

## **Prospectus**

### **Designing an Austere Field Light Attack Aircraft (Technical Topic)**

### **The Need for Low-Cost Aerial Platforms (STS Topic)**

By

Alfredo Basile

Fall, 2020

Technical Project Team Members:

Robbie Sorrentino

Riley Assaid

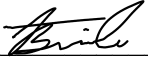
Ben Hamer

Ryan Hughes

Andrew Kraemer

Caleb Mallicoat

On my honor as a university student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

Signed:  Alfredo Basile

Technical Advisor: Jesse Quinlan

STS Advisor: Kathryn Neeley

## Introduction

This project is to design an austere field light attack aircraft in response to the American Institute of Aeronautics and Astronautics (AIAA) competition request for proposal (RFP). The RFP contains the requirements for the design of a light attack aircraft with one of the primary goals being reduction in cost. The mission of a light attack aircraft is to provide close air support (CAS) and intelligence, surveillance, and reconnaissance (ISR) in support of ground troops. There are many platforms that fill this role from fixed wing fighter jets to attack helicopters. These platforms provide ground troops with high end advanced aircraft for support; however, their primary mission is air combat and light attack aircraft may actually be more effective at providing CAS than the high end fighters do (Antal, 2020). The cost of these platforms is related to the level of advancement needed to fight a conventional war (Kosiak, 2017, page 7). The cost of procurement of these aircraft has been increasing exponentially to maintain this tactical advantage as can be seen in Figure 1. Full scale conventional wars have not been the norm, at

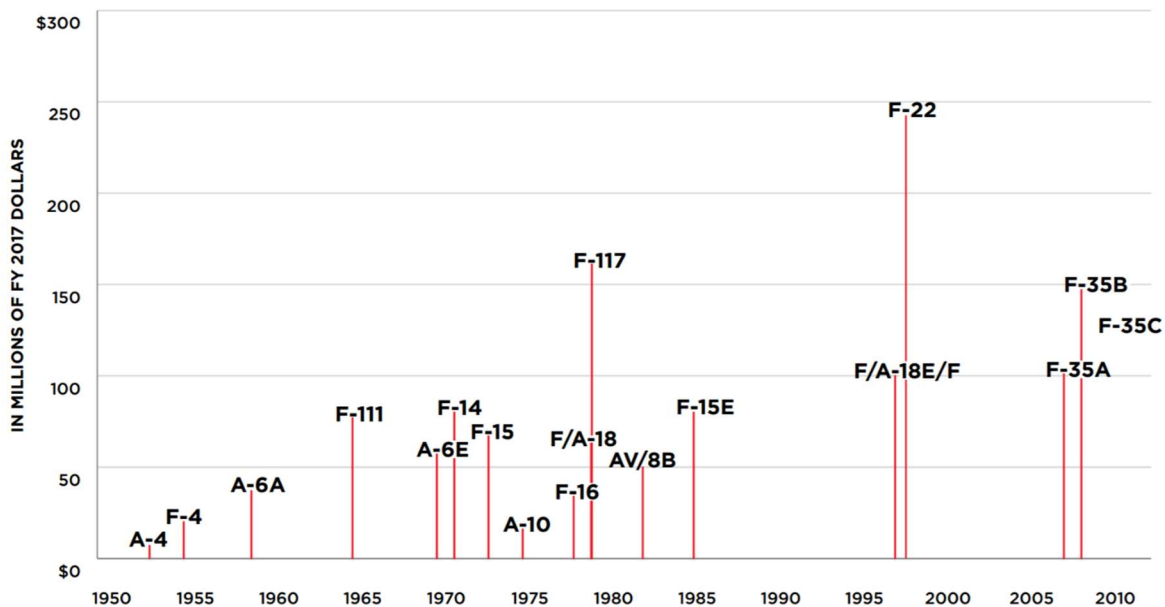


Figure 1

Rising unit cost of high-end fighters from post WWII to present (Kosiak, 2017).

least not for the US, rather unconventional warfare without enemy airpower has been the status quo. The result is a fleet of high-end fighters that are extremely expensive to buy, maintain and field, and are further disadvantaged by their need for large, developed runways and are too expensive for undeveloped nations to use for their on foreign internal defense (FID). Light attack aircraft are needed to fill the gap left by high end fighters and helicopters for reliable in expensive performance.

### **Technical Topic: Designing an Austere Field Light Attack Aircraft**

The technical difficulty of developing an attack aircraft that is also inexpensive is a difficult balance to achieve because more performance has a snowball effect on cost, especially new technologies. The primary focus must be low cost, but the ultimate design must be

advanced enough, technologically, to meet the needs of future warfare. That balance is the focus of the technical aspects of designing a light attack aircraft that also meets the design requirements set by the AIAA RFP. There are many possible configuration choices that have advantages and disadvantages that need to be analyzed to meet the demands of an attack



*Figure 2*

Two AT-6 Wolverines in flight, shows the standard configuration and look of light attack aircraft (AT-6 Wolverine, 2020).

aircraft. To set a baseline, a broad analysis of the two currently developed light attack aircraft, the A-29 Super Tucano, and the AT-6 Wolverine, will give initial metrics for the design to attempt to improve.

The first thing to note is the A-29 and the AT-6 both exceed the requirements for payload capacity, loiter time, range, minimum runway distance and are capable of landing on austere

airfields (Horne, A-29 Specifications). Both aircraft are turboprop for reduction in cost, noise, and heat signature. Both aircraft are redesigns of training aircraft that are retrofitted for weapons. As for cost, the Super Tucano has a unit price of almost \$18 million and \$500 per flying hour (Boechler, 2013). Compare that to the F-35B, according to the reimbursement rates via the Department of Defense (DoD) Comptroller, of \$23,891 per flight hour and a unit cost of just under \$150 million (Kosiak, 2020).

So why do we need a new light attack aircraft and where do the current ones fall short? In the original Air Force RFP for light attack aircraft, the Air Force specified the configuration. Boechler having access to the original RFP from 2011 states, “The specifications set forth for the LAS aircraft detail: a ‘single-engine, turbo-prop, tandem- and ejection-seat cockpit, pressurized aircraft with retractable, tricycle gear capable of operations from austere airfields with semi-improved (dirt, grass, gravel) landing surfaces.’”(Boechler, 2013). This is the basic configuration of military training turboprop aircraft which the AT-6 and A-29 are built on. This configuration limitation was necessary for getting quicker development of a light attack aircraft.

The AIAA RFP has no such limitations, therefore, any configuration that performs the mission requirements is acceptable. This leads to two basic approaches: Lower the cost of the platform or increase the capabilities without driving up the cost too much. It is unlikely that a less expensive configuration can be found that outperforms the AT-6 or the A-29 except for the AC208-B Armed Caravan which has a unit cost of \$7.5 million (Boechler, 2013). The Caravan can also land on all 52 unimproved runways in Afghanistan unlike the A-29 which can only land on 39, but the armed caravan is not considered a light attack aircraft and has been sidelined for consideration by the Air Force and others. The A-29 also has a high-tech glass cockpit which might meet some of the request specifications from the United States Special Operations

Command (USSOCOM) for advanced targeting systems that reduce pilot workload (AFLCMC/WW, call 001). It might be possible to build an aircraft that leverages the technology of the A-29 and the short-landing capability of the Caravan in a standard turboprop package. This is the standard approach which is not the approach my team has chosen.

As stated previously, the other approach, is to increase the capabilities without increasing the cost too much. As a general example, if a configuration can multiply the capability of the aircraft by a factor of four but only double the cost, then the additional cost can be justified. The capability our design is aimed at is vertical lift. If the designed vehicle can land anywhere, like a



*Figure 3*

Bell V-280 Tilt-Rotor Turboshift aircraft slated to replace the UH-60 (Bell V-280, 2020).

helicopter, and has the survivability, payload, and range of a fixed wing aircraft then, a high capability per cost ratio might be achievable. To maximize this ratio our team is looking at tilt wing configuration to achieve vertical takeoff. The more common approach is a tilt-rotor design where the rotors tilt up, see Figure 3, but a tilt wing requires half of the actuators. The other focus

of our team's design will be to internalize the payload. This will reduce the radar cross section of the aircraft which will increase its stealth. This is the initial design approach, and it will inevitably change as we evaluate the capability versus cost ratio of each configuration as we continue in our design process. This is a high-risk high reward approach that is attempting to leverage the future needs of USSOCOM and others for light attack aircraft while still maintaining lower overall cost.

## **STS Topic: The Need for Low-Cost Aerial Platforms**

The ability to have a low-cost attack platform has many possible side-effects for both the US and foreign militaries (Boechler, 2013). In the case of the US, it allows for more availability of aircraft that can be used in place of high-end fighters to reduce flight hour and maintenance costs, which is incredibly important when the national debt continues to skyrocket along with the defense budget (Why Light Attack?, 2018). In the case of foreign nations, it can add an otherwise non-existent capability, or at least expand their capability to the level that would be necessary for securing their country and borders, categorized as foreign internal defense (FID) by the DoD. This is what drove the US Airforce to create the first request for light attack aircraft with the combat environment of Afghanistan in mind. The Air Forces' goal being to aid the Afghan government in the process of providing their own defense. This can be accomplished primarily by the Intelligence, Surveillance, and Reconnaissance (ISR) mission of light attack aircraft by providing information on areas that are difficult to access from the ground. Information gathering is one of the most important means by which militaries fight insurgent groups, known as counterinsurgency (COIN) (Ybarra, 2011), which is also why US Special Operations Command (USSOCOM) is interested in light attack aircraft. Having a low cost option that provides the same missions as more expensive platforms has beneficial outcomes such as reducing US citizen's taxes in support of the defense budget, or to increase the coverage of support at similar costs, to reducing terrorism across the globe, light attack aircraft might be the workhorse of world security (Waltz, 2019).

As stated previously the US Air Force started the light attack aircraft concept with Afghanistan in mind. The rugged terrain makes many areas extremely difficult to access from the ground giving insurgents safe havens to train and operate. The Air Force, however, has been

moving too slow for some lawmakers like Rep. Michael Waltz, R-Florida who according to an article by Oriana Pawlyk, “introduced a measure into the House's version of the fiscal 2020 National Defense Authorization Act legislation that would put the propeller-driven planes under U.S. Special Operations Command's purview, taking it away from the Air Force” (Pawlyk, 2020). According to the same article USSOCOM wants 75 Light attack aircraft for armed air support and once the acquisition goes through USSOCOM plans to do experimentation in unconventional uses.

While the US is fumbling the light attack aircraft program, Afghanistan’s government has begun procuring and using light attack aircraft for FID and COIN operations. This means that Afghanistan will have the means to secure its own country as the US inevitably withdraws from the region. Afghanistan has recently entered a \$1.8 billion contract with Embraer for the A-29 Super Tucano (Kelly, 2018) and has already fielded the aircraft with over 46,000 combat hours according to Embraer’s A-29 website.

Even though the US, specifically the Air Force, started the light attack program, it has managed to take a life of its own because the demand is so great. This is because low-cost platforms result in more air support. If economics are on the minds of leaders when deciding who gets and does not get support, then an aircraft that provides support at an operating cost thirty-five to fifty times cheaper means they would be less inclined to choose dollars over lives. The other way to look at it is by that same factor you can provide additional ISR coverage for the same price which has a direct effect on FID and COIN operations for both the US and foreign nations which increases national and worldwide security (Ybarra, 2011).

## **Conclusion**

Inexpensive light attack aircraft does not mean cheap or less advanced. It means having available tools that have the most advanced capabilities for what the mission requires without having to fly those tools on a platform that offers no additional benefit to CAS or ISR. Troops on the ground do not care if a bomb dropped came from a \$250 million plane or a \$20 million plane, they just care if support is there when they call. They do not care if the plane can fly Mach two on its way, they just care if their leaders are deciding to support them because they need it, and not because it costs too much. Having a low-cost plane means more of them where you need them when you need them. Having austere field capabilities and possibly vertical lift capabilities extends this to every possible environment. It means those we send to fight will have the much-deserved guardian angels watching their back whenever they go out, and this is why my team and I are designing the austere field light attack aircraft of tomorrow.

Word count: 1851



## References

- A-29 Specifications. (2018). A-29 for America | Super Tucano | OA-X. Retrieved October 21, 2020, from <https://www.builtforthemission.com/a-29-super-tucano/a-29-specs/>
- Air Force Lifecycle Management Center, Fighters and Bombers Directorate (AFLCMC/WW), W. P. (2017). AFLCMC-17-BAA-WWB-001, Call 0001 Light Attack Support for U.S. Special Operations Command [Pdf.]. Retrieved October 1, 2020, from [https://beta.sam.gov/opp/87375cecad9bc8cc1bd86aa6235ddeec/view?keywords=%22light%20attack%20aircraft%22&sort=-relevance&index=&is\\_active=true&page=1](https://beta.sam.gov/opp/87375cecad9bc8cc1bd86aa6235ddeec/view?keywords=%22light%20attack%20aircraft%22&sort=-relevance&index=&is_active=true&page=1)
- Antal, J. (2020). The Light Attack Aircraft Challenge: Making Close Air Support Effective Again. *Military Technology*, 44(7/8), 28 - 31.
- AT-6 Wolverine. (2020). Retrieved October 22, 2020, from <https://defense.txtav.com/en/at-6>
- Bell V-280. (2020). Search and Rescue with Revolutionary Reach and Capabilities. Bell Flight. Retrieved October 26, 2020, from <https://www.bellflight.com/products/bell-v-280>
- Boechar, K. (2013). Going Tactical: A New Strike Aircraft for the Afghan Air Force | Small Wars Journal. Retrieved October 9, 2020, from <https://smallwarsjournal.com/jrnl/art/going-tactical-a-new-strike-aircraft-for-the-afghan-air-force>
- Horne, T. A. (2020). AT-6 Wolverine: On the prowl [Text]. <https://www.aopa.org/news-and-media/all-news/2020/april/pilot/turbine-at-6-wolverine-on-the-prowl>
- Kelly, F. (2018). Sierra Nevada awarded \$1.8 billion Afghanistan A-29 Super Tucano contract. *The Defense Post*. <https://www.thedefensepost.com/2018/09/05/afghanistan-a-29-super-tucano-1-8-billion-contract-us-air-force-sierra-nevada/>
- Kosiak, S. (2017). Is the US Military Getting Smaller and Older. Retrieved October 10, 2020, from <https://s3.us-east-1.amazonaws.com/files.cnas.org/documents/CNASReport-SmallerOlderMilitary-Final.pdf?mtime=20170310154527&focal=none>
- Laird, R. (2020). Inside the Capabilities of Textron's ISR/Light-Attack AT-6E Wolverine. *Second Line of Defense*. <https://sldinfo.com/2020/07/inside-the-capabilities-of-textrons-isr-light-attack-at-6e-wolverine/>
- Pawlyk, O. (2020). US Special Operations Command now wants its own light attack aircraft fleet. *Americas Military Entertainment Brand*. <https://www.wearethemighty.com/gear-tech/socom-light-attack-aircraft-fleet?rebellitem=1#rebellitem1?rebellitem=1>
- Secretary of the Air Force Public Affairs. (2019). Air Force requests for proposals for light attack aircraft. U.S. Air Force. <https://www.af.mil/News/Article-Display/Article/1998584/air-force-requests-proposals-for-light-attack-aircraft/>

US DoD Comptroller. (2018). Memorandum for the Assistant Secretary of the Army, 'Fiscal Year FY(2019) Department of Defense (DoD) Fixed Wing and Rotor Reimbursement Rates'. Retrieved October 20, 2020, from [https://comptroller.defense.gov/Portals/45/documents/rates/fy2019/2019\\_b\\_c.pdf](https://comptroller.defense.gov/Portals/45/documents/rates/fy2019/2019_b_c.pdf)

Waltz, M. (2019, November 18). THE CASE FOR LIGHT-ATTACK AIRCRAFT. *Air Force Times*, 80(22), 36.

Why Light Attack. (2018). A-29 for America | Super Tucano | OA-X. Retrieved October 10, 2020, from <https://www.builtforthemission.com/laa/>

Ybarra, M (2011). Light Attack Aircraft Seen as Key To Afghan Air Force COIN Success. *Inside the Pentagon*, 27(33), 11 - 10.