PILOTS PERFORMANCE AND FLIGHT SAFETY
Flight Physiology in Unpressurized Aircraft Cabins

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## SUMMARY:

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Introduction

- The light aviation and glider pilots are exposed to many different environmental situations due to the unpressurized and unacclimatized aircraft cabins;

- Human factors, as awareness of flight physiology, have an essential role in flight safety;

- The International Civil Aviation Organization (ICAO) and the European Aviation Safety Agency (EASA) do not require any type of ground training in flight physiology.
Flight Physiology

- Hypoxia phenomenon occurs during the fall of atmospheric pressure and the resulting decrease in the partial pressure of oxygen;

- Stress and prolonged performance of cognitive work results in mental fatigue that influences the susceptibility of hypoxia and increases the heart rate [HR];

- Fatigue is a very common symptom and frequently associated with pilot error. Some of the fatigue effects include degradation of attention and decreased ability to make effective decisions.
### Legislation

#### Need for supplemental oxygen:

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<tr>
<th></th>
<th>&gt; 10 000 Feet</th>
<th>&gt; 12 500 Feet</th>
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<tbody>
<tr>
<td>ICAO Annex 6, Part I</td>
<td></td>
<td></td>
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<tr>
<td>JAR – OPS 1.775</td>
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<td>FAR 91.211</td>
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<td>Dec. Lei nº 289/2003</td>
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Experimental Work

• Some experimental flights were realized in order to analyse the influence of flight conditions, as altitude, on pilots' performance, considering some physiological parameters and some of the theirs everyday habits;

• The experimental tests were performed by five male pilots (only one analysed here) in three different scenarios, hypobaric chamber, flight simulator and real flight.

<table>
<thead>
<tr>
<th>Individual</th>
<th>Gender</th>
<th>Age</th>
<th>Physical Exercise</th>
<th>Smoker</th>
<th>HR (bpm) (mean value at rest)</th>
<th>rSO2 (%) (mean value at rest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>27</td>
<td>Rare</td>
<td>No</td>
<td>83</td>
<td>77</td>
</tr>
</tbody>
</table>

Table 1. Characteristics of the tested pilot.
Experimental Work

Hypobaric Chamber

Fig. 1. rSO2, HR and altitude variation during the hypobaric chamber test.
Experimental Work

Flight Simulator

Fig. 2. HR variation during the flight simulator test.
Fig. 3. rSO2, HR and altitude variation during the real flight test.
Discussion

• The pilot showed inferior levels of HR and a minor variation of the rSO2, for both hypobaric chamber and flight simulator, comparatively with the real flight;

• The rSO2 minimum value and the HR maximum did not occur when the maximum altitude was reached, as it would be expected;

• Hypoxia isn't, probably, the only phenomenon that can compromise the pilots' performance;

• Factors as stress and fatigue, when combined with altitude, may become a real danger.
Future Work

- Extend the tests to commercial pilots;
- Apply for a potential restriction to pilots licensing legislation, regarding the training in flight physiology;
- Validate the implementation of the EEG and the EP's method.
Outputs


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