VTANG

BULLET BACKGROUND PAPER

ON

F-16 / F-35 OPERATIONAL EIS SAFETY STATISTICS / COMPARISONS AT BIAP

PURPOSE:

Provide a contextual analysis of the flight safety information that is reported in the F-35 Operational EIS as it pertains to the proposed basing of the F-35 at the 158 FW, Burlington International Airport (BIAP), based on national mishap / accident rates and historical data.

BACKGROUND:

- USAF Class A Mishap Definition:
  - -- Aircraft damage resulting from flight, or flight related ground operations totaling $1M or more (changed to $2M in Oct 2009) OR
  - -- Any fatality OR
  - -- Permanent disability OR
  - -- Destruction of aircraft

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CRITICAL to note that a Class A Mishap does not equate to an "aircraft crash"…see examples below

- -- Example 1: F-22 ingests a bird down engine and recovers safely to home base…damages to F-22 totals more than $1M (flight related Class A Mishap)
- -- Example 2: F-16 taxis into parked aircraft on ramp…damages total more than $1M (flight related ground operation Class A Mishap)
- -- Example 3: F-22 sustains $2.2M damage to engine (flight related Class A Mishap), recovers safely to home base

- NTSB Accident Severity Classifications:
  - -- Major: Aircraft destroyed or multiple fatalities or 1 fatality and substantial damage
  - -- Serious: Single fatality without substantial damage to aircraft or at least 1 serious injury and the aircraft was substantially damaged
  - -- Injury: Non-fatal accident with at least one serious injury without substantial damage to aircraft
  - -- Damage: No person was killed or injured, but the aircraft was substantially damage

- BIAP Flight Activity 10 year average (1994-2003):
  - -- General Aviation (Part 91): 48.3% of flight operations at airfield (54,056 flight operations/yr)
    - --- National Accident rate as reported by NTSB (2001-2010) = 6.71 / 100,000 flt hrs
  - -- Commercial Aviation: 41.6% of flight operations at airfield (46,548 flight operations/yr)

--- Commercial aircraft include both Part 121 (airlines) and Part 135 (smaller commuter) aircraft

--- National Part 121 Accident rate as reported by NTSB (2001-2010) = 0.2 / 100,000 flt hrs

--- National Part 135 Accident rate as reported by NTSB (2001-2010) = 1.59 / 100,000 flt hrs

-- VTANG F-16s: 4.6% of flight operations at airfield (5,100 flight operations/yr)

--- National F-16 Class A Mishap rate as reported in the Final EIS = 3.55 / 100,000 flt hrs

--- 158th FW F-16 Class A Mishap rate (1986-2013) = .926 / 100,000 flt hrs

-- Misc: 5.5% of flight operations at airfield (6,176 flight operations/yr)

- Using the above data, one can start to understand the true flight safety concerns based on national rates for both Military Class A Mishaps and Civilian Accident Rates

-- The Poisson Distribution Formula is used to help illustrate this point (supporting documentation and mathematical analysis based on facts is contained in attachment 1)

--- General Aviation is ***15.1 times more likely*** to have an accident during a one year period than the VTANG

--- Commercial Aviation is ***2.3 times more likely*** to have an accident during a one year period than the VTANG

--- Using the 158 FW's actual F-16 Class A Mishap Rate of .926/100,000 flight hours over the past 27 years of flying F-16s out of BIAP, then General Aviation is ***55.8 times more likely*** to have an accident and the Commercial Aviation is ***8.5 times more likely*** to have an accident as compared to the F-16

DISCUSSION:

- Page BR4-51 of the Final EIS states "as the F-35A becomes more operationally mature, the aircraft mishap rate is expected to become comparable with a similarly sized aircraft with a similar mission" (i.e. F-16)

-- F-16 lifetime Class A Mishap Rate is 3.55 / 100,000 flight hours across the entire USAF inventory. The 158 FW's Class A mishap rate since flying the F-16 in Vermont dating back to 1986 is .926 / 100,000 flight hours (Class A Mishap occurred at Cape May in New Jersey in 1993).

- Page BR4-51 of the Final EIS also states that "in order to provide a broader perspective on the potential mishap rate for a new technology like the F-35A, the following discussion refers to the mishap rates for the introduction of the F-22A"..."it is possible that the projected mishap rates for the F-35A may be comparable to the historical rates of the F-22A"

-- F-22 Class A Mishap Rates reported in the Draft EIS during timeframe of FY02-FY12

--- 10 x Class A Mishaps reported for 136,315 flight hours = 7.34 mishap rate / 100,000 flt hrs

---- Only 3 of 10 Class A Mishaps were an actual "aircraft crash" = 2.2 "crash" rate / 100,000 flt hrs

---- The remaining 7 x F-22 Class A Mishaps were not aircraft crashes and were either flight or flight related ground mishaps where damage to the aircraft was greater than $1M (or $2M post 1 Oct 2009 when the criteria was changed)

- F-35 1st flight occurred on 15 Dec 2006

-- F-35s have currently flown over 10,000+ hours and there are 78 F-35s currently flying at 6 different bases in the United States (Edwards AFB, CA, Eglin AFB, FL, Nellis AFB, NV, NAS Pax River, MD, MCAS Yuma, AZ)

-- There have been zero F-35 Class A Mishaps…that equates to a 0.0 Class A Mishap Rate during its first seven years of flying both at test locations and operational bases

- If selected by the Chief of Staff of the Air Force and the Secretary of the Air Force as a future F-35 base, the earliest F-35s would arrive to the 158th Fighter Wing, Burlington International Airport is Aug of 2020

-- That would equate to 14 years of flight safety / Class A Mishap information that will be available before F-35s arrive to Burlington

SUMMARY:

Based on the analysis above, NTSB safety data, USAF and ANG safety data, and flight history for BIAP, both the F-35 and the F-16 are ***less likely*** to have an aircraft accident at Burlington International Airport than a plane from the civilian sector.

The USAF and VTANG have a robust Flight Safety Program that will continue with the basing of the F-35. Flight safety is a culture within an organization that becomes inherent in leadership, maintenance practices, regulatory flight procedures, and flight training rules.

Not all Class A Mishaps result from a "crash" and the goal of any flying safety program is to mitigate risk associated with flying.

SOURCES:

1. Final F-35 EIS dated September 2013

2. NTSB Review of U.S. Civil Aviation Accidents, Calendar Years 2001-2010; http://www.ntsb.gov/doclib/reports/2012/ARA1201.pdf

3. Mr. Gary Snyder (Statistician for IBM Corporation, Essex Junction VT, 33 years of experience)

DISCLAIMER

This bullet background paper contains the opinions and calculations of the author and is not an official government document.

ATTACHMENT 1: Poisson Calculations / Supporting Documentation

VTANG F-16			VTANG F-16			General Aviation			Comm Aviation		
Poisson Prob Table for λ = .015			Poisson Prob Table for λ = .004			Poisson Prob Table for λ = .302			Poisson Prob Table for λ = .035		
X	Prob(x)	Prob(<=x)	X	Prob(x)	Prob(<=x)	X	Prob(x)	Prob(<=x)	X	Prob(x)	Prob(<=x)
0	0.9851	0.9851	0	0.9960	0.9960	0	0.7393	0.7393	0	0.9656	0.9656
1	0.0148	0.9999	1	0.0040	1.0000	1	0.2233	0.9626	1	0.0338	0.9994
2	0.0001	1.0000	2	0.0000	1.0000	2	0.0337	0.9963	2	0.0006	1.0000
3	0.0000	1.0000	3	0.0000	1.0000	3	0.0034	0.9997	3	0.0000	1.0000
4	0.0000	1.0000	4	0.0000	1.0000	4	0.0003	1.0000	4	0.0000	1.0000
5	0.0000	1.0000	5	0.0000	1.0000	5	0.0000	1.0000	5	0.0000	1.0000
6	0.0000	1.0000	6	0.0000	1.0000	6	0.0000	1.0000	6	0.0000	1.0000
7	0.0000	1.0000	7	0.0000	1.0000	7	0.0000	1.0000	7	0.0000	1.0000
8	0.0000	1.0000	8	0.0000	1.0000	8	0.0000	1.0000	8	0.0000	1.0000
9	0.0000	1.0000	9	0.0000	1.0000	9	0.0000	1.0000	9	0.0000	1.0000
10	0.0000	1.0000	10	0.0000	1.0000	10	0.0000	1.0000	10	0.0000	1.0000

Assumptions:

1. Flight time in BTV terminal area based on standard departure and arrivals is approx 5 min / operation
2. Computed λ calculation for VTANG based on 3.55 / 100,000 flt hours for 5,100 flight operations averaging 5 mins in terminal area to equate to .015
3. Computed GA λ calculation based on a 6.71 / 100,000 flt hours for 54,056 flight operations averaging 5 mins in terminal area to equate to .302
4. Computed Comm aviation λ calc based on a 0.895 / 100,000 flt hours for 46,548 flight operations averaging 5 mins in terminal area to equate to .035
5. Computed λ calculation for VTANG based on .926 / 100,000 flt hours for 5,100 flight operations averaging 5 mins in terminal area to equate to .004

The Poisson Distribution formula is used to determine the probability of an occurrence given the rate of occurrence. Since Mishap Rates (Accident Rates in the civilian sector) are given in the same frequency format (# of mishaps/accidents per 100,000 flight hours, we can use the Poisson formula to paint an accurate picture for Burlington International Airport (BIAP) based on the known mishap/accident rates and know flight activity at BIAP. The following assumptions have been made to keep consistency throughout the mathematical analysis:

Poisson Formula:

$$\frac{e^{-\lambda}\lambda^{x}}{x!}$$

VTANG Lambda (λ) Calc (using National Class A Mishap Rate of 3.55):

1. λ = .0000355 mishaps /flt hr * 425 hrs = .015

GA λ Calc (using National Class A Mishap Rate of 6.71):

2. λ = .0000671 mishaps/flt hr*4505 hrs = .302

Comm Aviation λ Calc (using National Class A Mishap Rate of 0.895):

3. λ = .00000895 mishaps/flt hr*3879 hrs = .035

VTANG λ Calc (using 158 FW Class A Mishap Rate of .926):

4. λ = .00000926 mishaps/flt hr*425 hrs = .004

Supporting Data:

10 yr avg for flight operations at BIAP:

1. VTANG F-16s = 5,100 flight operations or ~5% of total activity at BIAP
2. GA = 54,056 flight operations or ~48% of total flight activity at BIAP
3. Comm Aviation = 46,548 flt ops or ~42% of total flight activity at BIAP

Using a very conservative assumption that each flight operation (T/O & Arv) spends ~ 5 min in terminal area (20 NM radius of BIAP), you can compute the # of hrs for each respective type of aircraft (i.e. F-16s, GA & Comm Aviation)

Calculations for time spent in the BIAP terminal area:

1. VTANG F-16s = 5100 * 5 min / 60 min/hr = 425 hours
2. General Aviation = 54,056 * 5 min/ 60 min/hr = 4505 hours
3. Commercial Aviation: 46,548 * 5 min/60 mn/hr = 3879 hours

Commercial Aviation Accident Rate Calculation:

1. Part 121 = 0.2 accidents / 100,000 flight hours
2. Part 135 = 1.59 accidents / 100,000 flight hours

BIAP has both Part 121 and Part 135 flying into and out of the airport
Avg Commercial Aviation Accident Rate = (.2 + 1.59)/ 2 = .895