Intellectual Property Strategies for Additive Manufacturing in Defense Acquisitions

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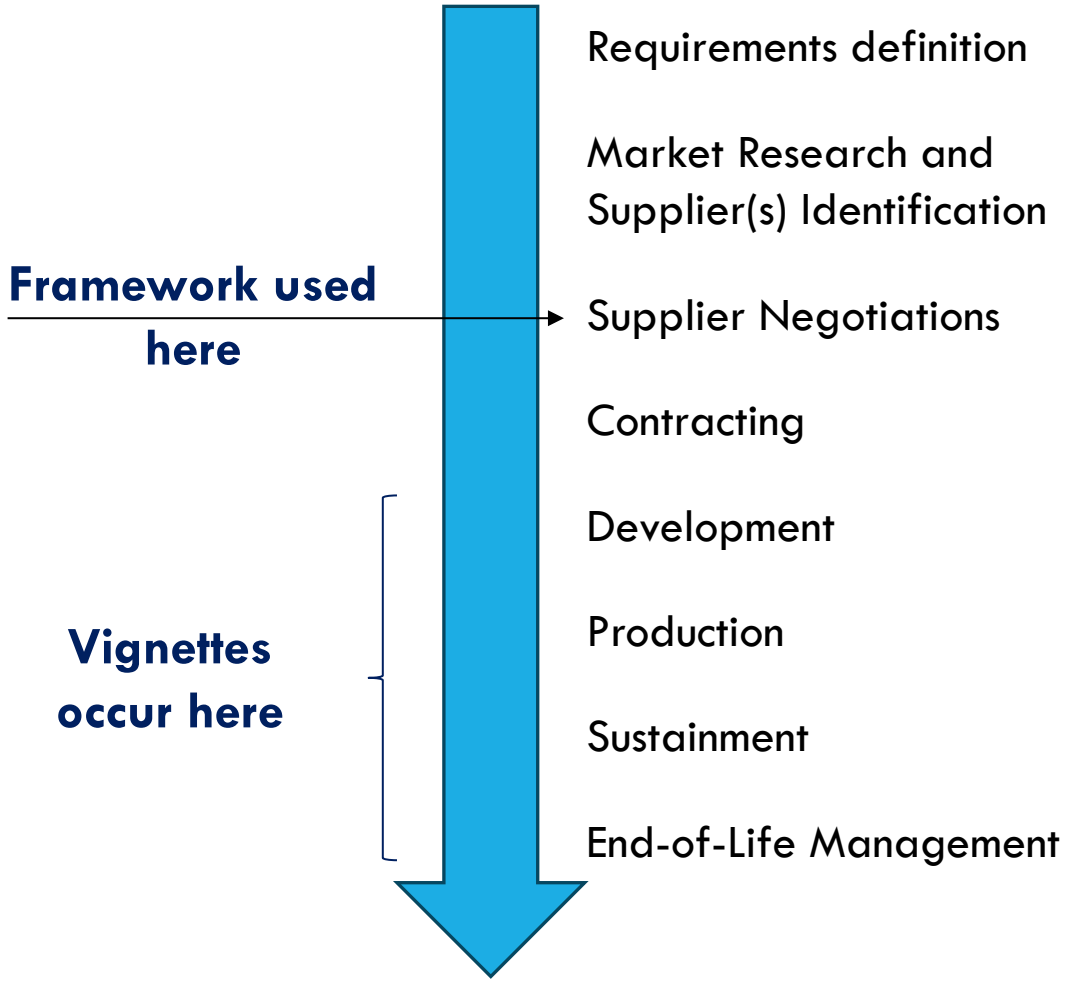
Agenda

- Motivation & objectives
- Proposed additive manufacturing (AM) IP acquisition framework
- Framework demonstration
- Summary of findings & future work

Motivation & Objectives

- AM presents unique challenges to **IP protection and compensation,** including in defense acquisition
- Motivation for a decision framework to ensure **sustainment of operations, adaptability, cost-effectiveness,** and **balance of government vs. contractor interests**
- Aim: Develop a decision support framework for IP acquisition in AM applications
  - Address the **why, what, and how** of IP acquisition
  - Apply concept of real options theory
  - Demonstrate framework applicability across a range of vignettes (use cases)

Acquisition Process Timeline

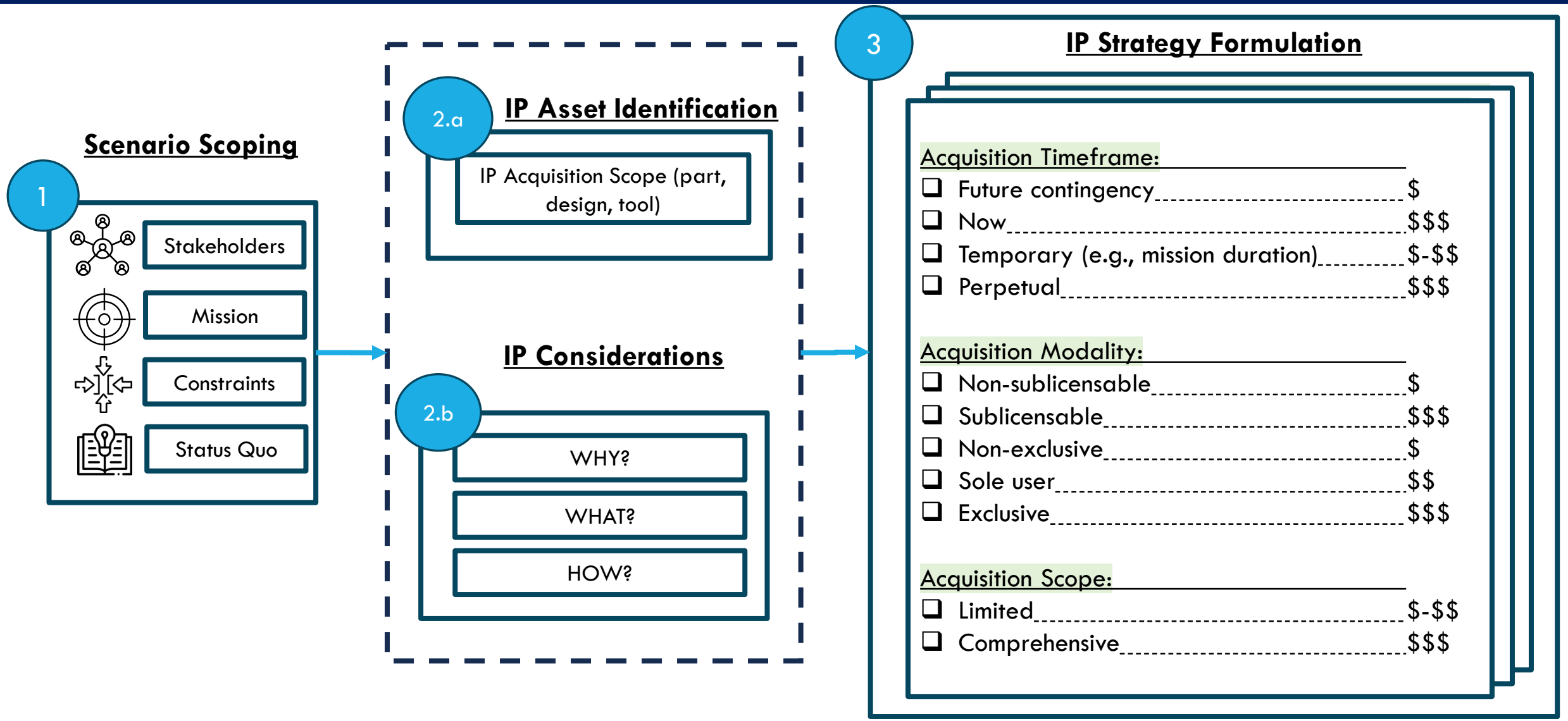


At point of applying framework:

- Vignettes have not occurred – **contingency planning**
- Consider both **process and product IP**

Goal: Develop IP acquisition strategy for AM processes to manage **future IP compensation** issues

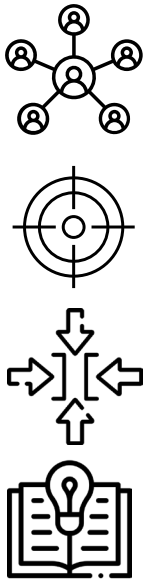
Proposed AM IP Acquisition Framework



Step 1: Scenario Scoping

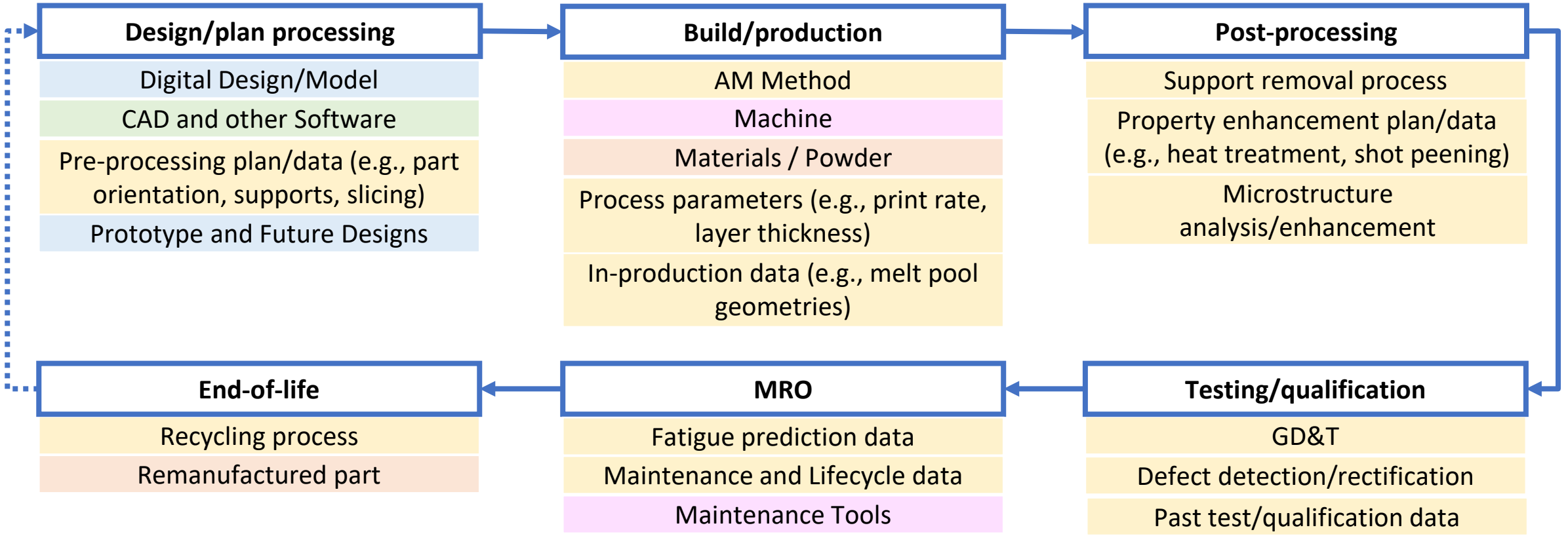
Step 1a: Identify the component or system for additive manufacturing

Step 1b: Gather relevant information to scope decision-making:



Scoping Category	Scenario features
OEM Status	Active or Inactive?
Manufacturing Status	Ongoing or discontinued?
Sourcing	Single-sourced or multi-sourced?
IP Acquisition Requirements	What are some needs/requirements that the IP acquisition strategy must fulfill?
Mission Status and Criticality	What are the timeline and criticality of the mission?
AM Capability Location	In-theatre or Out-of-theatre?
IP Rights Status	What parts/systems/processes and tools are protected by IP, and who owns the rights?

Step 2A: IP Asset Identification



IP Areas: **Design IP** **Process / Method IP & Data** **Software IP** **Part IP** **Tool IP**

Step 2B: IP Acquisition Considerations – Why/What/How

1. Why consider acquisition?

COST OF INACTION

- $: Low
- $$: Moderate
- $$$: High

2. What assets should be acquired?

ACQUISITION SCOPE

- $-$$: Limited
- $$$: Comprehensive

3. How to structure the IP compensation/transfer?

WHEN TO ACQUIRE

- $: Future contingency
- $$ - $$$: Now

EXCLUSIVITY

- $: Non-exclusive
- $$: Sole user
- $$$: Exclusive

IP OWNERSHIP DURATION

- None
- $-$$: Temporary
- $$$: Perpetual

SUBLICENSING

- $: Non-sublicensable
- $$ - $$$: Sublicensable

Step 3: IP Strategy Formulation

- Terminology:
  - *Option: A combination of timeframe, modality, and scope*
  - *Strategy: A set of recommended option(s)*
- Evaluation from previous steps informs generation of acquisition option(s)
- A set of options can be specified in an acquisition contract

Acquisition option

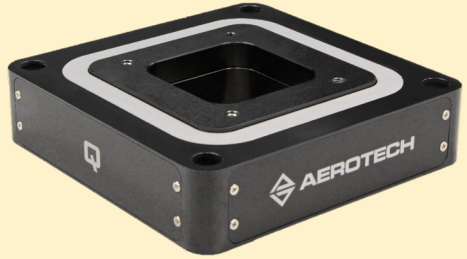
Acquisition Timeframe:
- ❑ Future contingency ---- $
- ❑ Now ---- $$$
- ❑ Temporary (e.g., mission duration) ---- $-$$
- ❑ Perpetual ---- $$$

Acquisition Modality:
- ❑ Non-sublicensable ---- $
- ❑ Sublicensable ---- $$$
- ❑ Non-exclusive ---- $
- ❑ Sole user ---- $$
- ❑ Exclusive ---- $$$

Acquisition Scope:
- ❑ Limited ---- $-$$
- ❑ Comprehensive ---- $$$

Three Vignettes with distinct features selected to demonstrate framework versatility

- Limited access to OEM (Sensor system)
  - AM well-placed to mitigate **supply chain disruptions**
  - Contingency IP acquisition strategy can enhance **adaptability** and ensure **proper IP transfer**



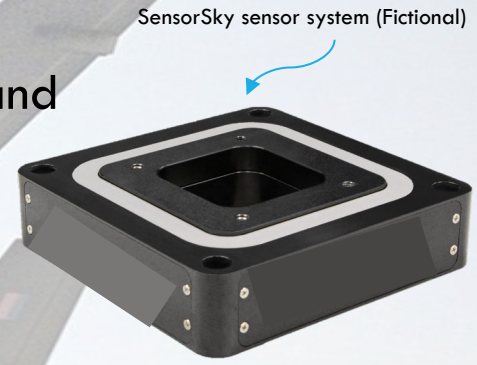
- In-theatre MRO (Aircraft tailhook)
  - AM well-suited to meet **on-site/decentralized production needs**
  - Appropriate IP acquisition and management can **minimize disruption to sustainment and operations** and **streamline inventory management**

- Demand surge (Respirator mask)
  - AM advantageous for **on-demand manufacturing**
  - IP compensation agreement upfront can facilitate **timely supply ramp up** and **avoid stifling innovation for crisis-critical products** during peacetime

Fictional Vignette Demonstration: Limited Access to OEM

Year: ~2035

Acquisition: DoD owns a fleet of advanced UAVs. Critical for both reconnaissance missions and tactical support. These UAVs rely on a sophisticated sensor system originally developed by SensorSky using Additive Manufacturing (AM), and industry leader in aerospace technology



Problem: SensorSky has recently dissolved due to financial instability.
The IP for the sensor system still exists, and the DoD wants to make sure that it will be transferred to them.

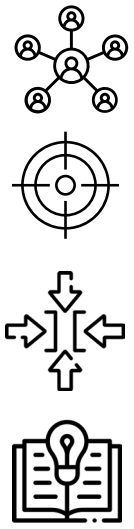
How can we use our AM IP Framework to prepare an IP strategy for this future contingency?

Assumptions and Scoping

Vignette Assumptions:

- DoD cannot find an alternative supplier in the market.
- The IP includes proprietary algorithms, integration, and manufacturing methods essential for the UAV's functionality.
- IP for the UAV sensor system has significant strategic value.
- No in-theatre capability requirement.
- Assume IP is intact (for IP protection during company dissolution).

Vignette Scoping:



Scoping Category	Scenario features
OEM Status	Active/ Inactive
Manufacturing of part/ system	Ongoing/ Discontinued
Sourcing	Single-source/ Multi-source
IP Acquisition Requirements	All IP required for DoD to **produce, qualify, operate, and replenish** the UAV sensors.
Mission Status and Criticality	Critical Sensor System. Ensure faultless operations.
AM Capability Location	In-theatre/ Out-of-theatre
IP Rights Status	IP is protected and intact, OEM owns all relevant IP

Relevant IP Assets in AM Lifecycle

Scoping Category	Scenario features
OEM Status	Active/ Inactive
Manufacturing of part/ system	Ongoing/ Discontinued
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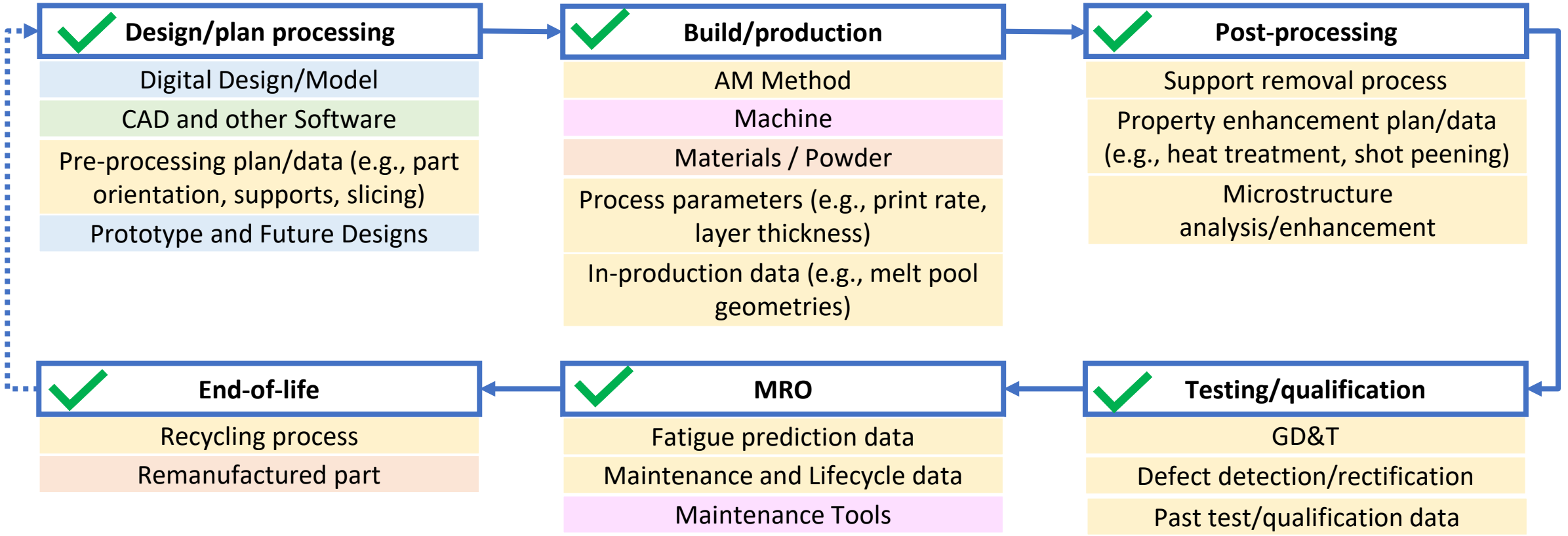
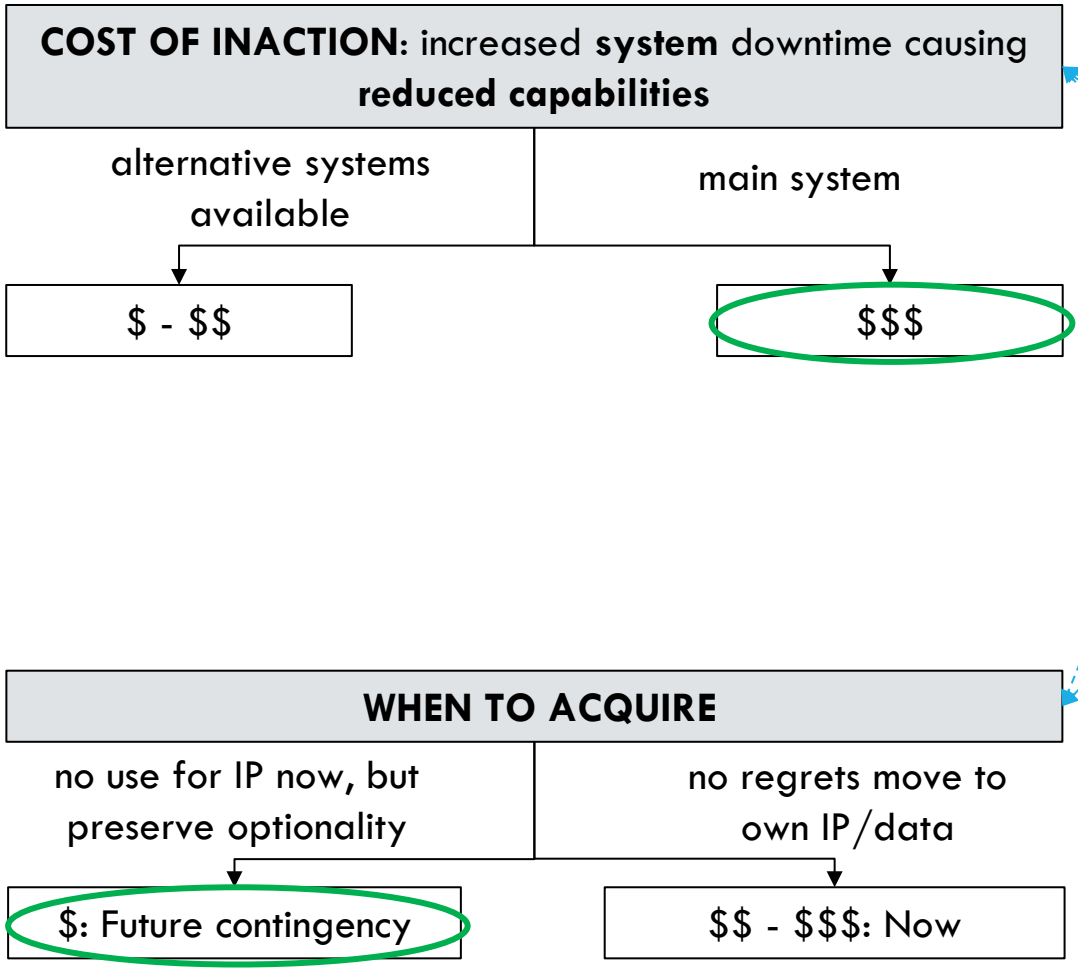


IP Areas: **Design IP** **Process / Method IP & Data** **Software IP** **Part IP** **Tool IP**

Identifying IP Considerations and Strategy (Detailed analysis)



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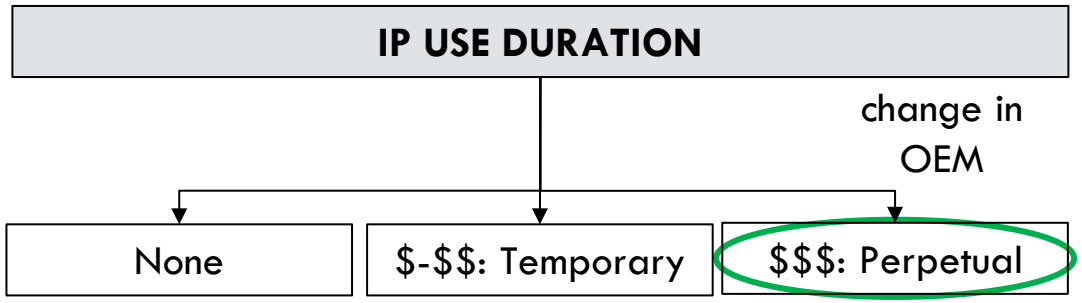
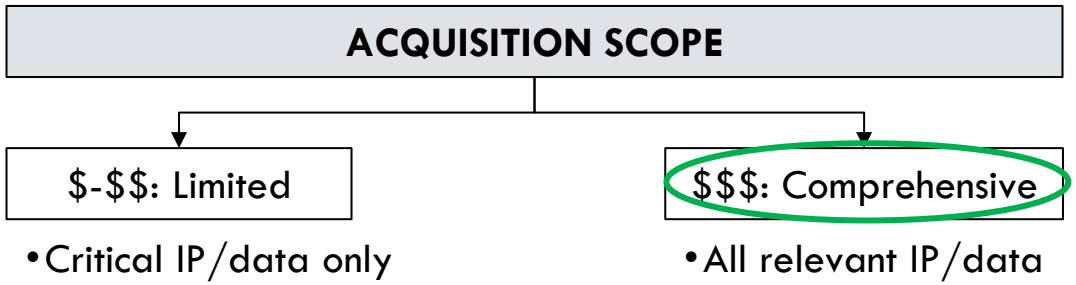
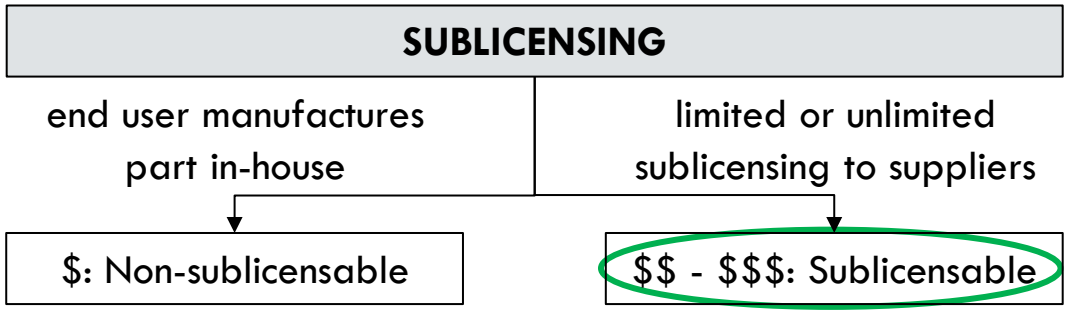
Mission Status and Criticality	Critical Sensor System. Ensure faultless operations.
AM Capability Location	In-theatre/Out-of-theatre
IP Rights Status	IP is protected and intact, OEM owns all relevant IP

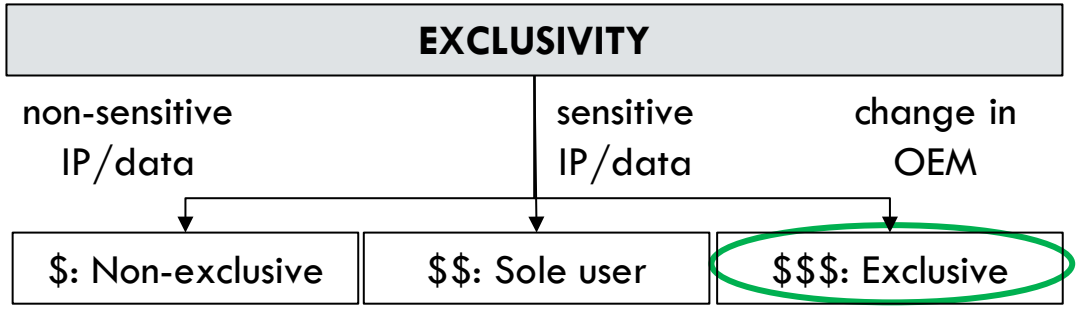
- **DoD may not be able to come to a similar manufacturing and operations agreement** with the OEM if the IP is transferred to a holding company with no manufacturing capabilities or overseas.
- Once the OEM is dissolved, it will **no longer manufacture, maintain, or support** the UAV sensors for the DoD.
- During supplier negotiations, there is **no immediate requirement** to establish in-theatre manufacturing capabilities, which remains unchanged when the vignette occurs.

Identifying IP Considerations and Strategy (analysis Summary)









IP Strategy Summarized

IP Option derived from above considerations

Acquisition Timeframe:	$$$
✓ Future contingency	$
❑ Now	$$$
❑ Temporary (e.g., mission duration)	$-$$
✓ Perpetual	$$$
Acquisition Modality:	**$$$**
❑ Non-sublicensable	$
✓ Sublicensable	$$$
❑ Non-exclusive	$
❑ Sole user	$$
✓ Exclusive	$$$
Acquisition Scope:	**$$$**
❑ Limited	$-$$
✓ Comprehensive	$$$

1. Strategy formulation based on performance requirement, not cost requirement
2. Exclusive, sublicensable, secretive and critical systems will lead to most expensive options

Sensitivity Analysis

I. **If OEM was still active** but manufacturing was discontinued, a temporary sublicensing arrangement could suffice.

II. **If substitutable goods exist**, critical-only data acquisition may be more suitable
- This can also reduce cost of inaction, and finding an alternative system may be preferable instead of IP acquisition

Summary of Findings

Project overview

- **Greenfield approach** to address **IP acquisition and management challenges unique to AM**
- To ensure sustainment of operations, adaptability, cost-effectiveness, and balance of government-contractor interests in defense acquisitions

Developed 3-step **framework to capture and evaluate key considerations** of AM IP acquisition decisions

- Scenario scoping: Distill **decision context, objectives** and **contingency scenarios**
- Asset identification and acquisition considerations: Evaluate decision **attributes, tradeoffs,** and **solution features**
- Acquisition strategy: Formulate acquisition **option(s) that best meet decision objectives**

Future Work

1. **Integration with existing acquisition rules and processes**
   - DoD acquisitions subject to existing acquisition frameworks, rules, processes, and decision support systems
   - Current framework can be adjusted to ensure it **supports/enhances existing processes**

2. **Portfolio-level acquisition decisions**
   - IP assets may create **acquisition dependencies**
   - Portfolio view factors in dependencies across IP assets to better support **agency-level outcomes**

3. **Uncertainty/risk quantification**
   - **Real option theory** can be used to simulate and quantify pricing of acquisition options
   - Specialized **software tools** can be developed to streamline quantification process

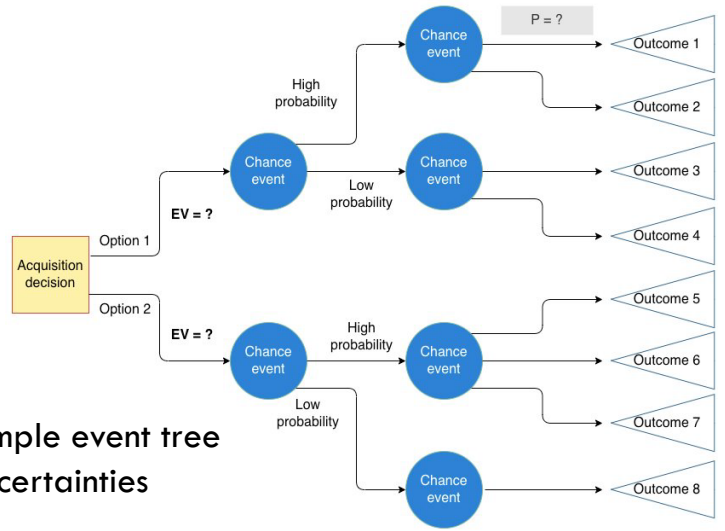


Figure: Example event tree with uncertainties

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