AD A 046156

Ramed was () And price ()

DEVELOPATEN SE AN ULTAL UIGH LEVEL ANDROP EGNANNER LUNCEPT

DOCY DECEMBED W: III Payno, lac. 1910 Forest Drive Annapolis, Maryland 21401

Approved for public releases, distribution valuations.

SEPTEMBER: 1977

NATION PROGRAMMED IN THE SHEET NATIONAL SHEET OF THE SHEET S



Aldry Lejininiki (Inska

Approved for public release; distribution unlimited.

Citation of trade names in this report does not constitute an official indorsement or approval of the use of such items.

Destroy this report when no longer needed. Do not return it to the originator.

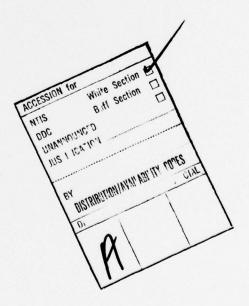
INCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Date Entered)

DEVELOPMENT OF AN ULTRA HIGH LEVEL AIRDROP CONTAINER CONCEPT S. TYPE OF REPORT A PERIOD COVERED Final Report June 74 - May 2577, 6. PERFORMING ORG. REPORT WUNDER Working Paper — 138-11	REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM	
DEVELOPMENT OF AN ULTRA HIGH LEVEL AIRDROP CONTAINER CONCEPT JUNE 274 - May 1977 AUTHOR(9) Peter R./Payne Peter R./Payne DAAK(93-74-C-6197	1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER	
DEVELOPMENT OF AN ULTRA HIGH LEVEL AIRDROP CONTAINER CONCEPT JUNE 274 - May 1977 AUTHOR(9) Peter R./Payne Peter R./Payne DAAK(93-74-C-6197				
CONTAINER CONCEPT CONTAINER CONTAINE			, - 1	
Peter R./Payne DAAK 03-74-C-0197 Peter R./Payne DAAK 03-74-C-0197		VEL AIRDROP /		
Peter R./Payne Peter R./Payne DAAKØ3-74-C-6197 DAAKØ3-74-C-6197	CONTAINER CONCEPT			
Peter R./Payne DAAK03-74-C-0197 Peperforming organization name and address Payne, Inc. 1910 Forcest Drive Annapolis, Maryland 21401 II. CONTROLLING OFFICE HAME AND ADDRESS U. S. Army Natick Laboratories Ransas Street Narick, Massachusetts 01760 Report) 18. MONITORING AGENCY NAME & ADDRESS/II dillerent from Controlling Offices 19. SECURITY CLASS, (of this report) Approved for public release; distribution unlimited. 19. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, If different from Report) 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Approved Continue on reverse side if necessary and identify by block number) APPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) APPLEMENTARY (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of		/ (14	Working Paper - 138-11	
P-PERFORMING ORGANIZATION NAME AND ADDRESS Payne, Inc. 1910 Forest Drive Annapolis, Maryland 21401 II. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Natick Laboratories Kansas Street Natick Massachusetts 01160 II. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) II. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) II. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) II. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) II. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) III. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, II different from Report) UNCLASSIFIED III. DECLASSIFICATION/DOWNGRADING III. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, II different from Report) III. SUPPLEMENTARY NOTES Aerodynamic Characteristics Airdrop Operations Aerial Delivery III. DISTRIBUTION STATEMENT (Continue on reverse side if necessary and identity by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin	7. AUTHOR(s)			
Payne, Inc. 1910 Forest Drive Annapolis, Maryland 21401 U. S. Army Natick Laboratories Kansas Street Natick Massachusetts 01760 Approved for public release; distribution unlimited. 19. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 19. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) WHICADS High Level Container Airdrop System Aerodynamic Characteristics Airdrop Operations Aerodynamic Characteristics Airdrop Operations Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	Peter R./Payne	(15)	DAAK03-74-C-0197	
Payne, Inc. 1910 Forest Drive Annapolis, Maryland 21401 U. S. Army Natick Laboratories Kansas Street Natick Massachusetts 01760 Approved for public release; distribution unlimited. 19. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 19. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) WHICADS High Level Container Airdrop System Aerodynamic Characteristics Airdrop Operations Aerodynamic Characteristics Airdrop Operations Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	(10)	and the same of th	and the same of th	
1910 Forest Drive Annapolis, Maryland 21401 11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Natick Laboratories Kansas Street Natick, Massachusetts 01760 12. REPORT DATE 13. SECURITY CLASS. (of this report) 14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Offices) 15. SECURITY CLASS. (of this report) 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES Aerodynamic Characteristics High Level Container Airdrop System Aerial Delivery 20. Apstract (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT HUMBERS	
Annapolis, Maryland 21401 11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Natick Laboratories Kansas Street 12. NATICK Massachusetts 01760 13. NEPORT DATE 14. MONITORING AGENCY NAME & ADBRESS(if different from Controlling Office) 15. NUMBER OF PAGES 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, 11 different from Report) 18. SUPPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) UHLCADS High Level Container Airdrop System Aerial Delivery A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of		Tr.		
U. S. Army Natick Laboratories Kansas Street Natick Massachuset's 01760 13. Number of Pages 23 15. SECURITY CLASS. (of this report) UNCLASSIFIED 15c. DECLASSIFICATION/DOWNGRADING 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) WHLCADS High Level Container Airdrop System Aerodynamic Characteristics Airdrop Operations Astudy was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of		1 16	1 471	
U. S. Army Natick Laboratories Kansas Street Natick Massachuset's 01760 13. Number of Pages 23 15. SECURITY CLASS. (of this report) UNCLASSIFIED 15c. DECLASSIFICATION/DOWNGRADING 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) WHLCADS High Level Container Airdrop System Aerodynamic Characteristics Airdrop Operations Astudy was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	Annapolis, Maryland 21401 11. CONTROLLING OFFICE NAME AND ADDRESS			
Ransas Street NATICE MASSACHUSETTS 01760 18. MONITORING AGENCY NAME AND RESSUIT different from Controlling Offices 19. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) NOV 2 1977 18. SUPPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree—of		(11)	Sep 771	
18. SECURITY CLASS. (of this report) INCLASSIFIED 18. DECLASSIFICATION/DOWNGRADING 19. MAPPROVED for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of this abstract entered in Block 20, if different from Report) NOV 2 1977 18. SUPPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identity by block number) UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identity by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of				
UNCLASSIFIED 15.e. DESCLASSIFICATION/DOWNGRADING Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) UHLCADS High Level Container Airdrop System Aerial Delivery 20. Apstract (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	Natick Massachusetts 01760	t from Controlling Office)		
Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, it different from Report) 18. SUPPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) UHLCADS High Level Container Airdrop System Aerial Delivery 20. Apstract (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of		122-1		
Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of		131× 24.1		
Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of			15a, DECLASSIFICATION/DOWNGRADING SCHEDULE	
Approved for public release; distribution unlimited. 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) 18. SUPPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	16. DISTRIBUTION STATEMENT (of this Report)			
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, it different from Report) 18. SUPPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of				
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, it different from Report) 18. SUPPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of				
18. SUPPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identity by block number) UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identity by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	Approved for public release; di	stribution unlim	ited.	
18. SUPPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identity by block number) UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identity by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of			DURA	
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamine aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	17. DISTRIBUTION STATEMENT (of the abstract entered	in Block 20, if different fro	m Report)	
UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of			1977 III	
UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of			10) NOV 2	
UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of			101-001511111111	
UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side it necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	18. SUPPLEMENTARY NOTES		111111111111111111111111111111111111111	
UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side it necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of				
UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side it necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of				
UHLCADS High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side it necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of				
High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	19. KEY WORDS (Continue on reverse side if necessary and	d identify by block number)		
High Level Container Airdrop System Aerial Delivery 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	IIUI CADS	Aor	odynamic Characteristics	
Aerial Delivery 20. ABSTRACT (Continue on reverse side it necessary and identify by block number) A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of				
A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of				
A Study was undertaken to determine the form and aerodynamic characteristics of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	20 ABSTRACT (Continue or severe side if nacressor on	d identify by block number)		
of an airdrop container capable of achieving a specified accuracy when dropped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of				
ped from ultra-high levels. This study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	of an airdrop container capable	of achieving a	specified accuracy when drop-	
"semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	ped from ultra-high levels. This study resulted in a final design for a			
models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of	"semi-streamline aeroshell" whi	ich was shown to	meet the limited technical	
the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of				
→				
	Sile vizitelly of hary tolle offer		→	

PREFACE

This program was conducted by Payne, Inc., Annapolis, Maryland, for the US Army Natick Research and Development Command, formerly the US Army Natick Laboratories, Natick, Massachusetts, under Contract DAAKO3-74-C-0197. The purpose of the program was to identify feasible approaches for achieving the capability of airdropping container loads weighing up to 220 lbs from high levels and landing them with a high degree of single-drop accuracy and minimum multiple-drop dispersion. The study resulted in a final design for a "semi-streamline aeroshell" which was shown to meet the limited technical criteria on which the program was based. During the program, half-scale models were dropped from helicopters at Natick, and wind-tunnel tested in the University of Maryland Glenn L. Martin Wind Tunnel. A six-degree-of-freedom trajectory program was assembled and proven. It is now available for a statistical analysis of delivery accuracy.

The program was performed under the direction of George Barnard, Project Officer, of the Aero-Mechanical Engineering Laboratory, Natick Research and Development Command. The project was managed at Payne, Inc. by P. R. Payne. The principal investigators and contributors were H. L. Newhouse, F. W. Fawker, and A. J. Euler.



Preceding Page BLANK - FILMED

TABLE OF CONTENTS

	Page
INTRODUCTION	5
THE PAYNE PROGRAM	6
CONCLUSIONS	12
REFERENCES	13
APPENDIX: Sequential Assembly of the Payne UHLCADS Aeroshell	15

Preceding Page BLANK - FILMED

DEVELOPMENT OF AN ULTRA-HIGH-LEVEL AIRDROP CONTAINER CONCEPT

INTRODUCTION

Improved mobile surface-to-air missiles have made it necessary to consider drop altitudes up to 25,000 feet for resupply of isolated military positions. One proposed solution is to permit dropped cargo to fall ballistically until close to the ground, then deploy the recovery parachutes. To achieve this with the desired degree of accuracy from high altitudes, it is necessary to increase the terminal velocity of the cargo packages and to provide them with low drag stabilizing features. This approach is embodied in the Ultra High Level Container Airdrop System (UHLCADS).

By making a streamline container which has the same ballistic coefficient as a bomb, one can clearly achieve conventional bombing accuracy down to the altitude for parachute deployment. But of course, the usable volume of such a container would be low in relation to its outside dimensions, the cost would be high, and the quantity of payload per drop severely restricted.

Between the extremes of the irregularly square shape of the present A-22 container on the one hand, and a streamline bomb shape on the other, there are many "semi-streamline" shapes which could be employed. And, of course, the ballistic coefficient can be reduced to a value compatible with actual cargo densities, at some cost in accuracy. The problem is to quantify these considerations, and develop a design which has "good enough" accuracy, yet is still affordable.

THE PAYNE PROGRAM

It was initially decided that the cargo must be contained inside an aerodynamic fairing - now called the "aero-shell" - and that this should deviate as little as possible from a square box shape, four feet on each side. Earlier work had suggested that a terminal velocity of 415 ft/sec would be adequate, implying a drag coefficient of about 0.45, a 55% reduction from that of the present A-22 container when unstabilized. Previous experience led us to believe that fairly modest radiusing of the forward facing edges of such a box shape would enable such a drag reduction to be achieved. The aero-shell would also need to be aerodynamically stabilized, of course, and because the cargo loading can never be perfectly symmetrical, the stabilizing fins need to impart a spinning motion to the vehicle, about the axis of flight, so that lateral aerodynamic forces are "averaged out".

Our first design (Figure 1) had stabilizer vanes analogous to the feathers on a shuttlecock. A number of half-scale models were airdropped and found to be unsatisfactory because

- (a) the drag was too high
- (b) static stability was marginal
- (c) damping was apparently negligible.

Two subsequent wind tunnel investigations³ revealed the reasons for these defects, and after a number of permutations, the configuration of Figures 2 and 3 was arrived at. The drag coefficient was found to be lower than the target figure (0.36 compared to 0.45) and stability was adequate.

A design for a practical aero-shell was then prepared, 4 illustrated in Figures 4 and 5 and in the Appendix.

In parallel with this effort, a six-degree-of-freedom trajectory program was developed⁵ so that the effects of various asymmetries on trajectory could be computed. A limited number of such studies were successfully carried out, but many more would be needed to completely characterize the system, and contract funds were unfortunately insufficient to permit this.

Farinacci, A.L., and Brunner, D.B., "High Level Container Airdrop System." US Army Natick Laboratories TR 73-55-AD, March 1973, AD 766-309.

Army Natick Laboratories TR 73-55-AD, March 1973, AD 766-309.

Payne, P.R., "On the Resistance of Blunt Forms." <u>Journal of Aircraft</u>, Vol.3, No. 6, November-December 1966.

Hawker, F. W., "Determination of Optimum Aerodynamic Shape for the Ultra High Level Container Airdrop System." Phase II Final Report, Contract DAAKO3-75-C-0197, Payne, Inc. Report No. 138-9, September 1975.

Wewhouse, H. L., "Preliminary Design of an Integrated Cargo Container/ Stabilizer, UHLCADS." Phase I Final Report, Contract DAAK03-74-C-0197, Payne, Inc. Report No. 138-8, September 1975.

⁵ Barlow, J.B., "A Six-Degree-of-Freedom Trajectory Program for the Ultra High Level Container Airdrop System." Phase III Final Report, Contract DAAK03-74-C-0197, Payne, Inc. Report No. 138-10, September 1975.

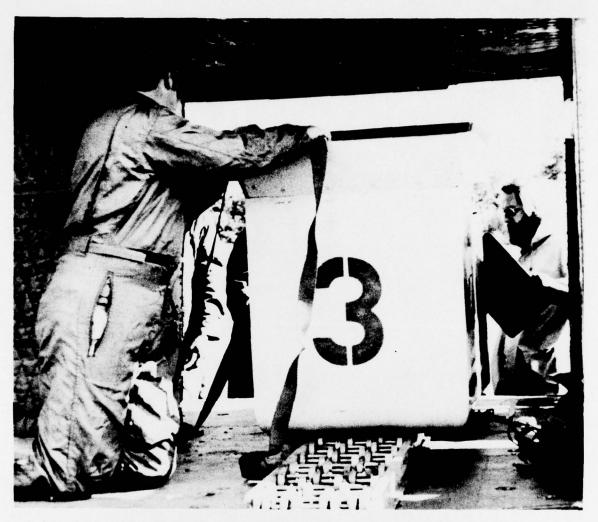


Figure 1. The first Payne aero-shell design for UHLCADS, shown here as a half-scale model built for air drop testing.

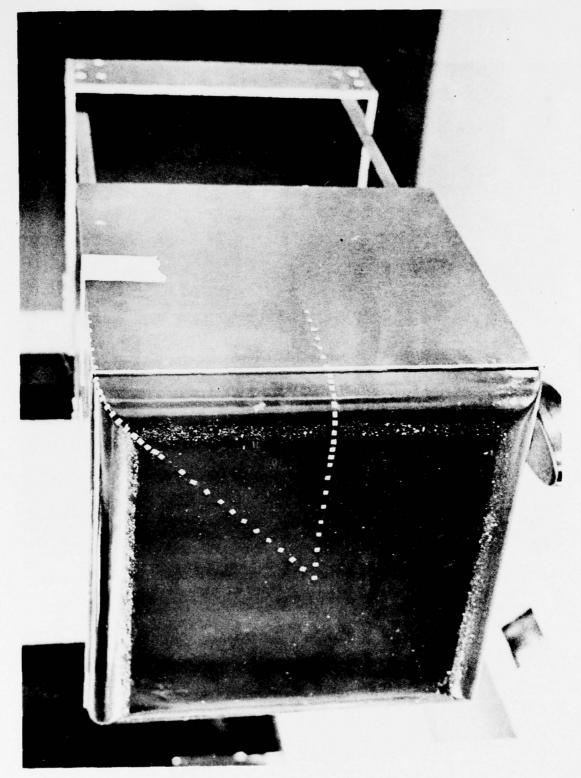
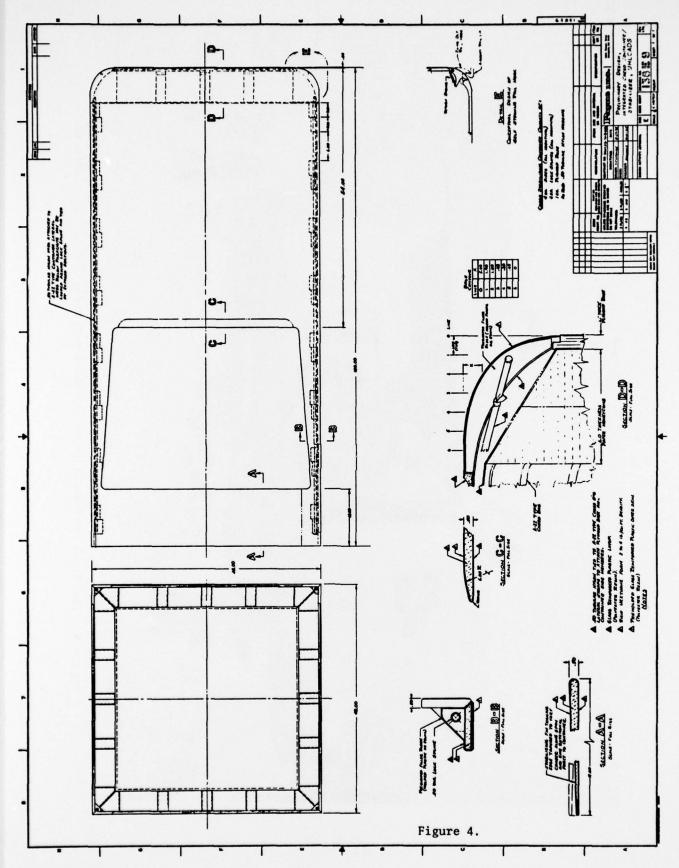


Figure 2. The final configuration, shown here as a half-scale wind tunnel model with pressure taps.



Figure 3. The final configuration as a half-scale model for air-drop testing.



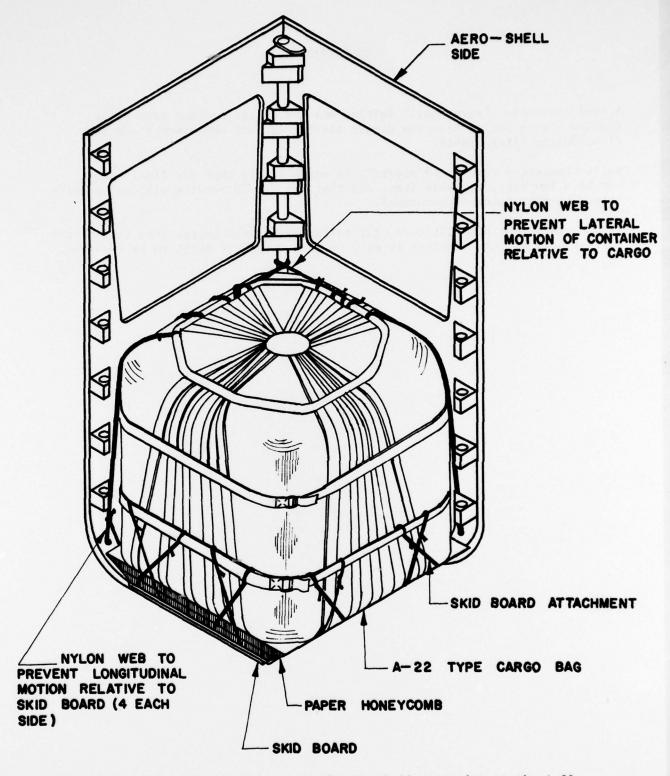


Figure 5. Schematic showing proposed aero-shell retention to the A-22 type cargo bag.

CONCLUSIONS

A semi-streamline "aero-shell" fairing enables a high descent rate to be reached - much higher than the drogue stabilized A-22 container - and the final design flies stably.

Built from glass-reinforced plastic, it seems likely that our final design can be a low cost, reusable item, and that its use in service will not require extensive retraining of personnel.

Its accuracy from high altitude will certainly be much better than that of the current A-22 system. Whether it will be good enough is still to be resolved.

REFERENCES

- 1. Farinacci, A.L., and Brunner, D. B.
- "High Level Container Airdrop System," U.S. Army Natick Laboratories TR 73-55-AD, March 1973, AD 766-309.

2. Payne, P.R.

"On the Resistance of Blunt Forms,"

Journal of Aircraft, Vol. 3, No. 6,

November - December 1966.

3. Hawker, F.W.

- "Determination of Optimum Aerodynamic Shape for the Ultra High Level Container Airdrop System," Phase II Final Report, Contract DAAKO3-75-C-0197, Payne, Inc. Report No. 138-9, September 1975.
- 4. Newhouse, H.L.
- "Preliminary Design of an Integrated Cargo Container/Stabilizer, UHLCADS." Phase I Final Report, Contract DAAK03-74-C-0197, Payne, Inc. Report No. 138-8, September 1975

5. Barlow, J.B.

"A Six-Degree-of-Freedom Trajectory Program for the Ultra High Level Container Airdrop System." Phase III Final Report, Contract DAAK03-74-C-0197, Payne, Inc. Report No. 138-10, September 1975.

Preceding Page BLANK - NOT |

APPENDIX A

SEQUENTIAL ASSEMBLY OF THE PAYNE UHLCADS AERO-SHELL

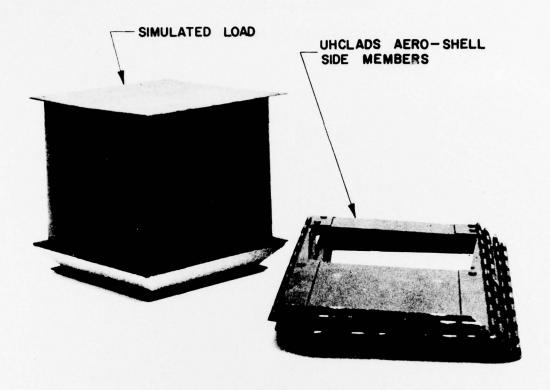


Figure I-1. Simulated load as built up and the UHLCADS aero-shell side members as removed from their shipping container.

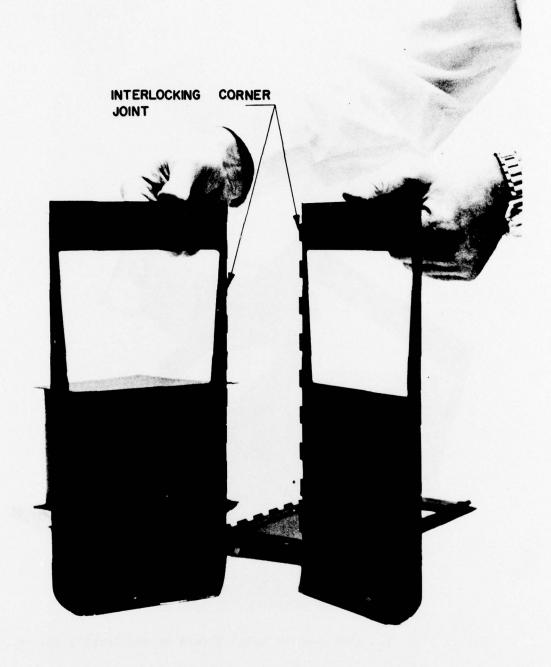


Figure I-2. Two side members showing the interlocking corner joint detail.



Figure I-3. Two side members being joined by the locking spline.

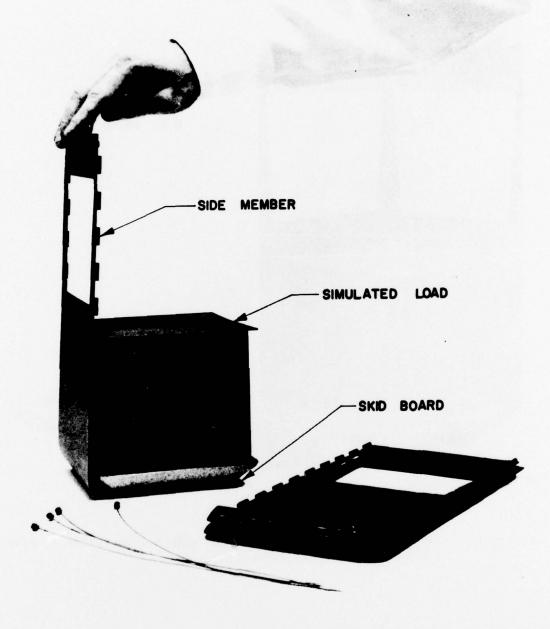


Figure I-4. A side member in position around the simulated load with the lower edge engaged in the skid board corner cutout.

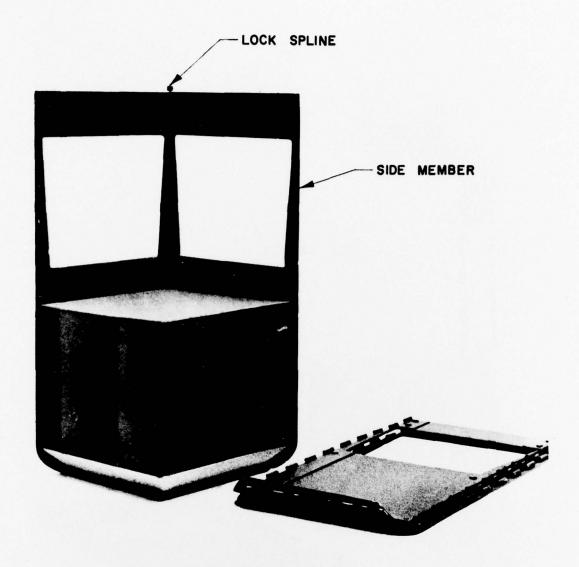


Figure I-5. Two side members locked together with a lock spline in place around the simulated load.

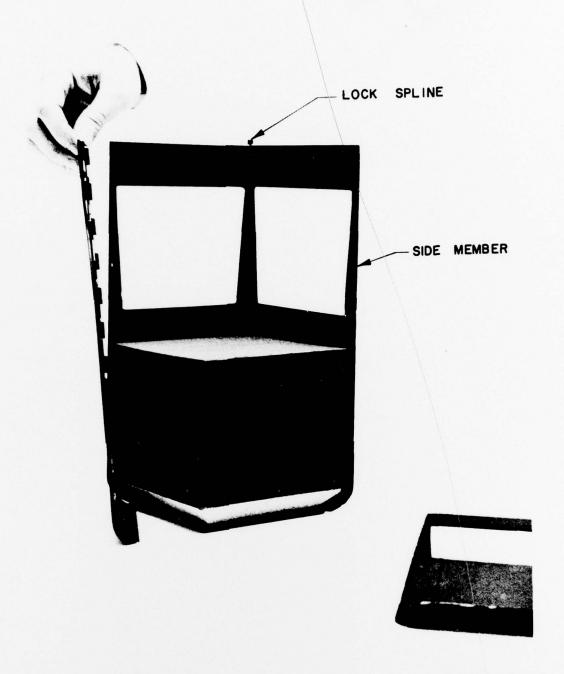


Figure I-6. Third side member being positioned around the simulated load.



Figure I-7. Fourth side member being moved into position.

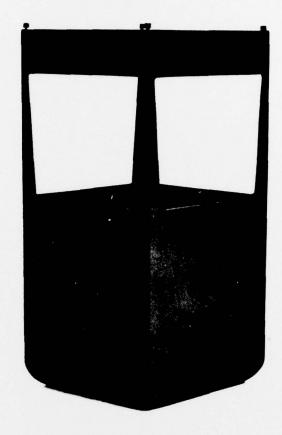


Figure I-8. Completed assembly of UHLCADS aero-shell.