

Accelerated Testing

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ACCELERATED TESTING

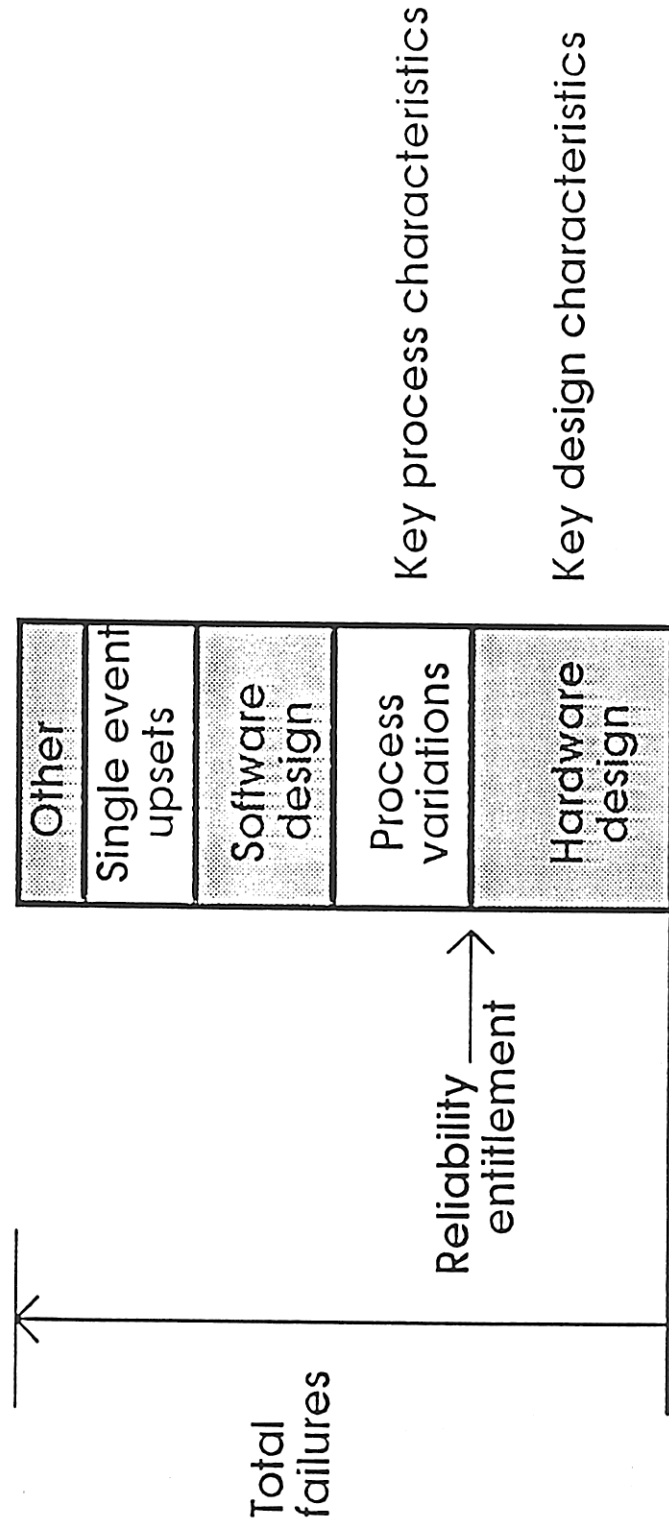
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TRADITIONAL USES OF ENVIRONMENTAL TESTING

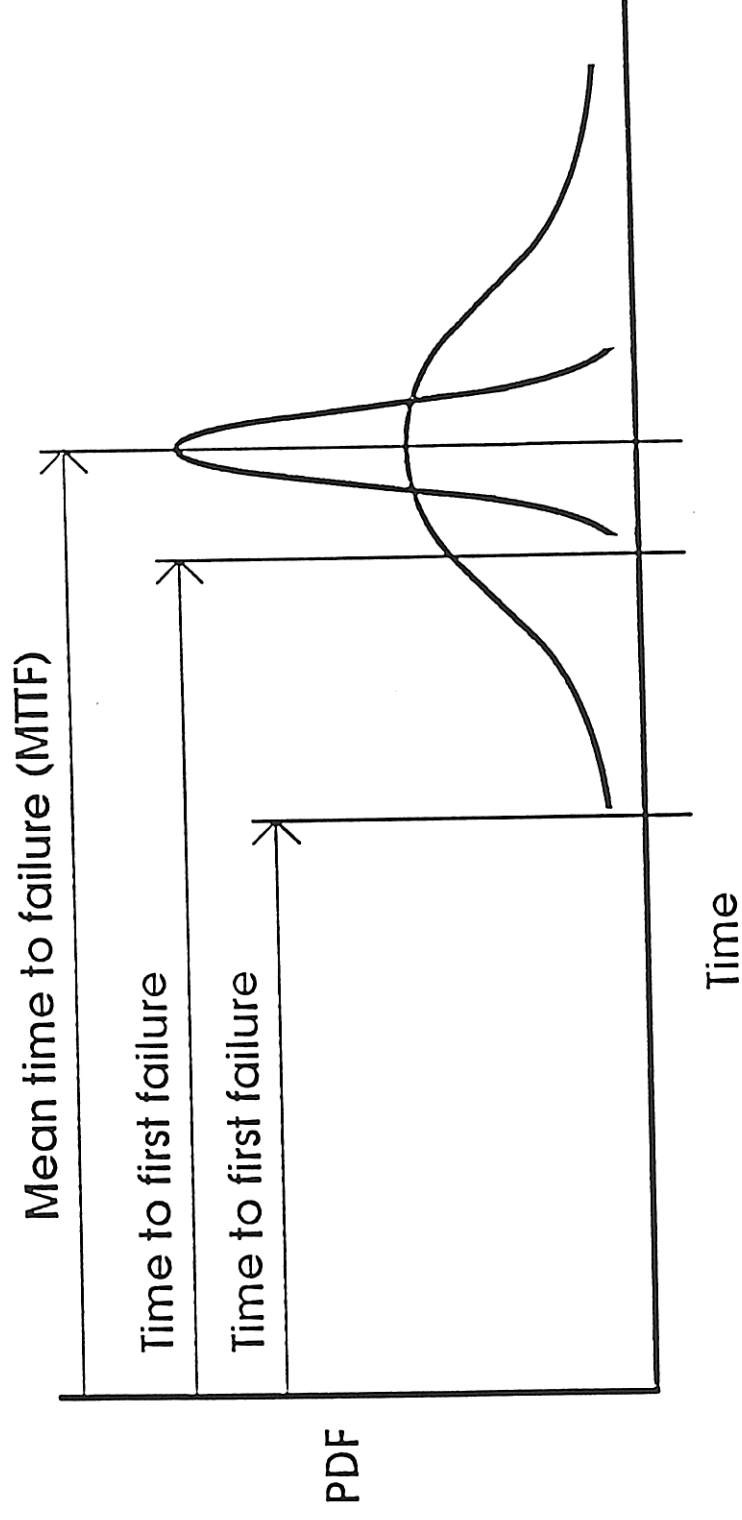
- . Purpose has been compliance to specifications, not quality or reliability improvement
- . Any other testing beyond specification testing has been discouraged
- . The goal has been to pass the test, not to learn about the product

CAUSES OF AVIONICS FAILURES

(not to scale)



PHYSICS OF FAILURE



ELECTRONIC DEVICE FAILURE MECHANISMS*

WEAROUT FAILURE MECHANISM	ACCELERATION STRESSES
Fatigue crack initiation	Mechanical stress/strain range, Cyclic temperature range, Frequency
Fatigue crack propagation	Mechanical stress range, Cyclic temperature range, Frequency
Creep	Mechanical stress, Temperature
Wear	Contact force, Relative sliding velocity
Diffusion	Temperature, Concentration gradient
Interdiffusion	Temperature
Corrosion	Temperature, Relative Humidity, Potential
Electromigration	Current density, Temperature, Temperature gradient
Dendritic growth	Voltage differential, Moisture, Temperature
Radiation damage	Intensity of radiation
Surface charge spreading	Temperature
Slow trapping	Temperature
Stress corrosion	Mechanical stress, Temperature, Moisture

* After Hu, J.M., Barker, D., Dasgupta, A., and Arora, A., "Role of Failure-Mechanism Identification in Accelerated Testing," Journal of the IES (July-August, 1993). Pp. 39-45.

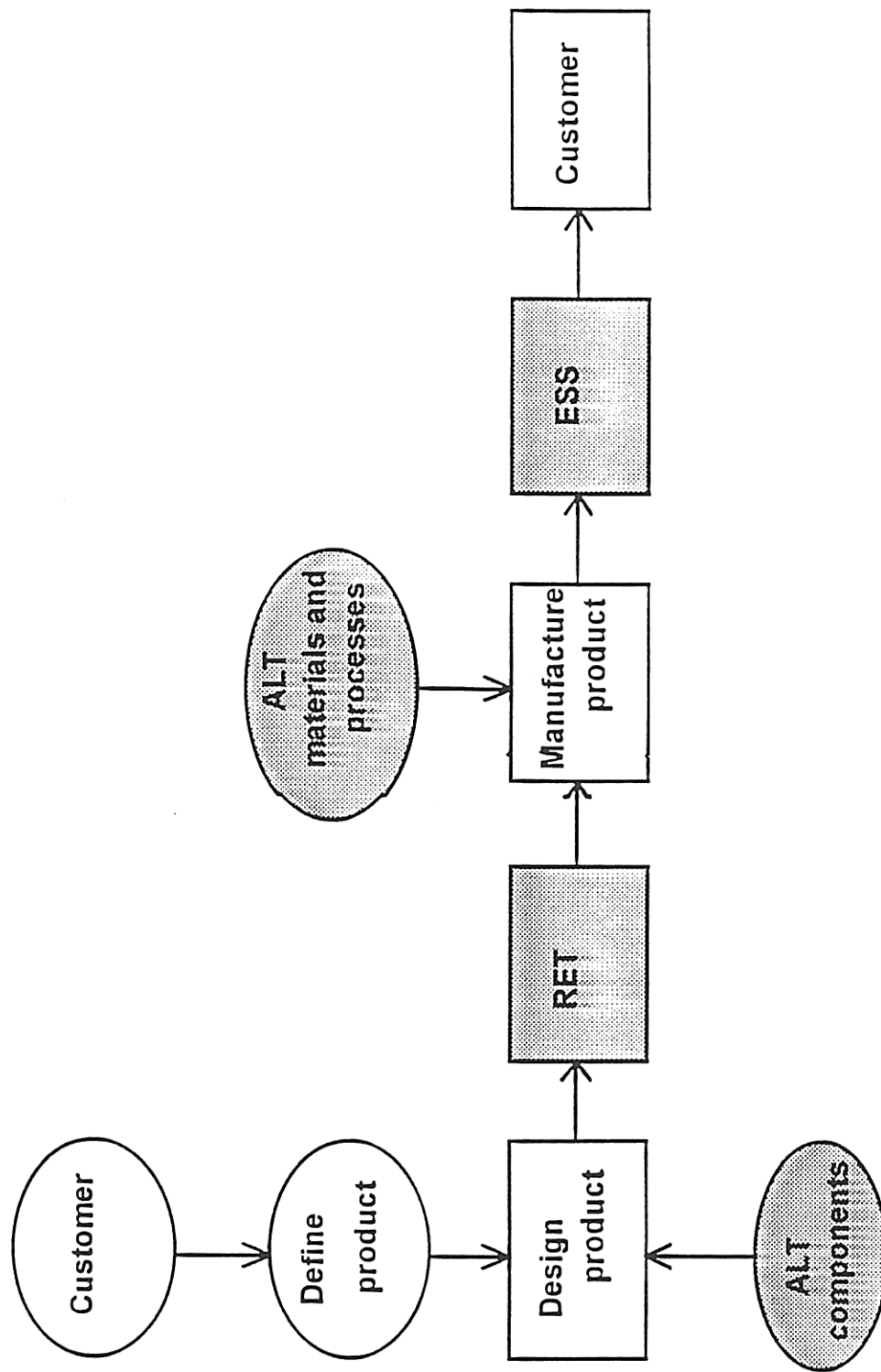
THREE BASIC TYPES OF ACCELERATED TEST

ACCELERATED LIFE TEST (ALT)

RELIABILITY ENHANCEMENT TEST (RET)

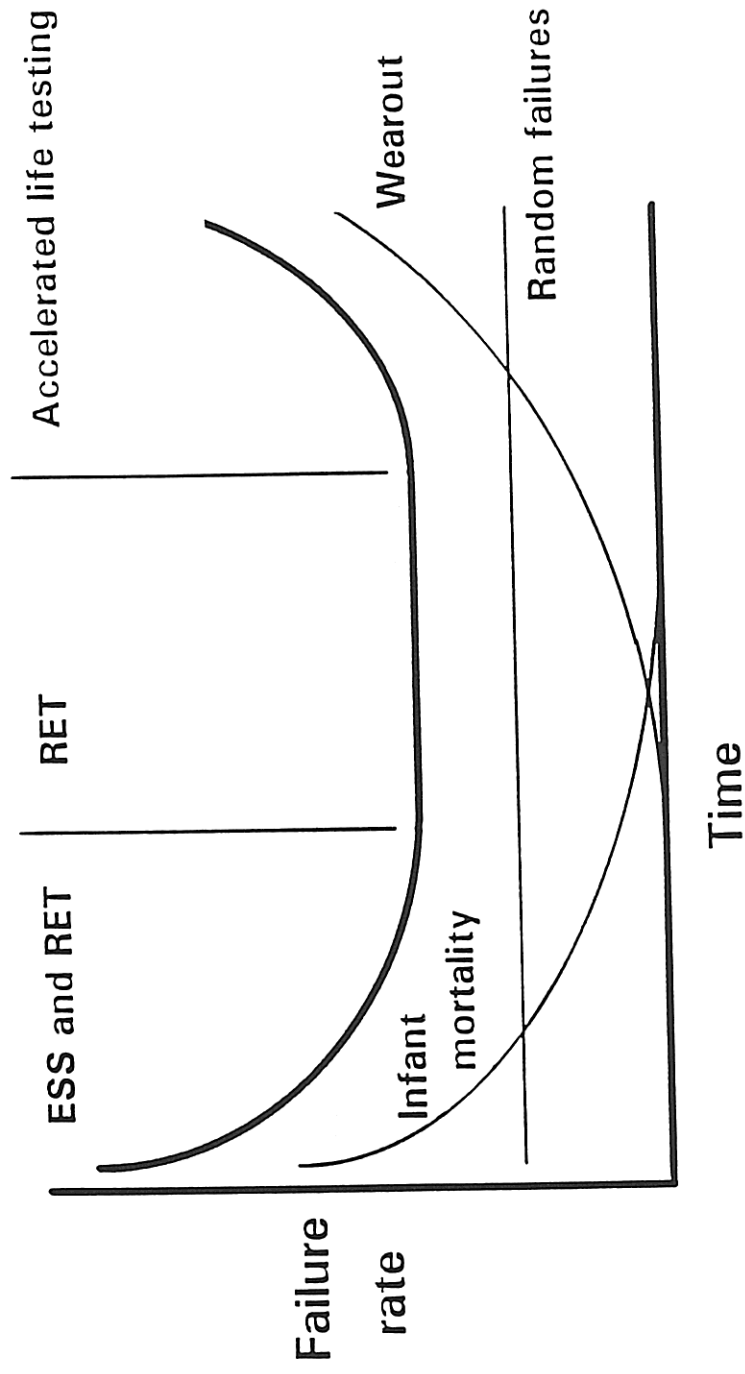
ENVIRONMENTAL STRESS SCREENING (ESS)

TYPES OF ACCELERATED TESTS



RELC 098

ACCELERATED TESTS AND THE BATHTUB CURVE



RELC 098a