KVA Engineering, Inc.

Product Risk Exposure to Airborne Equipment Suppliers

(and other manufacturers of safety related electronics)

Aerospace Vehicle Systems Institute

The Aerospace Vehicle Systems Institute (AVSI) is a cooperative of aerospace companies, the Department of Defense and the Federal Aviation Administration working to improve the integration of complex subsystems in aircraft.

An AVSI project generated the standard called **IEC/TS 62396-1** *Process management for avionics - atmospheric radiation effects - Part 1: Accommodation of atmospheric radiation effects via single event effects within avionics electronic equipment*

https://avsi-tees.tamu.edu

Introduction

1. This radiation is all around us and is the kind that exists in your office while you sit and learn about this topic.

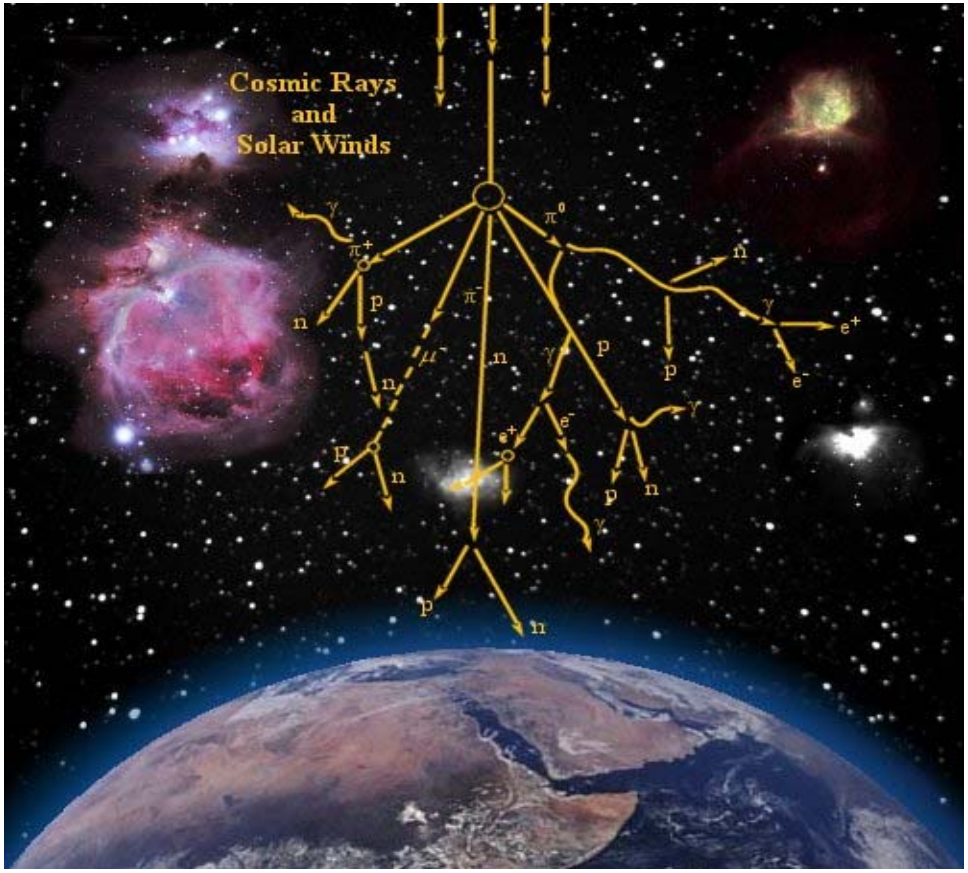
2. Continual evolution of electronic components has resulted in parts that are increasingly sensitive to this Atmospheric Radiation.

3. Most equipment being designed today with these components have new failure modes that will result in increased failure rates and increased **NTF**s (No Trouble Found). Very few designers have any awareness of these new issues.

4. These increased sensitivities will impact warranty claims, cause flight delays or operational restrictions, impact aircraft performance/safety and in more severe cases result in grounding of aircraft, decertification of systems and possibly loss of aircraft.

What Kind of Atmospheric Radiation are We Talking About ?

Charged and neutral particles penetrate the atmosphere affecting electronics especially in aircraft flying above 30,000 feet. At commercial aircraft altitudes, the radiation is at least 300X higher than on the ground.



Atmospheric Radiation Effects on Semiconductors

1. A single event upset (SEU) is a radiation induced event that causes electronic components to produce incorrect results or answers.

2. Energetic particles produced by solar flares strike the earth heaviest in the Polar Regions where the earth's magnetic field is weakest. These events occur on an 11 year cycle.

3. These particles cause an increase in the radiation an aircraft experiences by a factor ranging from 10-1000 times the normal rate.

4. Increase in radiation = increased SEU rates.

What Factors Are Driving This Sensitivity in Electronics?

1. Semiconductor manufacturers are shrinking designs to lower production costs and operating voltages. These factors make the components more sensitive.

2. Rapid rate of technology advancement makes it difficult for the average engineer to keep up with the issues associated with atmospheric radiation effects.

3. Military has no requirements for terrestrial radiation effects. Boeing and Airbus have minimal SEU requirements

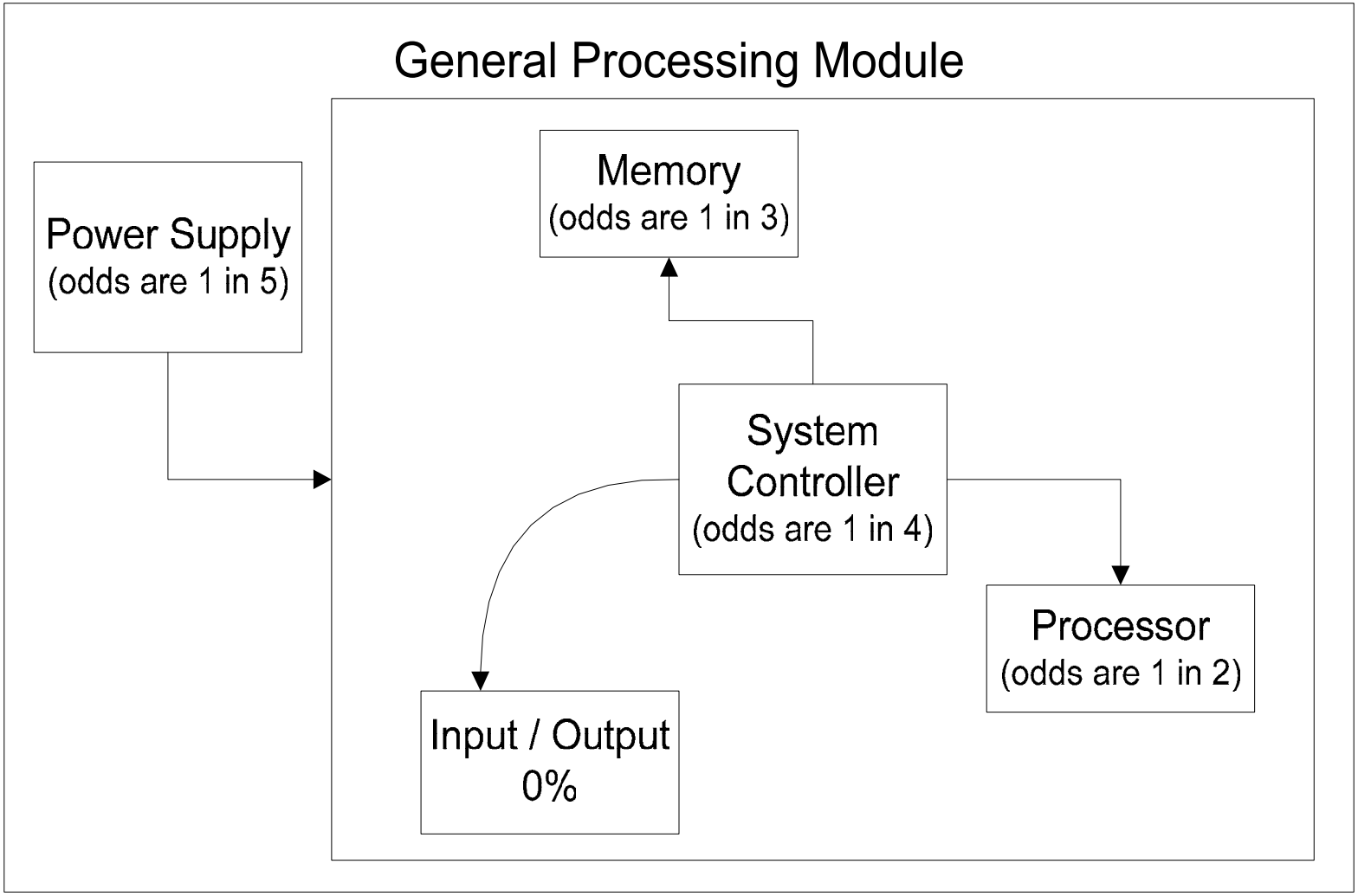
4. Accepted methods used to calculate the effects of atmospheric radiation on system reliability/availability are currently inadequate and have the potential of being in error by several orders of magnitude

5. Avionic design cycles result in significant lag between design and field service feedback. The gap is usually 5-7years

What are the Risks?

FAA Product Certification Category	Reputation	Excessive warranty claims	Possible grounding of aircraft and/or decertification of your product	Responsible for injuries to people or damage to aircraft	Responsible for loss of life and/or aircraft
Level C-E Non Essential	X	X			
Level B Flight Essential	X	X	X	X	
Level A Flight Critical	X	X	X	X	X

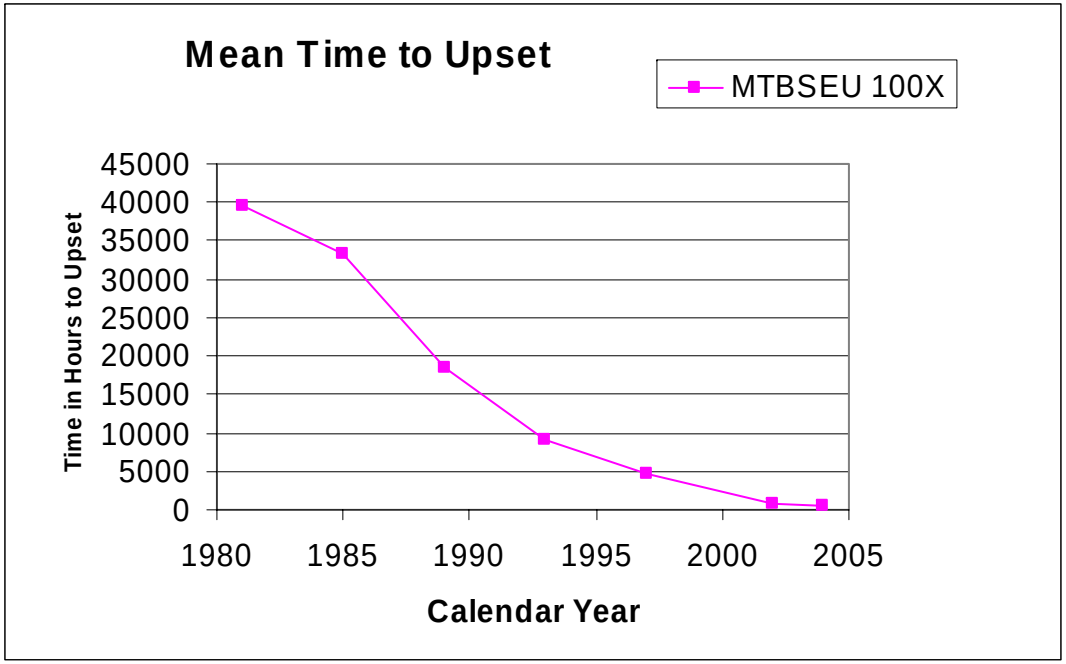
The Component Poker Game
What are the odds?



The Component Poker Game

The Probability that Atmospheric Radiation might impact a System					
	Went into Service before 2000		**Went into Service after 2007**		
	Nominal Number of Hours to Failure	Nominal Number of Hours to Failure during a Significant Solar Event	Nominal Number of Hours to Failure	Nominal Number of Hours to Failure during a Significant Solar Event	Samples of Problem Level A & B Systems
Power Supply	710,000	6,667	5,680	53	4
Video Processor	213,000	2,000	3,704	35	8
Data Concentrator	245,769	2,308	3,966	37	3.6
General Processing Module	127,800	1,200	3,022	30	2.5

Affects of Radiation on a Processor



This graph shows the SEU potential with a sharp decline that is approaching the length of a flight.

Summary

1. These radiation induced risks exceed Avionic industry attention, knowledge and priorities

2. There are no regulations driving change. An IEC standard has been developed but is not currently being applied

3. Major customers such as Boeing and Airbus have limited requirements for Atmospheric Radiation Effects. The military barely acknowledges the issue for terrestrial flight.

4. Without regulatory pressure and no customer paying for or driving such requirements, this becomes an unfunded issue

5. Companies are building and delivering potentially inadequate systems

6. The problem is a straightforward information and technology application gap

Solutions

1. Perform high level gap and risk analysis. *In an effort to rapidly get the word out to industry, KVA is offering a free one day onsite seminar to educate senior management and perform a high level gap and risk analysis so that management can make informed assessments of risk. The only charge is for actual travel expenses.*

   To schedule call Ken Vranish (616) 745-7483

2. Quantify risk factors to support management decisions

3. Provide technical support for corrective action

4. Provide training to technical & management personnel

Resource

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KVA Engineering, Inc.

- Provide an initial gap and risk analysis
- Perform detailed analysis of existing designs
- Provide system and LRU level analysis and guidance on new designs
- Provide training to engineers, designers and managers
- Provide data on components from our data library.
- Perform testing of proposed components that do not yet have test data
- Visit our website; www.kva-engineering.com for more information on this and other topics