

- c. Insertion of improper computer programs
- d. Support-personnel fatigue

A third limitation of the parts-analysis approach discussed in Ref. [4] deals with the subjectivity and invalid assumptions often used to estimate piece/component reliabilities. Here Booz•Allen quotes from a report⁽⁵⁾ by the Office of Technology Assessment, and we do likewise:

"The design reliability of proposed vehicles is generally estimated using:

Data from laboratory tests of vehicle systems (e.g., engines and avionics) and components that have already been built;

Engineer's judgments about the reliability achievable in systems and components that have not been built;

Analyses of whether a failure in one system or component would cause other systems and components, or the vehicle to fail; and

Assumptions (often tacit) that:

the laboratory conditions under which systems were tested precisely duplicate the conditions under which the systems will operate,

the conditions under which the system will operate are those under which they were designed to operate,

the engineer's judgments about reliability are correct, and

the failure analyses considered all circumstances and details that influence reliability.

Such engineering estimates of design reliability are incomplete and subjective...".

Effects influencing reliability that the analyst may fail to consider include:

- a. Lightning strikes
- b. Aging effects, particularly for solid propellants
- c. Corrosion
- d. Insufficient heat or cold insulation for critical components
- e. Icing
- f. Erroneous antennae patterns or instrumentation

Booz•Allen concludes as follows:

"Finally, due to its nature, the engineering approach can not account for undetected design flaws. (If these flaws were detected, and could be modeled,