

NASA CR-132788

THERMALLY OSCILLATING ACTUATORS

Final Report

Contract NAS 5-22108

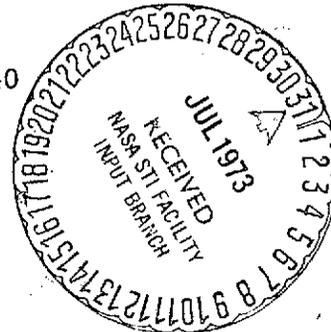
May 29, 1973

Prepared For:

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(NASA-CR-132788) THERMALLY OSCILLATING  
ACTUATORS Final Report (Weston  
Instruments, Inc ) 4 p HC \$3.00

N74-14142

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## OBJECTIVE

The purpose of this effort was to produce three oscillating actuators to GSFC Drawing GERIMP D 2900 and to GE 1073225, which documents certain changes to the original configuration. Also a large number of the detail pieces were to receive a black anodize finish for thermal control. This effort was nearly completed when EMR was notified that the Government furnished thermal motors (REF GD IMP D 3179) were not available.

Contract change #1 was issued for effort to redesign the actuator to accommodate a new type of thermal motor. EMR generated a new outline drawing of this motor based on a sample provided (GD 1077233).

## SUMMARY

The actuator was redesigned to accommodate the new thermal motor. This design retained the basic configuration and dimensions of the original actuator. Changes were made primarily to the cradle and motor assembly. Because of the increased dimensions of the thermal motor, it was necessary to increase the diameter of the pellet case and associated parts including the back off spring and the piston return spring. The new springs were designed to yield the same spring rate differential as the originals.

The design effort resulted in a new top assembly (REF 1077239) and approximately twenty sub-assembly and detail drawings. A list of drawings generated by EMR is attached.

Detail parts were fabricated by EMR and the actuators were assembled and bench tested. The new thermal motors and connectors were supplied by GSFC as GFE in accordance with the contract.

The motors supplied varied widely in their dimensions, particularly the main body diameter over the protective aluminum foil. The plunger does not seat in the rubber socket to a consistently repeatable depth. Bench tests indicated a pattern of extremely slow operations compared to those of the original design. This may be attributed to the fact that the original thermal motor resistance of approximately  $65 \Omega$  was increased to over  $210 \Omega$  in the new motor. Since the operating voltage was unchanged, the power/time was reduced by a factor greater than three. The heat transfer into the wax slurry does not seem to be as efficient as in the original motor. Operating times from room temperature were 9 to 10 minutes. The re-set time to cool the motor and retract the piston, also seems to be quite high.

#### CONCLUSIONS AND RECOMMENDATIONS

EMR considers the effort performed under this contract as developmental in nature. EMR's experience with several previous versions of this mechanism creates a strong feeling that the latest configuration is not as reliable as the earlier versions.

In general, any version of the mechanism is least reliable at low temperatures, since bearing clearances tighten up and the insulation on wiring and cables becomes stiffer. The increased lead wire size of the new motor, this difficulty is more of a potential hazard.

EMR suggests: 1) Consideration of a rigorous examination of these units under thermal vacuum environment before spacecraft integration. 2) A return to the original thermal motor should be considered. The present units can be retrofitted easily if the thermal motors are available.

HELIOS - FLIPPER REDESIGN 6341-2091

Dwg. No.	Size	Title
GD1077234	D	End Plate, Inboard Oscillating Actuator
GD1077235	D	Thermal Motor Assembly Oscillating Actuator
GD1077236	D	
GD1077237	D	
GD1077238	D	
GE1077239	E	Oscillating Actuator Assembly
GE1077240	E	
GC1077241	C	Cage guide, Oscillating Actuator
GC1077242	C	Yoke, Oscillating Actuator
GC1077243	C	Bracket, Oscillating Actuator
GC1077244	C	Spring, Piston Return Oscillating Actuator
GC1077245	C	Spring, Back off Oscillating Actuator
GC1077246	C	Yoke Micro Switch Oscillating Actuator
GC1077247	C	Pellet Case Oscillating Actuator
GC1077248	C	ARM Micro Switch Oscillating Actuator
GC1077249	C	Long Post Oscillating Actuator
GC1077250	C	Heater Shield Oscillating Actuator
GC1077251	C	Washer Oscillating Actuator
GC1077252	C	Washer Oscillating Actuator
GC1077253	C	Piston Oscillating Actuator
GC1077254	C	CAP Oscillating Actuator
GC1077255	C	Spur Gear and Rocker Arm Assy, Oscillating Actuator
GC1077256	C	Standoff, Offset, Oscillating Actuator
GC1077257	C	Gear Post, Oscillating Actuator
GC1077258	C	
GC1077259	C	
GC1077260	C	