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Employment of Hypersonic Glide Vehicles – Proposed Criteria for Use

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Systems Studies

*The views expressed in this paper are those of the author and do not necessarily reflect the views of Sandia National Laboratories.

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Hypersonic Glide Vehicles (HGVs)

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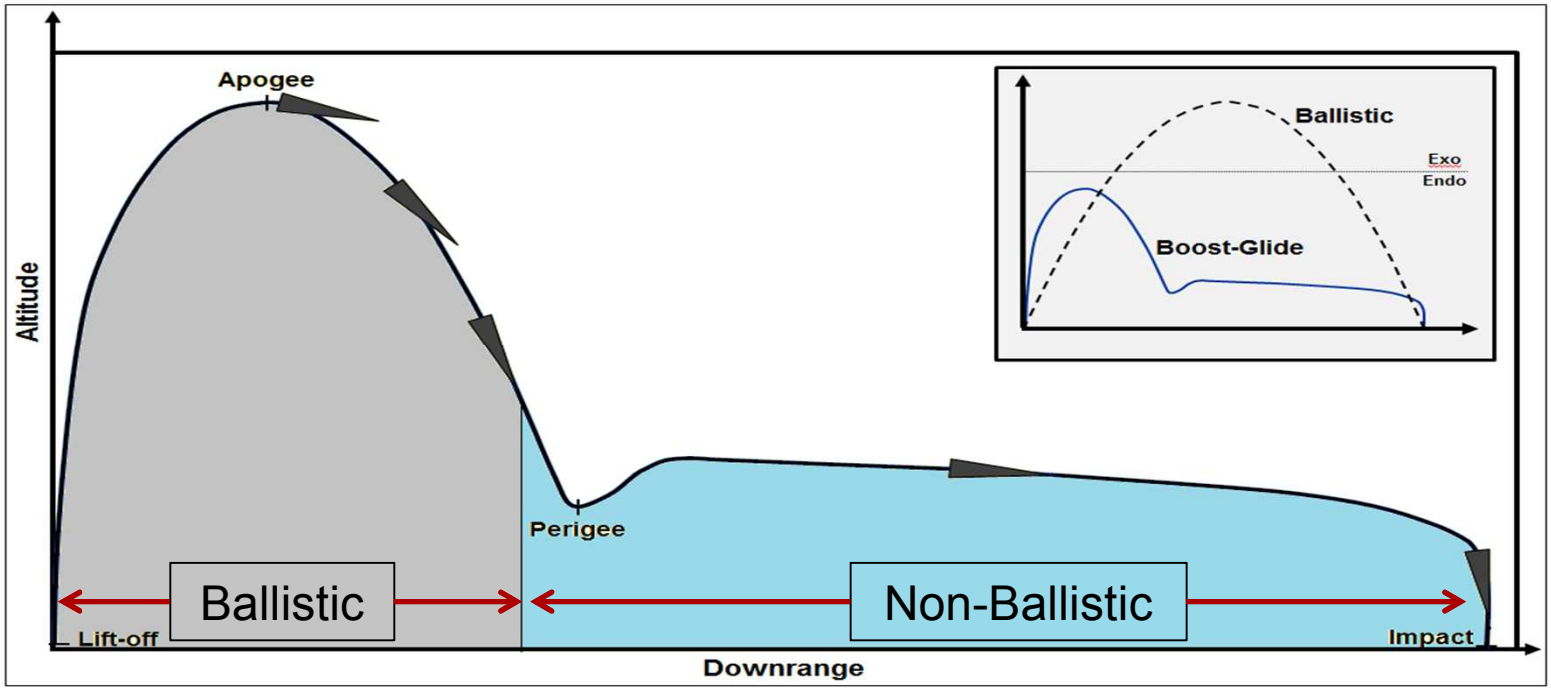
- A type of maneuverable reentry vehicle (RV)
- Combine exoatmospheric ballistic trajectory with in-atmosphere glide and maneuverability
- Originally designed to penetrate anti-ballistic missile (ABM) defenses
- Development began in the 1970s
- One of many technologies considered for Conventional Prompt Global Strike (CPGS)

Flight Characteristics

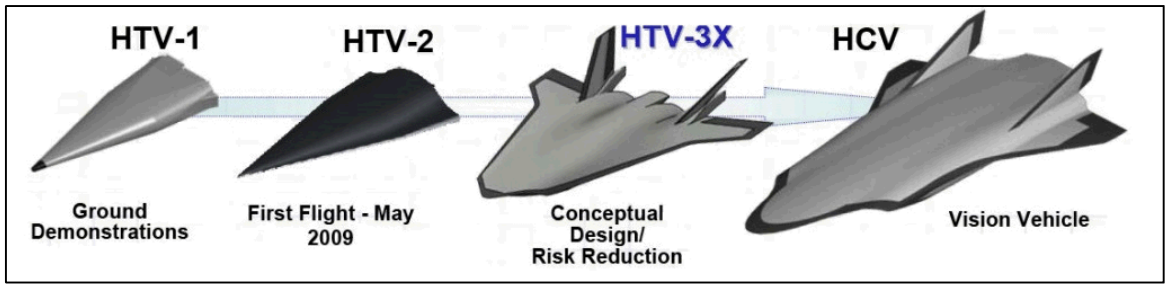
- Travel at hypersonic speed (above Mach 5)
- Boost phase trajectory is ballistic
- Capable of changing to a non-ballistic trajectory via aerodynamic lift and gliding



Recent Developments

- Hypersonic Technology Vehicle-2 (HTV-2)
  - The US's primary HGV effort from 2003-2012. Now considered a "risk reduction/technology maturation program"
  - Both test flights (2009, 2011) prematurely terminated by onboard flight termination system

- Advanced Hypersonic Weapon (AHW)
  - Direct descendant of Sandia Winged Energetic Reentry Vehicle Experiment (SWERVE)
  - Successful test in 2011; failed test in 2014 (booster failure)



HGV Benefits/Limitations

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Benefits

- Speed
  - Quickly reach targets
  - Difficult to intercept
- Range
  - 8,000-16,000 km (5,000-10,000 mi)
- Maneuverability
  - Increases chances of penetrating enemy air defenses
  - Non-ballistic trajectory differentiates from nuclear attack

Limitations

- Technology Challenges
  - Materials development to handle temperatures and other requirements
- Cost/Deployed Numbers
  - Expensive materials will keep numbers low (tens of units)
  - Small numbers drive up per unit cost ($26 million-$36 million each)

Proposed Criteria for HGV Applicability

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- Proposed criteria for HGV weapon applicability
  - 1. Do we need speed (or promptness)?
  - 2. Do we need surprise?
  - 3. Are there alternate means to attack the target?

- Two additional criteria to consider
  - 4. Do we have the enabling capabilities to support an alternate attack?
  - 5. Are the political enabling capabilities available?

1. Do we need **speed (promptness)?**

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The need to reach a target promptly is often cited as the reason for the need for HGV development

- Why do we have to attack a target so quickly?
- Is there a mobile target that will temporarily be stopped?
- Is there a terrorist target at a certain location for a limited period of time?
- Does the U.S. need to prevent an enemy's attacks on radars or satellites

2. Does attack need to be a **surprise?**

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Some targets must be attacked with as little warning as possible

- Can target detect launch of a HGV?
- What happens if the enemy knows attack is coming?
- How fast can the enemy react?
- Can the target be moved/launched in time, If warned of an incoming attack?

3. **Alternate means** to attack target?

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Target type, penetration of airspace, range, and cost affect whether a HGV or another system should be used for an attack

- Is there a drone in the area?
- Are bombers close enough?
- Are there shorter range systems in the area?
- Can Special Forces or other troops be deployed?

4. Do we have necessary **enabling capabilities** to support alternate attack?

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Enabling an attack requires capabilities such as target detection, location information, and damage assessment

Location information needs to be more detailed than needed for delivering a nuclear weapon

- Do we need Command and Control? Intelligence, Surveillance and Reconnaissance (ISR)? Battle damage assessment?
- Will these capabilities be in place and available to make the attack possible?

5. **Political enabling capabilities** available?

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HGVs are likely going to need Presidential approval to be used

- Is there time to produce an assessment and enable the decision?
- What are the repercussions (political?) of the attack?
- Would the US public support the attack?
- Would the attack be the opening salvo to a larger conflict?

Summary

- With the introduction of any significant new military capability, a doctrine for use should be defined and understood
- HGV targeting will likely be limited, at least initially
- The method described here can be applied to any scenario that might benefit from a HGV's combination of speed, range, and maneuverability