~~CONFIDENTIAL~~

CLASSIFICATION CHANGE

To UNCLASSIFIED
By authority of GDS-Ex 11652
Changed by L. Shirley Date 12/31/72
Classified Document Master Control Station, NASA
Scientific and Technical Information Facility Accession No. 02761-65

36

SID 65-337

PRELIMINARY

WEIGHT AND BALANCE REPORT

FOR

SPACECRAFT 002 (U)

CONTRACT NAS 9-150

1 MARCH 1965

Exhibit I, Paragraph 8.10

Prepared by

[redacted]

Weight Control

(NASA-CR-117614) PRELIMINARY WEIGHT AND BALANCE REPORT FOR SPACECRAFT 002 /U/ (North American Aviation, Inc.) 27 p

N79-76452

Unclas
00/18 11465

FF No. 602(A)

27 (PAGES)	none (CODE)
NASA-CR-117614 (NASA CR OR TMX OR AD NUMBER)	(CATEGORY)

[redacted]

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

~~CONFIDENTIAL~~

~~DOWNGRADED AT 12 YEAR INTERVALS~~
~~NOT AUTOMATICALLY DECLASSIFIED~~
~~DOD DIR 5200.10~~

"THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C. SECTIONS 793 AND 794. ITS TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW."

8-D-3 VELLUM REV. 2-61

TECHNICAL REPORT INDEX/ABSTRACT

C65-4717

ACCESSION NUMBER						DOCUMENT SECURITY CLASSIFICATION CONFIDENTIAL	

TITLE OF DOCUMENT

Preliminary Weight and Balance Report for Spacecraft 002 (U)

LIBRARY USE ONLY

AUTHOR(S)

D. D. Morgan

CODE	ORIGINATING AGENCY AND OTHER SOURCES	DOCUMENT NUMBER
	NAA-S&ID	SID 65-337

PUBLICATION DATE	CONTRACT NUMBER
	NAS9-150

DESCRIPTIVE TERMS

ABSTRACT

This preliminary weight and balance report for Spacecraft 002 presents summary mass property data and a detail weight statement for each module. It also includes a detailed weight statement for Government Furnished Equipment. The Command Module is ballasted to meet the required lift to drag ratio of 0.34 at entry. The Service Module is ballasted to maintain the spacecraft stack center of gravity on centerline. The Launch Escape System is ballasted resulting in a burnout center of gravity at Station 1122.0 which is consistent with the Spacecraft 002 mission.. Graphs representing weight versus center of gravity and moment and product of inertia for the LEV during main and pitch motor burning are also contained in the report. Weight distributions for each module are also presented.

TABLE OF CONTENTS

		PAGE
SECTION I	INTRODUCTION	
	TABLE OF CONTENTS	ii
	INTRODUCTION	1
	AIRFRAME 002 SPACECRAFT DIMENSIONAL DIAGRAM	2
SECTION II	WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARIES	
	MODULE MASS PROPERTIES SUMMARY	3
	AIRFRAME 002 MISSION	4
	LAUNCH ESCAPE VEHICLE	5
SECTION III	AIRFRAME 002 SUMMARY WEIGHT STATEMENT	
	LAUNCH ESCAPE SYSTEM	6
	COMMAND MODULE	7
	SERVICE MODULE	8
	ADAPTER - SPECIAL	9
	GOVERNMENT FURNISHED EQUIPMENT	10
SECTION IV	SPACECRAFT 002 WEIGHT VERSUS CENTER OF GRAVITY AND INERTIA	
	LAUNCH ESCAPE VEHICLE	11 - 19
SECTION V	SPACECRAFT 002 WEIGHT DISTRIBUTION	
	LAUNCH ESCAPE SYSTEM	20
	COMMAND MODULE	21
	SERVICE MODULE	22
	LITTLE JOE II ADAPTER	23

~~CONFIDENTIAL~~

INTRODUCTION

The following is a preliminary weight and balance report for Spacecraft 002 - Mission A-004. Spacecraft 002 mission shall be unmanned and is to be a power on (launch escape motor burning) tumbling boundary abort. The preliminary data contained in this report is in accordance with SID 63-699 (CSM End Item Specification, Part I, Performance Design Requirements, Spacecraft 002 Apollo) dated 11 January 1965.

The Command Module includes ballast for deleted systems (wiring, conduit, plumbing, full propellant, water tanks, RCS engines, etc.) and structure, (display panels and crew couches) to maintain the lift to drag ratio of 0.34 at entry and to achieve CM design weight of 11,000 pounds.

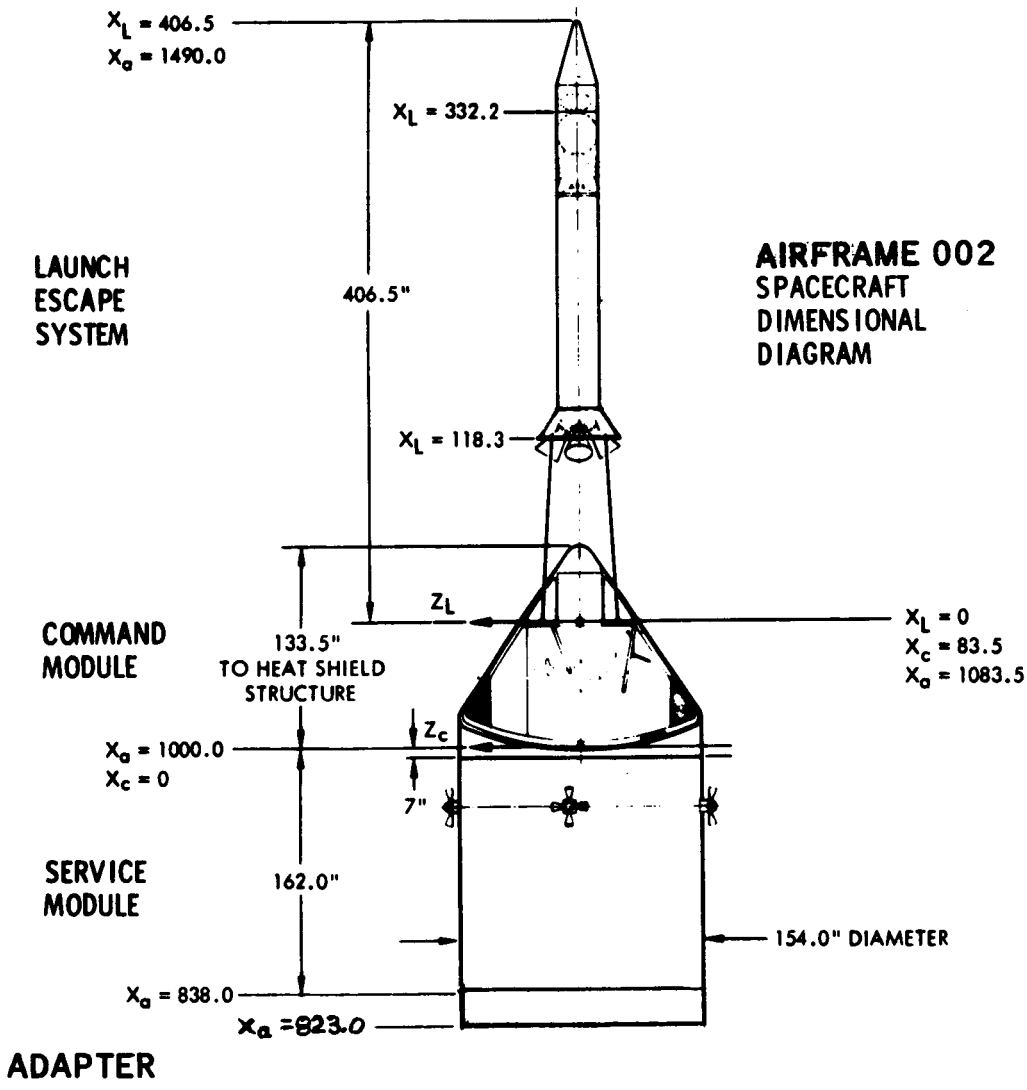
The Service Module has 1,582 pounds of ballast to maintain the Spacecraft stack center of gravity on centerline resulting in a 5,000 pound design weight. Recent Little Joe II information indicates that the Service Module ballasting for the stack center of gravity on centerline may not be required as the later booster configuration incorporates a Reaction Control System.

The Launch Escape System weight of 8,200 pounds includes 654 pounds of ballast resulting in a launch escape vehicle burnout center of gravity at Station 1122.0, which is consistent with the tumbling abort mission.

A special Adapter weighing 1000 pounds is utilized for the Little Joe II booster.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~



~~CONFIDENTIAL~~

AIRFRAME 002

MODULE MASS PROPERTIES SUMMARY

ITEM	WEIGHT	CENTER OF GRAVITY*			MOMENT OF INERTIA**			PRODUCT OF INERTIA**		
		X	Y	Z	I_{xx}	I_{yy}	I_{zz}	I_{xy}	I_{xz}	I_{yz}
LAUNCH ESCAPE SYSTEM	8200	1301.5	0.0	-0.1	528.0	20446.2	20445.8	-0.8	113.8	-0.2
COMMAND MODULE	11000	1038.1	0.7	5.5	5184.8	4688.1	4428.9	-21.4	-302.1	-3.0
SERVICE MODULE - Less Propellant	5000	905.2	-1.2	-11.8	5521.7	7185.7	6600.0	141.8	710.5	-6.6
ADAPTER - Special	1000	828.5	-0.8	0.1	1245.9	626.0	626.2	-0.2	0.0	0.0

*Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the Command Module substructure mole line.

**Moments and products of inertia are slug feet squared about the center of gravity.

AIRFRAME 002 MISSION

ITEM	WEIGHT	CENTER OF GRAVITY*			MOMENT OF INERTIA**			PRODUCT OF INERTIA**		
		X	Y	Z	I_{xx}	I_{yy}	I_{zz}	I_{xy}	I_{xz}	I_{yz}
COMMAND MODULE	11000	1038.1	0.7	5.5	5184.8	4688.1	4428.9	-21.4	-302.1	-3.0
SERVICE MODULE - Less Propellant	5000	905.2	-1.2	-11.8	5521.7	7185.7	6600.0	141.8	710.5	-6.6
TOTAL - LESS PROPELLANT	16000	996.6	0.1	0.1	10930.6	25189.5	24125.8	307.8	2111.1	14.9
ADAPTER - Special	1000	828.5	-0.8	0.1	1245.9	626.0	626.2	-0.2	0.0	0.0
TOTAL INJECTED - Trajectory	17000	986.7	0.1	0.1	12176.7	31555.1	30491.8	339.2	2110.7	14.8
LAUNCH ESCAPE SYSTEM	8200	1301.5	0.0	-0.1	528.0	20446.2	20445.8	-0.8	113.8	-0.2
TOTAL - AT LAUNCH	25200	1089.1	0.1	0.0	12704.8	170324.5	169260.8	300.8	2149.3	14.6

*Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the Command Module substructure mold line.

**Moments and products of inertia are slug feet squared about the center of gravity.

AIRFRAME 002

LAUNCH ESCAPE VEHICLE

ITEM	WEIGHT	CENTER OF GRAVITY*			MOMENT OF INERTIA**			PRODUCT OF INERTIA**		
		X	Y	Z	I_{xx}	I_{yy}	I_{zz}	I_{xy}	I_{xz}	I_{yz}
COMMAND MODULE	11000	1038.1	0.7	5.5	5184.8	4688.1	4428.9	-21.4	-302.1	-3.0
LAUNCH ESCAPE SYSTEM	8200	1301.5	0.0	-0.1	528.0	20446.2	20445.8	-0.8	113.8	-0.2
TOTAL - ABORT INITIAL	19200	1150.6	0.4	3.1	5745.1	95517.8	95226.9	-209.2	-1684.0	0.8
LESS - MAIN AND PITCH MOTOR PROPELLANTS	-3198	1294.3	0.0	0.0	71.4	1336.7	1336.6	0.0	0.0	0.0
TOTAL LEV - BURNOUT	16002	1121.9	0.5	3.7	5665.6	77069.3	76786.4	-161.4	-1314.1	-0.3

*Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the Command Module substructure mold line.

**Moments and products of inertia are slug feet squared about the center of gravity.

~~CONFIDENTIAL~~

AIRFRAME 002

SUMMARY WEIGHT STATEMENT

LAUNCH ESCAPE SYSTEM

STRUCTURE		1527
Tower and Insulation	437	
Escape Motor Skirt and Insulation	231	
Canard	828	
Q-Ball and Attachments	30	
SEPARATION PROVISIONS		15
BALLAST		654
PROPULSION		5410
Escape Motor	4826	
Jettison Motor	535	
Pitch Control Motor	49	
ELECTRICAL POWER		55
BOOST PROTECTIVE COVER		539
TOTAL LAUNCH ESCAPE SYSTEM		8200

~~CONFIDENTIAL~~

AIRFRAME 002

SUMMARY WEIGHT STATEMENT

COMMAND MODULE

WEIGHT EMPTY (Subsystems)		7774
Structure (Including Ballast)	5893	
Earth Recovery	610	
R & D Equipment	332	
R & D Equipment on Platform	939	
SIMULATED EQUIPMENT		2944
Ablative	1808	
Stabilization and Control	153	
Guidance and Navigation	54	
Environmental Control	168	
Instrumentation	62	
Electrical Power	253	
Reaction Control	195	
Communications	235	
Scientific Equipment	16	
USEFUL LOAD		282
Crew and Equipment (Including Ballast)	282	
TOTAL COMMAND MODULE		11000

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

AIRFRAME 002

SUMMARY WEIGHT STATEMENT

SERVICE MODULE

WEIGHT EMPTY		
Structure (Including Ballast)	4800	
Instrumentation	200	
TOTAL SERVICE MODULE		5000

[redacted]

AIRFRAME 002

SUMMARY WEIGHT STATEMENT

ADAPTER - SPECIAL

STRUCTURE		
Basic Body Structure	646	
Secondary Structure	354	
TOTAL ADAPTER		1000

~~CONFIDENTIAL~~

AIRFRAME 002

SUMMARY WEIGHT STATEMENT

GOVERNMENT FURNISHED EQUIPMENT

R & D INSTRUMENTATION EQUIPMENT

Timer Assembly	9.1
Tower Sequencer	5.0
Inverter	12.2
Gyro (Attitude)	19.0
Junction Box	5.0
Gyro (Rate)	5.7
Multiplexer (4 Channel)	10.0
Line Filter Transponder C-Band (2)	4.0
Transponder C-Band (2)	21.6
Power Control Box	14.0
High Level Commutator (2)	6.0
Time Reference Generator	1.5
Power Supply (5 Volt and 25 Volt D.C.)	1.2
Voltage Monitor	2.4
Frequency Detector	1.3
Battery (2)	15.6
Telemetry R.F. Assembly (2)	40.0
Programmer - Power	15.0
Amplifier D. C. (4)	92.0
Signal Conditioner	15.0
Tape Modulation Package	36.0
Acceleration Amplifiers (3)	3.0
L.E.S. Sequencer	35.0
Battery (2)	105.5
Accoustic Measurement	4.0
Tape Recorder Electronics (2)	26.0
Tape Recorder Transport (2)	80.0
Tape Transport Cover	60.0

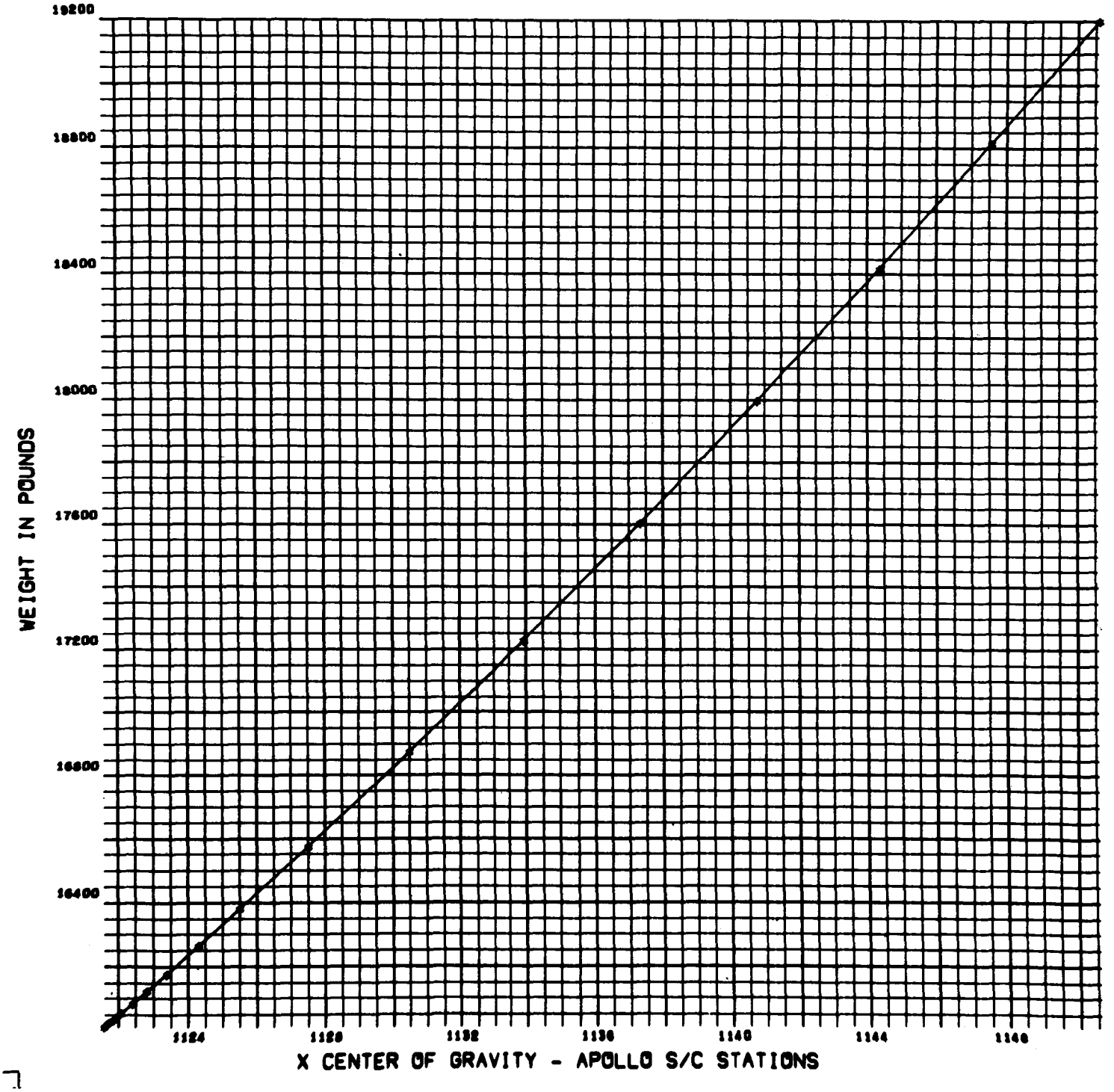
TOTAL GOVENMENT FURNISHED EQUIPMENT 645.1

~~CONFIDENTIAL~~

[redacted]

SPACECRAFT 002 LEV ABORT PHASE PRELIMINARY

0613-19
001 000

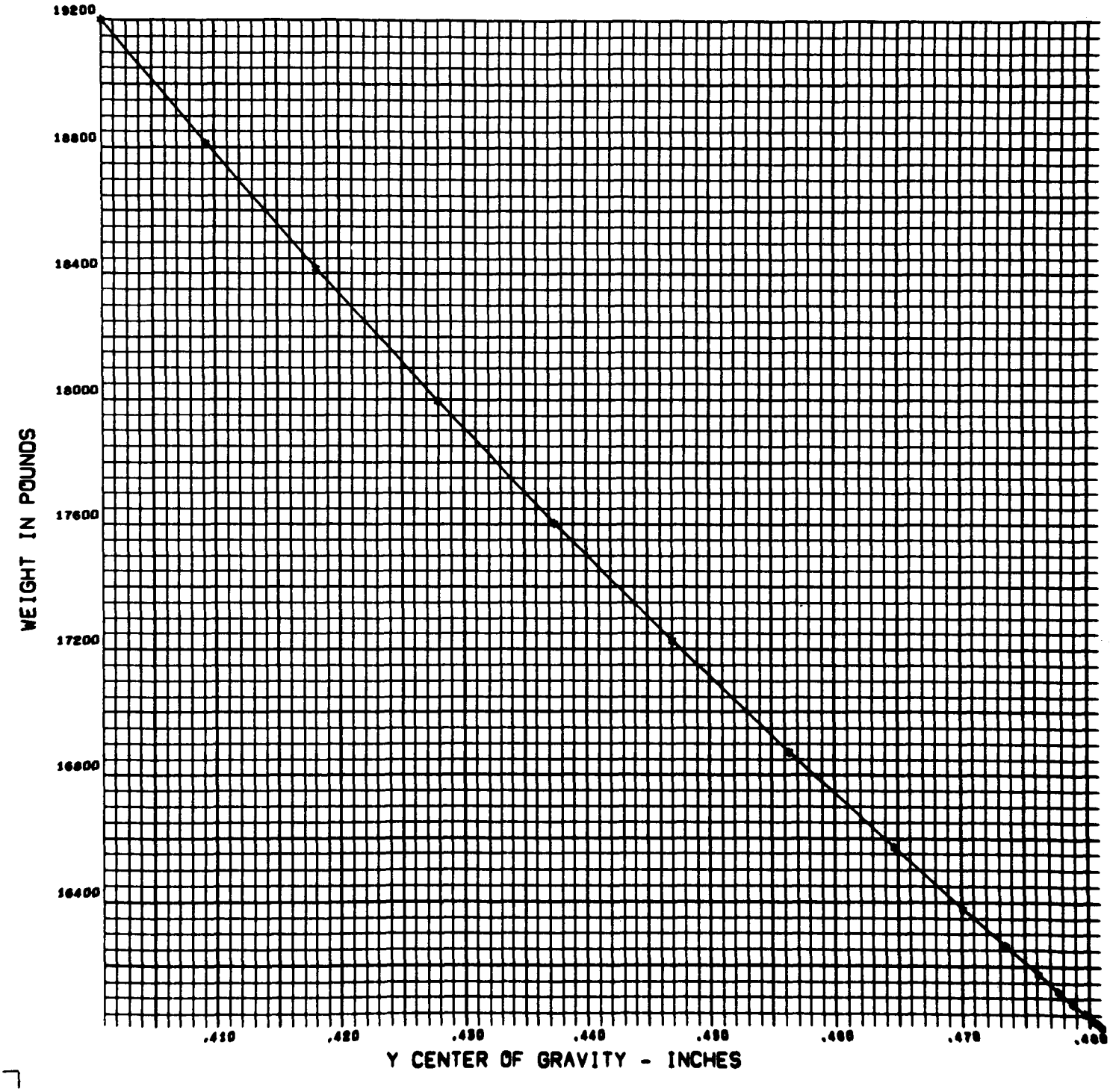


[redacted]

~~CONFIDENTIAL~~

SPACECRAFT 002 LEV ABORT PHASE PRELIMINARY

0613-19
002 000

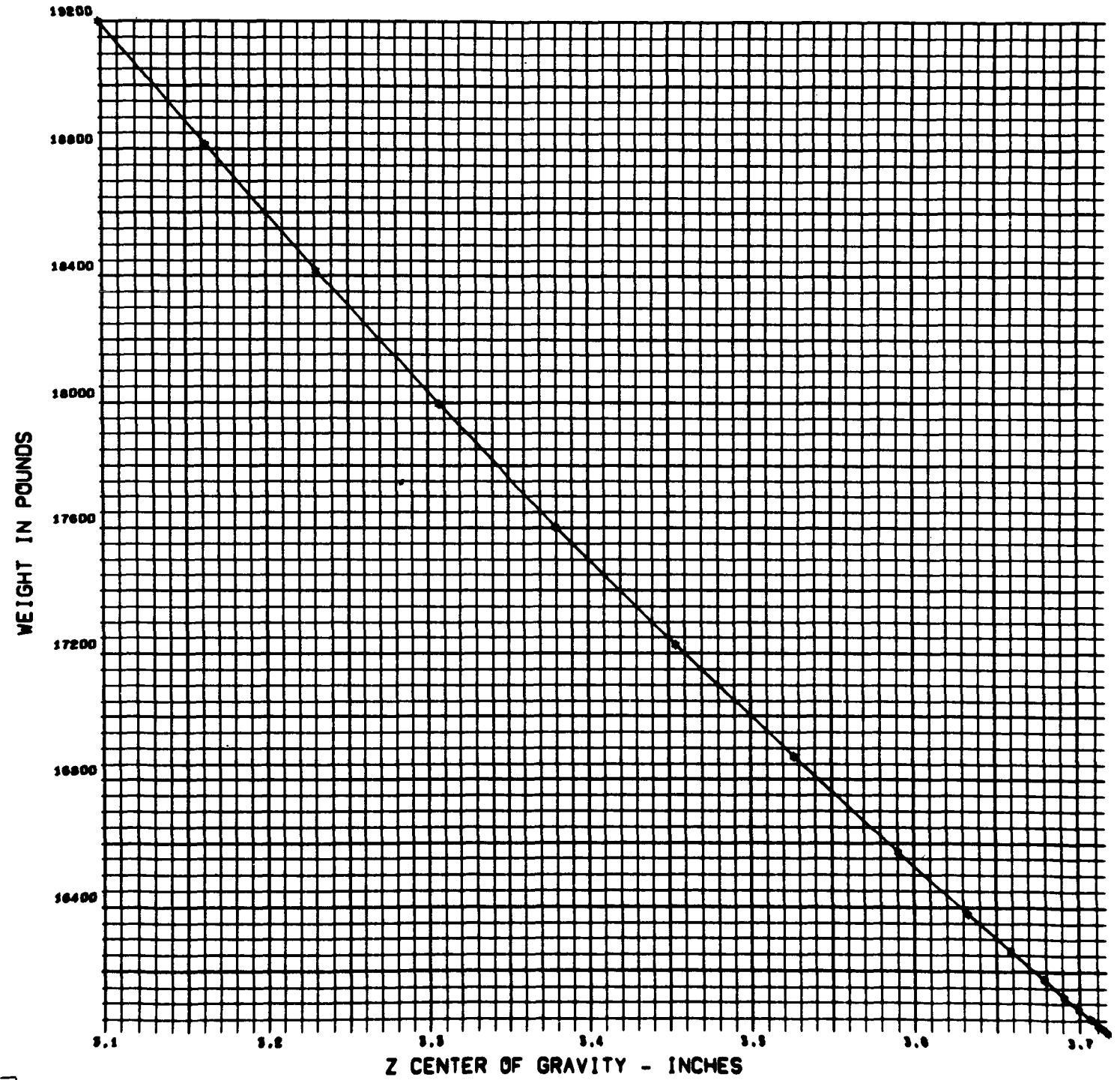


~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

SPACECRAFT 002 LEV ABORT PHASE PRELIMINARY

0613-19
003 000

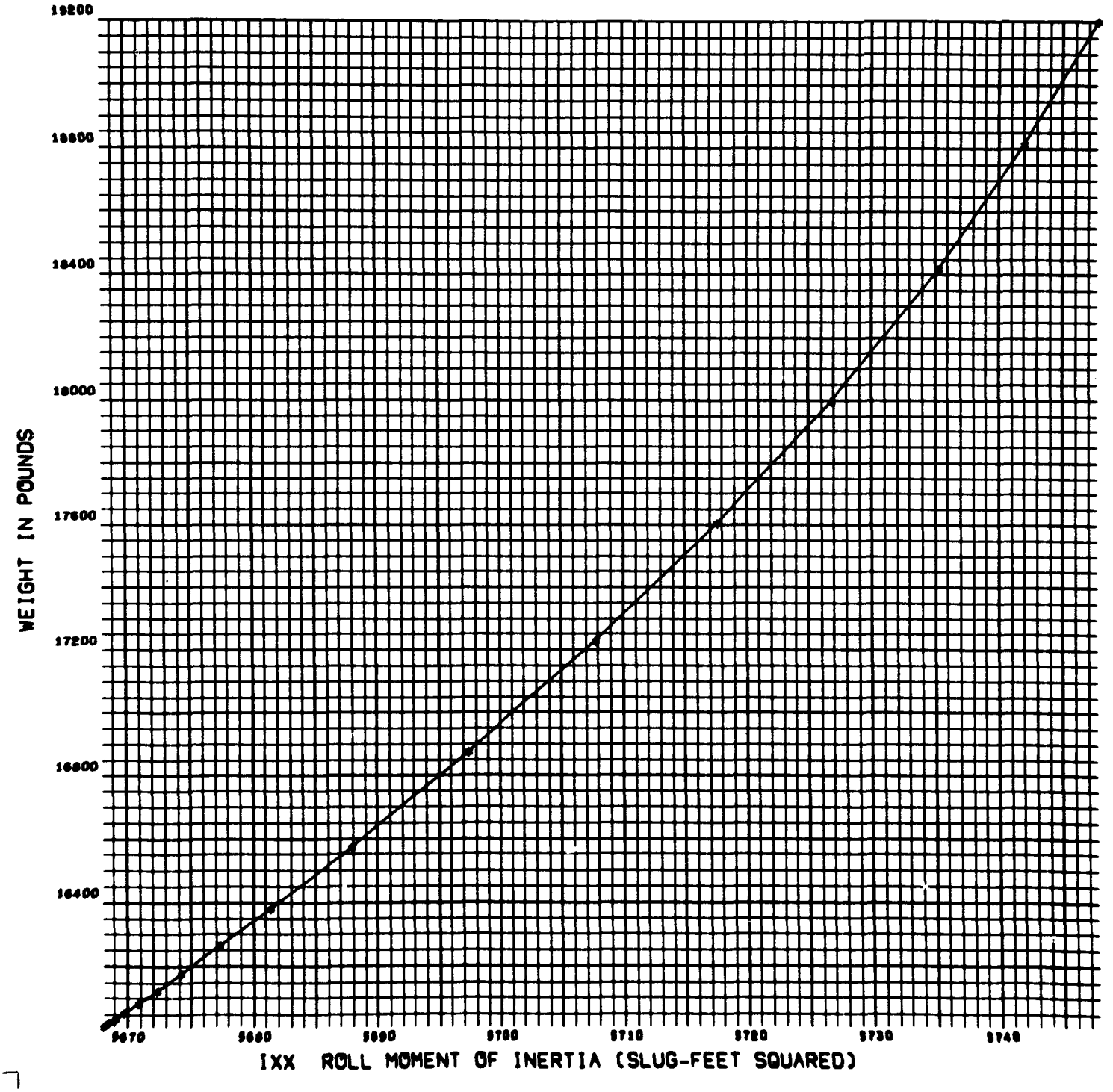


~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

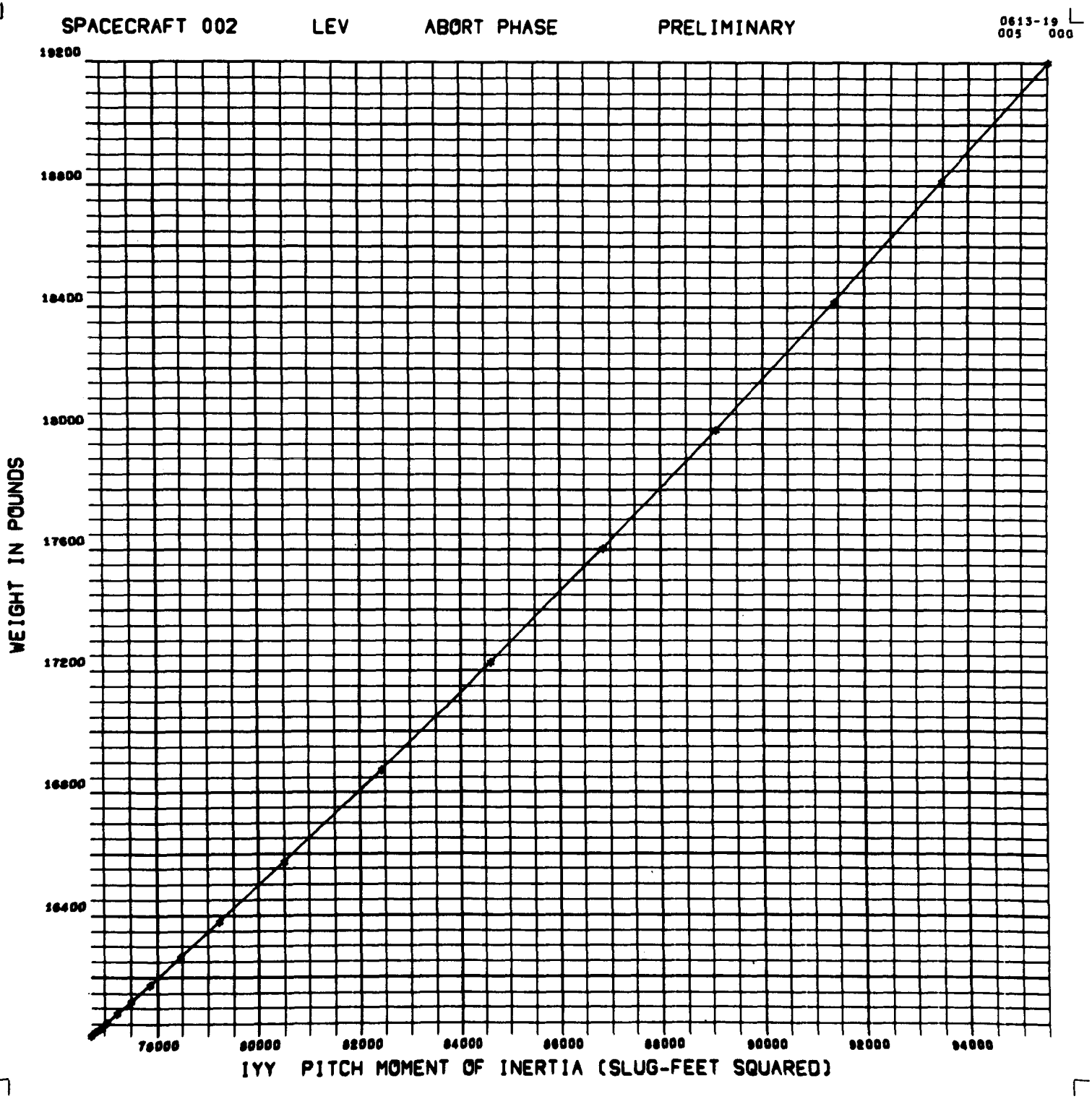
SPACECRAFT 002 LEV ABORT PHASE PRELIMINARY

0613-19 004 000



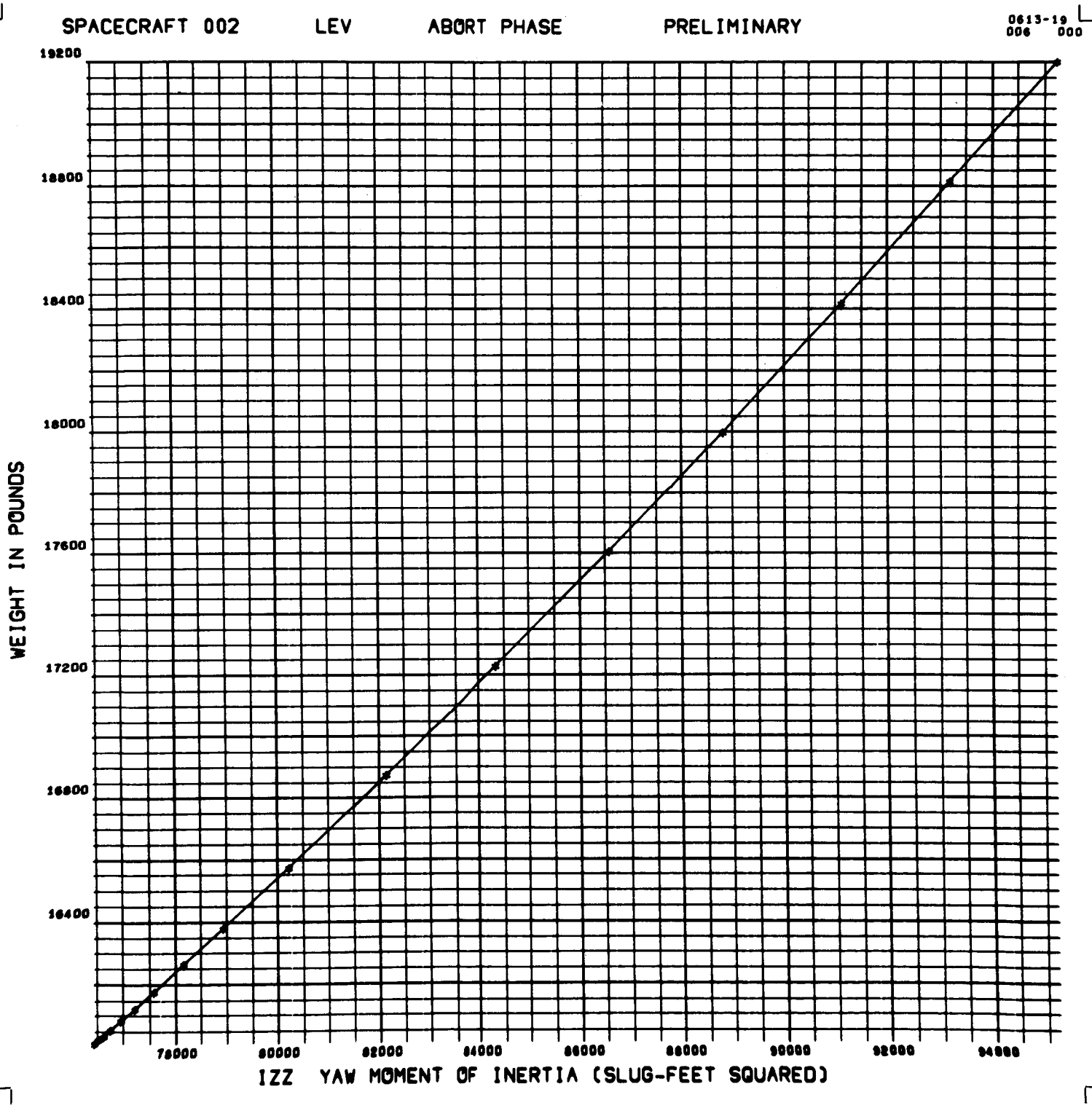
~~CONFIDENTIAL~~

[redacted]



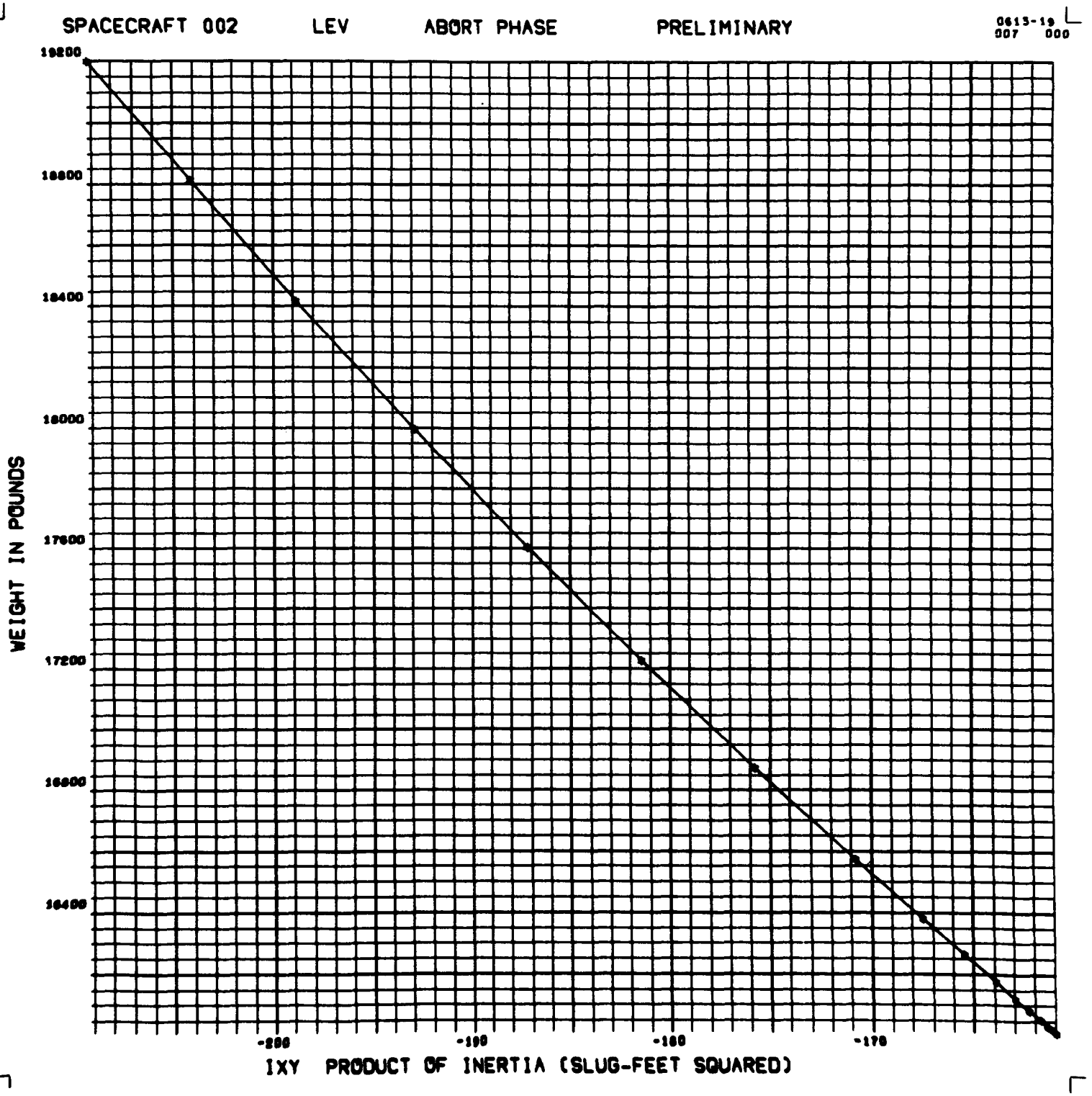
[redacted]

~~CONFIDENTIAL~~



~~CONFIDENTIAL~~

[redacted]

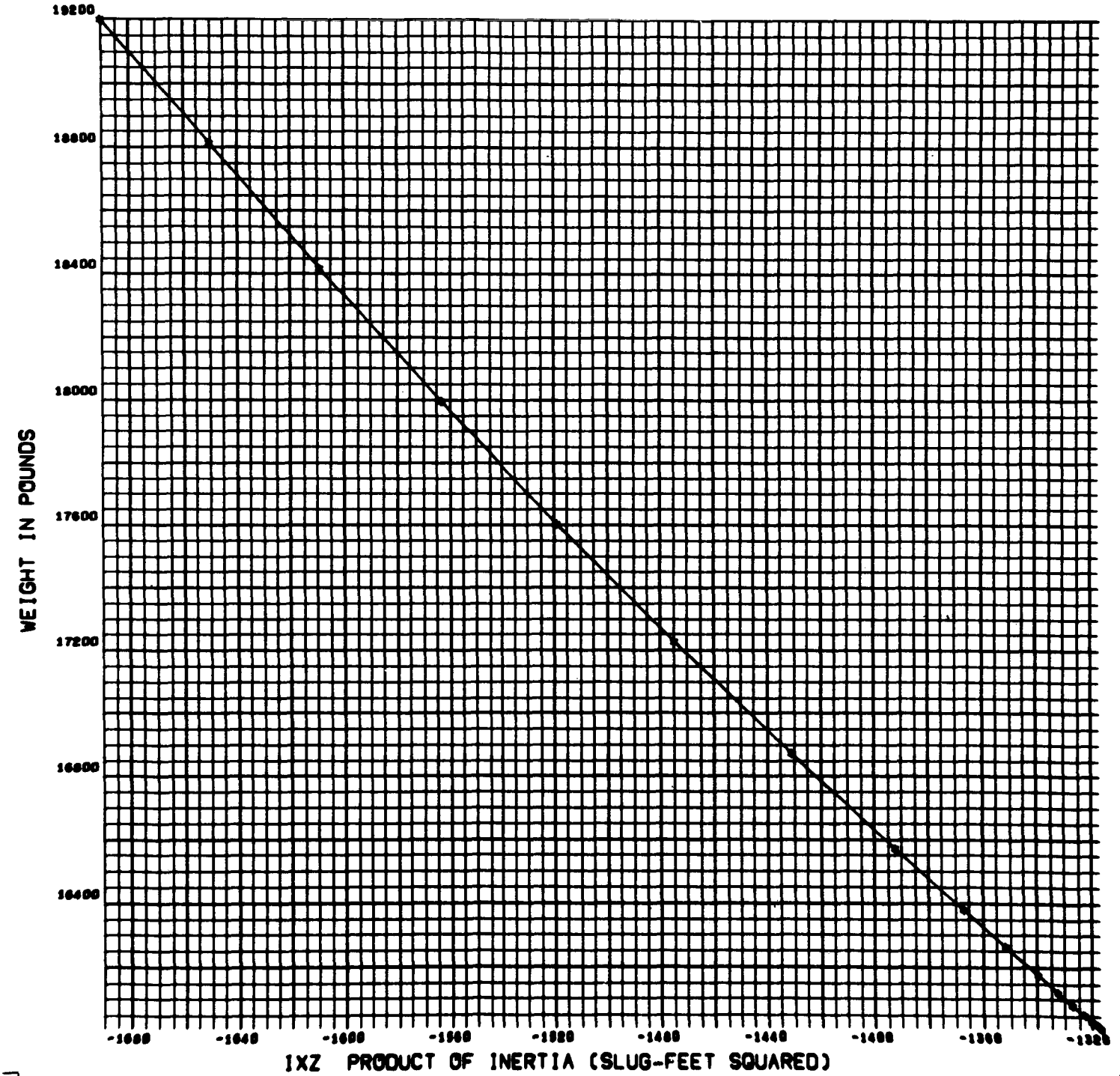


[redacted]

~~CONFIDENTIAL~~

SPACECRAFT 002 LEV ABORT PHASE PRELIMINARY

0613-18
008 000

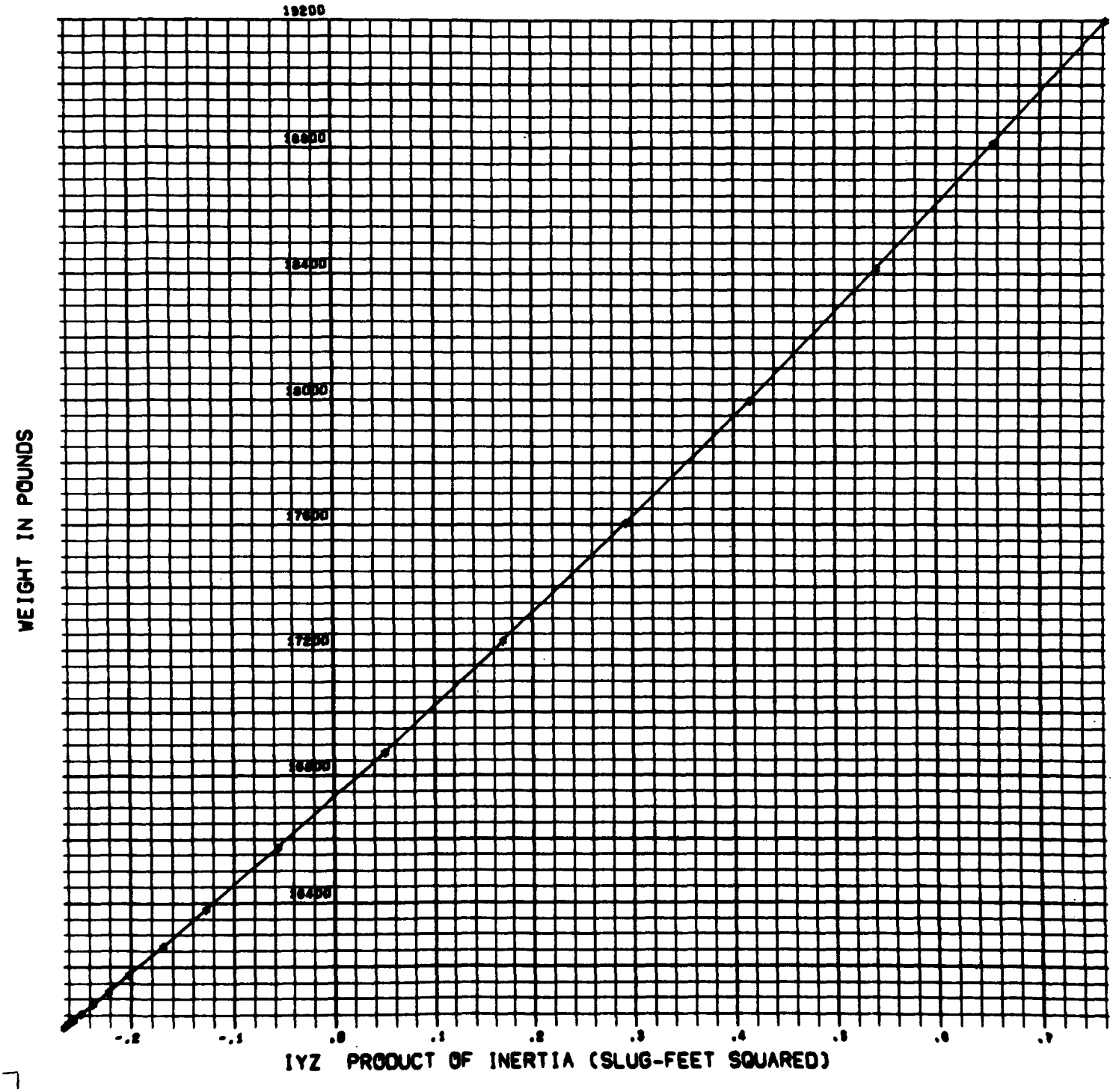


~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

SPACECRAFT 002 LEV ABORT PHASE PRELIMINARY

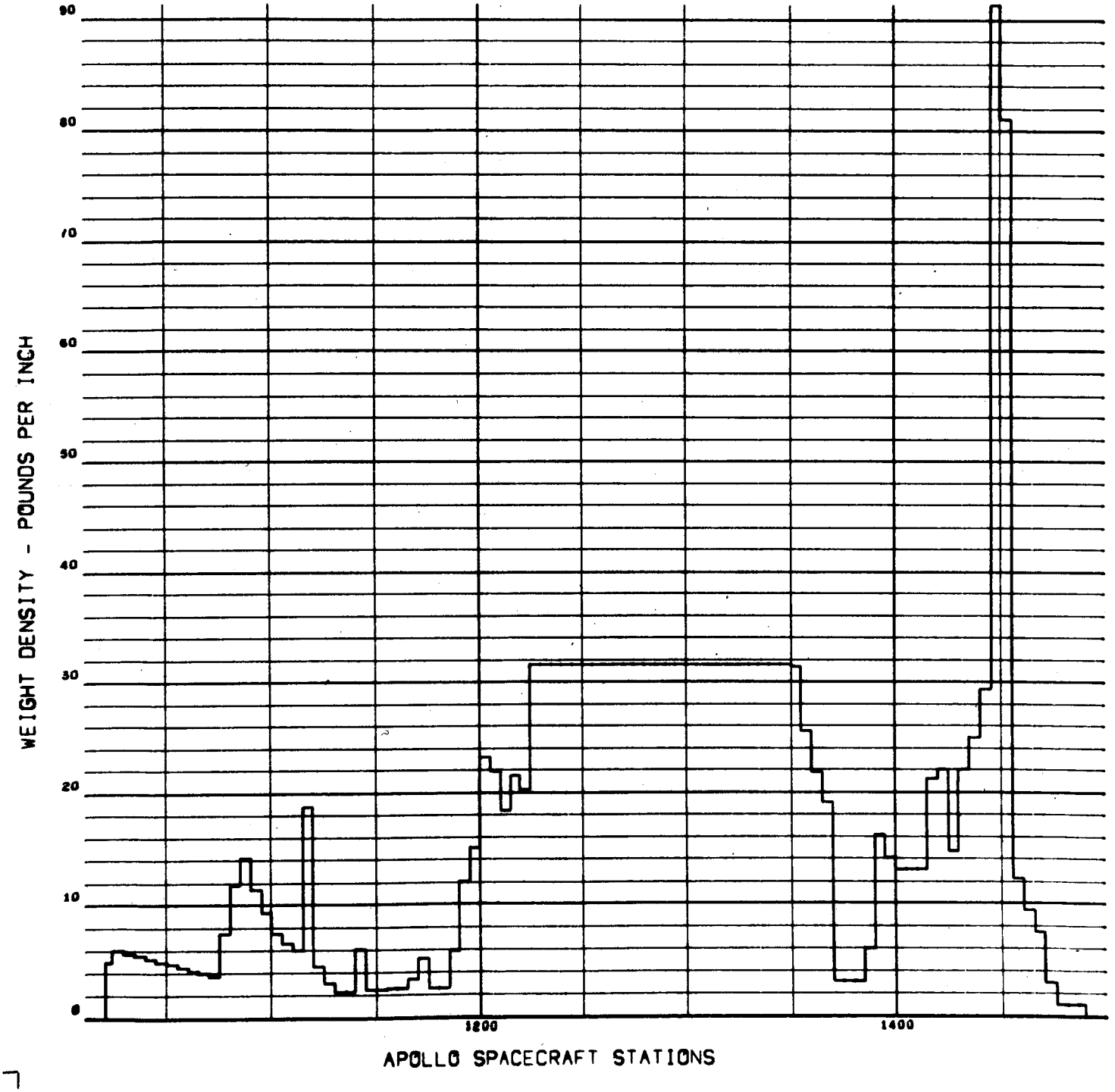
0613-19
009 000



~~CONFIDENTIAL~~

[redacted]

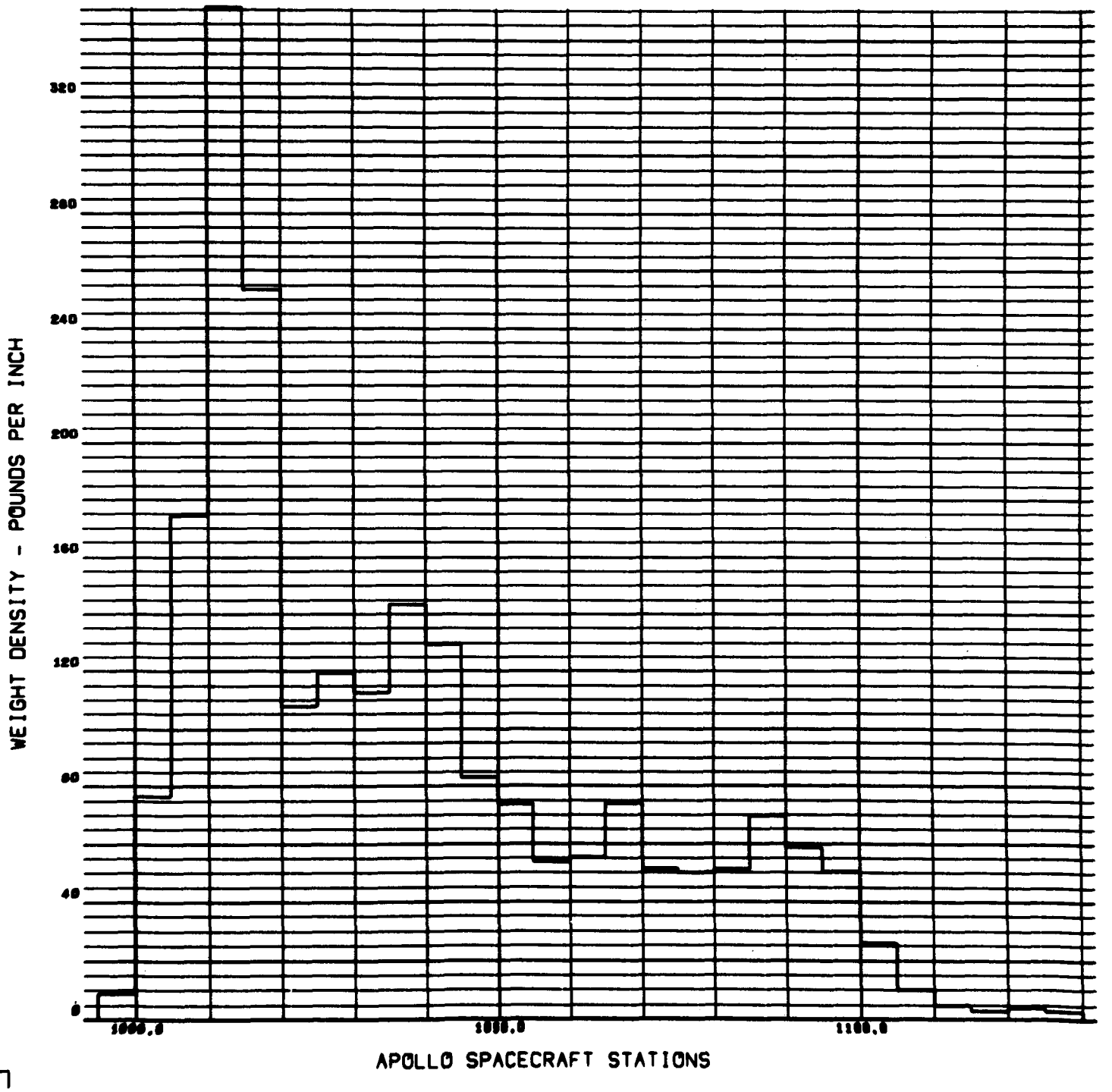
LAUNCH ESCAPE SYSTEM GROSS WEIGHT V15 3 1



[redacted]

~~CONFIDENTIAL~~

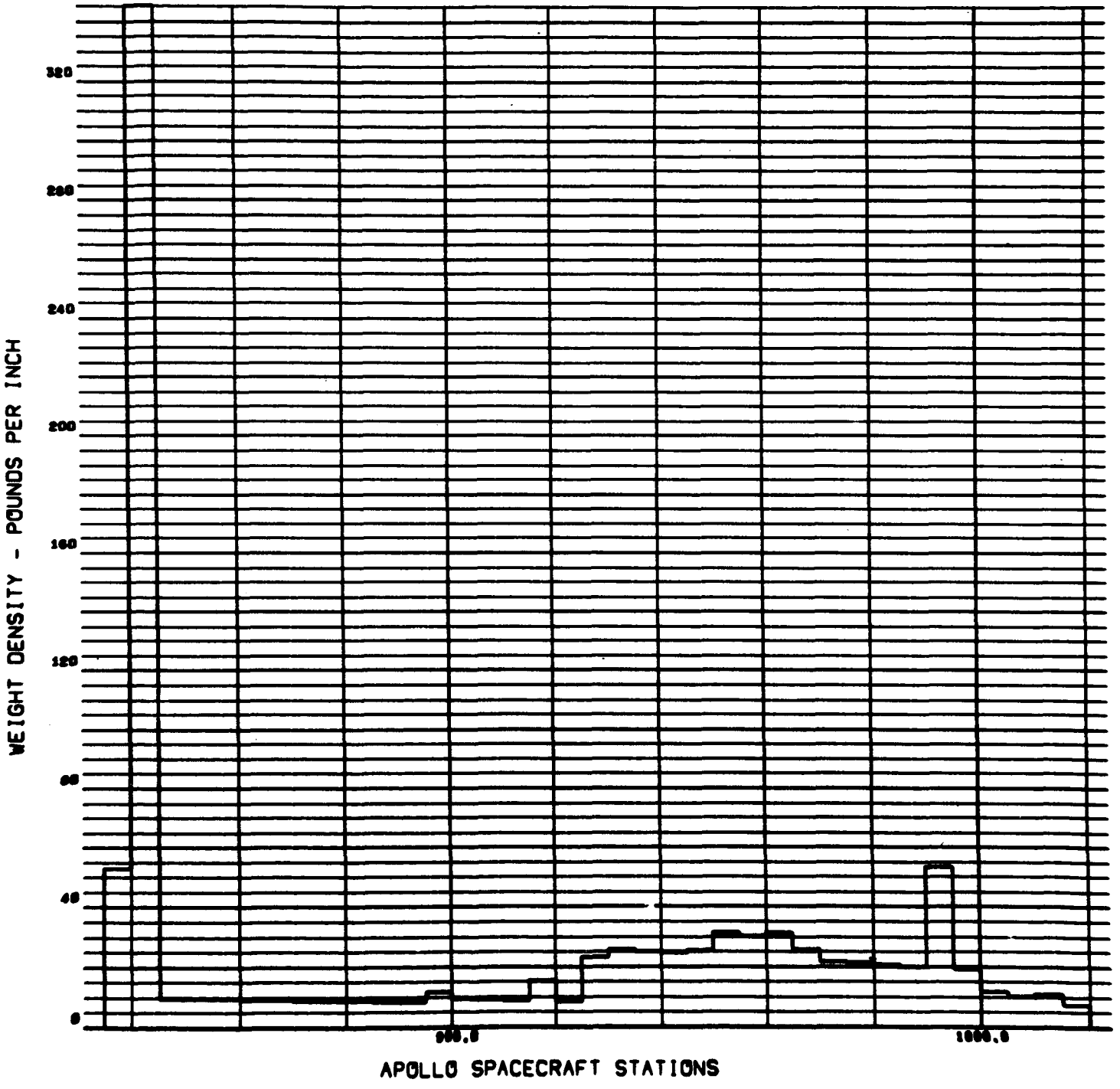
CM AFRM 002 LAUNCH WEIGHT DISTRIBUTION RUN 0613-20 001 000



~~CONFIDENTIAL~~

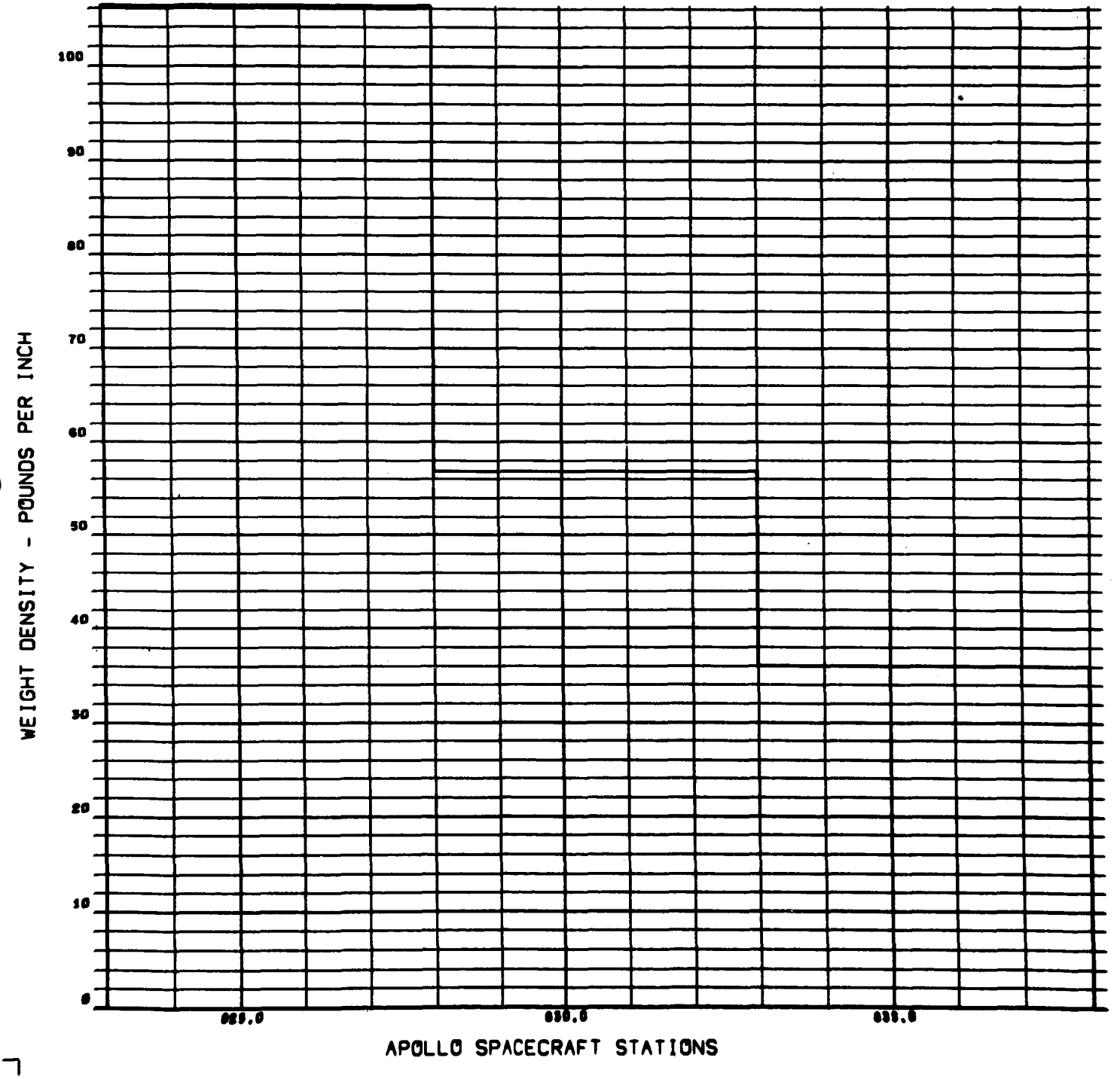
~~CONFIDENTIAL~~

SM AFRM 002 LAUNCH WEIGHT DISTRIBUTION RUN 0613-17 002 000



[redacted]

ADAPTER AFRM 002 LJ II WEIGHT DISTRIBUTION RUN 0613-17 003 000



[redacted]