



NAVSEA WARFARE CENTERS

# USAF Ejection Statistics

**Presented to:**

**CAD/PAD Technical Exchange Workshop**

**Presented by:**

**USAF Mishap Investigation Support Team**

**Investigator: Jacob J. Parkin**

**- July 2022 -**

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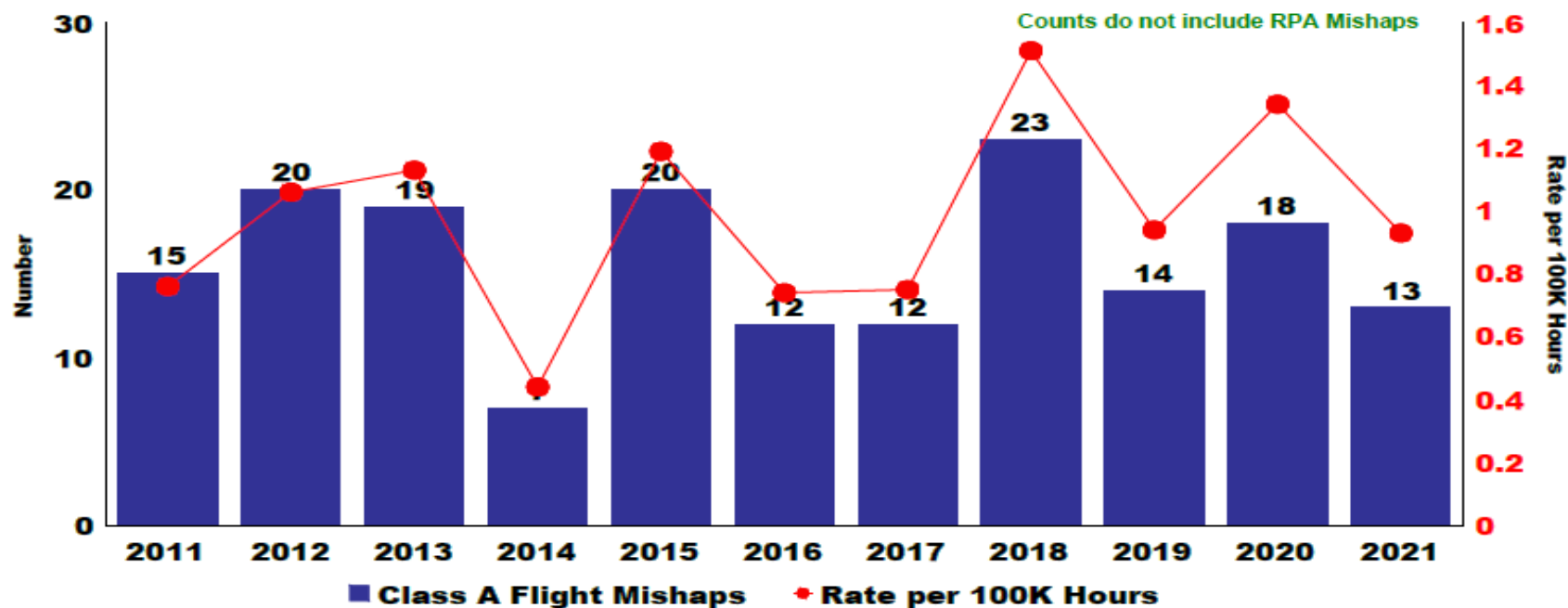


# Outline

- USAF Aircraft Mishap Statistics
- USAF Ejections Statistics
- FY21 and FY20 Ejection Details
- Ejection Concerns
- Recommendations



# Class A Aviation Flight Mishaps FY21



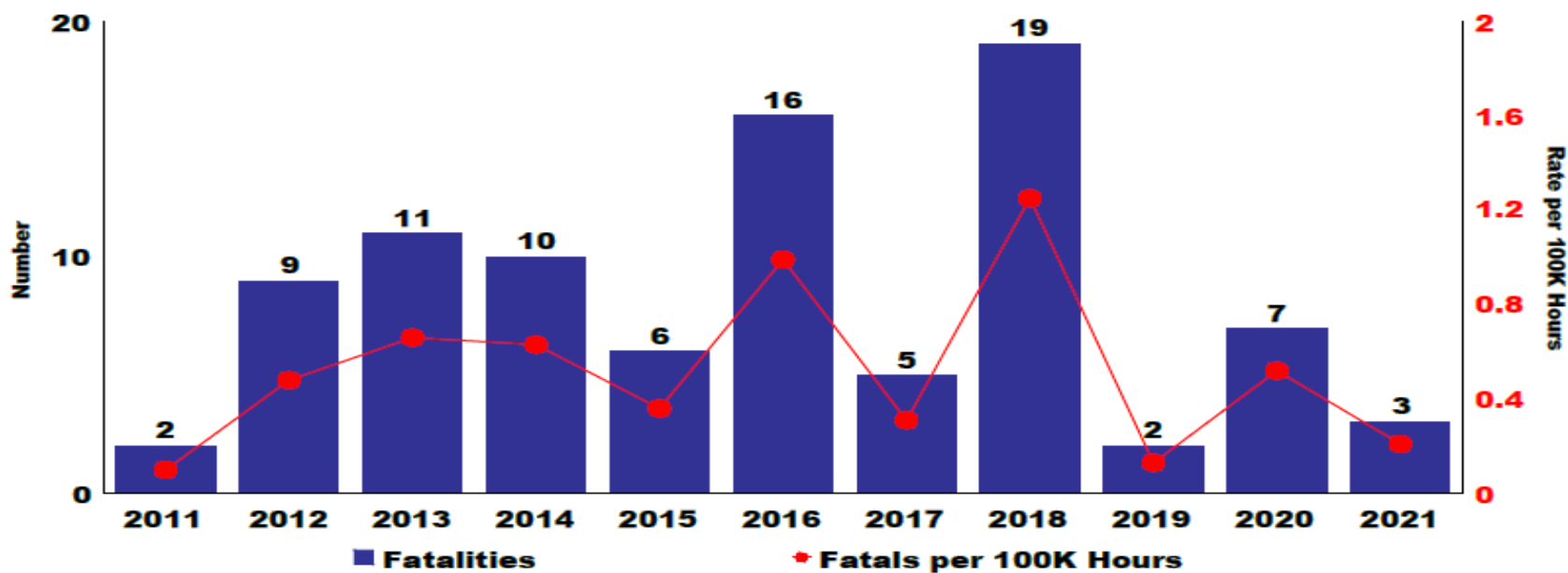
Last Class A: 14-Sep-21 B-2 ON LANDING ROLL; DEPARTED PREPARED SURFACE; ACFT DAMAGED/NO INJURIES; CREW E

Class A Flight Mishaps / Class A Rate to Date:	<b>FY21</b>	<b>FY20</b>
	13 / 0.93	18 / 1.34
10-Year Avg (FY11-20) Class A Mishaps / Mishap Rate:	16.0 / 0.98	

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# Class A Aviation – Related Fatalities FY21



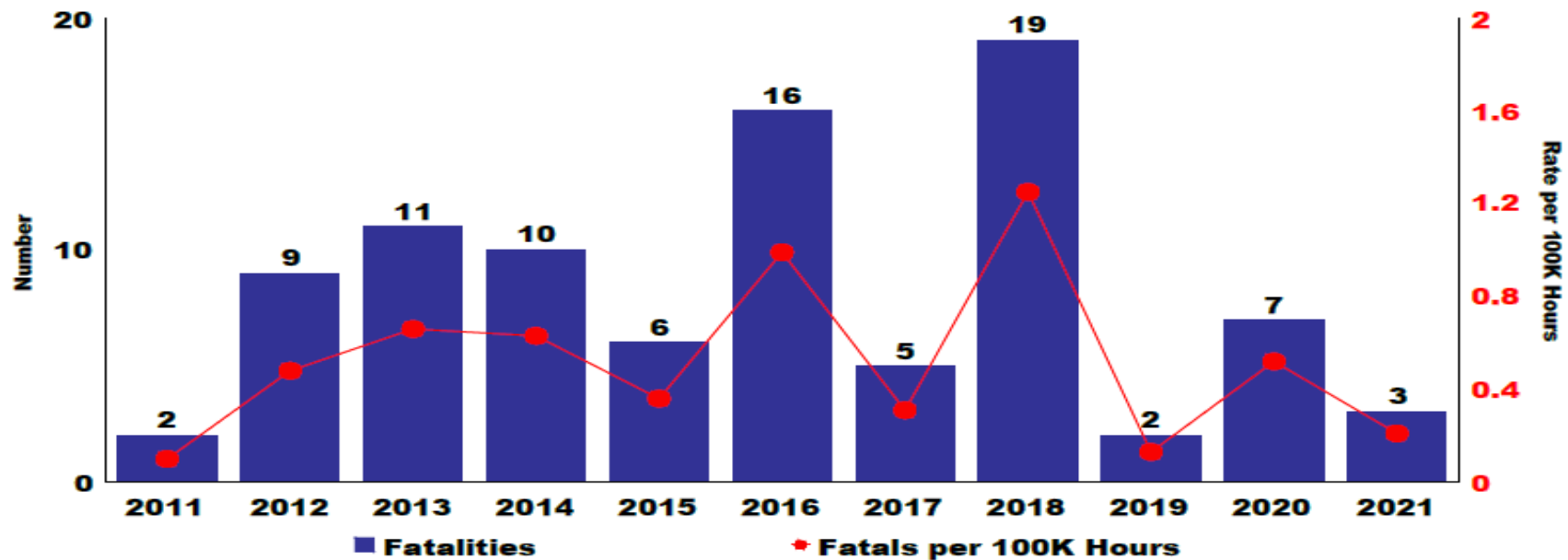
*Last Aviation Fatality: 19-Feb-21 T-38C IMPACT GROUND ON APPROACH; 2 FATALITIES; ACFT DESTROYED*

Aviation Fatalities / Fatal Rate to Date:	<b>FY21</b> 3 / 0.21	<b>FY20</b> 7 / 0.52
10-Year Avg (FY11-20) Annual Fatalities / Fatal Rate:	8.7 / 0.53	

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# Destroyed Aircraft FY21



Last Aviation Fatality: 19-Feb-21 T-38C IMPACT GROUND ON APPROACH; 2 FATALITIES; ACFT DESTROYED

	<b>FY21</b>	<b>FY20</b>
Aviation Fatalities / Fatal Rate to Date:	3 / 0.21	7 / 0.52
10-Year Avg (FY11-20) Annual Fatalities / Fatal Rate:	8.7 / 0.53	

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## All USAF Ejections FY12 - FY21

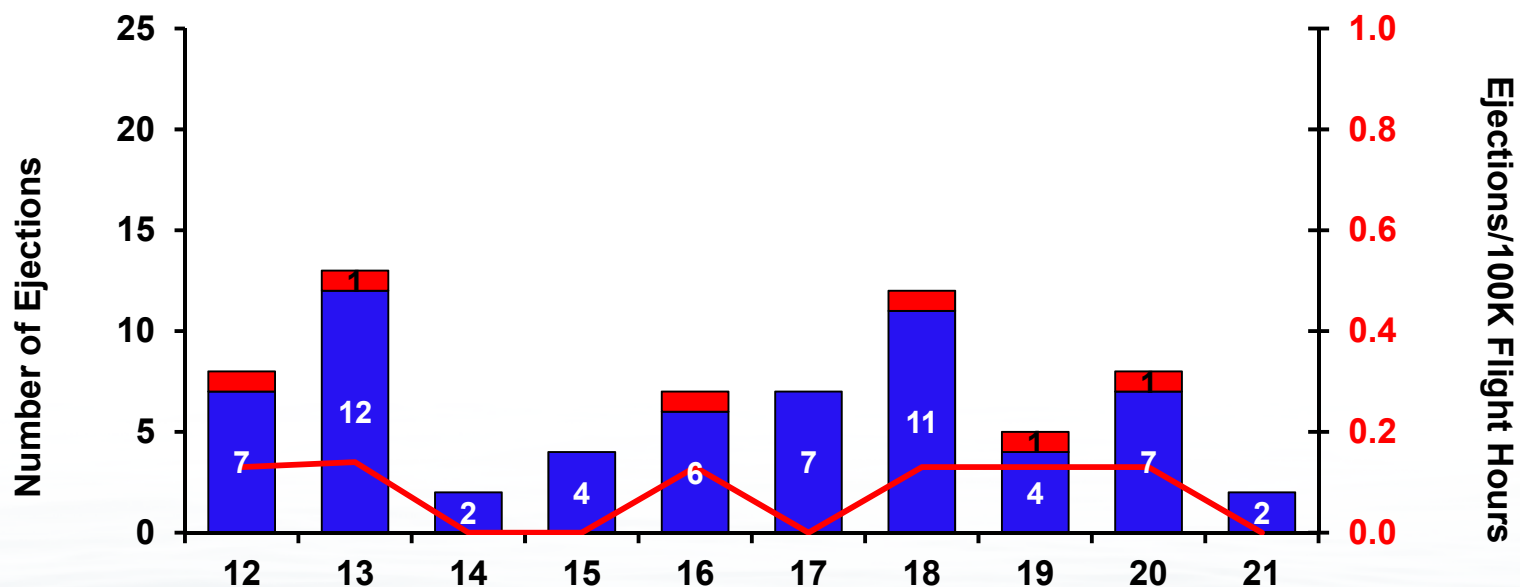
	Total	Survived	Rate	Fatal	Rate
F-35A	1	1	100%	0	0%
F-16	26	24	92%	2	8%
F-15	10	9	90%	1	10%
F-22	2	2	100%	0	0%
A-10	2	2	100%	0	0%
B-1	4	4	100%	0	0%
B-2	0	0	N/A	0	N/A
B-52	0	0	N/A	0	N/A
T-38	10	9	90%	1	10%
T-6	4	4	100%	0	0%
U-2	2	1	50%	1	50%
F-4	3	3	100%	0	0%
A-29	5	4	80%	1	20%
Total	72	66	92%	6	8%

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# All USAF Ejections FY12 - FY21

■ Successful 
 ■ Fatal 
 — Fatal/100K Flt-hr



10-Year Total/Rate (FY 12-21):

Ejections / Rate  
68 / 0.91

Fatal / Rate  
6 / 0.08

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# All ACES II Ejections: 8 Aug 1978 – FY21

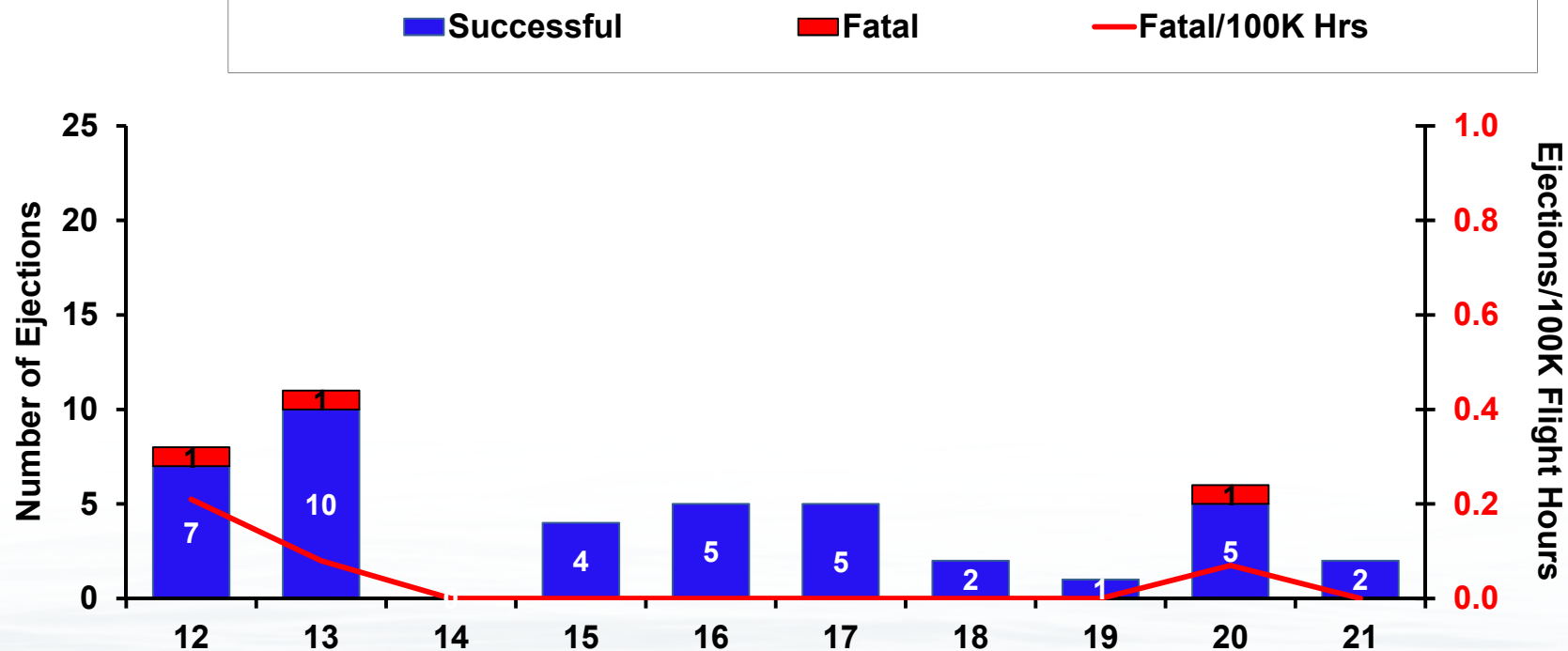
	Total	Survived	Rate	Fatal	Rate
F-16	312	290	93%	22	7%
F-15	92	84	91%	8	9%
A-10	57	47	82%	10	18%
B-1B	24	23	96%	1	4%
F-117	2	2	100%	0	0%
F-22	4	3	75%	1	25%
B-2	2	2	100%	0	0%
	493	451	91%	42	9%

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# ACES II Ejections FY12 – FY21

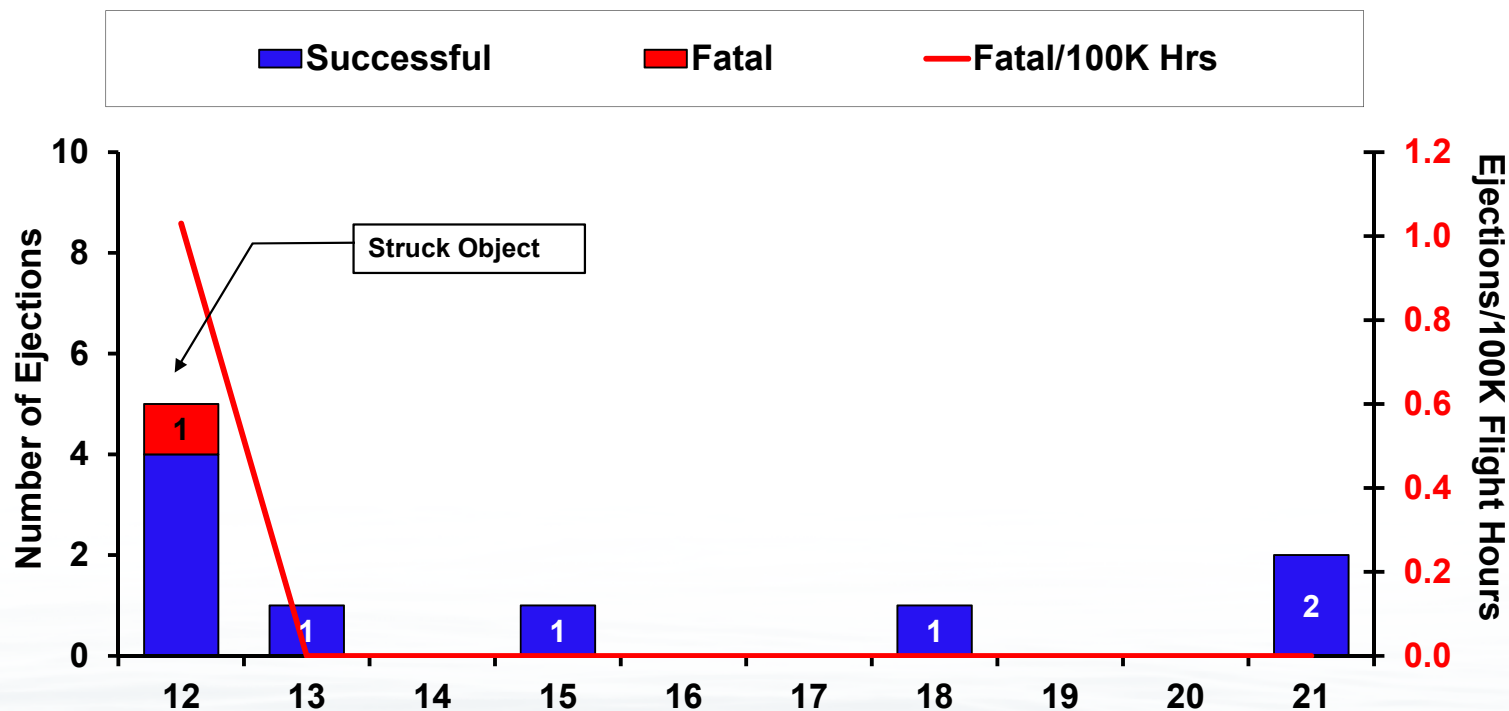


	<i>Ejections / Rate</i>	<i>Fatal / Rate</i>
<i>Lifetime (thru FY21):</i>	493 / 1.91	42 / 0.16
<i>10-Year (FY 12 – 21):</i>	44 / 1.04	3 / 0.07

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# F-15 Ejections FY12 – FY21



	<i>Ejections / Rate</i>	<i>Fatal / Rate</i>
<i>Lifetime (Aug 78 – FY21):</i>	92 / 1.34	8 / 0.12
<i>10-Year (FY12 – FY21):</i>	10 / 1.03	1 / 0.10

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## Recent Ejections FY21

MDS:	F-15QA
One Liner:	F-15QA Landing Rollout; Two pilots ejected; Aircraft departed runway; Aircraft and crew recovered
Occupant:	Pilot (front seat), Male, Age 37, Weight 200 lbs, height 70 in
Parameters:	0 feet AGL, 50 KIAS, Mode 1
Equipment Issues:	<ol style="list-style-type: none"><li>1. Wearing digital JHMCS</li><li>2. Aircraft equipped with Electrical Interseat Sequencing System (EISS) set in AFT INITIATE</li><li>3. Equipped with MASS</li><li>4. STAPAC Gyro spin up energy absorption cylinder not crushed to nominal length – but did lock out</li><li>5. Ejection handle linkage on right side missing cotter pin – ground impact</li><li>6. URT-46 not heard, but functioned normally. Set in 2 beacon mode, not registered in JSETS</li><li>7. Life raft did not deploy, insufficient time under canopy</li></ol>
Injuries:	<ol style="list-style-type: none"><li>1. T-12 Burst fracture with 50% height loss – out of position, leaning on left elbow, ejection force</li><li>2. L-4 non-displaced transverse process fx – PLF (heels, butt, back, head)</li><li>3. Right eyebrow abrasion – digital JHMCS contact</li></ol>

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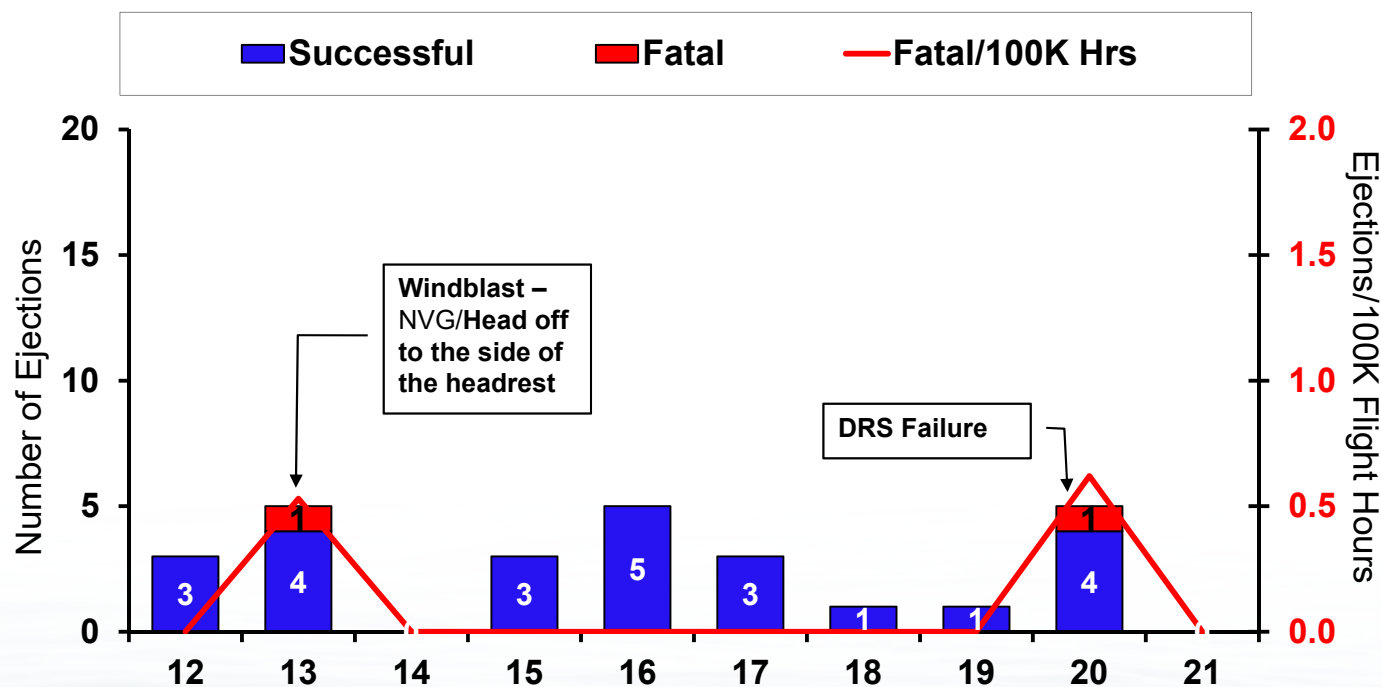
## Recent Ejections FY21

MDS:	F-15QA
One Liner:	F-15QA Landing Rollout; Two pilots ejected; Aircraft departed runway; Aircraft and crew recovered
Occupant:	Rear seat, Male, Age 46, Weight 181 lbs, height 70 in
Parameters:	0 feet AGL, 50 KIAS, Mode 1
Equipment Issues:	<ol style="list-style-type: none"><li>1. Wearing digital JHMCS</li><li>2. Aircraft equipped with Electrical Interseat Sequencing System (EISS) set in AFT INITIATE</li><li>3. Equipped with MASS</li><li>4. URT-46 not heard, but functioned normally. Set in 2 beacon mode, not registered in JSETS</li><li>5. Life raft deployed – possibly at ground impact</li></ol>
Injuries:	<ol style="list-style-type: none"><li>1. Minor soreness/bruising</li></ol>

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# F-16 Aircraft Ejections FY12 - FY21



	<i>Ejections / Rate</i>	<i>Fatal / Rate</i>
<i>Lifetime (Aug 78 – FY21):</i>	312 / 2.69	22 / 0.19
<i>10-Year (FY 12 - 21):</i>	26 / 1.35	2 / 0.10

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## Recent Ejections FY20

MDS:	F-16C
One Liner:	F-16C ACFT TRAINING SORTIE; ACFT DEPARTED RUNWAY DURING LANDING; PILOT EJECTED SUCCESSFULLY
Occupant:	Pilot, Male, Age Unk, Weight Unk lbs
Parameters:	0 feet AGL, 60 KIAS, Mode 1
Equipment Issues:	<ol style="list-style-type: none"><li>1. None reported</li><li>2. Equipped with DRS</li><li>3. Wearing JHMCS</li></ol>
Injuries:	<ol style="list-style-type: none"><li>1. Minor laceration above right eye – helmet</li><li>2. Minor neck soreness – ejection force</li></ol>

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## Recent Ejections FY20

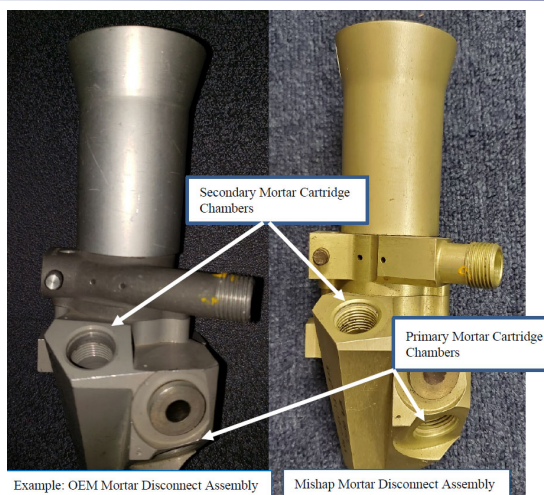
MDS:	F-16C
One Liner:	F-16C LANDING; DEPARTED SURFACE; PILOT EJECTED; MINOR INJURIES; ACFT SUSTAINED SIGNIFICANT DAMAGE
Occupant:	Pilot, Male, Age 28, Weight 180 lbs
Parameters:	0 feet AGL, 136 KIAS, Mode 1, right wing down (gear collapse)
Equipment Issues:	<ol style="list-style-type: none"><li>1. Right ballistic QD did not separate at union – tore hose</li><li>2. Both primary and secondary mortar cartridges fired – face fired secondary. Aftermarket parts not the same as OEM??</li><li>3. Mortar collar torn, holes in main parachute from both mortar cartridges firing simultaneously</li></ol>
Injuries:	<ol style="list-style-type: none"><li>1. Forehead contusions from JHMCS bracket – PLF</li><li>2. Nasal laceration – JHMCS visor - PLF</li><li>3. Mild concussion - PLF</li><li>4. Abrasions – dragging after PLF</li></ol>

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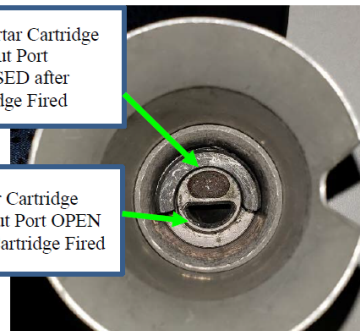


# Recent Ejections FY20



Secondary Mortar Cartridge Chamber Output Port Remains CLOSED after Primary Cartridge Fired

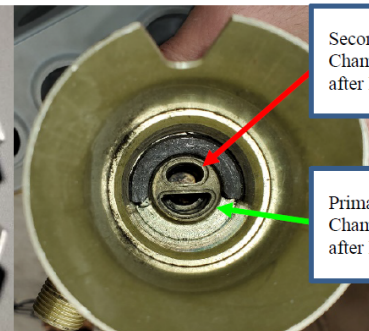
Primary Mortar Cartridge Chamber Output Port OPEN after Primary Cartridge Fired



Example: Typical Post Ejection Condition

Secondary Mortar Cartridge Chamber Output Port OPEN after Primary Cartridge Fired

Primary Mortar Cartridge Chamber Output Port OPEN after Primary Cartridge Fired



Mishap Mortar Disconnect Assembly

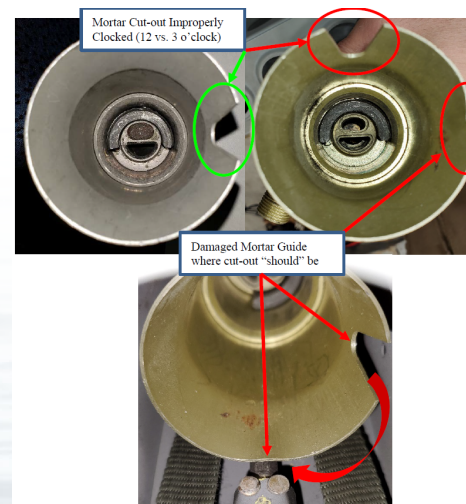
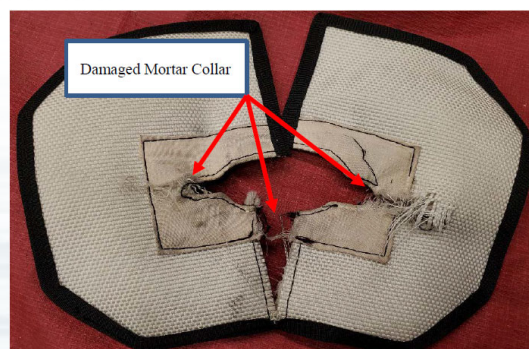


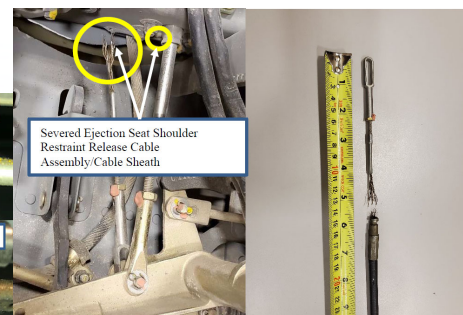
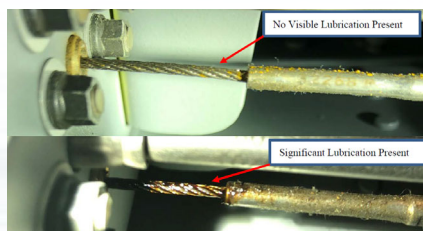
Photo Credits: CAD/PAD USAF AFLCMC

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# Recent Ejections FY20

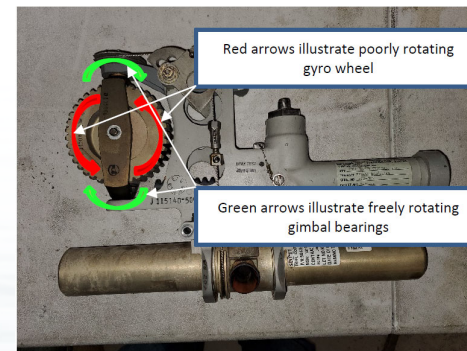
MDS:	F-16C
One Liner:	F-16 IMPACTED TERRAIN, PILOT EJECTED; AIRCRAFT DESTROYED, MINOR INJURIES
Occupant:	Pilot, Male, Age 39, Weight 232 lbs
Parameters:	2,900 feet AGL, 202 KIAS, Mode 1, level (loss of thrust)
Equipment Issues:	<ol style="list-style-type: none"> <li>1. Both ballistic QDs did not separate at union – tore hose</li> <li>2. One pitot static tube not zip tied to environmental sensor</li> <li>3. Shoulder restraint release cable severed – overload. Lubrication?</li> <li>4. STAPAC Gyro did not rotate freely by hand</li> <li>5. NVG not removed prior to ejection.</li> <li>6. URT-44 did not work, dead battery.</li> </ol> <p>Five more radios tested, one more dead battery Identified.</p>
Injuries:	<ol style="list-style-type: none"> <li>1. Superficial abrasion left inner bicep – JHMCS bracket on harness - PLF</li> <li>2. Soft tissue injury left ankle – PLF</li> <li>3. Minor extremity abrasions - PLF</li> </ol>





## Recent Ejections FY20

MDS:	F-16CM
One Liner:	F-16C; AIRCRAFT IMPACTED GROUND; AIRCRAFT DESTROYED; PILOT EJECTED; NO INJURIES (Spatial-D in IMC)
Occupant:	Pilot, Male, Age 31, Weight 215 lbs
Parameters:	4,080 feet AGL, 152 KIAS, Mode 1, 26 deg NU, 4 deg LWD, .81Gz
Equipment Issues:	<ol style="list-style-type: none"> <li>1. Both ballistic line QDs did not separate</li> <li>2. Parachute entangled in trees 30 – 40 ft above ground, no PLD, swung to tree trunk and climbed down</li> <li>3. URT-44 did not operate – battery dead</li> <li>4. STAPAC Gyro did not rotate freely by hand</li> </ol>
Injuries:	None







## Recent Ejections FY20


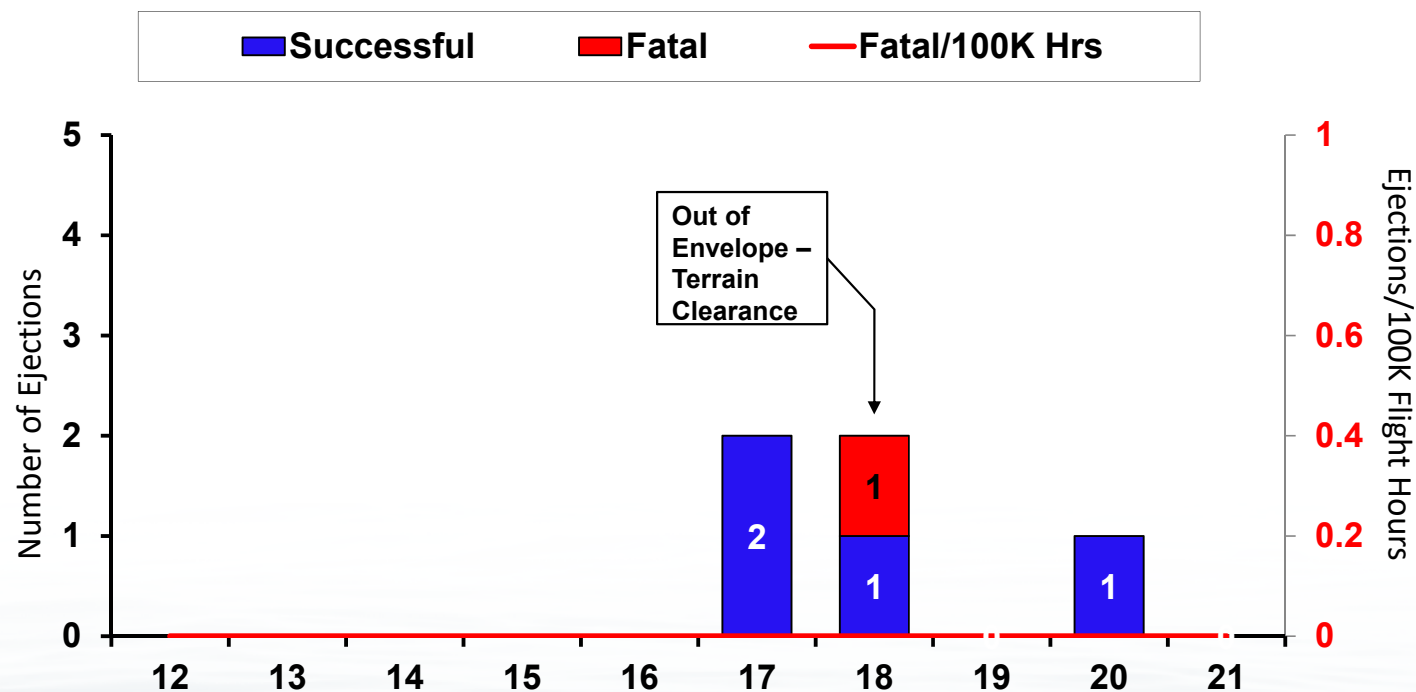
MDS:	F-16C
One Liner:	F-16 CRASH , ONE FATALITY, AIRCRAFT WAS DESTROYED
Occupant:	Pilot, Male, Age 32, Weight 171 lbs
Parameters:	0 feet AGL, 129 KIAS, Mode 1, 16 deg LWD, 8 deg nose up
Equipment Issues:	<div><div><div>1. DRS failed, no EEDs fired:<div><div>a) Likely noise in MCU 3, did not participate in ejection</div><div>b) MCU 2 parallel flash failure, did not participate in ejection</div><div>c) MCU 1 was the only operational voting channel, cannot fire EEDs</div></div></div><div>2. DRS did not have shorting plug installed</div><div>3. DRS had 3 temp shelf/service life extensions</div><div>4. EPS/secondary mortar cartridge fired – ground impact.</div><div>5. Right ballistic hose QD did not separate.</div></div></div> <div></div>
Injuries:	1. Fatal - multiple extreme – ground impact

Photo Credit: CAD/PAD USAF AFLCMC

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# A-29 Aircraft Ejection FY12 – FY21



	<i>Ejections / Rate</i>	<i>Fatal / Rate</i>
<b>10-Year (FY12 – FY21):</b>	<b>5 /</b>	<b>1 /</b>

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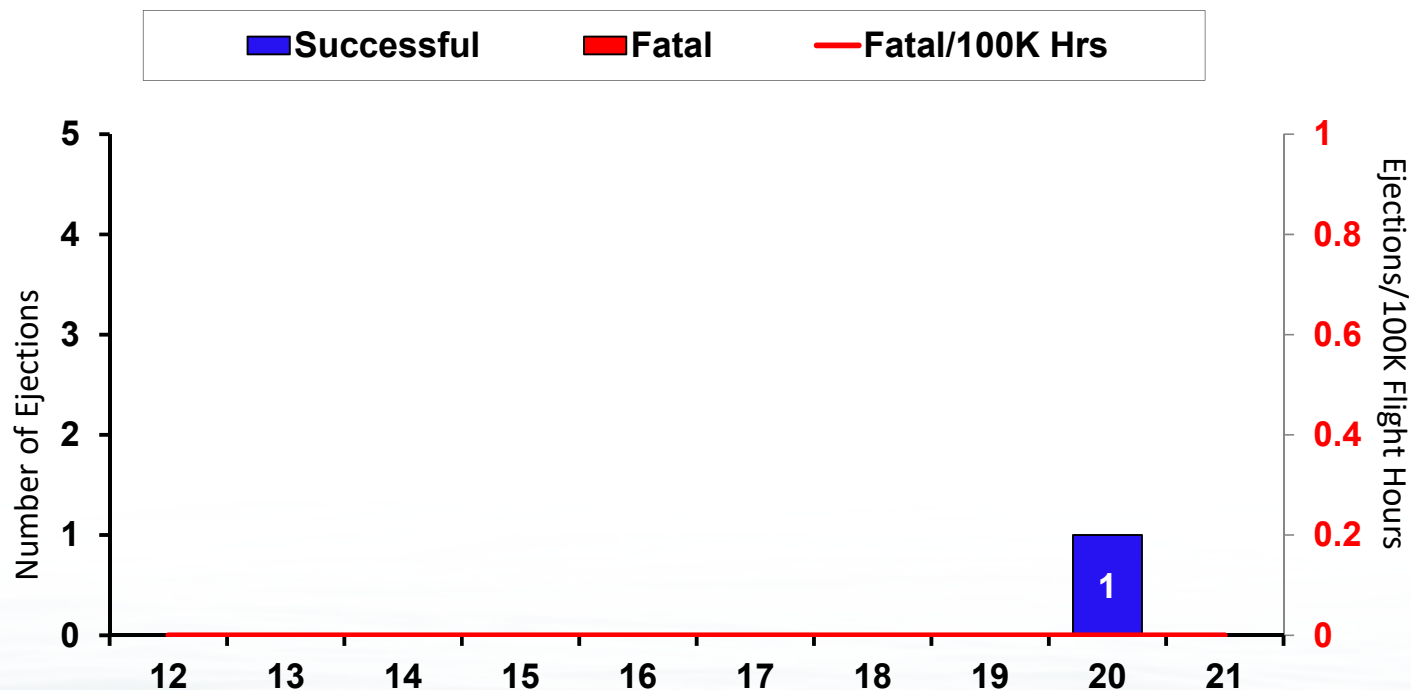
## A-29 Aircraft Ejection FY20

MDS:	A-29B
One Liner:	FOREIGN MILITARY A-29; USAF PILOT EJECTION; INJURIES TO PILOT; A/C DESTROYED
Occupant:	Pilot, Male, Age Unk., Weight Unk. lbs
Parameters:	20 feet AGL, 101 KIAS
Equipment Issues:	<ol style="list-style-type: none"> <li>1. Evaluation done from photos, hardware not recovered</li> <li>2. Single occupant in front seat – front handle initiated, both seats fired</li> <li>3. Command Control Unit (CCU) physically set to AFT mode. By design, w/ front seat initiation - rear seat ejects (.2s delay) followed by front seat (.4s delay)</li> <li>4. EICAS indicated CCU set for SINGLE mode – undetermined</li> <li>5. EICAS indicated aft seat pinned (expected) – will not prevent ejection of aft seat with front seat initiation in AFT mode</li> <li>6. Oxygen hose on ejection seat severed, QD did not release – undeterm.</li> <li>7. All other functions appeared normal</li> </ol>
Injuries:	<ol style="list-style-type: none"> <li>1. Superficial abrasions to the face, upper arms, left leg – PLF</li> <li>2. Perm/Partial - T-12 &amp; L1 anterior wedge fractures with 33% and 25% height loss, respectively, ligament strain – ejection force</li> </ol>

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# F-35 Aircraft Ejection FY12 – FY 21



10-Year (FY12 – FY21):

1 / 0.82

0 / 0.00

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## Recent Ejections FY20

MDS:	F-35A
One Liner:	F-35A; CRASHED DURING APPROACH; PILOT EJECTED SAFE
Occupant:	Pilot, Male, Age 31, Weight 181 lbs
Parameters:	0 feet AGL, 205 KIAS, 15 deg nose down, 30 deg left roll, -1.8Gz, Mode 2
Equipment Issues:	<ol style="list-style-type: none"> <li>1. Left arm restraint not fully retracted – hand on throttle, not ejection handle</li> <li>2. MWARS reset button popped off</li> <li>3. Pilot dragged by parachute – difficulty disconnecting helmet cable</li> <li>1. Helmet came off at some time during ejection sequence – riser interaction?</li> <li>5. Helmet damage, FLSC</li> </ol>
Injuries:	<p>T8 small acute anterior superior endplate compression fracture – body position (up, forward, -1.8 Gz) ejection force</p> <p>T6-T7 left paracentral disk protrusion – pre-existing</p> <p>Eye irritation – transparency removal system FLSC</p> <p>Minor burns – transparency removal system FLSC</p>



Photo Credit: CAD/PAD USAF AFLCMC

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## Recent Ejections FY20



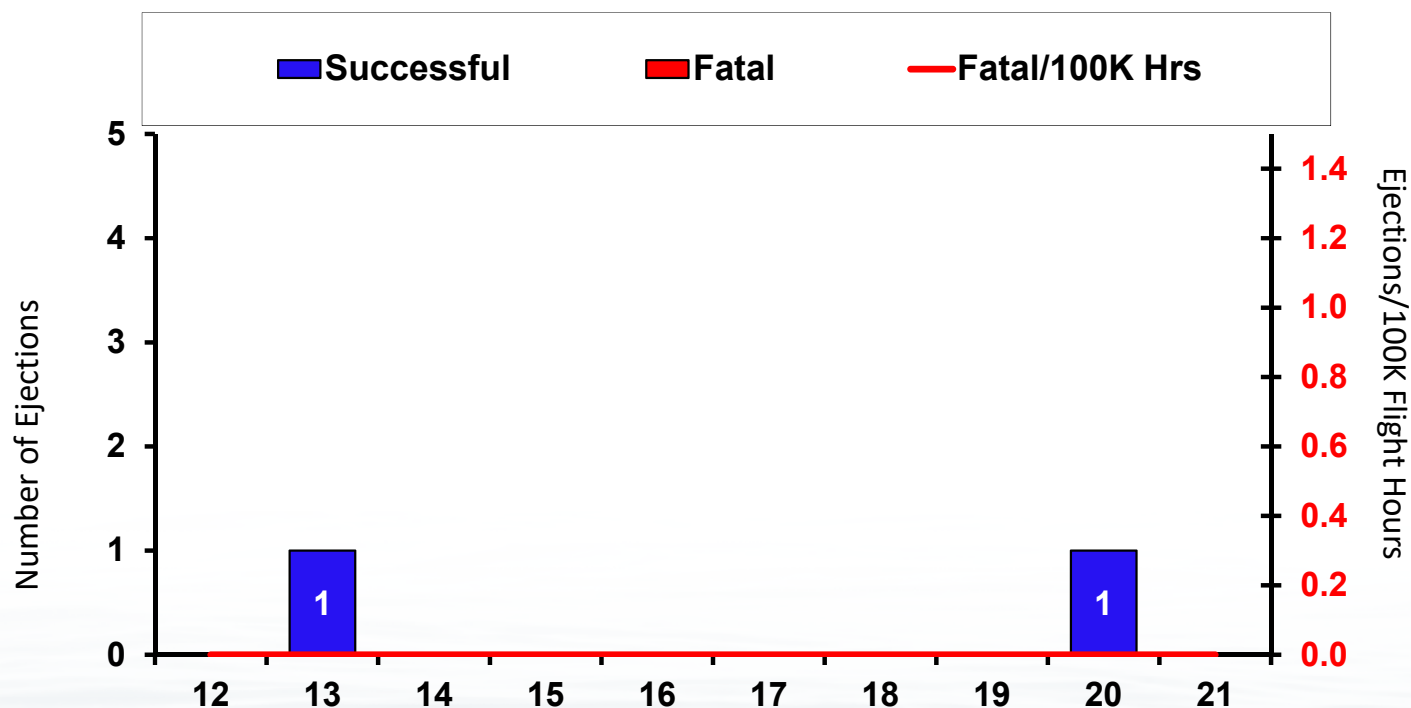
- Unapproved lumbar support pillow in use
  - Advanced Change/Study Notice 03 Apr 20: 76% of F-35A pilots report debilitating lower/upper back and neck stiffness and pain.
  - Off-Board Time Compliance Technical Directive: 12 sets of seat cushions provided for in-service performance testing. Lumbar support pillow in use was not one of these.

Photo Credits: CAD/PAD USAF AFLCMC

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# F-22 Aircraft Ejection FY12 – FY 21



	<i>Ejections / Rate</i>	<i>Fatal / Rate</i>
<i>Lifetime (FY02 – FY21):</i>	4 / 0.97	1 / 0.24
<i>10-Year (FY12 – FY21):</i>	2 / 0.67	0 / 0.00

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# Recent Ejections FY20

MDS:	F-22A
One Liner:	F-22 PILOT EJECTED SUCCESSFULLY SHORTLY AFTER TAKEOFF, AIRCRAFT WAS DESTROYED, NO FATALITIES.
Occupant:	Pilot, Male, Age 30, Weight 172 lbs
Parameters:	7,300 feet AGL, 197 KIAS, Mode 1, right roll, descending, out of control
Equipment Issues:	<ol style="list-style-type: none"> <li>1. STAPAC piston/rack head O-ring found broken</li> <li>2. Energy absorption cylinder had evidence of hot gas erosion</li> <li>3. Minor skidding on top and middle rollers</li> <li>4. Both bungees on parachute riser stowage assembly broken</li> </ol> <div style="display: flex; justify-content: space-around; align-items: center;">   </div>
Injuries:	<ol style="list-style-type: none"> <li>1. Minor – abrasions on fingers, contact with foliage during PLF</li> </ol>

Photo Credits: CAD/PAD USAF AFLCMC

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# Ejection Concerns

- Egress Training –
- Communication of ejection hazards - FLSC
- Unapproved equipment (seat cushions)
  
- FY20
  - DRS Failure – MASS similarities
  - Ballistic hose QD failures – catapult energy loss
  - Personnel Locator Beacon Failures



# Recommendations

- AFE/Egress Training - communication
- Qualify new seat cushions for F-35
- DRS Failure:
  - Shorting plugs or MASS – MUST DO! Quickly!
  - DRS/MASS Test Sets – Need them in the field, periodic testing to identify hardware failures
  - DRS Firmware – fault monitoring/error handling, default mode selection?
- Ballistic hose QDs – complete testing/analysis
- PLB Failures – replace all URT-44 soonest



# Thank you

# QUESTIONS?

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