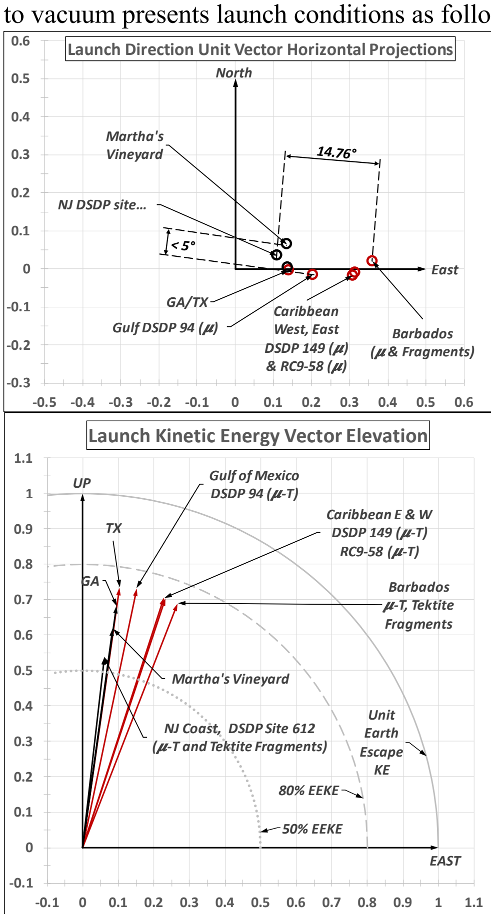
NORTH AMERICAN TEKTITE JETTING 'FIRST-LOOK' PORTRAIT. T.H.S. Harris, GE Astro Space Div., Lockheed Martin, Boeing Helicopter, retired (thsharris1@icloud.com).

Introduction: Novel methodology for tektite transport analysis and trend identification [1,2] suggests possible near-vertical jetting of N. American tektites (NAT), with expanded portrait presented. Relative to its size, the NAT strewn field has centroid closer to parent Chesapeake impact structure than do other strewn fields of known sources, making the NAT event important for tektite formation and transport research.

First-Look Portrait Developed: The suggested jetting to breach Earth's atmosphere and transport ejecta melt to vacuum presents launch conditions as follows:

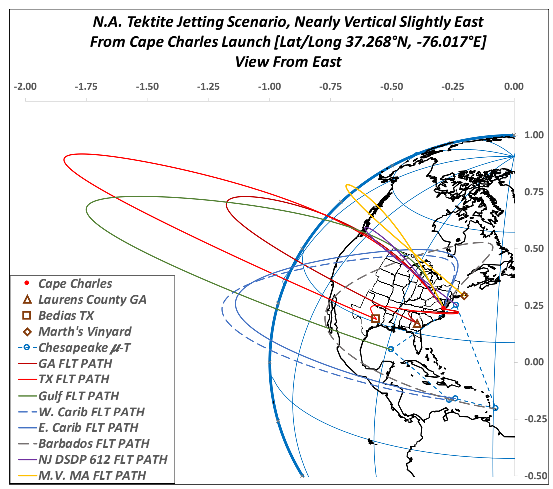


Contemporary Plate Tectonic configuration, launch conditions calculated from Cape Charles, Virginia and a simplified two-body gravity model are used. The projected horizontal spread in the upper frame could be further reduced if the 'Helix' suborbital solver setup had tighter Time-of-Flight (ToF) resolution at-regime. The point of the 'first-look' in SA, however, is that implied spacing for the set of launch conditions is already very tight in light of the limited two-body analysis tool capacity [2], as explained.

Bediasite (TX) and Georgiaite (GA) vectors are closely superimposed with less than 1° of 3D spacing, while the TX, Gulf of Mexico, Caribbean Sea pair and Barbados fall sites are reached by launch Kinetic Energy (KE) spread of less than eight tenths of one percent Earth's escape KE per red circles and red vectors in upper and lower first-look portrait frames, respectively.

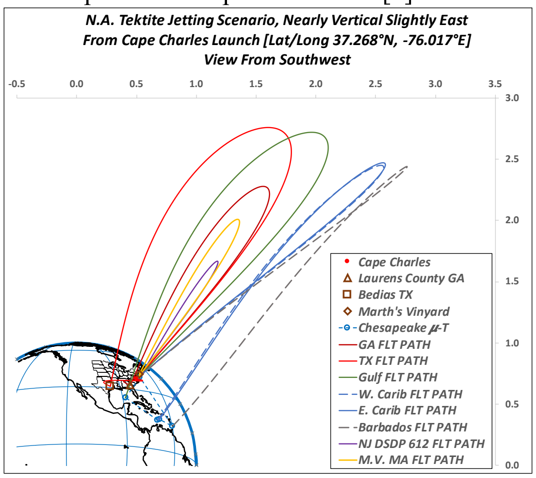
The clustered red vector KE results equate to a launch speed spread of < 52 m/s assessed in the launch local-topographic or rotating frame, while the groundrange from the TX to Barbados modeled fall points is > 4200 km, 37.8° of great circle arc. The sub-1° GA/TX vector spacing equates to a jet diameter at 60 km altitude of less than 400 meters, a small value compared to the 85 km diameter Chesapeake impact structure.

Various Views: Various view angles of trajectories resulting from launch conditions of the first plot pair are presented. Trajectories appear non-planar due to the Earth-fixed rotating frame.

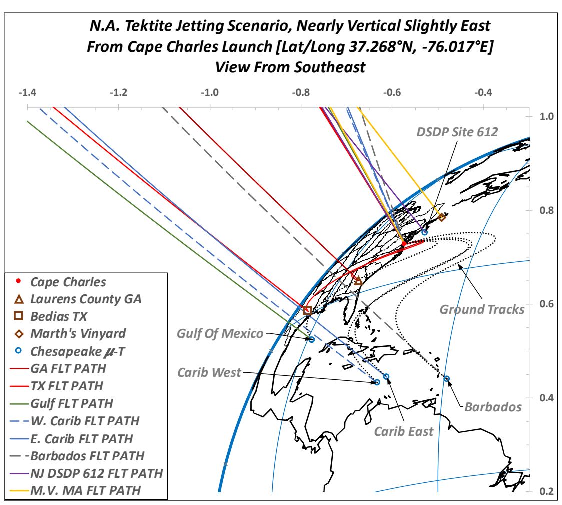


Helix. Launch condition solution functions for GA and TX are resolved with dedicated *Helix* [2] computational runs of > 110 points per fall site (PPFS) over 26 hours of ToF domain, with 15-minute ToF resolution for the GA and TX of-regime cases considered. The other 6 of 8 presented cases are combined in one *Helix* run, providing between 16 and 21 ToF PPFS, for lower ToF resolution (~30 min *Helix* ToF resolution for DSDP site 612, 1 hr. for Martha's Vineyard, and 2 hrs. for each of Barbados, Gulf of Mexico and both Caribbean sites).

Similitude for 5 of the 8 fall cases is not caused by equivalent ToF values – they are nearly coincident at ~90° launch AZ. The ***A***-to-***B*** suborbital problem treated via simplified two-body model involves an infinite ToF domain for each **A**-to-***B*** case. *Helix* is preprogrammed to resolve multiple trajectories (from long to short duration) per fall site, with shrinking ToF increment for improved resolution toward the minimum KE, minimum ToF end of the solution domain. Coarse-ToF resolution vs. KE and loft duration remains viable due to the slowly varying launch conditions as a function of ToF in higher KE regimes, an important issue for useful, functional problem setup within *Helix* [2].



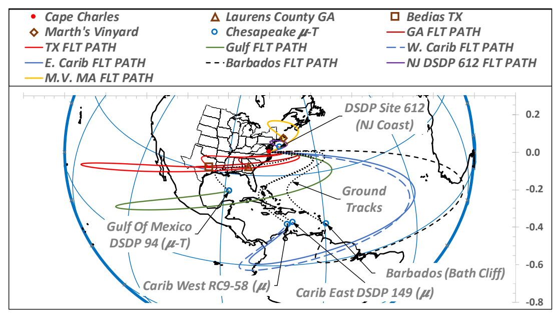
Tektite KE Regime is roughly established into lower, middle and upper range values. Lower middle 50% escape KE value (~7.9 km/s) is minimum circular orbital speed. Short range (<= 450 km) tektite trajectories such as Nordlinger-Ries Moldavites may be significantly below 50% escape KE. Upper mid-range value of 80% escape KE (~10 km/s) was determined as the minimum reentry speed for a vast majority of Australasian splash form tektite mass (ablated tektites and microtektites). The 10 km/s value was derived from reproduced 'button' tektite morphology via a triple-verified regimen, matching finely detailed, flow regime sensitive ring wave features, flange flattening and other details during well-funded 1960s Apollo program research headed by NASA hall of fame researcher D. R. Chapman [3,4].

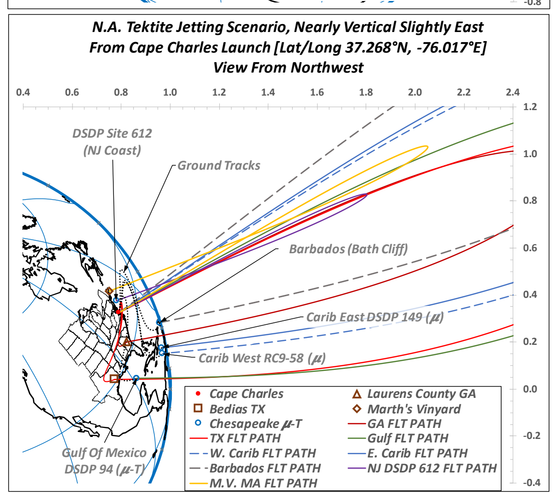


Unfortunately, Chapman subsequently omitted the requisite rotating frame transformation(s) provided herein by *Helix* [2], invalidating his lunar origin conclusion. Although the 1960s error dissuaded use of Chapman's high-validity button tektite reentry conditions, the 'Chapman equation' is still used in contemporary spacecraft heat shield design. It provided safe return of all Apollo lunar mission astronauts through the most severe reentry conditions in manned space flight history.

Features of NAT composition [5, 6] and microtektite Fe oxidation variation [7] may be considered within the jetting paradigm for insight not previously available. Gas dynamics and impedance effects of possible (quantifiable) atmospheric-breach jetting scenarios offer fertile ground for ejecta transport-related research.

These trajectories are very large compared to commonly applied minimum KE trajectory solutions that are strictly a human construct, an artifact of Cold War ballistic payload delivery constraints not applied here, since the tektites certainly never got that memo.





References: [1] H. Povenmire, T.H.S. Harris. (2015) *46th LPSC* Abstract #1291. [2] T.H.S. Harris. (2022) *GSA Special Papers vol. 553*. [3] Chapman (1962) *NASA TR R-134*. [4] Chapman et al. (1963) *NASA TN D-1556.* [5] C. Koeberl & B.P. Glass (1988) *Earth and Planetary Science Letters* 87, p. 286-292. [6] B.P. Glass (1989), *Meteoritics* 24 p. 209-218 [7] G. Giuli et al. (2013), *American Mineralogist* V. 98.