Vortically Injected Pressurized Expandable Ramjet (VIPER) Static Thrust Generating Jet Engine

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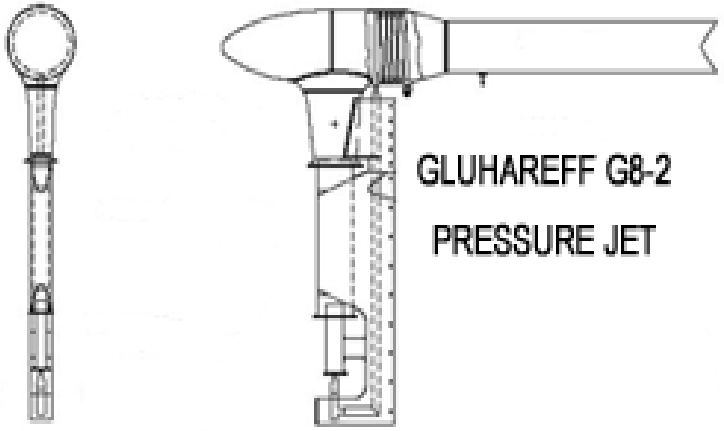


Purpose:

- ***Introduce the armaments community to an important line of aerospace propulsion history, new incarnations and its potential***

Outline

I. The Inventor: Eugene Gluhareff

II. Pressure Jet Engine

III. VIPER: Implications for Modern Weapon Systems

Dedication

To the Memory of

Eugene Gluhareff

Aeronautical Engineer
Inventor, Pioneer

1916 - 1994

I. The Inventor: Eugene Gluhareff

The Sikorsky Connection...

- Enrolled in Rensselayer Polytechnic Institute (1938)
- Graduated RPI with Bachelors of Aeronautical Engineering (1942)

I. The Inventor: Eugene Gluhareff

The Sikorsky Connection

The first Sikorsky jet-powered blade experiments:

by...

Eugene Gluhareff (1945)

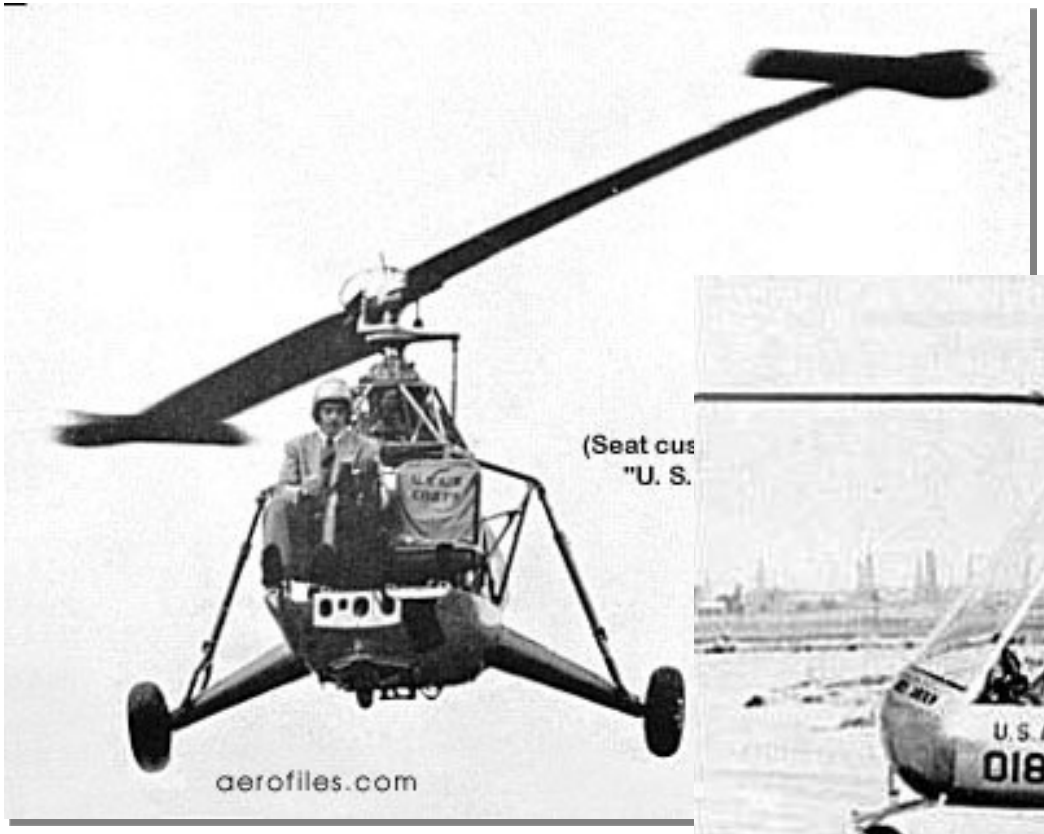
I. The Inventor: Eugene Gluhareff

The Sikorsky Connection... at an end...

Gene's “Flying Experimental Jet Test Stand” (1950)

I. The Inventor: Eugene Gluhareff

American Helicopters



XA-5 Top Sergeant & XH-26 Jet Jeep (1951 - 1953)

I. The Inventor: Eugene Gluhareff

American Helicopters

Reaction Motors RH-1 Pinwheel (1953 - 1954)

II. The Pressure Jet

G8 Pressure Jet Engine Development 1954 -

II. The Pressure Jet

MEG-1x Tipjet Aircraft (1956)

II. The Pressure Jet

Hiatus...

- China Lake (1960 - 1963)
  rotary-wing drones

- Douglas Aircraft Co. Huntington Beach
  (1963 - 1968) Saturn rockets

- Douglas Aircraft Co. Long Beach (1969 - 1972)
  Ejection seat group & rocket stabilization

II. The Pressure Jet

Private Enterprise

- “Build your own jet engine” engine sales, blueprints, plans (1972 - 1988)

II. The Pressure Jet

The last projects... 1988 - 1994

Eugene M. Gluhareff stands by EMG-300 helicopter.

II. The Pressure Jet

1.) self starting

2.) fully throttleable

3.) very low weight

4.) high-g capable

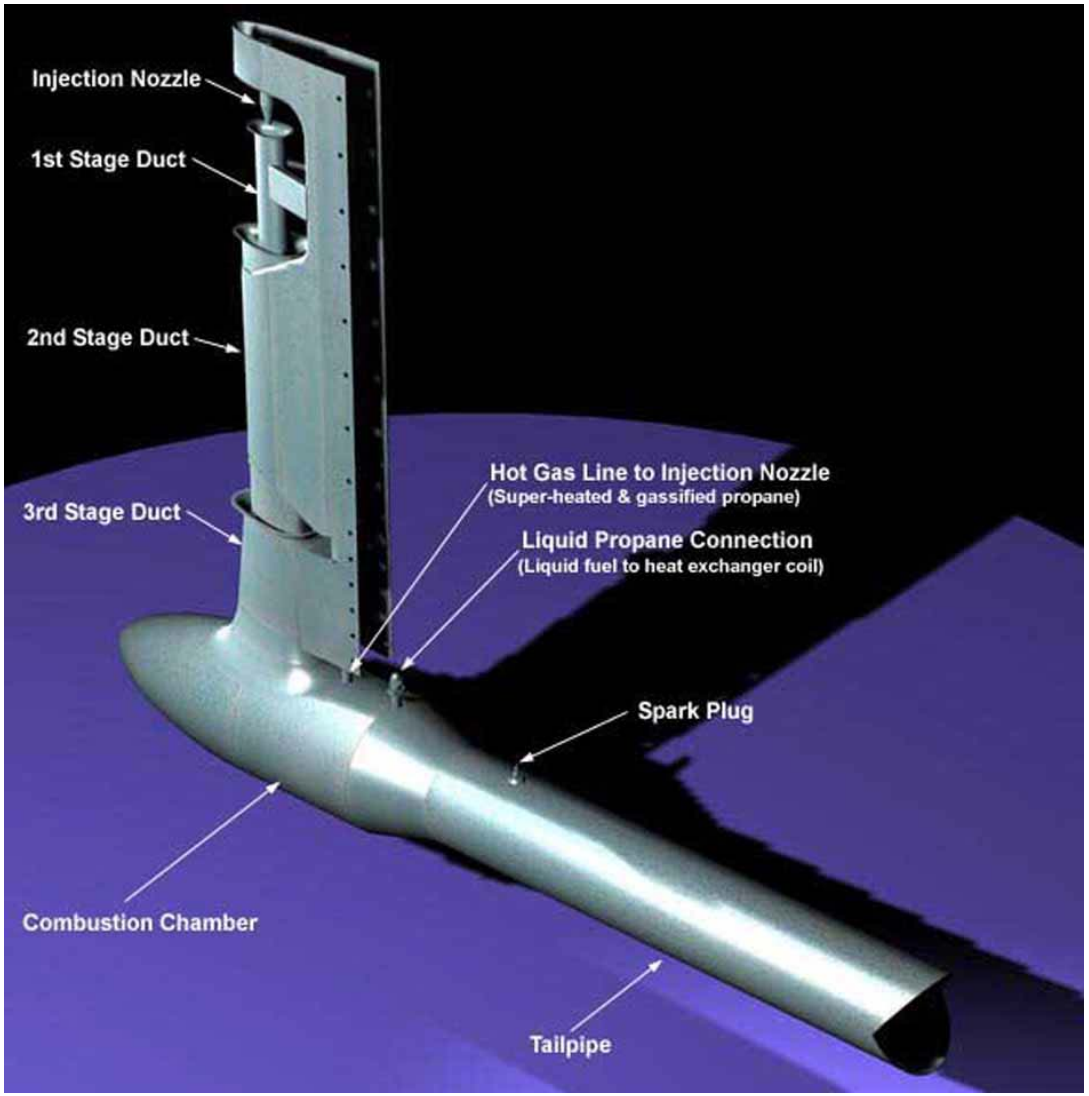
5.) efficient from static through transonic

II. The Pressure Jet

Keys:

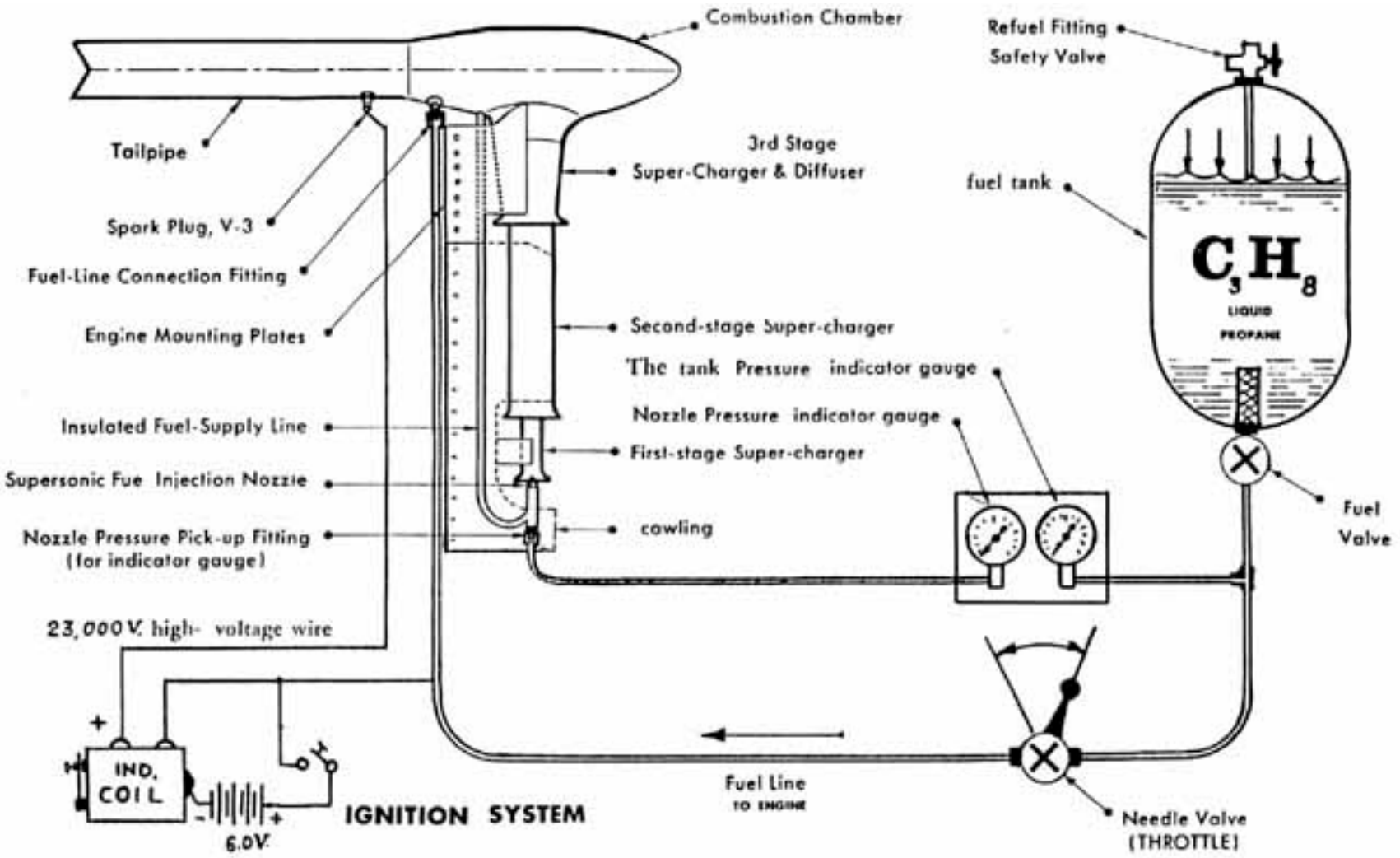
I. Extract kinetic energy from fuel

II. Manipulate flow to match dwell time for complete combustion



II. The Pressure Jet

Overall System

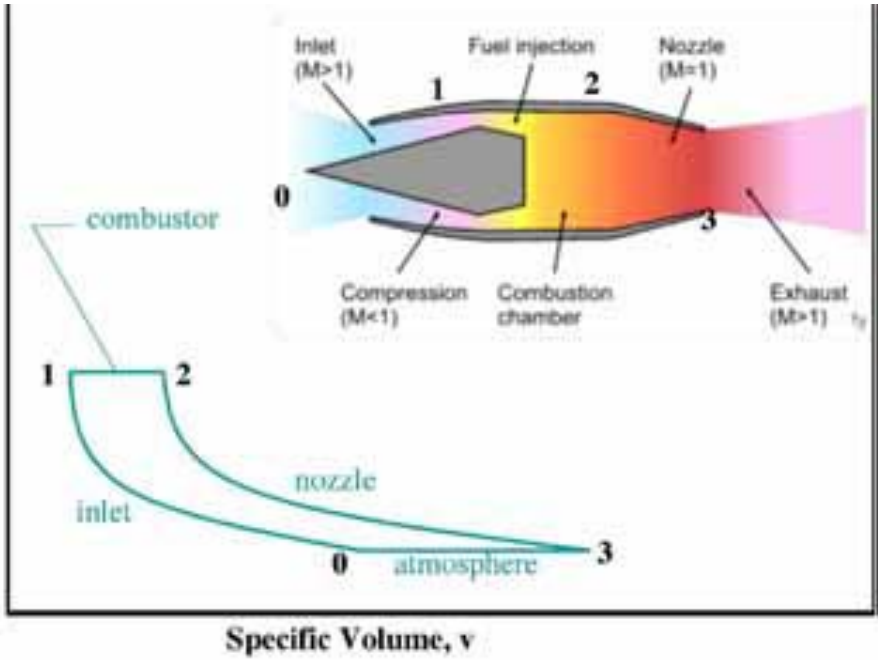


II. The Pressure Jet

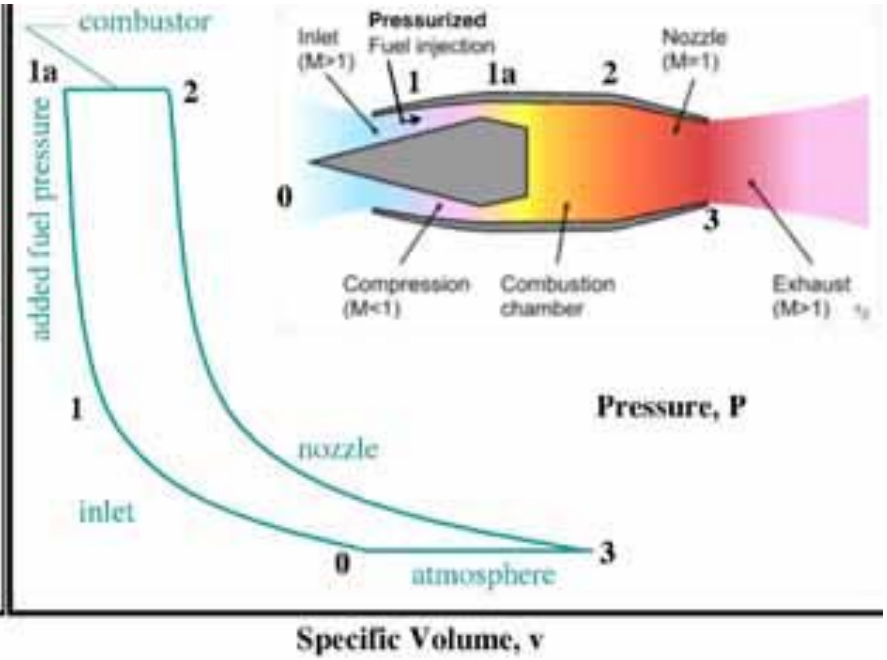
The Brayton-Gluhareff Cycle

$$P_o = \frac{\dot{m}_a P_{oa} + \dot{m}_f \eta_i P_{of}}{\dot{m}_a + \dot{m}_f} = \frac{P_{oa} + f \eta_i P_{of}}{1 + f}$$

Conventional Ramjet

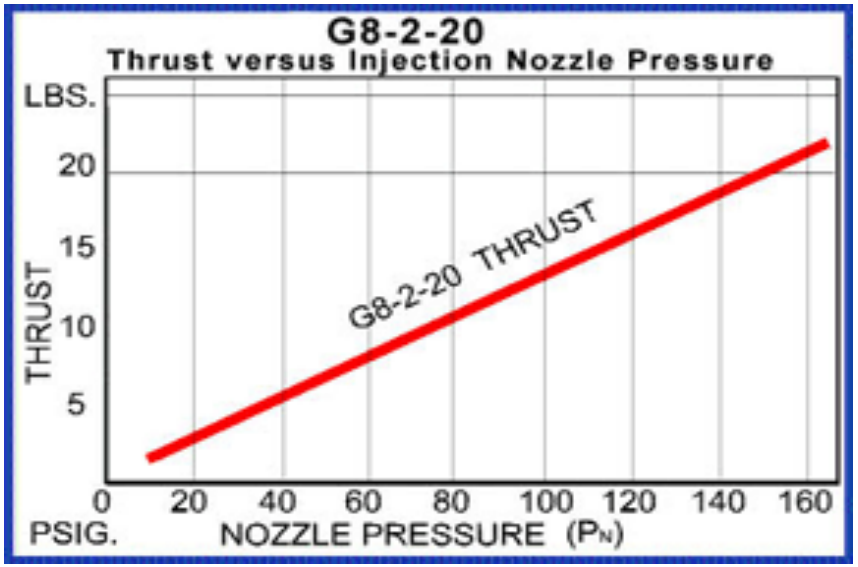


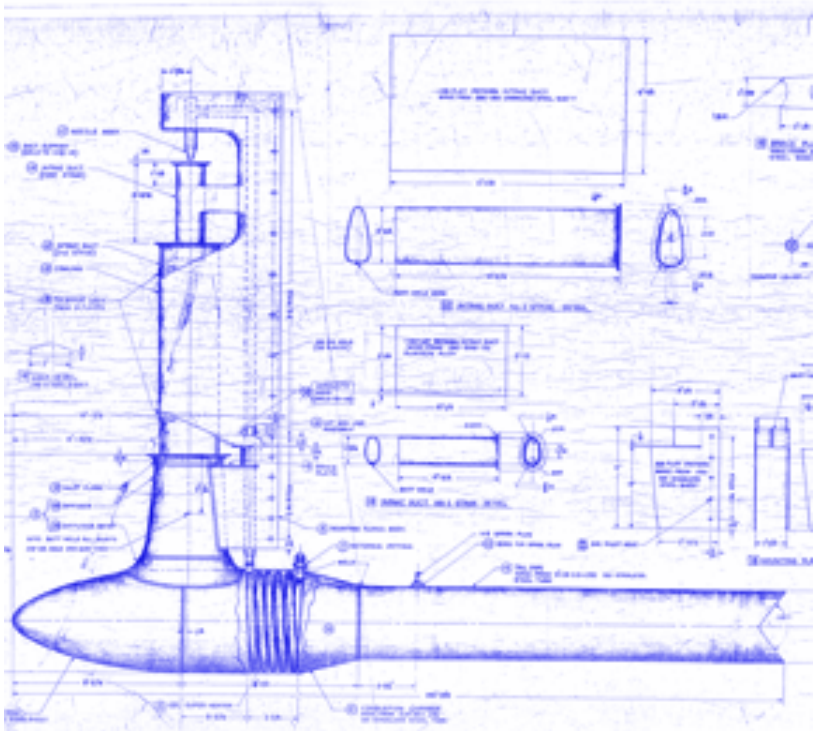
Pressure Jet



II. The Pressure Jet

The Brayton-Gluhareff Cycle





Engine	Max. Static Thrust (lb)	Length (in)	Lateral Dimension to Burner CL (in)	Combustion Chamber Dia. (in)	Tail Dia. (in)	Weight (lb)	Thrust-to-Weight	Static SFC (lbf/(lbf-hr))	Dynamic SFC (lbf/(lbf-hr))
G8-2-5	5.2	22	15.5	3	2	1.5	3.5	n/a	n/a
G8-2-20	23.5	36	25.5	5	3.5	5.5	4.3	4.8	1.67
G8-2-40	43	38.5	27.5	6.5	5	11	3.9	4.6	n/a
G8-2-80	82	45	36	8.5	6.5	21	3.9	4.2	n/a
G8-2-130	137	48	37	9	7	24.5	5.6	1.33	n/a

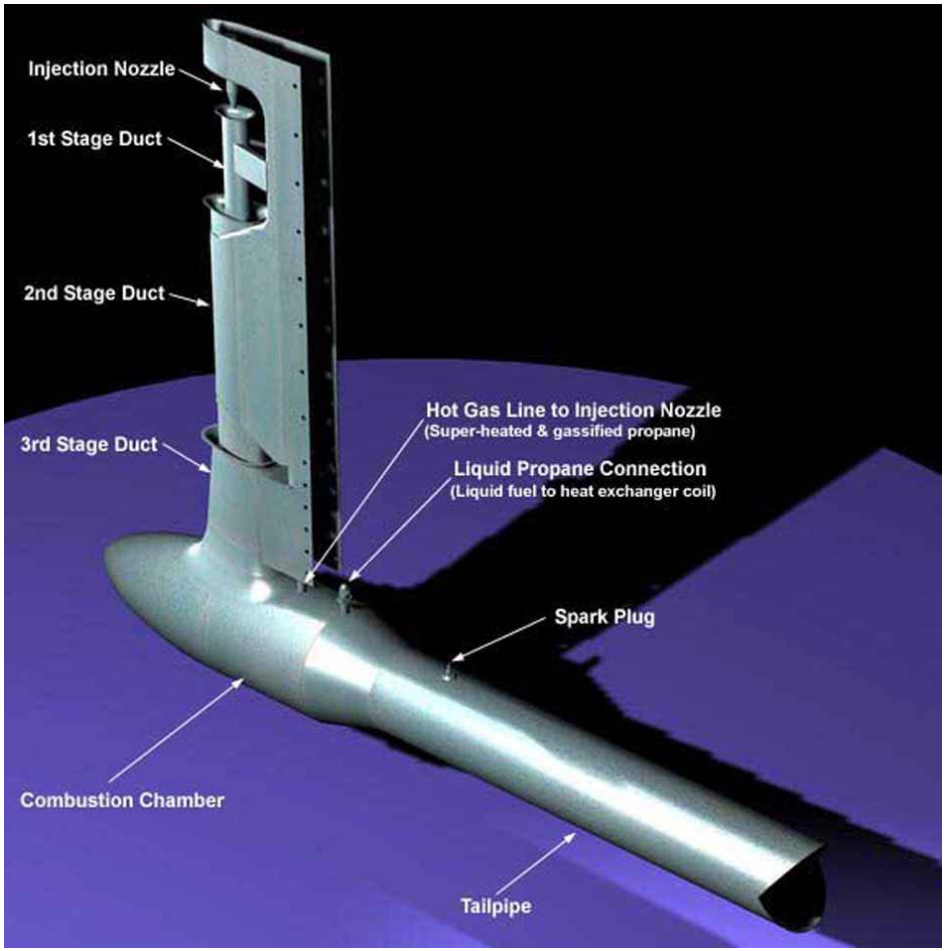
III. Vortically Injected Pressurized Expandable Ramjet (VIPER)

Gene's Last Experiments... and entries in his lab notebooks

I. Pressure Jet +...

II. M >> 1

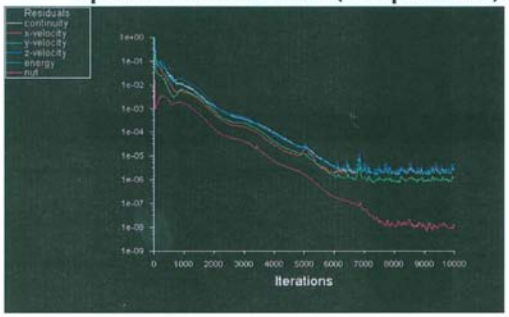
III. Fold & Unfold Engine



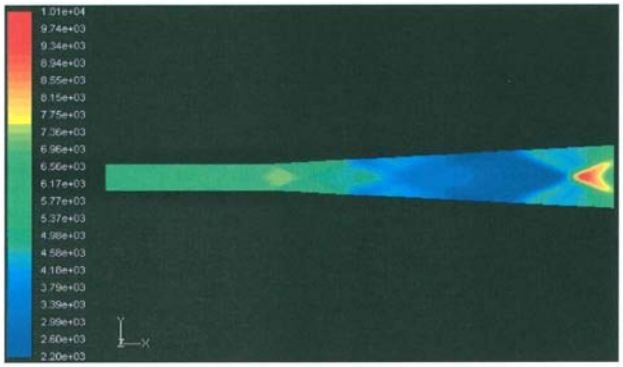
III. VIPER *Advances for Today's Weapons*

CFD Modeling

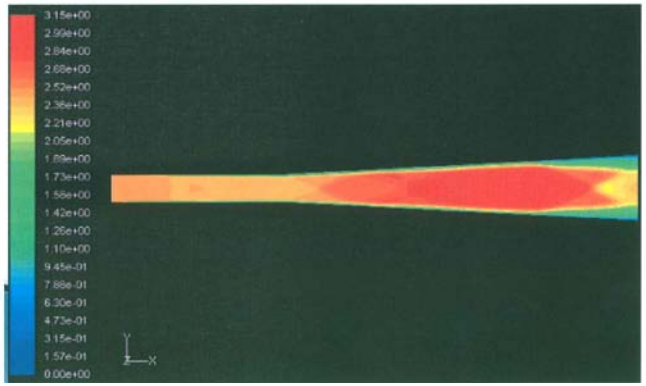
Spalart–Allmaras (1 equation):



a) Residual



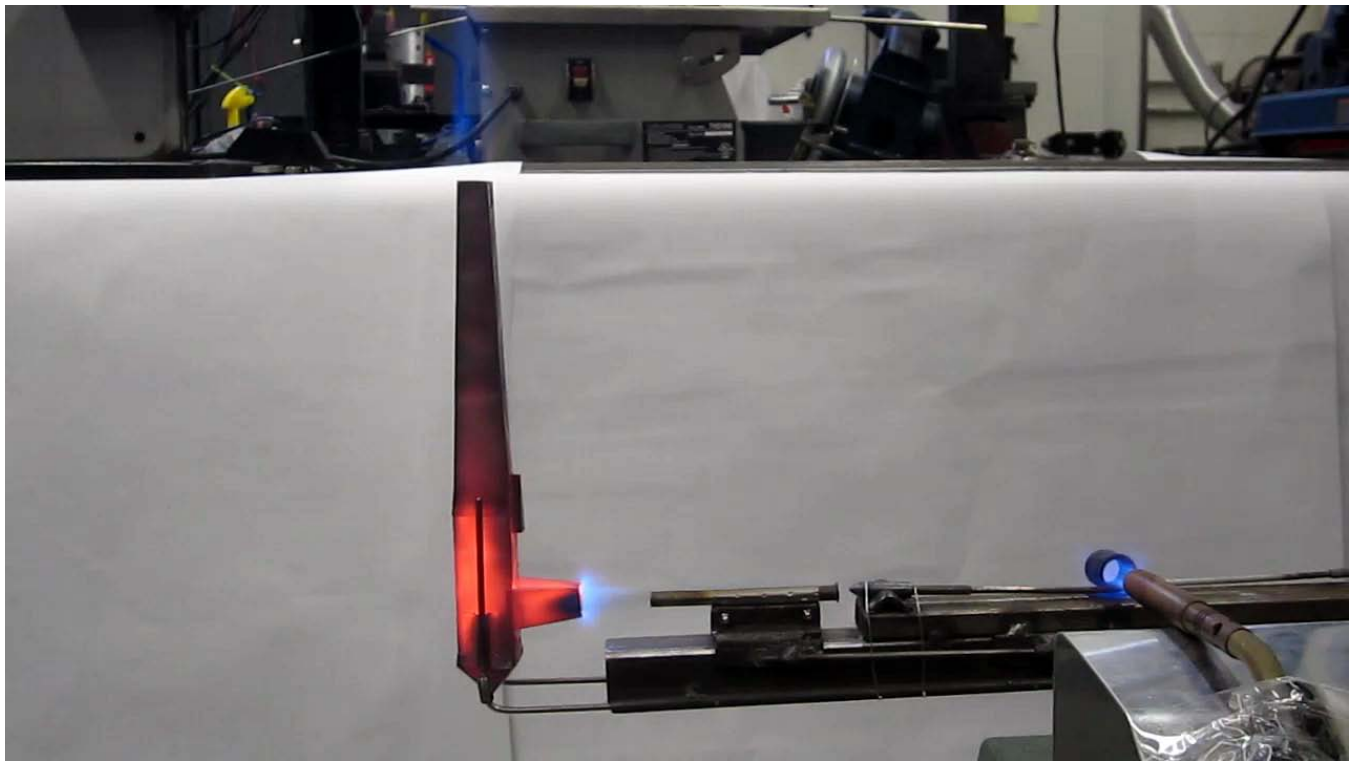
c) Static Pressure



b) Mach number contour

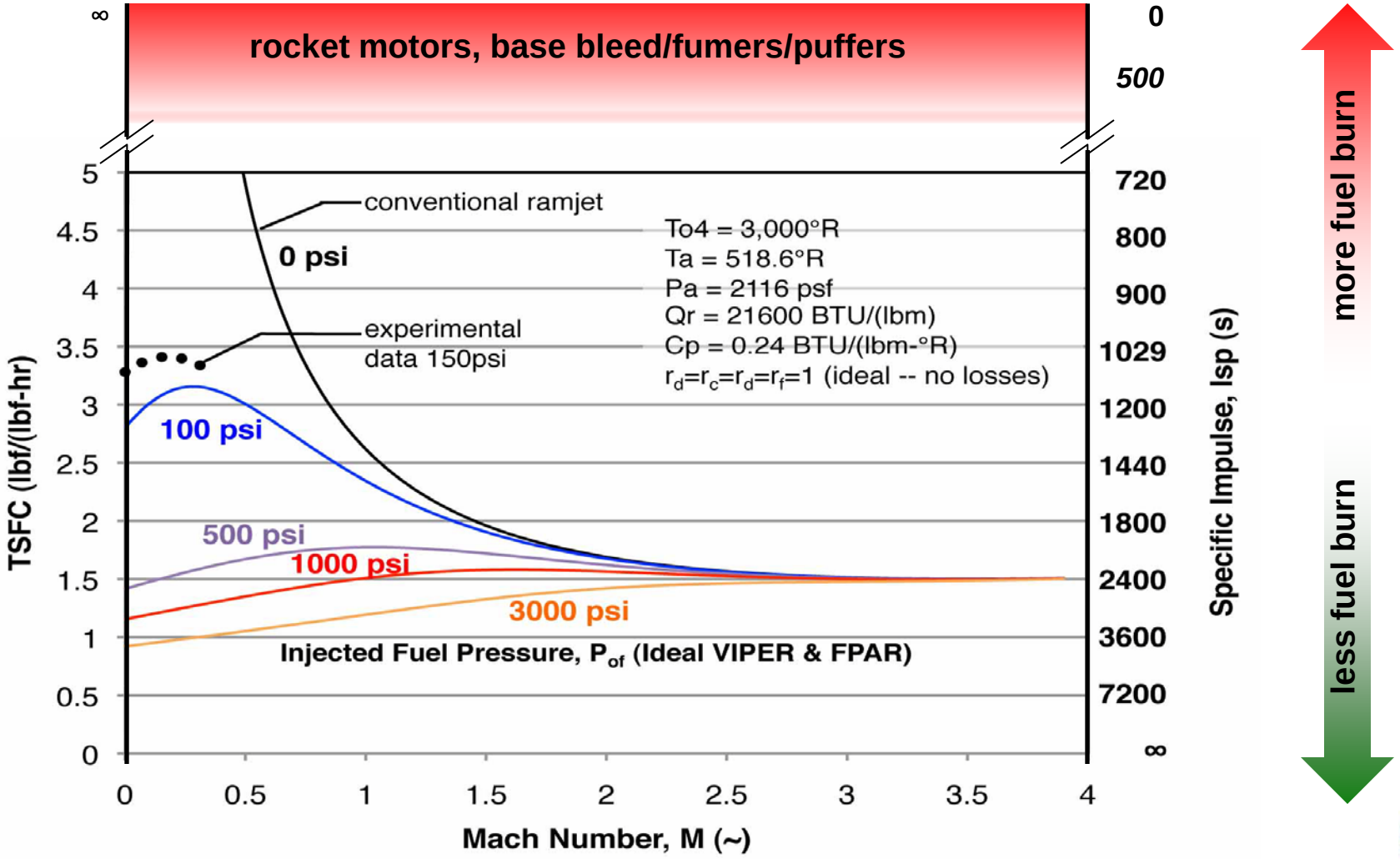
III. VIPER *Advances for Today's Weapons*

Engines Built & Running



III. VIPER *Advances for Today's Weapons*

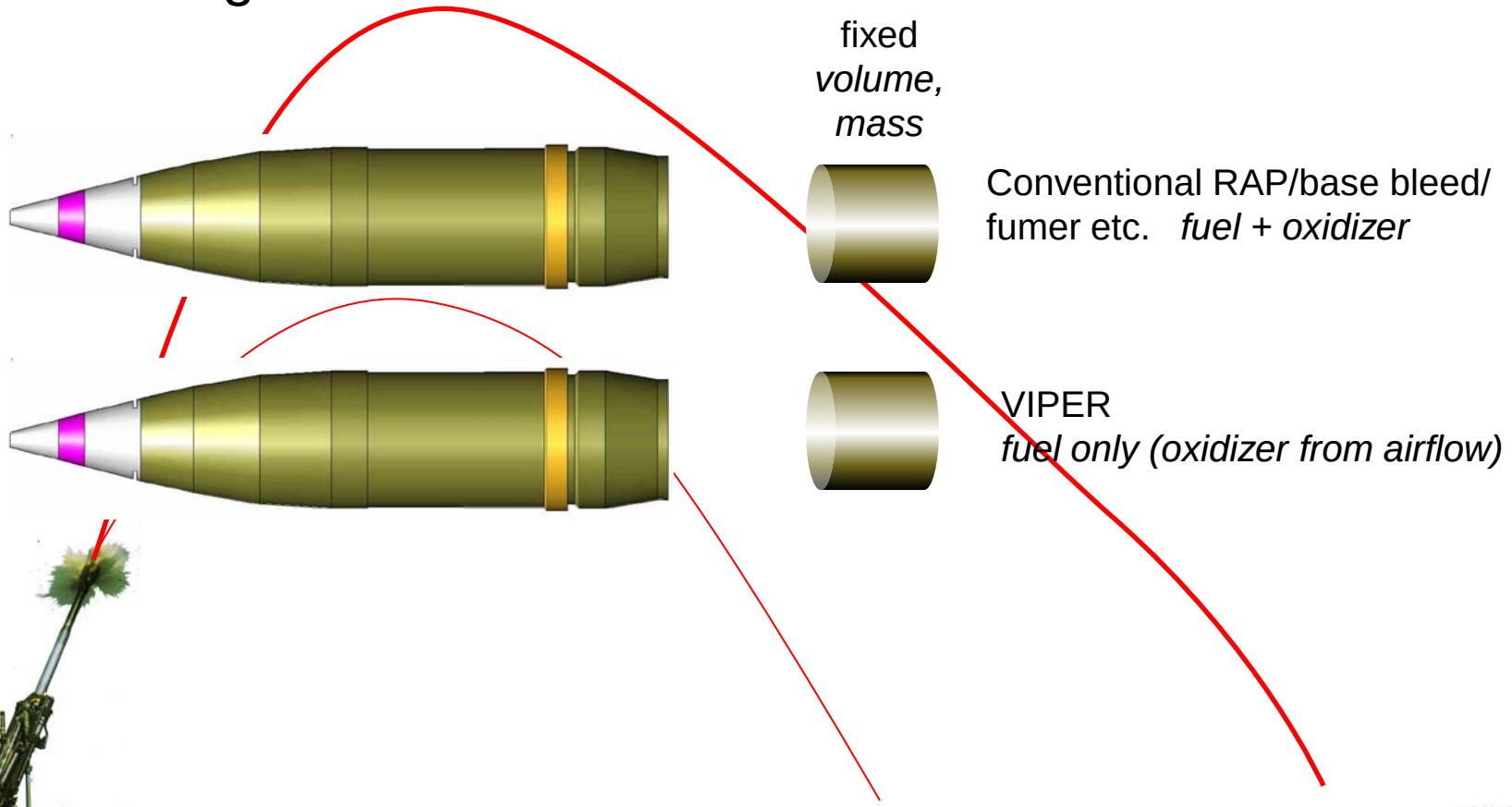
Performance comparison to rockets, fumers, puffers etc.



III. VIPER *Advances for Today's Weapons*

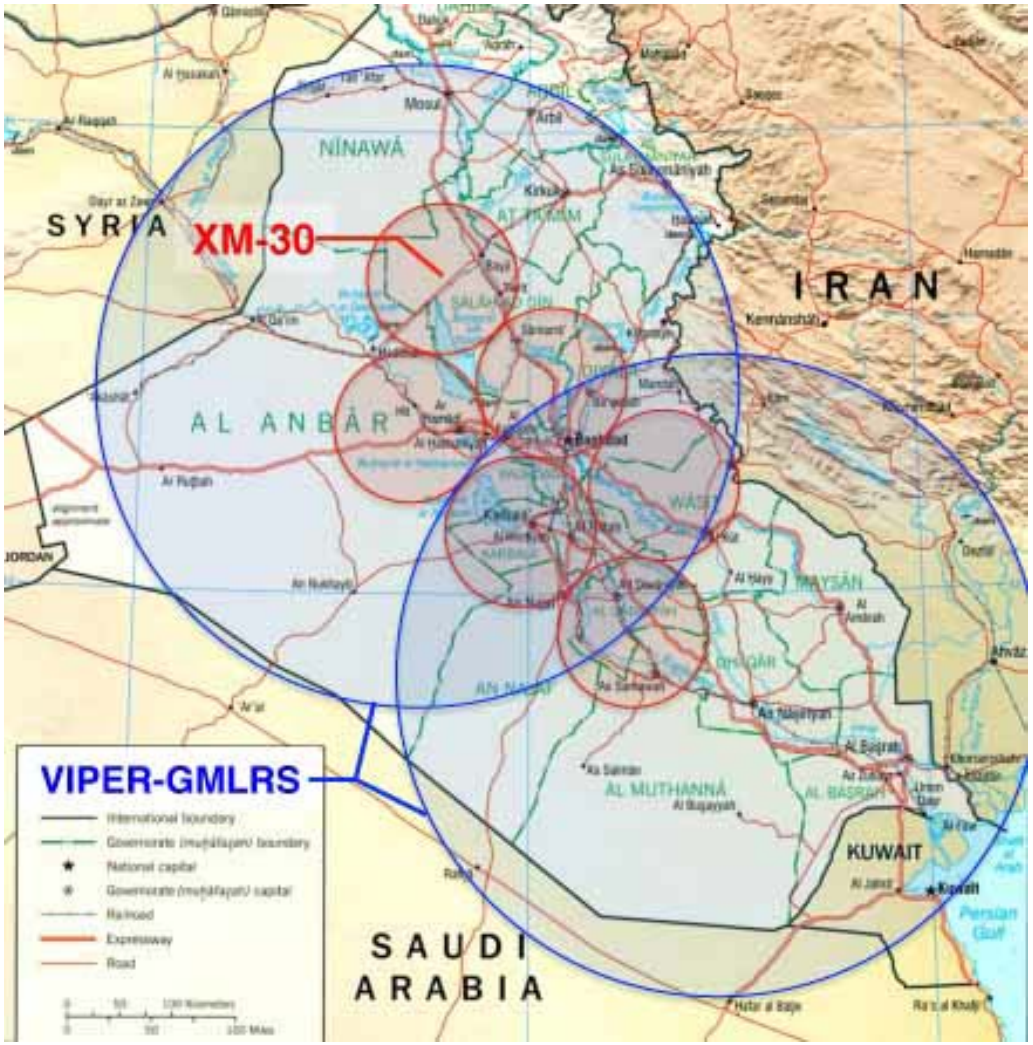
Implications for hard-launch munitions

> 58% range of best RAPs

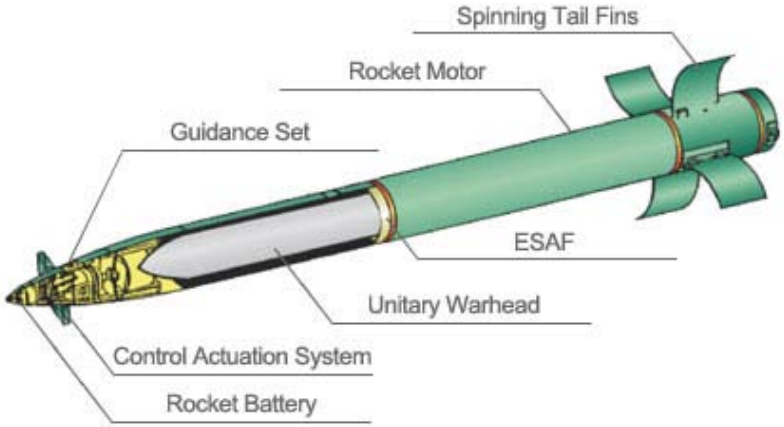


III. VIPER *Advances for Today's Weapons*

Implications for Tactical Munitions (GMLRS)



300+km range



Questions??