Parts, Materials, and Processes (PM&P) Management Workshop

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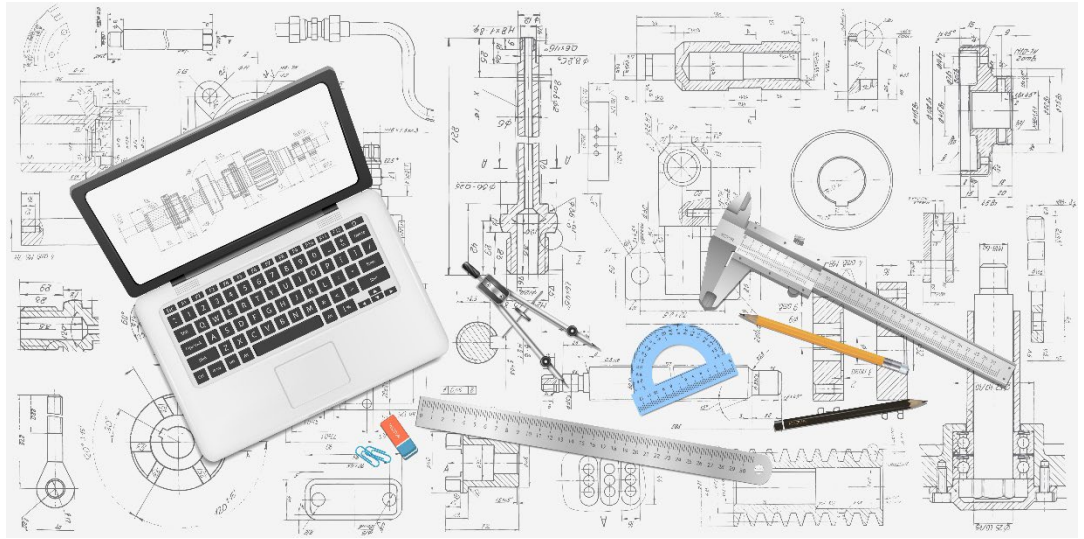
PM&P Management Definition

PM&P management is a *systems engineering discipline* for *selecting* and *assuring the performance* of parts and *assemblies* of parts, while accounting for the *materials and processes* used to manufacture them, throughout *all phases* of a system's (or equipment's) life cycle from initial design through disposal

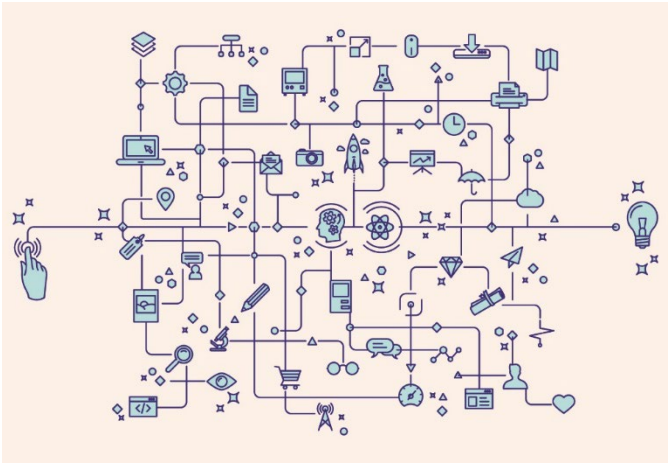


Aliaksander Trafimovich/Getty Images, 2024

Previously referred to as parts management; name changed to avoid confusion

PM&P Selection Considerations

- **Balance among design considerations**
  - PM&P selection decisions are based on the thoughtful assessment and balancing of numerous, overlapping engineering design considerations
- **Criticality**
  - The selection decision also varies as a function of criticality, the application of the PM&P within the design, program duration, risk that the program office is willing to accept, and other factors



Mustafahacalaki/Getty Images, 2016

Design consideration examples

- ✓ Performance
- ✓ Cost
- ✓ Quality
- ✓ Qualification
- ✓ Reliability
- ✓ Maintainability
- ✓ Supportability
- ✓ Standardization
- ✓ DMSMS risk
- ✓ Technology features and life-cycle stage
- ✓ Manufacturing processes and producibility
- ✓ System security
- ✓ Cyber weaknesses and vulnerabilities
- ✓ Hardware and software assurance
- ✓ Supply chain risk
- ✓ Susceptibility to counterfeiting
- ✓ Unauthorized tampering
- ✓ Use of hazardous materials

PM&P Management Importance

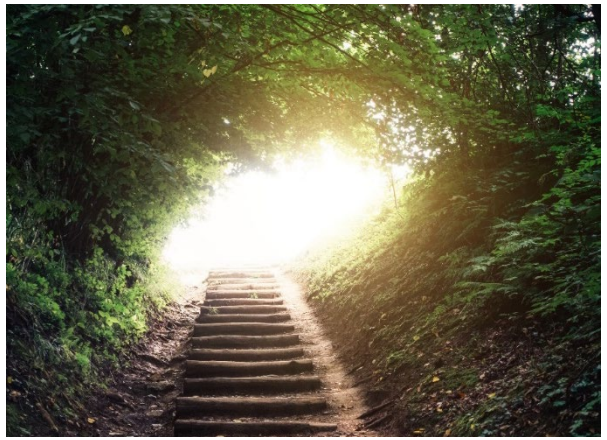
- **Consequences of inadequate government oversight of contractor or government PM&P selection**
  - **Improper parts utilization—insufficient derating; use of problematic parts**
  - **Poor performance—parts do not meet allocated and derived requirements**
  - **Poor reliability**
  - **Increased DMSMS issues**
  - **Increased cost—unplanned rework; greater footprint**
  - **Reduced mission assurance**
  - **Overreliance on sole source**
  - **Higher likelihood of cyber exploitation**
  - **Higher likelihood of system compromise**
  - **Increased likelihood of supply chain disruptions—counterfeiting; malicious tampering**
  - **Increased likelihood of an occurrence triggering any of the above consequences**

CnOra/Getty Images, 2019

Steps in a Program Office PM&P Management Program

1. **Assessing risk[1] to create a risk profile used to determine the level and type of oversight to be performed by the program office**
2. **Setting requirements for a contractor PM&P Management Plan that describes processes to assure PM&P selections meet all allocated and derived requirements**
3. **Verifying the contractor is following the processes in its Plan**
4. **Validating the contractor's PM&P selection is effective**
5. **Keeping records and developing metrics designed to improve PM&P selection**
6. **Performing steps 2–4 when PM&P selection performed by government design organizations**
7. **Evaluating metrics and changing oversight processes where needed**
8. **Detecting risk changes generated by triggering events and adjusting PM&P selections when warranted[2]**

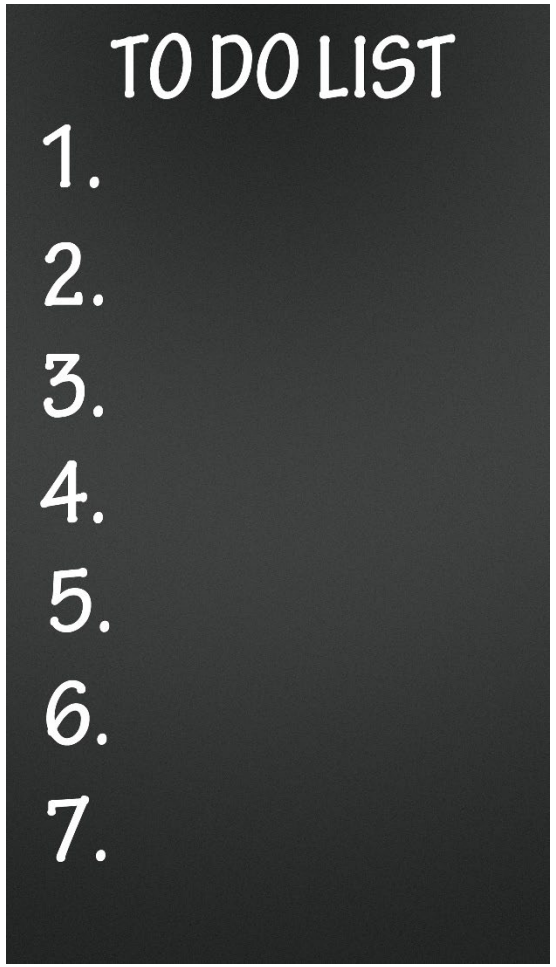
More on a risk-based approach



borchee/Getty Images, 2015

1. Not typically a PM&P community function—more on this later
2. Not typically a PM&P community function; PM&P community usually ensures that these activities occur—more on this later

Organization of a Program Office PM&P Management Plan

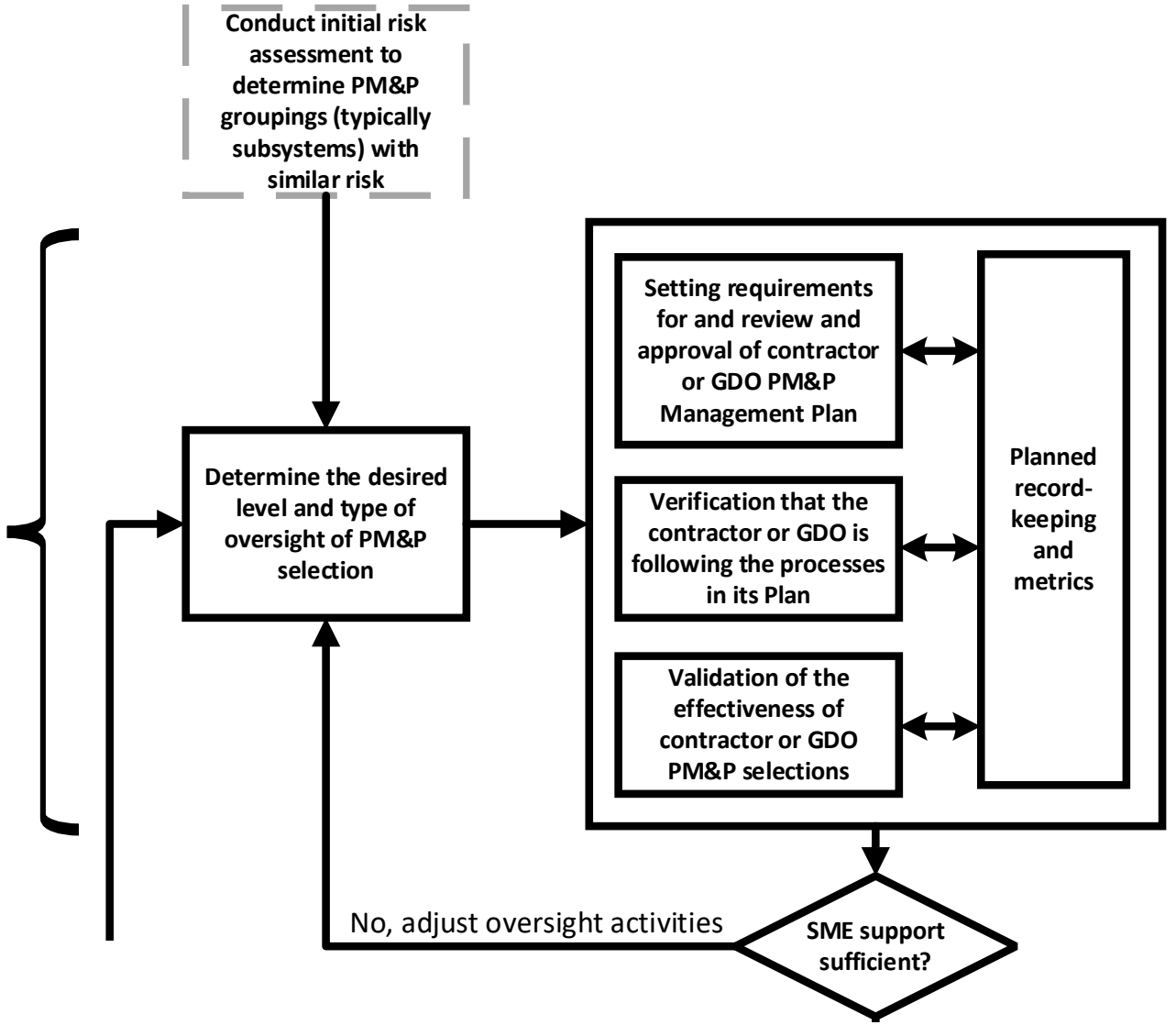


flytosky11/Getty Images, 2013

- Section 1 summarizes objectives, roles and responsibilities, and risk assessment results
- Sections 2–4 lay out the risk-based oversight activities the program office will perform associated with steps 2–4 of a program office PM&P Program when PM&P selection is done by a contractor
- Section 5 describes how the record keeping and metrics will be used to improve PM&P selection
- Section 6 covers the risk-based oversight activities the program office will perform associated with steps 2–4 of a program office PM&P Program when PM&P selection is done by a government design organization
- Section 7 describes monitoring for events that could trigger changes to PM&P selection and assessments of whether the risks associated with such triggering events warrant changes to be made

Program Office PM&P Management Program (part 1)

First step normally performed outside of the PM&P community. Output is a risk profile used by the PM&P community.

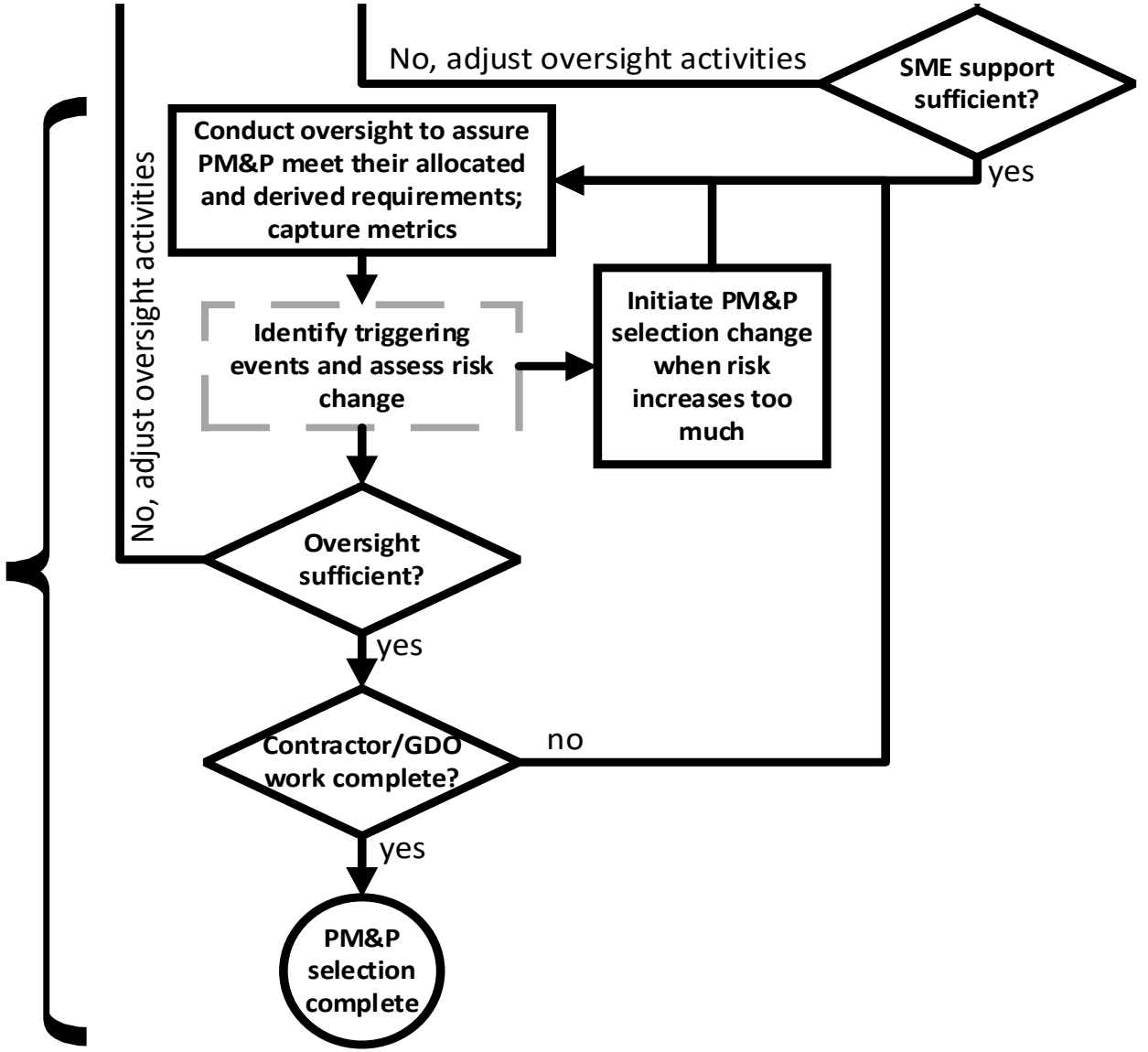


Key:

- PM&P is parts, materials, and processes
- GDO is government design organization
- SME is subject matter expert
- Processes in gray dashed boxes typically performed outside of PM&P community

Program Office PM&P Management Program (part 2)

This represents the execution of the oversight process. Triggering events are often identified and assessed outside of the PM&P community, whose primary responsibility is to ensure the work is done and appropriate actions are taken as a result of the assessment. Processes for identifying triggering events and associated actions should be described in the program office PM&P Management Plan to the extent that the program office is involved.



Key:

- PM&P is parts, materials, and processes
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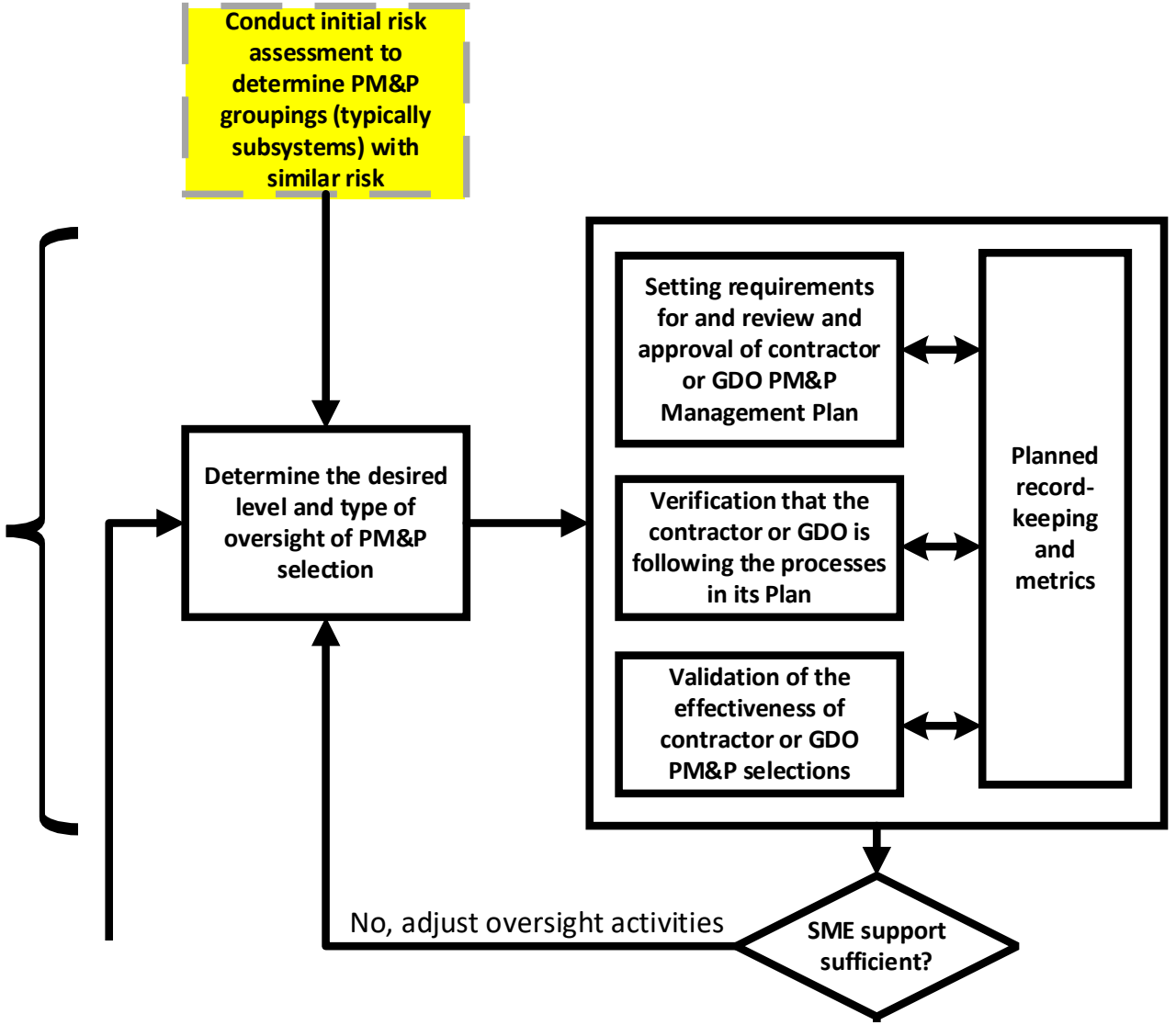
Risk Assessment Within a Program Office PM&P Management Program

First step normally performed outside of the PM&P community. Output is a risk profile used by the PM&P community.

Principal contents of a program office PM&P Management Plan



- Considers PM&P availability, performance, and security risks
- Normally performed outside of the PM&P community
- Outcome is a risk profile used by the PM&P community

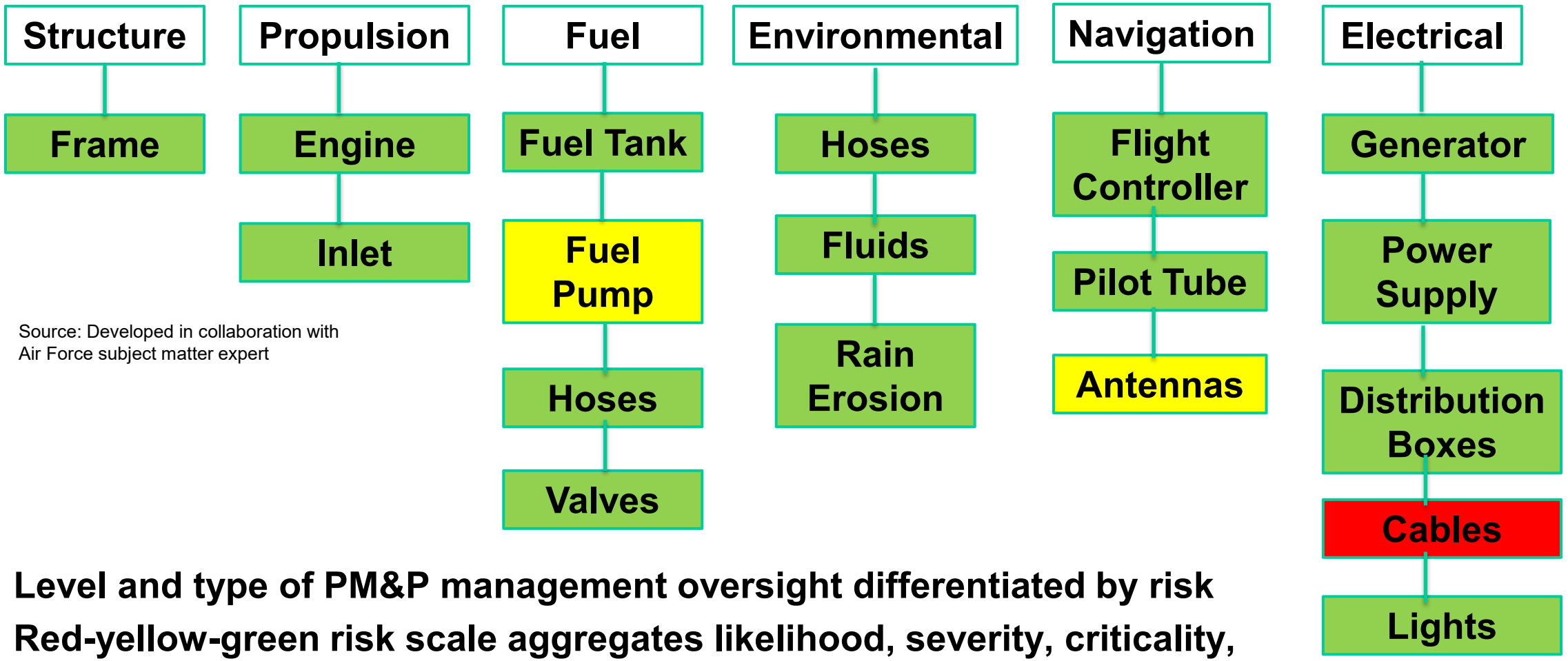
Why Conduct an Initial Risk Assessment

- **Given the program office's desired level of assurance that parts meet their allocated and derived requirements, a risk assessment provides a basis for:**
  - **Establishing the requirements for a contractor (or government design organization) PM&P Management Plan (often by tailoring MIL-STD-11991[9])**
  - **Determining the level and type of a program office's oversight to ensure that the contractor (or government design organization) is following the processes in its Plan (verification)**
  - **Determining the level and type of a program office's oversight to ensure that the PM&P selected by the contractor (or government design organization) meets their allocated and derived requirements (validation)**

bsd studio/Getty Images, 2024

The Outcome of a Risk Assessment is a Risk Profile

A Notional Aircraft Risk Profile for Generalized Subsystems



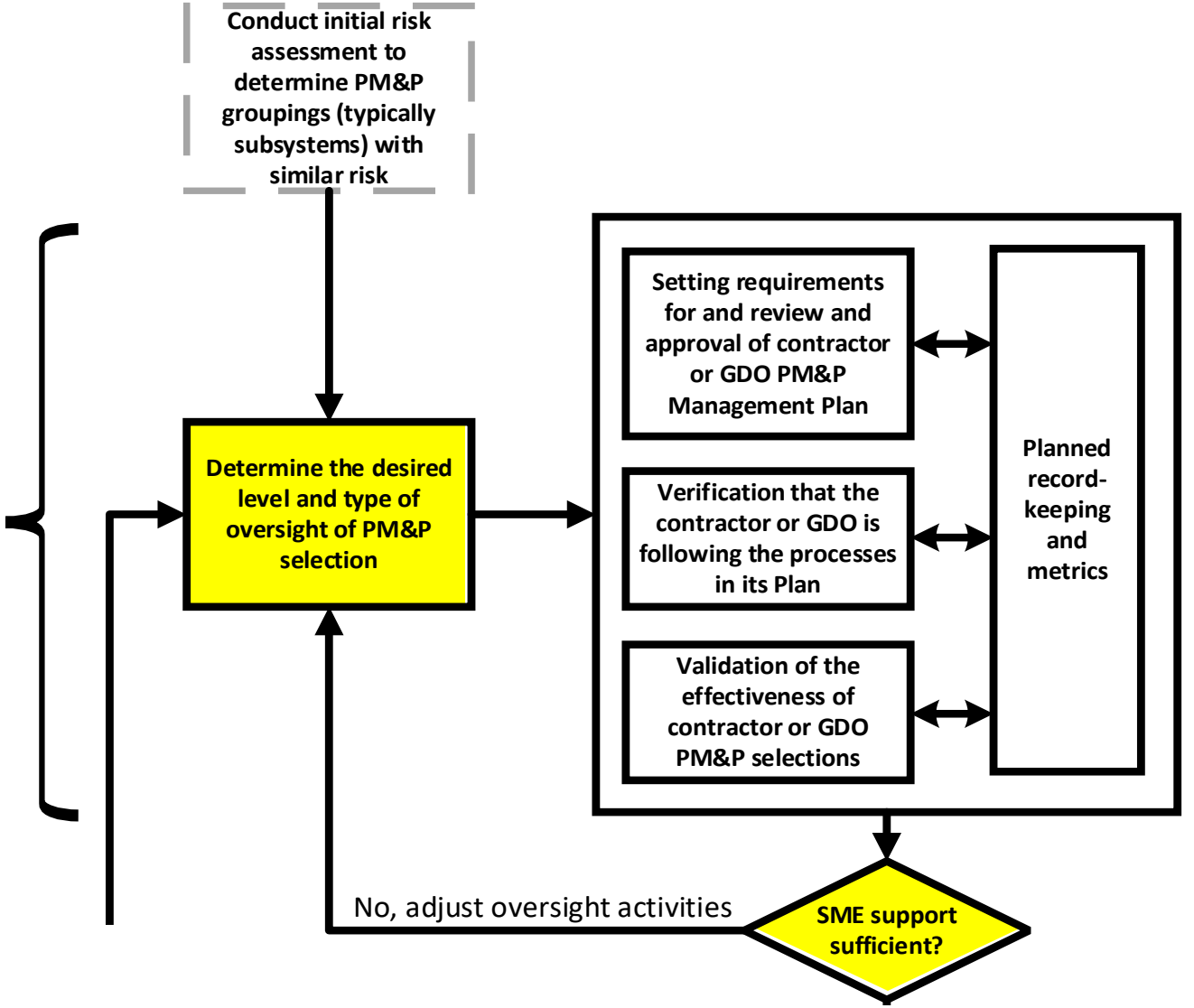
Source: Developed in collaboration with Air Force subject matter expert

- Level and type of PM&P management oversight differentiated by risk
- Red-yellow-green risk scale aggregates likelihood, severity, criticality, type of risk, and any other important factors
- Use less aggregation for greater oversight differentiation when warranted

Finalizing Level and Type of Oversight Within a Program Office PM&P Management Program

First step normally performed outside of the PM&P community. Output is a risk profile used by the PM&P community.

Principal contents of a program office PM&P Management Plan



- This section is a high level overview
- Details follow in the next three sections of this briefing

Finalizing the Level and Type of Oversight (1 of 2)

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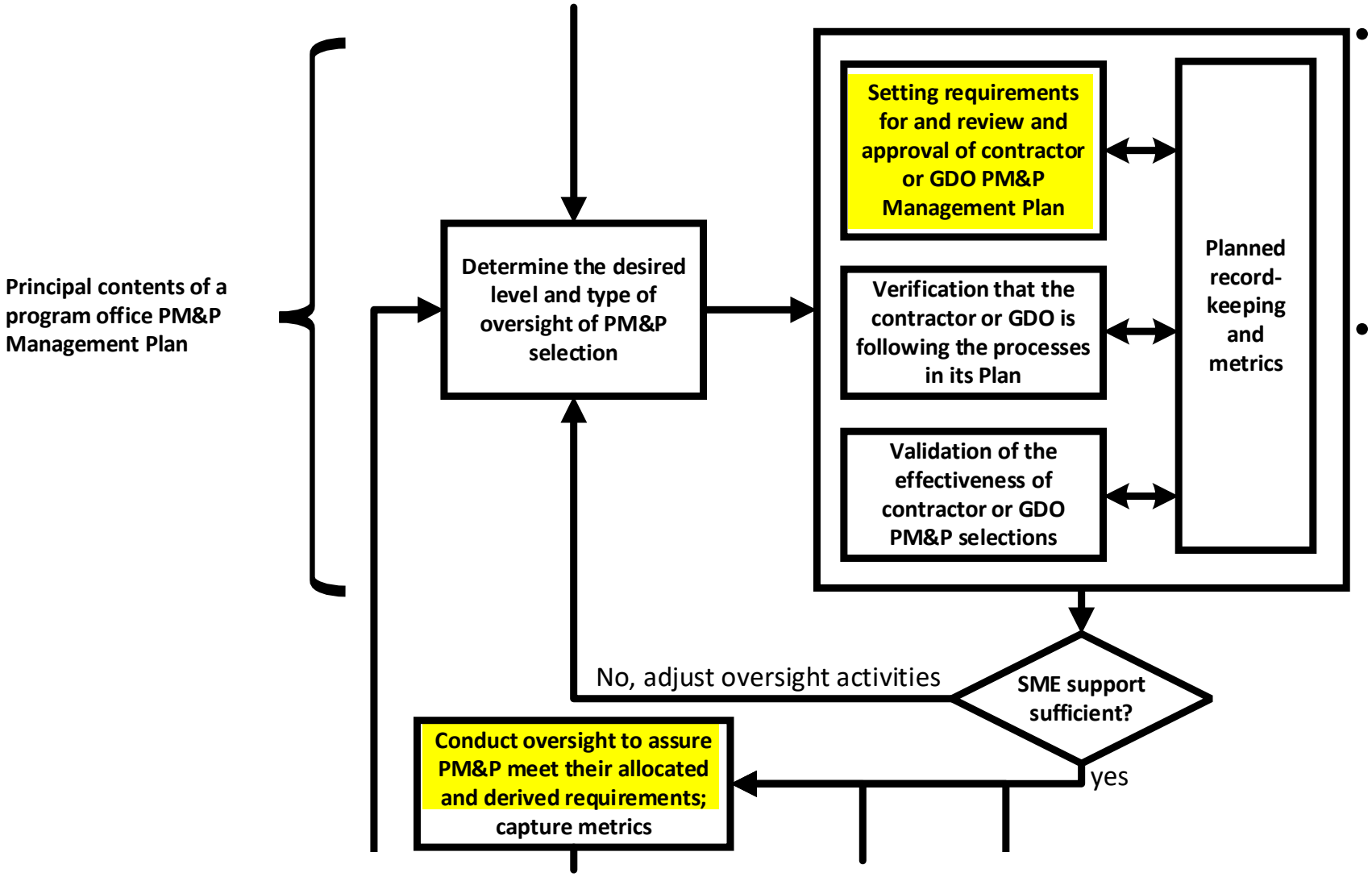
- PM&P community answers questions based on the risk profile
- For the combined PM&P groupings, as a function of degree of risk and other factors, PM&P community determines desired
  - Requirements for contractor (or government design organization) PM&P Management Plan
  - Level and type of verification to be performed
  - Level and type of validation to be performed

Finalizing the Level and Type of Oversight (2 of 2)

- **PM&P community modifies desired oversight activities based upon availability of necessary subject matter expertise; availability determined by**
  - **Specifying the knowledge, skills, and abilities (KSAs) needed**
    - **Mechanical, electrical, and chemical engineering**
    - **Part construction and manufacturing processes**
    - **Assembly processes**
    - **Part manufacturer business practices and critical customers**
    - **Reliability, quality, and design engineering**
    - **Supply chain risk management (SCRM)**
    - **System security engineering (cyber)**
  - **Identifying the associated level of effort**
    - **Oversight activities**
    - **Number of (critical) parts**
    - **Life-cycle stage of system**
  - **Securing access to the person hours needed by KSA**

abluecup/Getty Images, 2014

Oversight: Contractor PM&P Management Plan



- Details of the level and type of oversight associated with a contractor PM&P Management Plan
- Use of a government design organization (GDO) is unusual
  - Oversight considerations are the same
  - Additional discussion later in the training

Options for Establishing PM&P Selection Requirements

Increasing Rigor

- No contractor PM&P Management Plan required
- Require a contractor PM&P Management Plan in accordance with the general requirements of MIL-STD-11991 tailored to the specific situation
- Require a contractor PM&P Management Plan in accordance with the general and detailed requirements of MIL-STD-11991 tailored to the specific situation
- Supplement the manufacturing process requirements of MIL-STD-11991
- Supplement PM&P requirements and prohibitions of MIL-STD-11991
- Replace MIL-STD-11991 under circumstances where more rigorous requirements are necessary

soberve/Getty Images, 2007

MIL-STD-11991

Review and Approval of Processes in Contractor PM&P Management Plan (1 of 2)

- **Highest concern technical requirement areas where the processes in the Plan should provide the program office with confidence that they are sufficiently rigorous**
  - **Define customer contractor interfaces**
  - **Determine allocated and derived part requirements**
  - **Identify restricted or prohibited part usage**
  - **Qualify parts for use in the system**
  - **Use suitable industry standard processes**
  - **Define stress derating levels**
  - **Assure commercial-off-the-shelf (COTS) assemblies and GFP meet requirements**
  - **Notify customer when not using authorized source**
  - **Monitor failures to identify part issues**
  - **Provide configuration control processes**
  - **Flow down requirements to *subcontractors***

Hiranmay Baidya/Getty Images, 2020

Review and Approval of Processes in Contractor PM&P Management Plan (2 of 2)

WhataWin/Getty Images, 2024

- **Other important considerations for reviewing contractor Plan**
  - **Contractor lines of responsibility for the processes**
  - **Right to review and inspect data and references**
  - **Program office approval for Plan changes**
  - **Program office leverage**

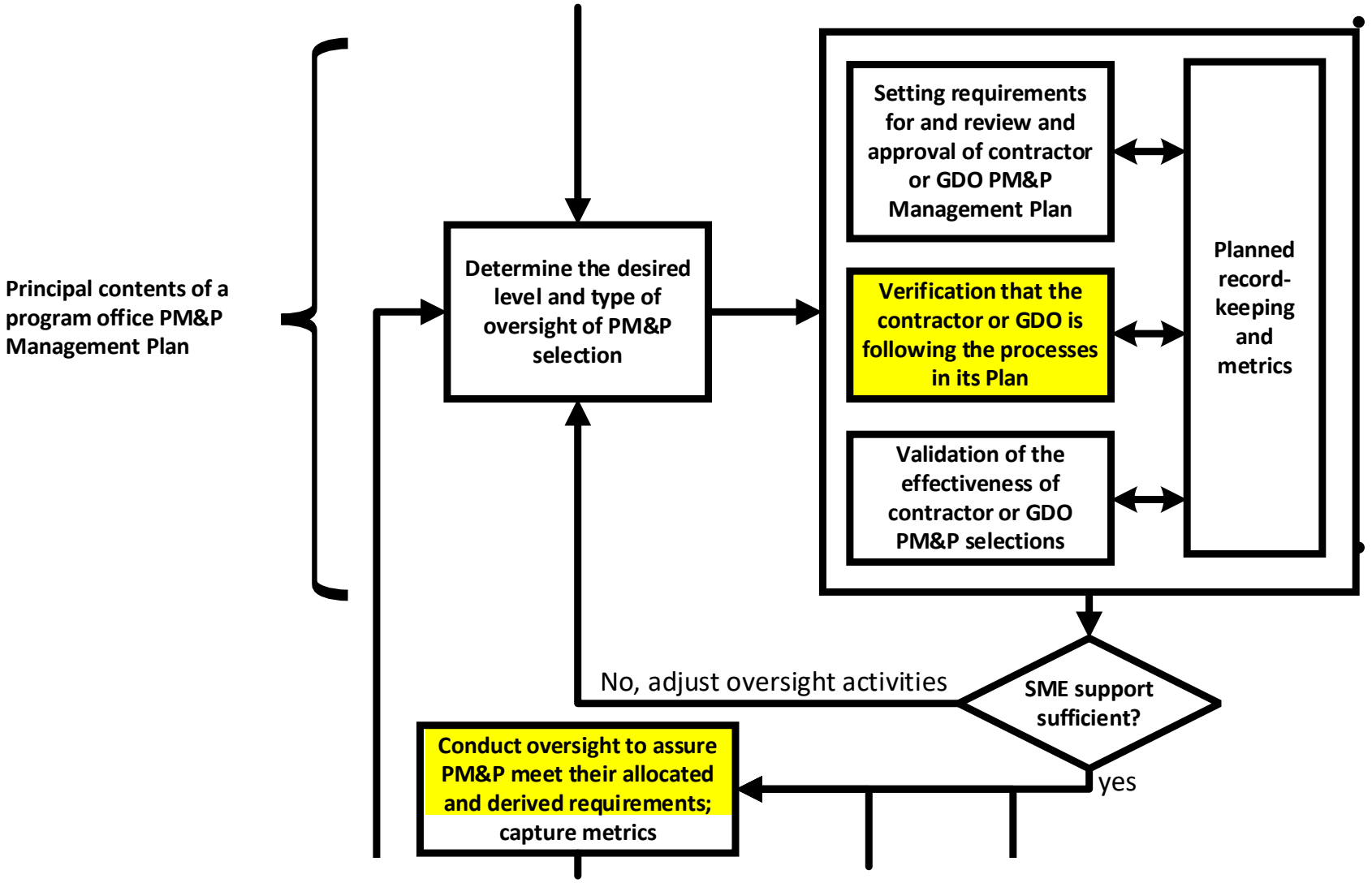
Breakout Group Exercises Concerning Oversight Associated with a Contractor PM&P Management Plan

- **Questions: Has anyone created or reviewed a contractor PM&P Management Plan (or the equivalent thereof)? What were the circumstances? What were the most important considerations?**

- **Discuss the importance of requiring a Plan that explains how PM&P will be selected during (1) design, (2) production, and (3) sustainment**

- **Exercise**
  - **Identify the most important requirements that a contractor PM&P Management Plan should meet. List the most important things for the program office to look for when approving a contractor PM&P Management Plan. List the red flags that would lead to rejection of the contractor PM&P Management Plan if not sufficiently justified**

Oversight: Verification that the Contractor is Following the Processes in its PM&P Management Plan



- Details of the level and type of oversight associated with verification, which means assuring that the contractor or GDO is following the processes in its PM&P Management Plan
- GDO usage is unusual
  - Oversight considerations are the same
  - Additional discussion later in the training

Verification Approaches

sonmez karakurt/Getty Images, 2024a

- From least to most rigorous
  - Informal site visits and other interactions, some of which are designed to flow down requirements throughout the supply chain
  - Address PM&P management during formal program office reviews
  - Embed engineers with the contractor
  - Request Defense Contract Management Agency (DCMA) surveillance
  - Official program office audit
- Approaches are not mutually exclusive
- No special contract requirements needed

Considerations for Selecting Level and Type of Verification

- **Program office should decide level and type of verification by PM&P grouping**
- **Last three approaches are more appropriate for highest risk and mission criticality scenarios**
- **First two approaches are more appropriate for lower risk scenarios**
- **Minimum level of verification should include interactions that focus on**
  - **A determination that PM&P management requirements are being contractually flowed down the supply chain correctly by the prime contractor**
  - **A determination by the prime contractor for the program office that PM&P management requirements are being contractually flowed down the supply chain correctly to the most critical subcontractors**

cnythzl/Getty Images, 2021

Other Important Contractor Practices to be Verified by the Program Office if Risk Warrants It (1 of 2)

- Document and understand the performance requirements
- Document prohibited parts, materials, and processes
- Identify suitable specifications for defining PM&P capability requirements
- Identify manufacturers with suitable product assurance programs and PM&P that meet suitable specifications
- Identify parts with maximum stress ratings that will meet stress derating requirements
- Identify PM&P with suitable functional and tolerance requirements
- Document PM&P manufacturer's qualification, quality, and reliability data

arcady_31/Getty Images, 2022

Other Important Contractor Practices to be Verified by the Program Office if Risk Warrants It (2 of 2)

arcady_31/Getty Images, 2022

- Document the part manufacturing (including materials and processes) to confirm suitable product assurance
- Document stress derating
- Document manufacturing and test supply chain
- Evaluate and document obsolescence and availability risks and mitigations
- Evaluate compatibility with higher level manufacturing processes and materials
- Evaluate compatibility with assembly parts and materials

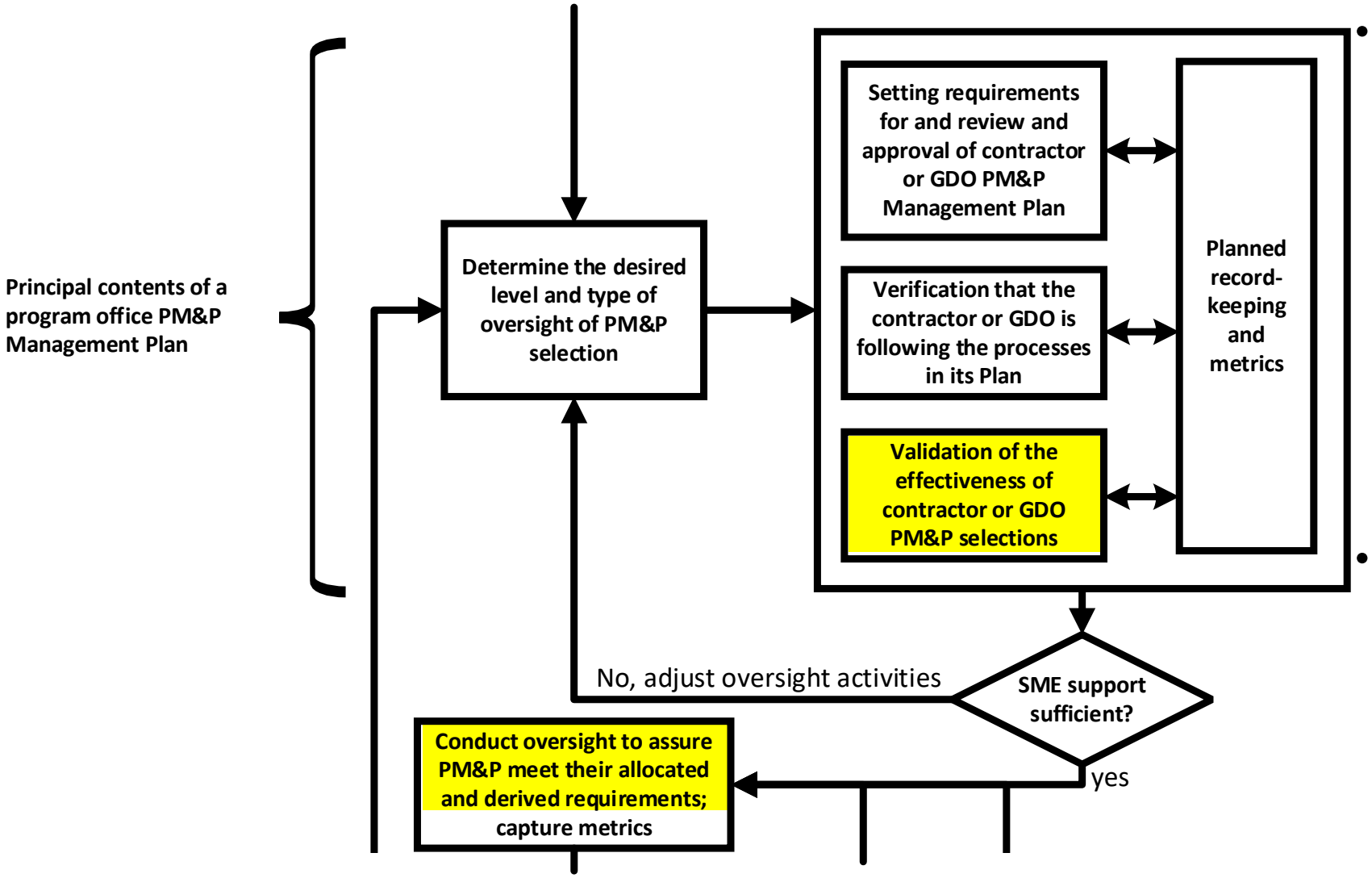
Breakout Group Exercises Concerning Oversight Through Verification of Contractor PM&P Management Processes

- **Questions: Has anyone had to verify that processes were being followed? What were the circumstances? What was done?**

- **Discuss why verification should be an important element of program office oversight of PM&P selections during (1) design, (2) production, and (3) sustainment**

- **Exercises**
  1. **Identify activities for high, medium, and low intensity verification during (1) design, (2) production, and (3) sustainment and describe how to accomplish those activities**
  2. **Explain how a program office could drive changes to contractor behavior with respect to a contractor following its own processes. Give specific examples**

Oversight: Validation That the Contractor's Processes in Its PM&P Management Plan Are Effective



- Details of the level and type of oversight associated with validation, which means ensuring that the contractor PM&P processes are effective (i.e., selections meet their allocated and derived requirements)
- GDO usage is unusual
  - Oversight considerations are the same
  - Additional discussion later in the training

Validation Approaches

- From least to most rigorous
  - Program office *monitoring* of contractor PM&P selections to facilitate suggested PM&P changes or processes for PM&P rejection or PM&P approval
  - Assessing the viability of PM&P selected that do not meet program office preferences leading to PM&P rejection, suggested PM&P changes, or expedited PM&P approval processes (*exception reporting*)
  - Specific program office *PM&P approval* or rejection
- Approaches are not mutually exclusive
- Contract requirements are needed to pursue the latter two approaches

sonmez karakurt/Getty Images, 2023

Considerations for Selecting Level and Type of Validation by PM&P Grouping (1 of 2)

bankrx/Getty Images, 2012

- **Monitoring contractor PM&P selections should usually occur, even in the lowest risk scenarios. Benefits include**
  - **Confidence in the PM&P that are used in DoD systems**
  - **Identification of contractor-chosen preferred PM&P not preferable to the program office**
  - **Negotiated PM&P changes before design lock**
  - **Enhanced program office influence**
  - **Improved contractor PM&P selection**
  - **Improved planning efficiency and future resource availability when changes cannot be negotiated**
  - **Improved PM&P approval process**
  - **Discovery of problematic PM&P**
- **Monitoring of contractor PM&P selections might not be needed when buying COTS items in a minimal risk environment**

Considerations for Selecting Level and Type of Validation by PM&P Grouping (2 of 2)

- PM&P approval is important for most critical scenarios
- For less critical situations, exception reporting should be used to supplement when monitoring contractor PM&P selections alone may not provide enough leverage to make changes (associated with preferences, not requirements) or the program office desires a better understanding of certain risks
- The balance between PM&P approval and exception reporting is a function of risk for lower criticality scenarios

bankrx/Getty Images, 2012

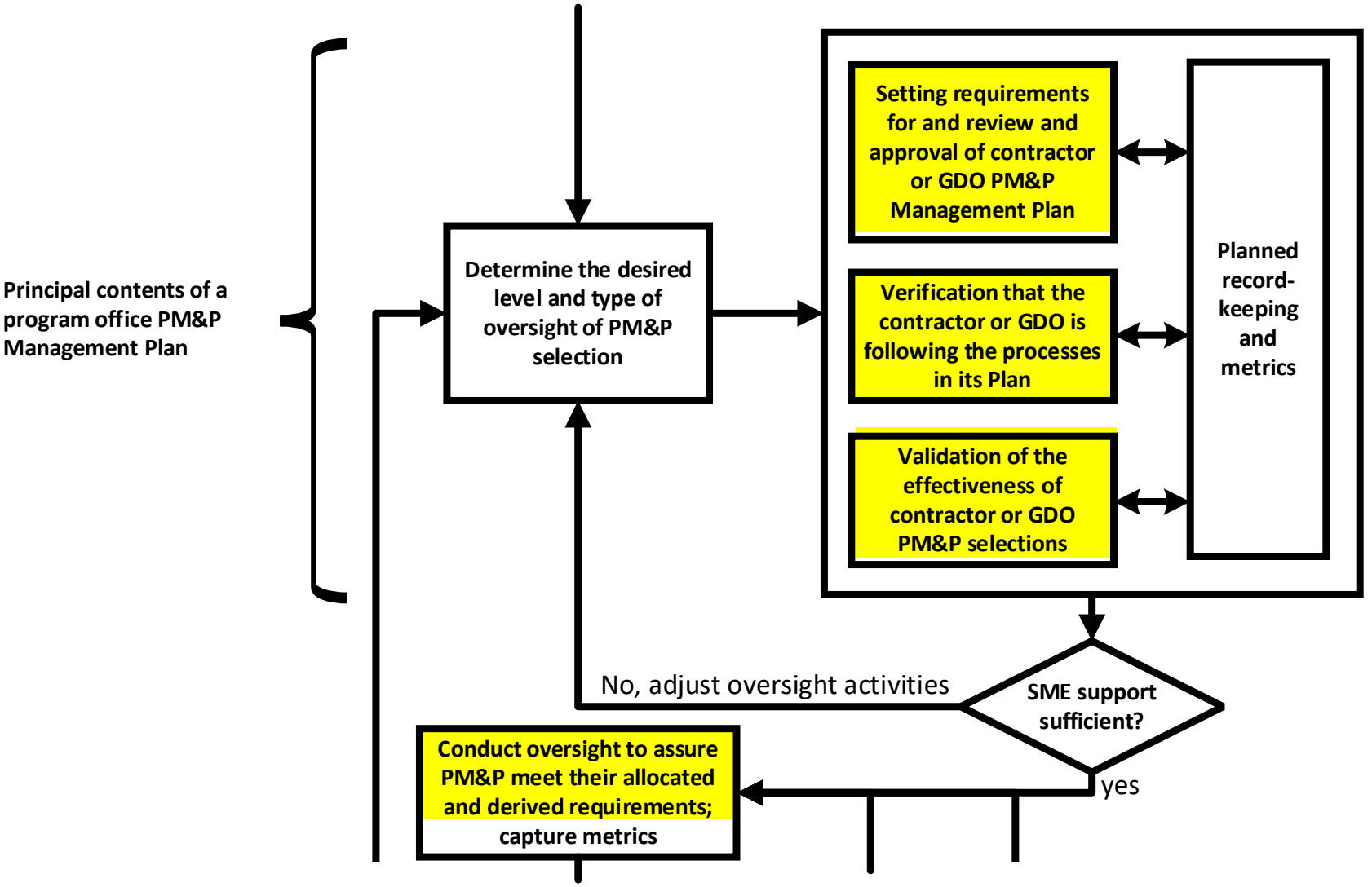
Breakout Group Exercises Concerning Oversight through Validation of Contractor PM&P Selections

- **Questions: Has anyone had to validate process effectiveness? What were the circumstances? What was done?**

- **Discuss why validation should be an important element of program office oversight of PM&P selections during (1) design, (2) production, and (3) sustainment**

- **Exercise**
  1. **Identify activities for high, medium, and low intensity validation during (1) design, (2) production, and (3) sustainment and describe how to accomplish those activities**
  2. **One aspect of part validation deals with the acceptability of its OEM. Describe activities that should be performed to ensure the suitability of the supplier and what would lead to rejection of the part**
  3. **If a part were found to be unacceptable, describe how the program office could drive changes to the contractor processes that led to that unacceptable choice. Give specific examples**

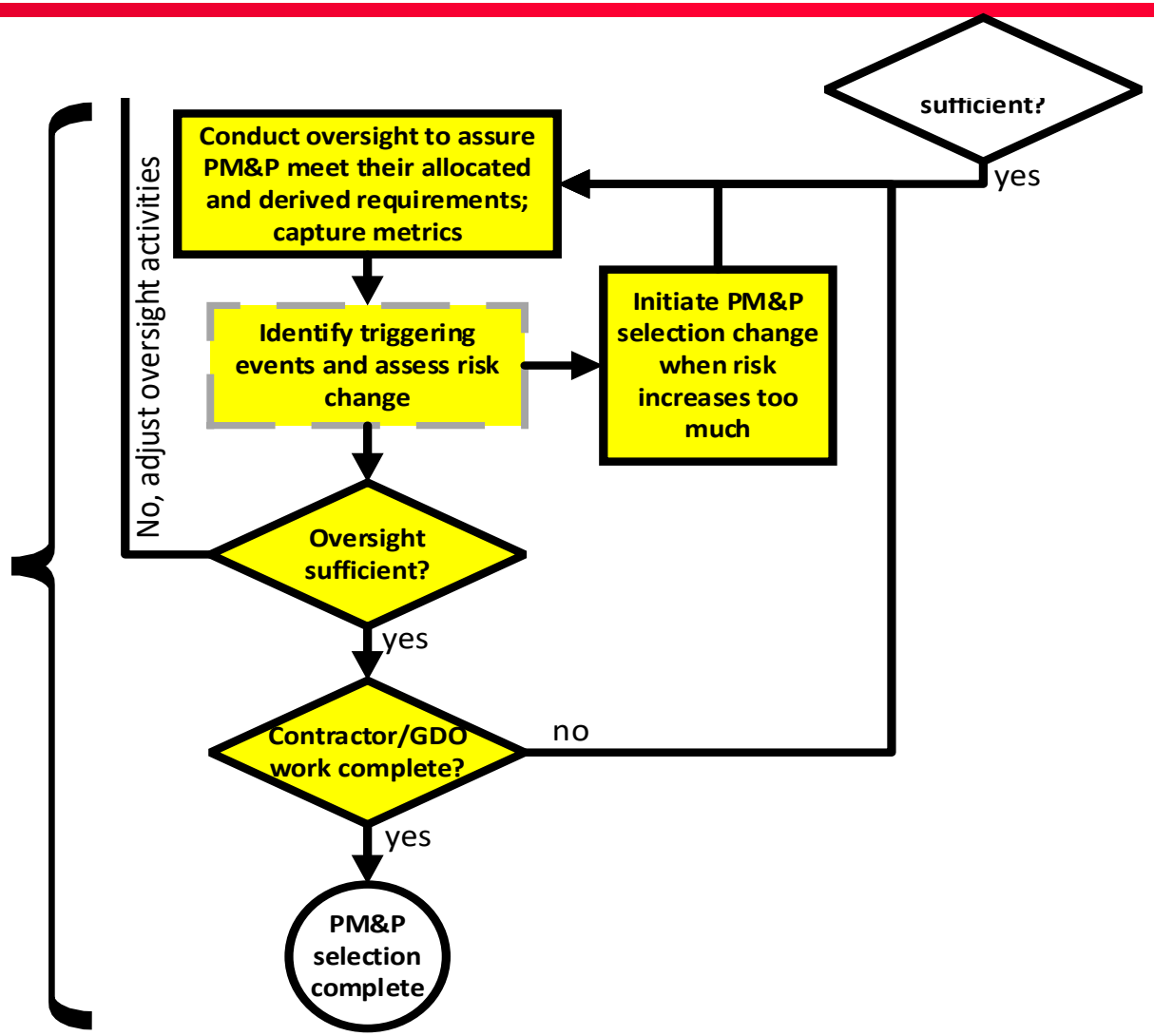
Oversight: PM&P Selections by Government Organizations



- In certain circumstances, a government organization may select PM&P
- Highlighted areas are equivalent to those shown in earlier sections of this training

Oversight: Replacing PM&P Selections

This represents the execution of the oversight process. Triggering events are often identified and assessed outside of the PM&P community, whose primary responsibility is to ensure the work is done and appropriate actions are taken as a result of the assessment. Processes for identifying triggering events and associated actions should be described in the program office PM&P Management Plan to the extent that the program office is involved.



- Top part of this graphic showed rigorous PM&P oversight during design
- Similar level of oversight should apply after a triggering event, depending on risk

References

Image References

- Abluecup*. Change answers*. Photograph. Getty Images. 2014.
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- Whatawin. *Halftone hand giving a thumbs up*. Illustration. Getty Images. 2024.