PRELIMINARY DRAFT V2 June 7th

Detonation Transfer Reliability –
Axial and Angular Alignment Evaluations using a Neyer Statistical Sensitivity Approach

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EXCELITAS TECHNOLOGIES®

Distribution A

Transfer Reliability Background

System level detonation transfer reliability

- Ordnance to ordnance (Donor to Acceptor)
- Critical to system performance

RCC 319 –Range Commanders Council
Flight Terminations Systems Commonality Standard

- Section 4.35.3 – Detonation Flier Plate Ordnance Transfer Systems
  - .999 Reliability at 95% Confidence Level

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Detonation Transfer Reliability

Transfer Reliability Background

RCC 319 (.999 Reliability at 95% Confidence Level)

- 2994 tests in flight representative configuration
  - Cost prohibitive
- Testing at 4X gap, axial, angular misalignment
  - May not be practical for some systems
  - No variable data
- Statistical sensitivity method that varies critical performance parameters: Gap, **Axial** and **Angular** alignment
  - Methods: Bruceton, Langlie, **Neyer**, etc.
  - Best Solution for variable data
- Testing must be conducted at qualification low temperatures (cold)

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Neyer D Optimal

Neyer D Optimal -Sensitivity Test

- Threshold of individual unit cannot be determined
  - Detonation transferred or it did not (binary response)
  - Testing at different levels establishes the parameters of the population
  - Test levels optimized to maximize information of the population
  - Software algorithm determines “next test level”
- Reliability of system or subsystem can be predicted

Sentest™ (Neyersoftware.com)

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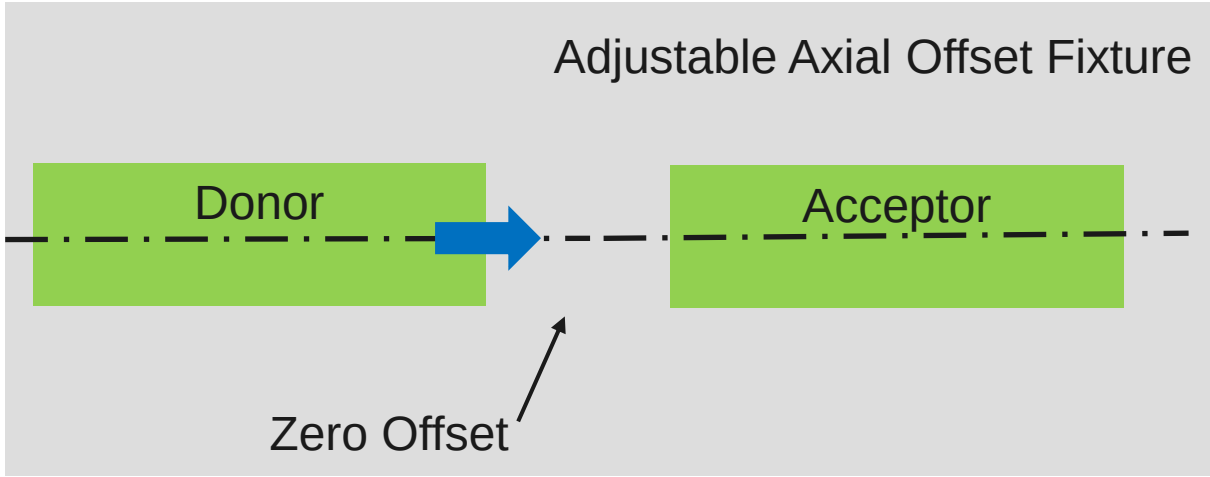
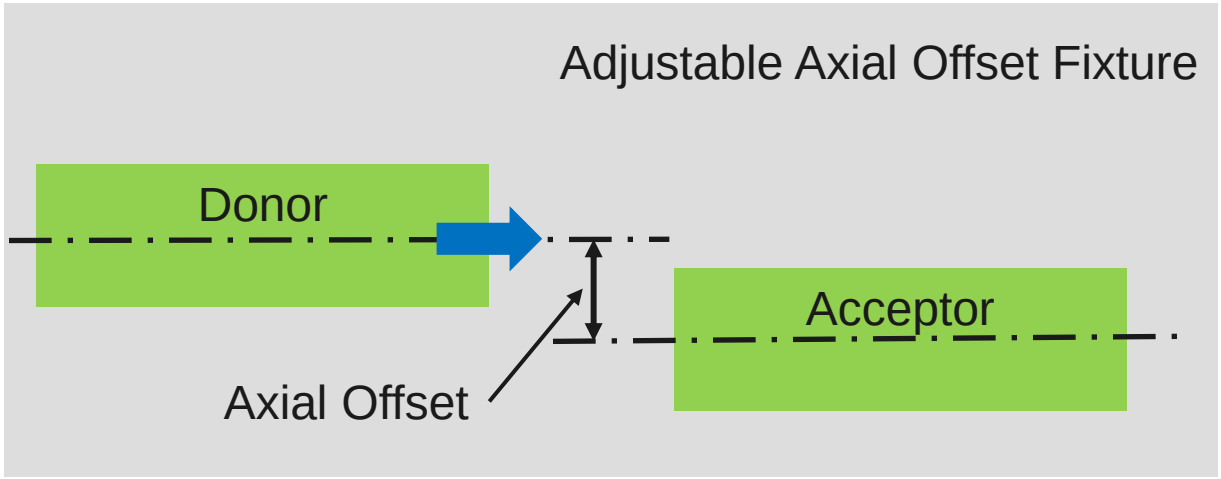
Detonation Transfer Reliability

Test Design – Axial Offset

Fixture Considerations

- Hold donor and acceptor
- Represent system level interface
- Large adjustment range
  - Beyond detonation transfer offset limit
    - Screening Tests Recommended
- High resolution required
- Fixture may be a single use
- Sentest™ software simulations
  - Evaluate potential outcomes





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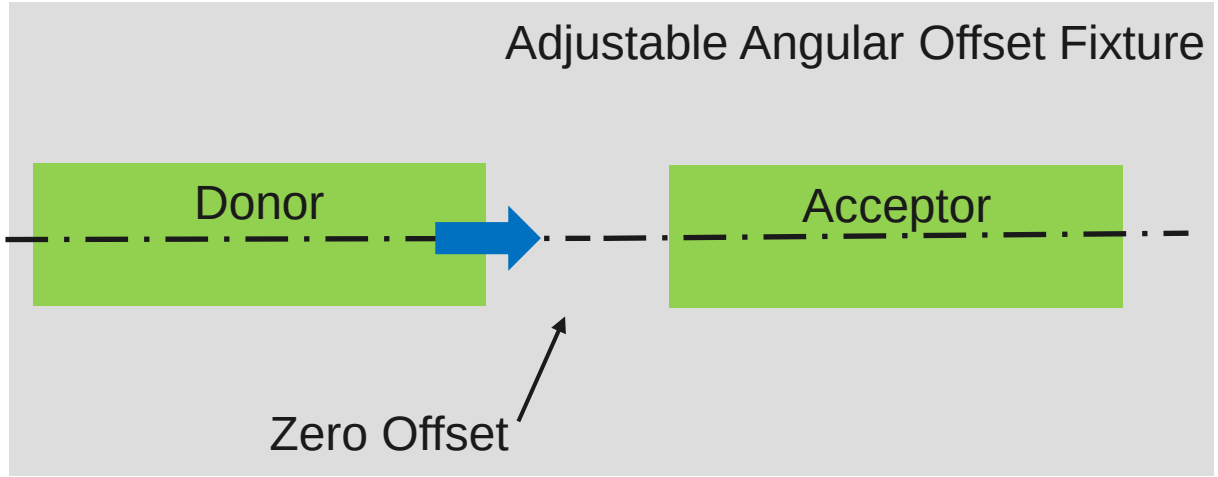
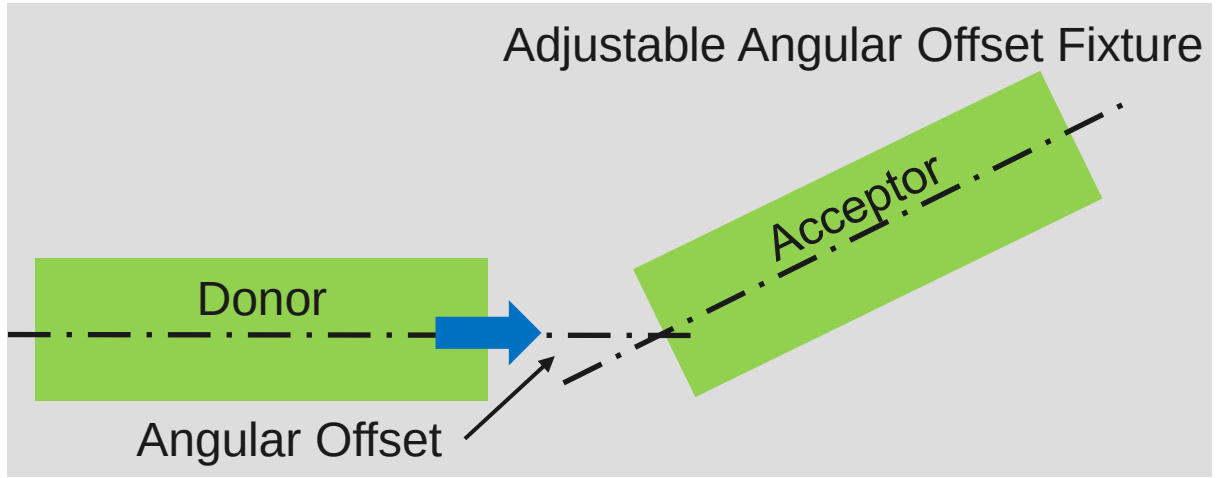
Detonation Transfer Reliability

Test Design – Angular Offset

Fixture Considerations

- Hold donor and acceptor
- Represent system level interface
- Large adjustment range
  - Beyond detonation transfer offset limit
    - Screening Tests Recommended
- High resolution required
- Fixture may be a single use
- Sentest™ software simulations
  - Evaluate potential outcomes





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Detonation Transfer Reliability

Test Considerations

Test Temperature (cold – system defined)

- Thermal conditioning
  - Study to determine minimum soak time
  - Fixture material effects
- Test temperature -actual
  - Study to determine maximum time out of environmental chamber
  - Insulation required?

Donor material

- System representative
- From a single lot to minimize variables

Acceptor material

- System representative
- From a single lot to minimize variables

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Detonation Transfer Reliability

Test Steps

Setup Software (Sentest)

- MuMin, MuMax, SigmaGuess (affects starting offset)
- Resolution, Upper and Lower Limits (fixture defined)

Setup & Test Unit 1

- Environmentally Condition
- Function
- Determine transfer success
- Enter Results of Test 1 into software
  - Neyer Software determines next offset to optimize data set

Setup & Test Unit 2

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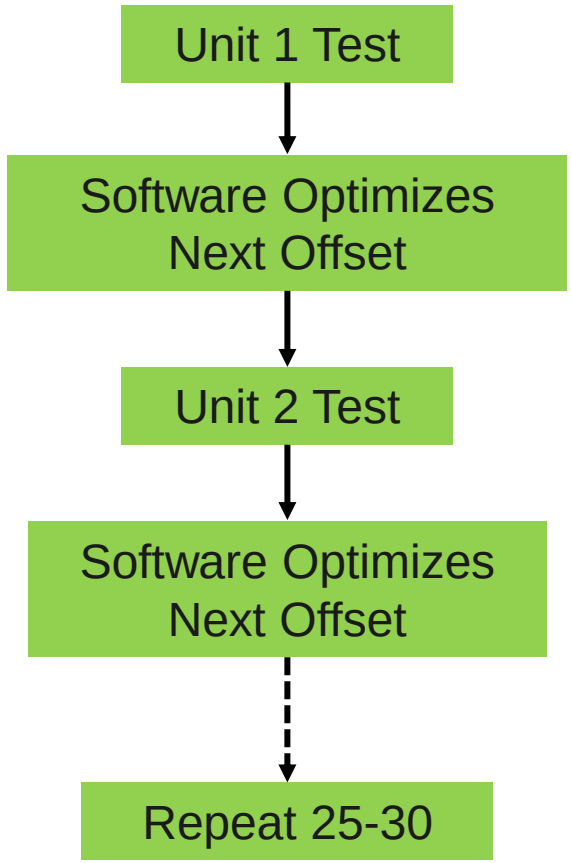
Repeat process 25 to 30 times (looking for stable data - Mu and Sigma)



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Interpretation of Test Results

Tolerance stack analysis of system Interface

- Determine worst case offset

Neyer D Optimal Results for .999 reliability and 95% confidence interval (one sided)

- Offset determined

Goal

- Tolerance stack results ≤ Offset required for .999 reliability and 95% confidence interval

Actual achieved reliability can be determined by setting the necessary statistical calculations in the Neyer D Optimal software

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Detonation Transfer Reliability

Interpretation of Test Results:

Axial Offset Example:

Tolerance stack (system interface between donor and acceptor)

- Worst case offset = .015”

Neyer D-Optimal Results (30-unit study)

- Mu= .082”
- Sigma= .0096”
- .999 Reliability at 95% Confidence Interval =.021”

.015”≤ .021” Therefore reliability goal is met

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Detonation Transfer Reliability

Summary

RCC 319 .999 Reliability at 95% Confidence Level

- Statistical sensitivity method that varies critical performance parameters:

  Gap, Axial and Angular alignment

  - Success demonstrated by use of **Neyer-D Optimal**

- Fixture Design that permits adjustment of critical performance parameters is required

Distribution A

Detonation Transfer Reliability

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