

Hybrid Enhanced Assurance

Using Historical Data and Laboratory Analysis to developed an enhanced assurance flow for DC-DC converters

Introduction

- Hybrid DC-DC converters are complex devices that are challenging to manufacture
- Multiple projects have experienced schedule and cost impacts due to parts failing during screening, qualification, and assembly level testing
- The goal of this project is to establish appropriate oversight and evaluation beyond M38534 Class K acceptance flow to reduce impacts to projects

Enhanced assurance is needed to improve DC-DC converter outcomes.

Plan

- Perform a comprehensive review of DPA and failure analysis reports – historical data
- Categorize workmanship faults
 - Identify trends and predominant causes of failure and schedule delays
- Use historical data and analysis to inform enhanced DPA on samples from multiple supplier
- Historical data and analysis results will be used to identify value added inspection points

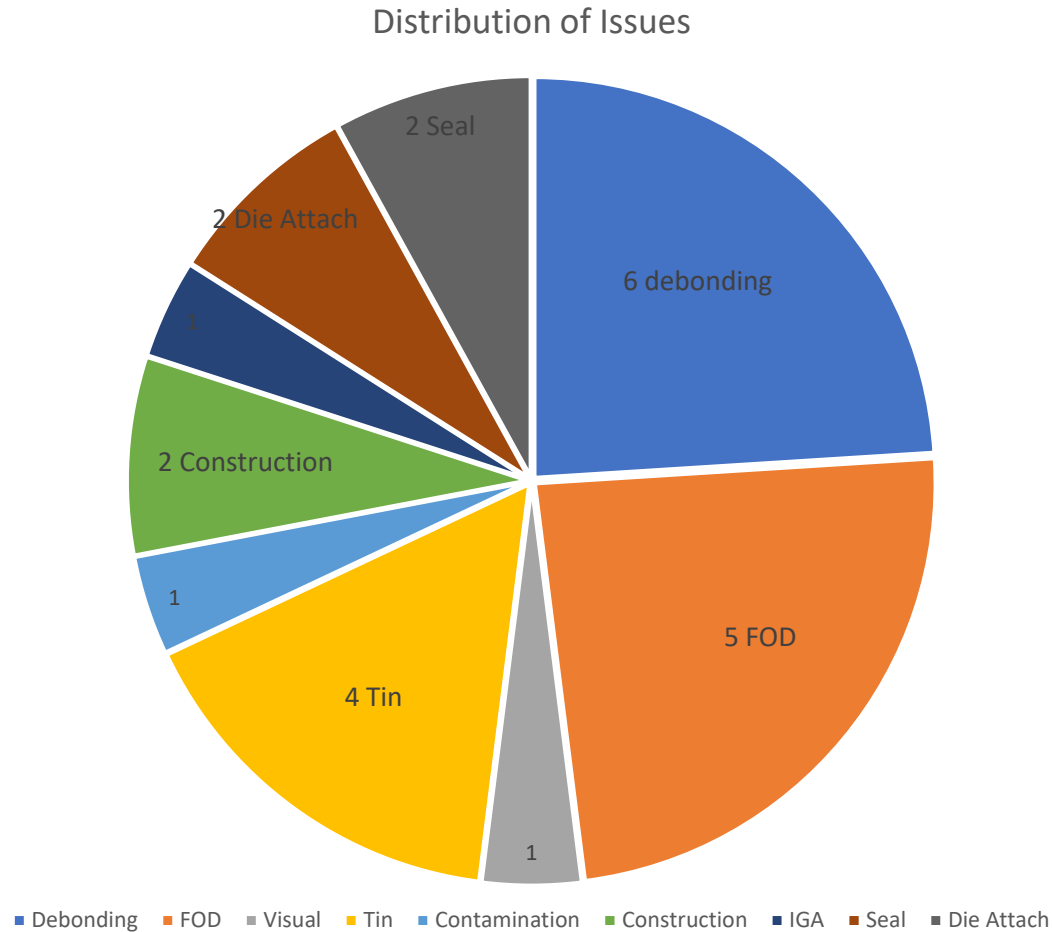
Project will use historical data review and lab analysis

Progress to date

- Historical data compiled and reviewed
- JPL ATLAS database searched for DPA, FA, or screening activity since 2017
- Reports were reviewed for any with issues: Failures, customer review required, etc.
- GIDEP reports also searched for recent DC-DC converter issues
- ATL performed analysis on 42 lots from Crane and VPT between 2017 and the present (no exposure to IR during this time).
- Issues were found with 22 of the lots.

Historical data identifies multiple issues

Distribution of Historical Issues



Issue	Manuf	Qty
Debonding	Crane	6
FOD	Crane	5
	VPT	1
Tin	Crane	4
Construction	Crane	2
Die Attach	Crane	2
	IGA	1
IGA	Crane	1
	VPT	1
Seal	Crane	2
Contamination	VPT	1
Visual	Crane	1

Data identifies workmanship and process issues

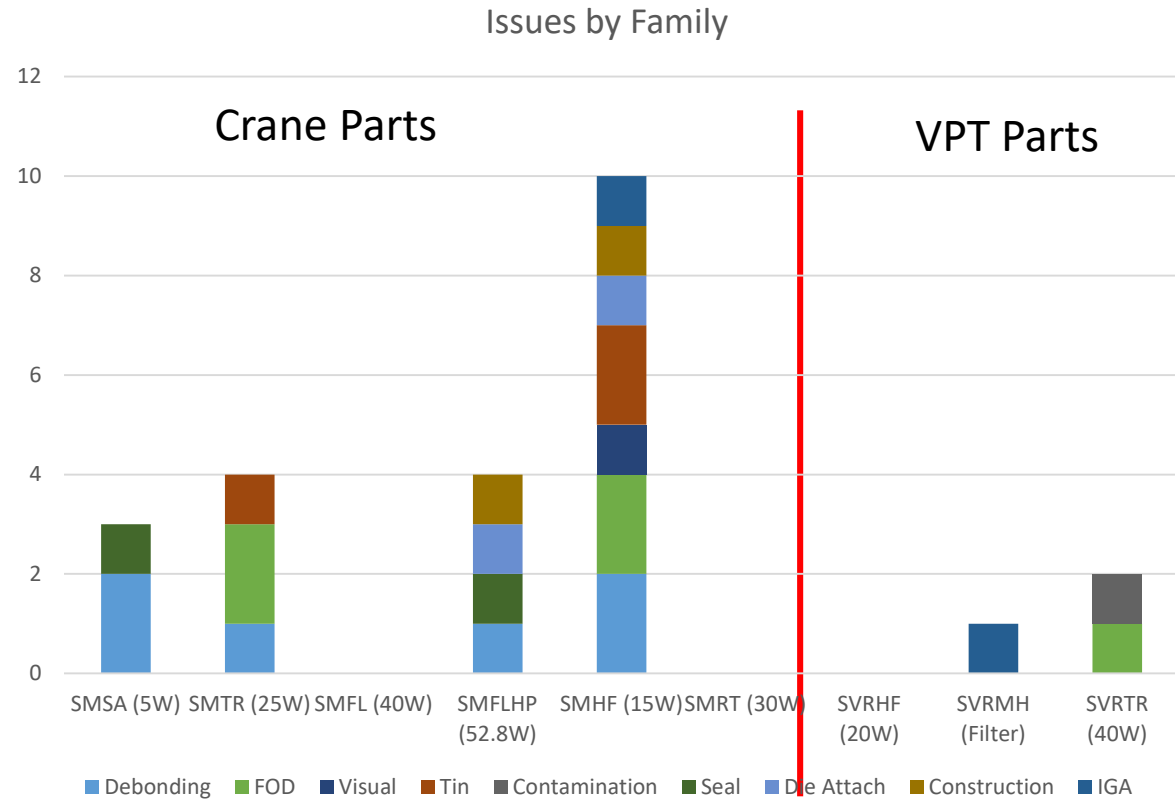
Families Evaluated

- Crane (Family / Number of Lots):

- SMTR 3
- SMFL 1
- SMFLHP 5
- SMHF 15
- SMRT 6
- SMSA 5
- SMTR 3

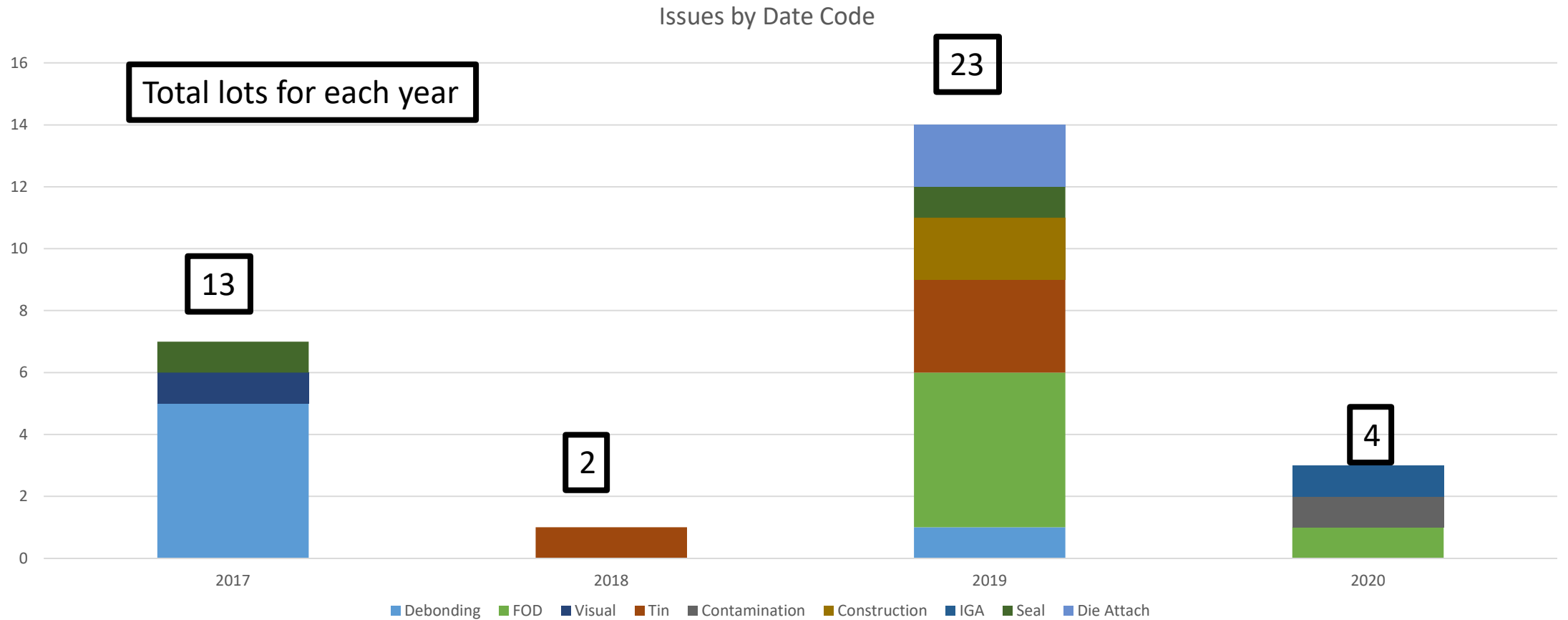
- VPT

- SVRHF 2
- SVRMH 1
- SVTRT 1



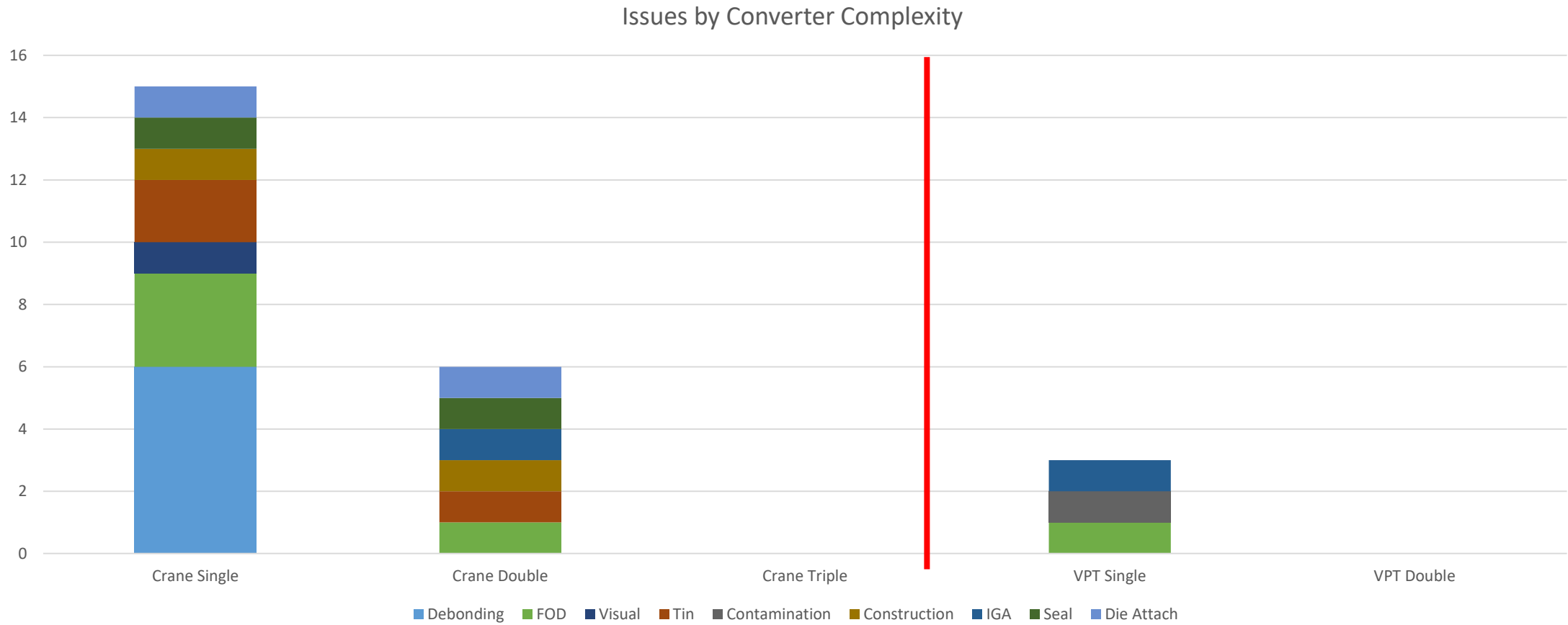
Issues distributed across part families

Issues by Date Code



Date code distribution largely based on usage

Issues by Converter Complexity



Higher complexity does not appear to be a driving factor

Historical Data Analysis Summary

- Issues mainly related to workmanship
- Issues are not limited to one supplier or part family
- Relative complexity is not a significant factor (reality is all these parts are pretty complex)
- Largest driver of part issues seems to be the quantity used

All DC-DC converters are subject to problems

Current Effort – Enhanced DPA

- Representative DC-DC converters from Crane, VPT, and IR have been selected for DPA/construction analysis(CA)
 - Parts chosen based on sufficient complexity to illuminate suppliers' construction methods, relevance to identified problems, and availability
 - We will also review lot travelers for yield issues
- Analysis in progress
- We are working closely with the lab during the DPA/CA for thorough understanding of the construction of the DC-DC converters
- We will analyze DPA/CA results and traveler findings to correlate with historical data
 - Identify potential failure modes, areas for design and construction improvements, and enhanced screening evaluations

Laboratory analysis is underway to complement the historical data analysis

Plans to Complete Task

- Review and correlate data from research and DPA/CAs
- Identify potential problem areas that could escape the standard hybrid assurance process
- Create enhanced assurance flow to fill in the gaps
- Consider cost and schedule effect of enhancements – justify based on benefits
- Review results with manufacturers
- Report on results and enhanced assurance process