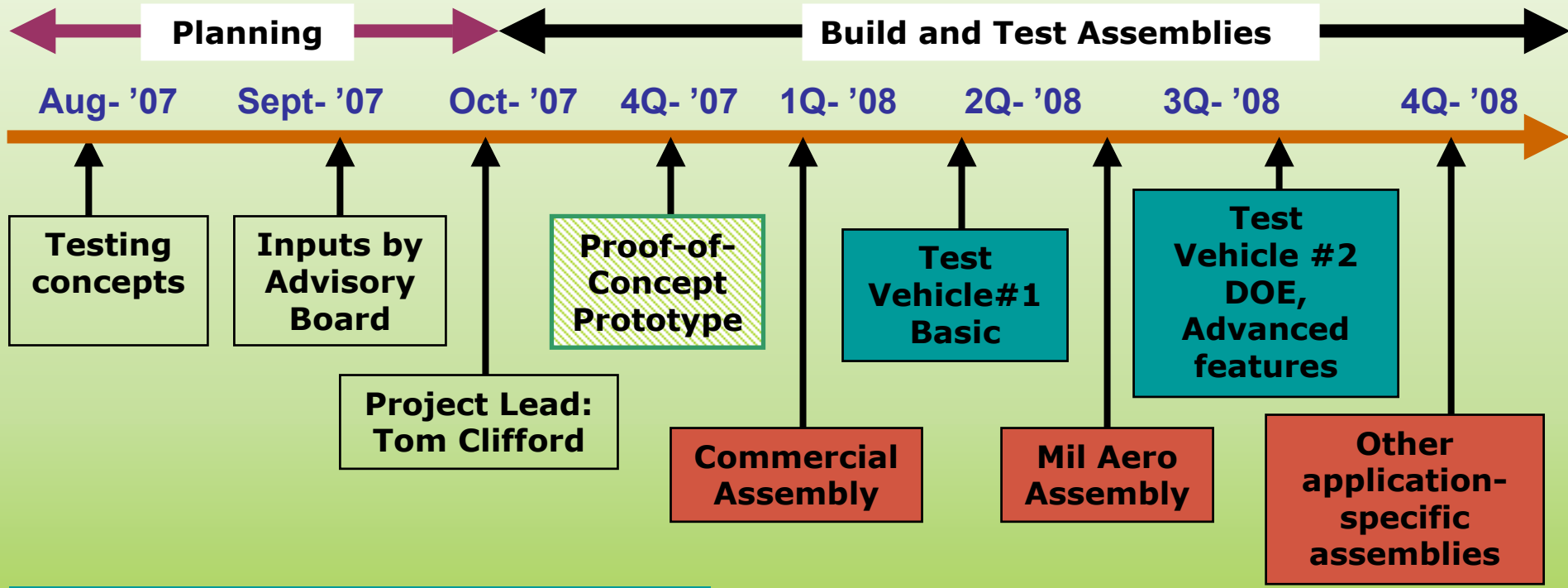
Occam Test Vehicle Road Map

Tom Clifford

Martin Hart

Test Vehicle Road Map



Tests: Fundamental characterization, electrical, thermal, T-cycle, vibe-shock, throw-test, long-term aging, etc. Statistically-valid, for modeling and data-bases, Increasingly more specialized, building on earlier test-vehicle results.

Tests: Specific, customer-directed, pass-fail acceptance and qualification tests: thermal, electrical, mechanical, aging etc, per IPC, mil-spec, other industry standards

Define Test Targets

- **Define the objectives for each test project – up front**
- **From these objectives, flow the schematic and BOM and testing protocols.**
- **Integrate inputs from advisors and project partners**

Objectives Statement

- **Three types of projects planned:**

"A" –Proof of concept models
Demo, design layouts, exploratory process and assembly.

"B" –Application-specific assemblies
Densities, costing, and performance versus conventional products, to industry acceptance specs

"C" – Advanced/Reliability tests vehicles
Reliability data, design and process proofing, optimized technology, materials specs and QC protocols.

"A" Proof of Concept Deliverables …

- **Timing …. Soon, Need it now !**
- **Demonstrate look and feel of Occam assembly**
- **Quantity … Sufficient handouts for demos**
- **Demonstration … Touch it. Feel it.**
- **Visually verifiable … Component layout and sequence of Occam process steps.**

"B" Application-Specific Deliverables …

Commercial and/or Mil-Aero Products

…**Replicate products in Occam format (functional)**

- **Quantity** **~20 Occam and conventional specimens**
- **Acceptance testing … Back-to-back comparative tests: Occam versus conventional assemblies**
- **Documentation … equal-or-better performance and reliability, cost savings, higher density form factors, reduced layers, etc**

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"B" Application-Specific Notes …

- **Design … in cooperation with customer-partners, provide credible comparative features & performance**
- **Test ~ IPC, mil-aero, NASA and/or other industry-accepted tests**
- **Funding, partnerships, licensing … TBD**

"C" Tech / Reliability Deliverables

- **Objective….** **Develop Occam technology, generating reliability and analytical model data, useful for all applications**

- **Quantity … ~50 for t-cycle, impact, process DOE, other basic data, for statistical significance**

- **Tests…** ***Mil-aero and IPC. Test to completion, for proper metrics, rather than simply pass/fail***

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"C" – Tech/Reliability Notes …

- **Documentation … product-design guidelines, materials proofing, process-control and QC attributes. FMEA & modeling analysis fundamentals.**

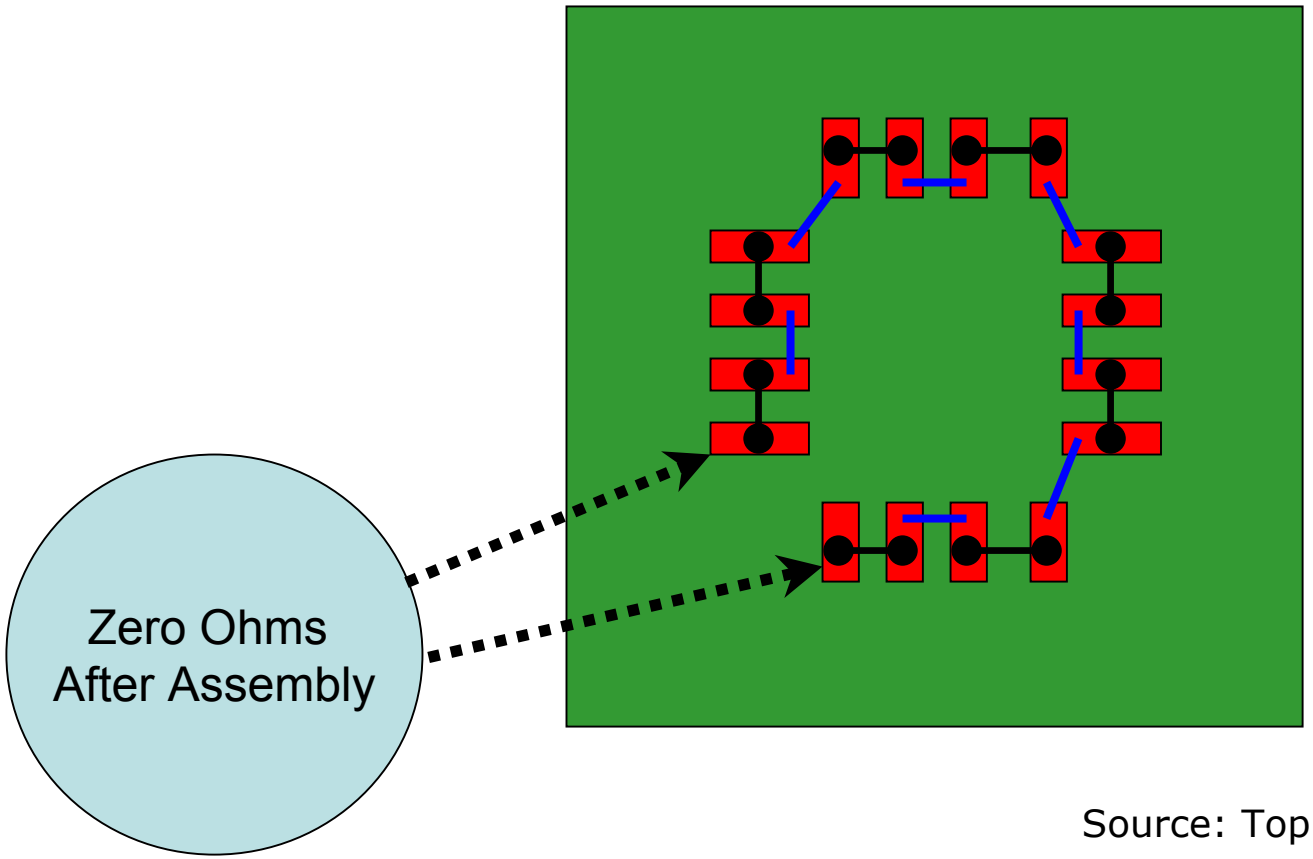
- **Demo enabling capability, such as:**
  - **Fine-Pitch … including blind and micro-vias**
  - **Multi-layer … high speed geometries, etc**
  - **Odd-Form … connectors, PTH and 2nd-op features.**
  - **Thermal-Management … embedded-passives, optical.**

General Notes …

- **Tests will explore and document material and process limits, control levels, workmanship impacts, M&P variants, etc. …. building on preceding tests and user experience**

- **Information will flow into design and process specs, application notes, FMEA, best practices, materials and sourcing documentation, etc**

Test Components with Daisy Chain



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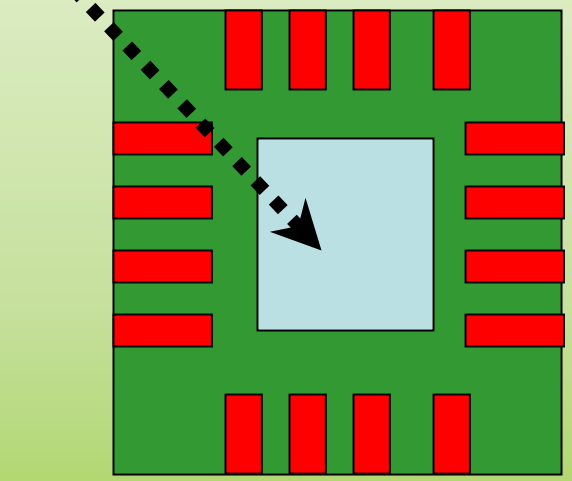
Test Components with Dummy Die

Die simulates real component

- Spreads Heat
- Weight Mass



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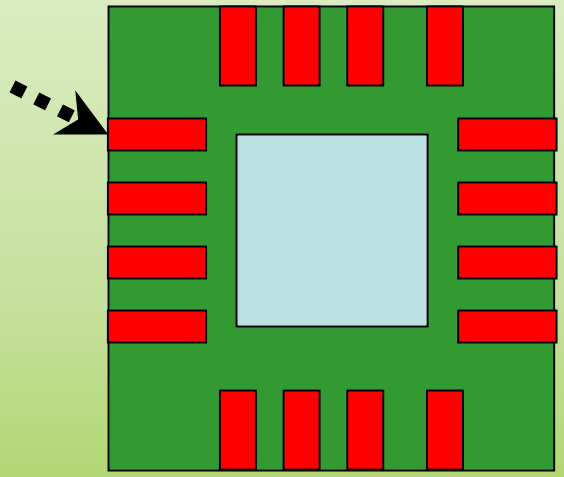
Test Components Plating & Alloys

Variants:

- Sn100
- Ni Pd Au
- Ni Au
- Sn Ag Cu
- Sn Bi
- Sn Pb (Mil Aero)



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Compare Occam vs Conventional Process

- **Assembled size**
- **Vibe-shock tests** ***(and throw test)***
- **Thermal-cycle test**
- **Thermal withstand test**
- **Electrical test**
- **Environmental aging**

Test Protocol Summary

- **Series of iterative designs** ***…for statistical reliability testing and product acceptance testing***
- **Each new design builds on predecessor**
- **High-quality, functional …** ***demonstrating cosmetic as well as fundamental process and material capability***
- **Encourage rough-handling …** ***and extreme condition tests by customers***
- **Fulfillment of stated objectives and deliverables**

Contacts

Project Leader:

Tom Clifford

Email: tom-clifford@sbcglobal.net

Tel: 650-726-3157

Test Components:

Martin Hart

email: info@topline.tv

Tel: (800) 776-9888

www.verdant-tv.com