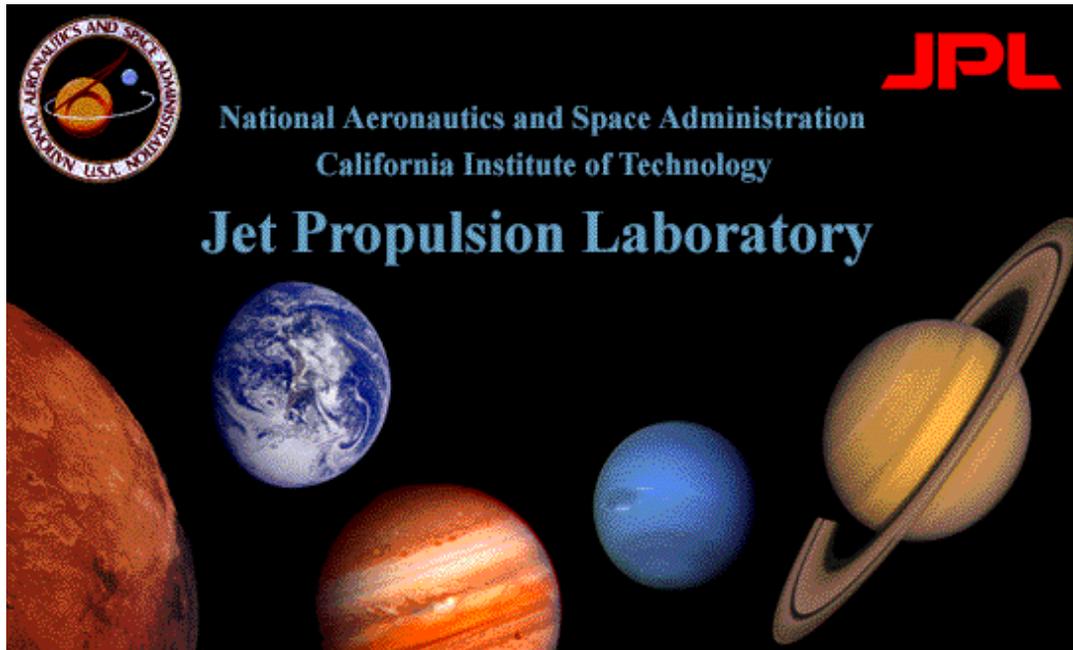


IEE International Frequency Control Symposium 1998

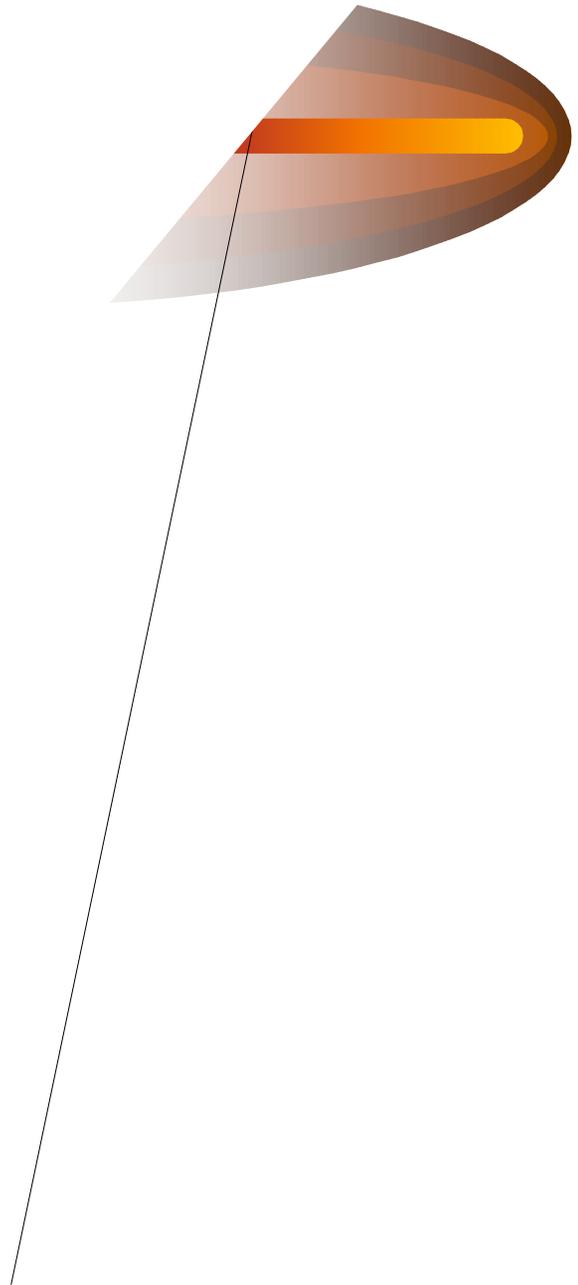
Commercial Off-The-Shelf (COTS)

A Study of Plastic Encapsulated
Microcircuits (PEMs) in JPL Space Hardware



Mike Sandor & Shri Agarwal

JET PROPULSION LABOR/
Electronic Parts Engineerin

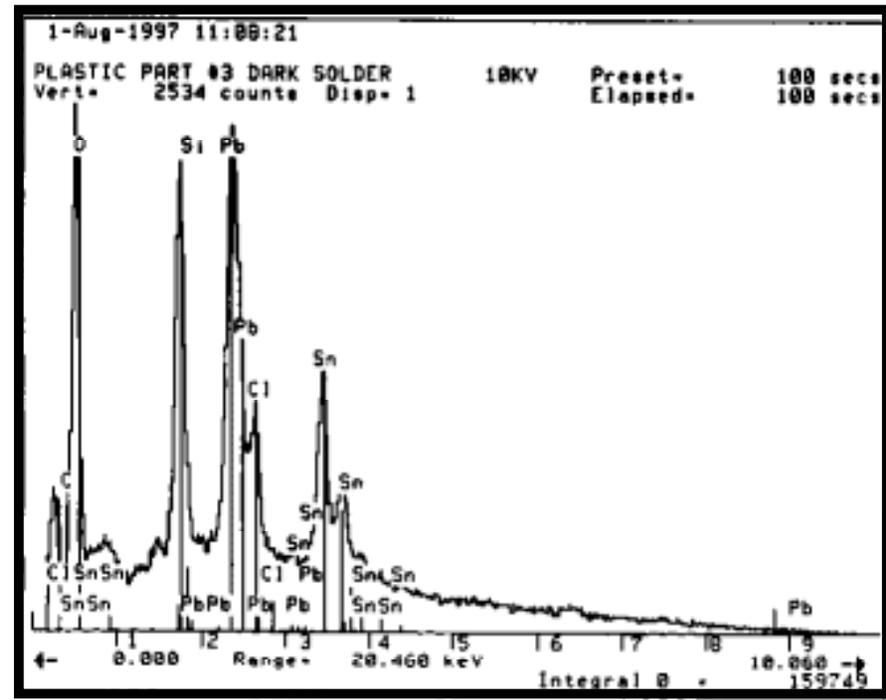
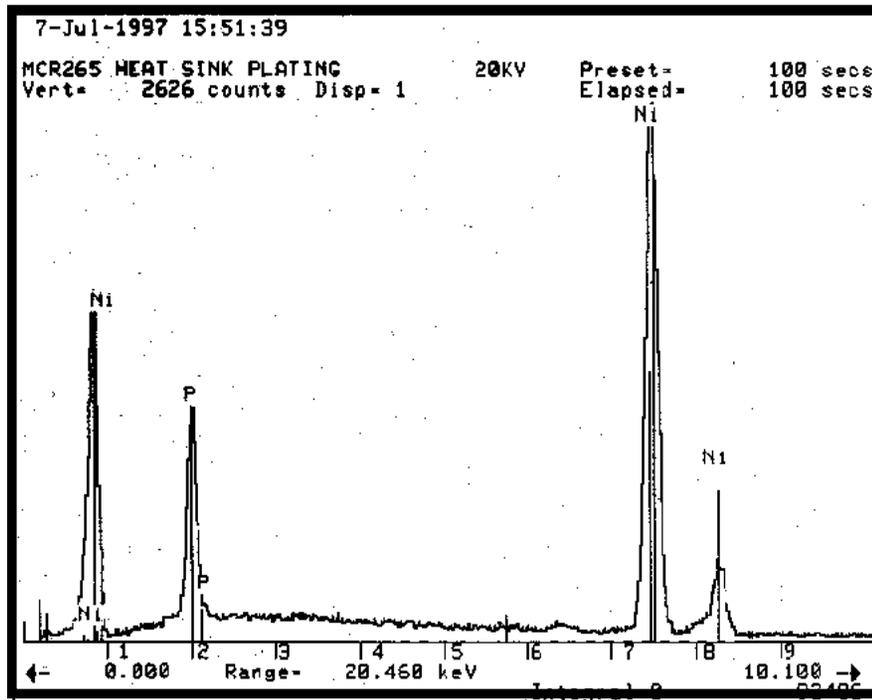


Nickel Plated Heatsink Shows No Oxidation

Post 85%RH/85°C for SCR265

Leads Show Extreme Oxidation

→ W1(t)

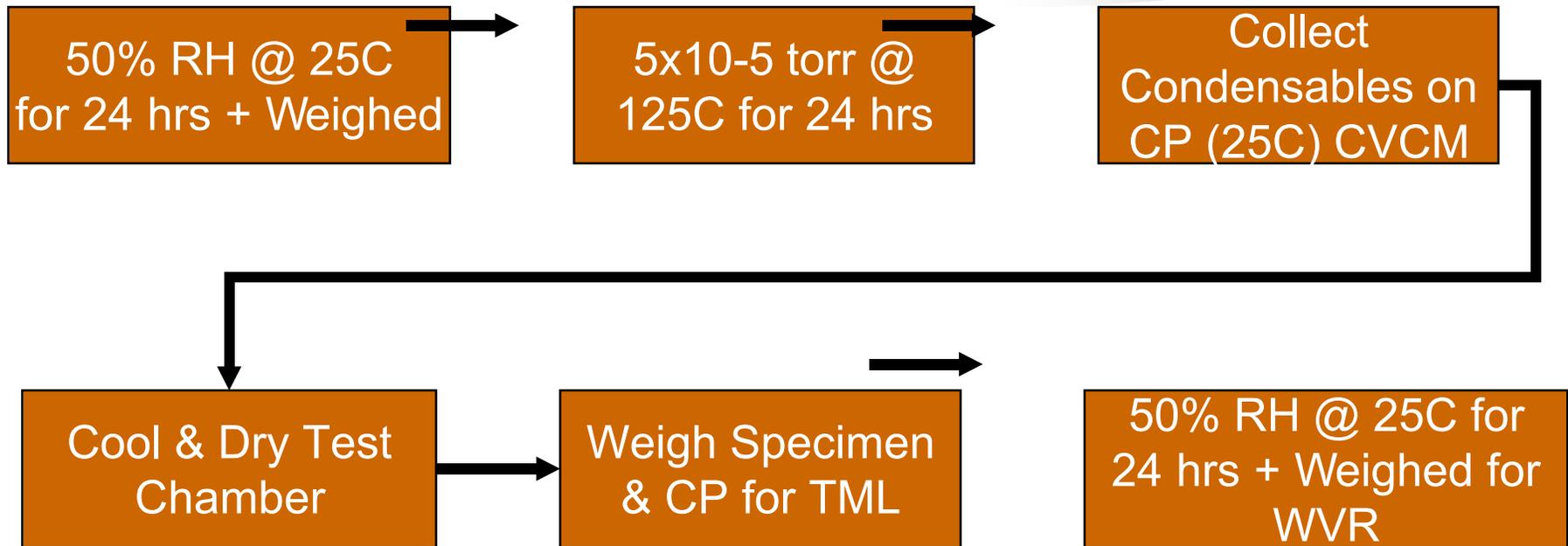


Conclusion: Weight gain is solely attributed to oxidation of leads. The internal chip has miniscule Al area available for oxidation because of Cu intermetallic bonding to the Al.

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Outgassing Test Flow



Ref: ASTM E595-93

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Outgassing Results of Plastic Packages

Material	MCR			7612382FBA, E24, DA28F016SV, K8055, U6240332			AM28F020-150PC, 9618FBB			CSI, CAT28F020F, 1-15 09550B		
Part	Motorola SCR			Intel 16 M Flash Memory			AMD 2M Flash Memory			Catalyst 2M Flash Memory		
Sample No.	5	6		7	8	a	9	10		11	24	
WT. Loss %	0.45	0.46	0.45	0.23	0.22	0.22	0.41	0.45	0.43	0.40	0.41	0.40
Water Vapor Recovered, WVR,	0.28	0.25	0.26	0.14	0.11	0.12	0.19	0.17	0.18	0.21	0.18	0.19
%ML (WT, LOSS-WVR) %	0.17	0.21	0.19	0.09	0.11	0.10	0.22	0.28	0.25	0.19	0.23	0.21
CVCM %	0.04	0.08	0.06	0.02	0.01	0.01	0.03	0.05	0.04	0.04	0.04	0.04
DEPOSIT on CP	Opaque			Negligible			Opaque			Opaque		
FTIR Results	Amine cured epoxy			Anhydride cured epoxy			Amine cured epoxy			Amine cured epoxy		

Conclusion: All materials passed. These tests are suited for lot-to-lot comparisons, tracking manufacturing continuity/changes, and measuring absorbed moisture at a known environment.

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Radiation of Plastic Parts Moisture Absorption / Bake for
Intel DA28F016SV in Plastic Package

(0.6 μ m ETOX IV Process Technology)

Conditions: Test Temperature = 25 $^{\circ}$ C, Vdd = 5.0V, Vpp = 5.0V

Dose rate = 25r/s

TID Response of Intel 16M Flash Memory

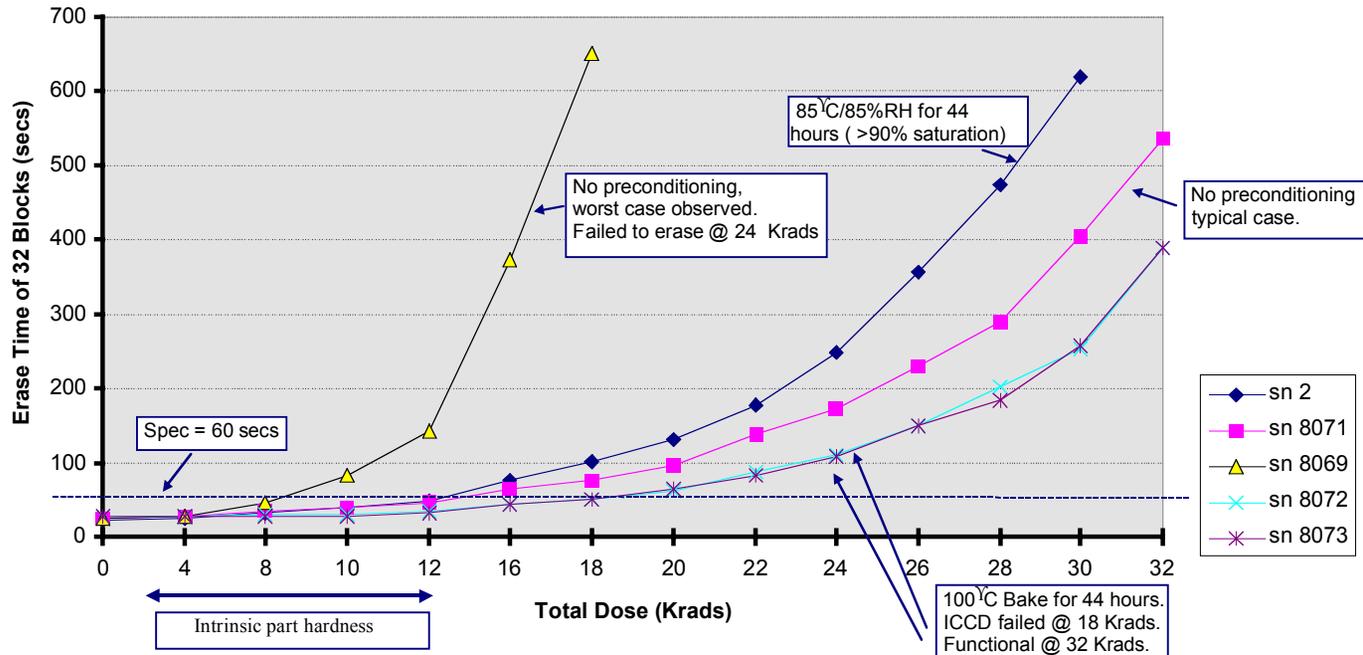


Figure 1
Jet Propulsion Laboratory
Electronic Parts Engineering Office 507



In Summary

- Using plastic parts without understanding their pedigree can lead to mission delay or worst  **Mission Failure**
- A methodology is in place in Office 507 to help JPL users of plastic parts ascertain their risk and acceptance for Space Application
- Work is underway in Office 507 to evaluate **all risk factors** using COTS parts (quality, reliability, radiation, package, and device performance)

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Electronic Parts Engineering Office



**For Further Information
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818-354-0681**

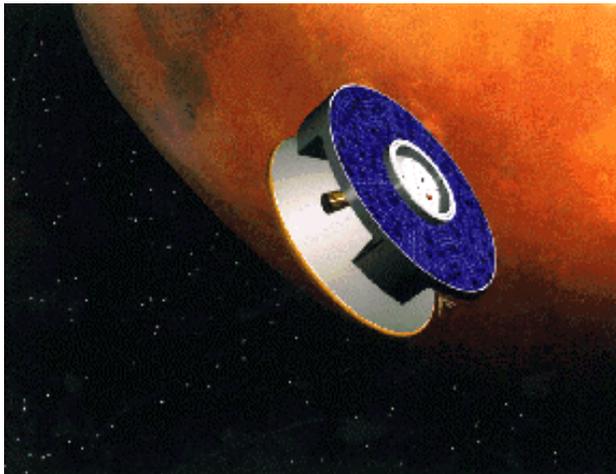
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Scott McDaniel - DPA Components, Inc.**

Plastic Parts Successfully Used For Mars Pathfinder:

16 Mbit DRAM Used in Pathfinder
Flight Computer



FETs ; ASIC & Microcontroller
Used in Modem for Lander and
Rover



Passed 1000 Hours Life Test on Mars !