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Panel Session IV - Protecting the General Public from Launch Hazards

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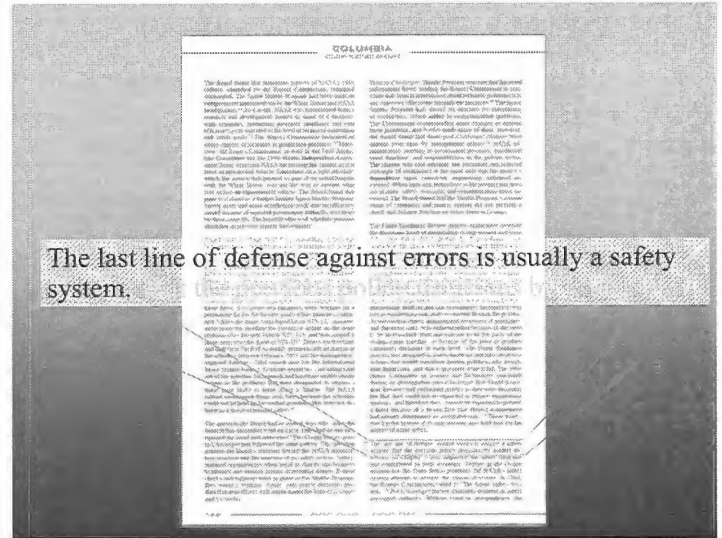
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**Protecting the General Public
From Launch Hazards
is Very Challenging/Expensive
for Many Users**

**Should the Government or an
Industry Group
Ease the Pain?**

45SW/SE
Peter Taddie



Overview

- Flight Termination System – Why?
- Cost Drivers
- ROM Costs for Typical FTS
- Notional Options
- Conclusions
- Recommendation

Protecting the General Public.ppt

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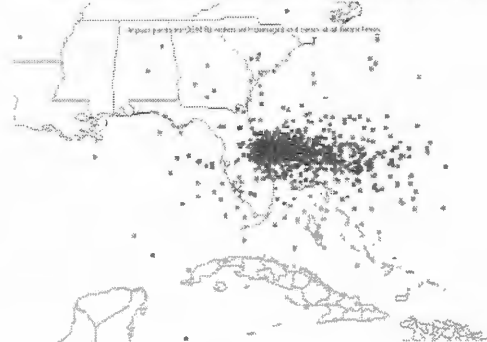


Flight Termination System

WHY?

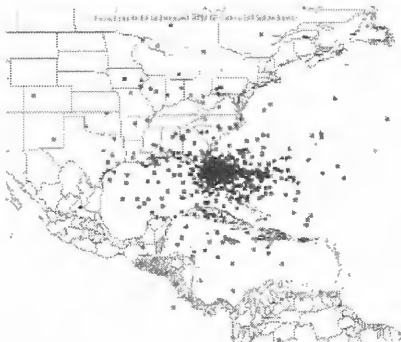
**Random Impact Locations - Free Flying GEM60s
with a Damaged Nozzle Bell**

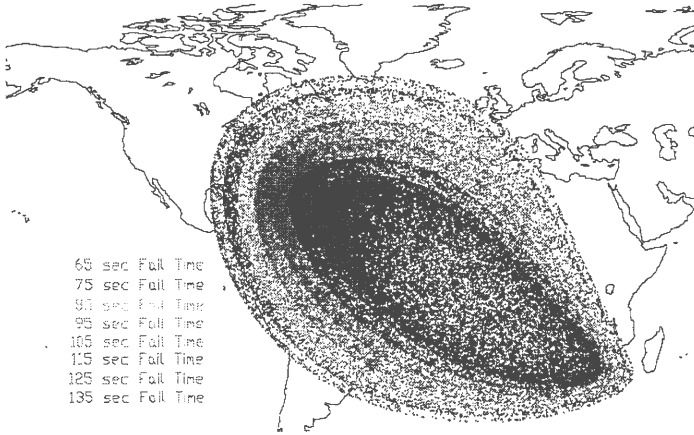
- The potential impact range of GEM60s with a damaged nozzle bell from avionics failures is smaller than for undamaged GEM60s but is still very large
 - 2500 impact points (1000 for each GEM60) are plotted for each of the 22 failure initiation times



**Random (Monte Carlo) Impact Locations -
Undamaged Free Flying GEM60s**

- The potential impact range of the undamaged GEM60s from avionics failures is very large
 - 2000 impact points (1000 for each GEM60) are plotted for each of the 22 failure initiation times





Cost Drivers



- Flight Termination System **must** function reliably when vehicle is breaking-up
 - Single Fault Tolerant
 - Highly reliable piece parts
 - Extensive development, qualification and acceptance testing



Typical Launch Vehicle Flight Termination System Costs (ROM)
Note: Does not include FTS Needs Analysis, system design, integration, or vehicle testing

Component	Quantity (Typical)	Recurring Cost Per Unit Including ATP	Development and Qualification Testing <small>Note 1</small>	Delta Qualification Testing <small>Note 2</small>	Margin/Gap Testing	Lot Acceptance Testing <small>Note 3</small>	Age Surveillance Testing <small>Note 4</small>
Antenna	2	\$10K - \$14K	TBD	TBD	NA	NA	NA
RF Coax Cable	AR	\$100 - \$200	TBD	TBD	NA	NA	NA
RF Power Divider	1	\$5K - \$7K	TBD	TBD	NA	NA	NA
Secure Destruct Receiver	2	\$60K - \$100K	\$1M - \$3M	\$70K - \$100K	NA	NA	NA
Non-Secure Receiver	2	\$10K - \$100K	\$0.5M - \$3M	\$70K - \$100K	NA	NA	NA
Battery	8	\$8K - \$10K	\$0.5M - \$1M	\$70K - \$100K	NA	NA	NA
ADS Logic Box	8	\$40K - \$75K	\$1M - \$3M	\$70K - \$100K	NA	NA	NA
S+A with EED	2	\$10K - \$25K	\$250K - \$1M	\$70K - \$100K	\$250K	\$70K-\$100K	\$70K-\$100K
S+A Interrupter	8	\$10K - \$25K	\$250K - \$1M	\$70K - \$100K	NA	NA	NA
Lanyard Pull Initiator	8	\$2K - \$4K	\$250K - \$1M	\$70K - \$100K	\$250K	\$70K-\$100K	\$70K-\$100K
Explosive Transfer System	AR	\$0.5K - \$1K	\$250K - \$1M	\$70K - \$100K	\$250K	\$70K-\$100K	\$70K-\$100K
Shaped Charge	AR	\$2K - \$4K	\$250K - \$1M	\$70K - \$100K	\$250K	\$70K-\$100K	\$70K-\$100K

1) New Design 2) Existing Design - Heat Environment 3) Does Not Include Component Costs



Option 2

- Government or Industry Group contract with various manufacturing vendors to develop and qualify a variety of unique, cutting-edge technology FTS components (e.g., space based, autonomous) IAW Government requirements
- User Responsibility
 - Design Flight Termination System IAW government requirements
 - If desired, purchase unique FTS components from pre-qualified manufacturing vendors and perform delta qual/acceptance testing IAW government requirements
 - Develop, qualify, build, and test remaining FTS components as required, IAW government requirements
 - Perform FTS integration/testing on vehicle IAW government requirements



Option 3

- Government or Industry Group purchases "rights" to qualification data for legacy FTS components and makes it available to all

Options 4 - 10

- Permutations and combinations of above options and others not yet offered



Conclusions

- Significant cost reduction for users (while maintaining high FTS reliability) can only be accomplished by solutions that are very much out-of-the-box
- Concept is radical and has risks for all involved (Gov't/Users)
 - Safety
 - Political
 - Contractual
 - Technical
 - Legal
 - Mission Assurance
- Cost/Benefit for each player is unknown at this time



Recommendation

- Government (federal or state) should fund a feasibility assessment with following objectives:
 - Survey all ranges and range users (DoD, NASA, Commercial) and determine level of interest in government or industry group developing, qualifying, and possibly fabricating high end FTS components
 - If level of interest is high enough perform cost/benefit analysis for all reasonable/rational options and all users