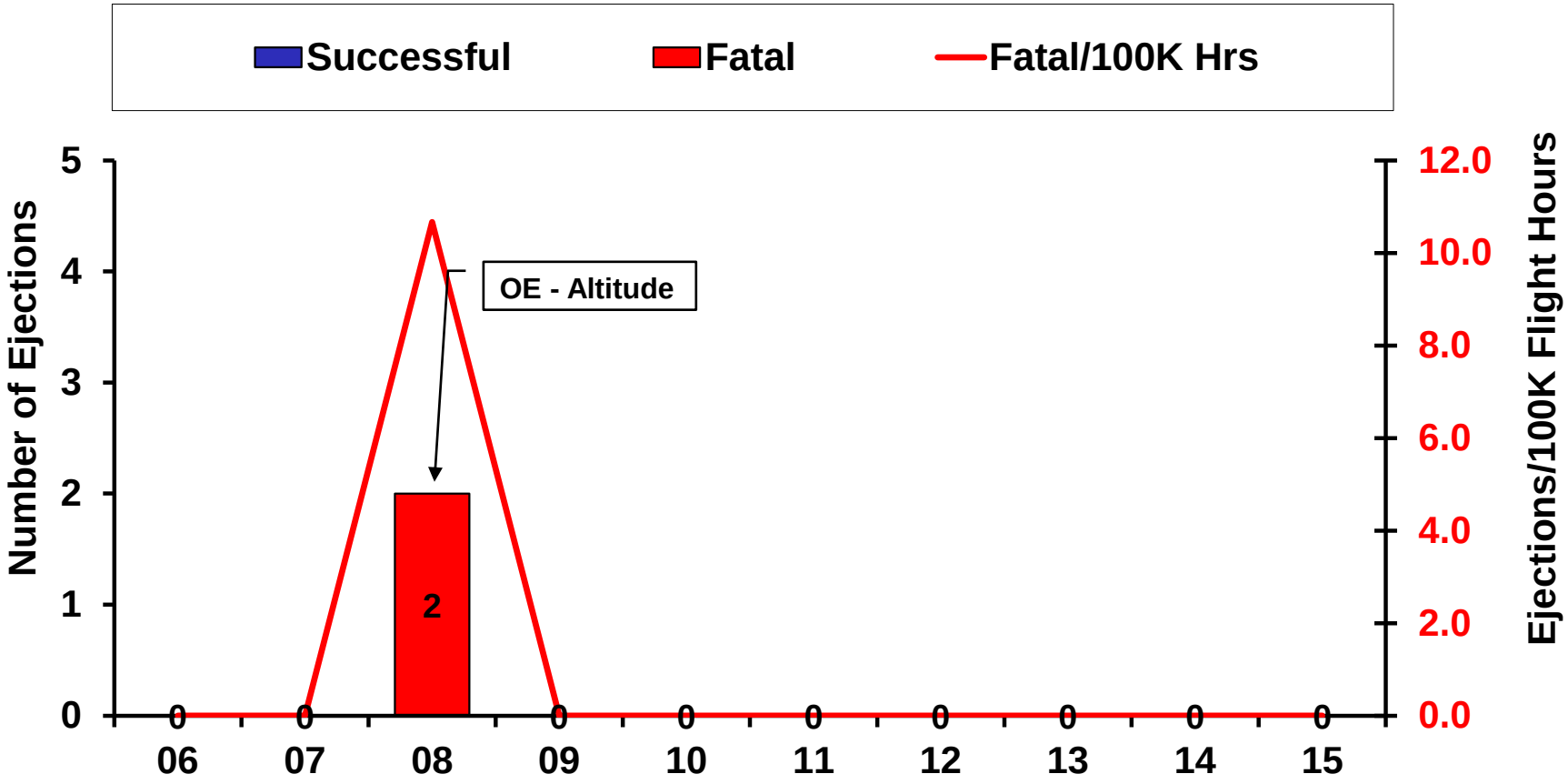
B-2 Aircraft Ejections
FY 06 – FY 15



	Ejections / Rate	Fatal / Rate
Lifetime (FY 90 thru FY 15)	2 / 1.70	0 / 0.00
10-Year (FY06 - FY15):	2 / 3.34	0 / 0.00

B-52 Aircraft Ejections

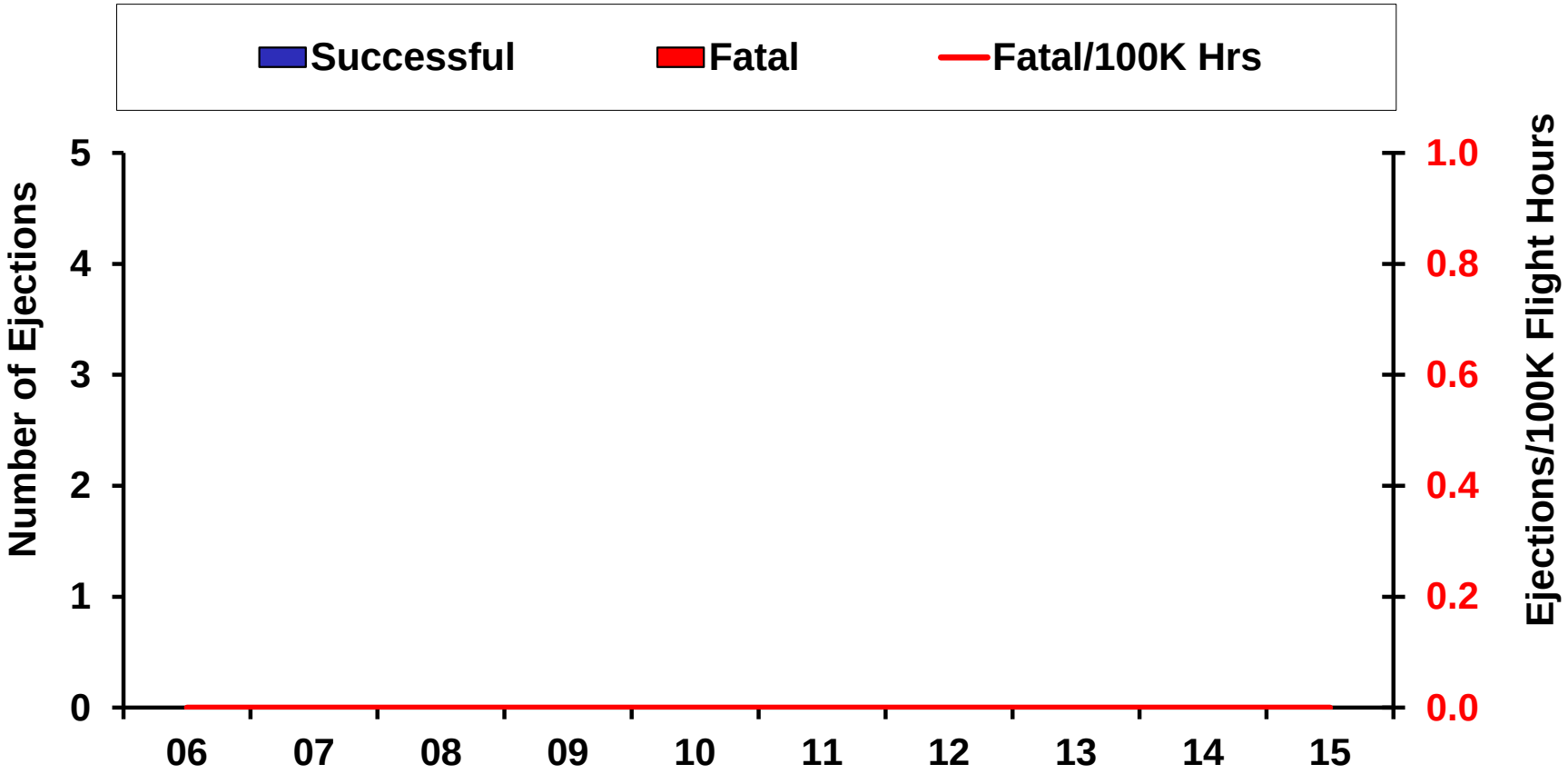
FY 06 – FY 15



	Ejections / Rate	Fatal / Rate
10-Year (FY06 - FY15):	2 / 1.08	2 / 1.08

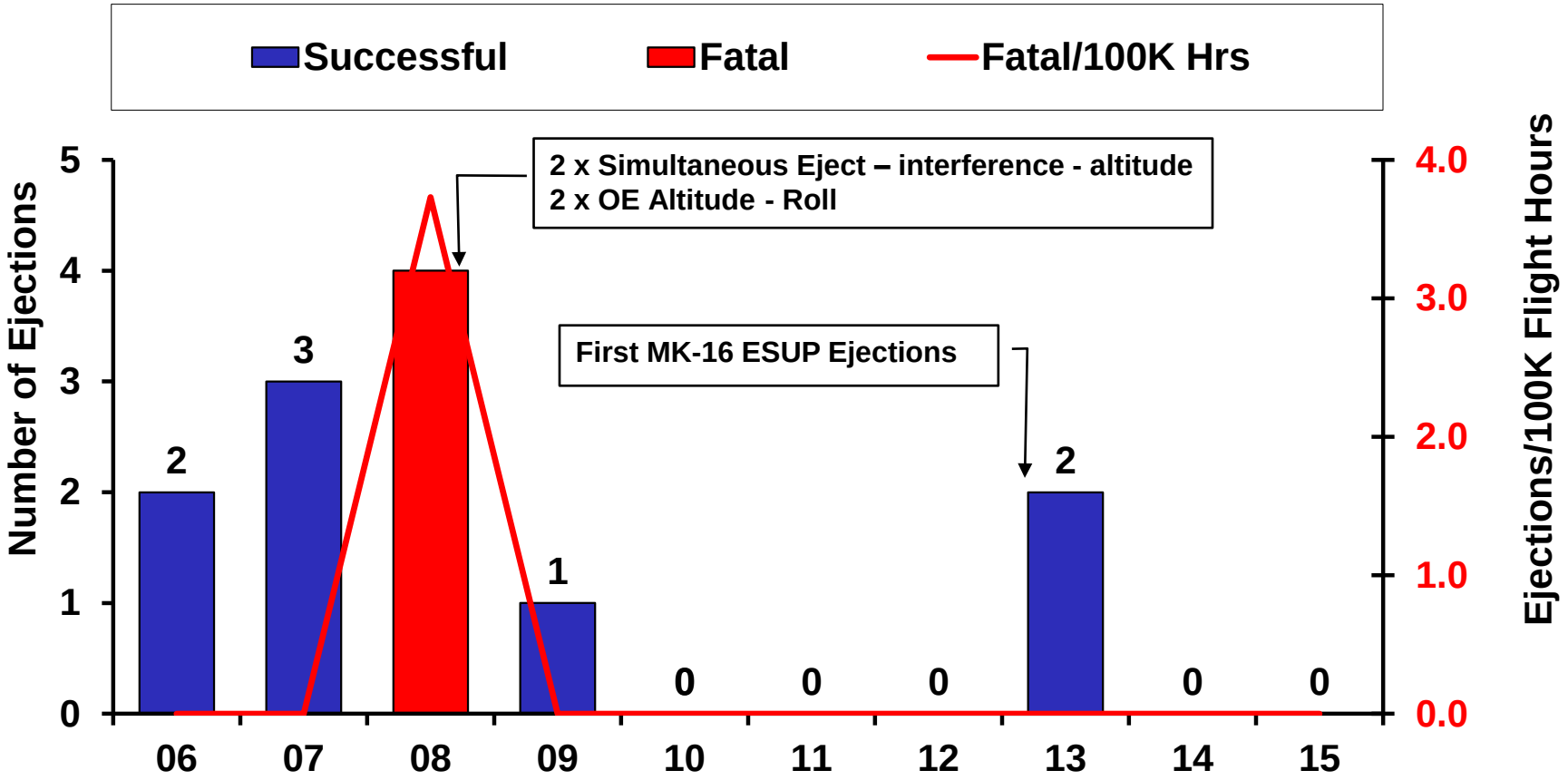
U-2 Aircraft Ejections

FY 06 – FY 15



	Ejections / Rate	Fatal / Rate
10-Year (FY06 - FY15):	0 / 0.00	0 / 0.00

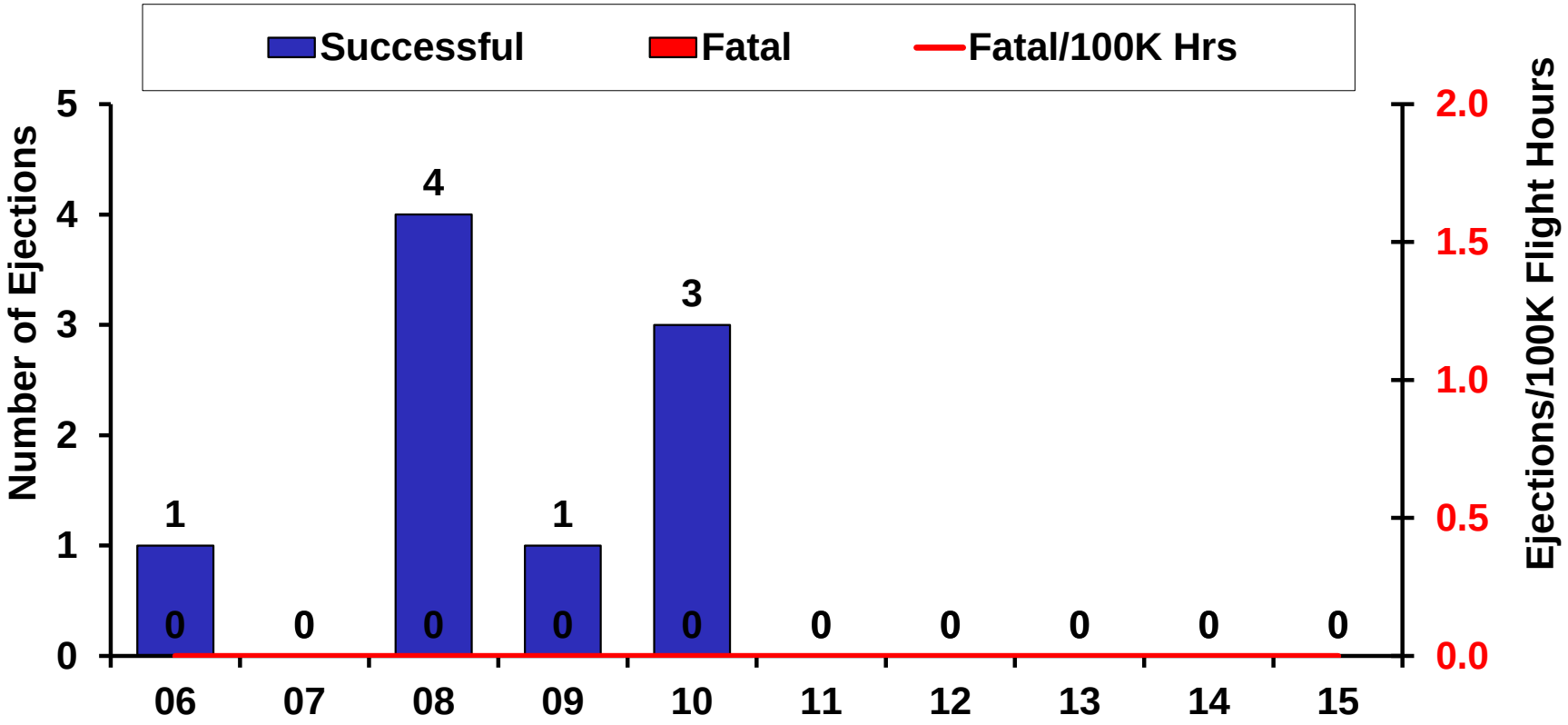
T-38 Aircraft Ejections
FY 06 – FY 15



	Ejections / Rate	Fatal / Rate
10-Year (FY06 - FY15):	12 / 1.18	4 / 0.38

T-6 Aircraft Ejections

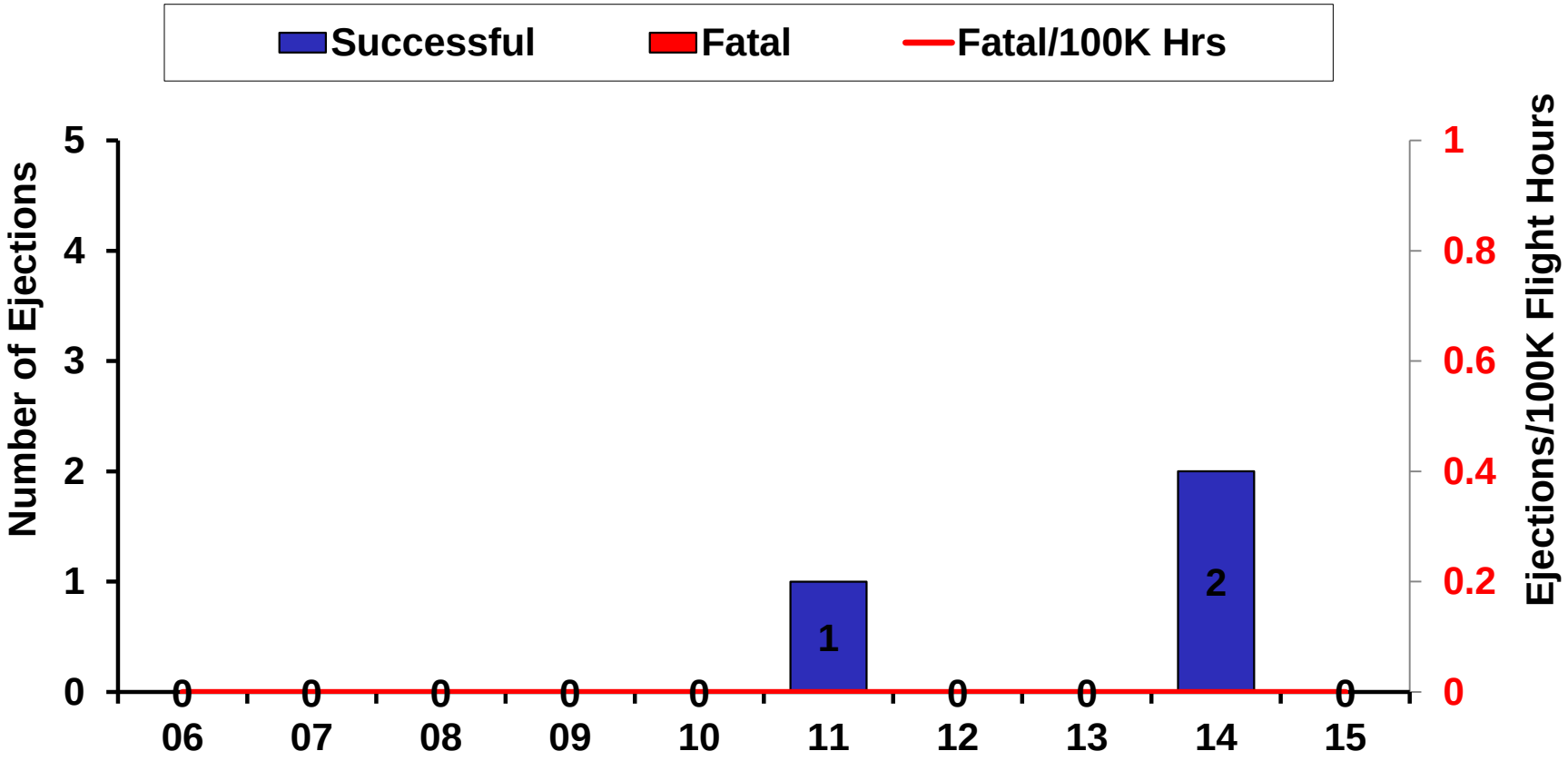
FY 06 - FY 15



	Ejections / Rate	Fatal / Rate
Lifetime (FY00 thru FY15):	12 / 0.66	1 / 0.06
10-Year (FY06 - FY15):	9 / 0.57	0 / 0.00

QF-4 Aircraft Ejections

FY 06 - FY 15



	Ejections / Rate	Fatal / Rate
10-Year (FY06 - FY15):	3 /	0 /

Recent Ejections
FY 16

MDS:	F-16
One Liner:	Under Investigation
Occupant:	Pilot, Gender , Age xx, Weight xxx lbs
Parameters:	xxx feet AGL, xxx KIAS, descending, wings XX, Mode 1
Equipment Issues:	
Injuries:	

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Recent Ejections
FY 16

MDS:	F-16C
One Liner:	Loss of engine thrust
Occupant:	Pilot, Male, Age 24, Weight 187 lbs
Parameters:	440 feet AGL, 132 KIAS, descending, wings level, Mode 1
Equipment Issues:	1. DRS download successful, anomalous data from Z-axis accelerometer, unknown cause. 2. Evidence of skidding on seat rollers. 3. 25 - 30 kt winds drug pilot 210 feet after PLF 4. HGU-55/P JHMCS Helmet, scars on the back from dragging. Nape strap was found rolled, right visor tang broken. Multiple electrical pins inside JHMCS DU bent. 5. Auxiliary kit ripped out of survival kit during dragging. 6. URT-44 functioned normally. 7. UWARS BIT checked okay.
Injuries:	1. Minor neck strain – ejection force

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Recent Ejections
FY 15

MDS:	F-16C
One Liner:	Loss of engine thrust
Occupant:	Pilot, Male, Age 27, Weight 160 lbs
Parameters:	527 feet AGL, 156 KIAS, descending, wings level, Mode 1
Equipment Issues:	1. DRS downloaded successfully. MCU-3 data corrupt, sFlash failed post ejection test, unknown cause. 2. HGU-55/P JHMCS Helmet: minor crack left side, nape strap not properly fit. Minor dirt and scratches on nose of visor. 3. URT-44 functioned normally. 4. Minor documentation errors on inspection paperwork (no date/signature). 5. UWARS/batteries removed, could not be tested. 6. Four line release deployed.
Injuries:	1. Minor neck strain, ejection force. 2. Note: Prior to PLF in trees, visor not lowered, head turned to side with hands on risers (not protecting face and neck)

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Recent Ejections
FY 15

MDS:	F-16C
One Liner:	Mid-air collision w/civilian aircraft, lost thrust
Occupant:	Pilot, Male, Age 34, Weight 235 lbs
Parameters:	270 feet AGL, 180 KIAS, wings level, descending Mode 1
Equipment Issues:	1. Wearing JHMCS, HVI cable QD unnecessarily disconnected 2. Inertia reel straps not fully retracted (4 – 5 inch extended), large occupant stature 3. Mask founded connected to CRU-120/P and both bayonet receivers 4. LRU-16/P life raft CO2 coupling nut found finger tight 5. URT-44 worked properly
Injuries:	1. Minor bruising and abrasions right shoulder, left upper arm, right forearm, bilateral shins, left ankle, timing and mechanism unknown 2. Minor soreness neck and back

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Recent Ejections
FY 15

MDS:	F-16
One Liner:	Mid-air collision
Occupant:	Pilot, Male, Age 41, Weight 185 lbs
Parameters:	7,000 feet AGL, 0 KIAS, out of control
Equipment Issues:	1. DRS had two internal failures: a) Power-on-reset of Microprocessor Control Unit (MCU) 1 b) “Noise” in MCU 3 put it in non-participating test mode These two failures resulted in not firing drogue gun, drogue severance cutters, primary parachute mortar cartridge, and harness release cartridge. 2. DRS accelerometer data indicates back up handle was pulled 3 – 4 seconds after DRS start switch 3. JHMCS worn. 4. URT-44 functioned.
Injuries:	1. Right ankle sprain – PLF 2. Sore/stiff neck – ejection forces

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Recent Ejections
FY 15

MDS:	F-15D
One Liner:	Pilot loss of control in-flight
Occupant:	Pilot, Male, Age 28, Weight 212 lbs. Fwd seat, (aft seat ejected unoccupied)
Parameters:	5,600 feet AGL, 21 KIAS (flat spin), Mode I, Solo, -10,800 ft/min descent, 91 deg/sec yaw
Equipment Issues:	1. DRS Data Received 2. URT-44, FWD and AFT Activated automatically 3. MBU-20/P and CRU-94/P discarded during descent 4. Twisted risers, forced head down during parachute opening 5. Survival kit entangled legs while “bicycle kicking” to untwist 6. Visor blown back on helmet 7. 4 line release successfully utilized 8. Flight gloves found in right G-suit leg pocket, modified by cutting tips off fingers
Injuries:	1. Minor finger abrasion – 2. Bilateral shin abrasions - 3. Left calf cramp -

Recent Ejections
FY 14

MDS:	QR-F4C	
One Liner:	Hydraulic failure, missed cable, eject as aircraft departed the prepared surface, Class C	
Occupant:	Pilot (front, second out), Male, Age 42, Weight 215 lbs	
Parameters:	0 feet AGL, 110 KIAS, initiated command ejection w/lower handle	
Equipment Issues:	1. Pressure operated initiator (POI) ruptured. Reddish brown fluid at lower section of line. Hypothesized that residual hydraulic fluid in the line could have been vaporized and ignited when cartridge fired leading to high internal pressure/rupture. 2. 3 leg restraints released the shear ring as designed, one tore the anchor assembly and some structure off the cockpit floor and did not break the shear ring. The cockpit floor had significant corrosion in the anchor attachment area.	
Injuries:	1. None	

Recent Ejections
FY 14

MDS:	QR-F4C
One Liner:	Hydraulic failure, missed cable, eject as aircraft departed prepared surface, Class C
Occupant:	Test Engineer (rear, first out), Male, Age 37, Weight 184 lbs
Parameters:	0 feet AGL, 110 KIAS
Equipment Issues:	1. 4 UWARS tested, 2 fired in 2 seconds or less, 2 fired in 4 seconds. Recent rain may have diluted the salinity/conductivity of the water from the Gulf used for the test
Injuries:	1. Ankle fracture – PLF

Recent Ejections
FY 13

MDS:	B-1B
One Liner:	In-flight fire, loss of control
Occupant:	OSO (right rear, first out), Male, Age 29, Weight 155 lbs
Parameters:	7600 feet AGL, 410 KIAS, Mode II, out of control
Equipment Issues:	1. DRS S/N 0757 successfully downloaded -Significant accelerations in all three axes at drogue correction, with lateral reaching +28g, indicating right seat yaw. Each subsequent ejection recorded progressively higher lateral acceleration in same direction. -Divergence inhibit switch position had some chatter but correctly selected inhibit at start switch activation 2. Helmet lost
Injuries:	1. Minor bruises and abrasions to face and neck from helmet loss 2. Tenderness in his lower back from ejection force and PLF

Recent Ejections
FY 13

MDS:	B-1B
One Liner:	In-flight fire, loss of control
Occupant:	DSO (left rear, second out), Male, Age 36, Weight 211 lbs
Parameters:	7600 feet AGL, 410 KIAS, Mode II, out of control
Equipment Issues:	1. DRS S/N 0750 successfully downloaded -Significant accelerations in all three axes at drogue correction, with lateral reaching +32g, indicating right seat yaw. -Divergence inhibit switch position had significant chatter but correctly selected inhibit at start switch activation 2. Helmet lost.
Injuries:	1. Left glenohumeral shoulder dislocation – flail/windblast 2. Fracture of the left posterior hyoid bone – equipment strike

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Recent Ejections
FY 13

MDS:	B-1B
One Liner:	In-flight fire, loss of control
Occupant:	Co-Pilot (third out), Male, Age 34, Weight 185 lbs
Parameters:	7600 feet AGL, 410 KIAS, Mode II, out of control
Equipment Issues:	1. DRS S/N 0726 successfully downloaded -Significant accelerations in all three axes at drogue correction, with lateral reaching +38g, indicating right seat yaw. 2. Left leg restraint not properly routed through roller, pulled backward through snubber 1 ¾ inch by leg flail 3. Both leg restraints had an improper, lower strength aluminum shear rivet installed. Right leg restraint only partially retracted 7 3/8 inch, due to low strength shear rivet. 4. Helmet lost.
Injuries:	1. Left knee posterolateral dislocation flail injury – windblast and improperly routed leg restraint 2. Bruises and abrasions to the face and neck – helmet loss/wind blast. 3. 6 cm posterior head contusion and mild traumatic brain injury – PLF without helmet

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Recent Ejections
FY 13

MDS:	B-1B
One Liner:	In-flight fire, loss of control
Occupant:	Pilot (last out), Male, Age: 30 Weight: 176 lbs
Parameters:	7600 feet AGL, 410 KIAS, Mode II, out of control
Equipment Issues:	1. DRS S/N 0741 successfully downloaded. -Environmental sensor speed switch open from power up -Significant accelerations in all three axes at drogue correction, with lateral reaching +40g, indicating seat yawed right. 2. Left leg restraint not properly routed through roller, resulting in very little retraction - 1 7/8 inch. 3. Both leg restraints had an improper, lower strength aluminum shear rivet installed. Right leg restraint only partially retracted 11 5/8 inch, due to low strength shear rivet. 4. Helmet lost
Injuries:	8 cm scalp laceration, bruises and abrasions to face and neck from helmet loss. All radiology studies normal.

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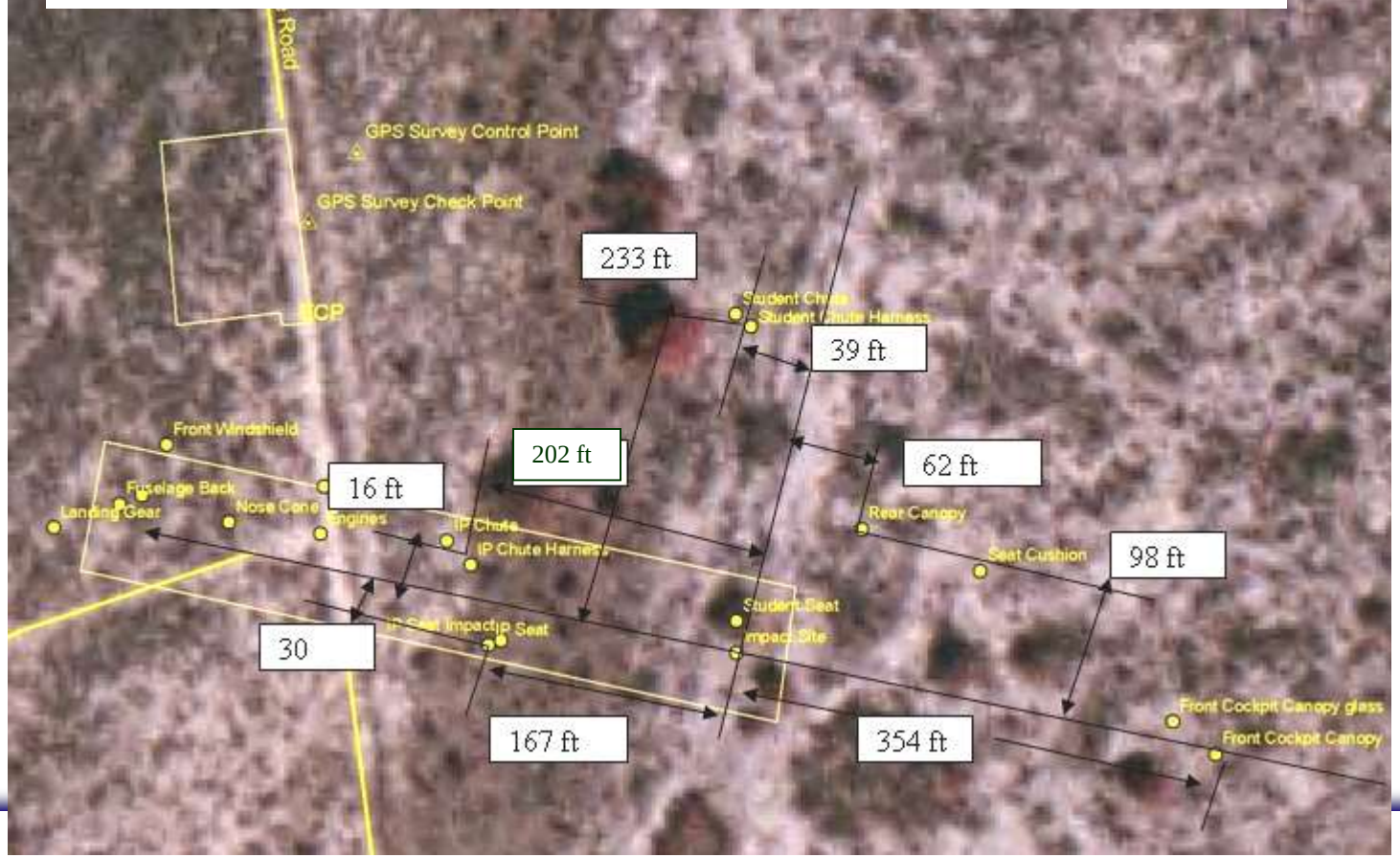
Recent Ejections
FY 13

MDS:	F-16C
One Liner:	Mid-air – over water
Occupant:	Pilot, Male, Age: 35 Weight: 185 lbs
Parameters:	11,000 feet AGL, 320 KIAS, Mode II (assumed), out of control
Equipment Issues:	1. Seat not recovered 2. Did not have time to remove AN/AVS-9 NVGs, ripped off in windblast but helmet was retained 3. Open right G-suit pocket possibly exacerbated flail 4. Possible UWARS failure – manually released when MP felt he was being pulled after water entry 5. Four line release not used – did not steer into wind 6. Wrapped left leg around survival kit lanyard to reduce oscillation 7. URT-44 activated automatically
Injuries:	1. Closed right knee dislocation with lots of ligament damage – flail/windblast 2. Left knee LCL tear, partial PCL tear, meniscal tear, large joint effusion – flail/windblast

Provided diagram...

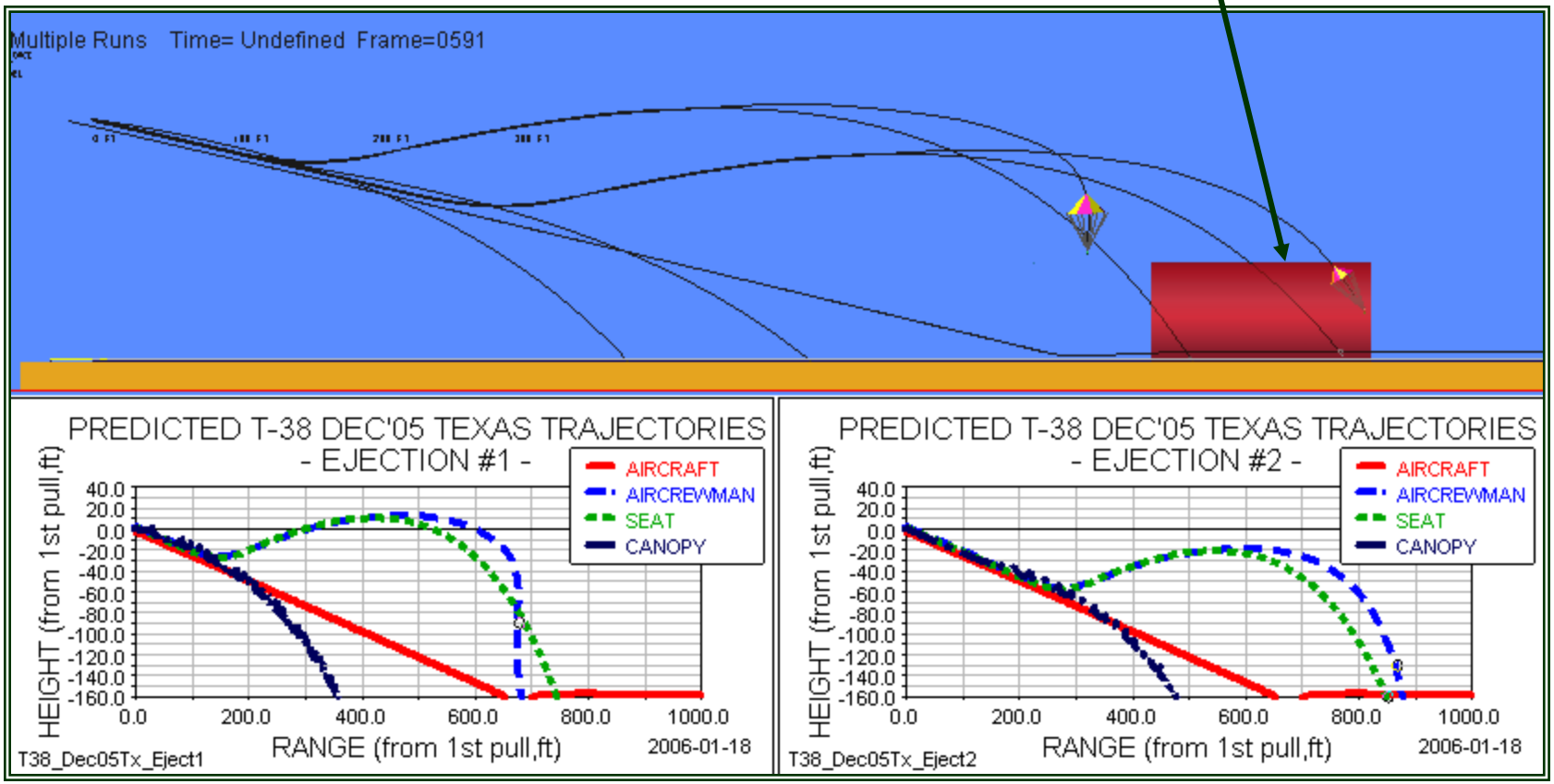
Aircraft Heading: 289
Winds: 180 at 12 knots
Student (front cockpit) ejected at approx 180 knots, 6 degrees nose down, wings level, no yaw.
Front Cockpit Canopy: almost directly in the flight path, 354 feet back from aircraft impact.
Student Seat (front cockpit) directly adjacent to aircraft initial impact.
Student: 39 feet forward and 233 feet right of aircraft impact point.
IP (rear cockpit) ejected shortly (approximately .75 seconds) after Student:
Rear Canopy: 62 feet back and 98 feet right of aircraft impact point.
IP Seat (aft cockpit): 167 feet forward and 30 feet left of aircraft impact point.
IP: 202 feet forward and 16 feet right of aircraft impact point.



RESULTS:

Note: Cylinder approximates aircraft "fireball"
- **Begins 50 ft after aircraft impact at ~670 ft**
- **Extends: ~ 150 ft**
- **Diameter: ~75 ft**

SIDE-VIEW TRAJECTORY REVIEW, STILL-SHOT:



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T-38 Ejection
FY 08

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T-38 Ejection
FY 08

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T-38 Ejection
FY 08

T-38 Ejection
FY 08

Recent Ejections
FY 13

MDS:	T-38C
One Liner:	Bird Strike on canopy, engine ingested canopy fragments
Occupant:	Instructor Pilot, Male, Age 38, Weight 200 lbs
Parameters:	200 feet AGL, 200 KIAS, 10–15 degrees nose down, left wing down, descending
Equipment Issues:	1. First MKUS-16T ESUP Ejections 2. Seat kit lowering line not properly attached to spacer block 3. URT-33 beacon activated, but battery depleted 4. Parachute harness side adjustments not evenly fit, 3 inch difference between the leg straps
Injuries:	1. Left non-displaced midshaft fibula fracture – PLF 2. Soft tissue muscle strains of the calves - PLF

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Recent Ejections
FY 13

MDS:	T-38C
One Liner:	Bird Strike on canopy, engine ingested canopy fragments
Occupant:	Student Pilot, Male, Age: 26 Weight: xxxx lbs
Parameters:	200 feet AGL, 200 KIAS, 10–15 degrees nose down, left wing down, descending
Equipment Issues:	1. First MKUS-16T ESUP Ejections 2. 35% of parachute melted, headbox rigging line trays melted, helmet visor sooted, flight suit, gloves, all showed signs of heat exposure, no ground fire around items on ground – student descended through aircraft fireball 3. URT-33 beacon activation lanyard broke, beacon did not activate 4. Parachute harness side adjustments not evenly fit. 5. ICNS nape strap folded from repeated incorrect wear
Injuries:	1. Wedge compression fractures T-10 and T-11 - PLF 2. Minimally displaced medial malleolus fracture left ankle with ligamentous injury – PLF 3. Laceration lower lip from mask microphone – windblast

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Recent Ejections
FY 13

Recent Ejections
FY 13

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Recent Ejections
FY 13

MDS:	F-16C	
One Liner:	Spatial Disorientation – over water	
Occupant:	Pilot, Male, Age: 32, Weight: 185 lbs	
Parameters:	7,066 feet AGL, 569 KIAS, Mode II	10 Hz TSPI data from ACMI pod: 17 deg left wing down rolling right, 17 deg nose down pitching up, +2g
Equipment Issues:	1. DRS S/N-0182 sent to vendor -Significant corrosion – sFlash ICs installed on engrg unit for download -Historical Scale Factor & Offset used to “calibrate” accelerometer data 2. Significant accelerations in all three axes at drogue correction, with lateral > -40g (clipped), indicating seat yawed ~90 deg left 3. JHMCS helmet fitted with NVG/bracket – recovered near pilot. Helmet ripped off in wind blast, likely NVG not removed prior to ejection. HVI cable pulled out from base of helmet 1.5 inch. Zeta liner not recovered, energy absorbing liner cracked, ICNS snap not connected when received. One mask bayonette connected, one not, when received. 4. URT-44 beacon did not activate at man-seat separation, functioned normally during post ejection test 5. Parachute harness not properly fit 6. LPU straps not properly routed, but LPU auto inflated normally	

Recent Ejections
FY 13

MDS:	F-16C (Continued)	
One Liner:	Spatial Disorientation – over water	
Occupant:	Pilot, Male, Age: 32, Weight: 185 lbs	
Parameters:	7,066 feet AGL, 569 KIAS, Mode II	10 Hz TSPI data from ACMI pod: 17 deg left wing down rolling right, 17 deg nose down pitching up, +2g
Injuries:	1. Atlanto-Ocipital dislocation – windblast/acceleration forces/head off to left side of headrest 2. Parietal, frontal and base of temporal lobes – subarachnoid hemorrhage – windblast/helmet loss 3. Right elbow joint dislocation – flail/windblast 4. Left Tib/Fib open fracture – flail/windblast 5. First rib fracture – windblast 6. Head and neck abrasions/contusions – helmet loss/riser interaction with un-helmeted head 7. Limb abrasions/contusions – ejection force and windblast	

Recent Ejections
FY 13

MDS:	F-16C (Continued)	
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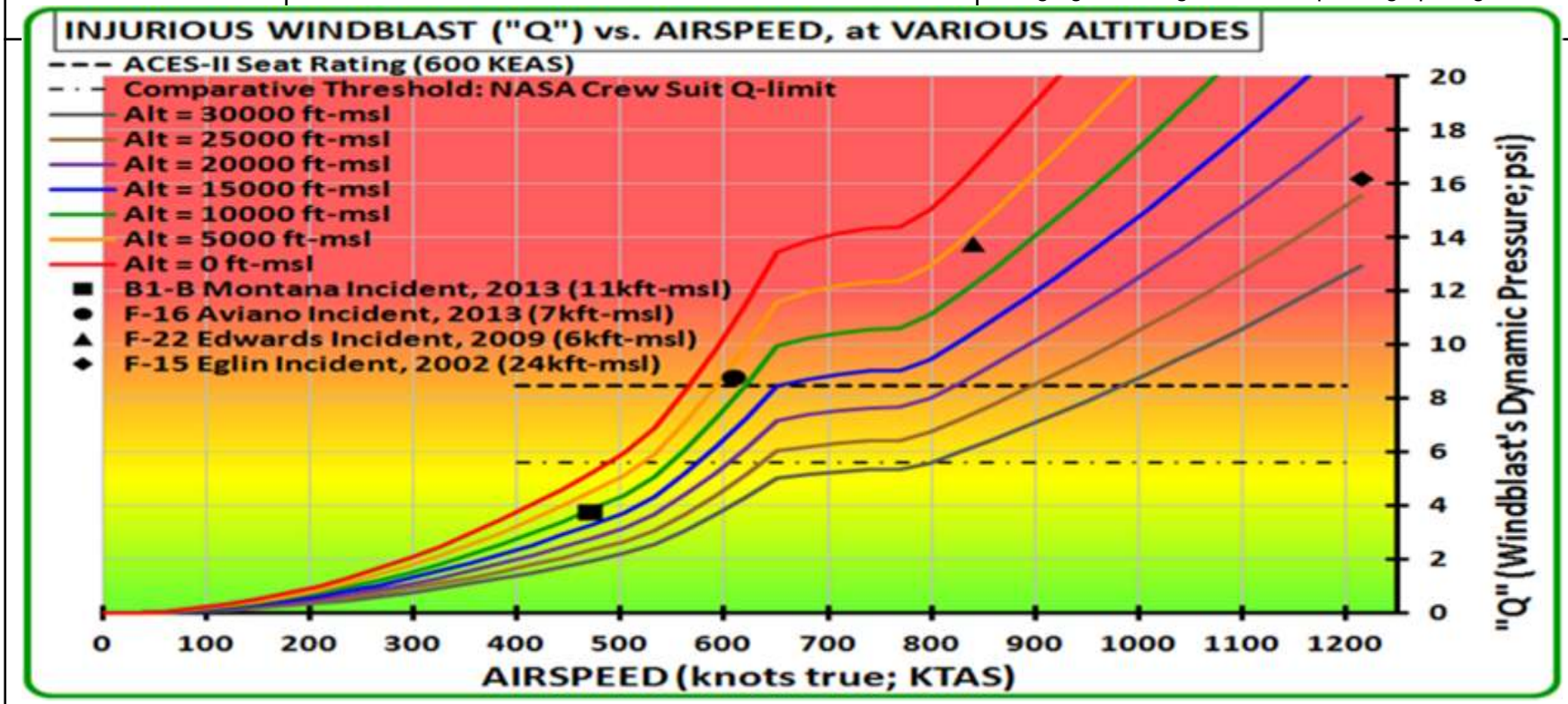


Ejection Concerns

FY08

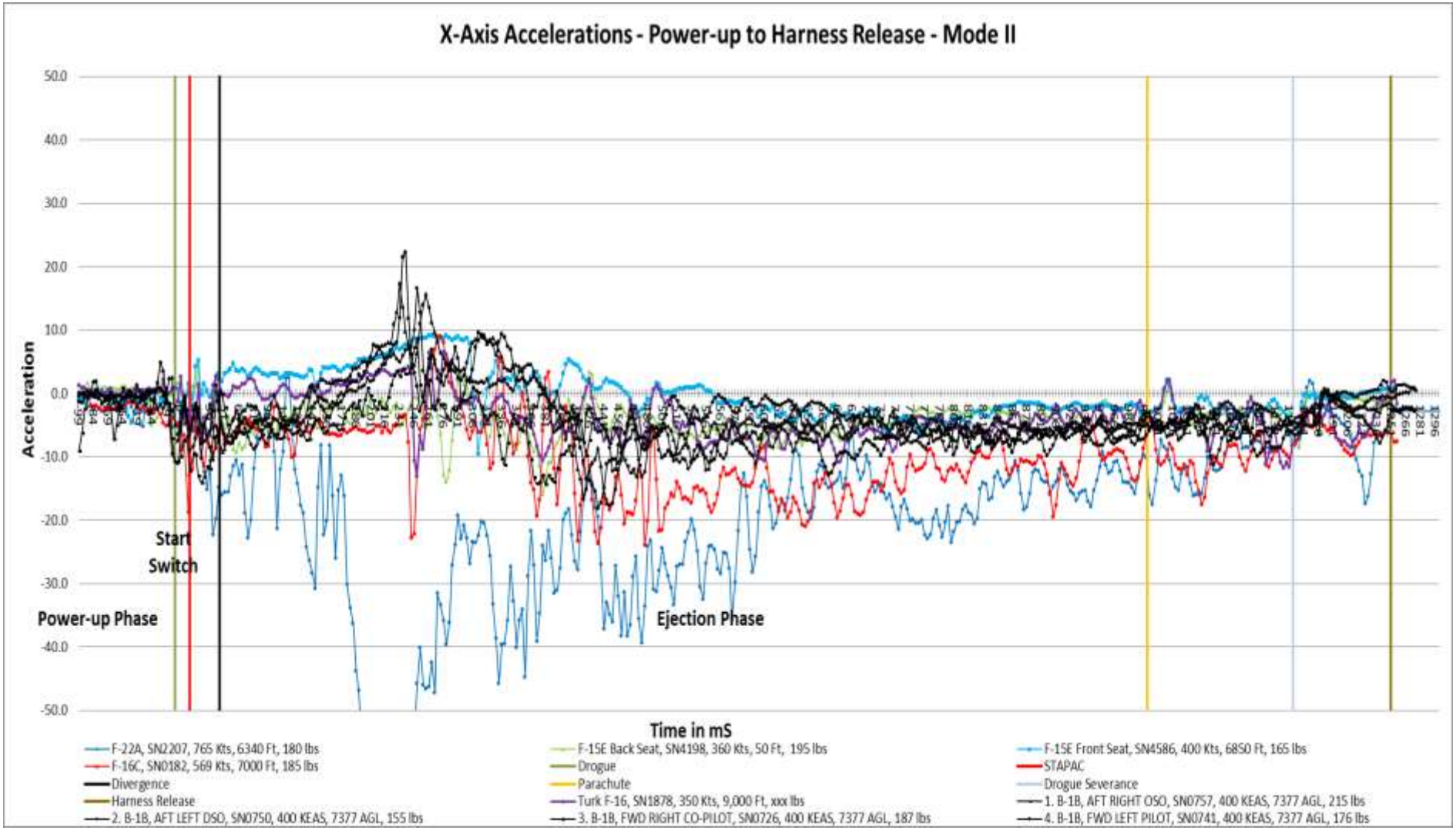
- Delayed Ejection Decisions
  - 8 of 10 ejection fatalities in FY08 from delayed ejection decision
    - T-38C Dual simultaneous ejection at 40 Ft AGL
    - F-15D Ejection
      - Aft seat occupant 744 Ft AGL – minor injuries
      - Fwd seat occupant 586 Ft AGL – fatal
    - B-52 Delayed ejection decision
- Possible lack of understanding or overconfidence in ejection seat performance
  - F-15 SIB Conducted a survey, 71 respondents
    - 21 (30%) believe ACES II can right itself, regardless of aircraft attitude
    - Highlights the need for training

Ejection Concerns
FY 13

- Seat Accelerations in Mode II ejections
  - Significant at drogue snatch
  - Possibly aircraft induced seat motion
  - Exacerbated by loose lap belts/equipment
  - Lateral acceleration – particularly high – seat yaw
- Too many preventable flail injuries
- Environmental Sensor Switch Chatter
- Equipment wear & training
- Roller Friction

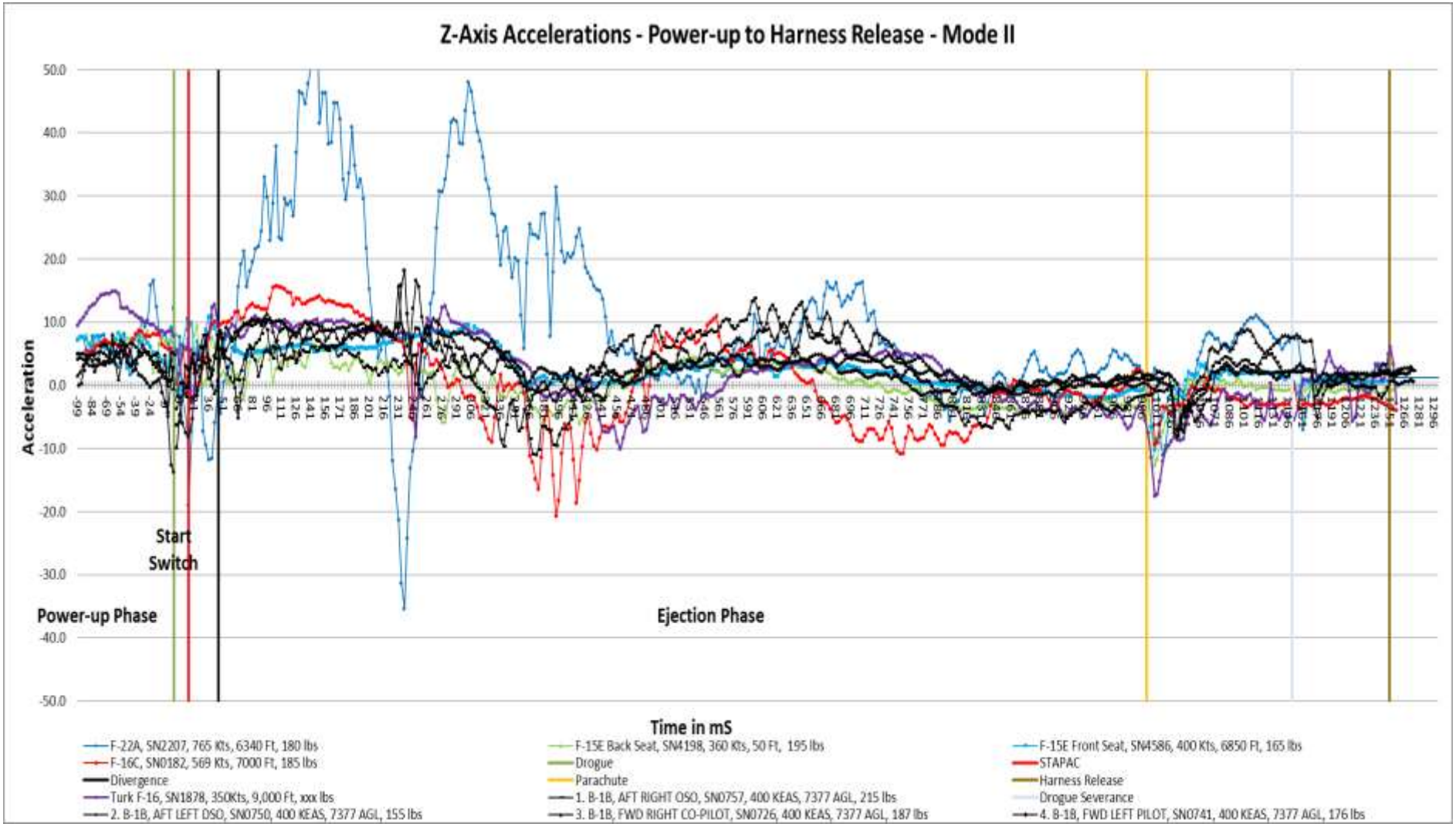
Ejection Concerns – Accelerations

FY 13



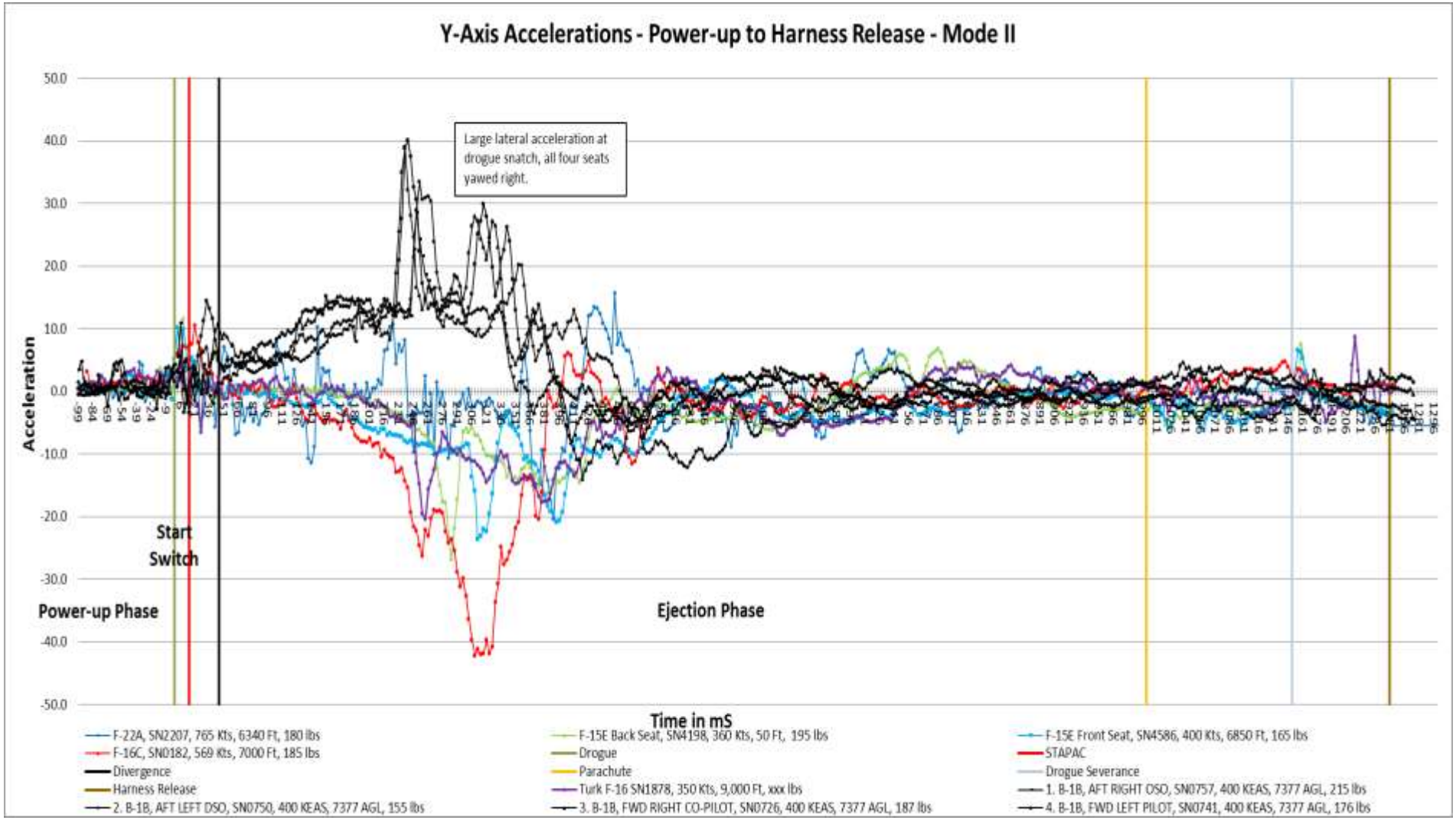
Ejection Concerns – Accelerations

FY 13



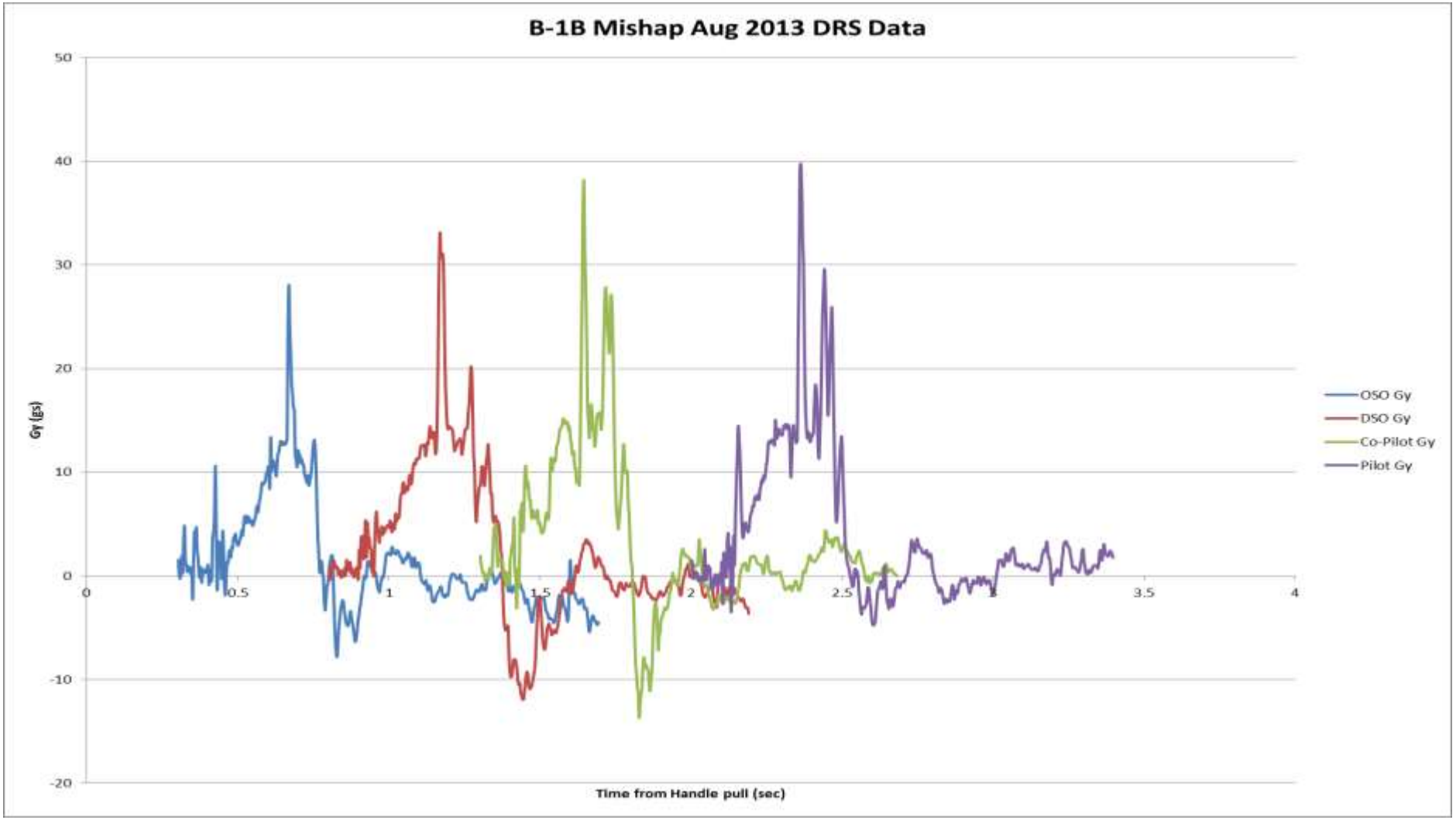
Ejection Concerns – Accelerations

FY 13

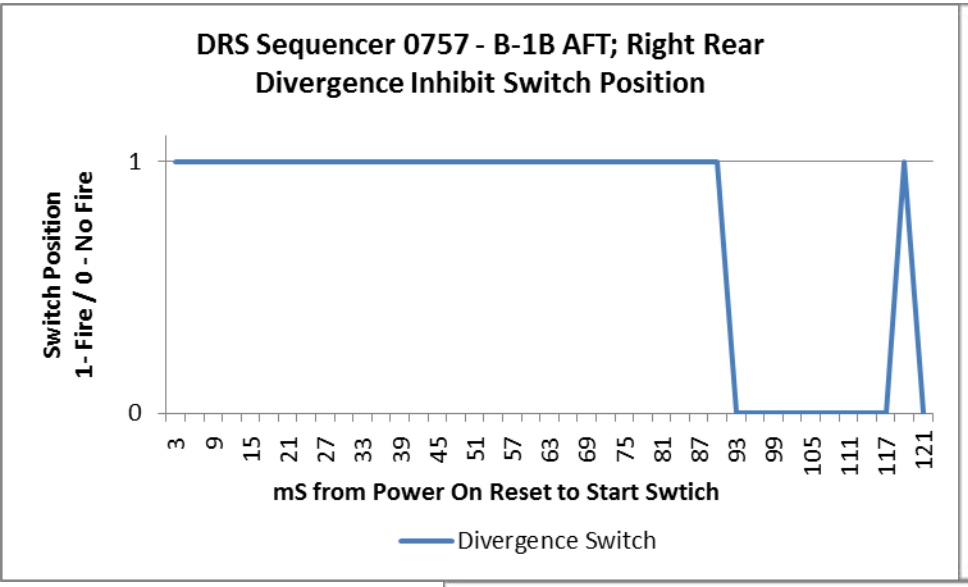


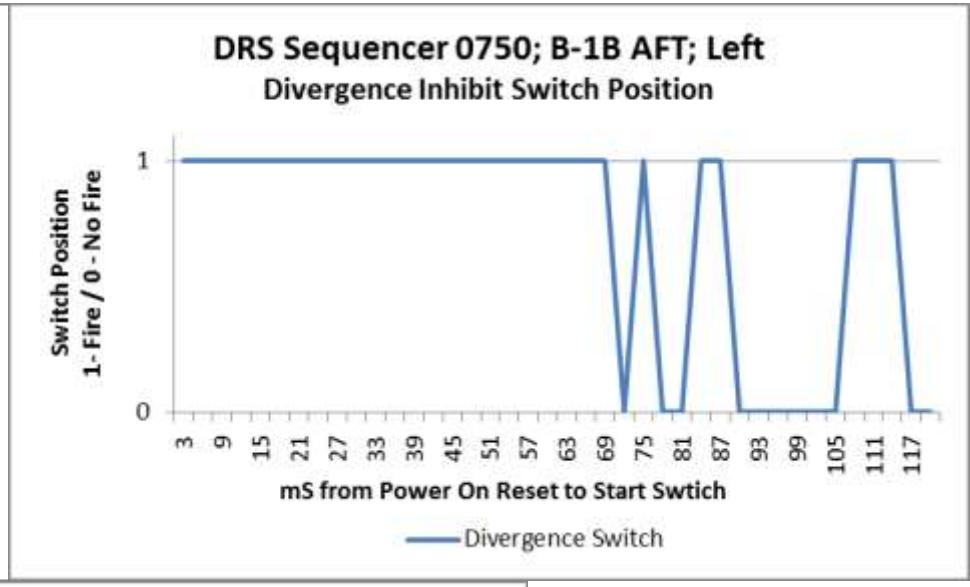
Ejection Concerns – Accelerations

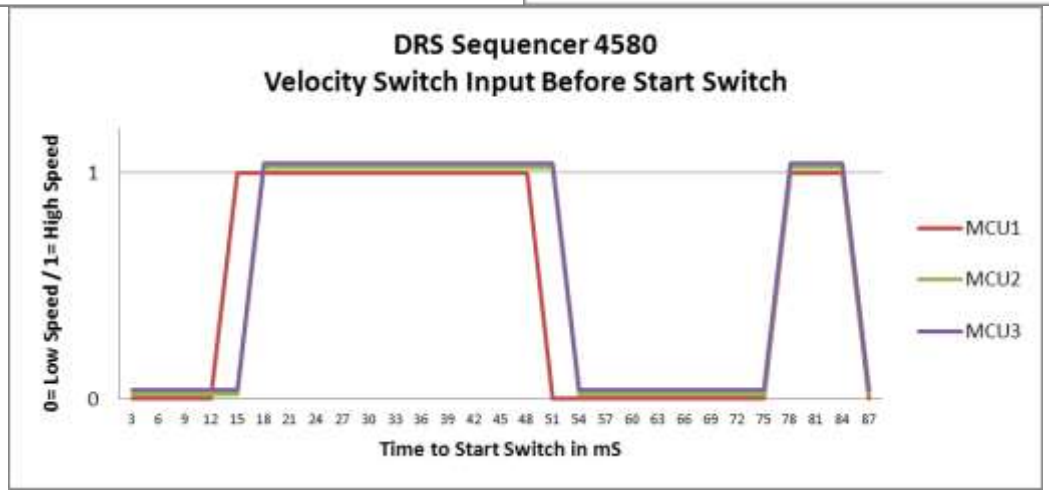
FY 13



Ejection Concerns
ES Switch Chatter







Thank you.

QUESTIONS?

U.S. AIR FORCE

Injury Definitions

AFR 127-4, "Investigating and Reporting US Air Force Mishaps", and are detailed in the following paragraphs.

"Fatal Injury or Occupational Illness: One that results in death in the mishap, or due to complications arising there from. The latter applies regardless of the time between the injury or illness and death.

Major Injury or Occupational Illness: A nonfatal injury or illness requiring admission to a hospital or quarters, or a combination of both, for 5 or more days. It also includes any of the following, regardless of hospital status:

(1) Unconsciousness for more than 5 minutes due to head trauma.
(2) Fracture or any bone, except simple fracture of the nose or phalanges.
(3) Traumatic dislocation of major joints or internal derangement of a knee.
(4) Moderate to severe lacerations resulting in severe hemorrhage or requiring extensive surgical repair.
(5) Injury to any internal organ.
(6) Any third degree burns, or any first or second degree burns (including sunburn) over 5 percent of the body surface.

Minor Injury or Occupational Illness: An injury or illness less than major which:

(1) Requires military personnel to be admitted to a hospital or quarters, or a combination of both, for at least 1 day but no more than 4 days; or
(2) Results in a loss of regular working time for civilians beyond the day or shift on which the injury or illness occurs; or
(3) Is a simple fracture of the nose or phalanges.

No Injury: Any injury less than minor. NOTE: Hospitalization for observation only, is not classified as an injury or illness."