Balancing Access and Protection: A Decision Framework for Additive Manufacturing Intellectual Property Rights in Defense Acquisition

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Agenda

- Motivation and objectives
- Proposed AM IP acquisition framework
  - Step 1: Scenario scoping
  - Step 2: Asset identification and acquisition considerations
  - Step 3: Acquisition strategy
- Framework demonstration
  - Vignette: Demand surge on respirator mask
- Summary of findings
- Future work

Abbreviations

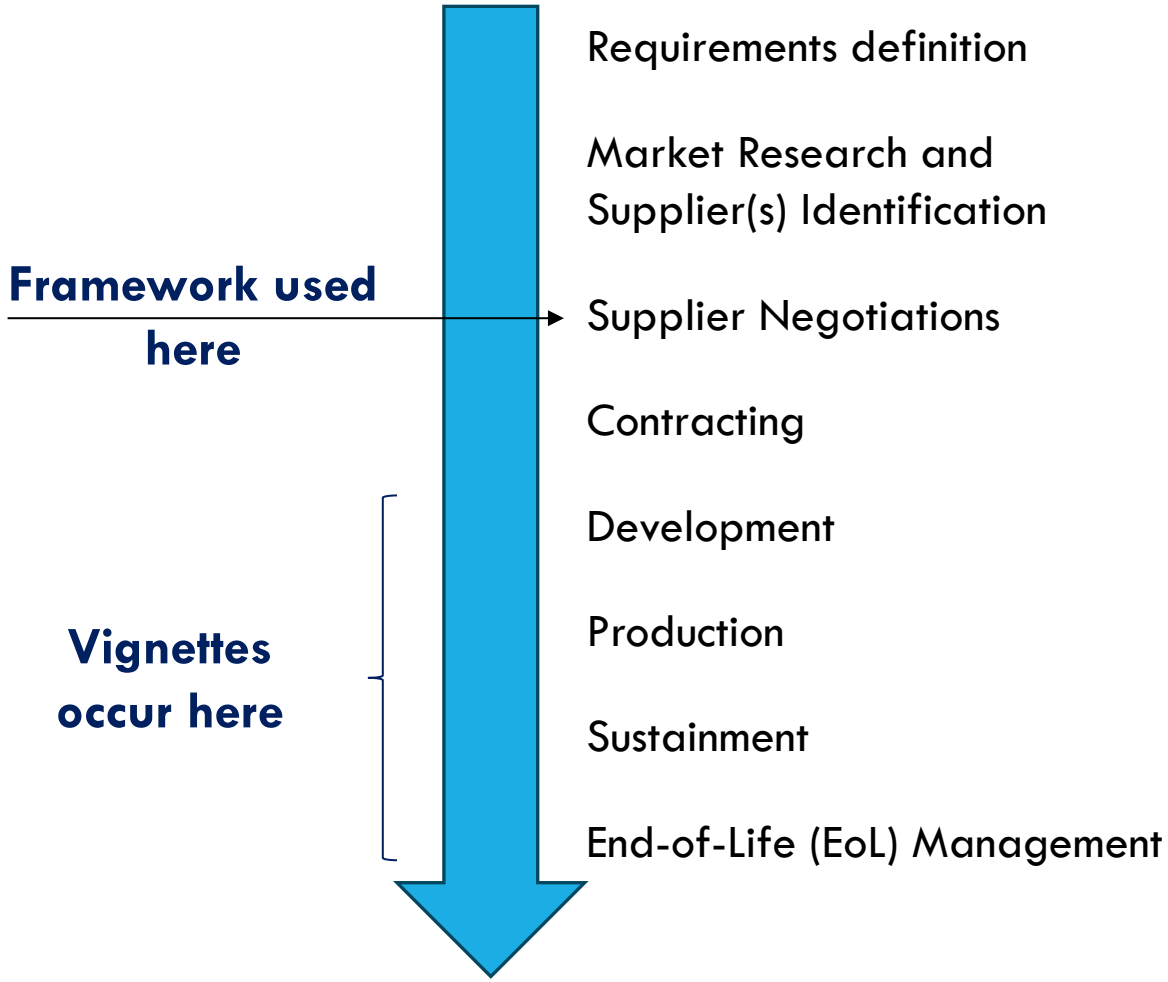
AM: Additive Manufacturing

IP: Intellectual Property

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

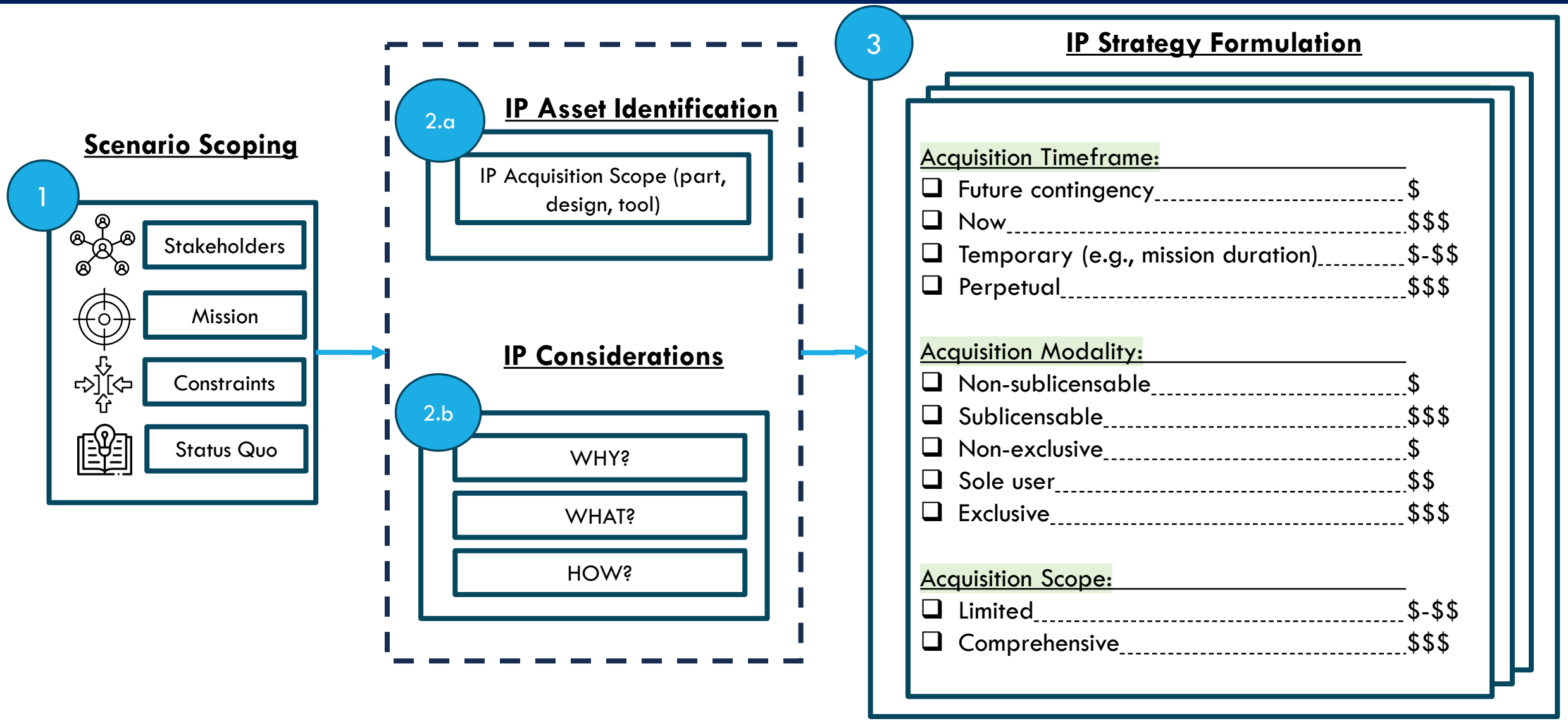


At point of applying framework:

- 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

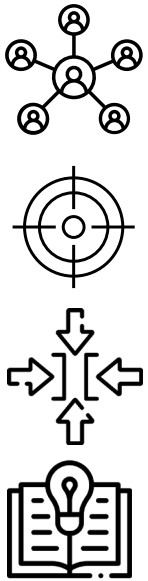
Proposed Three-Step AM IP Acquisition Framework



Step 1: Scenario Scoping

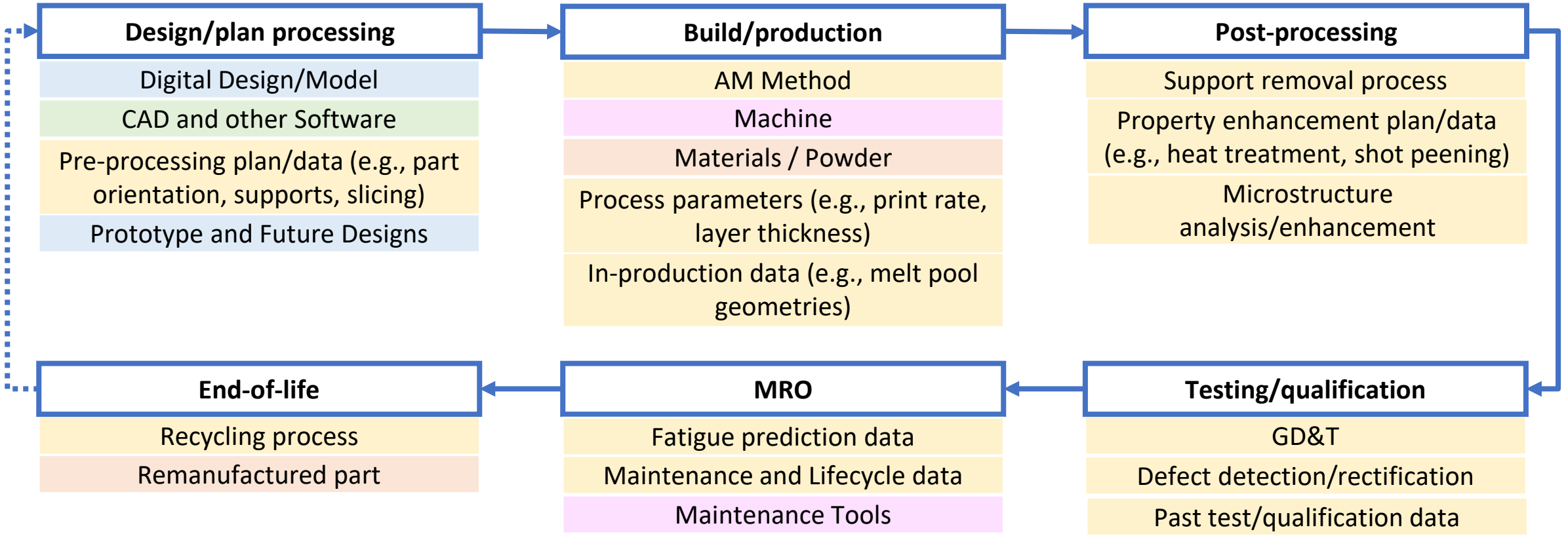
Step 1a: Identify the component or system for additive manufacturing

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-theater or out-of-theater?
IP Rights Status	What parts/systems/processes and tools are protected by IP, and who owns the rights?

Step 2A: IP Asset Identification



(MRO: Maintenance, Repair, Operations)

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

IP EXCLUSIVITY

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

IP OWNERSHIP DURATION

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

IP SUBLICENSING RIGHTS

- $: 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 ---------- $-$$
- ❑ Comprehensive ---------- $$$

Fictional Vignette: Demand Surge on Respirator Mask (Demonstrate Framework Versatility)

Background

- 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

Vignette Scenario (Fictional)

- In 2030, US intelligence sources warn of an imminent chemical warfare threat
- DoD wants to urgently ramp up PPE supply for its troops – specifically a proprietary respirator additively manufactured by Avon Protection

Problem

- OEM (Avon) alone cannot meet the demand surge – additional production capacity needed
- Respirator requires high precision to function – general manufacturers cannot manufacture them on demand with no additional data

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

Respirator Mask

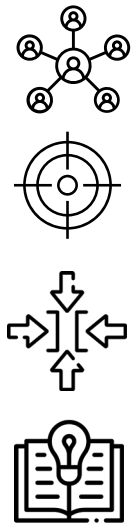
Image source: Avon Protection

Step 1: Scenario Assumptions and Scoping

Vignette Assumptions:

- Other respirator options exist but this OEM is deemed best-in-class and most mission appropriate.
- Both product and process IP are required to enable production by alternative suppliers.
- IP is not subject to invention secrecy or export control.
- Fair IP compensation agreement upfront will facilitate timely supply ramp-up and avoid limiting innovation for crisis-critical products during Business-as-Usual (BAU) operations.

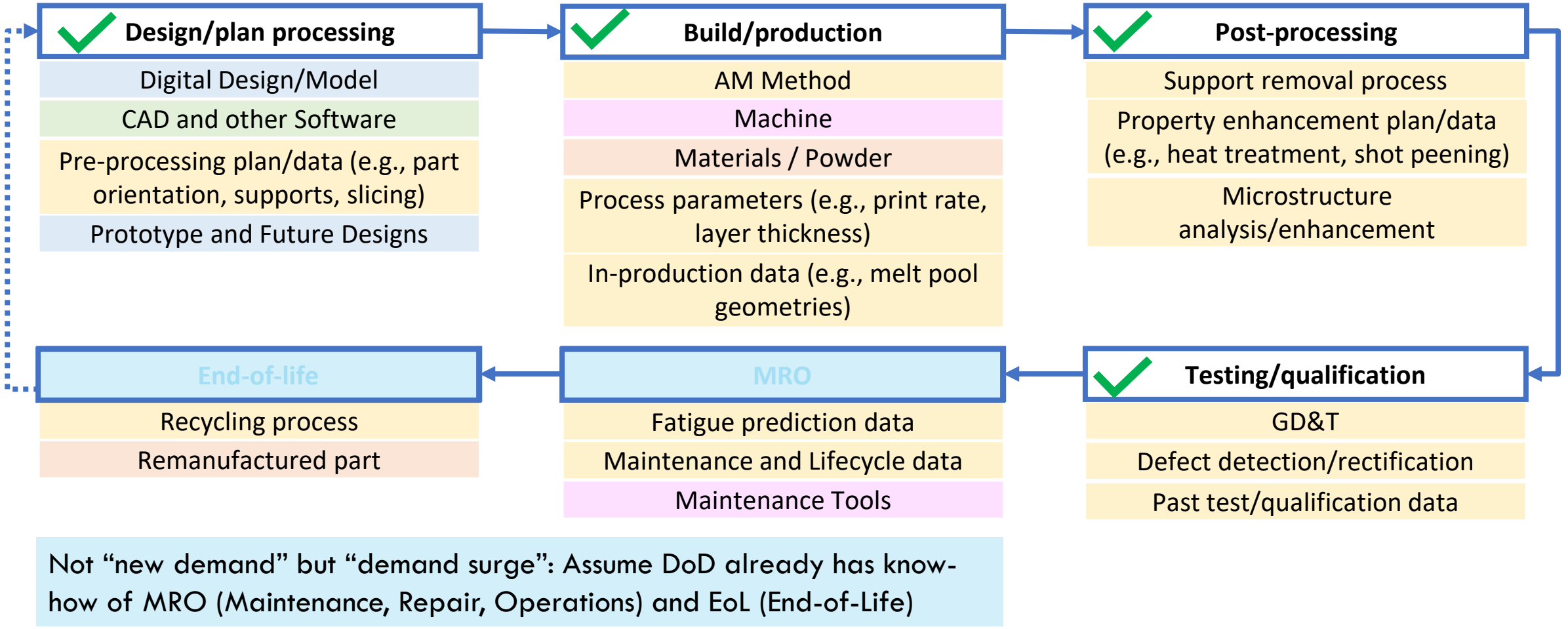
Vignette Scoping:



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 to produce and qualify the respirators**
Mission Status and Criticality	**National priority to ensure safety of troops**
AM Capability Location	~~**In-theatre**~~ / **Out-of-theatre**
IP Rights Status	**OEM owns all relevant IP**

Step 2A: Identify Relevant Parts of AM Lifecycle

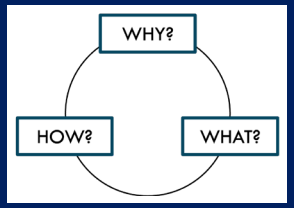
Scoping Category	Scenario features
IP Acquisition Requirements	All IP required to produce and qualify the product



Not "new demand" but "demand surge": Assume DoD already has know-how of MRO (Maintenance, Repair, Operations) and EoL (End-of-Life)

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

Step 2B: Identifying IP Considerations and Strategy



COST OF INACTION

Alternative systems available

Main system

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

Rationale: If no IP acquired:

- Possible to switch to inferior alternatives with some impact on performance
- Supply ramp-up is delayed if OEM withholds critical IP/production information

→ **Non-negligible cost of inaction: proceed with framework to determine IP acquisition strategy**

WHEN TO ACQUIRE

No use for IP now, but preserve optionality

No regrets move to own IP/data

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

Rationale:

- Production capacity sufficient for BAU operations
- No need to acquire IP (far) ahead of time to build human/system capability

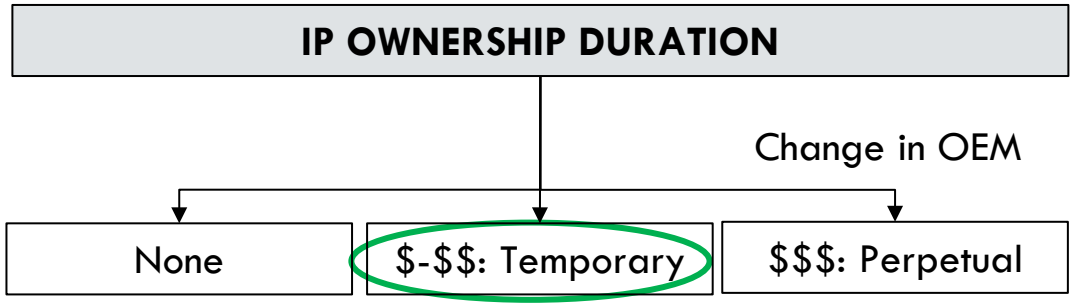
→ **Prepare option to acquire IP in future as contingency measure**

inform

inform

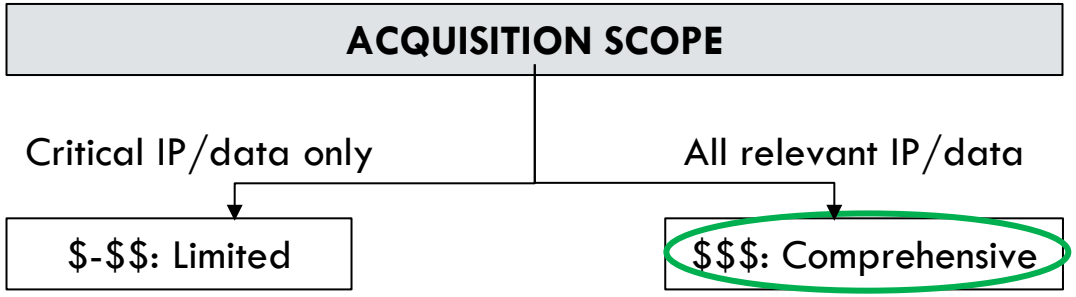
Scoping Category	Scenario features
OEM Status	**Active** / ~~Inactive~~
Manufacturing of part / system	**Ongoing** / ~~Discontinued~~
Sourcing	~~Single-Source~~ / **Multi-source** • Other respirators exist but this OEM is deemed best-in-class and most mission appropriate.
IP Acquisition Requirements	**All IP required to produce and qualify the respirators**
Mission Status and Criticality	**National priority to ensure safety of troops** • Fair IP compensation agreement upfront will facilitate timely supply ramp-up
AM Capability Location	~~In-theatre~~ / **Out-of-theatre**
IP Rights Status	**OEM owns all relevant IP** • Assume general manufacturers need short lead-time to start production upon access to IP

Step 2B: Identifying IP Considerations and Strategy (Cont.)



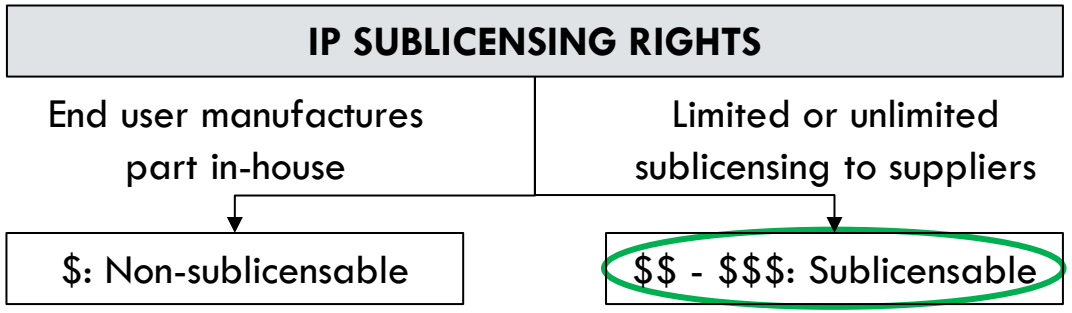
Rationale:
- Additional supply only required during demand surge, which should be temporary

→ **Consider "Temporary" for acquiring / leasing IP from OEM for the (expected) duration of the mission**



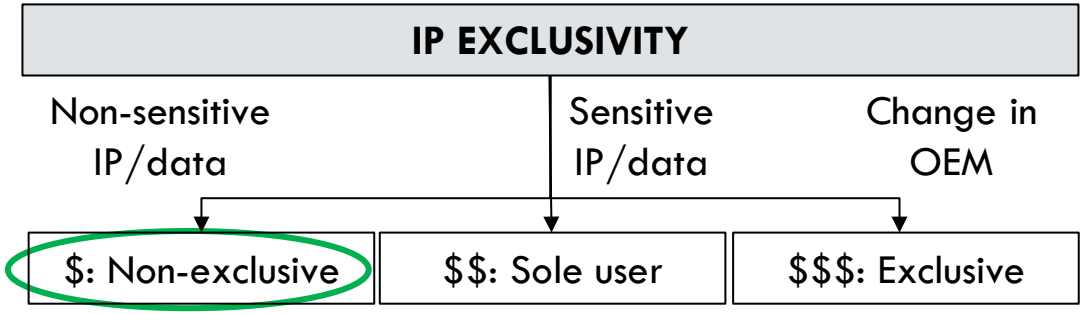
Rationale
- Respirators are mission-critical equipment
- Lead time is short – "good-to-have" IP can help new suppliers achieve required high precision more quickly

→ **Comprehensive IP acquisition preferred**



Rationale:
- DoD generally outsources manufacturing for out-of-theatre production needs

→ **Essential to acquire sublicensing rights for distribution to alternative suppliers**



Rationale:
- OEM requires access to IP to meet demand surge
- IP not deemed secret/sensitive

→ **Non-exclusive IP license will suffice**

Step 3: IP Acquisition Strategy Summarized

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	$$$

Note: Strategy formulation based on performance requirement, not budget requirements/constraints

Sensitivity analysis: How would different assumptions affect option formulation?

1. If fully substitutable goods exist in enough quantity to meet demand surge:
   - Cost of inaction significantly lower
   - Maybe no need to acquire any IP
2. If new suppliers need significant lead time to develop required human/system capabilities for production:
   - Consider acquiring IP now to grow strategic manufacturing capabilities in time; or
   - Identify appropriate triggers to exercise option, factoring in required lead time
3. If IP is classified or security-critical:
   - Consider sole user licenses (sensitivity of IP and product should align)
4. If OEM is inactive:
   - Consider IP/technical data escrow, which offers a middle ground between access and protection

Summary of Findings

Research overview

- **Novel Approach**: Developed a greenfield approach to address unique IP acquisition and management challenges in additive manufacturing
- **Strategic Objective**: Designed to ensure operational sustainment, adaptability, cost-effectiveness, and balanced government-contractor interests in defense acquisitions

How do we balance access (government) and protection (defense industrial base entities)?

- **Foundational Concept**: Implement flexible IP acquisition strategies recognizing that no "one-size-fits-all" solution exists for AM intellectual property
- **Practical Application**: Create a structured evaluation framework to determine optimal IP rights

Developed 3-step framework: Capturing and evaluating key considerations of AM IP acquisition decisions

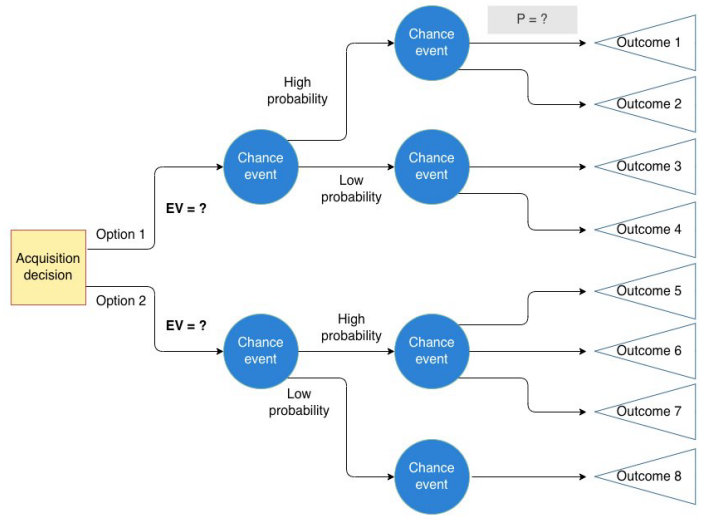
- **Step 1: Scenario scoping:** Distill decision context, objectives, and contingency scenarios
- **Step 2: Asset identification and acquisition considerations**: Evaluate decision attributes, tradeoffs, and solution features
- **Step 3: Acquisition strategy**: Formulate acquisition options that best 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



Example event tree with uncertainties

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