Operational Fatigue:
A Survey of 71 French Air Force Fighter-Aircrews
During Operation Harmattan (Operation Unifed Protector)
Libya, March-October 2011
AsMA – May 13, 2014
• I have no financial relationships to disclose.

• I will not discuss off-label use and/or investigational use in my presentation
Operation Harmattan

- Sustained operation (SUSOPS) at the beginning with around the clock preparation
- Missions departing from
  - France direct to Libya (1 – 2 months)
  - Crete direct to Libya (> 2 months)
- 2° Continuous operation (CONOPS)
## Main differences training/ops

<table>
<thead>
<tr>
<th></th>
<th>Training</th>
<th>Operation HARMATTAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight Activity</td>
<td>15hrs per month</td>
<td>50hrs in 3 weeks</td>
</tr>
<tr>
<td>Air to Air Refueling (AAR)</td>
<td>1 in 3 months</td>
<td>Several each flight</td>
</tr>
<tr>
<td>Weapon delivery</td>
<td>1 per year</td>
<td>Several each month</td>
</tr>
<tr>
<td>Flight Duration</td>
<td>1.5hrs</td>
<td>5 to 9hrs</td>
</tr>
<tr>
<td>Surface-to-Air Threat</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>CSAR capability</td>
<td>always</td>
<td>Depending on areas</td>
</tr>
</tbody>
</table>
Organizational countermeasures:

- July 2011
  - Overseas:
    - Rest time minimum one day a week
    - Dedicated room to QRA (alert) with rest capabilities
    - Dedicated night and day crew scheduling
  
  - In France:
    - Aircrews focused on flying ops - no more on ground duties
    - Qualifications (upgrade training) stopped (except to become combat ready)
    - A mandatory seven days rest after each deployment

Aim: evaluation of fatigue prevalence, consequences and countermeasures efficiency
Methods

- **Subjects**: 71 aircrews, 34 pilots and 37 weapon system officers (66% combat ready population; 4 females and 67 males from ages 23 to 41; 40 aircrews before CM and 31 after CM)

- **Questionnaire**: April to October 2011
  – broad spectrum, exhaustive method
  - Subjective items (fatigue, de-synchronisation, stress, motivation, day-off need),
  - Aeronautical activity,
  - Flight safety issues,
  - Rules of engagement (ROEs)
  - Used countermeasures (nap, sport, mental conditioning technics, physiotherapy, enhancing vigilance substance)
  - Sleep/wake management software utilization, FH cockpit...
Aircrew fatigue prevalence before countermeasures

- 58% felt tiredness
- 70% shift-lag
- 60% expressed a need for day off (at least once a week)
- 22% considered a breach flight safety
- 100% increase of sick leave on FAF Base
Countermeasures (CM) subjective effects
BEFORE CM / AFTER CM

– Fatigue

– Shift-lag
Countermeasures (CM) subjective effects

BEFORE CM / AFTER CM

– Performance

AAR difficulties

<table>
<thead>
<tr>
<th></th>
<th>% before CM</th>
<th>% after CM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before CM</td>
<td>17.50</td>
<td>10.00</td>
</tr>
<tr>
<td>After CM</td>
<td>10.00</td>
<td>22.50</td>
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</table>

– Flight safety breach

<table>
<thead>
<tr>
<th></th>
<th>% before CM</th>
<th>% after CM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before CM</td>
<td>15.00</td>
<td>19.35</td>
</tr>
<tr>
<td>After CM</td>
<td>19.35</td>
<td>37.50</td>
</tr>
</tbody>
</table>

– Flight safety report quality

<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>deficient</th>
<th>to improve</th>
<th>correct</th>
<th>excellent</th>
<th>perfect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before CM</td>
<td>15.00</td>
<td>0.00</td>
<td>37.50</td>
<td>45.00</td>
<td>2.50</td>
<td>0.000.00</td>
</tr>
<tr>
<td>After CM</td>
<td>19.35</td>
<td>16.13</td>
<td>45.00</td>
<td>58.06</td>
<td>2.50</td>
<td>0.000.00</td>
</tr>
</tbody>
</table>
Countermeasures (CM) subjective effects
F/Y and operational motivation

Before CM

After CM
Results (multivariate analysis):

**fatigue** risk factors:
- **Qualification** (workload/responsibility) (OR 4.4 CI<sub>95%</sub> 1.4-14.4)
- After **QRA** flight (environmental conditions/planning) (OR 8.7 CI<sub>95%</sub> 1.0-73)
- **Day-off** need (OR 7.1 CI<sub>95%</sub> 2.1-20.8)

**Shift-lag** risk factors:
- **Day-off** need (OR 5.1 CI<sub>95%</sub> 1.8-14.2)
- **Before countermeasures** (anarchic rhythms) (OR 3.8 CI<sub>95%</sub> 1.4-10.2)
- **Complicated strikes** are a protecting factor against shift-lag (OR 0.1 CI<sub>95%</sub> 0.3-0.6)
Conclusions

– First survey about operational fatigue in FAF combat aircrews during war operations
– Subjective fatigue prevalence and shift-lag sensation with important operational consequences (performance, flight safety, motivation)
– Risk factors identified
– CM efficiency proven
– Necessary improvements (at the top OP)
Prospects
Prospects

New questionnaire specific for fighter and UAV crews

Study in progress from March 2013 (OP SERVAL, Mali & OP SANGARIS, RCA)

- Sleep description of the night before the flight
- Mission specificities
- Workload evaluation (NASA TLX)
- Sleepiness evaluation (KSS)

→ Systematic workload and fatigue analysis will lead to elaborate predictive fatigue model and risk factors specific to fighter and UAV crews.
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Flight Surgeon Lt Col Eléna Kereun-Froger & Cpt Grégory Froger,
Lt Col Sauvet, Dr Chennaoui (IRBA)