Landing Site Safety Assessment
Fourth Mars 2020 Landing Site Workshop

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Mars 2020 EDL Team

October 16, 2018
Executive Summary

- Landing site safety assessment has been completed at all four sites

- External review of the safety assessment has been conducted
  - EDL standing review board concurs that the assessment is complete, valid, and likely to be stable
  - Safety assessment is more than sufficient to support site selection

- All sites have low EDL risk
  - Sites have differing levels of terrain risk, but the differences are very small
  - System margins are sufficient at all sites and don’t vary significantly between sites

- EDL team is comfortable flying to any site
Review Recap: Landing Site Safety Assessment
October 2-3, 2018

Success Criteria

- The landing site safety assessment is sufficiently mature to support site selection.
- The landing site safety assessment is sufficiently accurate to support site selection and relevant uncertainties are understood.
- Future work is not likely to endanger the risk assessment presented.

Board Comments Summary

- “All success criteria met with flying colors.”
- “All the work that needs to be done to provide the necessary inputs [to the landing site selection process] is complete.”
- “All the sites have high enough probability of measured success [for selection].”
- All sites have high and in-family probabilities of success.
  - There are still some small differences in relative risk.
- More than enough information is available to support final site selection.
  - Results expected to be stable.
  - Analysis improvements likely to only shrink the small risk differences between sites.
- Parachute inflation risk reduction activity was fantastic; board agrees that risk has been reduced to acceptable levels for flight.

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<th>Board Members in Attendance</th>
<th>Affiliation</th>
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<td>Gentry Lee, Chair</td>
<td>JPL</td>
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<td>Doug Adams</td>
<td>APL</td>
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<td>Bobby Braun</td>
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<td>Ben Cichy</td>
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<td>Miguel San Martin</td>
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<td>Steve Sell</td>
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<td>David Skulsky</td>
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<td>Adam Steltzner</td>
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Atmosphere Characterization

- 2020 is a great opportunity to land on Mars
- The atmosphere characterization approach is largely the same as it was for MSL, with incremental improvements
- Landing sites have been modeled with sufficient fidelity to support site selection; minimal work to go for flight
- Dust activity is low in the 2020 opportunity at our landing sites
- Council of Atmospheres has high confidence in the assessment provided
Excellent coverage of landing sites from orbital imagery

Key terrain hazards identified at all landing sites
- Rocks
- Slopes
- Inescapable hazards

TRN drives near complete characterization of landing ellipse

Hazard assessment is mature

Better characterization of landing sites than past missions even at landing
EDL System Performance and Margins

- Detailed performance assessments have been completed at all four landing sites.
- Performance is very similar between landing sites and is in family with MSL.
- Ample system margins available at all sites.
- System sensitivities are well understood.
- Touchdown terrain risk is the dominant risk type, but is minimized by TRN.

EDL performance is excellent at all four sites.
Conclusions

- The landing site safety assessment presented is sufficiently mature, accurate, and stable for site selection.

- Landing site safety is dominated by terrain hazards and ranges between ~98.5% - 99.5% probability of success for the final sites.
  - Future analysis improvements likely to only shrink the small risk differences between sites.

- Accuracy of safety assessment estimated to be of order +/- 0.5% based on engineering judgement.

- Although there are differences between the sites, the probabilities of success are all in family with each other given our TRN capability.

- **EDL is ready to support selection of any of the sites**