4-23-2015

F-35 and military spending

Colin J. Charpentier
College of Saint Benedict/Saint John's University

2015

F-35 and Military Spending

CASE STUDY

COLIN CHARPENTIER
charpcol@yahoo.com

Conclusion

In conducting the research on the F-35 it was found that while comparing cost data to capabilities the F-35 is not worth the money spent when compared to modern platforms. The data analysis is shown in lower sections.

Overview

Research Question

How does the F-35 Lightning II multirole fighter compare to current military airplanes in terms of costs and capabilities?

Background Information

This is a comparison study based around the F-35 and 5 other planes. The F-35 is chosen because of its status as an ongoing project and due to its controversy as a plane. This study looks at all values. It is completely numeric based allowing for objective analysis. These planes chosen for study are the F-16 C/D, F/A-18 E/F, F-22A, AV-8B Harrier II, and A-10C. These planes are chosen because the F-35

is meant to replace them in the case of all the planes except the F-22A.[1] In the case of the F-22A, it is the same generation as the F-35 and developed a bit earlier.[2] This will allow for the best comparison of information and make the study the most relevant.

Relevance

Case Study

This study allows for looking at the F-35 and comparing its value to that of current platforms. This can act as a case study for military spending. In this case, deeming that the spending is not worth the value based on the objective capabilities chosen. This opens the doors to further questions.

Civilians and military members

This study is relevant for civilians and military members as well. This lets people know what the future of our national defense is. We're looking at the F-35, a plane currently in development. Then it also evaluates cost. This is important so military members can know how the defense budget is being spent and for civilians so they know how their tax dollars are being spent. Finally this is also relevant to these people for accountability reasons. That military members and civilians are able to evaluate if those in charge are making responsible choices and then held accountable for those actions.

Existing Research

Costs

The F-35 is a costly jet and research and comparisons have been done based on this. Instances of this are in HIS Jane's study, *FAST JET OPERATING COSTS*. This study compares multiple planes based

[1] "About the F-35," https://www.f35.com/about
[2] "F-22 Raptor," http://www.lockheedmartin.com/us/products/f22.html

on Cost Per Flight Hour (CPFH), a statistic I use later. This one study values the F-35 at a much higher CPFH then any of the other planes used, the F-35 being less favorable than other platforms in this study. An instance of total spending is the Barr Group Aerospace "U.S Military Aircraft Program" cost comparison, showing the F-35 at the most costly aircraft program. Many other studies or comparisons show this as well, giving the F-35 to be very expensive.

Capabilities

The F-35 is deemed capable and affordable by the USAF.[3] Its logistics, stealth, and mission capabilities are all incredibly valued and seen as offering great potential to the national defense and coalition capabilities. Public opinions, which are retired military members or military related groups, find the F-35 to be less up to the task. Some call its munitions capability into question, citing a lack of ability for it to carry missiles when comparted to the F-22 or lack of ammunition for its main gun when compared to the A-10.[4] Others question the F-35 and its ability to combat other fighters, a role it can serve. One source deems it lacking when compared to the F-22 and ill-suited for the potential role.[5] Finally, some question it's capabilities in terms of future aircraft and performance.[6] As it can be seen, the F-35 is a greatly debated plane.

[3] Davis, Charles R. "F-35 Lightning II Program Brief." USAF, 26 Sept. 2006.
[4] "The F-35s Air-to-Air Capability Controversy." *Defense Industry Daily RSS News*. N.p., 30 May 2013. Web. McGarry, Brendan. "A Tale of Two Gatling Guns: F-35 vs. A-10." *Defense Tech RSS*. N.p., 2 Jan. 2015. Web.

[5] "Can the F-35 Win a Dogfight?" *Medium*. N.p., 17 Dec. 2013. Web.

[6] "RAAF vs F-35 Lightning II Joint Strike Fighter." Air Power Australia, 7 June 2014. Web.

Methodology

Sources

Sources chosen for finding information on this study are GAO publications, consulting firms, US military databases, manufactures sites, and analyst sites. These sources were chosen because they are believed to be the most relevant and factual. They all contained information related to the numerical valued metrics chosen.

Data factors

Listed below are the factors chosen in the beginning of the study. A caveat of these data points is that some proved more relevant then others later on in the study.

CPFH: Cost per flight hour is use of fuel, pre-flight preparation and repair, and scheduled maintenance and personnel costs.[7]

Program Cost: Program cost is the cost of procurement and research and development.[8]

Cost per unit: Cost to acquire one unit, normally taken as a division of total cost divided by units.[9]

Payload: The amount of munitions an aircraft can carry.[10]

Hard points: External point on airframe capable of carrying external load, munitions or fuel.[11]

Ferry Range: Range with minimal munitions and maximum fuel.[12]

[7] Hunt, Edward. "FAST JET OPERATING COSTS." *IHS Jane's* 13 Mar. 2012. Web.
[8] "Analysis of the Fiscal Year 2012 Pentagon Spending Request" *National Priorities Project* 15 Feb. 2011. Web.
[9] "Analysis of the Fiscal Year 2012 Pentagon Spending Request"
[10] "Payload" *Dictionary.com* Web.
[11] "Hardpoint" *Wikipedia* Web.
[12] "Range (aeronautics)" *Wikipedia* Web.

Combat radius: Range with munitions load and ability to maneuver on site.[13]

Maximum Speed: Top speed of the aircraft.

Cruising speed: Speed an aircraft can maintain for extended periods of time, most efficient.[14]

Total Force: Amount acquired or planned to acquire.

Ceiling: How high the plane can fly.

[13] "Range (aeronautics)" *Wikipedia* Web.
[14] "Cruise (aeronautics)" *Wikipedia* Web.

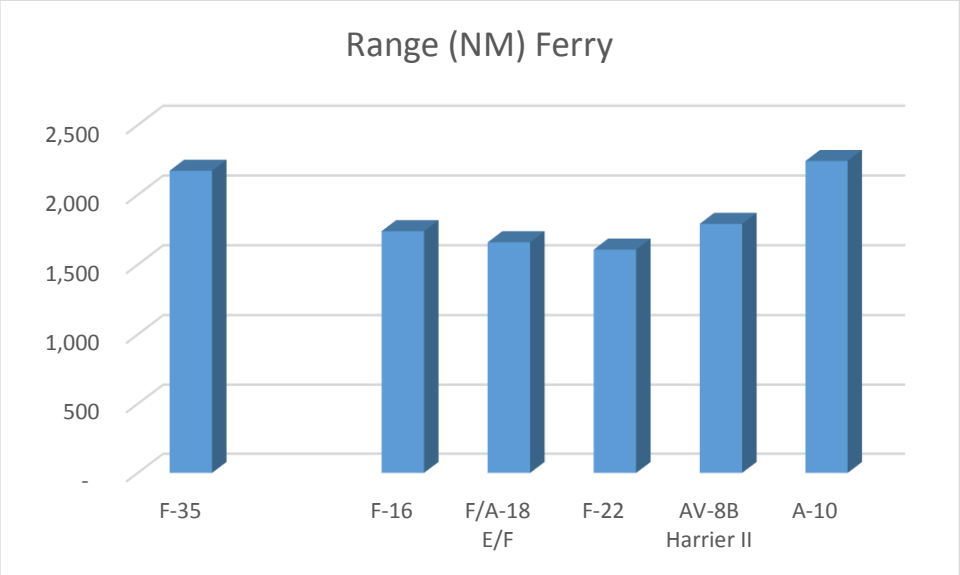
Data Manipulation

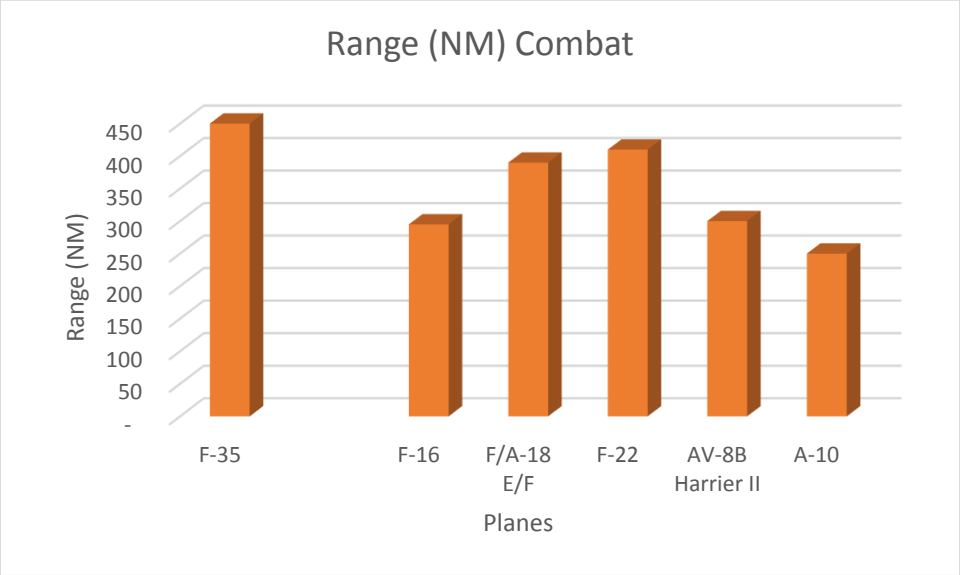
In this study data was manipulated in a number of ways. One was via charts, as can be seen below.

Range (NM)		
Planes	**Ferry**	**Combat**
F-35	2,172[15]	560[16]
F-16	1,740[17]	295[18]
F/A-18 E/F	1,660[19]	390[20]
F-22	1,608[21]	410[22]
AV-8B Harrier II	1,792[23]	300[24]
A-10	2,242[25]	250[26]

And another was more visual based, via graphs. This too can be seen below, representing the same data as above.

[15]"F-35 Lightning II Joint Strike Fighter" *Barr Group Aerospace* Web.
[16] "F-35 Lightning II Joint Strike Fighter"
[17] "F-16 Fighting Falcon" *US Air Force* Web.
[18] "F-16 Fighting Falcon" *Barr Group Aerospace* Web.
[19] "U.S Navy Fact Sheet F/A-18 Hornet Strike fighter" *United States Navy* Web.
[20] "F/A-18 Hornet" *Federation of American Scientists Military Analysis Network* Web.
[21] "F-22 Raptor" *US Air Force* Web.
[22] "F-22 Raptor" *Barr Group Aerospace* Web.
[23] "AV-8B Harrier II Plus VSTOL Fighter and Attack Aircraft, United States of America" *airforce-technology.com* Web.
[24] "AV-8B Harrier II" *Barr Group Aerospace* Web.
[25] "A-10 Thunderbolt" *Barr Group Aerospace* Web.
[26] "A-10 Thunderbolt"





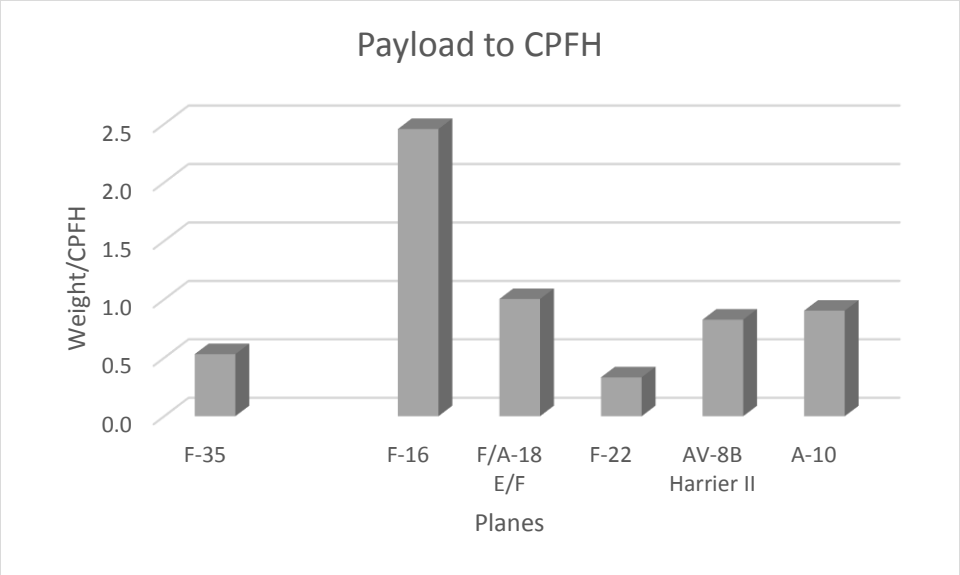
In this way data was manipulated to show side by side comparisons. Finally data was manipulated to show it against cost data. Examples below are shown comparing CPFH and Cost per unit to Payload and Combat radius, what I believe to be two key statistics to combat capability of an aircraft. Note, that in valuing statistics a higher number is better. Formulas are Combat radius or payload divided by cost value.

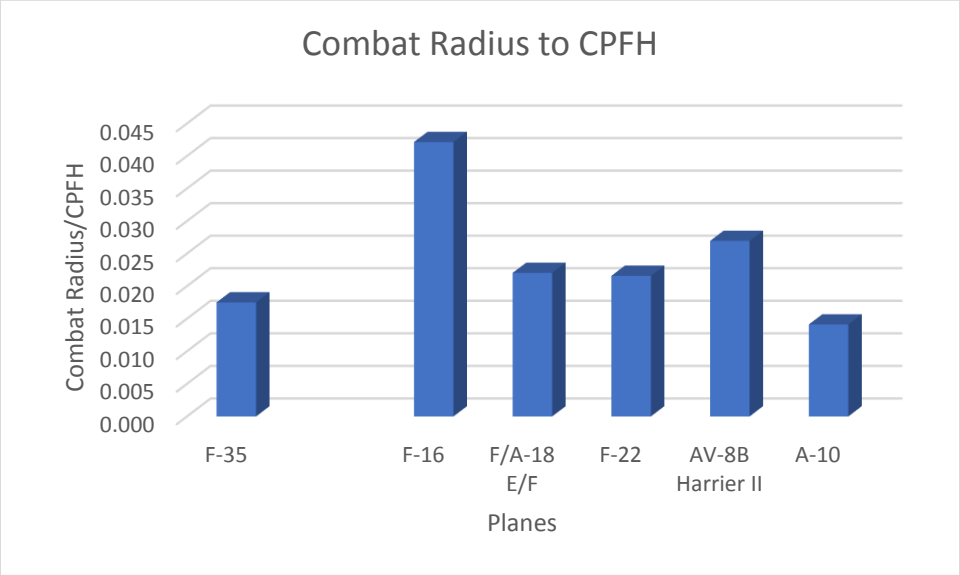
Planes	**CPFH**	**Payload (in pounds)**	**Payload to CPFH**	**Combat**	**Combat Radius to CPFH**
F-35	$ 32,000[27]	17,000[28]	0.5	560	0.018
F-16	$ 7,000[29]	17,200[30]	2.5	295	0.042
F/A-18 E/F	$ 17,700[31]	17,750[32]	1.0	390	0.022
F-22	$ 19,000[33]	6,325[34]	0.3	410	0.022
AV-8B Harrier II	$ 11,134 [35]	9,200 [36]	0.8	300	0.027
A-10	$ 17,716 [37]	16,000 [38]	0.9	250	0.014

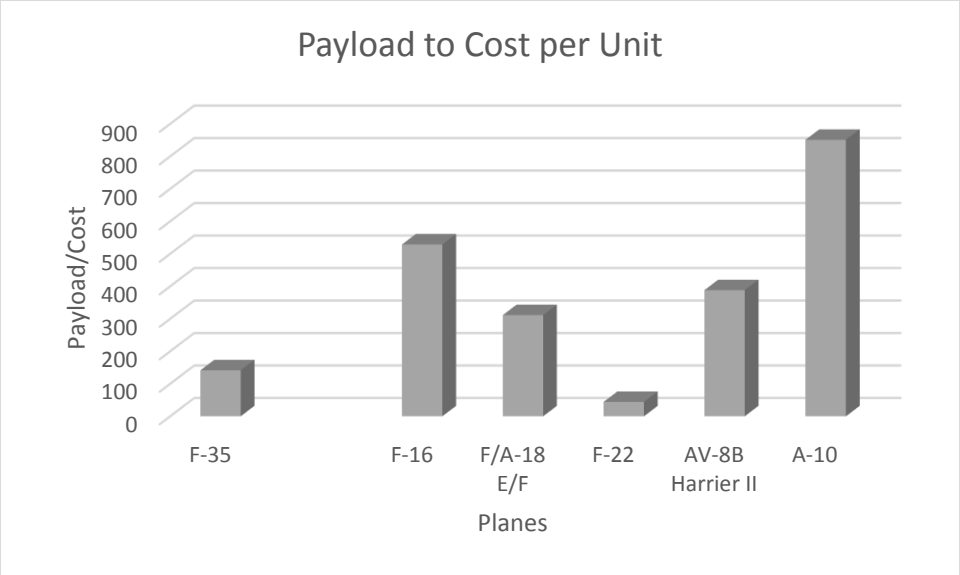
[27] Majumdar, Dave "USAF estimates F-35 will cost $32,000 per hour to operate" 29 May 2013 *Flightglobal* Web.
[28] "F-35 Lightning II Joint Strike Fighter" *Barr Group Aerospace* Web.
[29] "Project Air Force" *Rand* Web.
[30] "General Dynamics (now Lockheed Martin) F-16 Fighting Falcon Multi-Role Fighter" *aerospaceweb.org* Web.
[31] Hunt, Edward. "FAST JET OPERATING COSTS." *IHS Jane's* 13 Mar. 2012. Web
[32] "F/A-18 Hornet" *Federation of American Scientists Military Analysis Network* Web.
[33] "F-22 Assertions and Facts" July 2009 *US Senate* Web.
[34] "AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM), United States of America" *airforce-technology.com* Web.
"F-22A Raptor Advanced Tactical Fighter, United States of America" *airforce-technology.com* Web.
[35] "US Spends At Least $168 Million for First Strikes on Libya" 22 March 2011 *Newsmax* Web.
[36] Nordeen, Lon *Harrier II: Validating V/STOL* (Maryland: Naval Institue Press, 2006), 73
[37] Thompson, Mark "Costly Flight Hours" 02 April 2013 *Time* Web.
[38] "A-10 Thunderbolt II" 14 May 2004 *US Air Force* Web

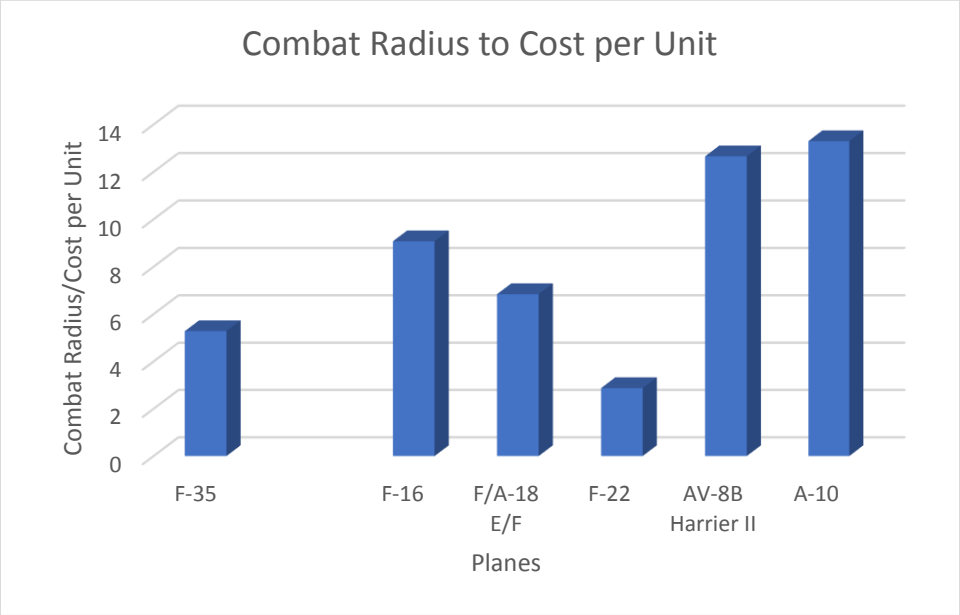
Planes	**Cost (in millions)**	**Weight (in pounds)**	**Cost/Weight**	**Combat**	**Combat Radius to Cost per Unit**
F-35	$ 106 [39]	15,000	142	560	5
F-16	$ 33 [40]	17,200	529	295	9
F/A-18 E/F	$ 57[41]	17,750	311	390	7
F-22	$ 143 [42]	6,325	44	410	3
AV-8B Harrier II	$ 24 [43]	9,200	388	300	13
A-10	$ 19 [44]	16,000	851	250	13
Inflation	3.28%[45]				

[39] "Producing, Operating and Supporting a 5th Generation Fighter" *Lockheed Martin* Web.
[40] "Status of the F-16 Aircraft Program" 01 April 1977 *GAO* Web.
[41] "Status of the F-18 Naval Strike Fighter Program" 01 March 1977 *GAO* Web.
[42] Kerr, Jennifer "Air Force's newest fighter jet, F-22 Raptor makes combat debut" 24 September 2014 *PBS* Web.
[43] "Harrier II Plus (AV-8B) VSTOL Fighter and Attack Aircraft, USA" *airforce-technology.com* Web.
[44] "COST AND PERFORMANCE OF THE AIRCRAFT AND MUNITIONS IN DESERT STORM Appendix IV" 12 June 1997 *US Air Force* Web.
[45] "United States Inflation Rate" *Trading Economics* Web.
Mchahon, Tim "Long Term U.S. Inflation" 01 April 2014 *InflationData.com* Web.


Payload to CPFH
Weight/CPFH
2.5
2.0
1.5
1.0
0.5
0.0
F-35
F-16
F/A-18 E/F
F-22
AV-8B Harrier II
A-10
Planes


Combat Radius to CPFH
Combat Radius/CPFH
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
F-35
F-16
F/A-18 E/F
F-22
AV-8B Harrier II
A-10
Planes





Findings

As can be seen in the 2 tables and 4 charts above, the F-35 does not compare favorably to other existing 4th generation aircraft. This evaluation holds true when comparing cost data to other

sources. This would allow for the conclusion, based on the data presented and examined, that the F-35 is not worth the cost.

Assumptions

Values are assumed to be correct in all instances of this study. Possible room for variations is in the accuracy of values the sources have; that is the most current data. Other sources could be if calculations of numbers by sources are varying from other sources.

Future Research

Further research could be done in to more extraneous factors. Looking at what new technologies generation 5 aircraft have over generation 4 would be one example. Others would be looking at mission set and determining value there, looking to see if it allows for better cooperation with coalition partners, impact on economies, and if future improvements to generation 5 and 4 aircraft change the values of those aircrafts. Subjective factors could also be researched, such as likability, likability, pilot preference, and factors similar to that.

Other Charts

Program Cost	
Planes	**Cost (in millions)**
F-35	$ 398,585[46]
F-16	$ 46,957 [47]
F/A-18 E/F	$ 44,234 [48]
F-22	$ 75,892[49]
AV-8B Harrier II	$ 16,024 [50]
A-10	$ 1,023 [51]
Inflation	3.28%

Hardpoints					
Planes	**Points**	**Unit Cost (in millions)**	**CPFH**	**Points/Unit cost**	**Points/CPFH**
F-35	6[52]	$ 106	$ 32,000	0.057	0.00019
F-16	9[53]	$ 19	$ 7,000	0.479	0.00129
F/A-18 E/F	11 [54]	$ 57	$ 17,700	0.193	0.00062
F-22	4 [55]	$ 143	$ 19,000	0.028	0.00021
AV-8B Harrier II	7 [56]	$ 24	$ 11,134	0.295	0.00063
A-10	10 [57]	$ 19	$ 17,716	0.532	0.00056

[46] "Selected Acquisition Report (SAR) F-35 Joint Strike Fighter Aircraft (F-35)" 2015 *Department of Defense* Web.
[47] "Status of the F-16 Aircraft Program"
[48] "Status of the F-18 Naval Strike Fighter Program"
[49] "Analysis of the Fiscal Year 2012 Pentagon Spending Request"
[50] "AV-8B hits trouble" 23 May 1987 *Flightglobal* Web.
[51] Jacques, David & Strouble, Dennis "A-10 Thunderbolt II (Warthog) SYSTEMS ENGINEERING CASE STUDY" 2010 *Air Force Institute of Technology* Web.
[52] Reed, John "Pics of the week: F-35 With Weapons" 21 Feb. 2012 *Defensetech* Web.
[53] "F-16 Fighting Falcon Multirole Fighter, United States of America" *airforce-technology.com* Web.

[54] "F/A-18 SUPER HORNET" *Boeing* Web.
[55] "F-22A Raptor Advanced Tactical Fighter, United States of America"
[56] "AV-8B Harrier II"
[57] Alex, Dan "Fairchild Republic A-10 Thunderbolt II (Warthog) Close Air Support / Forward Air Control (1976)" 2 Feb. 2015 *Military Factory* Web.

Speed (KPH)								
Planes	**Cruising**	**Max**	**Unit Cost (in millions)**	**CPFH**	**Cruising/Unit Cost**	**Cruising/CPFH**	**Max/Unit Cost**	**Max/CPFH**
F-35	1,470 [58]	1,960 [59]	$ 106	$ 32,000	13.87	0.05	18.49	0.06
F-16	929 [60]	2,165 [61]	$ 19	$ 7,000	49.39	0.13	115.14	0.31
F/A-18 E/F	1,250 [62]	2,205 [63]	$ 57	$ 17,700	21.94	0.07	38.68	0.12
F-22	2,229[64]	2,756 [65]	$ 143	$ 19,000	15.63	0.12	19.33	0.15
AV-8B Harrier II	759 [66]	1,041[67]	$ 24	$ 11,134	32.03	0.07	43.93	0.09
A-10	563[68]	918 [69]	$ 19	$ 17,716	29.95	0.03	48.83	0.05

[58] Tirpak, John "The F-35's Race Against Time" November 2012 *Air Force Association* Web.
[59] "F-35 Lightning II Joint Strike Fighter"
[60] "GENERAL DYNAMICS F-16A FIGHTING FALCON" 14 Jul. 2014 *National Museum of the US Air Force* Web.
[61] "GENERAL DYNAMICS F-16A FIGHTING FALCON"
[62] "McDonnell Douglas F-18 Hornet" *Virtual Aircraft Museum* Web.
[63] "F/A-18 SUPER HORNET"
[64] "F-22 Raptor"
[65] "F-22 Raptor"
[66] "Standard Aircraft Characterisitcs Navy Model AV-8B Harrier II Aircraft" Oct. 1986 *Naval Air System Command* Web.
[67] "AV-8B HARRIER II/(V/STOL) AIRCRAFT" *Boeing* Web.
[68] "A-10 Thunderbolt"
[69] "A-10 Thunderbolt"

Ceiling (feet)						
Planes		**Ceiling**	**Unit Cost (in millions)**	**CPFH**	**Points/Unit cost**	**Points/CPFH**
F-35		50,000[70]	$ 106	$ 32,000	472	1.56
F-16	>	50,000[71]	$ 19	$ 7,000	2660	7.14
F/A-18 E/F	>	50,000[72]	$ 57	$ 17,700	877	2.82
F-22	>	50,000[73]	$ 143	$ 19,000	351	2.63
AV-8B Harrier II		38,000[74]	$ 24	$ 11,134	1603	3.41
A-10		45,000[75]	$ 19	$ 17,716	2394	2.54

[70] "F-35A Lightning II Conventional Takeoff and Landing Variant" 11 Apr. 2014 *US Air Force* Web.
[71] "F-16 Fighting Falcon"
[72] "U.S Navy Fact Sheet F/A-18 Hornet Strike fighter"
[73] "F-22 Raptor"
[74] "AV-8B HARRIER II/(V/STOL) AIRCRAFT"
[75] "A-10 Thunderbolt"

Total Force					
Planes	**Number**	**Unit Cost (in millions)**	**CPFH**	**Points/Unit cost**	**Points/CPFH**
F-35	2,457[76]	$ 106	$ 32,000	23.0	0.076
F-16	1,018[77]	$ 19	$ 7,000	54.1	0.145
F/A-18 E/F	563[78]	$ 57	$ 17,700	9.9	0.032
F-22	183[79]	$ 143	$ 19,000	1.3	0.010
AV-8B Harrier II	134[80]	$ 24	$ 11,134	5.7	0.012
A-10	343[81]	$ 19	$ 17,716	18.2	0.019

[76] Gertler, Jeremiah "F-35 Joint Strike Fighter (JSF) Program" 29 Apr. 2014 *Congressional Research Service* Web.
[77] "F-16 Fighting Falcon"
[78] "F/A-18E/F Super Hornet" 25 Mar. 2015 *Barr Group Aerospace* Web.
[79] "F-22 Raptor"
[80] "AV-8B Harrier II"
[81] "A-10 Thunderbolt II"