



Quantifying the Landing Reaction of Cockroaches

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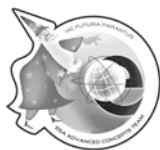
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Available on the

Ariadna ID: 08/6302
Study Duration: Medium Study (4 months)
Contract Number: 21958/08/NL/CBI

ANNEX D - EXECUTIVE SUMMARY

Research Category:
Biomimetics

Code and Title of the study:

08/6302 Quantifying the Landing Reaction of Cockroaches

Contract characteristics

University/Research Centre/Department:

*University of Applied Sciences Bremen, Bionics-Innovation-Centre (B-I-C)
Bremen, Germany*

Academic researchers:

Ms. Antonia B. Kesel, Mr. Andrew Martin, Mr. Florian Hoffmann

ACT researcher:

Mr. Tobias Seidl

Type of study:

4 months

Picture:



Motivation:

Is a controlled and directed aerial descent present in flying cockroaches? If so: Are there any stereotypical landing reactions that underlie a simple neuronal control architecture which may serve as biomimetic input for planetary landers?

ANNEX D - EXECUTIVE SUMMARY

Methodology:

*In order to gain insight into flight and landing behavior as well as strategies in cockroaches, flight was induced by launching cockroaches of the species *Blattella germanica* from an elevated point within a flight arena. Flight phases in aerial descent including landing were distinguished by experimentally applying kinematic and aerodynamic methods. In a first step, flight sequences were recorded from two different perspectives using digital video equipment allowing for the reconstruction of 3D descent trajectories. In a second step, high speed video sequences from characteristic flight phases observed in preliminary trials were obtained at 500fps. Both procedures allowed for the assessment of parameters such as e.g. descent (landing) angle and body posture. In further trials animals were loaded with additional weights, supplied with visual cues and confronted with different launch angles in order to assess the quality of the observed landing procedure.*

Results:

- 1. A controlled and stable, yet undirected descent is present.*
- 2. Two phases are present in descent: A ballistic dive and reorientation phase (1), and a stable descent and landing phase (2).*
- 3. At least three landing trajectory types are identifiable (ballistic, curved and helical).*
- 4. Axial stabilisation and vertical deceleration achieved by dorso-ventral righting, wing deployment and leg abduction, minimize the risk of rebound on impact*

Publications:

- In progress -

Highlights:

In our experiments, cockroaches showed no special adaptation to flight and/or landing with regard to the biomimetic potential aimed at in this study. Most remarkable were two facts: (1) Visual stimuli had no influence on flight or landing behaviour in cockroaches under the given experimental conditions. (2) Cockroaches showed no signs of damage or behavioural abnormality due to ground impact. Latter aspect may be of further biomimetic interest concerning impact resistant, shock absorbing biomaterials.