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Dublin, Ireland
July 2 - 6, 2024

How to Approach a Digitization Plan for Standards

Leslie McKay, Director of Digital Standards Development, SAE International

SAE INTERNATIONAL®

MISSION: *To advance mobility knowledge and solutions for the* ***benefit of humanity***

NEUTRAL FORUMS

Address society's mobility needs

RESOURCES

Engineering resources to advance mobility

EDUCATION

STEM programs and professional courses, building the workforce

COMMUNITY

Global community pulling from each other's collective wisdom

STANDARDS

Consensus-based standards that advance quality, safety and innovation

ROLES IN INDUSTRY: Professional Association, SDO, Publisher, STEM Educator, Professional Workforce Development, Knowledge & Networking Resource

Our Community – Aerospace and Ground Vehicle

105+
Years

44,000+
Standards

11,000+
Participants

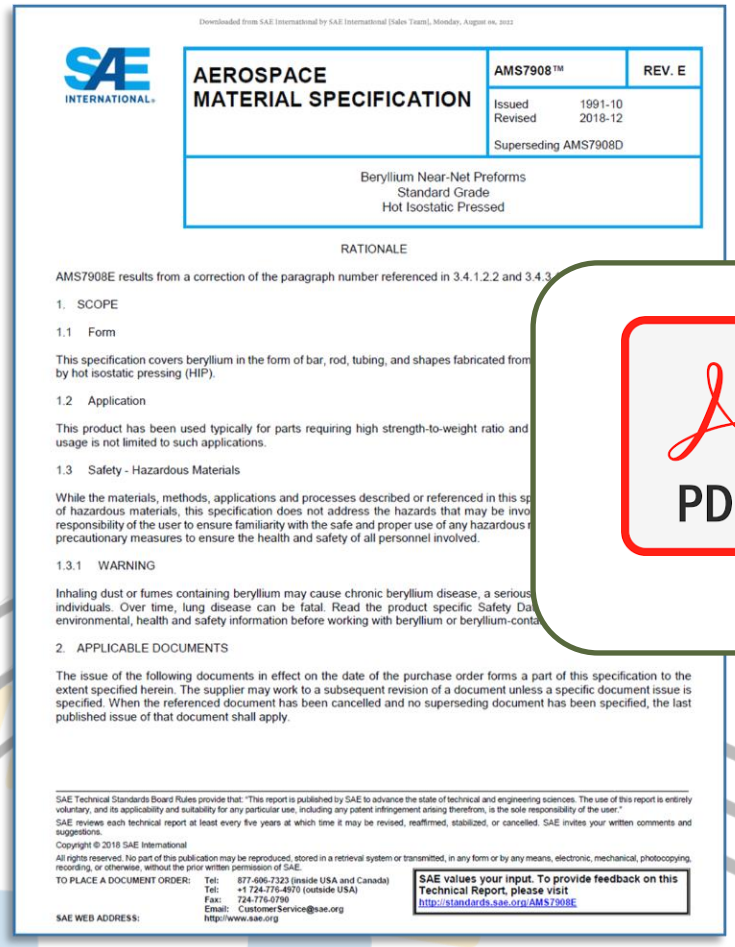
59+
Countries

1,800+
Works in Progress

570+
Technical Committees

550+
Committees & steering groups

How do Standards Fit in Age of Digital Transformation



AEROSPACE MATERIAL SPECIFICATION

AMS7908™ REV. E

Issued 1991-10
Revised 2018-12

Superseding AMS7908D

Beryllium Near-Net Preforms
Standard Grade
Hot Isostatic Pressed

RATIONALE

AMS7908E results from a correction of the paragraph number referenced in 3.4.1.2.2 and 3.4.3.

1. SCOPE

1.1 Form

This specification covers beryllium in the form of bar, rod, tubing, and shapes fabricated from by hot isostatic pressing (HIP).

1.2 Application

This product has been used typically for parts requiring high strength-to-weight ratio and usage is not limited to such applications.

1.3 Safety - Hazardous Materials

While the materials, methods, applications and processes described or referenced in this sp of hazardous materials, this specification does not address the hazards that may be invo responsibility of the user to ensure familiarity with the safe and proper use of any hazardous precautionary measures to ensure the health and safety of all personnel involved.

1.3.1 WARNING

Inhaling dust or fumes containing beryllium may cause chronic beryllium disease, a serious individuals. Over time, lung disease can be fatal. Read the product specific Safety Da environmental, health and safety information before working with beryllium or beryllium-conta

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

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SAE values your input. To provide feedback on this Technical Report, please visit
http://standards.sae.org/AMS7908E

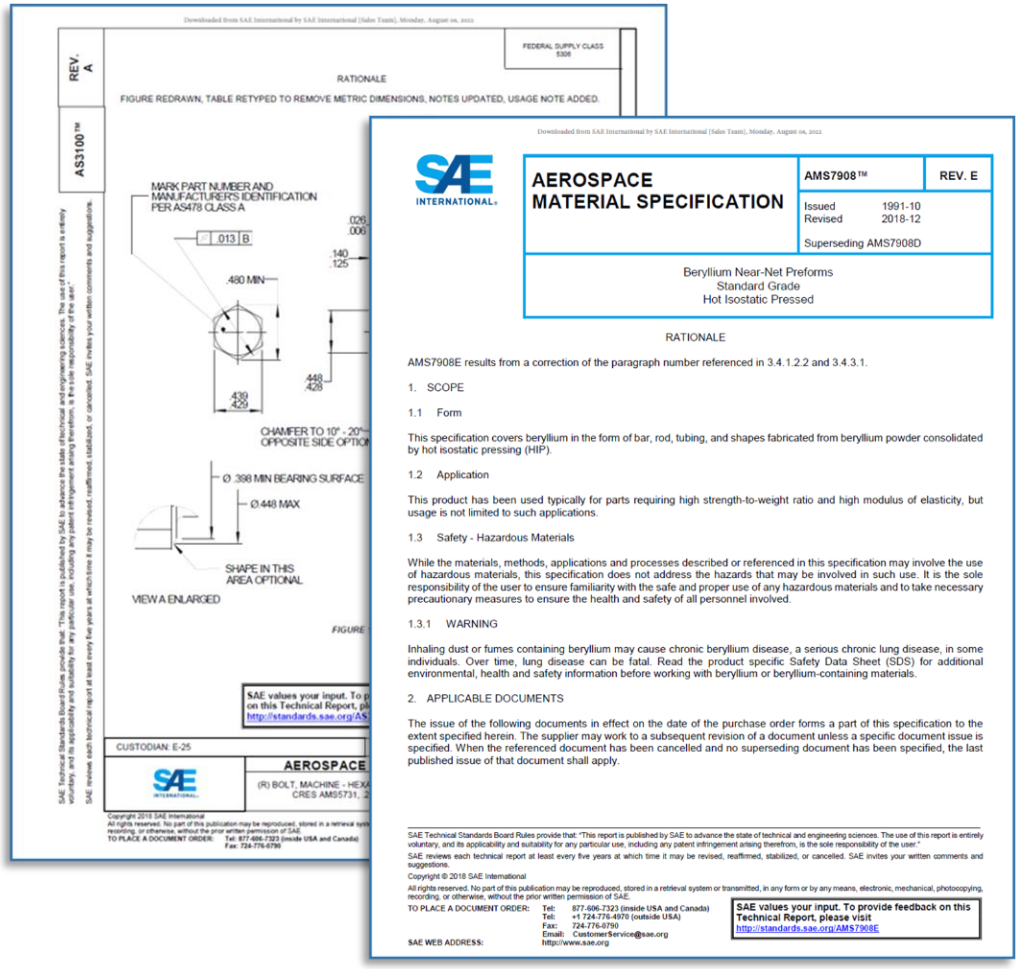
PDF

Standard	Title	Group Name	Element	Value (max)	Value (min)
AMS7908E	Beryllium Near-Net Preforms Standard Grade Hot Isostatic Pressed	T1 - Composition	Beryllium Oxide	1.5	
AMS7908E	Beryllium Near-Net Preforms Standard Grade Hot Isostatic Pressed	T1 - Composition	Carbon	0.15	
AMS7908E	Beryllium Near-Net Preforms Standard Grade Hot Isostatic Pressed	T1 - Composition	Iron	0.13	
AMS7908E	Beryllium Near-Net Preforms Standard Grade Hot Isostatic Pressed	T1 - Composition	Aluminum	0.1	
AMS7908E	Beryllium Near-Net Preforms Standard Grade Hot Isostatic Pressed	T1 - Composition	Magnesium	0.08	
AMS7908E	Beryllium Near-Net Preforms Standard Grade Hot Isostatic Pressed	T1 - Composition	Silicon	0.06	
AMS7908E	Beryllium Near-Net Preforms Standard Grade Hot Isostatic Pressed	T1 - Composition	Other Elements, each	0.04	
AMS7908E	Beryllium Near-Net Preforms Standard Grade Hot Isostatic Pressed	T1 - Composition	Beryllium		98.5

Standard	Group Name	Tensile Strength (ksi) min	Tensile Strength (mpa) min	Yield Strength at 0.2% Offset (ksi) min	Yield Strength at 0.2% Offset (mpa) min	Elongation in 4D (inch/inch or percentage) min	Inches | Millimeters (size) max	Tolerance, Inch plus | Tolerance, Millimeters plus (inch) min	Tolerance, Inch plus | Tolerance, Millimeters plus (inch) max
AMS7908E	T2 - Tensile Properties	60	414	43	296	3			
AMS7908E	T3 - Dimensional Tolerances						76	0.016	0.016
AMS7908E	T3 - Dimensional Tolerances						508	0.062	0.062
AMS7908E	T3 - Dimensional Tolerances							0.25	0.25
AMS7908E	T3 - Dimensional Tolerances						508	0.125	0.125
AMS7908E	T3 - Dimensional Tolerances							0.25	0.25

Rethinking How You Write Standards

- Going digital is changing how standards are written
- A document does not always translate well to a digital format
- Sentence structure, table layouts, and variable naming can all be impacted
- Need to consider how digital standards are searched and retrieved—not how a document is read



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1. SCOPE

1.1 Form

This specification covers beryllium in the form of bar, rod, tubing, and shapes fabricated from beryllium powder consolidated by hot isostatic pressing (HIP).

1.2 Application

This product has been used typically for parts requiring high strength-to-weight ratio and high modulus of elasticity, but usage is not limited to such applications.

1.3 Safety - Hazardous Materials

While the materials, methods, applications and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards that may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

1.3.1 WARNING

Inhaling dust or fumes containing beryllium may cause chronic beryllium disease, a serious chronic lung disease, in some individuals. Over time, lung disease can be fatal. Read the product specific Safety Data Sheet (SDS) for additional environmental, health and safety information before working with beryllium or beryllium-containing materials.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

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Digitizing Existing Standards

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- Authoring guidelines, etc. can help transform new standards
- But there are still thousands of existing standards to digitize
  - Various SDOs have libraries of thousands of standards
  - Various companies have libraries of thousands of internal standards that may or may not be based on industry standards
- It is critical to think through how to develop a digitization plan

Where to Begin?

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Step 1 What Do You Want to Accomplish?	Step 2 What Do You need to Achieve Goals?	Step 3 How Do You Get There?
Identify the End Goal and What in Needed to Accomplish it	Identify Technologies and Expertise Needed	Develop a Digitization Plan

Step 1

What Do you Want to Accomplish?

There are Many Different Types of Standards

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- Process Standards
- Management Standards
- Product Standards
- Standard Parts and Materials
- Quality Standards
- Vocabulary Standards
- Manufacturing Standards
- Safety Standards
- Security Standards
- And More…

Not All Digital Standards Will Be the Same

Different Standards Convey Different Information

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Standard Type	Conveys	Possible Information Needed in Digital Form
Parts Standards	Dimensions, composition	• Models • Drawings • Data tables • Requirements statements
Quality Standards	Requirements	• Prose • Requirements statements
Process Standards	Process steps	• Prose • Process steps • Calculations
Manufacturing Standards	Manufacturing processes	• Prose • Process steps • Calculations • Testing requirements
…	…	…

Start With The End To Determine What You Need

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Use Cases	Digital Information Needed
As an enterprise data systems engineer, I want to automate the **programming of ovens** to perform standard heat treatments on raw metals so that my manufacturing process is defined from an authorized source.	Process steps that can be translated into code
As a design engineer, I want to easily **find standard parts and materials** that are the best fit for the requirements of my project so that I do not have to waste time and effort designing custom parts.	Dimensions, composition, properties, requirements, drawings, 3D models
As a compliance engineer, I want to have **all product requirements tracked** in a single area so that I can easily trace test results to requirements from standards and have a digital thread to present to regulatory agencies.	Requirements extracted in ReqIF or equivalent format to track in customer's requirements tracking system
…	…

Identifying Standards Needed

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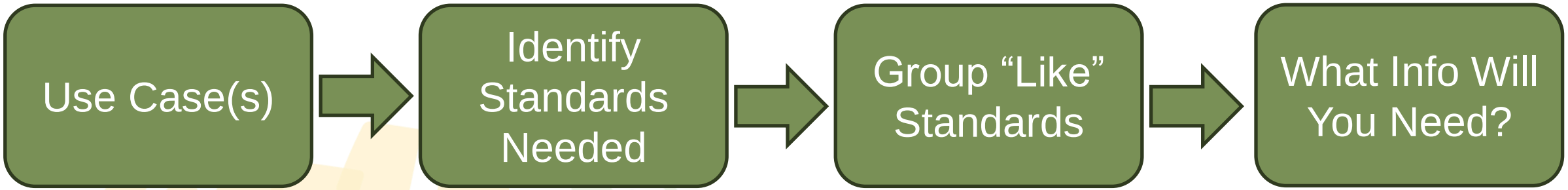

Stay Focused to Achieve Incremental Wins

(Standards and Referenced Standards)

- Outline
- Discoverability
- Output

Target Must-Have Information

Why Grouping is Important: Examples of Different Aluminum Standards

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Aluminum Alloy (AMS4016)

1. Scope
2. Applicable Documents
3. Requirements
    1. Composition
    2. Condition
    3. Properties:
        1. Tensile Properties
        2. Bending
    4. Quality
    5. Tolerances
4. QA
    1. Inspection
    2. Acceptance
    3. Periodic Tests
    4. Sampling and Testing
    5. Reports
    6. Resampling and retesting
5. Prep for Delivery
    1. Identification
    2. Packaging

Aluminum Alloy (AMS4044)

1. Scope
2. Applicable Documents
3. Requirements:
    1. Composition
    2. Condition
    3. Properties
        1. Tensile Properties Annealed
        2. Bending Annealed
        3. Tensile Properties T62 Temper
        4. Bending Parameters T62 Temper
        5. Tensile Properties T732 Temper
        Quality
    4. Quality
    5. Tolerances
4. QA
    1. Inspection
    2. Acceptance
    3. Periodic Tests
    4. Sampling and Testing
    5. Reports
    6. Resampling and Retesting
5. Prep for Delivery
    1. Identification
    2. Protective Treatment
    3. Packaging

Different Information → Different Digital Format

What Do You Want to Accomplish?
Leveraging End Goals to Develop Digitization Plan

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1. Start with the End Goal in mind—work towards incremental wins

2. Identify target standards and group together similar standards

3. Identify the information needed from each standard to support your use case
    a) Requirements list
    b) Dimensions
    c) Properties
    d) Etc.

Step 2

What Do you Need to Achieve Your Goals?

Start With The End To Determine What You Need

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Use Cases	Digital Information Needed	PDF Likely Contains
As an enterprise data systems engineer, I want to automate the **programming of ovens** to perform standard heat treatments on raw metals so that my manufacturing process is defined from an authorized source.	Process steps that can be translated into code	• Prose • Process steps • Calculations • Testing requirements
As a design engineer, I want to easily **find standard parts and materials** that are the best fit for the requirements of my project so that I do not have to waste time, money, and effort designing custom parts.	Dimensions, composition, properties	• Models • Drawings • Data tables
As a compliance engineer, I want to have **all product requirements tracked** in a single application so that I can easily trace test results to requirements from standards.	Requirements extracted in ReqIF or equivalent format to track in customer's requirements tracking system	• Prose • Requirements statements
…	…	

Forming a Digitization Plan

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- Think about the information needed from each standard and the best format for the information to be consumed
- Consider the technologies to obtain the needed information
- Also consider that some standards may not make sense to digitize at all

Standards With…	May Be Best Digitized By…
Standards with prose, process steps, requirements	Natural Language Processing (NLP), such as Machine Learning (ML) or Large Language Model (LLM)
Standards that contain primarily images, drawings	Optical Character Recognition (OCR) or Data Entry
Table-heavy standards with lots of data	Data Entry
Standards targeted for processes or standards to be applied as part of a larger system	SysML (MBSE model)
Handwritten or scanned standards (no electronic copy, e.g., MIL standards)	Large Language Model (LLM)

Many Titanium Standards Contain Similar Information

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1. Scope
2. Applicable Documents
3. Technical Requirements
    1. Composition
    2. Melting Practice
    3. Condition
    4. Annealing or Heat Treatment
    5. Properties
    6. Quality
    7. Tolerances
    8. Exceptions
4. Quality Assurance Provisions
    1. Responsibility for Inspection
    2. Classification of Test
    3. Sampling and Testing
    4. Reports
    5. Resampling and Retesting
5. Preparation for Delivery
    1. Identification
    2. Packaging
6. Acknowledgement
7. Rejections
8. Notes

- How do you want to have this standard found?
    - Search by composition
    - Search by properties
    - Other?
- What do you really need from this standard?
    - Technical requirements
    - Quality assurance provisions
    - Preparation for delivery
- What format do you need this in?
    - ReqIF or equivalent
    - Data for input to models
- What is the best way to get this information?
    - Some form of NLP is best start

Titanium vs. Aluminum: Different Families

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Titanium

1. Scope
2. Applicable Documents
3. Requirements
    1. Composition
    2. Melting Practice
    3. Condition
    4. Annealing or Heat Treatment
    5. Properties:
        1. Tensile Properties
        2. Bending
        3. Stress-Corrosion Resistance
        4. Microstructure
        5. Surface Contamination
    6. Quality
    7. Tolerances
4. QA
    1. Inspection
    2. Acceptance
    3. Periodic Tests
    4. Sampling and Testing
    5. Reports
    6. Resampling and retesting
5. Prep for Delivery
    1. Identification
    2. Packaging

Aluminum Alloy (AMS4016)

1. Scope
2. Applicable Documents
3. Requirements
    1. Composition
    2. Condition
    3. Properties:
        1. Tensile Properties
        2. Bending
    4. Quality
    5. Tolerances
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    1. Identification
    2. Packaging

What Do You Need to Achieve Your Goals? Categorize and Plan

1. Identify families of standards that are similar enough to group together and determine best digitization process for each family

2. Plan out:
    1. What data needs to be searched
    2. What info/data needs to be extracted
    3. What other information is relevant in the standard

Step 3

How Do You Get There?

Digitization Plan Accounts for Different Digitization Methods

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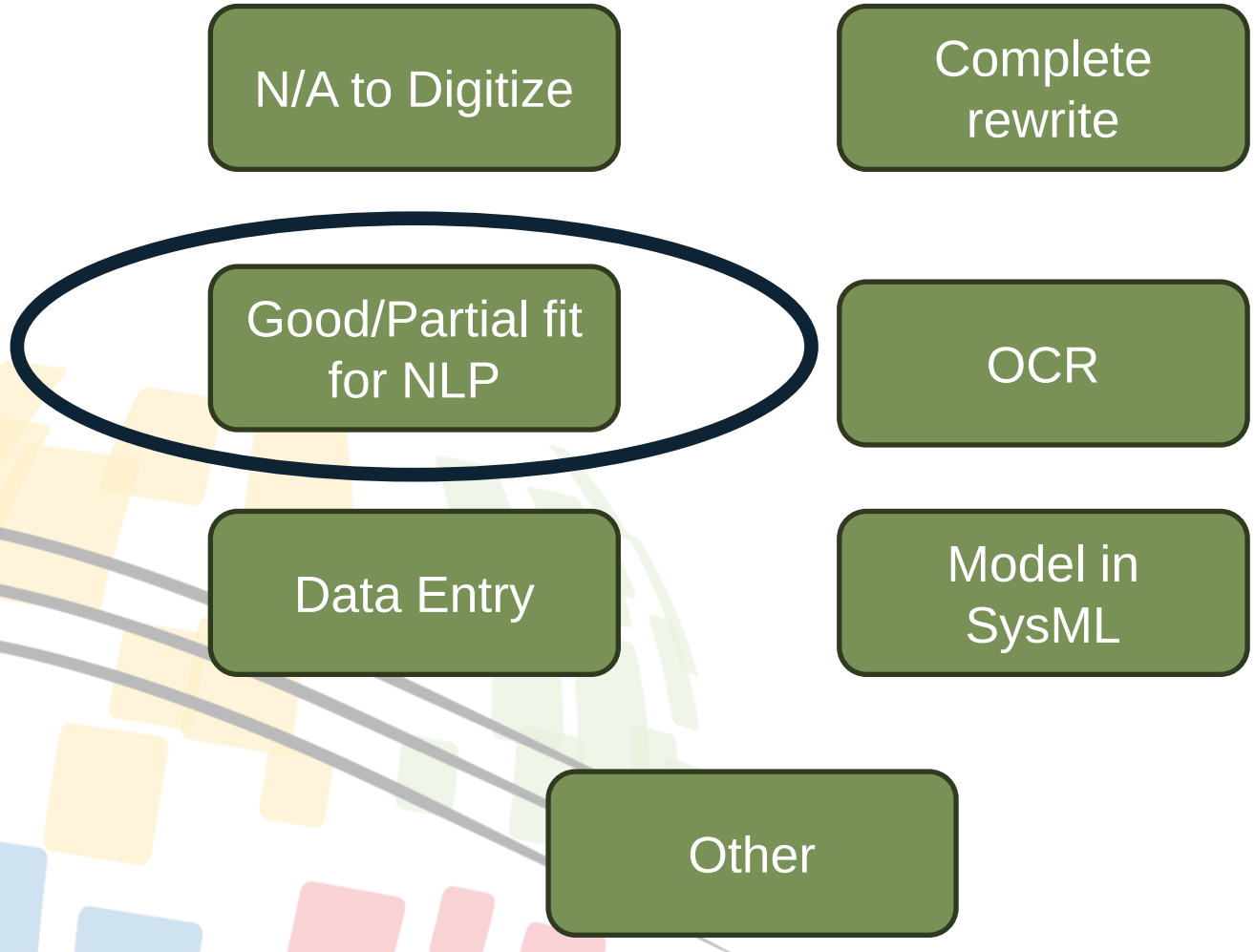

Managing NLP-Based Digitization Projects

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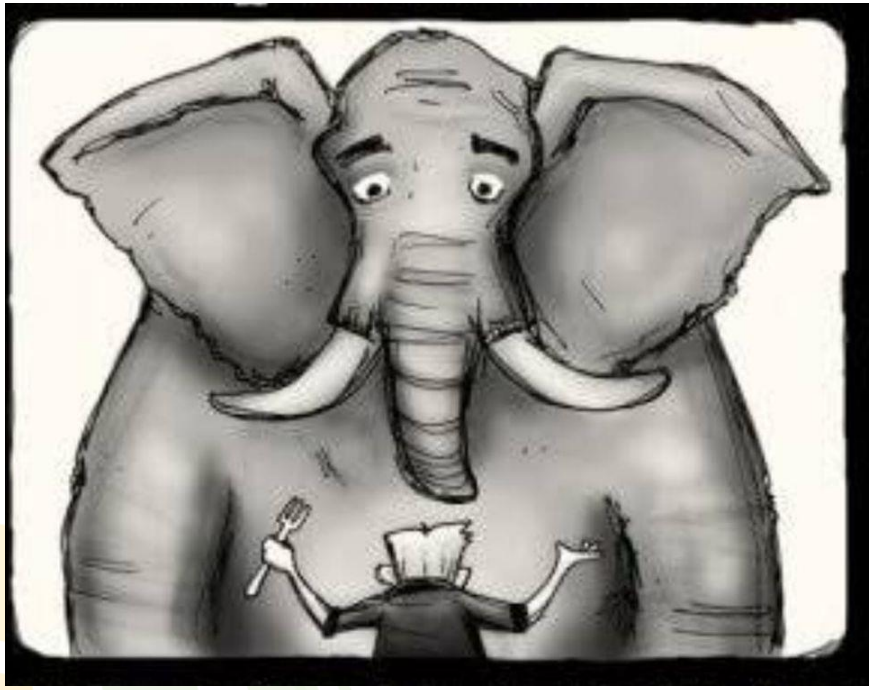


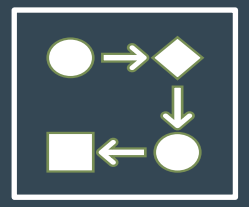
1. Incremental Wins
2. Prepare and Plan
3. Iterate
4. Manage Scope Creep
5. Leverage Successes

Incremental Wins

- Focus on a specific use case
- Limit number of targeted standards and families
- Plan how to demonstrate success

Prepare and Plan

- Determine how to digitize standards family(s)
- Identify prep work before you start
- Plan out the data model considering search and extraction requirements



Iterate

- Test, test, test
- Re-evaluate and iterate
- Test, test, test

Manage Scope Creep

- Consider the manageability of your use case
- Avoid expanding beyond your capabilities
- Done is better than perfect

Leverage Successes

- Demonstrate accomplishments
- Roll out in phases
- Leverage ROI from successes to fund future projects

How Do You Get There?

- Focus on incremental wins
- Prepare and plan
- Iterate
- Manage scope creep
- Leverage success

Step 3

Summary

Summary

- Start with the End Goal in mind—work towards incremental wins
- Identify the information needed from each standard to support your use case
- Group standards into families that are similar
- Plan out what data needs to be searched, what info/data needs to be extracted, and what other information is relevant in the standard
- Identify incremental wins, prepare and plan, iterate, manage scope creep, and leverage successes

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