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AEROSPACE RECOMMENDED PRACTICE

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Superseded by ARP9134

Supply Chain Risk Management Guideline

RATIONALE

ARP9113 is a duplicate of ARP9134. Therefore, we are cancelling ARP9113.

CANCELLATION NOTICE

This document has been declared "CANCELLED" as of March 2012 and has been superseded by ARP9134. By this action, this document will remain listed in the Numerical Section of the Aerospace Standards Index noting that it is superseded by ARP9134.

Cancelled specifications are available from SAE.

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1. INTRODUCTION:

1.1 Purpose:

Aerospace businesses depend upon a complex network of suppliers, each one exposed to a different assortment of risks that could jeopardise supply businesses. Because supplier networks are becoming increasingly wide-spread as more suppliers across the world become available to the industry (some in countries that are not covered by recognised national and inter-national authorisation), early identification and management of those supply chain risks that could affect product/service quality becomes increasingly necessary. The application of supply chain risk management provides business protection by ensuring the continued success of the customers supply base in delivering products/ services in accordance with programme and quality requirements.

Supply chain risk awareness should be part of an integrated business culture.

This document may be used as an “aide memoire” to supplement the existing risk management philosophy of the user. As such, each user of the guideline is free to apply it to its own selected/ categorized suppliers, and to select, according to their needs, the risk factors and associated elements to be assessed.

Documented risk factors and elements to be assessed are not exhaustive and may be enlarged by the respective risk factor owner.

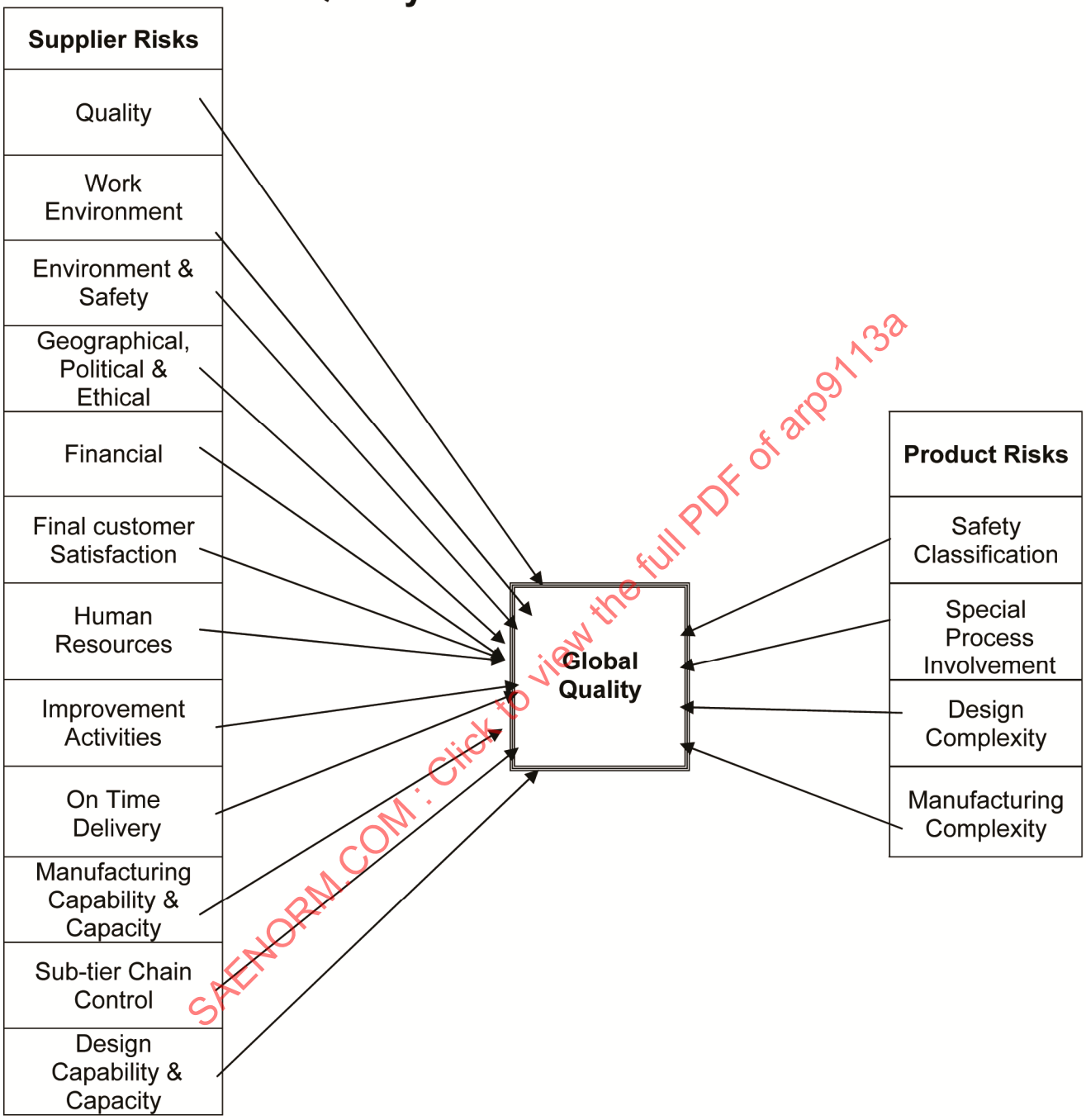
The frequency of reassessment is the responsibility of each user of the guideline (e.g., 6 months; 12 months; 2 years, etc.).

1.2 Scope of the Document:

Supply Chain Risk Management (SCRM), defined in this guideline, can be applied proactively for the protection of all procured products and services; both flying and non-flying through all levels of the supply chain.

The guideline focuses on Quality as a key risk assessment factor taking into account elements from all aspects of the business having a direct link to global quality management. This concept/model is shown below:

Quality Risk Assessment Model



1.2 (Continued):

While traditional “small q” Quality is a key element to be assessed, from a company business point of view, other elements play an important part in minimising risk. This guideline defines such risk factors for consideration.

SCRM as a business protection tool will be most effective when used to identify, and reduce risks when generating new business with new and existing suppliers. However the tools and techniques described hereafter can also be applied to evaluate the existing supply chain network and determine the level of control required.

The SCRM can be applied by merging identified risk factors associated with procured products or services and the supplier itself with the target for overall supplier quality risk management (see Chapter 6).

This guideline is recommended to be cascaded to sub-tier suppliers in the supply chain.

1.3 Guideline of the Document:

Quality risk identification and recording is the responsibility of everybody associated with Customer procured products and services.

This may also include Purchasing, Contractual, Logistics, Finance, Cost Estimating, Engineering (all design and manufacturing disciplines), Configuration control, Project, Operations and Business Management, etc.

Having identified and recorded a risk that could affect quality, it is essential that the risk is managed effectively through a designated person/department.

As a means of managing the risk process it is recommended to use the “risk register form” (Appendix B) and the “risk assessment scoring chart” (Appendix A).

2. RISK FACTOR DEFINITION:

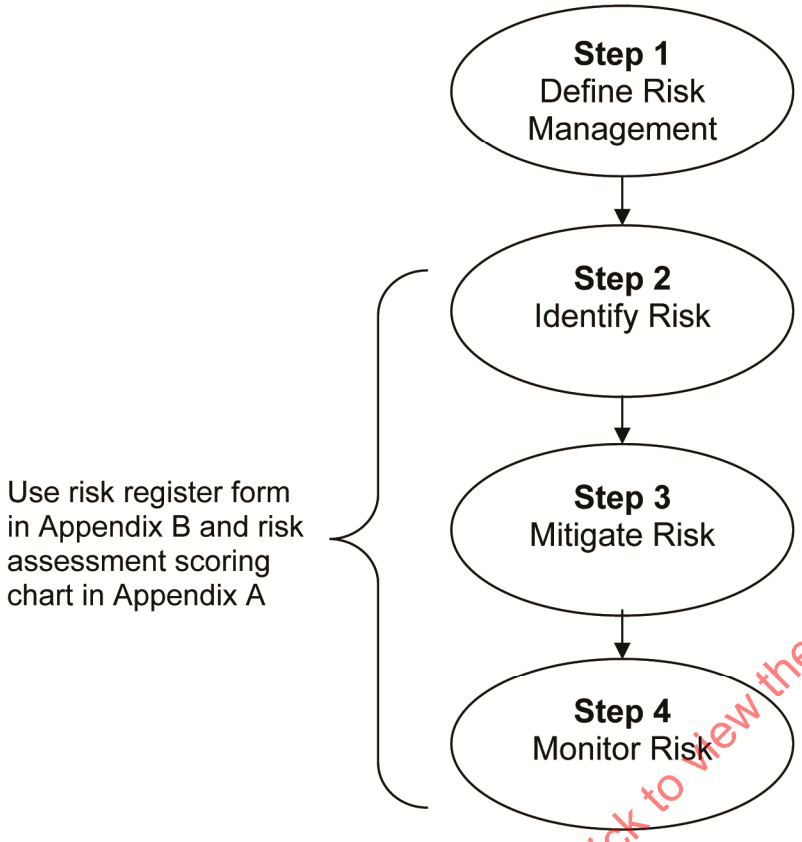
2.1 Supplier Risk:

On time Delivery	Capability to deliver products and/or services to the Customers scheduled requirement
Quality	Capability to deliver products and/or services to the Customers quality requirement
Sub-tier chain control	Capability to manage and control all sub-tier suppliers in the supply chain.
Manufacturing Capability and Capacity	Capability to provide manufacturing services in accordance with the contract requirements
Environment & Safety	Capability to manage environmental, health and safetyfactors which may affect the project/program
Work Environment	Capability to manage work environment factors such as temperature, humidity, lighting, cleanliness, protection from electrostatic discharge, etc. according to JISQ;EN/AS 9100:2001 that may affect the conformity of the product
Geographical, Political & Ethical	Capability to manage social, geographical, political, economical & ethical factors which may affect the project/program
Financial	Capability to manage factors which may affect the project/program
Final customer satisfaction	Factors that affect customers expectations
Human resources	Human resources factors which affect the quality and confidence of the customer
Improvement activities	Capability for continuous improvement
Design Capability and Capacity	Capability to provide design services in accordance with the contract requirements

2.2 Product Risk:

Safety Classification	In accordance with regulatory authority requirements
Special Process Involvement	Those processes where the parameters are directly influenced by component, geometry and/or the results can not be confirmed by inspection
Design Complexity	Capability to design innovative solutions that meet customer requirements
Manufacturing Complexity	Capability to manufacture components to meet the complex design intent

3. PROCESS STEPS TO APPLY THE GUIDELINE:



- Define risk management process
- Including risk factors and risk factor ownership
- Identify functions involved

- Assess, identify and report the risks
- Evaluate the risk
- For risk identification it is recommended to use checklists

- Decide if the risks may be accepted without action
- Define action plan to reduce unacceptable risk

- Follow up the consequences of risks that where accepted without action
- Monitor the effectiveness of action plan
- Escalate or close out as required

4. PRODUCT RISK TABLES FOR GUIDANCE:

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Safety Classification	Safety classification process Classified part manufacturing Control of classified parts to Customers requirements Customer approval status (e.g., agreement to manufacture certain parts classification)	Checklist for process assessment	Improvement of safety classification process Recovery plan Life Limited Overhaul inspection Retrofit Classification plan Limitation for procurement

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Special Process Involvement	Each special process Employee skills, experience and certification Documentation for special processes, including qualification file Evidence of control parameters Equipment Special process approval documentation issued by other customers (e.g., certificate, report)	Checklist covering all elements to be assessed including review of approval files Key process indicators	Training On site assistance Limitation for procurement Recovery plan Quality inspection plan Statistical process Control Frozen process parameters

4. (Continued):

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Design Complexity	Design & Development Plan Technologies involved Material selection/resources Design maturity level Previous experience Number of Sub-components Similarity of existing designed product Feasibility to manufacture the design	Design process audit FMEA (Failure Modes and Effect Analysis) Lesson learned Design of Experiments Review of current development plan Tolerance analysis	Updated Design and Development plan including tests Concurrent engineering Requirements review with Customer Technology to be adopted Performances required including cost & timeframe Design for six sigma

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Manufacturing Complexity	Equipment Documentation for processes, including qualification file Control parameters Existing & specialist Experience Equipment Production Control System Knowledge material used Design complexity	Checklist covering all elements to be assessed Process Indicators on capability & stability	Sealed Manufacturing Plan Manufacturing Plan improvement SPC, six sigma New process development Dual source Training on exotic material Concurrent Engineering investment for new equipment Optimise material/product flow

5. SUPPLIER RISK TABLES FOR GUIDANCE:

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Quality	Quality System Approvals/certification: ↘ Aerospace (JISQ, AS/EN9100 series, regulatory authority requirements etc.) ↘ Non Aerospace Customer Special processes approval/certification (customers, NADCAP, etc.) Previous supplier experiences on similar products to be identified Current Aerospace Customers references Contract review process Quality performance indicators (e.g., scrap, concession rate, quality system scoring result, Customers audit results, etc.)	Checklists covering elements to assess risk e.g.: ↘ Quality System assessment per SJAC, AS/EN9101 ↘ Supplemental checklist for other elements	Continuous Improvement plan agreed by suppliers with suppliers mandatory indicators and corrective action request Quality Assurance Plan Specific training on identified weaknesses and specific requirements Selection of relevant parts Increased products receiving inspection Identify frozen process parameters Assistance on site (including people on site for a limited time) Mandatory FAI per SJAC, AS/EN 9102 Management of process variation (SPC) Unscheduled requirements delivery versus MRP Dual source Buffer stock

5. (Continued):

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Environment Safety	ISO 14001 certification Hazardous products involved Safety plant classification (if any) Accident rating in the past years with trend Safety policy (e.g., equipment availability, fire escape) Training for health & safety	Specific checklist depending on nature of supply Analysis of safety rules/controls implemented by supplier Supplier action plan overview	Mitigation plan Dual source Buffer Stock

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Work Environment	JISQ, AS/EN 9100:2001 requirements (Chapter 6.4)	Specific checklist depending on nature of supply Quality system assessment per SJAC, AS/EN 9101	Preventive and/or corrective action plan Part/process specific work environment plan

5. (Continued):

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Geographical, Political & Ethical	Political regime Restriction on government funded design and manufacturing technology transfer to specific nations Government export and import restrictions Export credits, support & guarantees government handling Tax & customs rules Government policy for counter trade and off set Potential for natural disasters Country economical aspects (inflation, gross national product per habitant, average wages, economical growth, export level, import level, external debt, interest rate, Energy cost, etc.) in relation to developed countries. Visit of plant for ethic aspect in compliance with ILO 182 clauses (child employment)	Specific checklist covering element to assess Various web and government sources	Mitigation plan Dual source Buffer Stock On Site surveillance assistance Translator for Prime's language Specific clauses on the purchase contract for child care Supplier stoppage with recovery plan (child care)

5. (Continued):

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Financial	Date of foundation & history Major shareholders Contract connection (Holding, merging) Capital evolution/breakdown Turnover Ratio of Capital/Turnover Results Earning before interest & tax Investment Self financing capacity % of turnover for the research and development Financial debt Dependence rate with customers Legal company structure	Checklist taking into account all element for assessment Various external database (e.g., Internet, Financial Intelligence Agencies) Annual report	Mitigation plan Dual source Buffer stock

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Final Customer Satisfaction	JISQ AS/EN 9100 with additional investigation such as : ↘ Number of Quality escapes ↘ Number of Customers Quality complaints affecting supplied product General communication between all Functions Responsiveness level and effectiveness: ↘ for Customers Quality complaints ↘ after quality escape Concession rate	Checklists covering elements to assess risk e.g. : ↘ Quality System assessment per SJAC AS/EN9101 with scoring results ↘ Supplemental checklist for other elements Identification/review of current indicators	Continuous Improvement plan agreed by suppliers with suppliers mandatory indicators (e.g., customer perception) Increasing surveillance & inspections (product, process, product receiving inspection) Supplier stoppage with recovery plan

5. (Continued):

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Human Resources	JISQ, AS/EN 9100 with additional investigation such as: ↘ Supplier staff ratio of management and operational level through all Functions, e.g. : - Commercial (sales & after sales - Studies/Engineering - Production (Management, process engineering, production assembly, …) - Purchasing - Information system - Quality (Quality assurance, methods, inspection, laboratories, investigation/inquiry, …) Other performance metrics e.g., sickness, accident, strike, training plan, competence matrices Staff evolution during the last three years (temporary or fixed duration contract personnel, departures, number of recruited persons, average seniority, average age) Skill and education level of employees through all functions Percentage of relevant employees speaking the language of the customer or English	Checklists covering elements to assess risk, e.g.: ↘ Quality System assessment per SJAC, AS/EN9101 with scoring results ↘ Supplemental checklist for other elements Review of organization charts	Improvement plan agreed by suppliers Resource planning On site surveillance assistance Buffer stock Dual source

5. (Continued):

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Improvement Activities	JISQ, AS/EN 9100 with additional investigation: Review of existing internal supplier key performance indicators Existence of a continuous improvement plan and policy on all processes identified (lead time, quality, cost reduction, customer satisfaction, etc.) Existence of Quality models such as EFQM,TQM (European Foundation for Quality Management, Total Quality Management, six sigma, AQS, etc.) Existence of business efficiency activities (e.g., lean tools and techniques, continuously being used, 5S, cost reduction, ...)	Checklists covering elements to assess risk, e.g.: ↘ Quality System assessment per SAJC, AS/EN9101 with scoring results ↘ Supplemental checklist for other elements Assessment of continuous improvement plan results from the last 3 years and future objectives Process capability measures	Specific training on identified weaknesses (e.g., root cause analysis) Assistance to put in place continuous improvement plans when necessary Mandatory strategy plan Oversight of the effectiveness of improvement plan

5. (Continued):

Risk Factors	Elements for Assessment	Risk Identification Tools	Risk Reduction Control Tools
On Time Delivery	Current delivery performances Current action to reduce lead-time through lean techniques Infrastructure & transport availability Supplier Internal delivery indicators System in place for internal production management (manual, computerized) including ↘ Management of change ↘ Priority system ↘ Capacity planning (per operation, per P/N, per machine, per job, etc.) ↘ Alert process ↘ Recovery plan process with procedures Sub-tiers and sourcing management system including sourcing alert process Manufacturing Review Planning (MRP2) system Customers alert process Logistics audit results performed by other Customers Resource for new product introduction	Specific checklist for production control Identify and check Supplier procedures covering elements assessed Delivery performance measures	Specific training on identified weaknesses Buffer stock Recovery plan Lead-time taking into account infrastructure & transport Assistance on site (including people on site for a limited time) Free-issue material (provided by customer) Continuous Improvement plan agreed by suppliers with suppliers mandatory indicators and Corrective Action request Dual source

5. (Continued):

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Manufacturing Capability and Capacity	**Capability:** Key processes identified and under control for each part number Process capability known through Statistical Process Control (SPC) Type equipment & facilities Special process capability	Application of SAJC, AS/EN9103 Control charts checking results Specific checklist covering all elements to assess List of processes, facilities and equipment available	Specific training on identified weaknesses Continuous Improvement plan agreed by suppliers with suppliers mandatory indicators and Corrective Action request Supplier sampling inspection relevant to process capability Customer specific inspection plan on site for capability concern or increased receiving inspection On site assistance Dual source
	Capacity: Sufficient equipment, facilities & processes available relevant to products being purchased Lead time identified with critical path for each part number Bottleneck identification process	Specific checklist covering all elements to assess List of processes, facilities and equipment available	Orders in compliance with agreed capacity Mandatory action plans for bottlenecks and critical path failures Assistance to reduce lead time Dual source

5. (Continued):

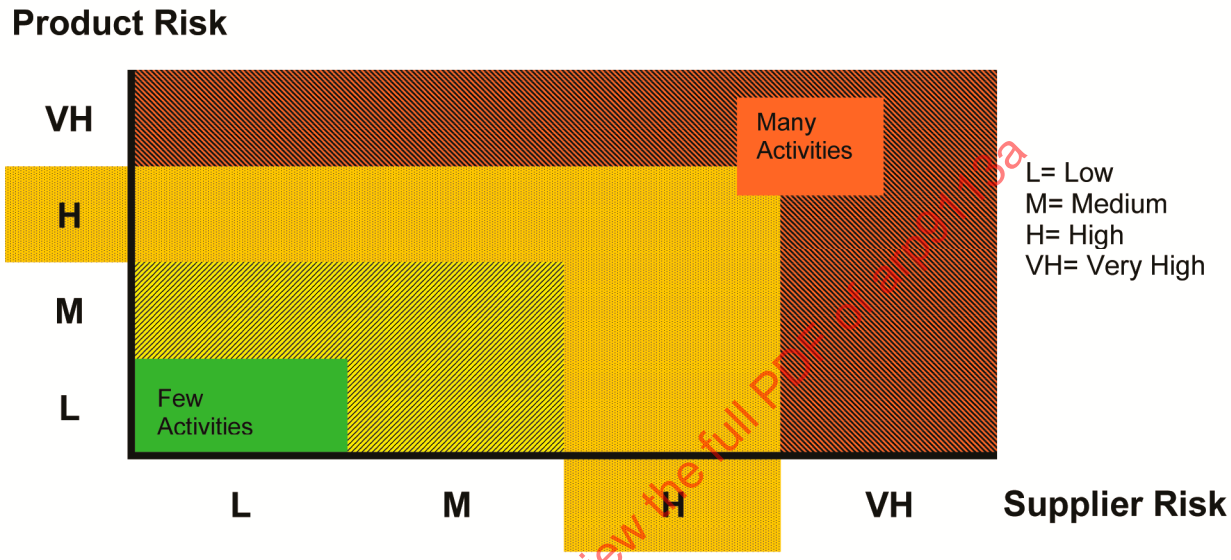
Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Sub-tier Chain Control	JISQ, AS/EN 9100 with additional investigation: Documentation management within the supply base FAI acceptance process Sub-tier monitoring process (receiving inspection, audits on site, frequency, risk management, indicators, etc.) with an identified program/plan Supply chain cascade process and activities covered during audits performed by direct supplier (system, process, product) Corrective Action process & follow-up to sub-tiers Traceability of record process Continuous improvement plan focused on quality sourcing	Checklists covering elements to assess risk e.g.: ↘ Quality System assessment per SJAC, AS/EN9101 with scoring results ↘ Supplemental checklist for other elements	Specific training on identified weaknesses and specific requirements Quality Assurance Plan required by direct supplier of sub-tiers JISQ, AS/EN9100 requirements flow-down with appropriate audits performed by suppliers Audits on site with direct supplier (system, process & product) Mandatory sub-tiers Continuous Improvement plan agreed by suppliers with suppliers mandatory indicators and corrective action request

5. (Continued):

Risk Factors	Element for Assessment	Risk Identification Tools	Risk Reduction Control Tools
Design Capability and Capacity	JISQ, AS/EN 9100 with additional investigation Validation by corresponding expert of various reviews at each major milestone Classification of design capabilities Electronic Data Process (EDP) tools in use and data exchange between customer, supplier and supply chain Capability of current tools Existence of procedures and tools for validation/ qualification in connection with Customers requirements Use of cross functional development team (Concurrent Engineering) Lead time identified with critical path for each design activity (identification of milestones, reviews, …) Identification of bottlenecks Implementation Corrective action process Lesson learned process	Quality System assessment per JISQ, AS/EN 9101 with scoring results Specific checklist covering all elements to assess	Continuous Improvement plan agreed by suppliers with suppliers mandatory indicators and corrective action request Specific training on identified weaknesses Assistance on site Customer participation to certain reviews organized by suppliers Selection of relevant design activities Cross-checking of qualification tests versus requirements Quality Assurance Plan Design resource back-up plan

6. MODEL FOR SUPPLIER/ PRODUCT RISK MERGER:

This chart may be used as an indicator of the criticality of a particular supplier. Based on the merger of the supplier/product risk assessment scoring charts (Appendix A) the final risk can be made visible. It may be used as an indicator for determining the frequency of reviews carried out by respective risk factor owners as defined below.



7. RISK REDUCTION/CONTROL ACTIVITIES:

Based on the identified supplier/product risk the user should define the necessary activities to mitigate the related risk (see the previous tables for guidance).

APPENDIX A
RISK ASSESSMENT SCORING CHARTS

SUPPLIER RISK ASSESSMENT
PRODUCT RISK ASSESSMENT

SUPPLIER :		Risk Level							
	Supplier Risk Assessment (SRA)	1	2	3	4	weighting	Result	Max. possible. Result	**Risk register Yes No**
N° A	**On time delivery**								
N° A.1	Delivery performance								
N° A.2	Action to reduce lead time								
N° A.3	Infrastructure & transport								
N° A.4	Supplier internal delivery indicator								
N° A.5	System in place for internal production management								
N° A.6	Sub-tiers & Sourcing								
N° A.7	Manufacturing Review planning								
N° A.8	Customer alert								
N° A.9	Logistic audit results performed by other customer								
N° A.10	Resource for new product introduction								
	Total Risk								
N° B	**Quality**								
N° B.1	Quality System Approval/Certification								
N° B.2	Aerospace								
N° B.3	Non Aerospace								
N° B.4	Special Processes approval/certification								
N° B.5	Previous supplier experience on similar products								
N° B.6	Current Aerospace Customer reference								
N° B.7	Contract review process								
N° B.8	Quality performance indicator								
	Total Risk								
N° C	**Financial**								
N° C.1	Date of foundation & history								
N° C.2	Major shareholders								
N° C.3	Contract connection								
N° C.4	Capital Evolution / breakdown								
N° C.5	Turnover								
N° C.6	Ratio Capital / Turnover								
N° C.7	Results								
N° C.8	Earning before interest & tax								
N° C.9	Investment								
N° C.10	Self financing capacity								
N° C.11	Percentage of turnover for research & development								
N° C.12	Financial debt								
N° C.13	Dependence rate with customers								
N° C.14	Legal company structure								
	Total Risk								

SUPPLIER :		Risk Level							
Supplier Risk Assessment (SRA)		1	2	3	4	weighting	Result	Max. possible Result	Risk register Yes No
N° D.	**Improvement Activities**								
N° D.1	JISQ/AS/EN 9100 with additional investigation								
N° D.1	Review of internal KPI's								
N° D.2	Existence of continuous improvement plan								
N° D.3	Existence of Quality models								
N° D.4	Existence of business efficiency activities								
	Total Risk								
N° E	**Environment & Safety**								
N° E.1	ISO 14 001 certification								
N° E.2	Hazardous products involved								
N° E.3	Plant Safety classification								
N° E.4	Accident rating in the past years & trend								
N° E.5	Safety policy								
N° E.6	Training on health and safety								
	Total Risk								
N° F.	**Human Resources**								
N° F.1	JISQ/AS/EN9100 with additional investigation								
N° F.2	Performance metrics e.g. sickness, strike, training								
N° F.3	Staff evolution during last 3 years								
N° F.4	Skill and education level of employees through all functions								
N° F.5	Percentage of employees speaking language of customer and English.								
	Total Risk								
N° G.1	**Final Customer Satisfaction**								
N° G.2	JISQ/AS/EN9100								
N° G.3	Number of quality escapes								
N° G.4	Number of customer complaints								
N° G.5	Communication between all functions								
N° G.6	Concession rate								
N° G.7	Responsiveness level and effectiveness								
	Total Risk								
N° H.	**Geographical, Political, Ethical**								
N° H.1	Political Regime								
N° H.2	Restriction on government funded design & manufacturing								
N° H.3	Government export and import restriction								
N° H.4	Export credits, support & guarantees								
N° H.5	Tax & custom rules								
N° H.6	Government policy for counter-trade and off set								
N° H.7	Potential for natural disasters								
N° H.8	Country economical aspects								
N° H.9	Visit of plant for ethical aspects ILO 182 (children employment)								
N° H.10	Language used								
	Total Risk								

SUPPLIER :		Risk Level							
Supplier Risk Assessment (SRA)		1	2	3	4	weighting	Result	Max. possible Result	Risk Register Yes No
N° I	**Design Capability and Capacity**								
N° I.1	JISQ/AS/EN 9100 with additional investigation								
N° I.2	Validation by corresponding expert of various reviews and each major milestone								
N° I.3	Classification of design capabilities								
N° I.4	Electronic data process (EDP) tools in use and data exchange between customer, supplier, supply chain								
N° I.5	Capability of current tools								
N° I.6	Existence of procedures and tools for validation, qualification in connection with customer requirements								
N° I.7	Use of cross functional development team (concurrent engineering)								
N° I.8	Lead time with critical path for each design activity								
N° I.9	Identification of bottlenecks								
N° I.10	Implementation corrective action process								
N° I.11	Lesson learned process								
	Total risk								
N° J	**Manufacturing Capability and Capacity**								
N° J.1	Key process identified and under control								
N° J.2	Machine capabilities (SPC)								
N° J.3	Sufficient equipment, facilities & processes available relevant to products being purchased								
N° J.4	Lead time identified with critical path for each part number								
N° J.4	Bottleneck identification process								
	Total risk								
N° K.	**Sub tier chain control**								
N° K.1	JISQ/AS/EN 9100 with additional investigation								
N° K.2	Document management among supplier bases								
N° K.3	FAI acceptance process								
N° K.4	Sub tier monitoring process								
N° K.5	Supply chain cascade process								
N° K.6	Corrective action process and follow -up								
N° K.7	Traceability of record process								
N° K.8	Continuous improvement plan								
	Total risk								
					⇨ R			⇦	M

Supplier Risk Assessment Scoring (SRAS) = R x 20 / M =

D VERY HIGH	**C HIGH**	**B MEDIUM**	**A LOW**

The responsible risk leader agrees on the risk scoring		
Representative :	**Signature :**	**Date :**