M1002

120 mm Tank Ammunition
Advanced Case System (ACS)

Presented At
The National Defense Industrial Association's Joint Armaments Conference, Exhibition, & Firing Demonstration

19 May 2010

Jeff Berg
Principal Engineer
120mm Training Ammunition
ATK

M865

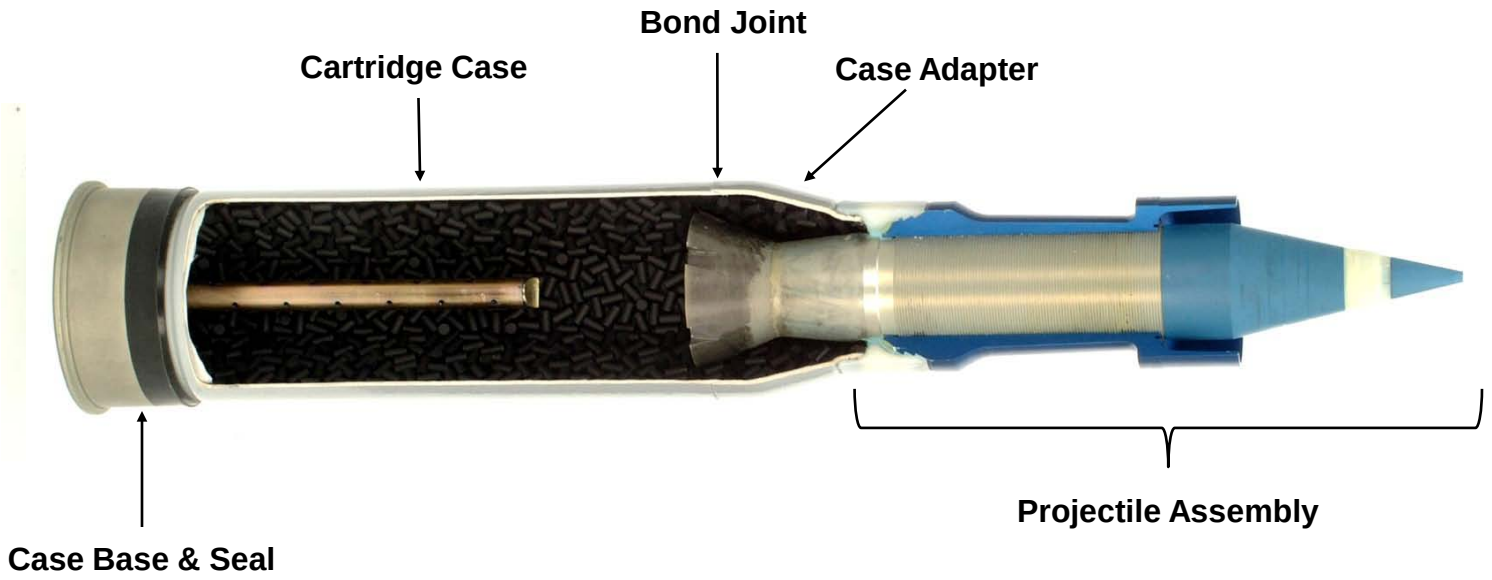
Agenda

120 mm Tank Ammunition Advanced Case System (ACS)

- Background
- Program Summary
- ACS Design Options
- Double Wall Joint vs. Skive Joint
- Technical Challenges – Bond Joints
- Analysis and Solutions
- Conclusion

M1002 Cartridge (current case design)

A premier aerospace and defense company



Advanced Case System (ACS)

- **Program**:
  - **Product Manager Large Caliber Ammunition: Program Management and Guidance**
  - **Joint Munitions Command (JMC): Executes and Manages the 120mm Multi-Year contracts**

- **Members: PM-MAS, PM-LC, JMC, ARDEC, ATK, GD-OTS, Esterline Defense Group, American Ordnance**

- **Objective: Provide a re-designed cartridge solution to eliminate a contributing cause of damaged rounds during training.**
  - **Relocate the cartridge bond joint**
  - **Qualify the modified cartridge design**
  - **Transition into production with qualified design**

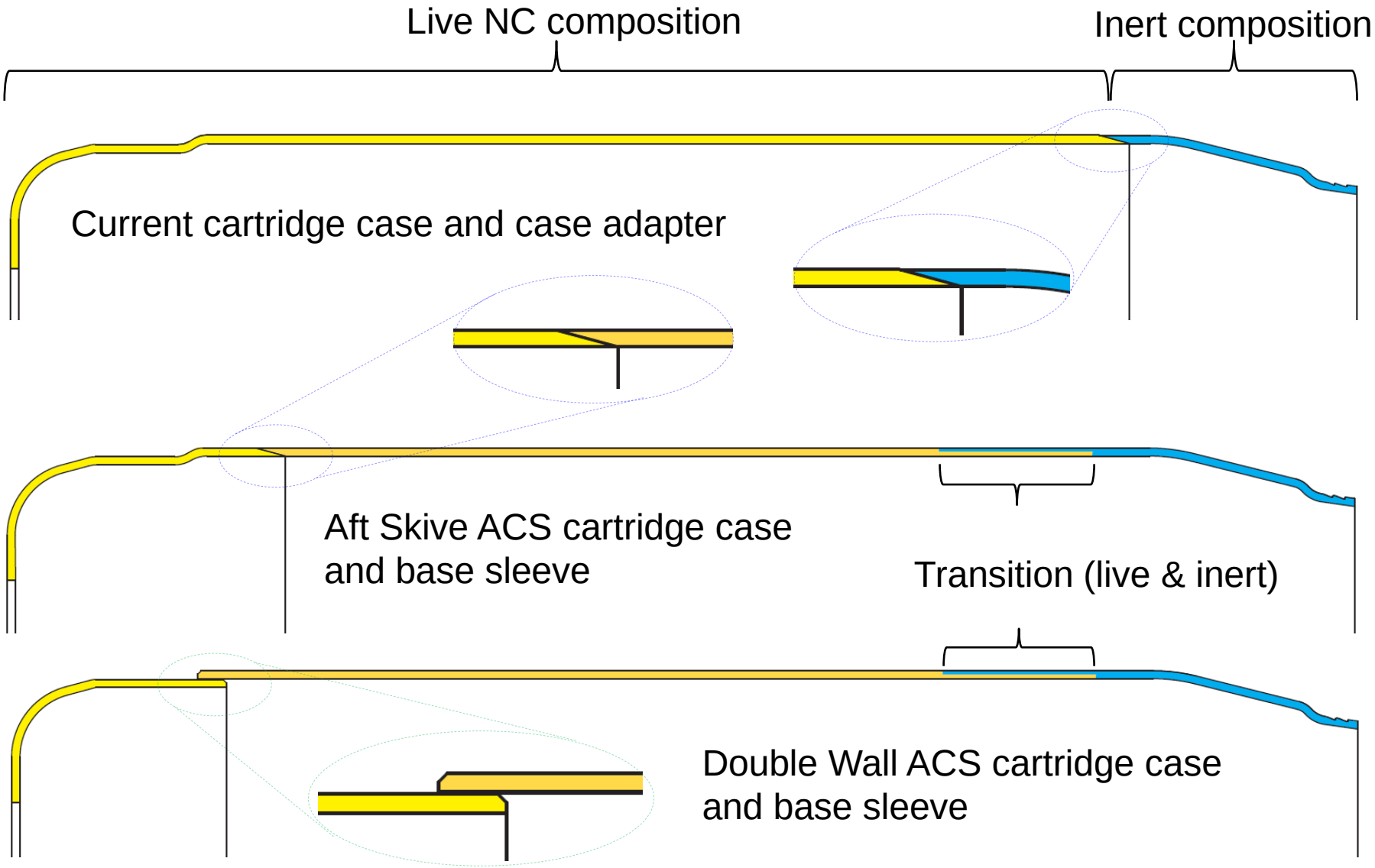
ACS Design Options

ACS Design

- **Joint: Double Wall, Skive, Single Wall**
- **Adhesive: Green two-part epoxy or Red NC based adhesive**
- **Propellant Bag: Tailored or Tied**

ACS Design Options – Cartridge Joint

A premier aerospace and defense company



Double Wall vs. Aft Skive Joint

	Double Wall Joint	Aft Skive Joint
Pros	•Manufacturing process simpler. •Joint is more robust •Joint has better protection	•Producibility – similar to current design.
Cons	•Ballistic concerns: •Increased risk for residue. •Restricts seal performance (joint too strong). •Diametric repeatability risk (adhesive). •Trimmed end of case difficult to paint.	•Component manufacturing more complex (same as current design). •Cartridge bonding process more difficult. •Joint is more exposed.

Aft Skive Joint - Technical Challenges

Aft Skive Joint:

- Cartridge alignment (straightness): joint location allows for misalignment.
  - Early concern that has since been resolved.
- Aft skive joint is more exposed than double wall.
  - Preliminary qualification results demonstrate aft skive location is superior compared to the current design.
  - Actual protection is quite good due to proximity to case base.

Double Wall Joint -Technical Challenges

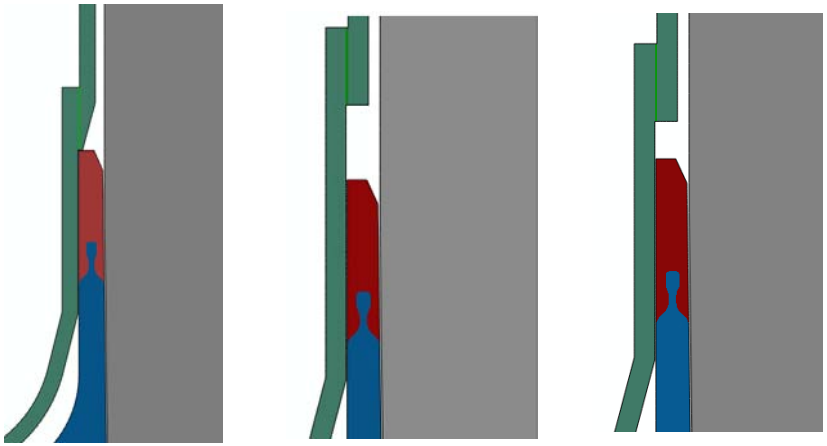
Double Wall Joint:

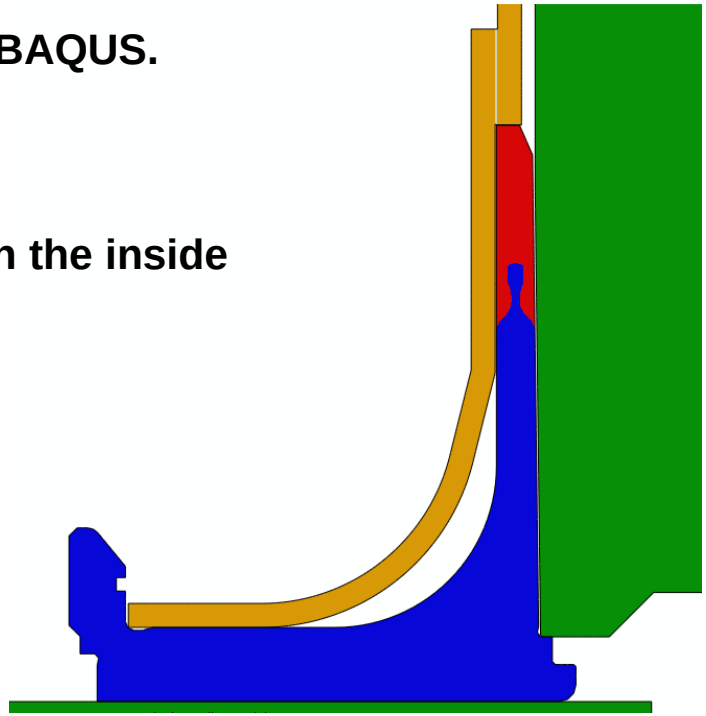
- Case base seal performance
  - Occasional gas leakage aft of case base seal.
  - Modeling was able to repeat the condition.
  - Design modifications investigated and modeled to correct.
  - Testing successfully validated the model results.
- Design Modifications lead to increase risk of energetic exposure
  - Continue to evaluate solutions.
  - Objective – no more risk than current design

Comparative Analysis of ACS Double Wall and Current Case System

MODEL ASSUMPTIONS:

- **Explicit dynamic analysis performed in ABAQUS.**
- **Axi-symmetric analysis performed.**
- **Up to 200 psi uniform pressure applied on the inside of the case.**

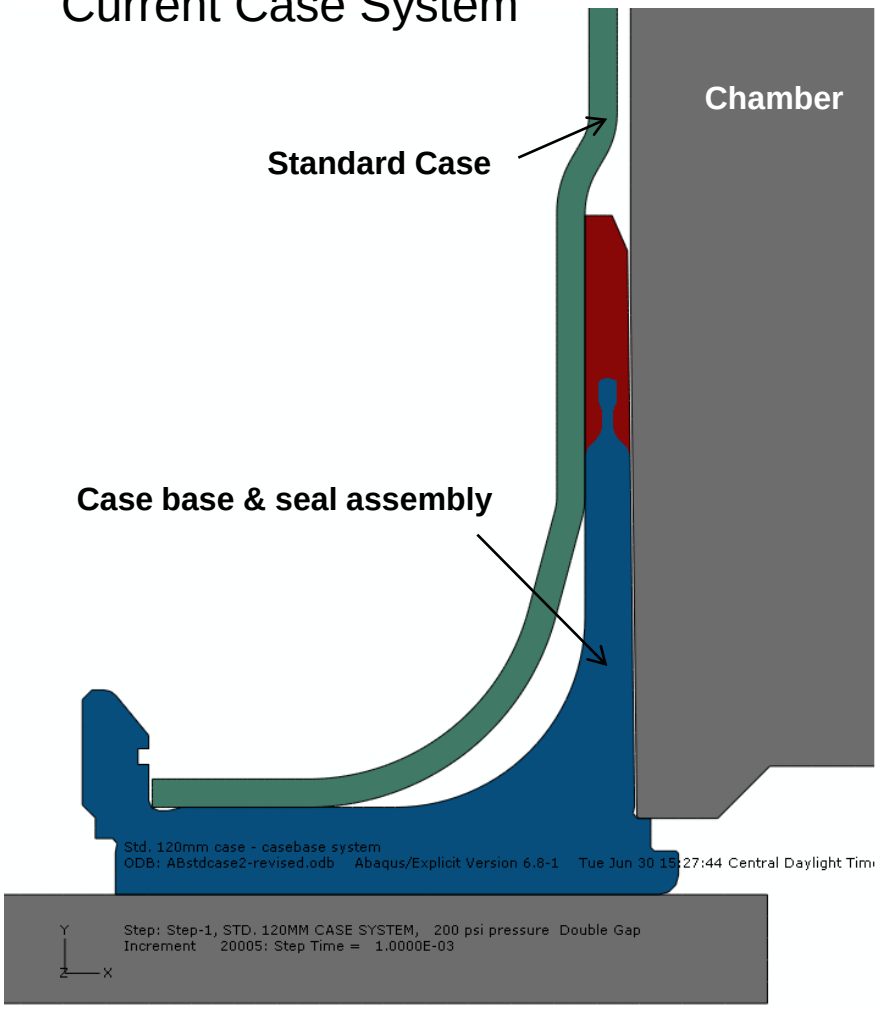




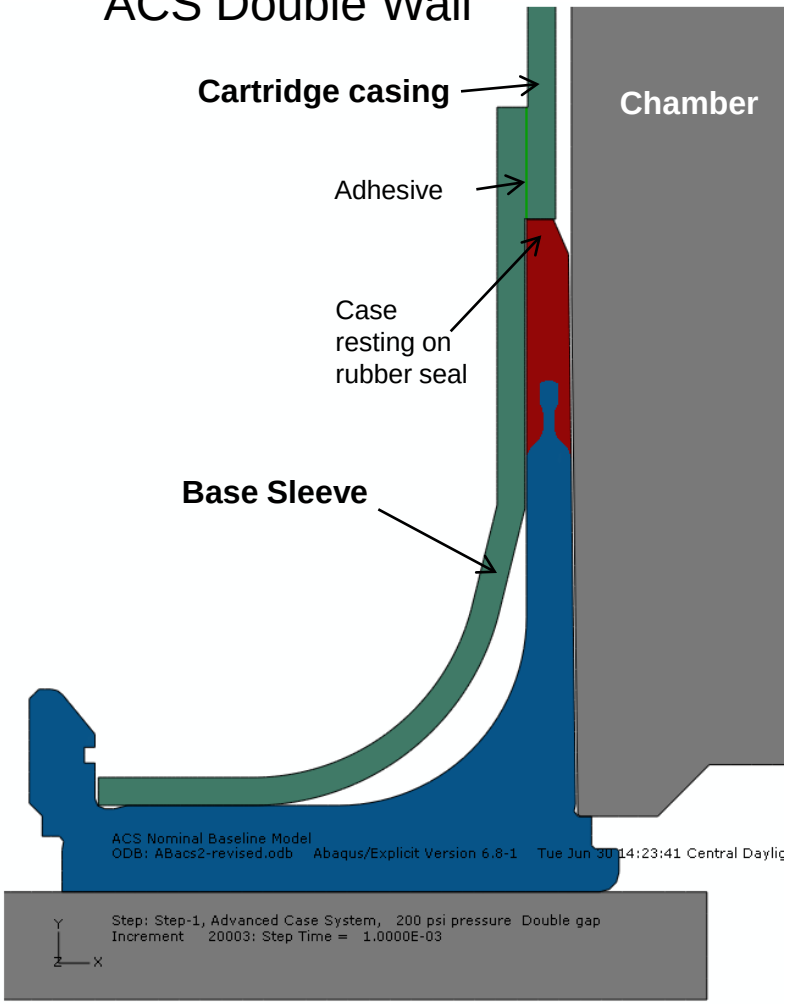
Comparative Analysis

A premier aerospace and defense company

Current Case System



ACS Double Wall

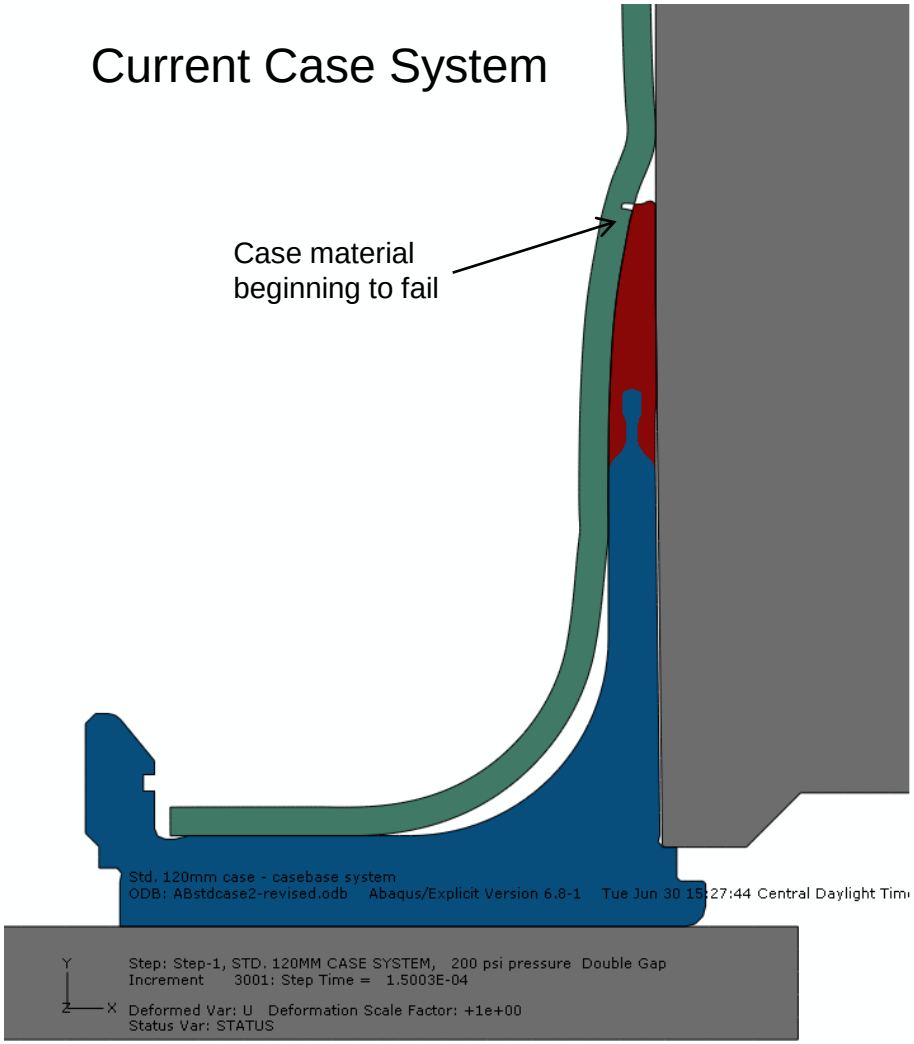


Current Case vs ACS Double Wall

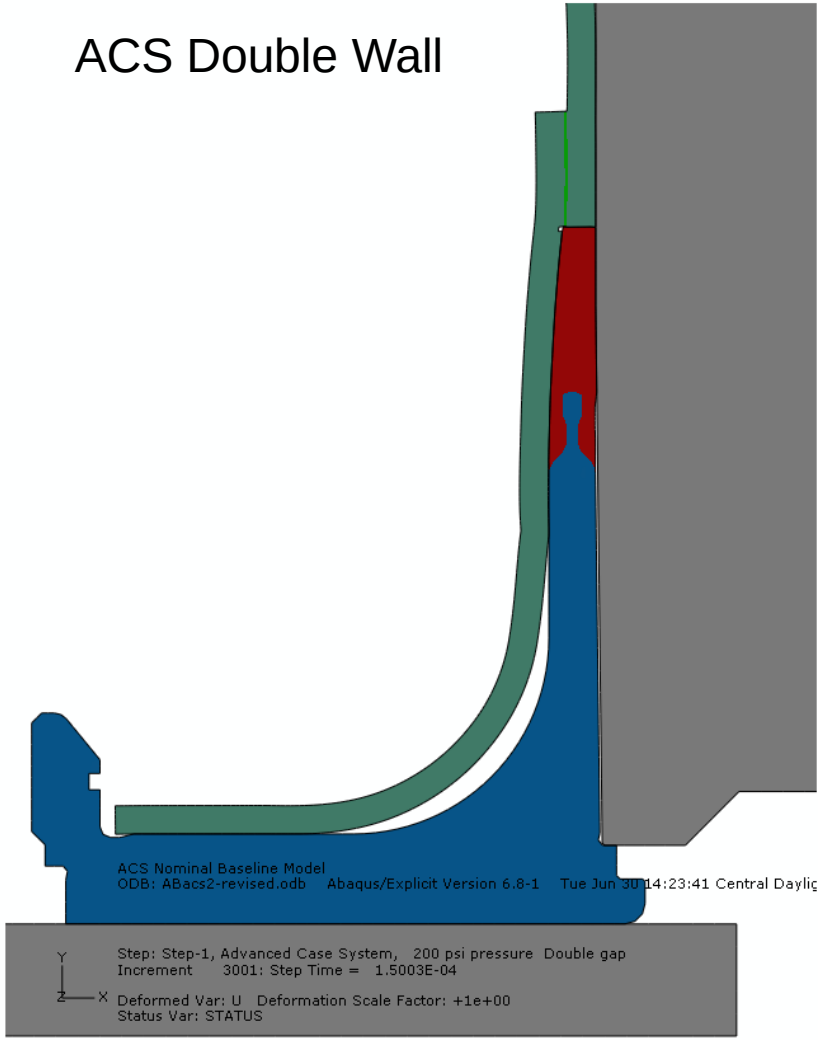
A premier aerospace and defense company

30 psi uniform pressure on case

Current Case System

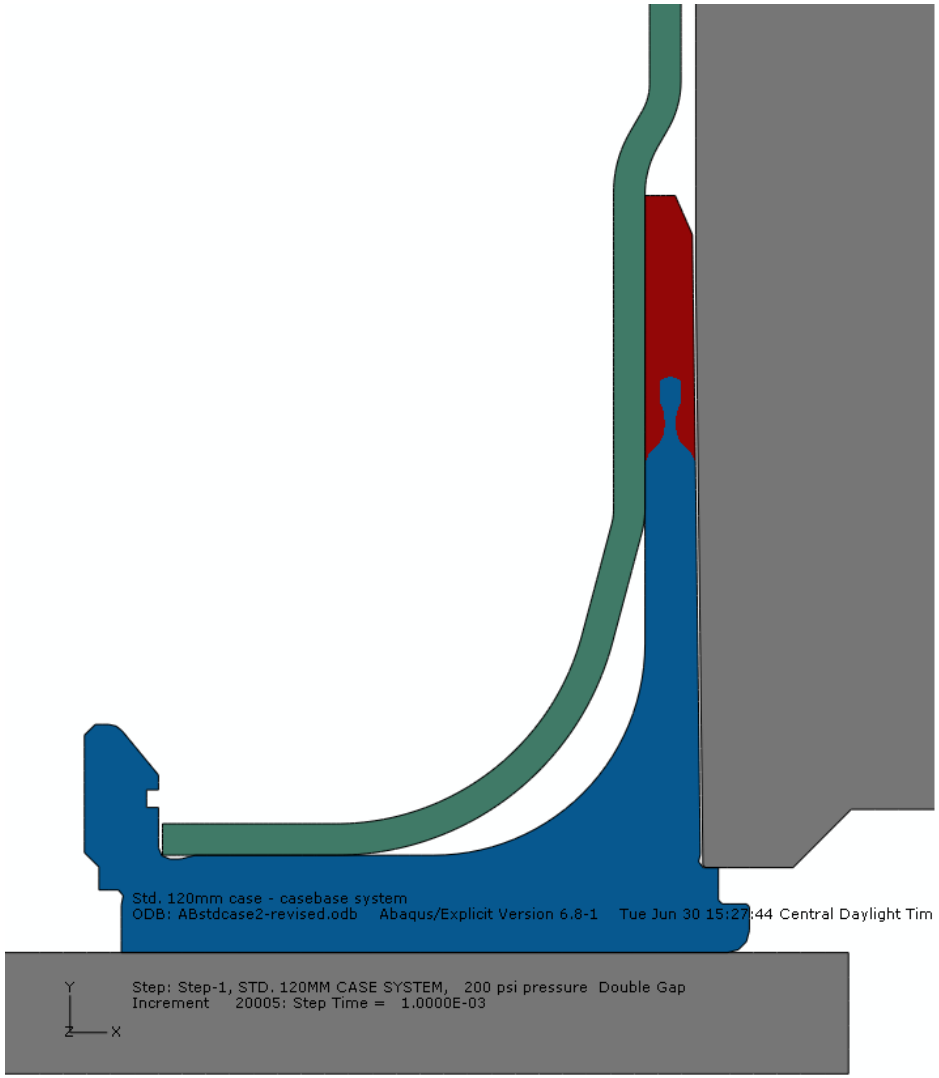


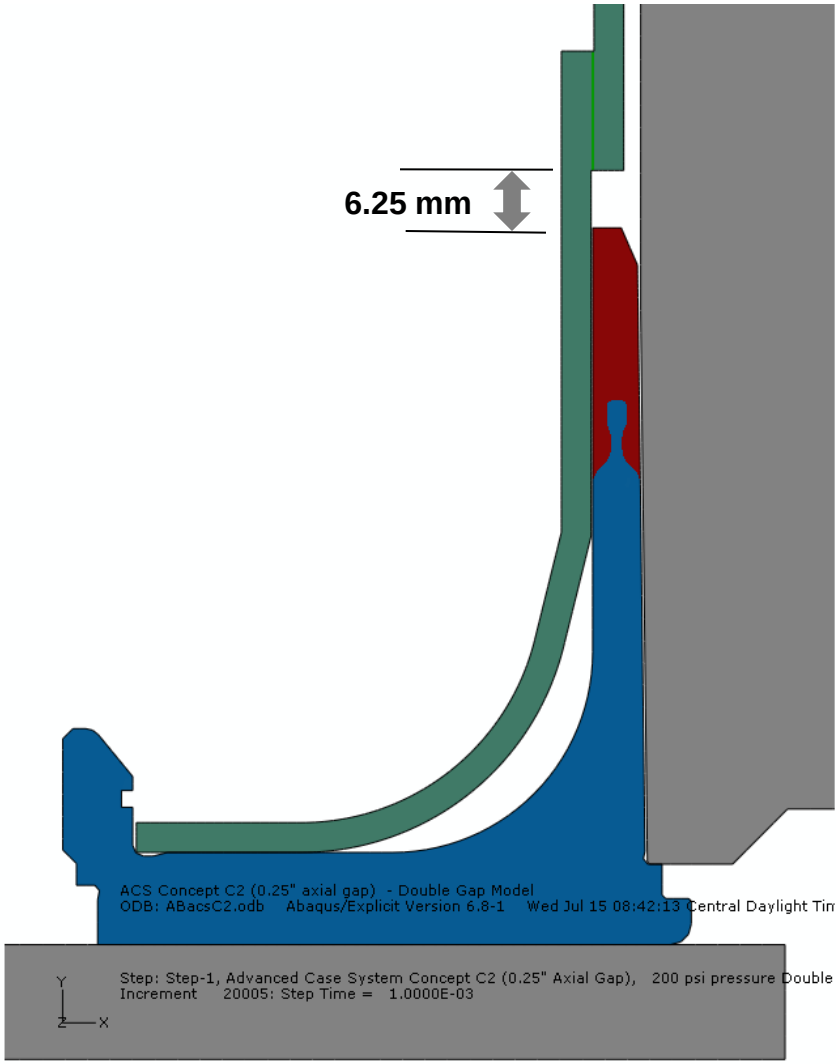
ACS Double Wall



Improved Double wall with 6.25 mm gap

A premier aerospace and defense company

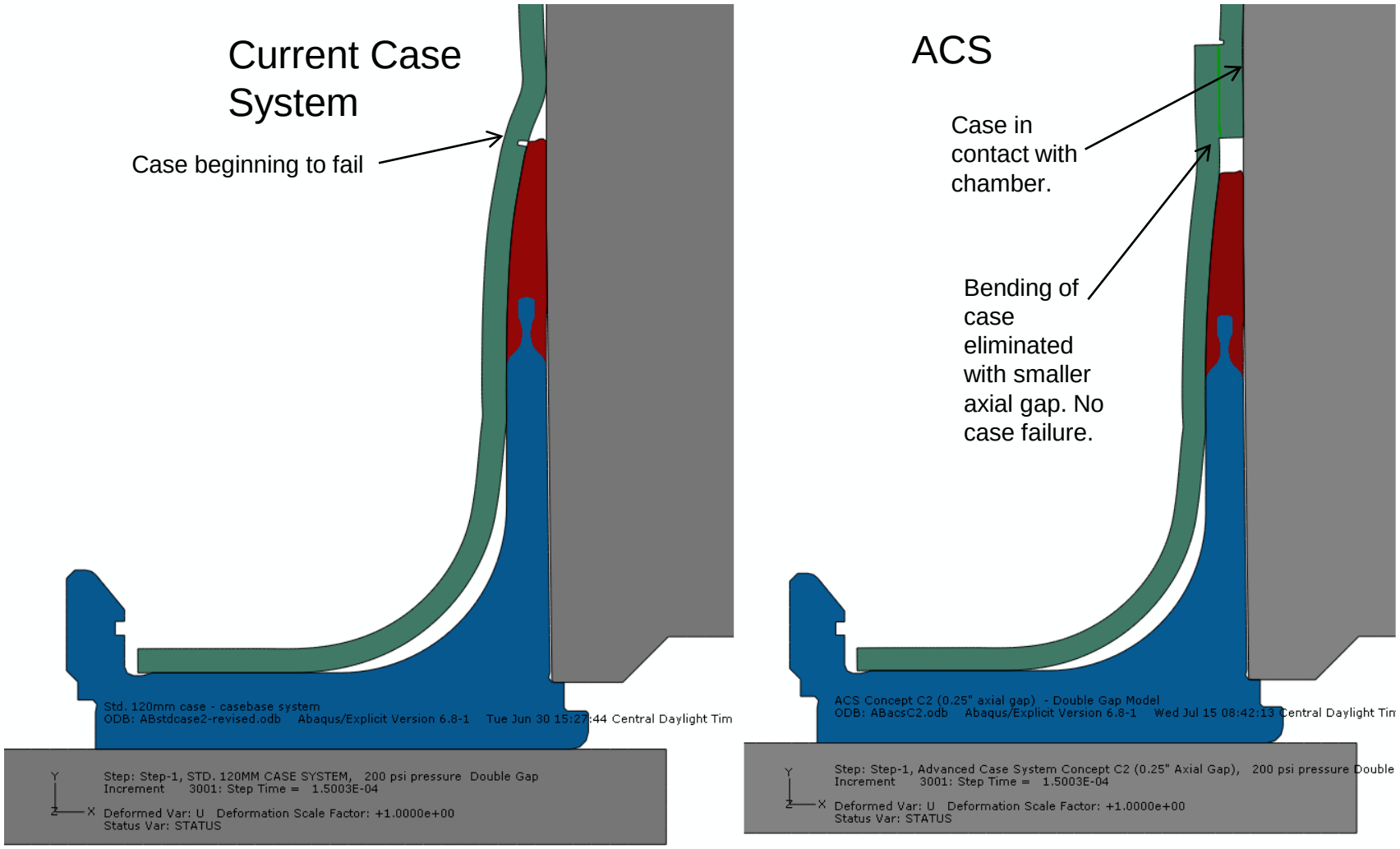




Current Case vs ACS Improved Double Wall

A premier aerospace and defense company

30 psi uniform pressure on case



Model Conclusions

- **Model of improved double wall with 6.25 mm axial gap showed good sealing.**
  - **Seal performance was comparable to the current case system.**
  - **Of all ACS double wall designs models, the 6.25 mm gap had the best results.**
- **Ballistic testing completed to validate results.**
- **ACS qualification program proceeding with both the ACS double wall and skive joints.**
- **Down-select to a single joint anticipated upon completion of qualification tests.**

QUESTIONS???

Jeff Berg

Principal Engineer – 120mm Tank Training Ammunition

Alliant Techsystems – Advanced Weapons Division

763-744-5523

jeff.berg@atk.com