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Integration Challenges and Solutions for CBRN Defense-Respiratory Equipment in Modern Fixed Wing Military Aircraft

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Outline

- Background
- Integration challenges and solutions
- A future vision of CBRN PPE
- Conclusions
- Questions

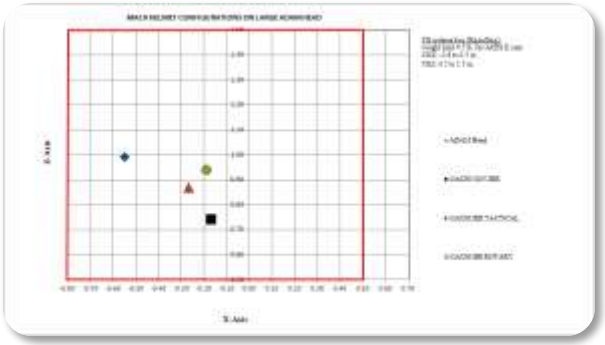
Background

- The challenge with the integration of CBRN defense respiratory equipment into modern, military fixed wing aircraft is well known to CBRN PPE materiel developers and procurement specialists.
- Integration challenges can greatly minimize mission effectiveness, and in some cases, aircrew might decide to forego the use of their CBRN defense equipment and “take their chances” in lieu of wearing the equipment provided to them.
- This integration vs. protection dilemma is a constant battle for CBRN PPE developers such as Gentex.
- The aim of the presentation is to detail some of the most onerous integration challenges that have been experienced with CBRN PPE for fixed wing aircrew and solutions that have been effective.

Integration Challenges

1. Helmet stability and fit/comfort
2. Human factors and thermal burden
3. Optical equipment effectiveness
4. Seamless transition to and from CBRN mode (MOPP4) to non-CBRN modes of pilot operation
5. Alterations to the fluid dynamics of the PPE system under rapid and explosive cockpit decompression
6. Effective torso integration across a broad aircrew population and aircraft platforms

Challenge: Helmet Stability and Fit/Comfort



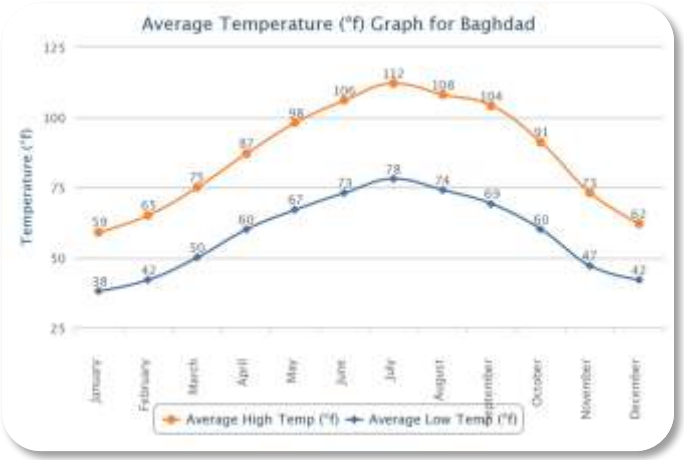
CBRN respirators create the following types of helmet stability and fit/comfort issues:

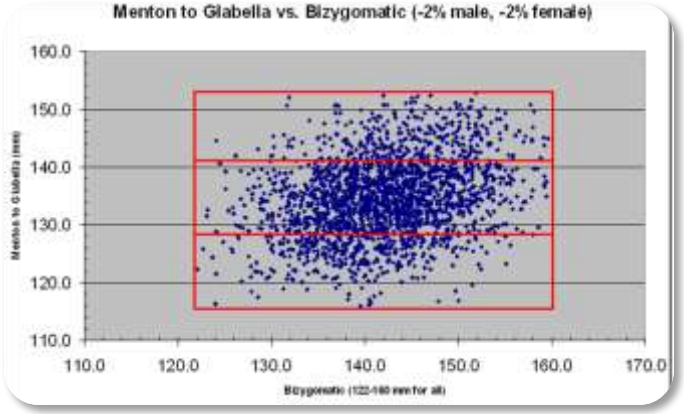
- Improper alignment of the helmet on the wearer's head
- Decreased helmet stability; interference with the helmet suspension system and chin strap
- Non optimal center of gravity (C.G.)
- Decreased comfort / hot spots

Solution:

- Optimized hood patterning
- Minimized material thicknesses
- Respirator sizing
- Integration with the helmet suspension and fitting systems

Challenge: Human Factors and Thermal Burden





CBRN respirators create the following types of human factors and thermal burden issues:

- Increased thermal burden which results in reduced mission duration and effectiveness
- Added sizes to fit the required population
- Increased weight and bulk; neck fatigue
- Potential head mobility and field of view/field of regard restrictions

Solution:

- Hood ventilation
- Hood stand off from the head
- Selectively permeable and/or breathable barrier materials
- Optimized anthropometric analysis for the end user population
- Minimize weight and optimize C.G.

Challenge: Optical Equipment Effectiveness

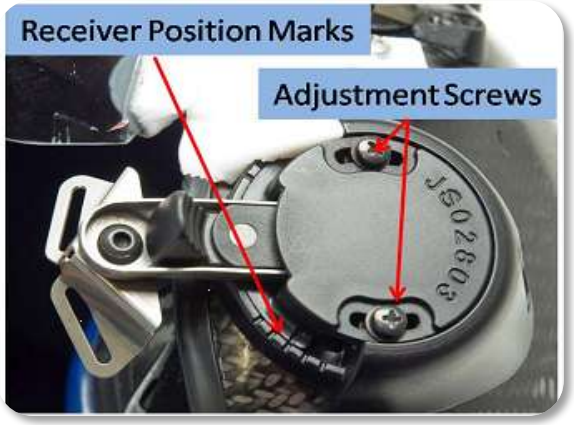
CBRN respirators create the following types of optical equipment effectiveness issues:

- Interference with NVG tubes; reduced NVG FOV
- Helmet visor interference
- Optical distortion and reduced luminous transmittance
- Physical or optical interference with HMD systems

Solution:

- Optimized respirator eye relief, radius of curvature, and pantoscopic tilt
- Optimized respirator profile over the nose and cheek area
- High quality, low distortion, neutral density respirator visor

Challenge: Transition to/from MOPP4



CBRN respirators create the following types of transition to/from MOPP4 issues:

- Different aircraft connectors
- Different mask bayonet angle/force vector
- Altered COMBAT EDGE (PBA/PBG) protection
- Need to reconfigure/refit the helmet
- Different mask and helmet “feel” for the wearer

Solution:

- Standardize connectors
- Utilize the same O_2 mask for MOPP4 vs. non-CBRN operations
- Training

Challenge: Rapid and Explosive Decompression

CBRN respirators create the following types of RD/ED issues:

- Added internal volume from CBRN respirator hoses and filters
- Altered aircraft regulator flow dynamics due to in-line filtration
- Pressure spike in O_2 mask

Solution:

- System vent valve to vent high pressure air trapped inside of the respirator hoses and filters

Challenge: Torso Integration

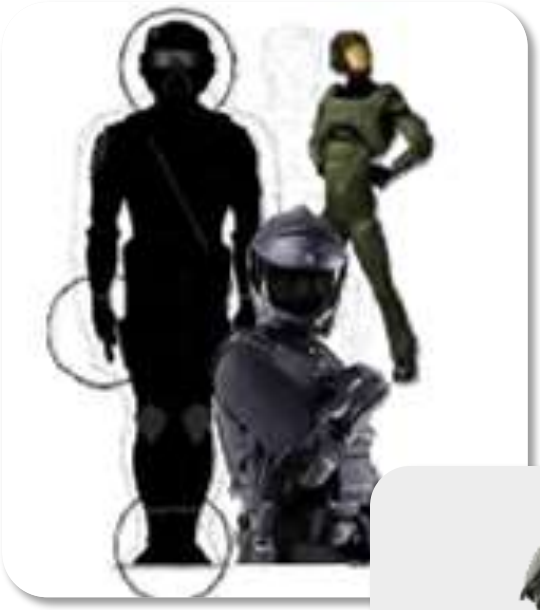
CBRN respirators create the following types of torso integration issues:

- Wide variety of cockpit designs (e.g. side stick vs. center stick)
- Wide anthropometric range to fit with fixed CBRN equipment sizes
- Aircraft control interference
- Ingress/egress difficulties
- More hardware added to already crowded real estate on the vest

Solution:

- CBRN specific vest
- Modular design to allow tailorability by aircraft and wearer
- Re-positioned standard equipment to accommodate CBRN specific gear on the vest

A Future Vision of CBRN PPE



- Changing CBRN requirements to match a changing CBRN threat
- CBRN as a normal, every day part of the aircrew's aircrew flight equipment (AFE)
- Integrated systems

Conclusion

- The CBRN integration challenge in modern military fixed wing aircraft is a solvable problem.
- Doing so requires an holistic and proactive approach to development of performance requirements with:
  - CBRN accounted for early in the development and procurement process
  - Implementation of life support as a “system” mentality
  - Leveraging and continued optimization and improvement of previously proven design solutions.

Questions?