Re: Briefing on SRB based CEV at NPS with Scott Horowitz

Source: http://sci.tech−archive.net/Archive/sci.space.policy/2005−05/msg00433.html

- *From*: "Murray Anderson" <murraya@xxxxxxxxxxxx>

- *Date*: Thu, 19 May 2005 19:18:46 −0400

I picked the Proton, a so−so launch vehicle in reliability, but with a good first stage, and the Delta, with it's good record. The Delta first stage is the obvious one to compare, having a gas−generator cycle engine like the one used on Atlas as well.
One problem in doing comparisons is that the reliability has gone up over the years for all rockets, especially as compared with the 50's and 60's. If you compare all the launches since the beginning of the space age, as was done in the Journal of Propulsion and Power several years back, then you find that the Soviet/Russian record is better than the U.S., but only because the U.S. had a launch bulge in the 60's, whereas the USSR had the bulge in the late 70's to early 80's. There was no difference otherwise.
If you want to compare the shuttle SRB with other stages you should start counting in 1981. There hasn't been much reliability growth since then. It would be interesting to include the R−7 family core stage in the comparison, starting from 1981, but there have been 2 launch failures on about 100 manned flights, so that's just under 1% per stage.
The Atlas isn't a good basis for comparison because of the 1.5 stage design. The Minuteman launches suggest a failure rate per stage of somewhat under 1%.
The overall picture is one of similarity in reliability between solids and liquids, and liquids have the higher specific impulse and lighter case. The shuttle SRB would need a comparatively larger upper stage to match the performance of an EELV, which requires a bigger engine than the RL−10. I see the SRB has having a number of disadvantages without having any really compelling advantages, compared with liquid propellant boosters.

"Ed Kyle" <edkyle99@xxxxxxxxxxx> wrote in message
news:1116515493.739835.272900@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
> Murray Anderson wrote:
> > >
> > > The fact is that the SRBs so far have a better overall safety
> record
> > > than any liquid booster available.
> >
> > Actually no. You can't distinguish 1% from 0.5% with sample sizes of
> order
> > 200.
> > A contingency table analysis of the SRB and first stages of Delta

> (all
> > versions except IV) and Proton shows no difference:
>
> Aren't you cherry−picking a bit here? What would
> happen if you added Rocketdyne−powered Atlas or
> Ariane 4 or R−7 or Titan or all of the Thor−based
> launchers, etc?
>
> It only makes sense that a solid should be more
> reliable than a liquid due to complexity reduction.
>
> Consider Minuteman, which started flying in 1961 −
> back when liquid boosters were more frequently
> falling out of the sky. By the end of 2004, there
> had been 838 Minuteman or Minuteman−based launches
> (including two orbital Minotaur flights) with 25
> failures. During the same time frame there had
> been 685 Thor−based flights (including IRBM, Thor,
> Delta, and NASDA N−1, N−2, H−1) with 76 failures,
> 581 Rocketdyne Atlas flights with 112 failures,
> 366 Titan flights with 61 failures, 1,693 R−7
> flights with 96 failures, 311 Proton launches with
> 37 failures, etc. This isn't a comparison of just
> booster stages, but entire vehicles.
>
> The comparison isn't perfect, of course, since solid
> boosters were used on Thor, Titan and Atlas and
> accounted for a few failures. But I think it shows
> a trend.
>
> I think solids are still more reliable today, but
> there can be little doubt that the reliability
> difference between solid and liquid has closed.
> Consider just the "modern" big solid boosted
> launch vehicles − STS, Titan 3/4, H−II/IIA,
> and Ariane 5. Up to the end of 2004, they had
> flown 267 times with 24 total failures. Four of
> the failures were caused by solid boosters. Four
> were problems with liquid core stages. The rest
> were upper stage or guidance or fairing problems.
> Solids still seemed to have a slight edge with this
> "modern" group, but it is hard to discern in the
> statistical haze.
>
> − Ed Kyle
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Murray Anderson

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- ***References***:
  - ***Briefing on SRB based CEV at NPS with Scott Horowitz***
    - *From:* Tom Cuddihy
  - ***Re: Briefing on SRB based CEV at NPS with Scott Horowitz***
    - *From:* Rand Simberg
  - ***Re: Briefing on SRB based CEV at NPS with Scott Horowitz***
    - *From:* Tom Cuddihy
  - ***Re: Briefing on SRB based CEV at NPS with Scott Horowitz***
    - *From:* George William Herbert
  - ***Re: Briefing on SRB based CEV at NPS with Scott Horowitz***
    - *From:* Tom Cuddihy
  - ***Re: Briefing on SRB based CEV at NPS with Scott Horowitz***
    - *From:* Murray Anderson
  - ***Re: Briefing on SRB based CEV at NPS with Scott Horowitz***
    - *From:* Ed Kyle

- Prev by Date: ***Re: Briefing on SRB based CEV at NPS with Scott Horowitz***
- Next by Date: ***Re: Stanley Committee to Drop LOR?***
- Previous by thread: ***Re: Briefing on SRB based CEV at NPS with Scott Horowitz***
- Next by thread: ***Re: Briefing on SRB based CEV at NPS with Scott Horowitz***
- Index(es):
  - ***Date***
  - ***Thread***