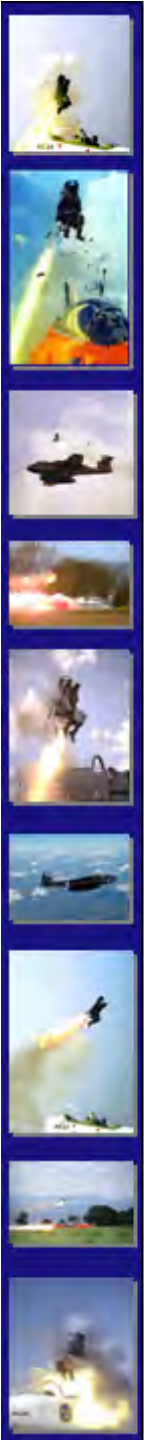


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Mk17 Ultra Lightweight Escape System

James Pearse

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Alicante, Spain

Martin-Baker Aircraft Company Limited

Higher Denham, Near Uxbridge, Middlesex, UB9 5AJ, England. Telephone: +44 (0) 1895 832214 Fax: +44 (0) 1895 832587



Background

- ▼ In 2010 the Indian Air Force issued a RFP for a Basic Trainer Aircraft to replace the HPT-32 Deepak



- ▼ The HPT-32 had been grounded earlier than planned due to an unacceptable number of accidents



Background

- ▼ **The premature grounding of the HPT-32 had resulted from the unacceptable flight safety record**
 - ▼ 19 pilots had been killed in 17 accidents
- ▼ **This prompted the inclusion of a requirement for a pilot escape system within the IAF Basic Trainer Aircraft RFP**



Background

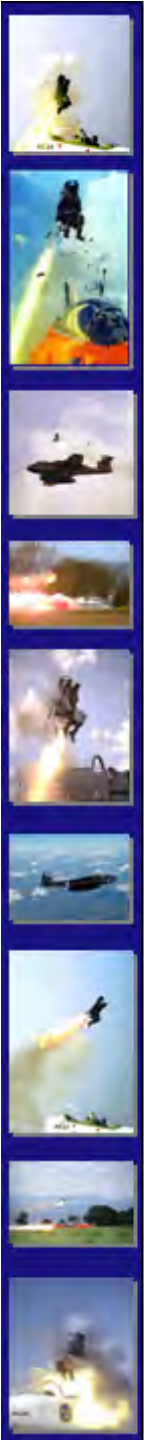
- ▼ Competitors included PZL-130 Orlik, Aermacchi SF.260, KAI KT-1, HBC T-6C and Pilatus PC-7 MkII
- ▼ Among the potential aircraft to satisfy the IAF's requirement was the Grob Aircraft G120TP



- ▼ **G120TP is derived from G120A with the addition of:**
 - ▼ Rolls-Royce M250-B17F Turboprop engine
 - ▼ 3-screen 'glass' cockpit

Escape System for the G120TP

- ▼ To produce a compliant offering for the IAF Basic Trainer Aircraft, Grob approached Martin-Baker for an extremely compact and lightweight ejection seat
- ▼ Grob's aircraft offering also highlighted an emerging military pilot training principle



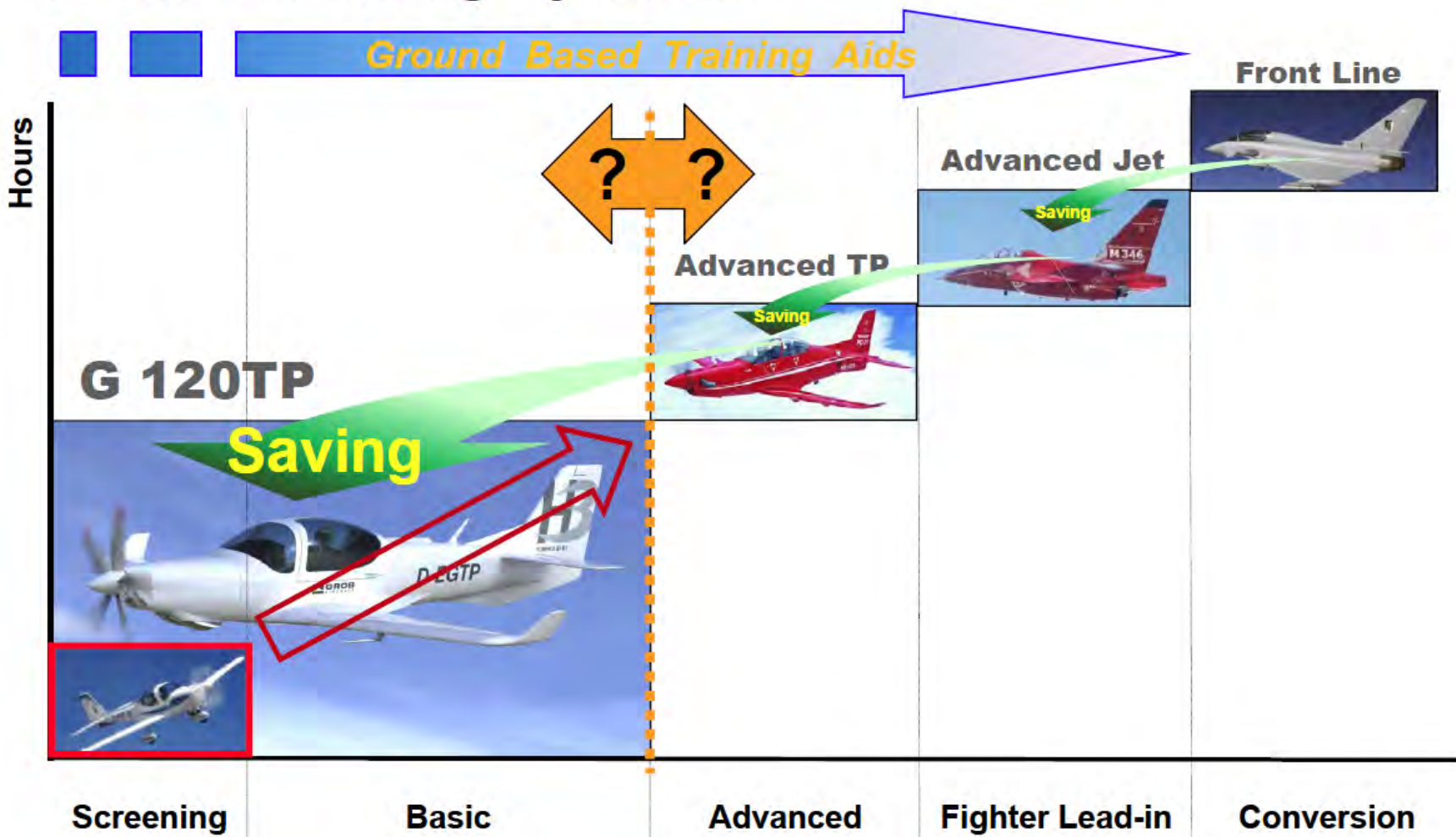
Grob's G120TP Strategy

Traditional Training Syllabus



Grob's G120TP Strategy

Future Training Syllabus



.... **Handling** **Mission** **Advanced Mission**

Key Design Drivers

▼ Minimise Escape System installed mass

- ▼ Aircraft empty weight as low ~1,000kg
 - Aircraft target was less 40kg per seat
 - Existing Mk16 range of ejection seats 75 – 105kg per seat

▼ Minimise installed volume

▼ Low purchase price

▼ Low life cycle costs

- ▼ Minimise lifed/replaceable items
- ▼ Minimise maintenance overhead

Mk15B

▼ Derived from the CH15A

- ▼ Installed in variants of the Pilatus PC-7
- ▼ Developed in the late 1980s
- ▼ Most lightweight ejection seat in Martin-Baker inventory

▼ Mk15B

- ▼ Significant redesign to reduce installed volume
- ▼ Further efforts to reduce mass resulted in single piece carbon fibre seat pan



▼ Drawbacks to the Mk15B

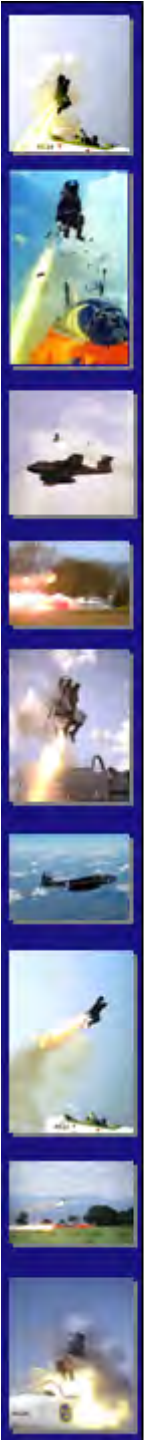
- ▼ Did not benefit from manufacturing improvement established in Mk16 ejection seats
 - Loss of seat survival kit provision
 - Difficultly in modification or tailoring to aircraft specific requirements
- ▼ Seat ballistic performance and aircrew parachute limited permissible aircrew boarding range

▼ Simulation tools aided the development of a new ejection sequence

- ▼ Utilising the Mk16 ejection gun and structure
- ▼ Reduce installed mass yet further



Mk17 Ultra Lightweight Escape System



▼ Zero Altitude – 60KEAS Ejection Performance

- ▼ 300KEAS Maximum ejection speed
- ▼ 25,000ft Maximum ejection altitude

▼ Ultra Lightweight Design

- ▼ From 36Kg installed mass per seat

▼ USAF JPATS Case 1 – 6 Accommodation Range

- ▼ Crew Boarding Range 56 – 123kg (124 – 271lbs)



Mk17 Ultra Lightweight Escape System



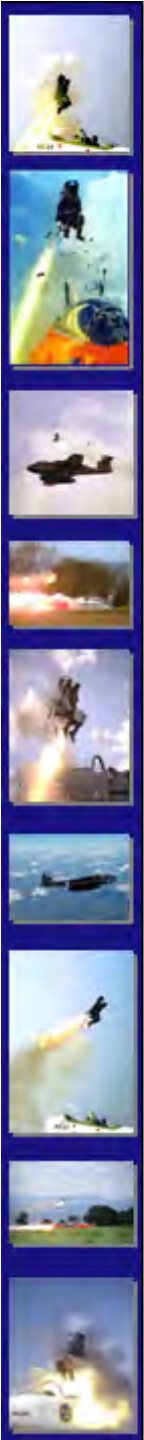
- ▼ Low Life Cycle Cost
 - ▼ Half the pyrotechnic cartridges required for Mk16
 - ▼ No Under Seat Rocket Motor
 - ▼ Minimal maintenance overhead

- ▼ Seat Survival Kit
 - ▼ 8kg of survival aids
 - ▼ Optional emergency liferaft

- ▼ Compact and Simple Installation
 - ▼ Minimal cockpit envelope



Mk17 Ejection Sequence

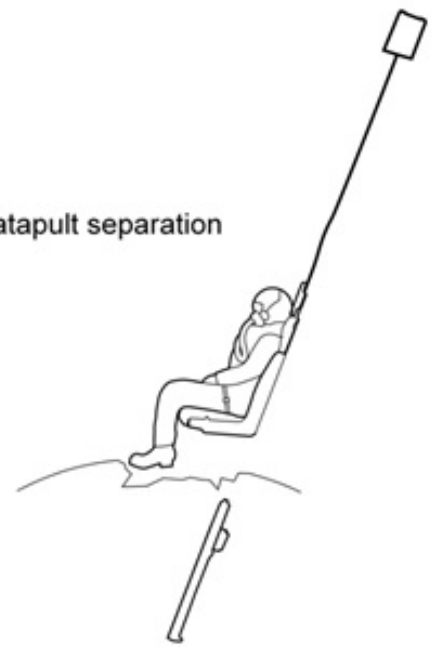


- 1 a) Seat firing handle pulled
- b) Parachute deployment unit activates deploying parachute container and clearing escape path through canopy
- c) Ejection catapult initiated
- d) Top latches released

Mk17 Ejection Sequence



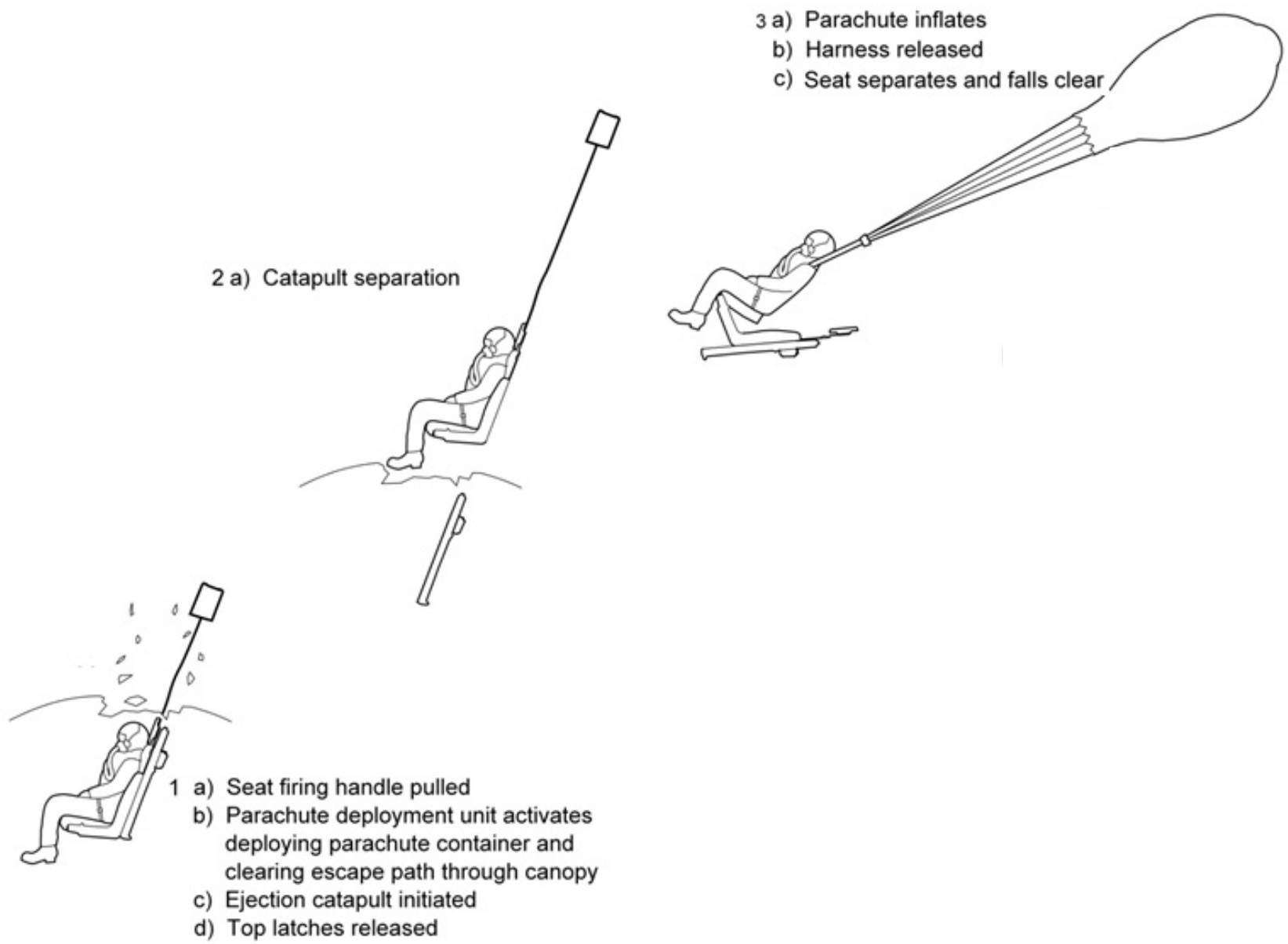
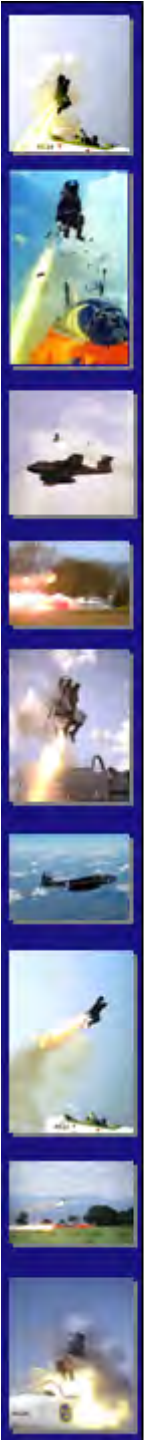
2 a) Catapult separation



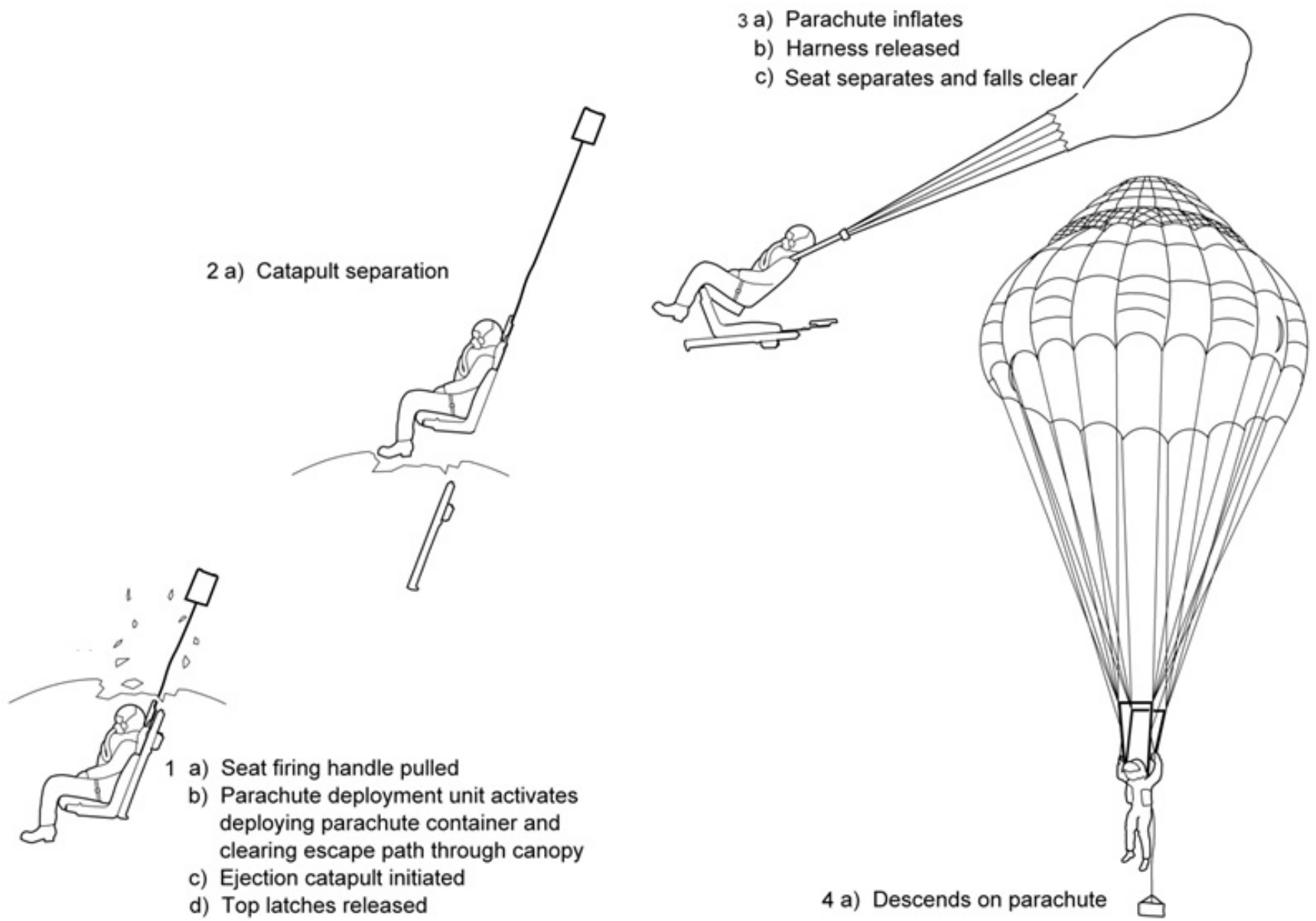
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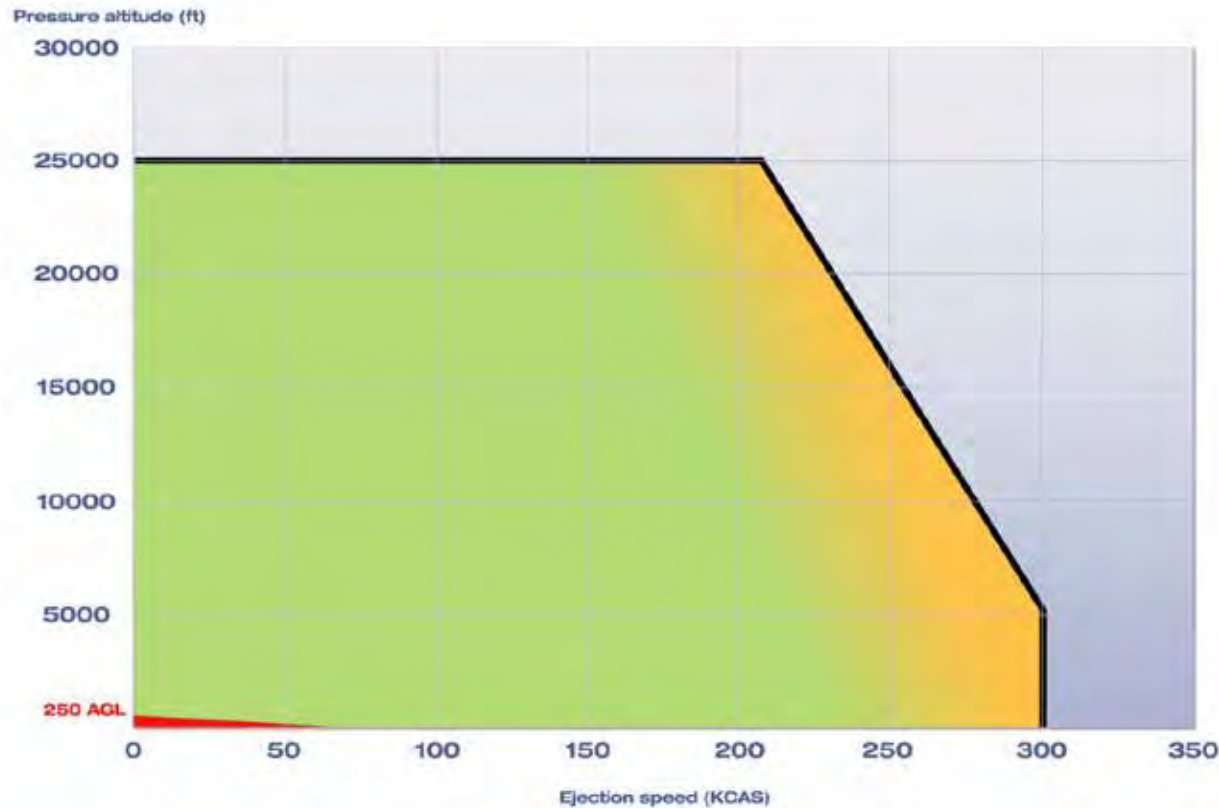
Mk17 Ejection Sequence



Mk17 Ejection Sequence



Mk17 Safe Escape Envelope



Seat escape envelope chart

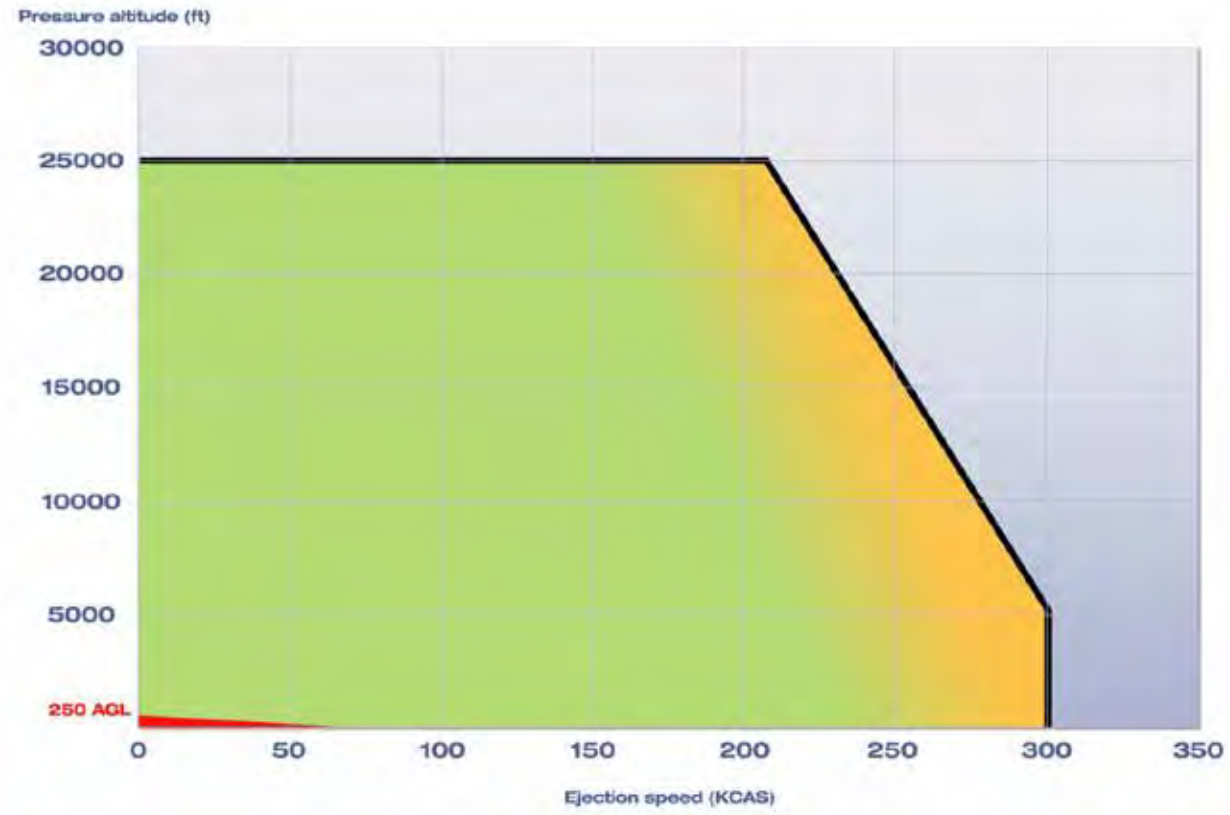
▼ Minimum Speed

- ▼ 60 KCAS at ground level
- ▼ 0 KCAS at 250ft above ground level

▼ Maximum Speed

- ▼ 300 KCAS or Mach 0.5

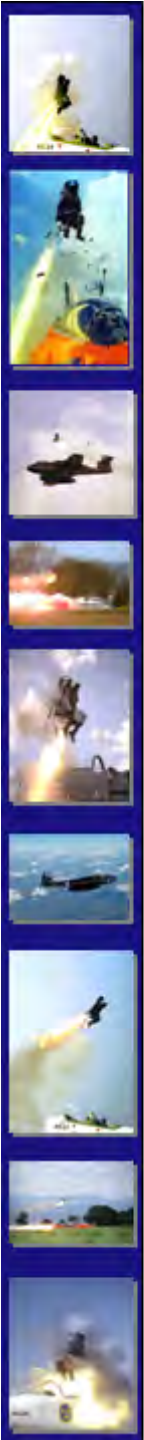
Mk17 Safe Escape Envelope



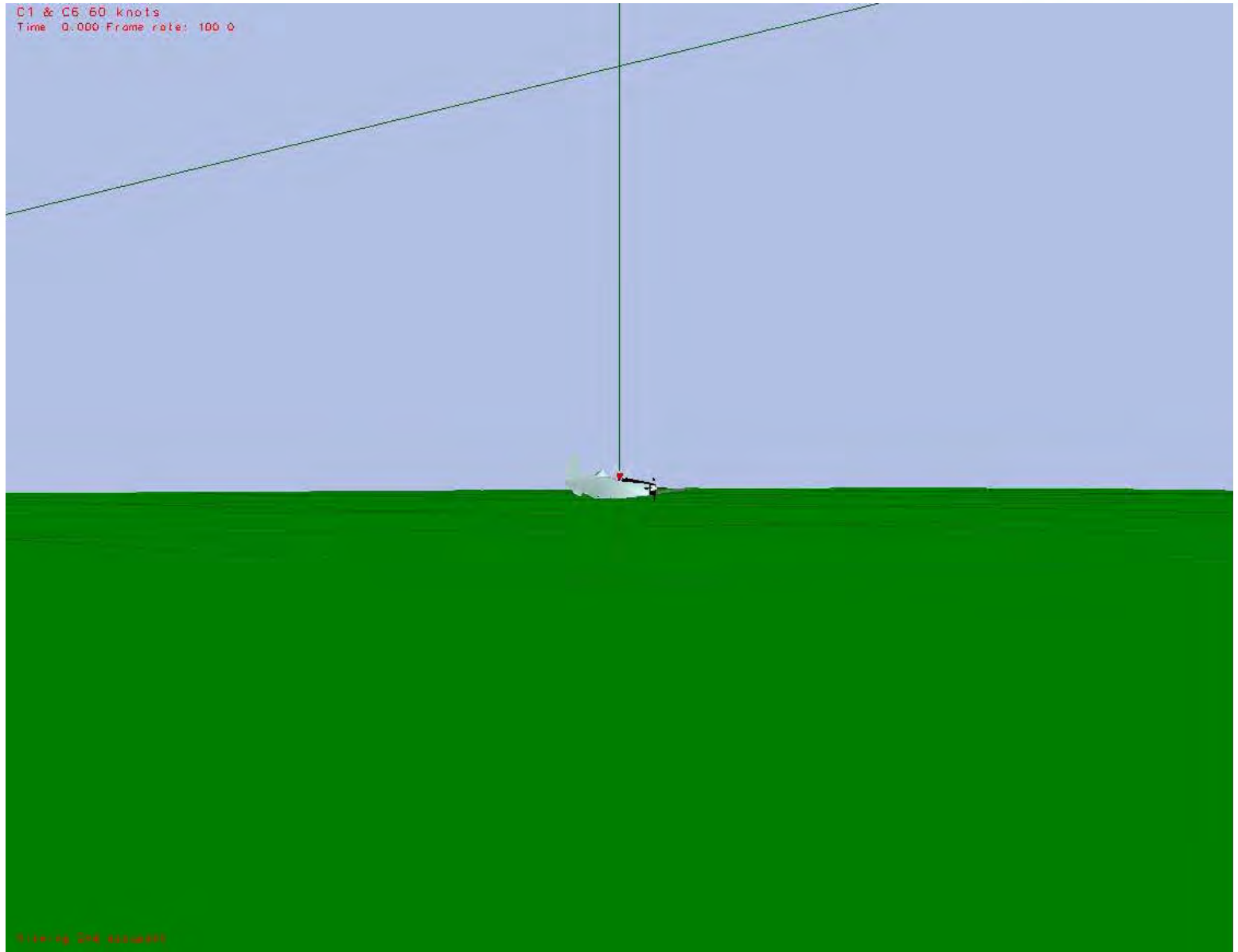
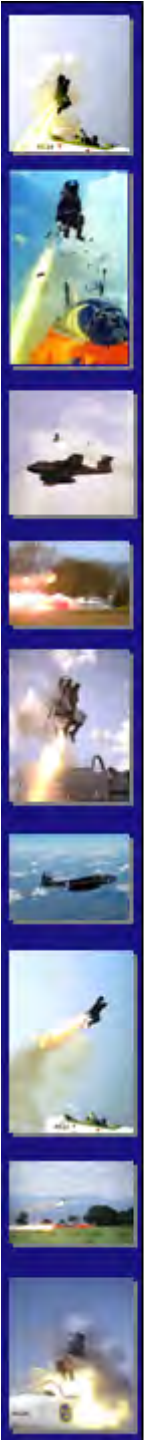
Seat escape envelope chart

▼ **Maximum Altitude**

▼ 25,000ft

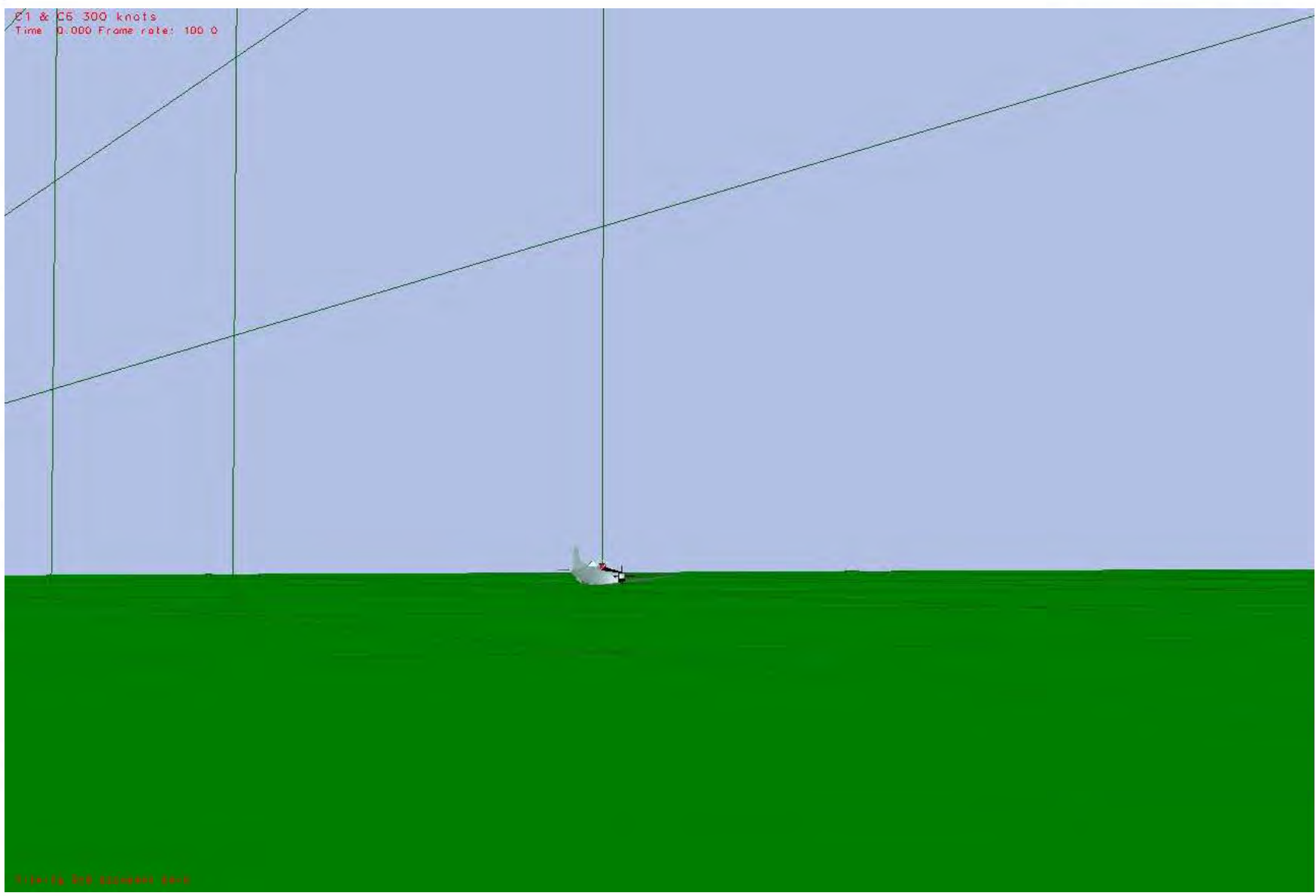


System Simulation



▼ **60 KEAS, Ground level**

System Simulation

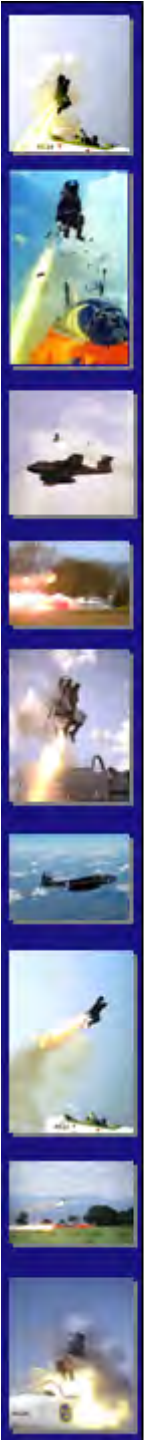


▼ **300 KEAS, Ground level**

Development Testing

▼ Net testing

▼ Used to evaluate and develop ejection gun performance



Development Testing



Development Testing

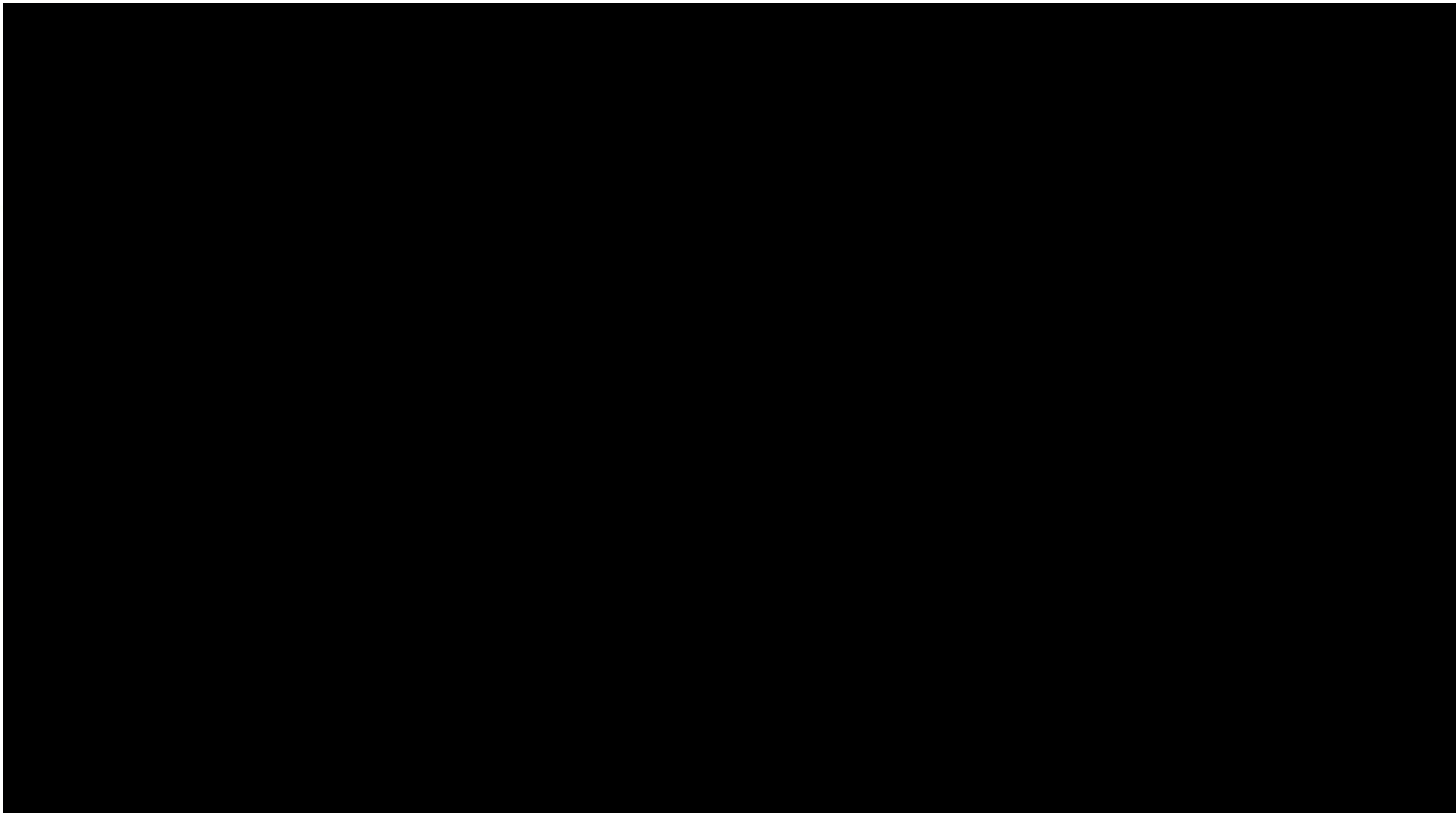
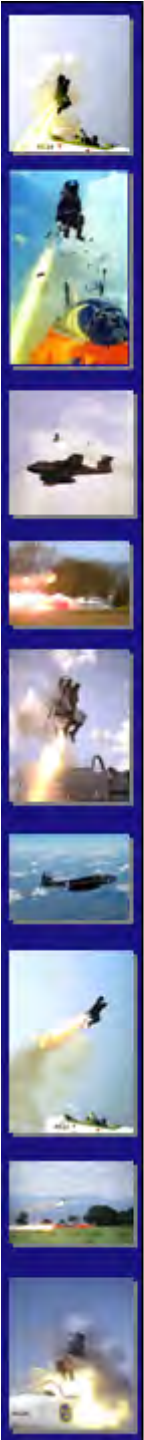


Development Testing

▼ Ejection Testing

- ▼ Evaluate full ejection sequence at minimum and maximum speeds





Potential Aircraft



- ▼ Grob G120TP
- ▼ UTVA Kobac
- ▼ Alenia Aermacchi – New Generation Screener
- ▼ HAL HTT-40





Questions?

Mk17 Product Demonstration in exhibition hall

Contact Details

▼ For further information contact:

James Pearse
Martin-Baker Aircraft Company Limited
Higher Denham
near Uxbridge
Middlesex
England
UB9 5AJ

Email. jpearse@martin-baker.co.uk

www.martin-baker.com

