

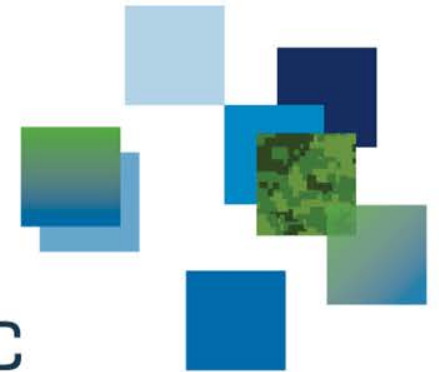


Six Aircrew Neck-Pain Solutions **NOT** Implemented for CH-146 Helicopter Aircrew

SAFE Europe

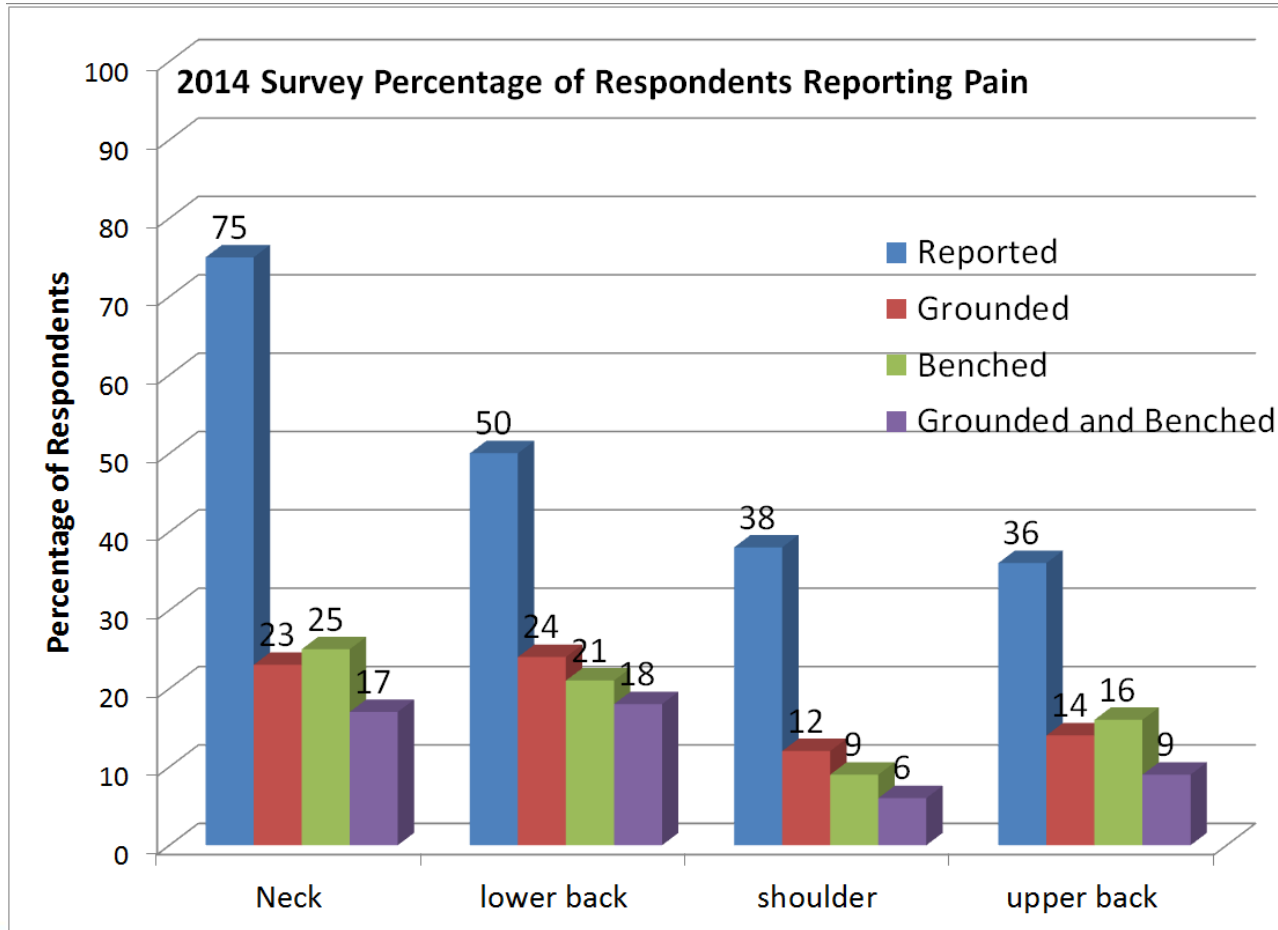
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CH146 Griffon Helicopter Neck Pain Prevalence Rates



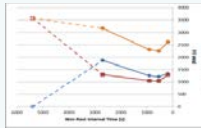





5% (per 1000 person-hours) diagnosed with Dorsalgia: Common Cervical ([Hawes, Whitehead, & Gray, 2014](#))



Over **80%** neck trouble prevalence rate reported in 2004 ([Adam, 2004](#)), and **75%** in 2014 ([Chafé & Farrell, 2016](#)) ¹

Objective

- To suggest 4 key reasons why 6 of 12 aircrew neck pain mitigating solutions will **not** be immediately implemented within the CH-146 Helicopter community.

<p>Work-Rest Cycle/ Smart Scheduling</p>	<p>Task Sharing/ better Postures</p> 	<p>Helmet Fit</p> 	<p>Education</p>  <p>Low Torque</p>
<p>Exercise</p>	<p>Helmet Mass Properties</p> 	<p>Neck Support Devices</p> 	<p>MFD FE</p> 
<p>MFD Pilot</p> 	<p>CDU Position/Orientation</p> 	<p>Seat Ergonomics</p> 	<p>Collective & Cyclic Ergonomics</p> 

Contents

- 6 Solutions to be implemented (Video)
- 6 Solutions **not** immediately implemented
- Discuss: Why?
- Conclusion

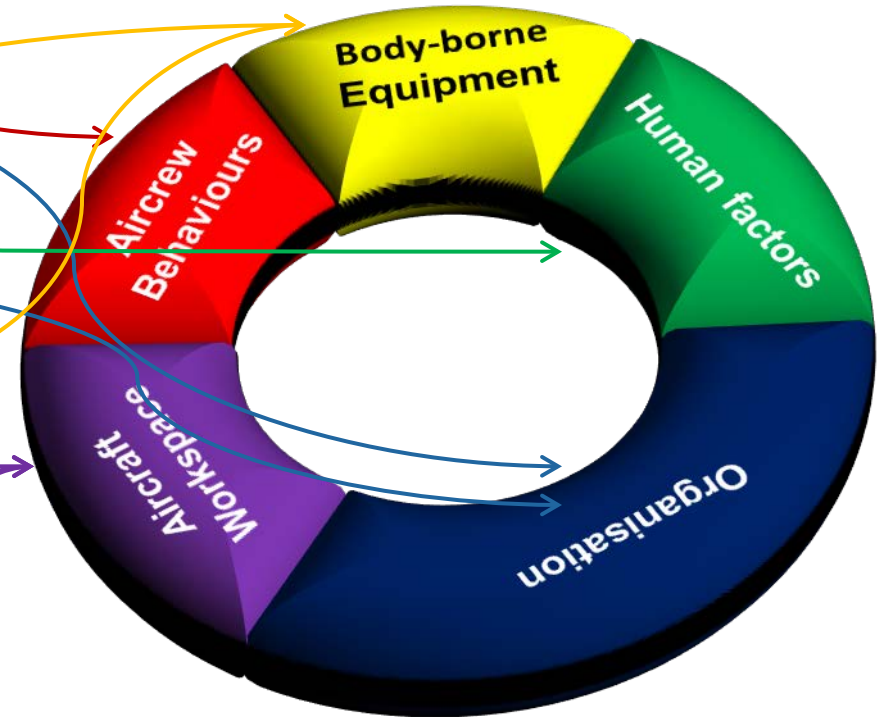
6 Solutions to be Implemented

- Video 2

Aircrew Neck Possible Causal Factors

Solution Space

- Task Sharing
- Neutral Postures
- **Smart Scheduling**
- Helmet Fit
- Education
- Exercise
- **Head/Neck Supported Mass Study**
- **Helmet System Support Devices**
- **Pilot and FE Multi-Function Displays**
- **Collective/Cyclic Redesign**
- **CDU position/orientation**
- **Seat Ergonomics**



1 Wing Solutions **NOT** to be implemented

Solution Space

1. Smart Scheduling
2. Head/Neck Supported Mass Study
3. Helmet System Support Devices
4. Pilot and FE Multi-Function Displays
5. CDU position/orientation
6. Collective/Cyclic Redesign

Smart Scheduling

- allows aircrew to rest and recover their neck muscle strength. Interview data yielded a suggested recovery time of **28** and **33** hours for day and night missions, respectively.

Mission	Duration	Start	End

- Operation scheduling will take precedence over scheduling aimed to rest and recover neck muscle strength.

Head/Neck Supported Mass Study

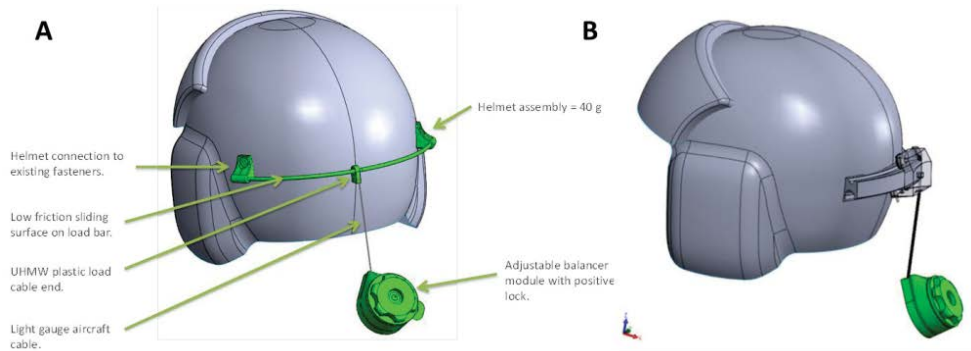
- Lighter, lower inertia, and more balanced Helmet Systems produce less neck loads and muscle activity, which should delay the onset of injury and chronic pain in the long run.



- Significant helmet system investment is required.

Helmet System Support Devices

- Helmet System Support Devices also have been shown to reduce neck loads and muscle activity. Informal flight tests yield low operator acceptance



- Operational concerns include full range of motion and snagging during emergency ingress/egress

Pilot and FE Multi-Function Displays

- Multi-Function Displays (MFDs) may include flight relevant data allowing for more up-right postures. Modelling and simulation results yielded up to a 70% reduction in neck torque with MFDs for specific task.

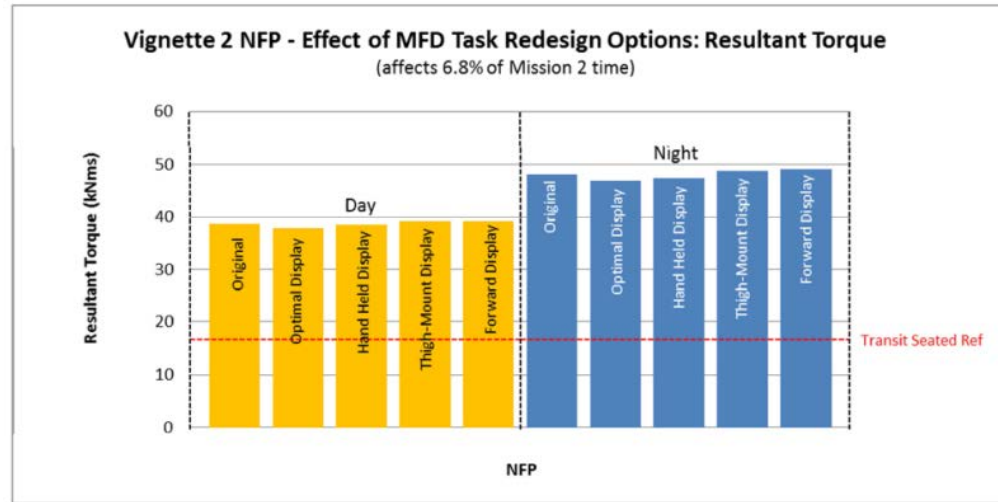


Figure 37: Effect of MFD design option (NFP) on Cumulative Resultant Torque for Mission Vignette 2

- But MFDs are used 6.8% of the time. Integrating MFDs into aircraft is cost prohibitive. Our advice is not to use MFDs to reduce the risk of neck pain

Pilot and FE Multi-Function Displays

Vignette 2 NFP - Effect of MFD Task Redesign Options: Resultant Torque
(affects 6.8% of Mission 2 time)

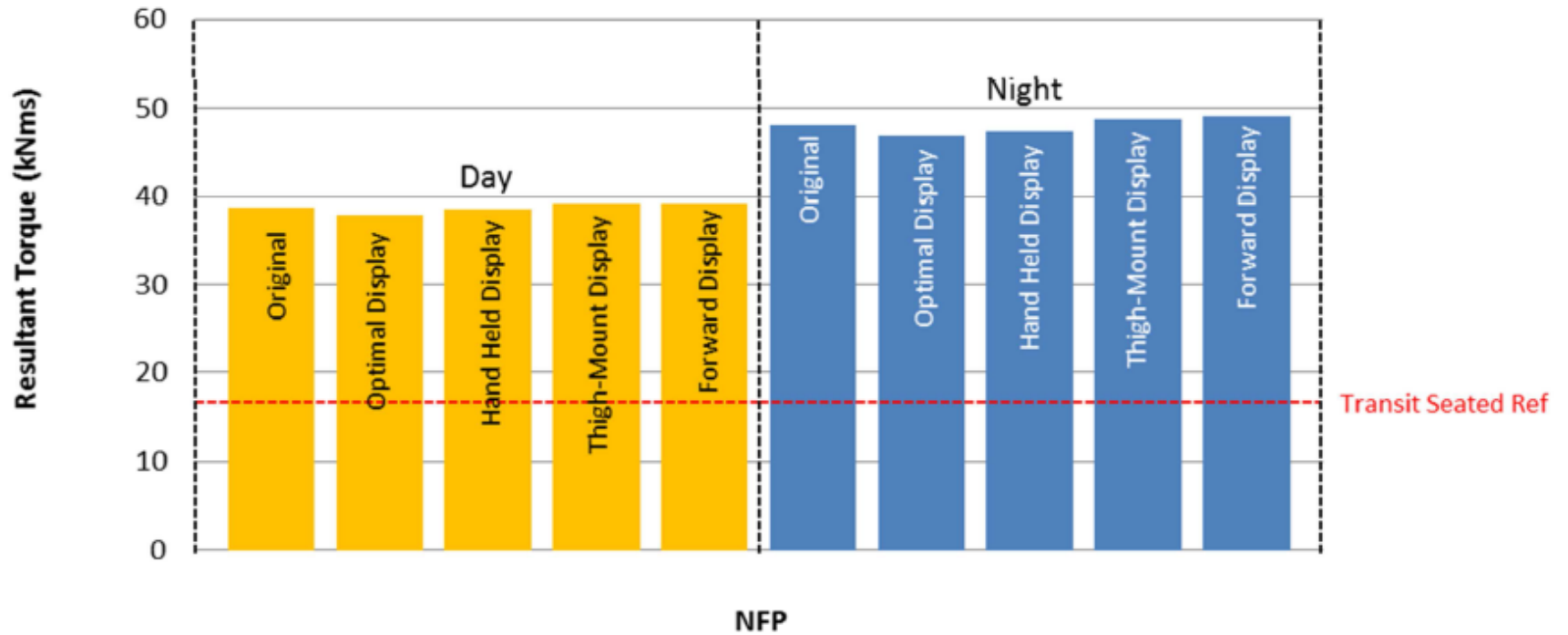


Figure 37: Effect of MFD design option (NFP) on Cumulative Resultant Torque for Mission Vignette 2

CDU position/orientation

- Control Display Unit's position and orientation may allow for biomechanically advantageous postures. Simulation yields 34% reduction for a single task.

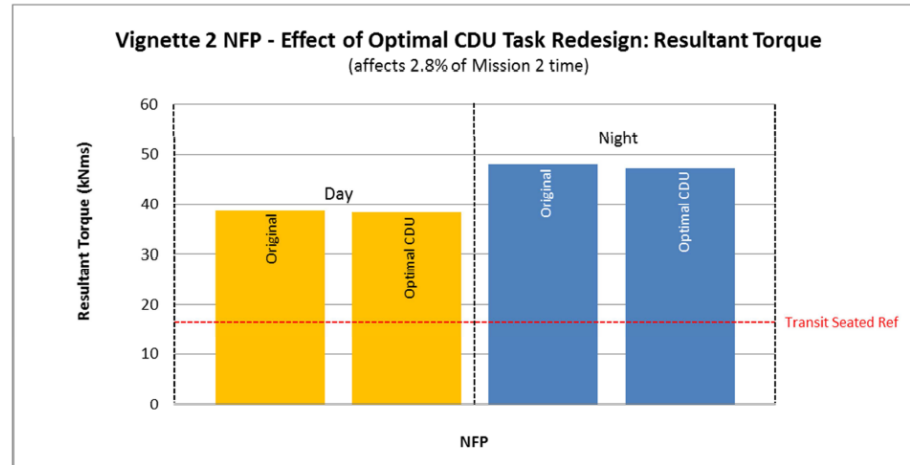


Figure 35: Effect of CDU design option (NFP) on Cumulative Resultant Torque for Mission Vignette 2

- But CDU is used 2.8% of the time. Changing CDU is cost prohibitive. Our advice is not to change CDU to reduce the risk of neck pain

Why?

1. Smart Scheduling
2. Head/Neck Supported Mass Study
3. Helmet System Support Devices
4. Pilot and FE Multi-Function Displays
5. CDU position/orientation
6. Collective/Cyclic Redesign

Why?

- Operational impact
 - Smart Scheduling
 - Helmet System Support Devices
- Technological Readiness Level
 - Helmet System Support Devices
 - Helmet System Study
- Cost
 - Pilot and FE Multi-function Displays
 - CDU position and orientation
 - Collective/Cyclic Redesign
- No Evidence
 - Pilot and FE Multi-function Displays
 - CDU position and orientation
 - Collective/Cyclic Redesign

Conclusion

- Scientific evidence for reducing the risk of aircrew neck pain is one of many considerations.
- Operational impact, technology readiness, and cost are also key considerations.
- The project yielded a high return on research investments given that:
 - Six of twelve solutions will be implemented in operations, and
 - The assessment tools and techniques are be re-used for fast jet aircrew (and possibly soldier) neck- and back-trouble issues.

Questions

