

# HSI TF and ad hoc working group: Back and neck pain, vibration, and impact from military systems

USAARL Overview

John Crowley MD MPH  
Science Program Director

31 Jan 12



UNITED STATES ARMY AEROMEDICAL RESEARCH LABORATORY



ISO Jolt Standard



Historical Successes



Cockpit Air Bags

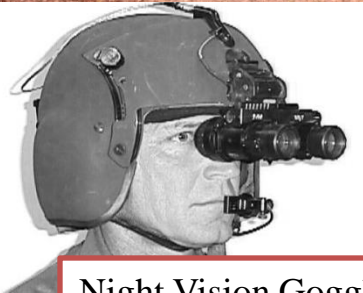


Operational Stimulants for Aircrew

Crash Neck Injury



Crash Helmet Standards

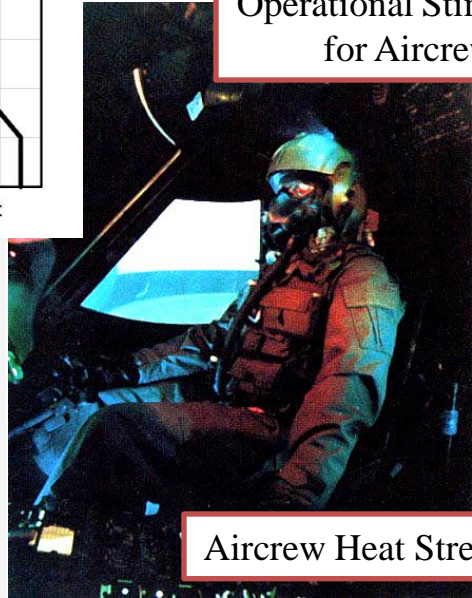


Night Vision Goggles



Crash Survival

Communication Ear Plugs



Aircrew Heat Stress





# Jolt ISO Standard Summary

- A new biomedically-based method was developed for HHA of repeated shocks
- An International Standard (ISO 2631-5) was proposed and adopted in unusually fast time
- Both parts of the ISO 2631 and the HHA method have been implemented in a user-friendly software program used by CHPPM and supported by USAARL

**WBV and Repeated Jolt Acceleration Data**

**UES, Inc.**  
Research, Development & Technology Transfer

**Whole-Body Vibration & Multiple Shock**

**WBV**  
ISO 2631-1  
Signal Processing & Health Hazard Assessment

**JOLT**  
ISO 2631-5  
Software Version 6.0  
January 31 2006

This WBV-JOLT® software was developed jointly by UES, Inc. (under Army contract # DAMD17-03-D-0001) and the U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL.

**ISO**

**USACHPPM**  
Readiness thru Health

**WBV and Repeated Jolt Acceleration Data - [Page 8: Risk Assessment Code]**

File Name: VZAB1C05 Speed: 5 mph Terrain: paved Seat: Commander Vehicle/System: M1A1

Health risk assessment for the above conditions

Item		Fleet	
Severity Category	Probability Level	Severity Category	Probability Level
II	D	II	B
RAC = 3		RAC = 1	
III	D	III	B
RAC = 4		RAC = 3	

Repeated Jolt Hazard

Risk Assessment Codes (Army Regulation 40-10)

	A	B	C	D	E
I	1	1	1	2	3
II	1	1	2	3	4
III	2	3	3	4	5
IV	3	5	5	5	5

**Overall RAC**  
Recommended: 1 Re-assigned: 1

Acquisition Program: Major ☒ Non-Major ☐ Risk Level: High

Decision Authority: AAE or designee

Delete Open Write Home Exit



U.S. Army Aeromedical Research Laboratory

Injury Biomechanics Branch

AIBS Review, 12-14 February, 2008





Medical Research and Materiel Command  
U.S. Army Aeromedical Research Laboratory  
Fort Rucker, Alabama



# USAARL's Key Focus Areas Under MOM

*Develop effective medical countermeasures against combat and operational stressors to maximize Warrior health, performance and fitness.*

## Science

### INJURY

Injury Prevention and Reduction

#### THREATS

Blast Overpressure  
Blunt Head and Body Trauma  
Traumatic Brain Injury  
Acoustic Trauma  
Face, Eye and Spinal Cord Injury  
Return to Duty for Wounded Soldiers

### PSYCH

Psychological Health and Resilience

#### THREATS

Concussion (mTBI)  
Return To Duty Standards for Wounded Soldiers

### PHYSIO

Physiological Health

#### THREATS

### ENVIRO

Environmental Health and Protection

#### THREATS

## Soldier

# Neck Pain in U.S. Army Female Aviators



John Crowley  
Joanna Greig

US Army Aeromedical Research Lab

Vivienne Lee  
QinetiQ Ltd, UK



*Aircrew Protection Division*



# Conclusions

- 40% of US Army female aircrew (respondents) report in-flight neck pain.
- Neck pain during and after flight is associated with use of NVG's
- Neck pain during flight is associated with total hours of NVG use
- Neck pain during flight is associated with hours of NVG use per night



***Aircrew Protection Division***





## Acute and Chronic Neck Injury Exercise Countermeasures Workshop



Friday, May 14, 2010  
Sheraton Phoenix Downtown Hotel



<b>Agenda at a Glance</b>			
<b>Time</b>	<b>Item</b>	<b>Speaker</b>	<b>Organization</b>
<b>Registration 0730-0800</b>			
<b>Administration</b>			
0800-0810	Welcome, administrative announcements	John Crowley MD MPH Barry Shender PhD	US Army Aeromedical Research Laboratory US Naval Air Systems Command/TP-7 Chair
<b>Overview</b>			
0810-0840	Neck Pain, Injury, and Disease in Aviation	James Persson MD MPH LTC MC	US Army Aeromedical Activity
0840-0900	Current Treatment of CSD in Aircrew	Shean Phelps MD MPH LTC MC	US Army Aeromedical Research Laboratory
0900-0920	C-Spine Injury Modeling	Barry Shender PhD	US Naval Air Systems Command
<b>Break 0920-0940</b>			
<b>Countermeasures</b>			
0940-1000	Exercise as Injury Prevention	Ed Zambraski PhD	US Army Research Institute of Environmental Medicine
1000-1020	Muscle Training and Injury Studies	John Keel	Harvard University
1020-1040	Manipulation Therapy Studies	Jason Eggers DC	
1040-1100	Massage Therapy Studies	Jo Sefton PhD	Auburn University
<b>Research Presentations</b>			
1100-1130	C-Spine Assessment in Military Helicopter Crew	Maneke Van den Oord PhD	
1130-1200	Neck Exercise Training in Canadian Forces Helicopter Crew	Patrick Neary PhD	Regina University, Canada
<b>Lunch 1200-1300</b>			
<b>Research Presentations (con't)</b>			
1300-1340	Neck Problems in Swedish Air Force Helicopter Pilots	Bjorn Ang PhD	Karolinska ...
1340-1400	High Performance Fixed-Wing Neck Injury Countermeasures	Greg Hampson Nic Green	Royal Australian Air Force, Australia Royal Air Force, UK







# Mitigation of acute and chronic neck pain in military aircrew



## Problem

- Neck pain is a common complaint that can affect mission performance ranging from an incapacitating event to low level distraction

## Purpose

- Evaluate a neck exercise program and manual manipulation therapy (MMT) as tools for the prevention of acute and chronic neck pain

## Plan

- Recruit 80 subjects at Fort Rucker and Patuxent River
- Randomize into 4 groups (exercise, MMT, exercise and MMT, control) and follow their symptoms for 1 year.

## Product/Payoff

- A tool for prevention of neck pain in aircrew

## Progress

- Recruitment problems; scope extended and new push to recruit in Feb 2012
- Report completion est. 4Q/FY14

## Schedule & Funding

MILESTONES	FY11	FY12	FY13	FY14
Literature Review	■			■ Planned Completion
Protocol Development	■			
Data Collection		■	■	■
Analysis/Writing			■	■
Total Funding =				







# Mitigation of acute and chronic neck pain in military aircrew

- USN/USAARL collaboration
- Examines long term effectiveness of a graded core exercise program and/or manual manipulation therapy for prevention of neck pain and management of chronic neck pain. Based on original study by Dr Bjorn Ang.
- Approaching 1 year out of 3. Experiencing difficulties with recruitment.





# Aircrew Health Cohort Study of Apache Mk1 Pilots



## Schedule & Funding

MILESTONES	FY11	FY12
Literature Review	<div></div>	
Protocol Development	<div></div>	
Data Collection	<div></div>	
Analysis/Writing	<div></div>	<div></div>
Total Funding = \$		

## Problem

- The Apache was newly introduced to the UK in 2000-2001
- Little was known about long term health effects of monocular helmet mounted displays

## Purpose

- Analyze data collected form British Army pilots over a 10 year period
- Compare visual, neck and back symptoms of Apache aircrew with non-Apache aircrew

## Plan

- Collate data then analyze questionnaires and examinations for statistical differences

## Product/Payoff

- Increased knowledge of risks to Apache aviators

## Progress

- Database created, initial descriptive statistics and entry level statistics complete. Longitudinal analysis ongoing.
- Report completion est. 4Q/FY12





# Aircrew Health Cohort Study of Apache Mk1 Pilots

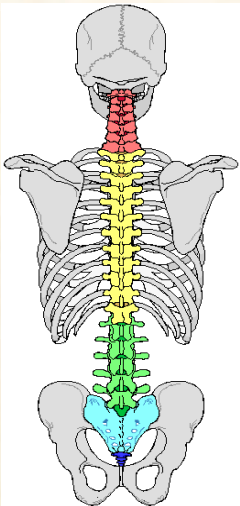
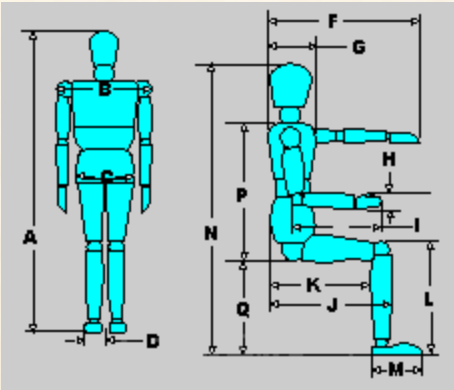
- Study predominantly aimed at visual effects of IHADSS however questionnaire included neck and back symptoms.
- Currently analyzing data however small numbers of Apache aircrew and high dropout rate reduce likelihood of significance in data.







# Anthropometry neck and back pain study



## Problem

- Anthropometry recommendations are often ignored when selecting aircrew
- Neck and back pain are common disabling or incapacitating conditions among aircrew

## Purpose

- Determine whether there is evidence that extreme anthropometric measurements are a risk factor for neck and back pain among aircrew

## Plan

- Measure and survey aircrew volunteers (front and rear, all airframes) based at Fort Rucker

## Product/Payoff

- Model for measurements that best predict neck or back pain in aircrew

## Progress

- Data collected from 88 aircrew (3 female)
- Data analysis in progress
- Report completion est.4Q/FY12

## Schedule & Funding

MILESTONES	FY10	FY11	FY12
Literature Review			Planned Completion
Protocol Development			
Data Collection			
Analysis/Writing			
Total Funding = \$1.25M	200K	451K	354K





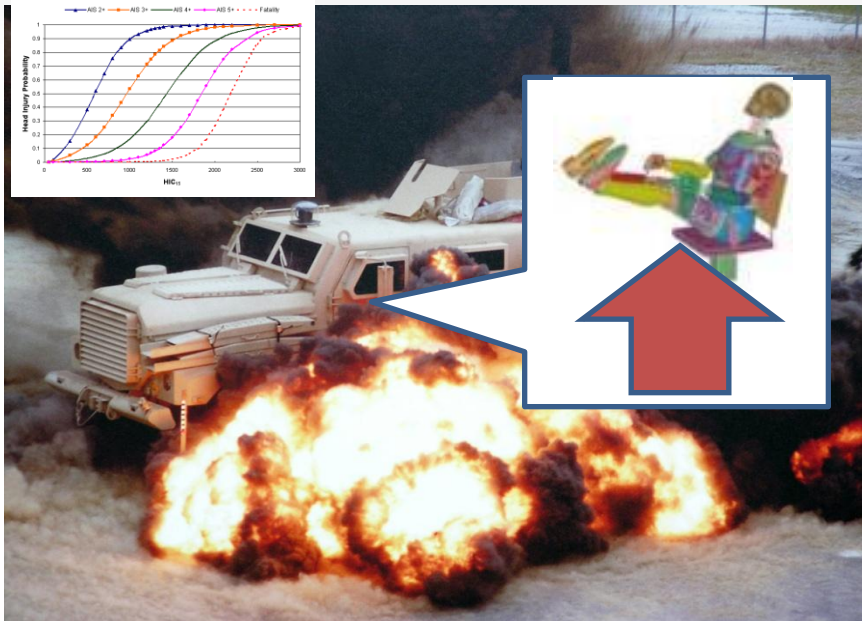
# Anthropometry neck and back pain study

- Study to evaluate anthropometric measures as risk factors for neck and back pain
- Data collected from 88 aircrew (front and rear), currently being analyzed.





# WIAMan Program FY11-17



## Schedule & Funding

MILESTONES	FY11	FY12	FY13	FY14	FY15	FY16	FY17
Define Warrior Environment							
Cadaveric Testing							
Injury Assessment Dev.							
Guidance to Stakeholders							
WIAMan Gen 1 Fab, & Test							
WIAMan Gen 2 Fab, & Test							

FY17 funds to be obtained through a coordinated 14 POM request



DESIGN • DEVELOP • DELIVER • DOMINATE  
SOLDIERS AS THE DECISIVE EDGE

## Purpose:

Conduct cadaveric research to establish a scientific and statistical basis for evaluating **SKELETAL** injuries to occupants during Under Body Blast events.

Develop an improved blast test manikin that incorporates the medical research which provides an increased capability to measure and predict skeletal occupant injury during Under Body Blast events.

## Results:

- A medically validated set of skeletal injury criteria for occupant injury during blast events
- Human response curves that inform the concurrent design and Biofidelity of the blast test manikin
- Improved prototype blast test manikin that incorporates the medical research which provides an increased capability to measure and predict occupant injury during Under Body Blast events

## Payoff:

- Improved ability to accurately measure the occupant injury from accelerative loads during Under Body Blast Testing by using medically validated accelerative loading methodologies and metrics
- Increased knowledge of soldier survivability in Under Body Blast Testing
- Potential for enhanced vehicle design and soldier survivability



# POINT of CONTACT

Dr. John S. Crowley  
334-255-6917  
DSN 558-6917  
[john.s.crowley@us.army.mil](mailto:john.s.crowley@us.army.mil)



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