



NASA White Sands Test Facility

**Honeywell**

# Good Laboratory Practices of Materials Testing at NASA White Sands Test Facility

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NASA/JAXA Technical Interchange Meeting  
Tsukuba, Japan  
April 4-8, 2005



# Agenda

- Current approach
- Data Analysis
- Improvements sought by WSTF to enhance the diagnostic capability of existing methods



## Current Approach

- The approach to GLP testing is dependent on the type of test method (numerical vs attribute-type data)
- WSTF has a much wider aerospace materials testing capability than that described in NASA STD 6001
- WSTF is capable of supporting many ASTM International and ISO methods



## Current Approach (Continued)

- NASA STD 6001 Tests: 1, 2, 3, 4, 6, 7, 13A, 13B, 14, 15, 17, 18
- ASTM International Methods: G 72, G 74, G 86, 86, G 124, G 125, D 92, D 93, D 240, D 2512, D 1354,
- ISO Methods 14624 and 22538



## Current Approach (Continued)

- WSTF maintains a large stock of standard materials used to verify consistency of data obtained and to minimize uncertainties related to batch/lot variability
- If there is a method with well characterized repeatability and reproducibility (as is the case with many ASTM methods), prior to a new system use (either before actual testing by a new method, or upon re-designing existing systems), the precision of the method is evaluated and compared with existing data. The bias is also estimated (it's exact evaluation is not possible for most methods)



## Current Approach (Continued)

- At regular intervals the precision is determined, the bias is evaluated, and the data is analyzed statistically
- WSTF participates in round robin testing when there are other laboratories conducting the same type of testing
- Statistical Process Control principles are followed for the course of action



## Current Approach (Continued)

- Prior to implementing new standard methods developed in house, as is the case with many aerospace materials methods, extensive testing is conducted to characterize their statistical repeatability
- Upon implementing the new methods, the consistency of system performance and adherence to procedures are monitored



## Data Analysis

- The statistical analysis focuses on investigating data variability both within and between laboratories
- Variability which is statistically significant is determined and an investigation is conducted
- The extreme results are tested to determine whether they resulted by chance or from nonrandom causes (human error, loss of instrument calibration, non-adherence to procedures, differences in the test material, etc)





## Data Analysis (Continued)

- The results determined to occur by chance within our laboratory 5% of the time or less are tested additionally. These additional tests are conducted to estimate the probability of occurrence for data obtained by all participating laboratories. In addition, an investigation is conducted.



## Improvements Sought by WSTF

- Selecting test conditions to optimize the diagnostic capability of methods used to evaluate data consistency:

Hirsch and Beeson, *An Approach to Evaluate Precision and Inter-Laboratory Variability of Flammability Test Methods for Aerospace Materials*, SAE 05ICES-21, to be presented at the ICES International Symposium in July 2005, Rome, Italy



## Improvements Sought by WSTF (continued)

- Approach to statistically designing experiments that identify problems in running the method, clarify potential sources of errors, and evaluate conditions which may adversely affect the results. These experimental procedures may also point out the need for tightening requirements thus leading to reduced variability
- This study is in work