StarBooster™

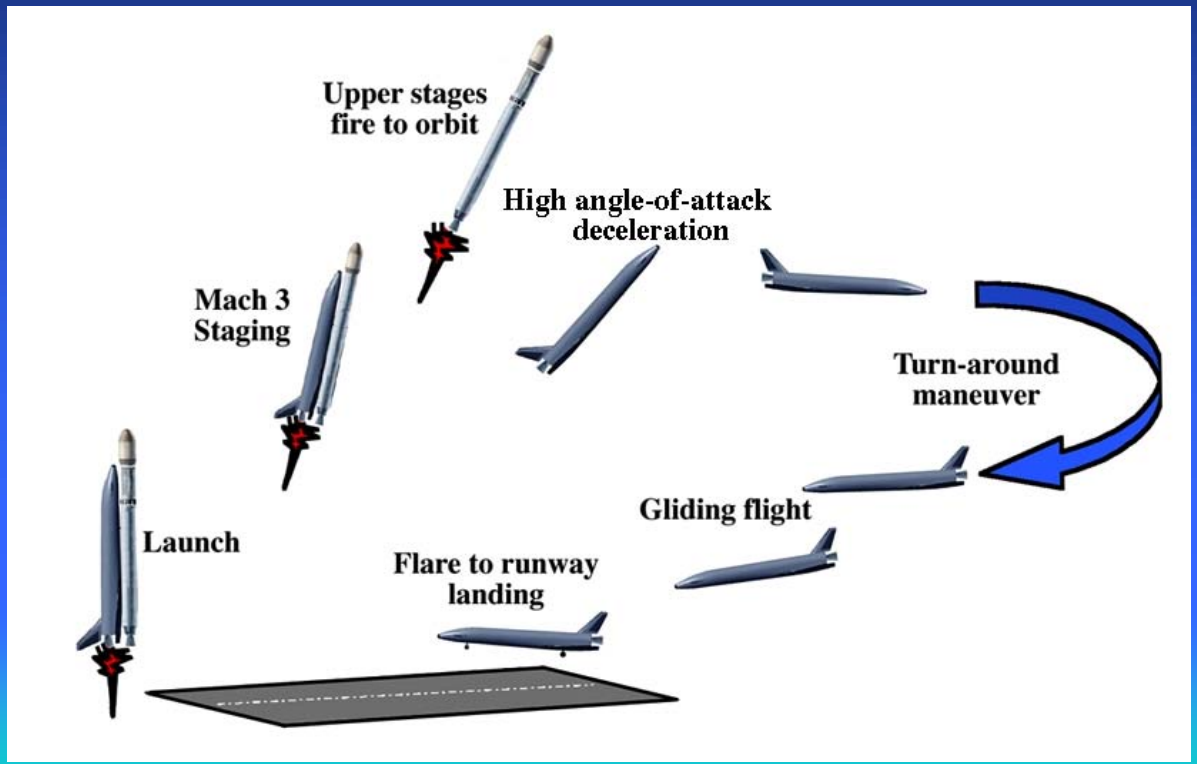
The Optimum Reusable, Rapid Response, Affordable, and Effective U.S. Military Space Launch Capability

Dirk Jameson, Lt.Gen. USAF (Ret)

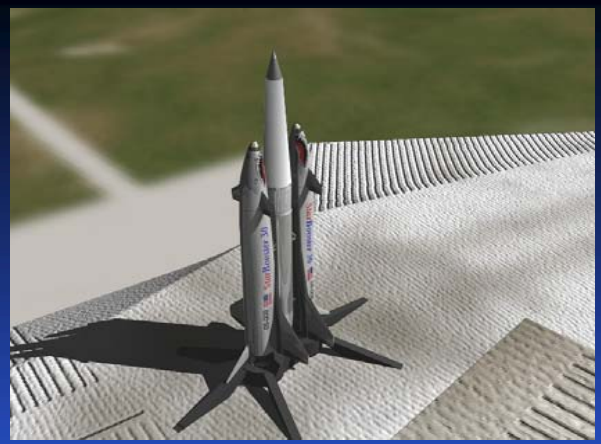
March 2006

What is *StarBooster*™ ?

- **Reusable First Stage - Return to launch site after low-Mach number (M ~ 3) staging**
  - **<u>Evolutionary</u> approach to <u>reusability</u> – Learn by experience**
  - **Current jet-fighter technologies - operationally effective - not technology driven (the downfall of many other systems)**



StarHawk Operational System

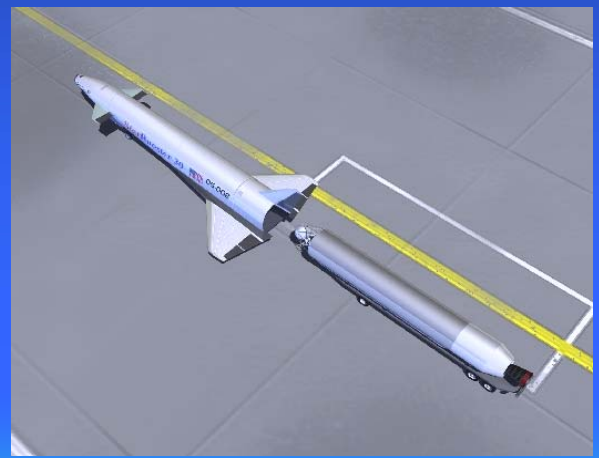


StarHawk on alert status

StarBooster separation - Mach 3

AFRL upper stage separation

StarBooster return



StarBooster servicing

AFRL upper stage recovery option

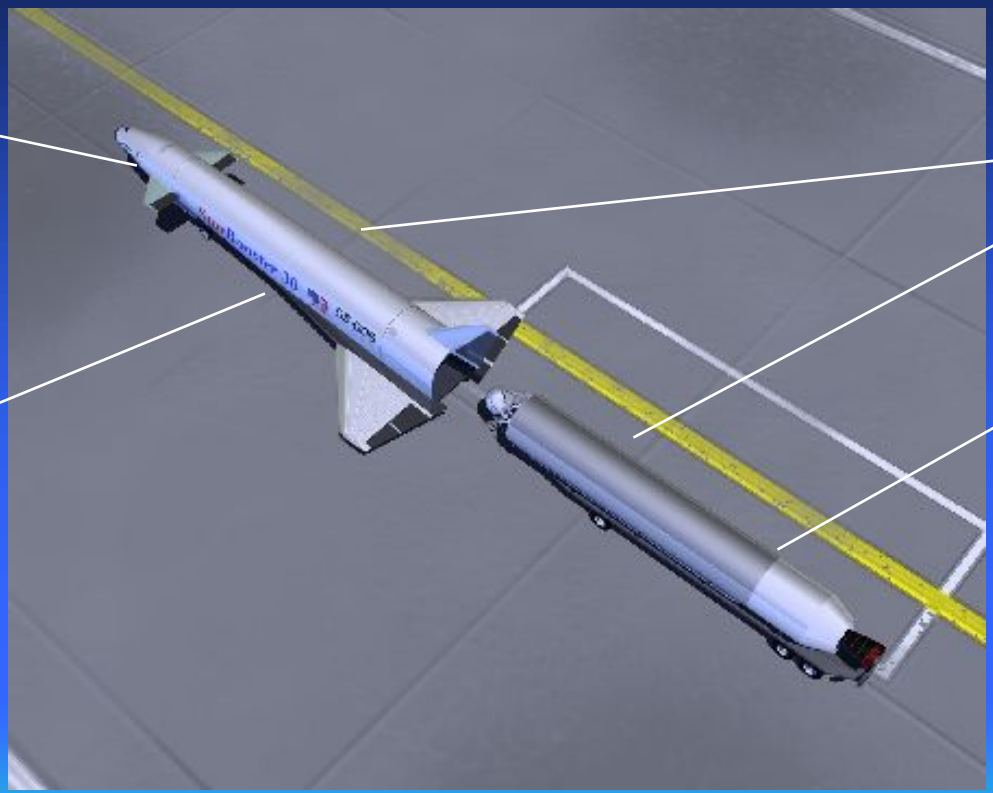
StarHawk Squadron at CONUS Base

StarBooster™ Elements

- **Operable - Separable airframe and *Reusable Propulsion Module*™ - a key to easy access, fast maintenance, quick turnaround, rapid response**

Panel access to modularized subsystems

Low-maintenance aluminum airframe
Low landing speeds



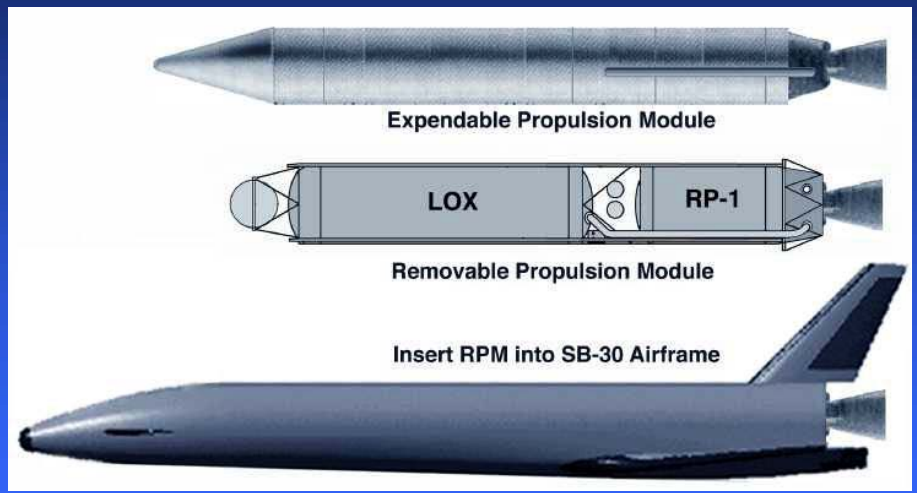
Mate any available airframe and propulsion module for rapid turnaround

Separate propulsion inspection, maintenance

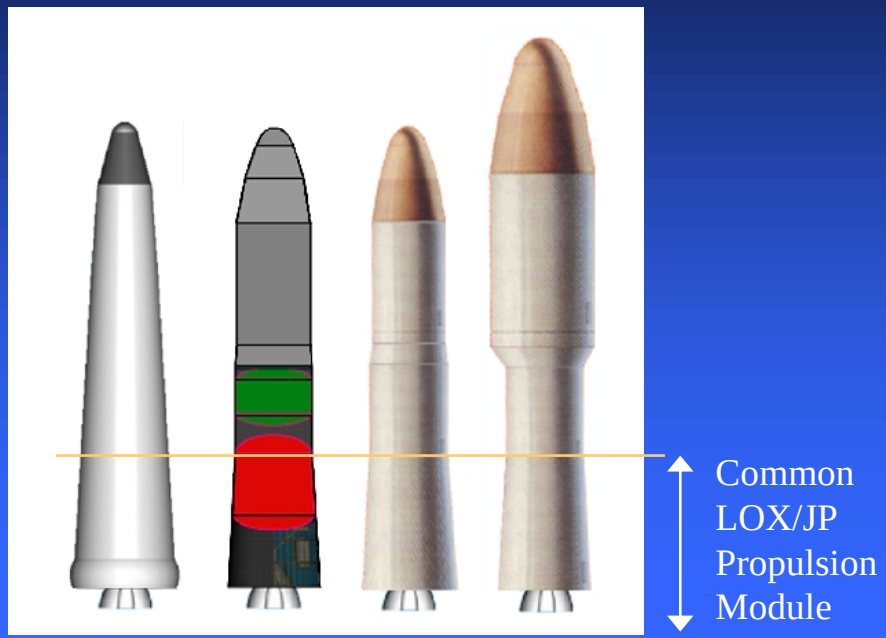
Kerosene fuel & liquid oxygen loaded on the pad

StarHawk Modular Approach

- **Modular**
  - **Utilize common elements to minimize development, production and operations costs and allow flexibility in missions & operations**



Common design & production
- ***RPM*** for booster
- ***EPM*** for core stage; drop tanks



Upper stage modularity
Reusable & Expendable Mission Options
(Reusable AFRL-VS based design)

Application to Growth Systems

- Concept scalable to meet multiple mission requirements
- Common booster & core stage designs

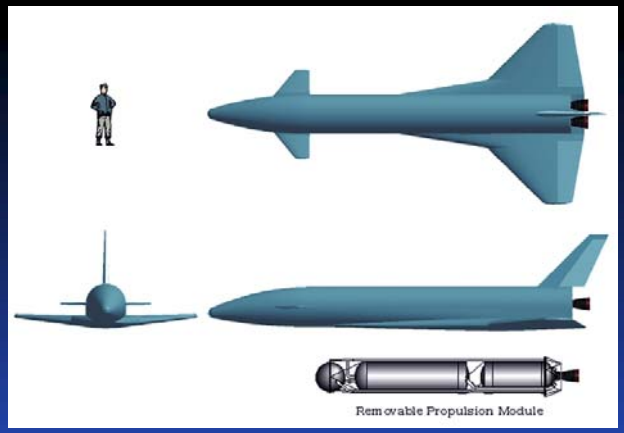
Demo **SLV** 1,000 lbm **StarHawk I** to 6,000 lbm **StarHawk II** to 25,000 lbm

Early Testing to Date

Langley Research Center Langley Glideback Booster (LGBB) Wind Tunnel Tests

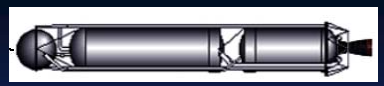
- Supersonic tests up to Mach 4.6
  - Determine control effectiveness
  - Support aero database development
  - Support glideback analysis & stability/control design
  - Support staging model

Demonstrator Development Program



Selected smaller scale engineering & risk mitigation activities
– Facility Verification Vehicle Projects

Ground Test Propulsion Module

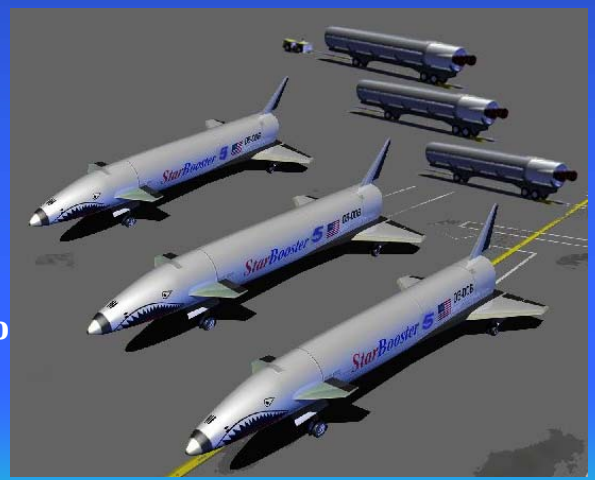


+

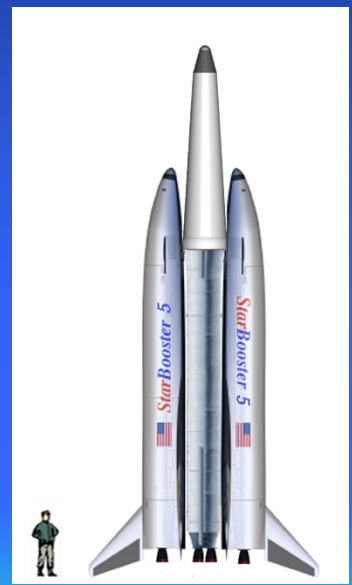
Subsonic Landing Test Vehicle

3 Supersonic *StarBooster 5* Test Vehicles with *RPM*s

Flight Test Program to Mach 3+



Integrated *StarHawk* Configuration Tests - Includes subsonic staging dynamics tests and dual *StarBooster* glide backs & landing



Comparisons

- *StarBooster* not technology driven (e.g. unrealized expectations of high tech *Space Shuttle* and *X-33*, *NASP* projects)
- Expendable systems more costly as flight rates increase

  (and costly still at low flight rates - e.g. *Titan IV* and *EELV*)
- *StarBooster* stages at low-Mach numbers:

  Hypersonic airbreathers with hypersonic staging raise costly development & technology issues and complicates operations
- *StarHawk* system based on *StarBooster* modular approach provides optimum mix of reusability and expendability to minimize development and required technologies while minimizing recurring costs of operations
- *StarHawk* system modularity also provides tailoring of elements used for specific mission needs - not an option in many other approaches