Attachment 0022
Blast Protection Data Sheet

04 November 2011

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SECRET responses should use the following Classification/Declassification Instruction:

Derived From: ***JLTV SCG, dated 19 September 2008***
Declassify On: ***25 years from (date of document - NOT date of SCG)***

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Required data for M&S analysis with submission. This data must match the configuration of components and subsystems in the delivered CAD models:

a. Vehicle Geometry in either IGES or STEP format (unless already delivered in CDRL Data Item A053)
    i. POC for clarifications on CAD data
    ii. Parts split into various subassemblies for vehicle structure, powertrain, seats, engine, HVAC, suspension, electrical, etc.
    iii. BOM should include material names and grades
    iv. Part attachment info – How parts are attached
b. CAE Mesh data for all the vehicle parts (unless already delivered in CDRL Data Item A052)
    i. Shell elements with associated thicknesses
    ii. Solid elements
    iii. High strain-rate material properties either already encoded in CAE format (LS-DYNA) or in Excel; Initial Modulus, stress-strain curves at different strain rates, Poisson's ratio, strain at failure, density, etc.
    iv. Bolt and weld failure properties so that they can be included in the simulation
c. Vehicle Inertial properties – Overall vehicle weight, Vehicle C.G, Inertia Properties, Front and Rear Weight distribution for all available variants
d. Seat CAD, material properties and attachments (unless already delivered in CDRL Data Item A053)
    i. Local characterization of the energy absorption (EA) behavior as a function of stroke, usually a force-displacement curve
    ii. Seat belt material properties
    iii. Local characterization of the energy absorption (EA) behavior as a function of stroke, usually a force-displacement curve
e. Underbody Blast kit CAD (unless already delivered in CDRL Data Item A052), including material properties and attachment information
f. Charge Characteristics from simulations used in the underbody blast analyses
    i. Charge Characteristics (Size, type, burial Depth, Standoff, etc.)
    ii. Asymmetric threats used in testing, e.g., HME.
    iii. Charge location (x, y, z coordinates)
    iv. JWL Explosive Burn model if charge type is non-standard
    v. Charge sizes as STANAG levels
g. Soil Characteristics of simulations used in the underbody blast analyses
    i. Soil Characteristics - Type of soil (clay, sand, clay-sand mix, saturated sand, etc)
    ii. Density of soil, and humidity %
    iii. Equation of state of model, other material properties
h. Special materials used in underbody hull/armor design
    i. High strain-rate material properties either already encoded in CAE format (LS-DYNA) or in Excel; this should include Initial Modulus, stress-strain curves at different strain rates, Poisson's ratio, strain at failure, etc.

ii. Other innovative blast mitigation design info - Information on how new blast mitigation features are modeled, for example, blast mats, other energy absorbing features, etc

2. Additional system level vehicle data required
    a. Weights/approximate dimensions of individual chassis components.
        i. Engine
        ii. Transmission
        iii. Front/rear axles
        iv. Suspension
        v. Tires
        vi. Full fuel tank(s)
    b. Stiffness Characteristics
        i. Suspension
        ii. Engine mount type/stiffness
    c. Ground Clearance at GVW
        i. Measured, with noted reference point

Required Questions for M&S Underbody Protection Analysis Report

The report must address the following items in all underbody protection analysis submissions:

1. General Questions:
    a. Provide the level of TNT in net explosive weight (NEW) when the cab design shows initial floor perforation?
    b. What areas of the vehicle interior fail initially? Is this intended by design?
    c. What are the primary damage mechanisms of the vehicle design?
    d. Provide the maximum level of TNT in net explosive weight (NEW) capable without an expected fatality?
2. Worst Case scenario location
    a. Where under the vehicle would be the worst case area? Why?
    b. Describe the performance from a threat under this worst case area. Include vehicle damage and crew injury estimates.
3. Best Case scenario location
    a. Where under the vehicle would be the best case area? Why?
    b. Describe the performance from a threat under this worst case area. Include vehicle damage and crew injury estimates.

4. Underbody Damage Analysis
    The contractor shall incrementally provide damage analysis for underbody blast events ranging from Level 1 threshold through Level 2 objective threats. The following questions shall be considered for a threat scenarios: (1) under crew 3 and 4, (2) under driver and commander, (3) under front wheel (left or right), (4) under rear wheel (left or right):

a. At Level 1 underbody threshold level (with applied underbody B-kit armor):
   i. What was the maximum floor acceleration in simulation? Where was this located on the vehicle?
   ii. What was the maximum floor velocity in simulation? Where was this located on the vehicle?
   iii. What was the maximum seat acceleration in simulation? Where was this located on the vehicle?
   iv. What was the maximum seat velocity in simulation? Where was this located on the vehicle?
   v. What is the expected injury level for each crew member at this threat level?
   vi. Describe the vehicle part list which typically would have to be repaired and replaced from this event?

b. At Level 1 underbody objective level (with applied underbody B-kit armor):
   i. What was the maximum floor acceleration in simulation? Where was this located on the vehicle?
   ii. What was the maximum floor velocity in simulation? Where was this located on the vehicle?
   iii. What was the maximum seat acceleration in simulation? Where was this located on the vehicle?
   iv. What was the maximum seat velocity in simulation? Where was this located on the vehicle?
   v. What is the expected injury level for each crew member at this threat level?
   vi. Describe the vehicle part list which typically would have to be repaired and replaced from this event?

c. At Level 2 underbody threshold level (with appropriate underbody B-kit armor):
   i. What was the maximum floor acceleration in simulation? Where was this located on the vehicle?
   ii. What was the maximum floor velocity in simulation? Where was this located on the vehicle?
   iii. What was the maximum seat acceleration in simulation? Where was this located on the vehicle?
   iv. What was the maximum seat velocity in simulation? Where was this located on the vehicle?
   v. What is the expected injury level for each crew member at this threat level?
   vi. Describe the vehicle part list which typically would have to be repaired and replaced from this event?

d. At Level 2 underbody objective level (with applied underbody B-kit armor):
   i. What was the maximum floor acceleration in simulation? Where was this located on the vehicle?

ii. What was the maximum floor velocity in simulation? Where was this located on the vehicle?
iii. What was the maximum seat acceleration in simulation? Where was this located on the vehicle?
iv. What was the maximum seat velocity in simulation? Where was this located on the vehicle?
v. What is the expected injury level for each crew member at this threat level?
vi. Describe the vehicle part list which typically would have to be repaired and replaced from this event?