

To: NASA
Space Technology Mission Directorate
Attn: Mia Siochi

From: Northrop Grumman Innovation Systems (NGIS)
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Subject: NASA Tipping Point Technology Advancement

NGIS, formerly Orbital ATK, was awarded the NASA Tipping Point contract in August 2017. Over the past year significant R&D advancements have been made through this contract that are opening the door to large improvements across our launch vehicles. This letter recognizes a few of the R&D advancements the Tipping Point contract has directly enabled.

Standard operating procedure for the majority of industry launch vehicles is to fly isolation systems (on payloads and all vehicle hardware) to protect from the severe dynamic environments seen in flight. A long-standing goal of NGIS has been to eliminate all these isolation systems. A case study on the Minotaur IV launch vehicle (described in detail in our original proposal) quantified the savings of eliminating isolation systems to be 16% of the overall launch vehicle cost (or 13% increased payload mass to orbit). R&D advancements through the Tipping Point contract are allowing us to measurably achieve this in three key areas:

1. Advanced Material Use – use of carbon nanotubes, co-cured viscoelastics, and CLD have yielded 30x improved damping
2. Optimized lattice geometry – demonstrated 12dB attenuation over baseline structures
3. Improved analysis and test methodologies – proven 20dB of conservatism is industry standard analysis/test shock test methods.

The NGIS Launch Vehicle Division has many “Production” launch vehicles, opportunities to perform basic application focused R&D are rare. Fresh thinking is welcomingly embraced across our launch vehicle programs who are continuously striving to push the envelope with technical, schedule, and cost challenges. Our Minotaur IV program is already incorporating Tipping point’s recent R&D advancements, moving currently to eliminate isolators on one of their upcoming launches. Moreover, our results have been presented at various industry conferences (Aerospace Testing Seminar in Oct 2018 and Shock and Vibration Exchange in Nov 2018) and were very well received as a paradigm shift in shock test methods; we are hopeful to inform and evolve the standards which govern our industry to share the benefits Tipping Point has helped NGIS realize.

The NASA Tipping Point contract is a highly embraced/appreciated contract at our launch vehicle Division. We remain grateful for this opportunity and look forward to the on-going second phase of the program as it helps us better serve the needs of NASA and our broader industry.

Sincerely,



Esteen Bottlinger