WHITE PAPER

Packaging for Aerospace

A buyer's guide to AS9100D, FOD control, and the conformity documentation an aerospace customer actually expects

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Executive Summary

Aerospace packaging fails differently. A cardboard box fails by getting crushed. A custom plastic tote fails by leaving a witness mark on a $50,000 titanium fitting, by depositing silicone on a surface that has to take paint at the next station, or by losing lot traceability on a flight-critical part. The damage is not to the packaging. It is to the part inside, and to the supplier's quality record.

This paper is for the packaging engineer or buyer at an aerospace OEM, Tier 1, or Tier 2 supplier scoping custom plastic packaging for parts that have to survive both the shipment and the audit. It covers what AS9100D actually means for a packaging vendor, the five jobs aerospace packaging has to do, the materials that belong in the program and the ones that do not, the conformity documentation an aerospace customer expects with every shipment, and the questions to ask a vendor before the RFQ goes out.

The short version: aerospace packaging is not a commodity. The cheapest tote is almost never the cheapest tote when the audit happens. Spec it right and the program runs quietly for years. Spec it wrong and the supplier has bigger problems than a damaged box.

1. Why Aerospace Packaging Is Different

Three things separate aerospace packaging from general industrial packaging. The parts inside are expensive. The supply chain is audited. And the cost of a single failure cascades into places that have nothing to do with packaging.

On the part side, a single titanium fitting, machined casting, or avionics module can cost more than the entire annual packaging program. A single scratched anodized surface, a single composite edge chip, a single contaminated bondline becomes a non-conformance report, a containment action, and sometimes a flight-line removal. Packaging that protects a $40 commercial part is not built to protect a $40,000 aerospace part.

On the supply chain side, AS9100D requires every supplier to be auditable. A packaging vendor that cannot produce material certs, lot trace, or conformity documentation becomes a finding on the customer's next surveillance audit. The cost shows up later as a corrective action, not at the receiving dock.

On the failure side, aerospace failures cascade. A piece of foam liner that sheds onto a wire harness becomes a FOD event downstream. A silicone-contaminated tote ruins a paint operation three steps later. A lost lot identifier on a flight-critical part can trigger a recall. The packaging is the cheapest part of the program, and the most expensive one to get wrong.

2. AS9100D, Explained

AS9100D is the quality management standard for the aerospace industry. It is built on ISO 9001:2015 and layers on aerospace-specific requirements: configuration management, First Article Inspection, counterfeit parts prevention, risk management, and product safety. It is audited by a registered third-party body on a regular surveillance cycle.

AS9100D certifies the management system, not individual parts. A part made in an AS9100D facility is not automatically aerospace-grade. What AS9100D tells the buyer is that the supplier runs a system the prime can trace through, hold accountable, and audit against.

There is a family of related standards. The table below sorts them out.

Standard	Applies to	What it certifies
AS9100D	Aerospace manufacturers and design organizations	A quality management system that adds aerospace-specific requirements (configuration management, FAI, counterfeit parts prevention, risk management) on top of ISO 9001.
AS9120B	Aerospace distributors and stockists	A QMS for organizations that buy, hold, and resell aerospace product without altering it. Focuses on traceability and lot integrity through the distribution chain.
AS9110C	MRO and repair stations	A QMS for organizations that perform maintenance, repair, and overhaul of aerospace product.
ISO 9001:2015	Any industry	The general-purpose quality management standard that AS9100D is built on. Required, but not sufficient, for most aerospace supply chains.

> *If a prime requires AS9100D in the flow-down, a non-certified packaging vendor cannot supply direct. The work has to flow through an AS9120B distributor or get re-quoted. The cost shows up as longer lead times and a markup. Verifying the vendor's certification before the RFQ goes out saves both.*

3. The Five Jobs Aerospace Packaging Has to Do

Strip away the documentation and the certifications and aerospace packaging still has to do five things. Get any one of them wrong and the program has a problem.

Job 1: FOD Control

FOD (Foreign Object Debris or Damage) is the single biggest packaging-related risk in aerospace. Anything that can migrate from the packaging into the part, the workstation, or eventually the aircraft is a FOD

source. Loose fibers from cardboard, plasticizer residue, foam crumbs, label adhesive, broken die-cut slugs, and silicone release agents are all FOD risks.

Aerospace-grade packaging is designed not to shed, flake, or transfer. That means sheet stock that holds its edges, dunnage that does not crumble after twenty cycles, welded seams instead of adhesives where possible, and labels that stay on without leaving residue when removed.

Job 2: Surface Protection

Aerospace parts have surfaces that matter. Anodized aluminum, plated steel, painted finishes, composite gel coats, polished optical surfaces, and machined sealing faces all have to arrive at the next station the way they left the last one. A witness mark from packaging is a non-conformance.

Design the dunnage pocket so the part contacts the packaging only where the drawing allows. Cradle the part on non-critical surfaces. Use anti-static foam, felt, or flocked liners on surface-critical contact zones. Avoid hard plastic against soft aluminum. Avoid sharp die-cut edges against polished surfaces.

Job 3: Contamination Control

The contamination spec is usually written into the customer's flow-down. The two most common requirements are silicone-free and hydrocarbon-free. Silicone migrates onto adjacent surfaces and prevents paint, primer, sealant, or adhesive from bonding at the next operation. Hydrocarbons leave residue that interferes with bonding and finishing the same way.

Silicone-free is harder than it sounds. Many plastic sheet stocks use silicone release agents during manufacturing. A tote labeled "polypropylene" is not necessarily silicone-free. Spec it explicitly and ask the vendor for the certification on the raw sheet, not just on the finished tote.

If the part touches a cleanroom downstream, the packaging has to be cleanroom-compatible. That means low particulate shed, no plasticizer migration, and material grades verified for the cleanroom class.

Job 4: ESD Control

Any avionics, sensor, harness, or board-level part that ships in plastic packaging needs ESD protection. Standard polypropylene and polyethylene are insulators. They build static charge. A static discharge into a sensitive component is a damage event whether or not anyone sees it happen.

ESD packaging comes in two grades. Static-dissipative materials (surface resistivity 1E6 to 1E9 ohms) drain charge slowly enough to protect against discharge events. Conductive materials (below 1E5 ohms) drain charge quickly and are used for higher-sensitivity components. The drawing or the customer spec tells you which one the part needs.

Job 5: Traceability

Every aerospace shipment expects a paper trail. Lot trace on the packaging is part of it. Material certs, conformity documents, and lot identifiers tie the packaging back to its raw material lot, its manufacturing run, its quality records, and its operator. Document retention runs 7 to 10 years depending on the prime and the program.

The audit question is not whether the packaging is good. It is whether the supplier can prove it three years from now. AS9100D suppliers build that record automatically. Non-AS9100D suppliers usually cannot.

4. Materials and Grades for Aerospace

Material selection is where most aerospace packaging programs go wrong. The right resin family is the easy part. The right grade within that family is the hard part. Same polypropylene, different release-agent history, different downstream result.

Material grade	Used for	Aerospace consideration
Silicone-free polypropylene	Returnable totes, dividers, dunnage cradles	Standard for parts headed to paint, bond, or coating downstream. Silicone migration ruins paint adhesion. Spec it explicitly.
Silicone-free corrugated polypropylene	Flat-pack totes, dividers, light dunnage	Same silicone concern as molded PP. Confirm the supplier's sheet stock is certified silicone-free, not just "silicone-free product family."
ESD polypropylene (static-dissipative)	Electronics, avionics, harness dunnage	Surface resistivity 1E6 to 1E9 ohms. Required for any part with ESD-sensitive components.
Conductive corrugated and sheet	Avionics, board-level handling, high-charge environments	Surface resistivity below 1E5 ohms. Use when static control is a hard spec, not a preference.
Cleanroom-compatible thermoformed sheet	Cleanroom assembly, optics, sensors	Low particulate shed, no plasticizer migration. ABS, polycarbonate, and PETG cleanroom grades are common. Match the cleanroom class.
Anti-static foam liners	Surface-critical parts in dunnage pockets	Low-outgassing, non-shedding. Pair with ESD substrate. Confirm the foam itself meets aerospace fire and smoke specs if cabin-adjacent.
Avoid: standard PVC, plasticized vinyl	Not aerospace appropriate without verification	Plasticizer migration and outgassing risk. Use only if the application is verified non-critical and the spec allows.

> *Spec material grade by name and by verification. "Silicone-free polypropylene" is not the same as "polypropylene" on a quote. "ESD" is not the same as "static-dissipative." Get the vendor to*

> *confirm the specific grade, the specific sheet stock, and the certification documentation before tooling.*

5. Conformity Documentation

Documentation is half the deliverable in aerospace. The packaging itself meets one set of requirements. The paperwork meets another. Both have to land in the receiving dock for the shipment to be acceptable.

WHAT AN AEROSPACE CUSTOMER EXPECTS

- Certificate of Conformance (CoC) tied to the lot or shipment, signed by an authorized quality representative.
- Material certs traceable from the finished tote back to the sheet lot and resin lot, retained for the program life plus the customer's retention requirement.
- First Article Inspection (AS9102 FAI) on the first production article of any new part. Delta FAI on subsequent revisions.
- Customer-specific quality clauses applied (Boeing D6-1276, D6-82479, Lockheed Martin PIM, Raytheon QN, Northrop, prime-specific flow-down).
- Configuration control tied to the drawing revision in effect at the time of manufacture.
- Counterfeit parts prevention statement where the program requires it.
- Document retention for 7 to 10 years (program-dependent), with retrievability on request.

A capable AS9100D vendor produces all of this as a matter of course. The supplier's quality system does it without the buyer having to ask. The buyer just verifies receipt.

6. ITAR and Export Control

If the part being packaged is ITAR-controlled, the packaging vendor inherits some of the export-control burden. The drawing carries restrictions. The geometry of the part can be export-controlled even when the packaging is not. The vendor has to handle the drawing as controlled technical data, restrict access to US persons (or licensed persons), and keep the records to prove it.

Most packaging vendors do not have ITAR controls in place. Asking the question before the RFQ goes out is faster than discovering the answer at first article. The right question is not just "are you ITAR compliant." It is "how do you handle controlled drawings, who at your facility sees them, and how do you prove that on audit?"

US-based fabrication helps. Single-facility fabrication helps more. Both narrow the question of where the controlled data lives.

7. What to Send a Vendor for an Aerospace RFQ

The aerospace RFQ has a longer checklist than a general industrial one. The fastest quote comes from the most complete package.

1	**Part drawing or 3D file with revision.** STEP or IGES preferred. Include the drawing revision and any geometry change notes.
2	**Surface and contamination spec.** Silicone-free, hydrocarbon-free, cleanroom class, ESD level, surface-critical contact areas.
3	**Customer-specific quality clauses.** Boeing D6-series, Lockheed Martin PIM, Raytheon, Northrop, or the prime's flow-down document. The vendor needs to know which clauses apply before quoting.
4	**Documentation required with each shipment.** Certificate of Conformance, material certs, lot trace, FAI, customer-specific reports.
5	**First Article Inspection.** AS9102 FAI required on first article? Full or delta FAI on revisions?
6	**ITAR or export control status.** Is the underlying part ITAR-controlled? Does the drawing carry export restrictions? Does the vendor need US-person handling?
7	**Volume, cadence, and program life.** Annual usage, expected program duration, projected revisions.
8	**Traceability requirements.** Lot control level, document retention period, serialization if applicable.
9	**Compliance and certifications.** AS9100D required at the vendor? AS9120B acceptable through a distributor? Specific accreditations the prime requires?
10	**Lead time target.** First-article date and production ramp.

> *Send the customer flow-down with the RFQ. Vendors who quote aerospace work without seeing the prime's quality clauses are either guessing or planning to deal with surprises after PO. Neither is acceptable on an AS9100D program.*

About Kiva Container Corporation

Kiva Container Corporation is a custom thermoforming and corrugated plastic shop in Anaheim, California. Founded in 1986. AS9100D and ISO 9001:2015 certified. Women-owned. All design, tooling, and production in-house at a single facility.

WHAT THAT MEANS FOR AN AEROSPACE PROGRAM

- AS9100D certification at the manufacturing facility, not contracted out through a distributor.

- Materials run include silicone-free polypropylene, ESD and conductive grades, FDA grades, and cleanroom-compatible sheet stock across thermoforming and corrugated plastic.
- Lot trace, material certs, and Certificate of Conformance produced as part of the quality system, not as a custom add-on.
- First Article Inspection (AS9102) on new programs.
- Single-facility fabrication in Anaheim, CA. No outsourcing of tooling, fabrication, printing, or finishing. ITAR-aware drawing handling.
- In-house design through production cycle, with 40 years of custom engineering in aerospace, medical, and material handling.

Most customers are packaging engineers and buyers at aerospace OEMs and Tier 1 / Tier 2 suppliers. Order profile runs from short prototype runs to repeat production. Custom engineering is the default, not the exception.

> *Have an aerospace program coming up? Send the part drawing, the flow-down, and the documentation requirements. We will tell you what we would change in the design and what the documentation package looks like before we quote.*

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