Surveillance Testing
10407-11 Rocket Catapults

TASK SO-0637

Prepared
for
Brazilian Navy Contract No 70200/24-01/00

	Name	Date
Prepared By:	R. Sadler	240329
Project Engineer:	J Petronzio	240330
Quality Engineer:	D Kalisz	240330
Program Manager	J Ochs	240330

TASK AEROSPACE

CAGE Code:	**99YV8**
Document No.:	TR1097
Revision:	-

CHANGE RECORD

Revision	Description of Change	Approved	Date
-	Initial Release	JAO	24/04/01
A	Update Table 1, include info only data	JAO	24/04/12

1.0 Scope

This Task Aerospace, Inc. (TASK) document reports the results of the first surveillance test conducted on the Part Number 10407-11 Rocket Catapult (RoCat) used in the ESCAPAC Ejection Seat. It compares the results of functional testing of four (4) RoCats with the functional test results of DLAT (Destructive Lot Acceptance Testing) of the same lot number (NT120J001-001) as well as data generated from qualification test units for this same PN using a regression analysis trend line. The limited quantity of four RoCats is not statistically significant, so no viable variability analysis is possible.

1.1 Purpose

The 4 units were provided by the Brazilian Navy for the purpose of testing to gather the data necessary to support the TASK assigned Service Life of 60 months for this specific lot or RoCats.

1.2 Assigned Service Life

TASK assigned an initial Shelf / Service Life of 84 / 60 months to the 10407-11 RoCat based on similarity to design and propellant formulations widely used in current, similar egress systems. The 4 units provided by the BN were approximately 42 months old when subjected to the testing documented herein.

The testing reported herein was performed using the same test procedures, fixtures, and equipment used during DLAT.

1.3 Test Detail

Four (4) RoCats were functionally tested two each at -40F and 160F following temperature conditioning for a minimum of 6 hours prior to test and functioned within five minutes after being removed from the conditioning chamber. The cold units were tested on 19 March 2024 and the hot units were tested on 21 March 2024

The traceability of the units is listed below.

Lot Number	Serial Number	Test Temperature (°F)	Sled Weight (lbs)
NT120J001-001	APB100-70	-40	410
NT120J001-001	APB100-71	-40	410
NT120J001-001	APB100-74	+160	315
NT120J001-001	APB100-76	+160	315

1.4 Test Facility

The testing was performed by Nammo Defense Systems (Nammo herein) located in Mesa Arizona.

1.5 Procedures

This testing was performed per Acceptance Test Procedure 19959.

1.6 X-Ray and MOS Tear Down

The four units were X-rayed and reviewed by Nammo Non Destructive Testing (NDT) responsible Level III personnel prior to testing. Marginality of Success (MOS tear down and inspection was conducted by Nammo engineering personnel post testing. No discrepancies were found.

1.7 Test Data Evaluation Methodology

Functional performance test data from two groups of previously tested 10407-11 RoCats, the qualification units, plus the DLAT units for this specific lot, was plotted as baseline or zero age data. The second set of data was obtained from the Brazilian units, two each tested at -40F and 160F, which was plotted at an age of 42 months. Comparing these two groups of data provided a trendline which was then compared to the ballistic requirements for the 10407-11 RoCat as defined in Table 1 and shown in Figures 1 thru 20 herein. Also shown on these figures are the USL (Upper System Limits) and LSL (Lower System Limits). Some requirements have both USL and LSL limits while others only have a single limit as shown in Table 1 below.

2.0 Test Results

2.1 Functional Requirements

The functional requirements are summarized in Table 1.

Table 1 Functional USL and LSL Requirements

Test Temp. (°F)	RoCat Actuation Pressure (psig	Cat Ignition Delay (ms)	Cat Peak Onset (g/s)	Cat Peak Accel (g)	Sep Velocity (ft/s)	Rocket Ignition Time (ms)	Rocket Mtr Action Time (ms)	Rocket Mtr Resultant Thrust lbf	Rocket Motor Impulse (lb-s)	Cat Output Press (psi)
-40	USL 600 LSL 400	USL 5	USL250	USL 19	LSL 41	USL 35	USL 425 LSL 290	USL 4,395 LSL 3,165	LSL1,027	LSL1,080
160	USL 600 LSL 400	USL 5	USL350	USL 20	None	USL 25	USL 320 LSL 210	USL 7,300 LSL 4,750	LSL1,027	LSL1,080

2.2 Service Life Test Data

The Service Life testing was conducted March 19th thru 21st in Mesa, Arizona. See Figures 1 through 20 below for comparison of the Brazilian units to the previously tested "Baseline" data. Each figure covers one of the 10 parameters above. All data falls within the USL and LSL limits. No ambient data was evaluated as the sample size of 4 RoCats was too small to support ambient as well as hot and cold tests. The green "Task Service Life" line is based on 60 months of service life, with the assumption that the RoCats were installed 6 months after the Date of Manufacture. This places the "Task Service Life" line at 66 months after date of manufacture.

Max Catapult Thrust and Rocket Burn Time are collected as information only and have no performance limits (USL or LSL). Table 2 contains the test results obtained for these parameters. These are not graphed as the data is collected for informational purposes only and do not factor into the Service Life Evaluation.

Table 2 Information only Parameter values

Parameter	Units	Test Results	
		Firing Temp -40°F	Firing Temp +160F
Peak Catapult Thrust (info only)	lbf	4997 & 4819	4883 & 4891
Rocket Motor Burn Time (info only)	seconds	0.23 & 0.23	0.17 & 0.17

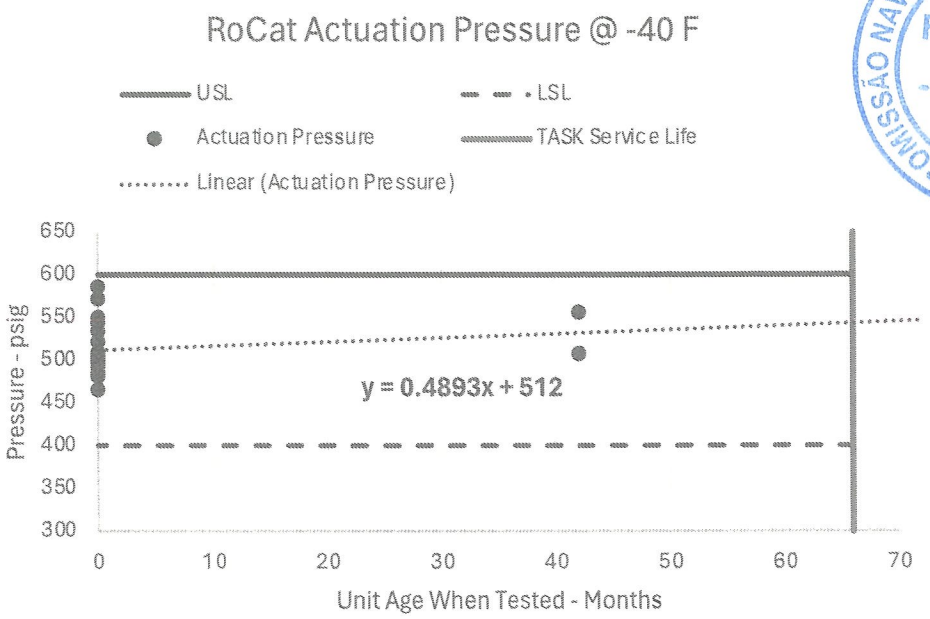

Figure 1: RoCat Actuation Pressure @ -40F

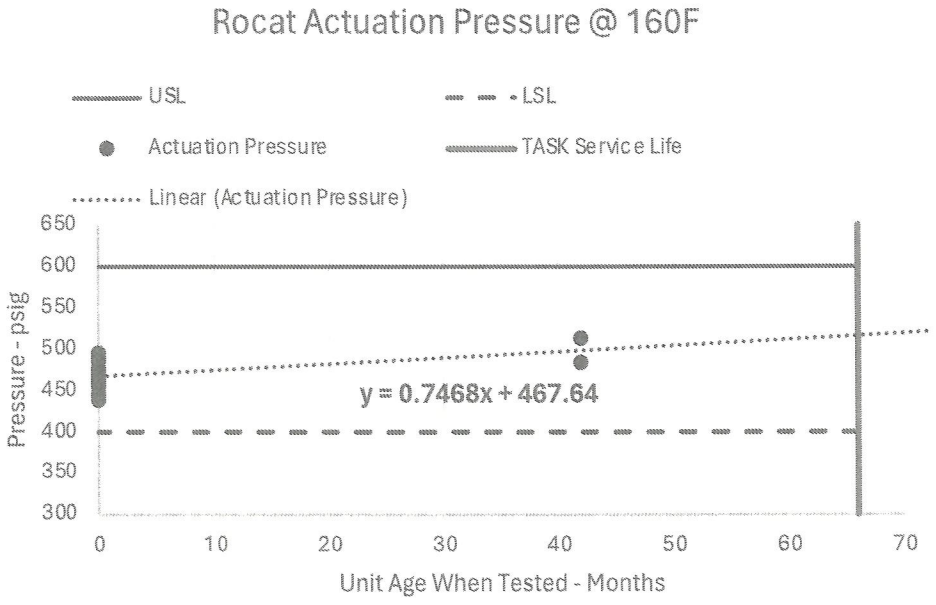

Figure 2: RoCat Actuation Pressure @ 160F

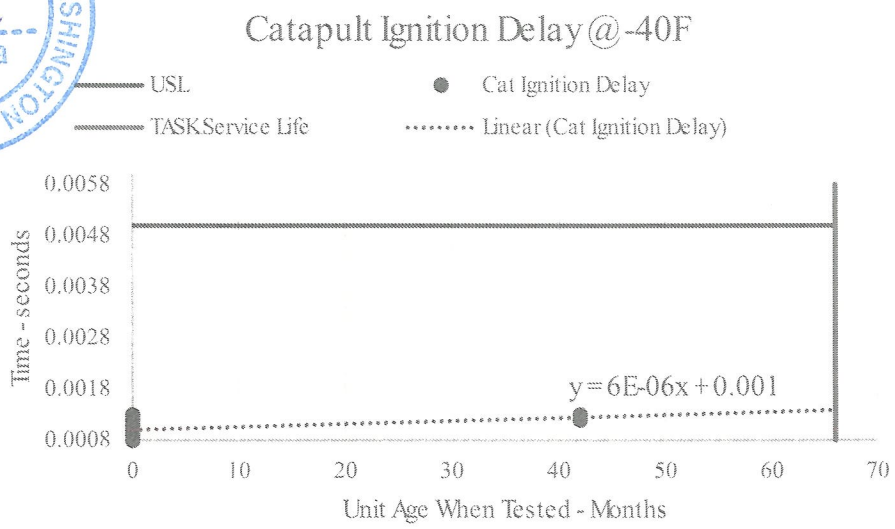

Figure 3: Catapult Ignition Delay @ -40F

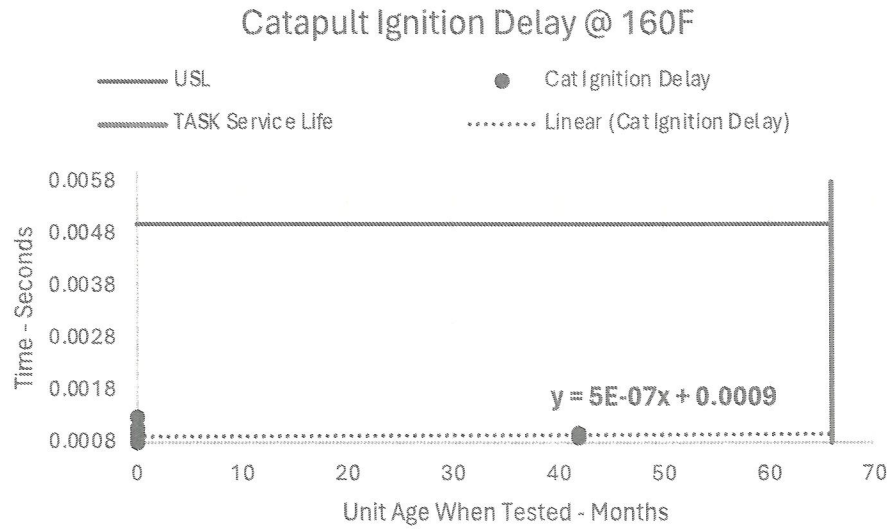

Figure 4: Catapult Ignition Delay @ 160F

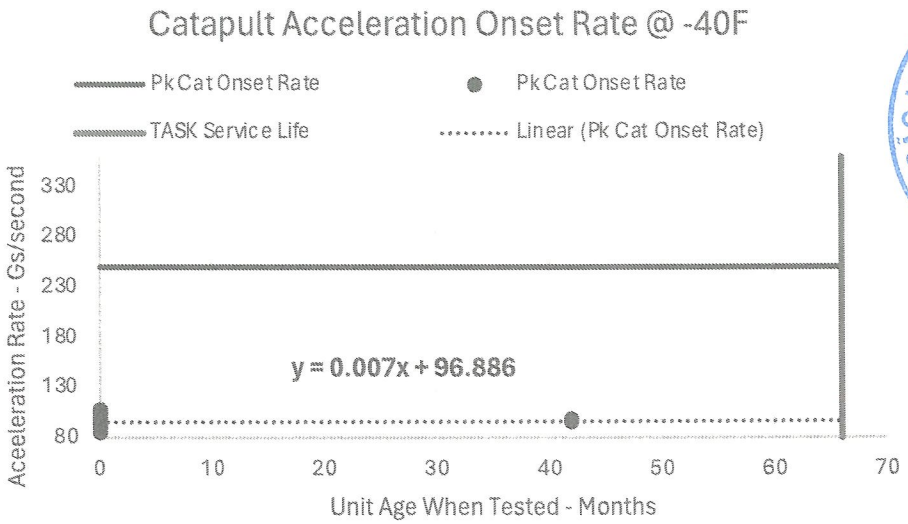

Figure 5: Catapult Acceleration Onset Rate @ -40F

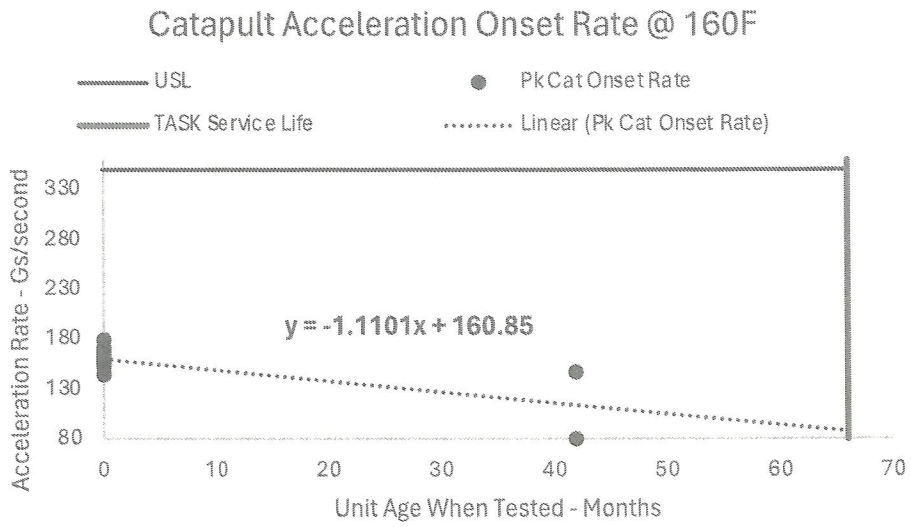

Figure 6: Catapult Acceleration Onset Rate @ 160F

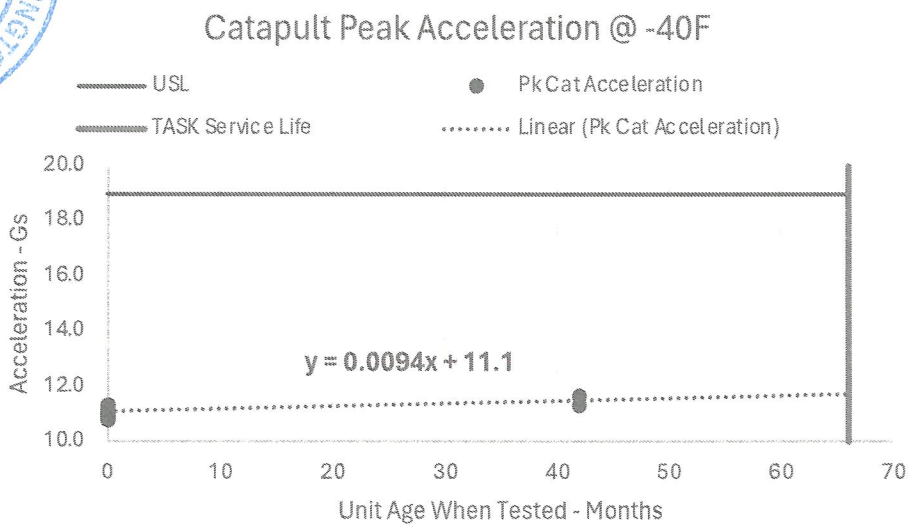

Figure 7: Catapult Peak Acceleration @ -40 F

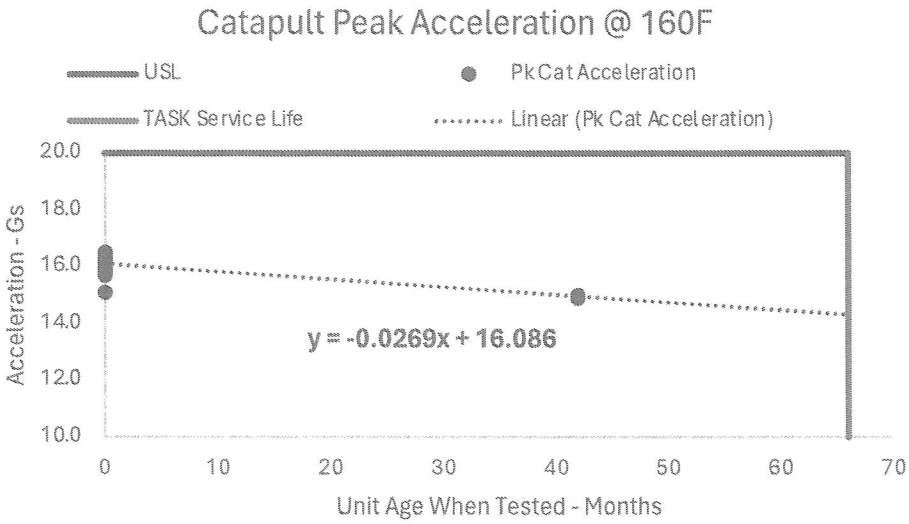

Figure 8: Catapult Peak Acceleration @ 160F

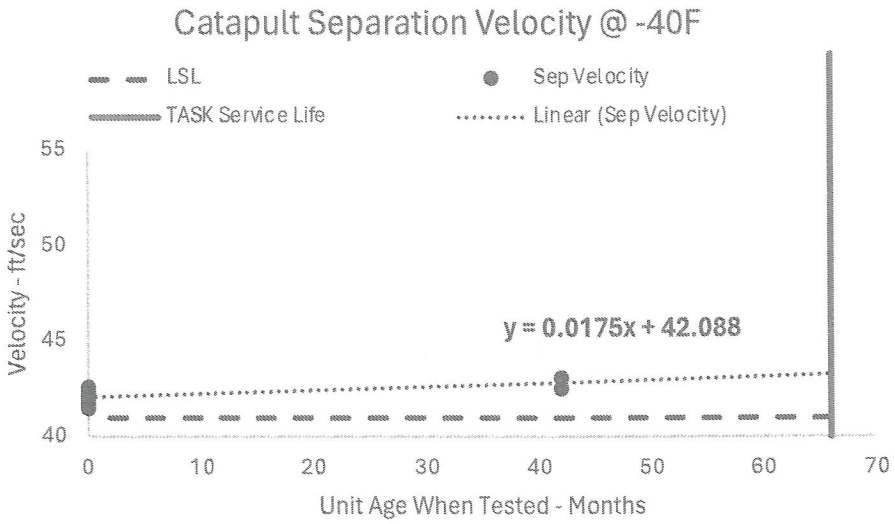

Figure 9: Catapult Separation Velocity -40F

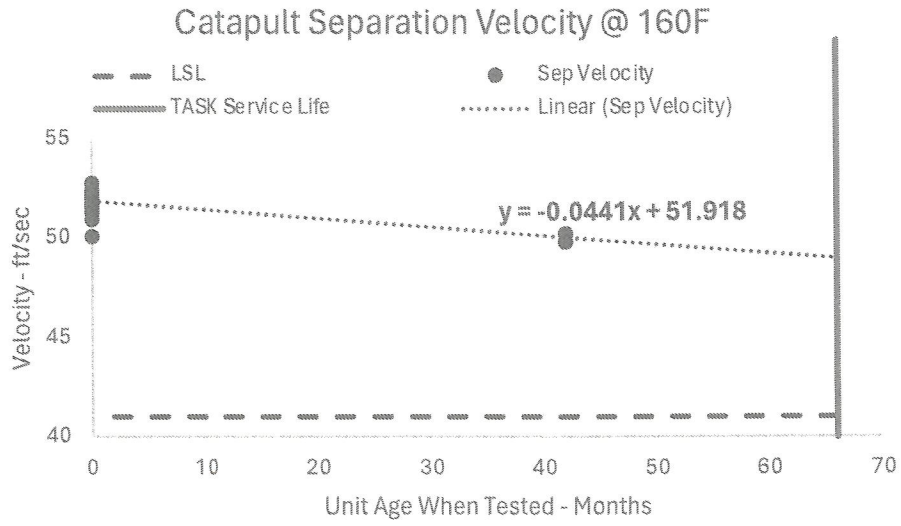

Figure 10: Catapult Separation Velocity @ 160F

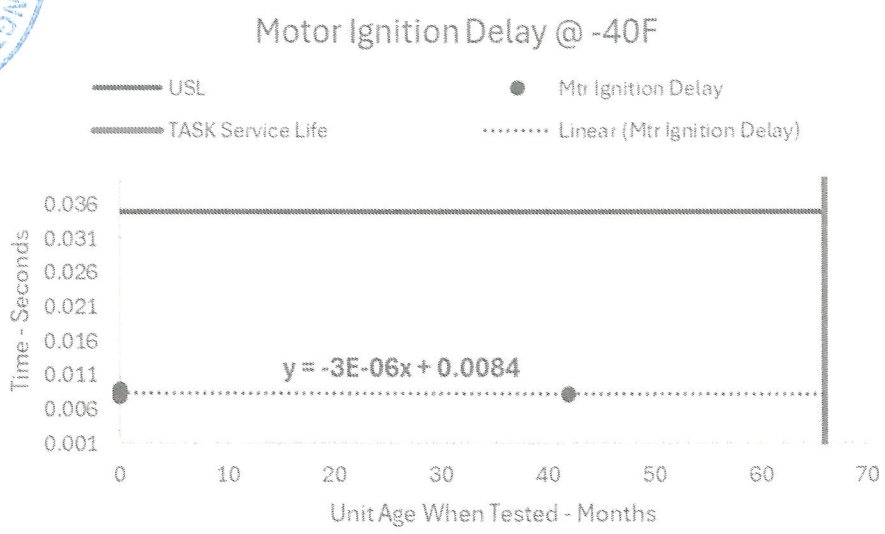

Figure 11: Rocket Motor Ignition Delay @ -40 F

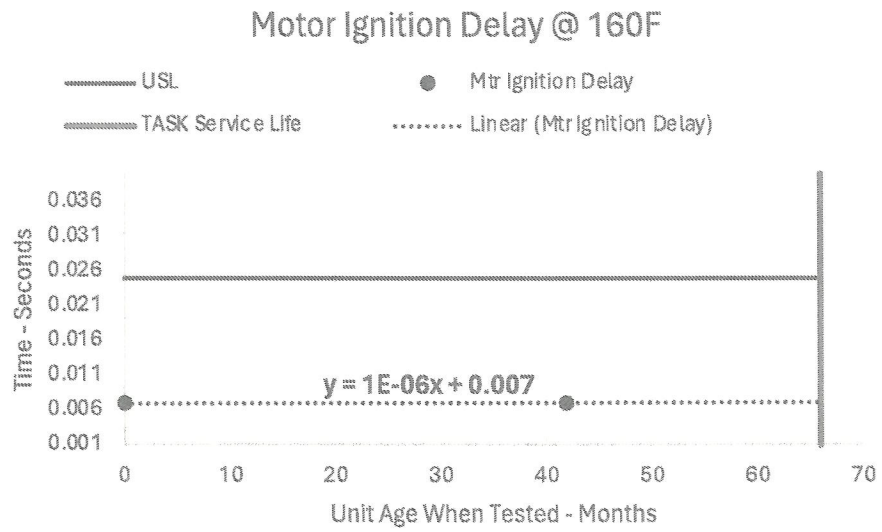

Figure 12: Rocket Motor Ignition Delay @ 160F

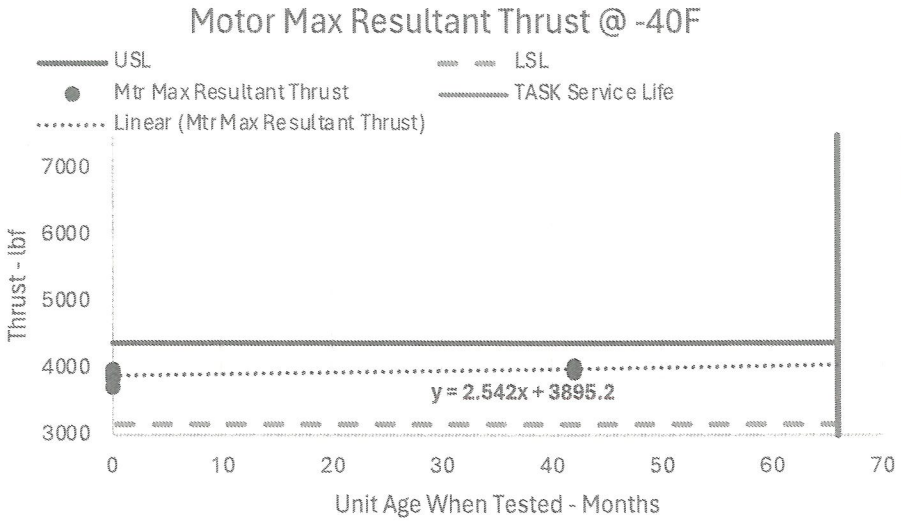

Figure 13: Rocket Motor Max Resultant Thrust @ -40 F

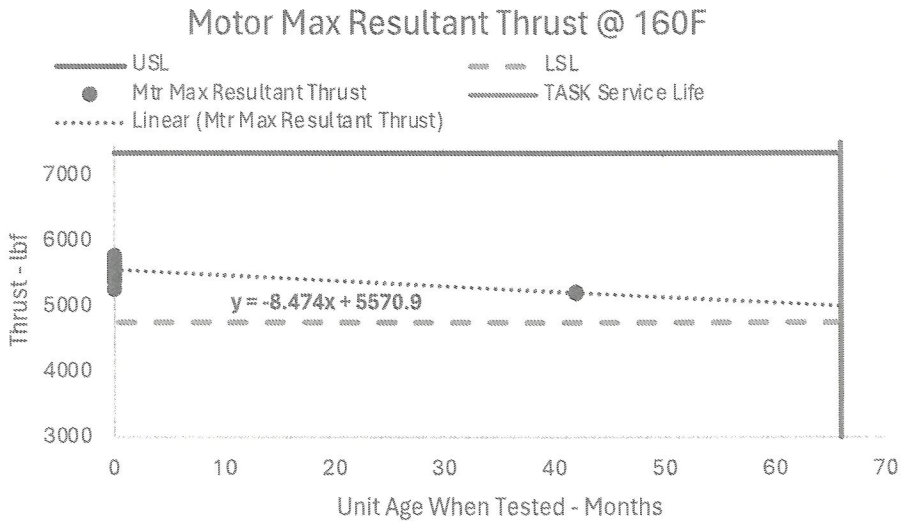

Figure 14: Rocket Motor Max Resultant Thrust @ 160F

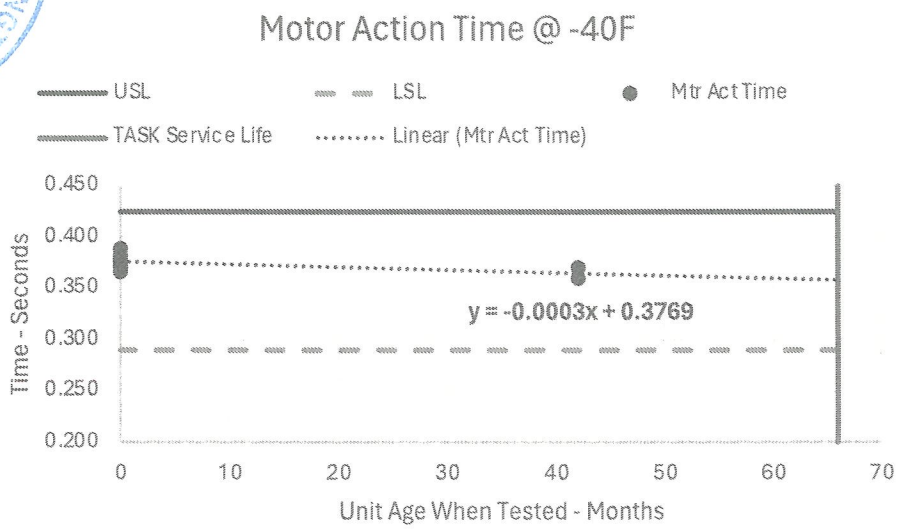

Figure 15: Rocket Motor Action Time @ -40F

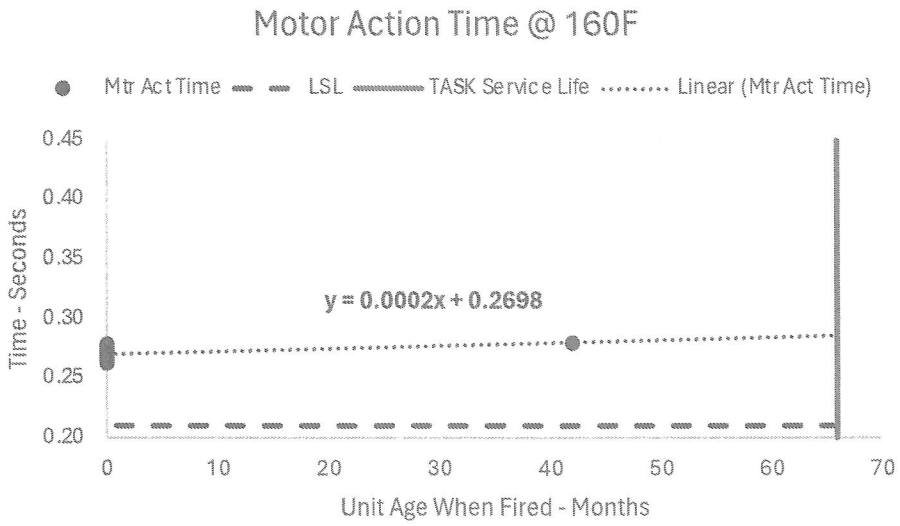

Figure16: Rocket Motor Action Time @ 160F

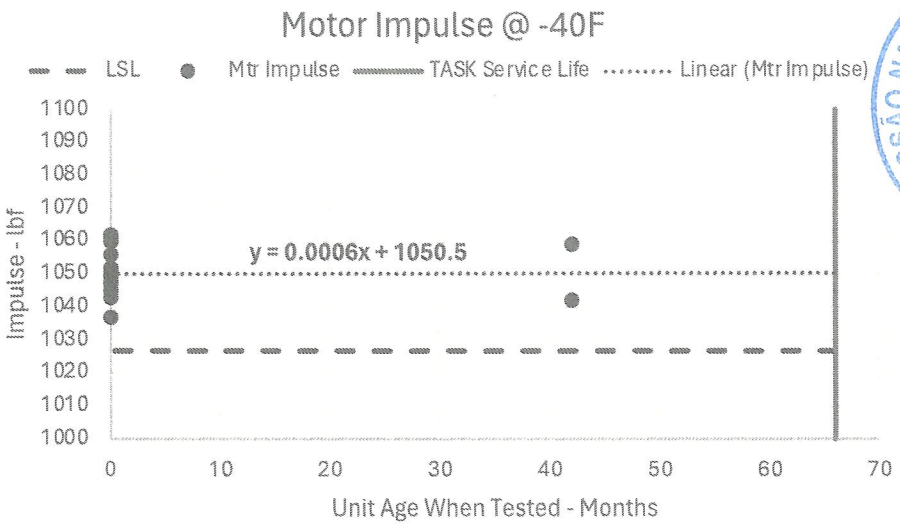

Figure 17: Rocket Motor Impulse @ -40F

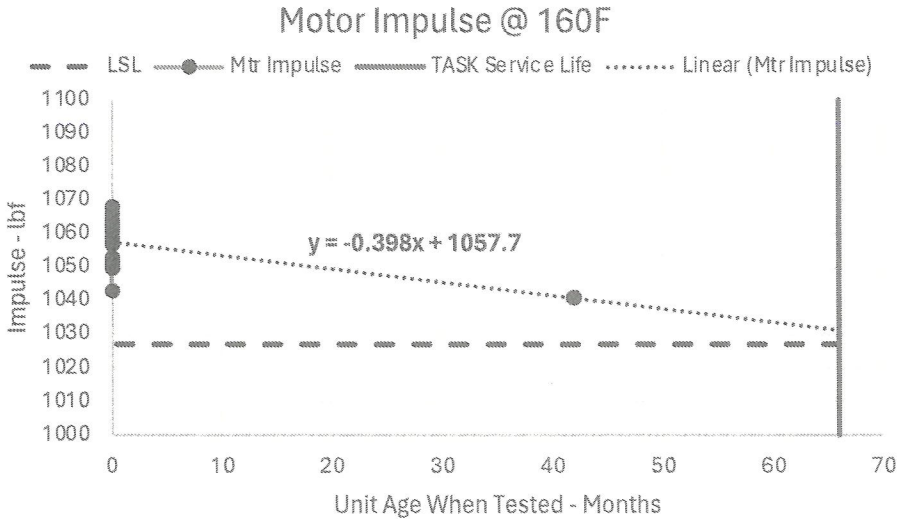

Figure 18: Rocket Motor Impulse @ 160F

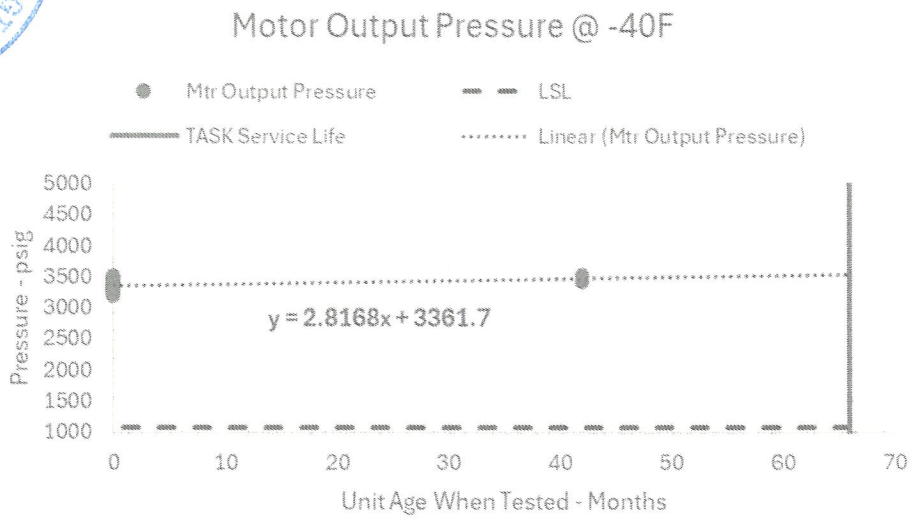

Figure 19: Rocket Motor Output Pressure @ -40 F

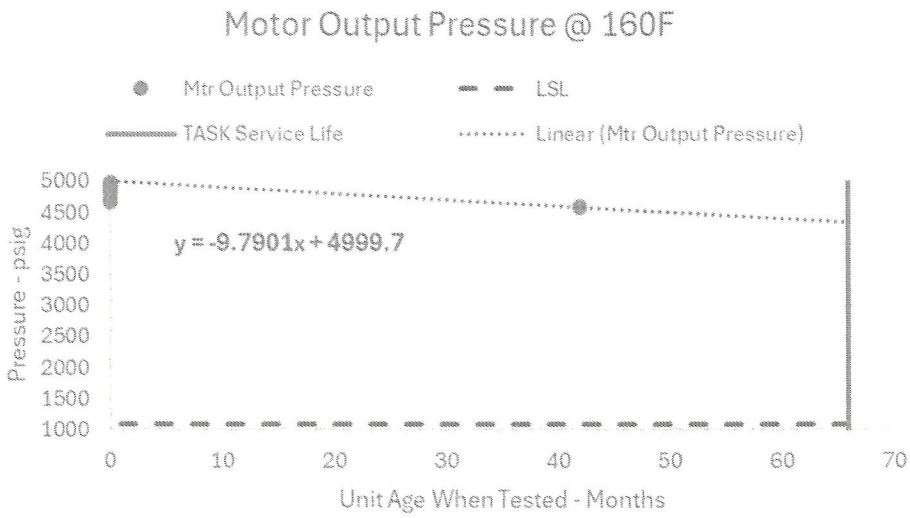

Figure 20: Rocket Motor Output Pressure @ 160F

3.0 Analysis of Service Life Extension Test Results

The ten different parameters of functional performance requirements for the 4 BN supplied RoCats were compared to the same metrics for baseline Qualification and DLAT units. Graphic presentations of each metric comparison are presented in Figures 1-20. All units performed within the USL and LSL limits shown in Table 1. All RoCats functioned mechanically as required with no abnormal behavior.

4.0 Conclusions

The functional data measured, recorded, and reported herein met the functional requirements specified in Table 1. This data generated in this program fully supports and validates the initial Life assignment of 60 months service life and 84 months shelf life.. Due to the limited quantity of test samples, there is not sufficient data to support evaluation of temporary life extension requirements at this time.

5.0 Recommendations

The lead time for procurement of replacement RoCats is projected to be (a minimum of) 24 months. TASK recommends that the Brazilian Navy ensure Purchase Orders are in place to procure replacement RoCats to avoid impacts to fleet operational readiness requirements.

Additionally, to better determine how the environment and aging affects performance of RoCats after spending time in service, installed in operational aircraft, TASK recommends that further surveillance testing be conducted as soon as viable test samples become available.

EM BRANCO

COMISSÃO NAVAL BRASILEIRA EM WASHINGTON
5130 MacArthur Boulevard, NW
Washington, D.C., 20016
Tel.: (202)244-3950 Fax: (202) 363-5138

TERMO DE ENCERRAMENTO DE VOLUME

Em 24 de maio de 2024, procedeu-se ao encerramento deste Volume atinente aos Autos do Processo, NUP 63435.008797/2023-06, TJIL 1/2024, da Diretoria de Sistemas e Armas, contendo 352 folhas.

Washington, DC, em 24 de maio de 2024.

ELIAS FERREIRA DA SILVA
Capitão de Fragata (T)
Encarregado da Divisão de Licitações e Acordos Administrativos