May 20th, 2021

John Casano
CEO
Strike Labs LLC

[redacted]
United States Special Operations Command
7701 Tampa Point Blvd
MacDill Air Force Base, Florida 33621

Regarding: **Atmospheric Summation & Adjustment for Snipers**

To Whom It May Concern,

We are interested in working on one of the problem sets [redacted] described in his presentation at the SOFIC 2021 conference. Specifically, we would like to create a system for an operator that calculates the adjustment needed for a long-distance sniper shot with different atmospheric conditions between the operator and target.

This is similar to work we have done in the past. We have built a model to calculate the [redacted] with variable atmospheric conditions. It required us to gather atmospheric data every 5 meters along a path and its effect on a radio signal to get power efficiency. Most of the lessons learned on that project are directly applicable to this respective task.

We are currently unaware of a tool that captures atmospheric data remotely across a 3D geographic space. Should that exist in a national laboratory or within the DoD, we would be happy to work with it. Pulling from previous experience creating solutions for other DoD partners we feel there are a number of ways to tackle this unique challenge We propose the following approach, and would request a simple engagement with appropriate points of contact to proceed.

Proposed Process

1. Understand the location of the operator based on entered coordinates, or some other device on the operator.
2. Understand the location of the target based on where the rifle is pointed, or coordinates entered by the operator (or other system used by the operator).
3. Then, get all coordinates in a 1 meter grid along the path within a 3D football shape.
   Why a football shaped grid? We don't know the path yet, but we know the starting and ending point, so we need to be able to calculate all likely potential paths between the two points. The middle of the path will have the highest path variability, hence the wide football 'belly', while the start and end have the least, hence pointy football "nose".
4. Is the optical device electronically "connected"?
   a. Yes - pull live atmospheric NOAA data from each point within the 3D grid.
   b. No - the device itself will need to hold the historical averages of each point on the grid over the previous # (40?) years for the time and day of the year when the target is engaged.
      i. Given a single point in the grid with the following information:
         1. Date/Time: 2:30am UTC on a January 15th
         2. Latitude: 26.80297020492543
         3. Longitude: 20.776226400939972
         4. Altitude: 50.34 meters above sea level
      ii. then get:
         1. Temperature: 85.34° Fahrenheit
         2. Humidity: 49.34% humidity
         3. Barometric Pressure: 12.32 pounds per square inch
         4. Average Wind Speed: 5.34 miles per hour
         5. Direction of Wind: 343 degrees
         6. etc.
      iii. This will need to be done for every point on the grid.
5. Calculate the path the munition must take to hit the target based on all of the atmospheric data with each point within the potential football shaped path. We don't know the mathematical answer yet, but we have the skill internally and within our network to create the proper model.

If atmospheric effects are detailed mathematically and published in peer reviewed research, we can code that in quickly and then test it with your help. If not, we will need to leverage the assistance of a national or private ballistic lab to discover how each atmospheric variable individually affects the bullet, and then create the algorithms for the proper calculation.

Down the Rabbit Hole

For any single shot (i.e. scenario) , there may be more than one correct path (i.e. solution).

If we were playing catch with a frisbee inside a gym with a constant atmospheric condition one could toss the frisbee with different angels to make it reach the target on different paths without having to move. The same is true in this problem set, except that the path is determined by the atmosphere and not the projectile. There will always be one answer (assuming there are no barriers), but there may be a few lines or arcs of solutions that are correct. Given that, understanding the variables of outcomes based on the atmospheric variables and pointing out which is the most accurate given subtle changes is the next likely step to take.

For example, an operator may be provided with 2 solutions to a 1,500 meter target: solution A, and solution B. In solution A, the munition is shot more to the left, and blown right by wind 100 meters into the flight. In solution B, the munition is shot more to the right and blown left by wind 100 meters from its target. Both were expected, have the same probability of change, are accounted for. If nothing changed, the operator could use solution A or solution B to terminate the target. But if the wind on path A and path B changed and the effect on the projectile is equal, then solution B would be the better shot given its closer distance to the target, resulting in lower variability in proximity from the target. Simply put, solution B will result in a more accurate shot and should be the solution the operator uses.

Output

The initial prototype would be a portal computer based mathematical system that returns to the operator or spotter the x-y offset from a target, when given the target and firing coordinates. This could be tested 1) in a hyper-long range firing facility over different atmospheres, or 2) firing at a sea-based target from a location a few hundred meters inland, or vice versa.

The integration of a system like this into a rifle scope would require us to team with an optics hardware manufacturer, but such a problem is not needed to be solved yet.

Path Forward

This is mostly Research and Development work leading to a rapid prototype to get the warfighter this capability. If it is all about mathematics, this is months and not years of work.

[redacted]

If we can help in any way, please don't hesitate to contact us.

Sincerely,

John Casano
917.929.9002
john@strikelabs.io

Strike Labs LLC
strikelabs.io
Fairfield, Connecticut

DUNS: 113679478
CAGE: 8ENX8
EIN: 83-2382916
DEMOGRAPHICS: Small Business & Non-Traditional Defense Contractor | EDWOSB Filed
NAICS: 541511 (Custom Computer Programming Services)

Additional Research

Following publications will be helpful to you and others working on the problem.

Publication	Year Published	Where Published / Author	URL
Determination Of Atmospheric Effects Through Eosael	1988	U.S. Army Atmospheric Sciences Laboratory (United States)	https://www.spiedigitallibrary.org/conference-proceedings-of-spie/0926/0000/Determination-Of-Atmospheric-Effects-Through-Eosael/10.1117/12.945778.short?SSO=1
Effects of Atmospheric Turbulence on Ballistic Testing	2008	Journal of Applied Meteorology and Climatology	https://journals.ametsoc.org/view/journals/apme/47/5/2007jamc1775.1.xml
Long-range ballistics with EM guns	2001	IEEE Transactions on Magnetics	https://ieeexplore.ieee.org/abstract/document/911887
Motion of a ballistic missile angularly misaligned with the flight path upon entering the atmosphere and its effect upon aerodynamic heating, aerodynamic loads, and miss distance	1957	NASA in the Journal of Applied Meteorology and Climatology	https://ntrs.nasa.gov/citations/19930084822
DARPA's Extreme Accuracy Tasked Ordnance (EXACTO)	2015	DARPA	https://www.darpa.mil/news-events/2015-04-27
Army Picks Firm to Build Deadly New Sighting System Prototype for NGSW	2020	Military.com	https://www.military.com/daily-news/2020/04/21/army-picks-firm-build-deadly-new-sighting-system-prototype-ngsw.html