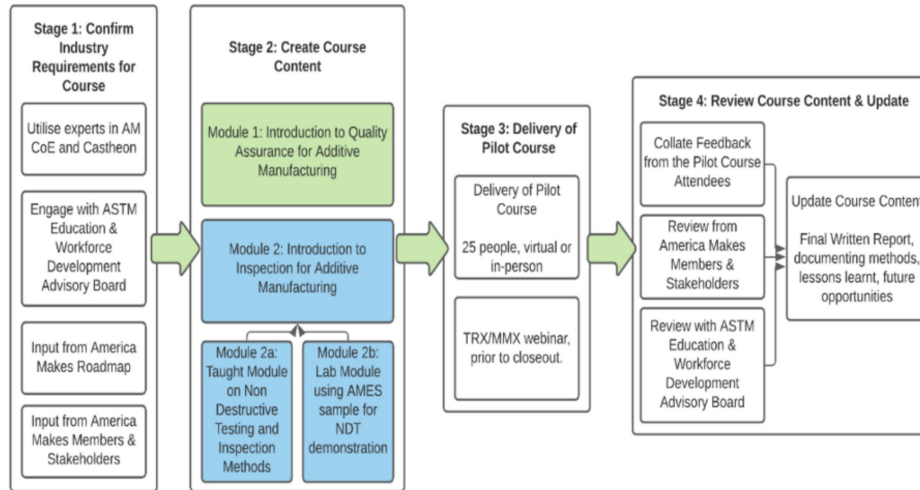


*Input utilized to effectively create an Introductory Course to Quality Assurance and Inspection for Additive Manufacturing*

**Over 150 course registrations indicated the AM community recognized quality assurance and inspection as key challenges**



*Steps needed to effectively create a course that teaches students the importance of qualification in additive manufacturing.*

**PROBLEM**

It can take a nondestructive examination (NDE) inspector years to learn to accept or reject parts. Many good parts are scrapped because the NDE inspector lacks the skills to adequately evaluate additively manufactured (AM) parts. Training for inspection and quality assurance in AM is needed to meet the requirements of safety-critical applications. AM is different from traditional manufacturing—an entire generation of manufacturing personnel requires new skills to determine whether a part meets all the requirements for the specific applications.

**OBJECTIVE**

This project aimed to create an NDE training module to enable inspectors to consistently make correct decisions. The intent was to enable the quality assurance and NDE communities to have input at the start of the course and then use a post-pilot review to update the content. To provide hands-on experience, the America Makes Educational Specimen (AMES) was developed.



**AMERICA MAKES  
TECHNOLOGY  
DEVELOPMENT  
ROADMAP**

This project aligns to:



**PROCESS**

**ASTM PROCESS  
CATEGORY**

Directed Energy Deposition  
Binder Jetting  
Powder Bed Fusion

**EQUIPMENT**  
Concept Laser M2

**MATERIAL**  
Nickel Alloy  
IN718

## TECHNICAL APPROACH

The project team, led by ASTM International Additive Manufacturing Center of Excellence (AM CoE), utilized several approaches to create a successful training course. The first step was for the AM CoE and Castheon project team to convene with America Makes members and stakeholders to confirm industry requirements for the course. Next, course content was created to fit into two modules: "Introduction to Quality Assurance for Additive Manufacturing" and "Introduction to Inspection for Additive Manufacturing." The AMES was designed by Castheon as a teaching NDE sample, created with intentional artifacts for the demonstration of testing various inspection methods. A virtual pilot study was delivered to present the course to a wide range of organizations and individuals to effectively provide a peer-based review of the content and delivery methods. The course was managed and executed by ASTM International, with strong support from America Makes to market the course.

## ACCOMPLISHMENTS

The project team was able to create a course that teaches the critical skills needed to correctly inspect and assure quality in additive manufacturing of parts. This was accomplished through a virtual pilot study to present the information to a wide range of organizations and individuals. Overall feedback from the pilot course attendees was positive. From the course author's perspective, the face-to-face experience for training would still be preferred, but the virtual world enables a pilot study with a wide global reach. When conducted virtually, course times were maintained at 4 hours per module to ensure that engagement level remained high throughout, despite the initial survey requesting a longer training time. The post-pilot survey confirms that this more concise version was effective. Based on the feedback from the course participants, the content and delivery methods were both highly rated.

## PROJECT END DATE

May 2022

## DELIVERABLES

- Student learning modules
- Model file for printing of AMES with artifacts
- Instructor materials and guide
- Student handbook
- Pilot course
- Final report

## FUNDING

### \$269,500 total project budget

(\$195,000 public funding/\$90,000 private funding)

## PROJECT PARTICIPANTS

### Project Principal:

ASTM International Additive Manufacturing Center of Excellence

### Project Participants:

Castheon  
NCDMM/America Makes

### Public Participant:

U.S. Department of Defense