



Audit Process
&
Root Cause Analysis
4th September 2024



Today's Objectives

- Quick Poll
 - Introduction
 - Some key definitions & terminologies
 - Basic audit process
 - Audit challenges faced by operators
 - Best industry practices for audit performance
 - *Detailed example of Flight Safety Foundation Basic Aviation Risk Standard*
 - 7 basic quality tools for root cause analysis
 - *Detailed example on non-mission ready flight*
 - Conclusion – *What lies ahead? Future of auditing.*
 - Robert Sumwalt AsBAA Virtual Safety Summit 2020
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What are the top 5 challenges you face today?

Source: ASQ

- ☐ Adapting to Technological Advances & Industry 4.0
- ☐ Ensuring Regulatory Compliance & Quality Standards
- ☐ Managing Supply Chain Complexity & Risk
- ☐ Balancing Cost Efficiency with Quality
- ☐ Driving a Culture of Quality & Continuous Improvement
- ☐ Insufficient Communication & Coordination
- ☐ Difficulty Measuring Quality Metrics
- ☐ Employee Resistance to Change & Lack of Buy-In
- ☐ Limited Resources & Budget Constraints

Introduction

“A project or process is made up of primary components aimed toward successful completion of the project/process objectives. Those individual components are the deliverables.

In other words; you have Inputs and Outputs. An Output is a deliverable resulting from the process (Input).

The old aphorism “Everyone is responsible for quality” is strongly encouraged throughout ISO 9001:2015.

*Therefore, with the adage of Risk Based Thinking to the new standard, the Quality manager and the QA department would be responsible for the deliverables of their department and its processes. **They would also be responsible for discerning any risks to the company’s goals and objectives.”***

Bud Salisbury

ASQ Senior Member, CQT, CQI

<https://asqasktheexperts.org/2015/11/12/iso-9001-2015-deliverables-and-processes/>



Definitions

Online Oxford Dictionary

Quality Audit

Audit



audit

/ˈɔːdɪt/

noun

an official inspection of an organization's accounts, typically by an independent body.
"audits can't be expected to detect every fraud"

verb

1. conduct an official financial inspection of (a company or its accounts).
"unlimited companies must also have their accounts audited"

Similar: inspect examine survey look over go over go through ▼

2. **NORTH AMERICAN**
attend (a class) informally, without working for credit.
"he made use of the knowledge gleaned from economics classes he audited"

Quality



quality

/ˈkwɒləti/

noun

1. the standard of something as measured against other things of a similar kind; the degree of excellence of something.
"an improvement in product quality"

Similar: standard grade class classification calibre status condition ▼

2. a distinctive attribute or characteristic possessed by someone or something.
"he shows strong leadership qualities"

Similar: feature trait attribute characteristic point aspect facet ▼

adjective **INFORMAL**

of good quality; excellent.
"he's a quality player"

Root Cause

Root



noun

1. the part of a plant which attaches it to the ground or to a support, typically underground, conveying water and nourishment to the rest of the plant via numerous branches and fibres.
"cacti have deep and spreading roots"

Similar: radicle rhizome rootstock tuber tap root rootlet radicle

2. the basic cause, source, or origin of something.
"money is the root of all evil"

Similar: source origin starting point seed germ beginnings genesis

verb

1. cause (a plant or cutting) to grow roots.
"root your own cuttings from stock plants"

Similar: plant bed out sow

2. establish deeply and firmly.
"vegetarianism is **rooted in** Indian culture"

Similar: embedded fixed firmly established implanted deep-rooted

Cause



noun

1. a person or thing that gives rise to an action, phenomenon, or condition.
"the cause of the accident is not clear"

Similar: source root origin beginning(s) starting point seed germ

2. a principle, aim, or movement to which one is committed and which one is prepared to defend or advocate.
"she devoted her whole adult life to the cause of deaf people"

Similar: principle ideal belief (in) conviction tenet object end

verb

make (something, especially something bad) happen.
"this disease can cause blindness"

Similar: bring about give rise to be the cause of lead to result in create



Root Cause (American Society of Quality)

- **Root cause:** A factor that caused a nonconformance and should be addressed with corrective action.
- **NEW! Root cause analysis:** The method of identifying the cause of a problem, solving it and preventing it from occurring again. Uncovering the correct and accurate reason(s) why something is happening or has already occurred.
- **Assignable cause:** A name for the source of variation in a process that is not due to chance and therefore can be identified and eliminated. Also called “special cause.”

What is an audit?

KCAA: *Quality Audit – A systematic and independent comparison of the way an operator's activity is being conducted against the way the published procedure says it should be conducted. A Quality Audit is also used to confirm that policies, structures, facilities, resources and procedures remain relevant to the certificate holder's operation and effective in maintaining standards.*

ISO: 3.1
audit

systematic, independent and documented process for obtaining *objective evidence* ([3.8](#)) and evaluating it objectively to determine the extent to which the *audit criteria* ([3.7](#)) are fulfilled

Note 1 to entry: Internal audits, sometimes called first party audits, are conducted by, or on behalf of, the organization itself.

Note 2 to entry: External audits include those generally called second and third party audits. Second party audits are conducted by parties having an interest in the organization, such as customers, or by other individuals on their behalf. Third party audits are conducted by independent auditing organizations, such as those providing certification/registration of conformity or governmental agencies.

[SOURCE: ISO 9000:2015, 3.13.1, modified — Notes to entry have been modified]

What is an audit?

ASQ:

The on-site verification activity, such as inspection or examination, of a process or quality system to ensure compliance to requirements. An audit can apply to an entire organization or might be specific to a function, process or production step.

FSF BARS: © 2023 FSF Ltd | BAR Standard Program Manual - Version 11 (01 Oct 2023)

Audit:	A structured and objective review conducted under the Program by an Audit Team on an Operator in order to establish the level of conformity with the Standard by the Operator on that particular day.
Auditing:	The process of conducting an Audit by an Audit Team.
Auditor:	An experienced aviation lead auditor who meets the requirements for a Program accredited auditor, who has completed the process of qualification and has been accredited by the FSF as an Auditor. [AU]

Simplified audit definition

Simplifeid:

SAY what we DO, DO what we SAY!

Parties involved:

Auditor/ Audit Team & an Auditee/ Auditees.

CAPA

Corrective action: A solution meant to reduce or eliminate an identified problem.

Corrective action recommendation

(CAR): The full cycle corrective action tool that offers ease and simplicity for employee involvement in the corrective action/process improvement cycle.

Cost of poor quality (COPQ)

The costs associated with providing poor quality products or services.

There are four categories:

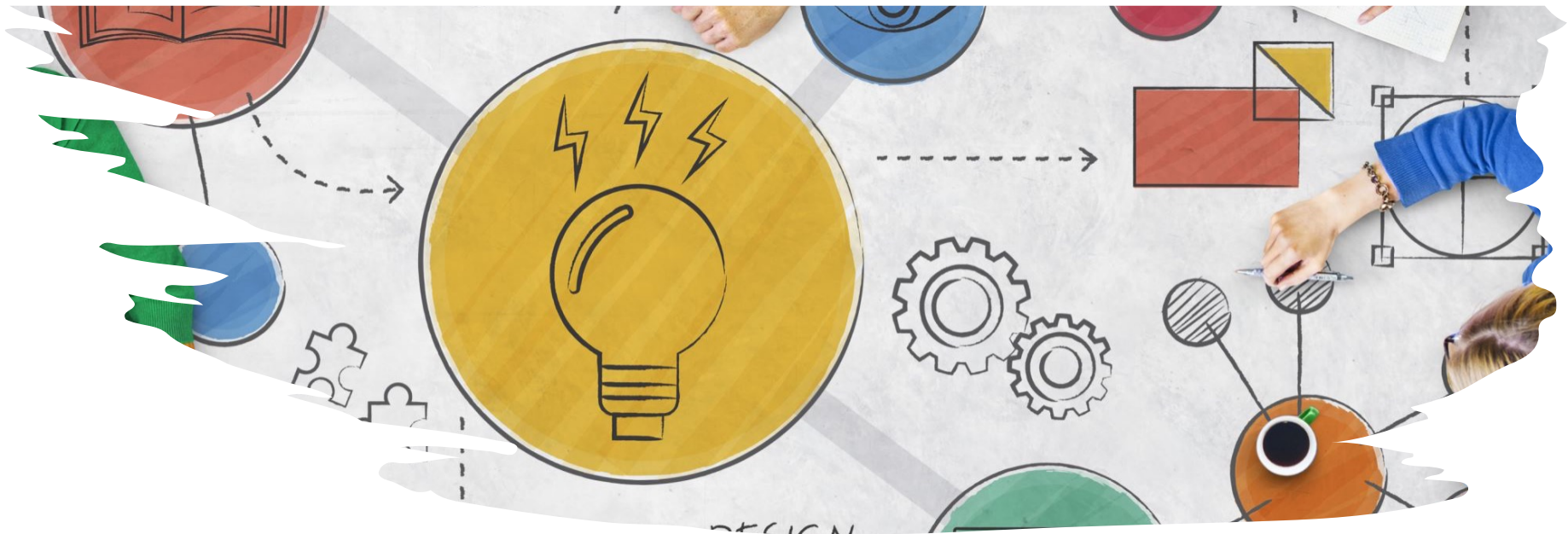
- ✓ internal failure costs (costs associated with defects found before the customer receives the product or service),
- ✓ external failure costs (costs associated with defects found after the customer receives the product or service),
- ✓ appraisal costs (costs incurred to determine the degree of conformance to quality requirements) and
- ✓ prevention costs (costs incurred to keep failure and appraisal costs to a minimum).

Cost of quality (COQ) is another term for COPQ. It is considered by some to be synonymous with COPQ but is considered by others to be unique. While the two concepts emphasize the same ideas, some disagree as to which concept came first and which categories are included in each.

Cost of Quality

Activity-based costing: An accounting system that assigns costs to a product based on the amount of resources used to design, order or make it.

Failure cost: The cost resulting from the occurrence of defects. One element of cost of quality or cost of poor quality. These costs can be categorized as internal or external.



Audit Process

Purpose of an audit

- 1) **Monitor** the ongoing compliance with applicable regulations, standards and rules for all audited areas
- 2) **Provide** objective evidence that Operator and sub/contracted organisations meet Operator's, regulatory, safety, security and quality requirements, or rules, and stated operational needs.
- 3) **Provide** the organisation with an opportunity to continuously improve its system by identifying hazards, relevant operational safety or security events that have occurred, areas of waste, inefficiency, deficiency and excessive re-work areas which, once corrected, should result in higher company profitability, performance and efficiency

The Audit Process *(adopted from SCAR template)*

CAR Steps	Auditee	Auditor	Quality Manager
CAR entry		Create CAR request for written Corrective action.	
Containment	Review CAR, work on containment action.		
Investigation/root cause analysis Corrective action	Perform root cause analysis and determine action plan.	Determine whether internal actions such as NTC, DCO or CAPA are required.	Follow up progress with the auditor. Check whether RCCA is on track.
Implementation & Review responses	Document investigation, plans and implemented actions, and forward to the Auditor.	Review and approve responses if RCCA are verifiable.	
Effectiveness & Closure		Verify CAPA done as per the verification plan. Sample the plan for CAPA	Sign and close CAR if verification is performed as per the plan.

CAPA = corrective and preventive action

DCO = documents amended

NTC = Fleet Notice/ Maintenance Advisory/ Ops Memo

CAR = corrective action request

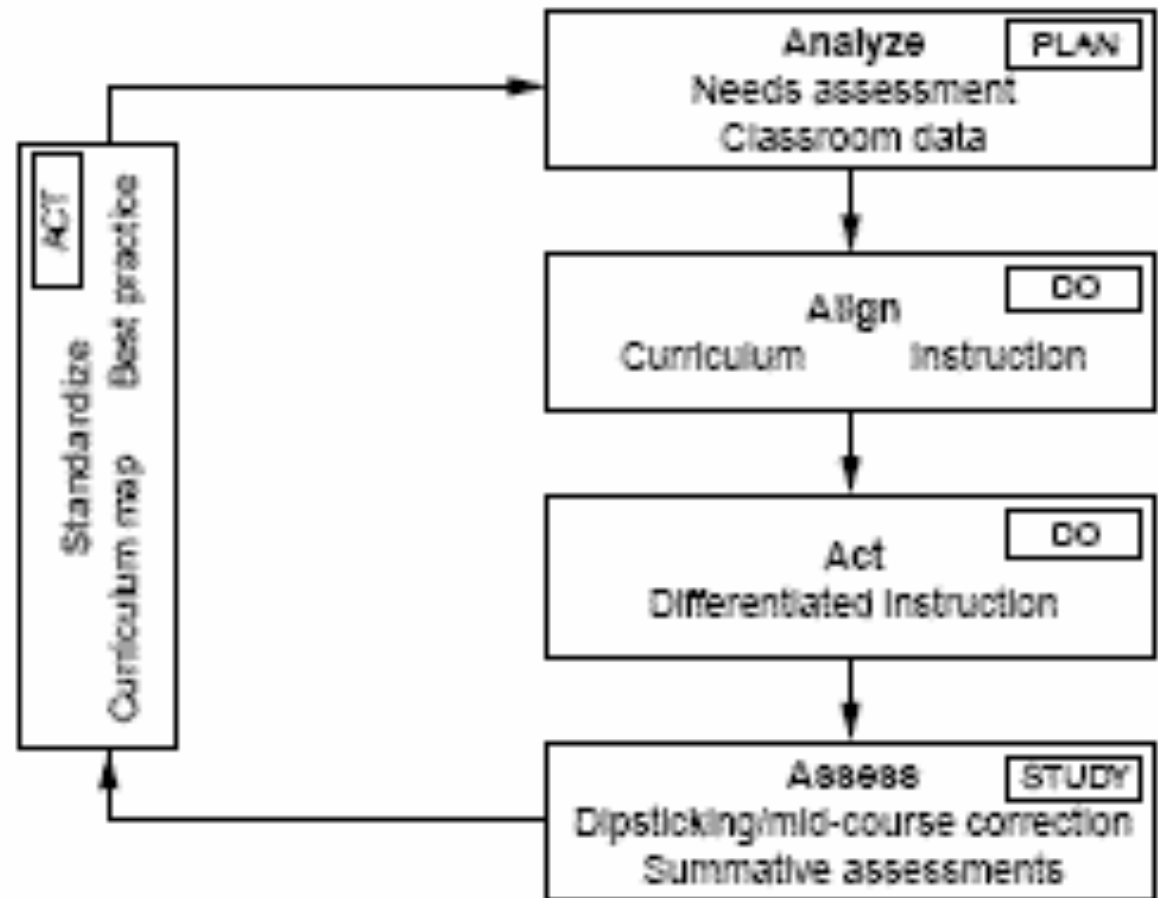
RCCA = root cause corrective action

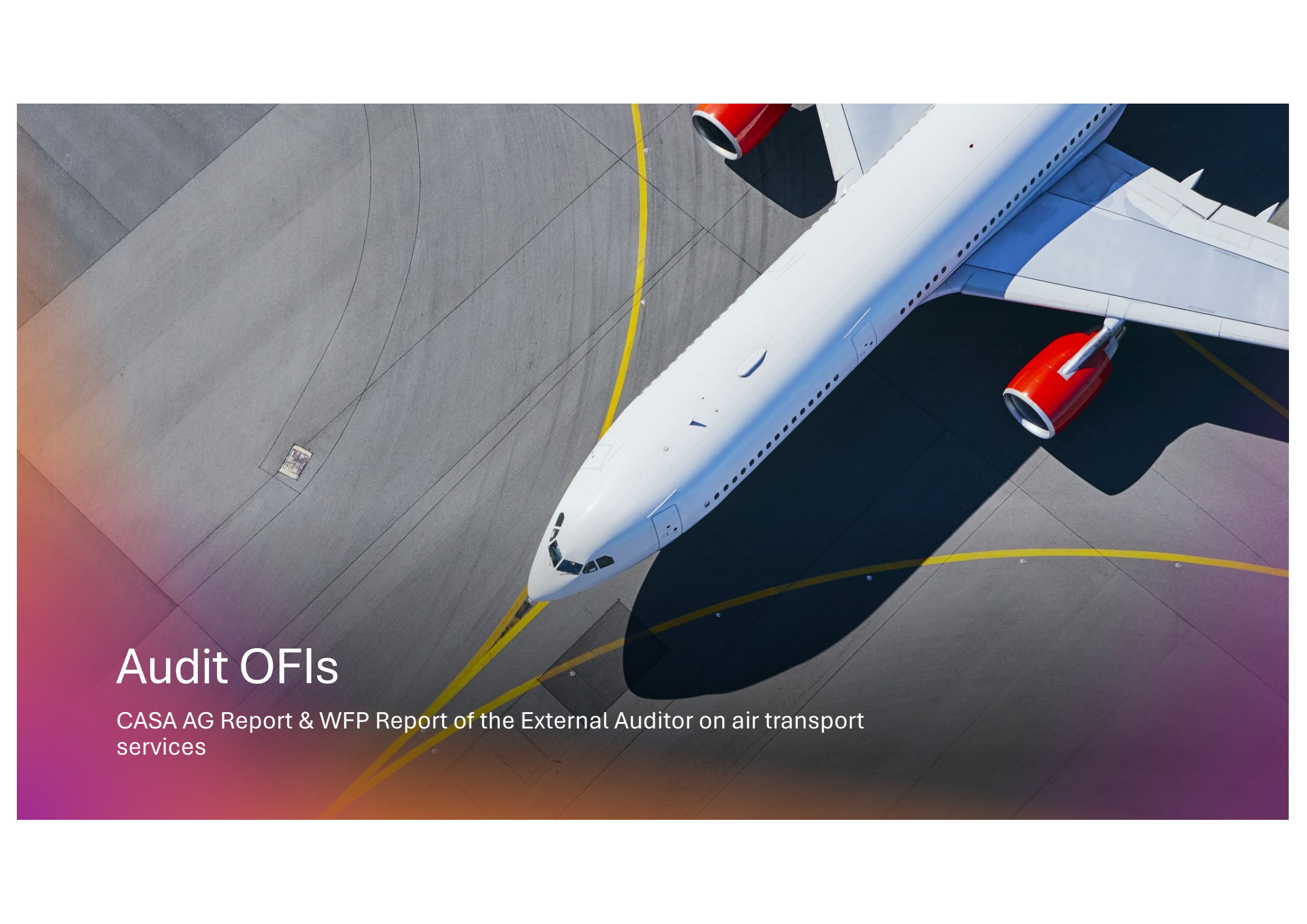
CAT = quality manager

Table A.1 — Audit methods ISO 19011:2018(E)

Extent of involvement between the auditor and the auditee	Location of the auditor	
	On-site	Remote
Human interaction	Conducting interviews Completing checklists and questionnaires with auditee participation Conducting document review with auditee participation Sampling	Via interactive communication means: — conducting interviews; — observing work performed with remote guide; — completing checklists and questionnaires; — conducting document review with auditee participation.
No human interaction	Conducting document review (e.g. records, data analysis) Observing work performed Conducting on-site visit Completing checklists Sampling (e.g. products)	Conducting document review (e.g. records, data analysis) Observing work performed via surveillance means, considering social and statutory and regulatory requirements Analysing data
On-site audit activities are performed at the location of the auditee. Remote audit activities are performed at any place other than the location of the auditee, regardless of the distance. Interactive audit activities involve interaction between the auditee's personnel and the audit team. Non-interactive audit activities involve no human interaction with individuals representing the auditee but do involve interaction with equipment, facilities and documentation.		

Plan do
check/study
act

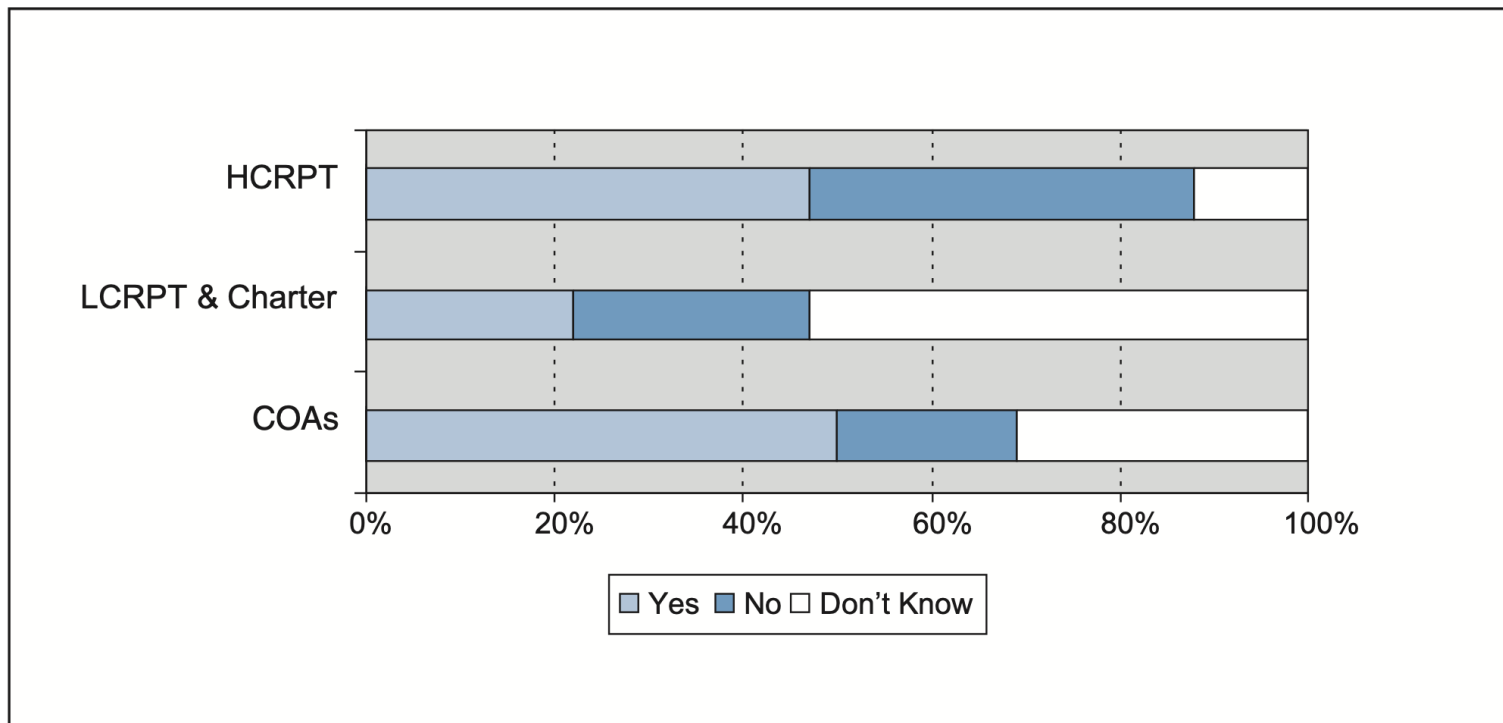


An aerial photograph of a large commercial airplane, likely an Airbus A320, parked on an asphalt tarmac. The aircraft is white with blue accents along the fuselage and red engines. Yellow ground markings are visible on the tarmac. A small ground service vehicle is positioned near the tail of the plane. The bottom left corner of the image features a purple and orange gradient overlay.

Audit OFIs

CASA AG Report & WFP Report of the External Auditor on air transport services

Responses to STI question: Does the operator have procedures to address root causes rather than applying superficial fixes?



Source: ANAO analysis of CASA STI database.

Report of the External Auditor on air transport services

18 May 2020

WFP/EB.A/2020/6-G/1

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Annex 6: Summary of the main findings of QAU assessments, 2017–2019

N.B.: OSCA indicates that following the QAU assessments it took the appropriate corrective actions.

For steering of air operations, the procedures set out in the Air Transport Manual are not always followed (SAOPs not updated or incomplete in 40 percent of cases and annual work plans provided for in the annual performance planning guide for country offices not prepared in 40 percent of cases).

Overall safety management for the operations was weak: in all cases, the safety management systems were unsatisfactory; the aviation safety plans were incomplete, out of date or unsigned; the aviation emergency response plans were lacking; and required drills were not conducted. In 80 percent of cases, aviation security procedures were not fully implemented. Risk registers were not kept in 73 percent of cases and flight following showed technical weaknesses in 60 percent of cases.



Best Industry Practices



Addressing audit shortfalls



Six Criteria for a Good CAP (“RCDSRC”)

- 1) **Relevant**: CAP addresses the *issues* and *requirements* related to the finding and corresponding PQ and CE.
- 2) **Comprehensive**: CAP is *complete* and includes *all elements or aspects* associated with the finding.
- 3) **Detailed**: CAP outlines implementation process using *step-by-step approach*.
- 4) **Specific**: CAP identifies *who will do what, when* and in coordination with other entities, if applicable.
- 5) **Realistic**: In terms of *contents* and *implementation timelines*.
- 6) **Consistent**: In relation to *other CAPs* and with the *State’s self-assessment*.

Source: ICAO USOAP MIR presentation dated 17 Jan 2019

Sample Quality KPIs

Finding Risk Level	Target Dates	
	To Propose Corrective / Preventive Action Plan and Root Cause Analysis	Full Implementation or Execution
1	- Immediate action agreed on site with the relevant HOD. - 7 days	7 days
2	- 30 days	60 days
3	- 30 days	60 days
0	- Not required, but recommended - However, the Root Cause must always be completed, whether or not the observation is corrected by the auditee	Not required, but recommended

Maintaining integrity & effectiveness of our audit processes

- 1) **Timely Follow-Up:** Ensure that follow-up actions are conducted within the timelines established during the audit. Prompt action helps mitigate risks and fosters a culture of accountability.
- 2) **Thorough Documentation:** Document all follow-up activities meticulously. This includes recording responses from the auditees, actions taken, and any remaining issues.
- 3) **Effective Communication:** Engage in clear and constructive communication with relevant departments to facilitate the resolution of audit findings. Ensure that any barriers to implementation are identified and addressed promptly.
- 4) **Continuous Monitoring:** Regularly review the status of corrective actions to verify their effectiveness. Follow-up should not be a one-time event but an ongoing process until all issues are resolved.
- 5) **Feedback and Improvement:** Provide feedback on the follow-up process and suggest improvements if needed. Your insights are valuable for enhancing our overall audit function.

FSF BARS

Corrective Action Management

Root Cause and Corrective Action Plans

- 1) Co-ordinate with the reviewing Auditor to reach agreement regarding acceptable Root Cause classifications and a Corrective Action Plan (CAP) based on finding risk factors..
- 2) Timeframe includes time allocated to the audit team for verification of Corrective Action Plans.
- 3) Provide a Root Cause Analysis :
 - Providing a Corrective Action Plan indicating there is “No corrective action to be taken”; or
 - Providing a Corrective Action Plan indicating the closeout timeline.
- 4) The Operator’s nominated representative shall notify the Lead Auditor/AC in writing when Root Causes and CAPs have been loaded to BARSoft and are ready for review.

Root Cause and Corrective Action Plans

- 5) Auditor reviews RCs and CAPs and provide feedback to Operator's within seven days. Once reviewed, the Auditor shall:
- 6) Confirm acceptance of CAPs on BARSoft; or Make the required BARSoft annotations and advise the Operator that a Root Cause and/or CAP has been rejected, together with the reasons for the rejection.
- 7) These processes could include follow-up notifications on a weekly basis if acceptable CAPs have not been received.
- 8) Once all Root Causes and CAPs are deemed satisfactory by the Auditor, the Operator's nominated representative should monitor the timely implementation of actions taken by assigned personnel by gathering and providing suitable Objective Evidence to the reviewing Auditor via BARSoft.
- 9) Objective Evidence may include but is not limited to:
 - Copies of revised sections of company manuals and documentation;
 - Copies of suitable records, such as training, aircraft fitment, component purchasing or project planning records; or
 - Photographs of operational areas and conditions with necessary changes implemented

Root Cause and Corrective Action Plans

- 10) Once corrective actions have been completed by Operator company personnel and accepted by the Operator's nominated representative, the representative should upload the relevant information to the "Aircraft Operator Corrective Action Taken" field on BARSoft.
- 11) When all Corrective Actions have been deemed completed by the Operator's nominated representative, a written notification shall be sent to the reviewing Auditor requesting their review.
- 12) Upon receipt of the Operator's notification of CAT(s), the reviewing Auditor shall review the CAT evidence available, enter data into BARSoft and provide written feedback on BARSoft to the Operator's nominated representative within seven days.
- 13) The reviewing Auditor shall:
 - Confirm acceptance of CAT; or
 - Provide advice that CAT evidence is unsatisfactory, together with guidance regarding what type of evidence would be deemed satisfactory for closure.

Corrective Action Taken

- 1) If a CAT is rejected by the reviewing Auditor, the Operator must review and revise the evidence and/or statements in BARSoft in accordance with reasons provided by the reviewing Auditor.
- 2) Upon completion of these revisions, the Operator's nominated representative should again notify the Lead Auditor/AC in writing that the CAT(s) are ready for review.
- 3) The reviewing Auditor shall repeat the review process until he/she deems all corrective action closures satisfactory.
- 4) A finding shall only be declared Closed after corrective actions, in accordance with the agreed CAP, have been implemented by the Operator and verified by the reviewing Auditor.
- 5) Should an Operator not be able to meet the agreed close out date for a finding, or findings, an extension to the 30-day close out period for P1 findings or the 90-day close out period for P2 findings may be granted by the BPO. The BPO shall make the determination of approval or rejection of a requested extension.

Corrective Action Taken

- 6) The Operator's representative must record Corrective Action Taken (CAT) for all findings within 30 days of audit checklist upload for P1s and 90 days of checklist upload for P2s and P3s.
- 7) These periods include the time allocated to the audit team for verification of Corrective Action Taken.
- 8) Operators must ensure that their selected AC has enough time to verify the CAT, and enough time to accommodate rework and further verification if the CAT is rejected.
- 9) The reviewing Auditor is responsible for the verification of corrective action implementation in accordance with the agreed CAP.
- 10) The exact method of verification shall be at the discretion of the reviewing Auditor based on the nature of individual findings and associated corrective action

Auditor Responsibilities

- 1) Verifying that all findings have been closed.
- 2) Ensuring that the text in all fields entered by the Operator is correct in terms of spelling and grammar; this includes fields entered by the Operator.
- 3) Once all findings are marked as closed on BARSoft by the reviewing Auditor, the reviewing Auditor is to notify the AC that the Audit Report is now ready for AC quality checking.

Quality Check

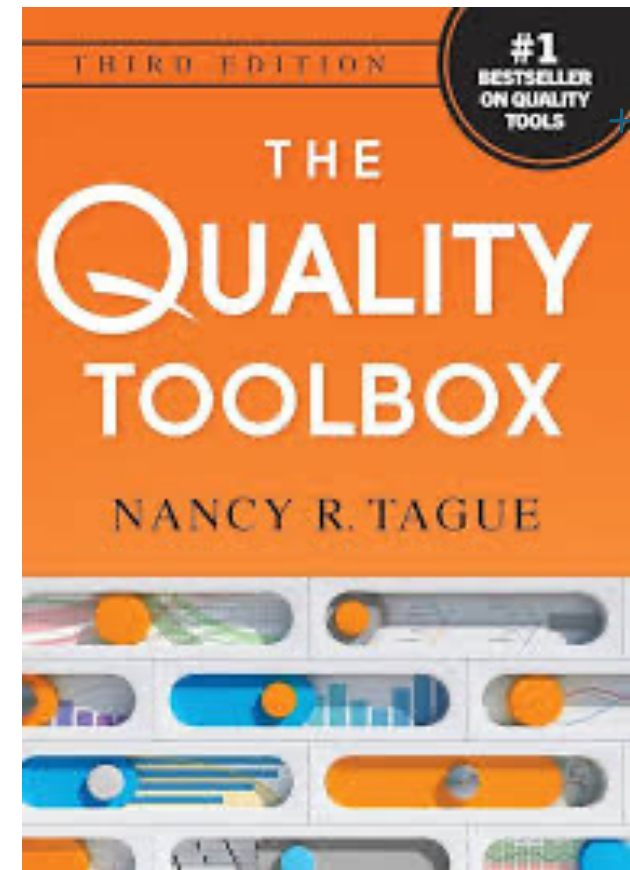
- 1) The AC quality representative shall perform a quality check on the Audit Report prior to releasing it to the BPO.
- 2) This quality check should be completed within 7 days of the Audit being closed and shall:
 - Identify and correct all typographical and grammatical errors;
 - Verify correct and consistent application of cross-referencing standards to Operator manuals and documents;
 - Verify accurate Standard interpretations;
 - Verify that Corrective Actions address the Root Cause and the identified Non-Conformity; and

Quality Check

- 3) Upon satisfactory completion of AC quality checking processes, the AC shall have a process for declaring final Audit Closure to the BPO and the date at which this occurred.
- 4) The AC shall have a process to ensure that all material or information collected during the Audit that is not part of the Final Audit Report is either destroyed or returned to the Operator.

Industry best practices

- ☐ KCAA Process
- ☐ WFP ASU Process
- ☐ ICAO Six Criteria for a Good CAP (“RCDSRC”)
- ☐ General RCA Tools, Nancy Tague Book
- ☐ FSF BARS
- ☐ IOSA Audit Handbook
- ☐ Using Certification or Registration Guidance Material to address findings
- ☐ *Determining Quality Costs & ABCs*



THE 7 BASIC QUALITY TOOLS

for process improvement

"The Old Seven." "The First Seven." "The Basic Seven."

Cause-and-effect diagram (also called Ishikawa or fishbone diagrams): Identifies many possible causes for an effect or problem and sorts ideas into useful categories.

Check sheet: A structured, prepared form for collecting and analyzing data; a generic tool that can be adapted for a wide variety of purposes.

Control chart: Graph used to study how a process changes over time. Comparing current data to historical control limits leads to conclusions about whether the process variation is consistent (in control) or is unpredictable (out of control, affected by special causes of variation).

Histogram: The most commonly used graph for showing frequency distributions, or how often each different value in a set of data occurs.

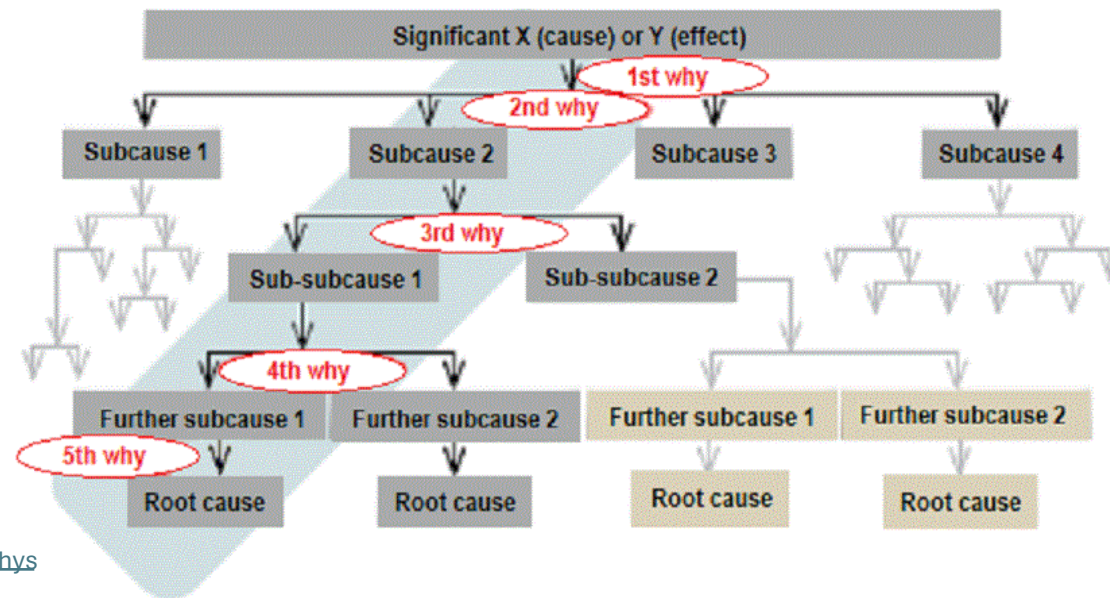
Pareto chart: A bar graph that shows which factors are more significant.

Scatter diagram: Graphs pairs of numerical data, one variable on each axis, to look for a relationship.

Stratification: A technique that separates data gathered from a variety of sources so that patterns can be seen (some lists replace stratification with flowchart or run chart).

Five whys

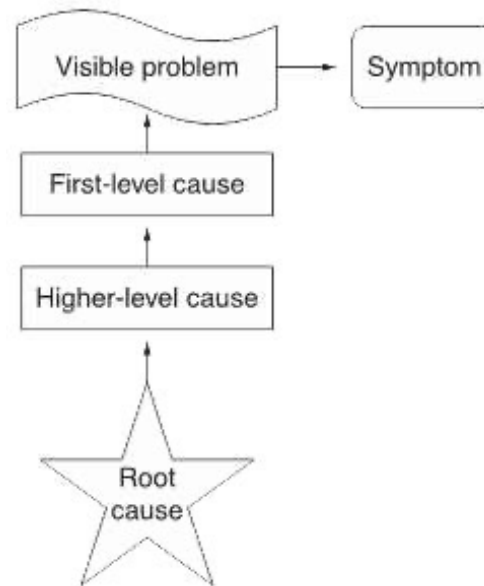
Five whys: A technique for discovering the root causes of a problem and showing the relationship of causes by repeatedly asking the question, “Why?” A repetitive questioning technique to probe deeper to surface the root cause of a problem. The number of times “why” is asked depends on when the true root cause is reached.



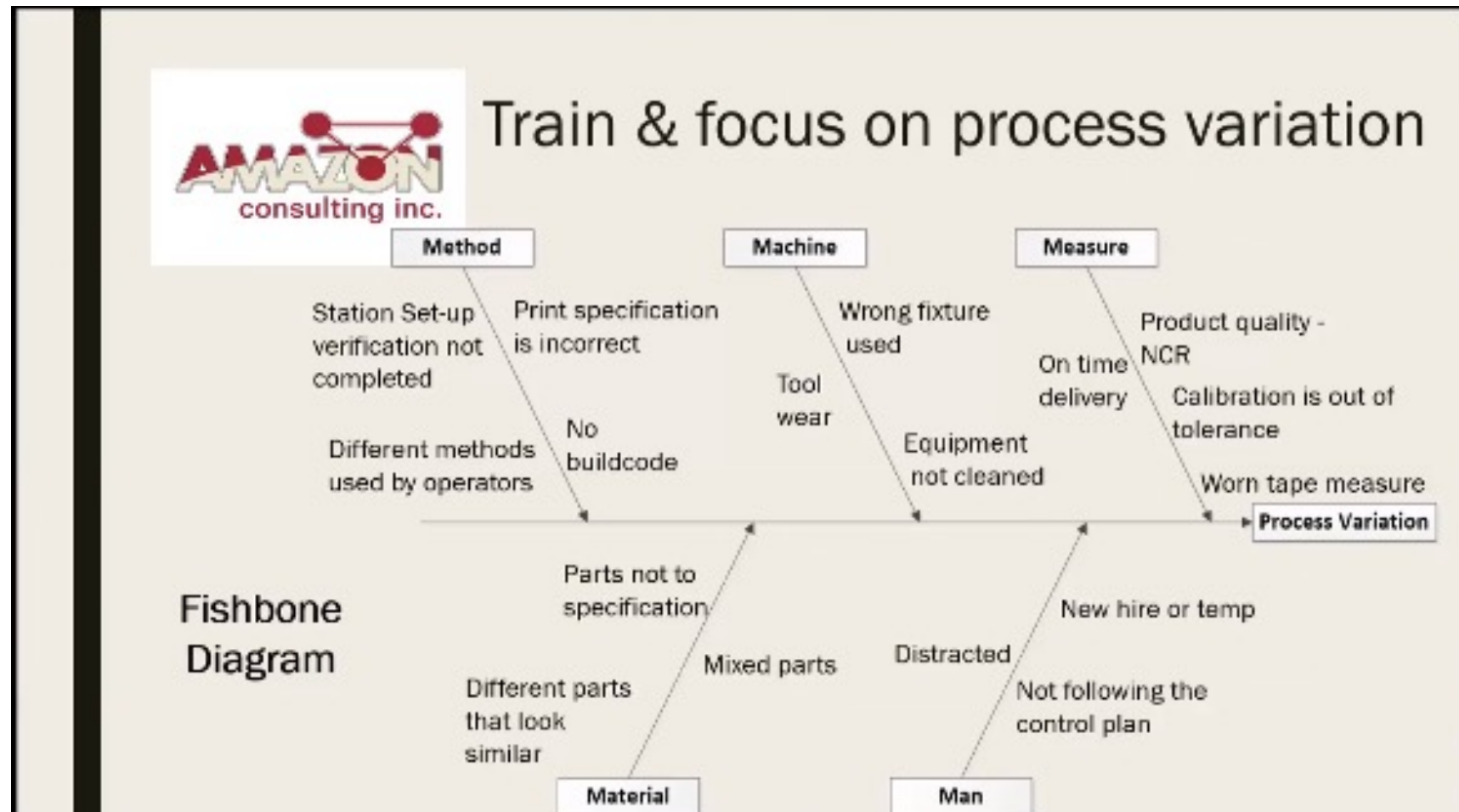
Source: <https://asq.org/quality-resources/five-whys>

Fishbone

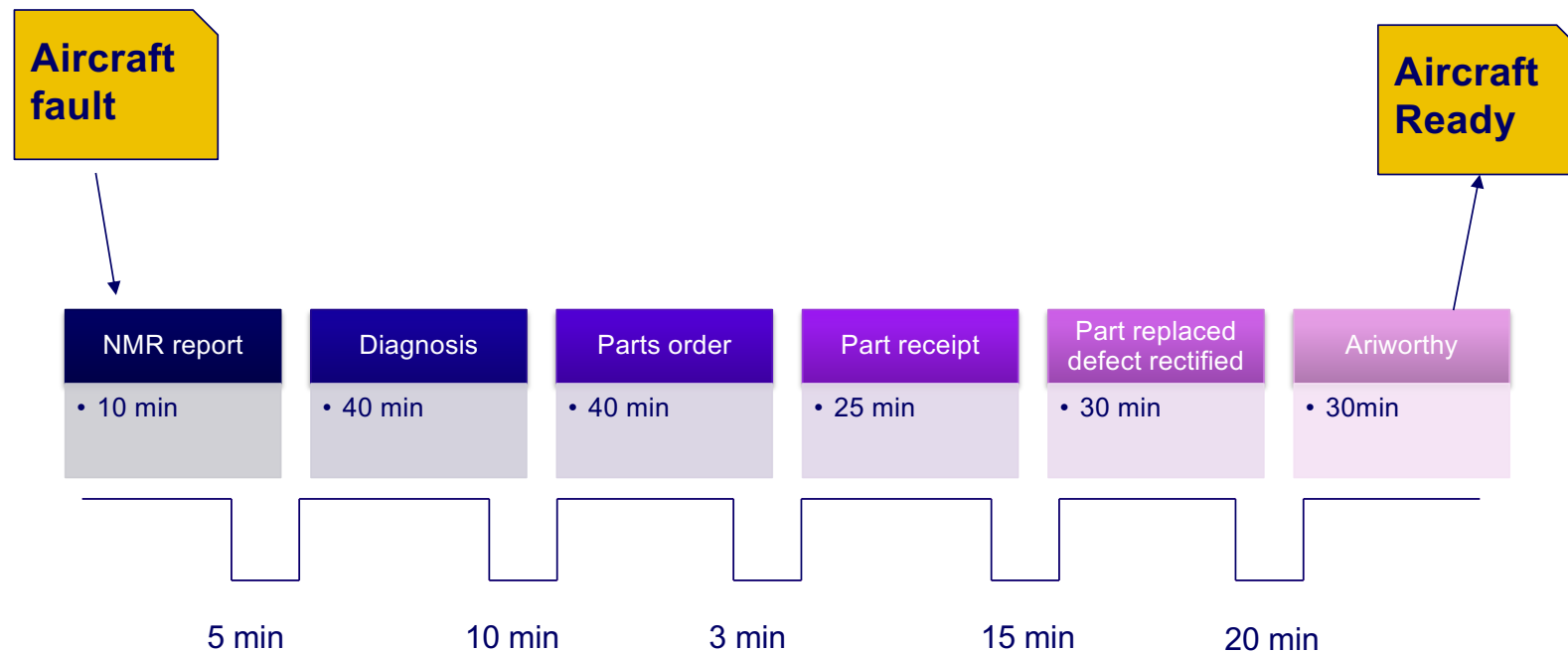
Cause and effect diagram: A tool for analyzing process dispersion. It is also referred to as the “Ishikawa diagram,” because Kaoru Ishikawa developed it, and the “fishbone diagram,” because the complete diagram resembles a fish skeleton. The diagram illustrates the main causes and subcauses leading to an effect (symptom).



Cause and Effect Diagram (Source: Shauna Wilson, Amazon Consulting, Inc.)



Current state VSM with Improvement

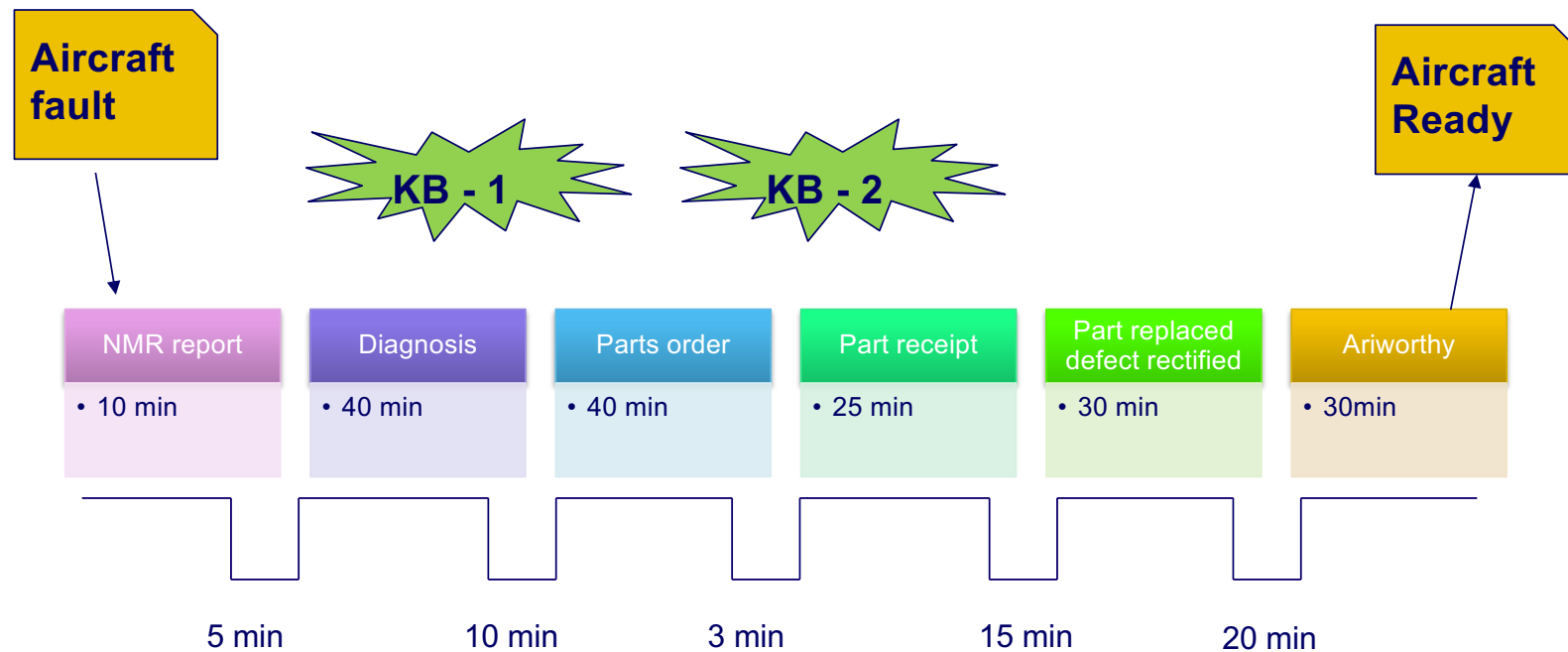


Improvement: Fault specific standard parts list to be sent to the hangar the moment aircraft is fault and the hangar is identified.

Take time

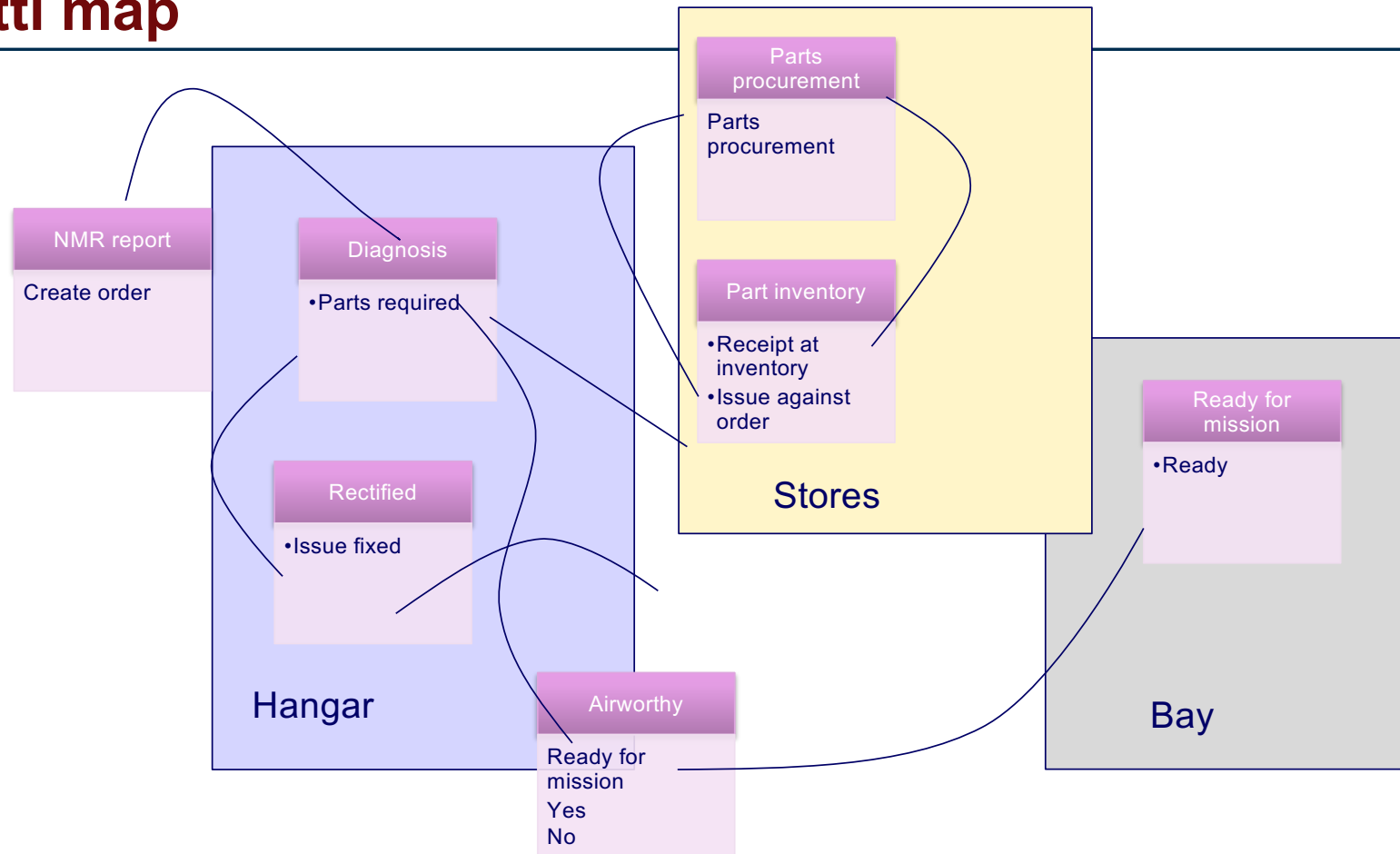
- Engine uptime demand - 3000 hrs / year (i.e 8.2 hrs / day, 365 days)
- Available time = 9 hrs per day = 3285 hrs / year
 - 285 hours total to carry out all planned and unplanned maintenance
 - Take time = $3285 / 3000 = 1.095$ hrs
 - So general unplanned maintenance should be complete within 1.095 hrs

Future state VSM with Kaizen bursts



Kaizen Burst 1 : Early signal about the fault to the base station to trigger ground activities
Kaizen Burst 2 : Keep common used parts near to the bay reducing store issue time

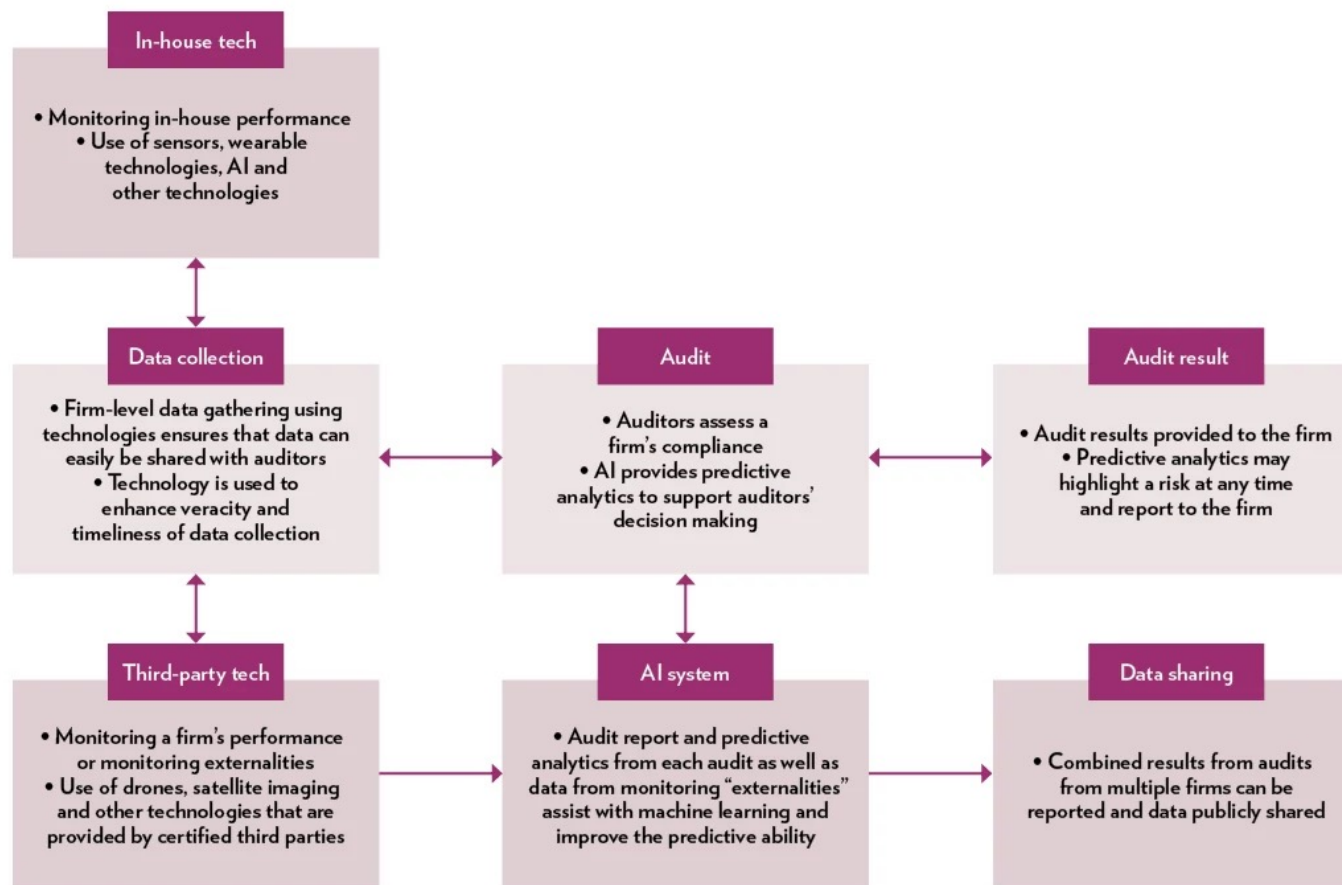
Spaghetti map



Conclusion

- Future of auditing
 - Remote
 - Risk-based approach
- Areas of innovation AI & Smart Technologies etc.
- Integrated Management Systems
 - *Single Safety & Quality Management Manual*

Technology-Enhanced Auditing Ecosystem



AI = artificial intelligence

Source: Castka, Pavel, Searcy, Cory (2021). Artificially Intelligent Audits: The Era Of Technology-Enhanced Auditing Is Upon Us.

<https://asq.org/quality-progress/articles/artificially-intelligent-audits?id=a60c4e95bd7349c4aafec40b5927ac02>

Professionalism and Safety Culture by Robert Sumwalt (NTSB) at the AsBAA Virtual Safety Summit 2020

(timeline: 05.07 – 06.53)



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- 2) www.asq.org
- 3) Report of the External Auditor on air transport services Executive Board Annual session Rome, 29 June–3 July 2020
- 4) www.ngs.edu
- 5) Castka, Pavel, Searcy, Cory. (2021). Artificially Intelligent Audits: The Era Of Technology-Enhanced Auditing Is Upon Us. <https://asq.org/quality-progress/articles/artificially-intelligent-audits?id=a60c4e95bd7349c4aafec40b5927ac02>
- 6) Ajay Agrawal, Joshua Gans and Avi Goldfarb, Prediction Machines: The Simple Economics of Artificial Intelligence, Harvard Business Review Press, 2018.



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*Asante
+
sana
Thank you*

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