

A model to estimate damage to the tiles protecting flat surfaces of the wing

uses Conservatism for Tile protection

data used to create Crater -87 Southwest Research data

tration of tile coating

cribed by normal velocity

ss of projectile (e.g., 200ft/sec for

ired for the softer SOFI particle

hard tile coating

that it is possible at sufficient mass

penetrated SOFI can cause

l energy (above penetration level) le damage

antly outside of test database

in vs 3 cu in for test

The vigorous, vaguely quantitative, words “significant” and “significantly” are used 5 times on this slide, with meanings ranging from “detectable in a perhaps irrelevant calibration case study” to “an amount of damage so that everyone dies” to “a difference of 640-fold.” None of the 5 “significants” refer to “statistical significance;” such wordplay hints that a formal statistical analysis has been done.

Note the analysis is about *tile* penetration. But what about RCC penetration? As investigators later demonstrated, the foam did not hit the tiles on the wing surface, but instead the delicate reinforced-carbon-carbon (RCC) protecting the wing leading edge. Alert consumers should carefully watch how presenters delineate *the scope of their analysis*, a profound and sometimes decisive matter.

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Slideville's low resolution and large type generate space-wasting typographic orphans, lonely words dangling on 4 separate lines:

Penetration significantly 3cu. In and velocity

The really vague pronoun reference “it” refers to *damage to the left wing*, which ultimately destroyed the Columbia (although the slide here deals with tile not RCC damage). Low-resolution presentation formats encourage vague references because there isn't enough space for specific and precise phrases.

The same unit of measurement for volume (cubic inches) is shown in a slightly different way every time

3cu. In 1920cu in 3 cu in

rather than in clear and tidy exponential form 1920 in^3 .

Shakiness in conventions for units of measurement should always provoke concern, as it does in grading the problem sets of sophomore engineering students.* PowerPoint is not good at math and science; here at NASA, engineers are using a presentation tool that apparently makes it difficult to write scientific notation. The pitch-style typography of PP is hopeless for science and engineering, yet this important analysis relied on PP. Technical articles are not published in PP; why then should PP be used for serious technical analysis, such as diagnosing the threat to Columbia?

*The Columbia Accident Investigation Board (final report, p. 191) referred to this point about units of measurement: “While such inconsistencies might seem minor, in highly technical fields like aerospace engineering a misplaced decimal point or mistaken unit of measurement can easily engender inconsistencies and inaccuracies.” The phrase “mistaken unit of measurement” is an unkind veiled reference to a government agency that had crashed \$250 million of spacecraft into Mars because of a mix-up between metric and non-metric units of measurement.