Lead-Free Electronics

United States Department of Defense

Acknowledgements

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Technical Training Instructor

00-ALC/DP/CTO/Arrowpoint
Courseware Developer

The DoD is currently feeling the effects of a dramatic change in the technology used to produce and repair micro-circuitry…

This change effects the reliability and maintainability of…

All DoD Weapon Systems

Why you should care…

Why you should care…

Why you should care…

History of Tin-Lead Solder

63% Tin / 37% Lead solder alloy

Utilized in the electronics industry for over 60 years

- Mature technology
- Used to inhibit growth of “Tin Whiskers”
- Proven industry standard
- Well documented engineering characteristics
- Excellent history of reliable use
- Low cost

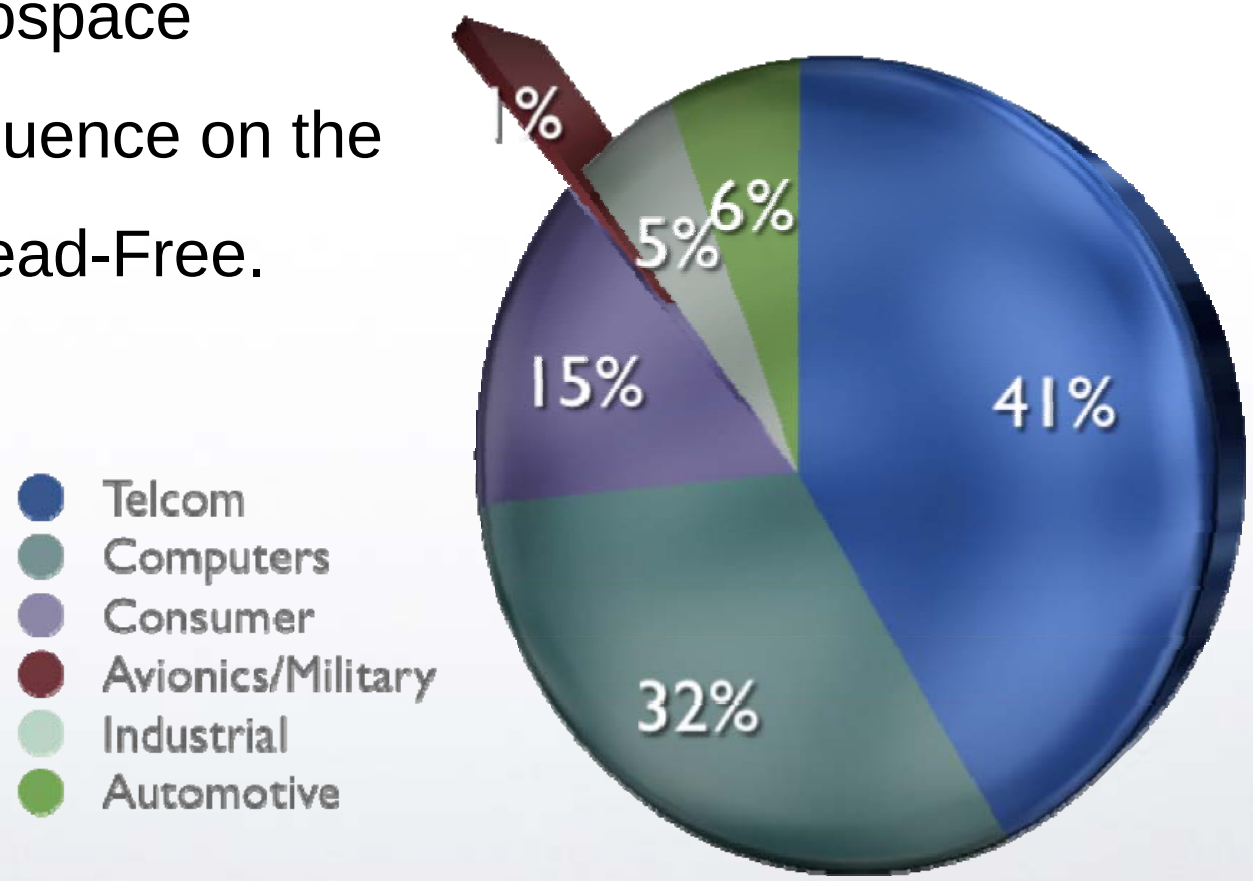
History of Tin-Lead Solder

The electronics industry is eliminating Lead from the world-wide market.

Because of Lead-Free, DoD is in the middle of an uncontrolled transition for which we are currently unprepared.

Electronics Market Share

The Military and Aerospace sectors have little influence on the global transition to Lead-Free.



Reliability & Maintainability Issues

- Lead-Free parts have entered the supply chain
- Technicians lack knowledge and have not received guidance
- Lead-Free outside of current directives
- No standard Lead-Free alloy
- Over 300 different Lead-Free alloys
- No reliability/engineering data
- Tests prove some alloys are not compatible
- Tin Whiskers have been found on components

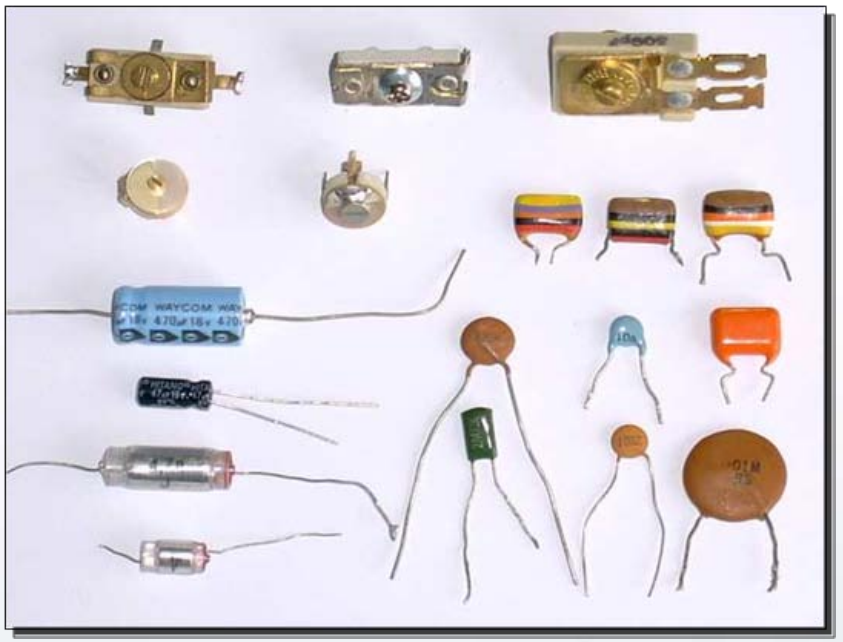
Reliability & Maintainability Issues

There is high reliability risk for DoD when we don't know for sure what solder we are using in the repair process.

Lead-Free Parts

Involves multiple electronic components:

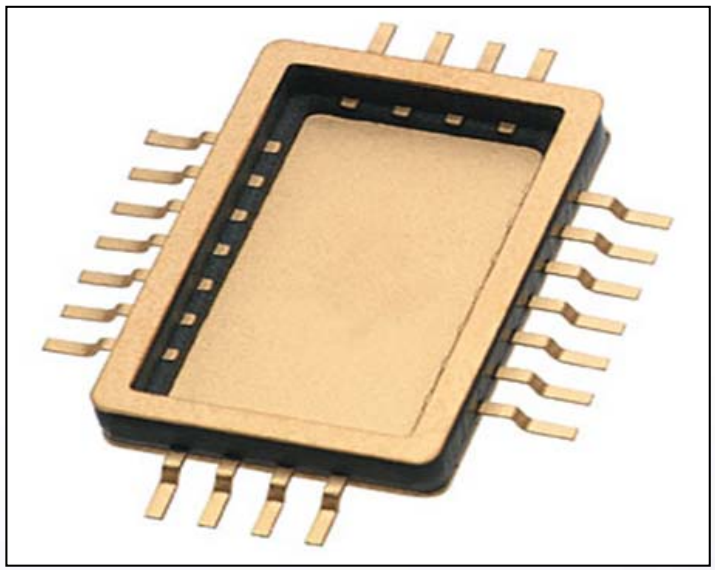
- Capacitors



Lead-Free Parts

Involves multiple electronic components:

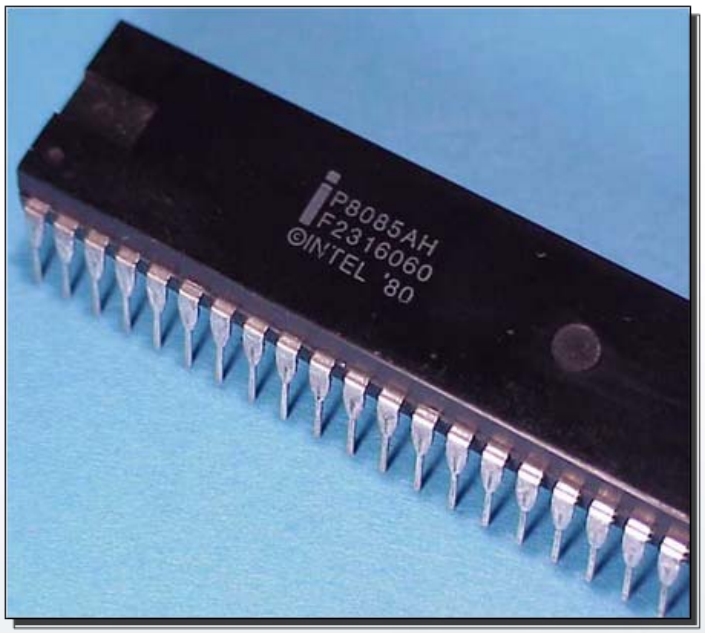
- Capacitors
- Flat Packs



Lead-Free Parts

Involves multiple electronic components:

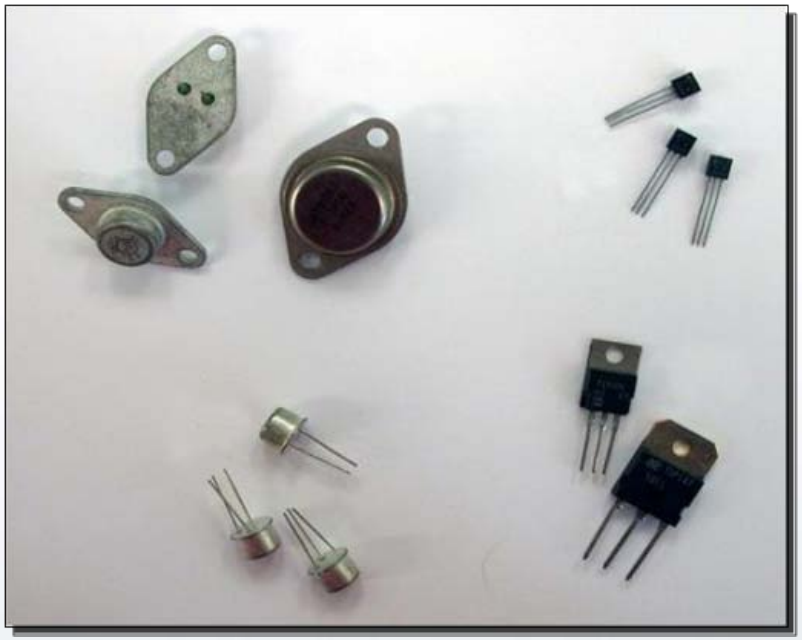
- Capacitors
- Flat Packs
- DIPS



Lead-Free Parts

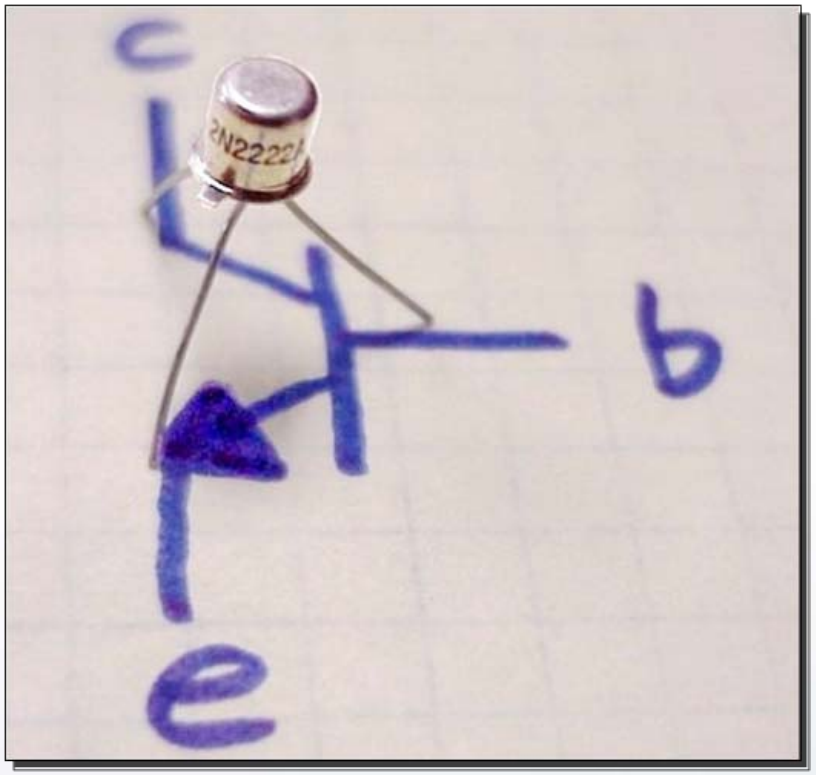
Involves multiple electronic components:

- Capacitors
- Flat Packs
- DIPS
- Transistors



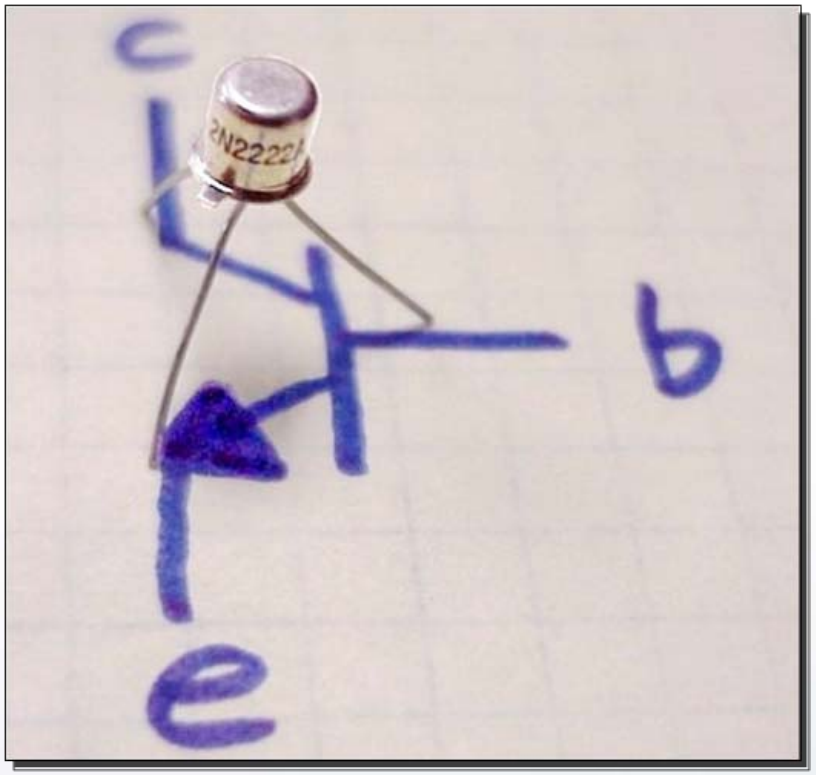
Lead-Free Parts

- A recent random sampling identified 90% of 2N2222A transistors are Lead-Free



Lead-Free Parts

- A recent random sampling identified 90% of 2N2222A transistors are Lead-Free
- 2N2222A transistors are used in over 170 USAF assets



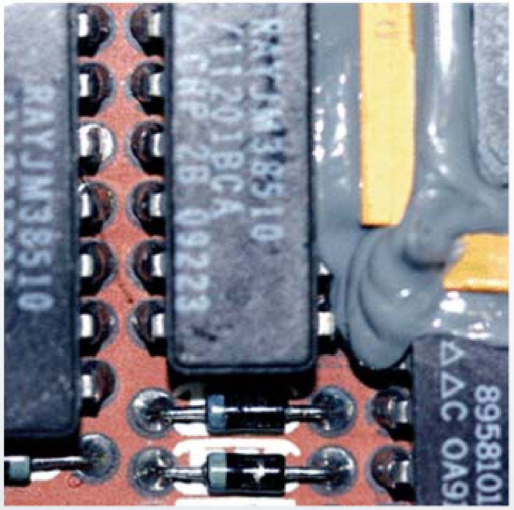
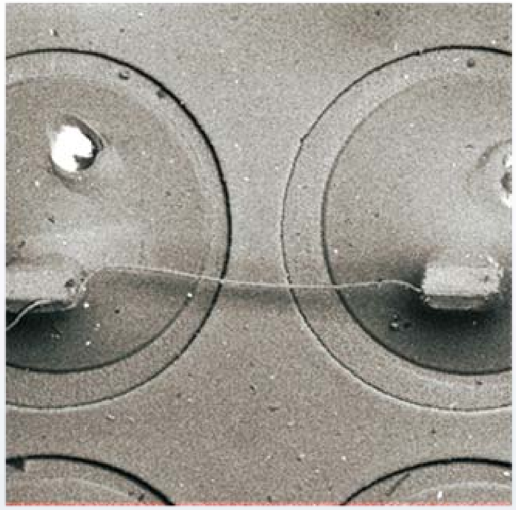
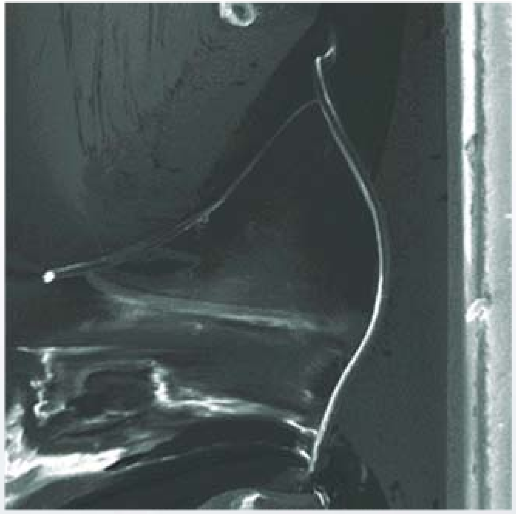
Tin Whiskers

Tin Whiskers are electrically conductive, crystalline structures that grow from tin surfaces.

- Numerous electronic system failures have been attributed to short circuits caused by Tin Whiskers.
- Tin Whiskers have been successfully suppressed for decades by the addition of at least 3% lead to the tin plating used in high reliability applications.
- Tin Whiskers pose a serious reliability risk to electronic assemblies.

Lead Standardization Activity



Immediate Needs

Establish Policy

- Develop DoD Lead-Free Control Plans
- Define Lead-Free risk management strategies and processes
- Define quality and reliability assurance strategies

Stop unintended infiltration of Lead-Free parts into supply system

Obtain management awareness & support

- Bigger than any Service/Agency/Command

Immediate Needs

Obtain funding

Investigate New Materiel Solution

- Viable options available
- Both DoD and Industry will need to find “the” solution
- Requires extensive testing, reliability data collection

Educate key personnel on impending changes

- Program Managers, Planners, Buyers, Electronics Technicians, Engineers, Equipment Specialists, Contracting Officers

Long Term Solutions

Transition Challenges

Long Term Solutions

Transition Challenges

Technical

- Potential redesign
- Manufacturing (legacy systems)
- Quality and reliability issues
- Repair/Rework challenges
- Troubleshooting difficulties

Long Term Solutions

Transition Challenges

Logistics

- Supply Chain
- Materiel Control
- Quality and Deficiency Reporting (QDR)
- Vendor Compliance Certification
- Sustainment of Legacy Systems

Long Term Solutions

Transition Challenges

Economic Considerations

- Materiel
- Parts
- Education/Training
- Guidelines for repair of Lead-Free assemblies
- New/emerging systems meet LFCP requirements