UNCLASSIFIED

CLASSIFICATION LEVEL
(S, C OR U)

ATOMICS INTERNATIONAL
A Division of North American Aviation Inc.

NAA–SR–MEMO COVER SHEET

REPORT TITLE

AUTHOR

NAA–SR–MEMO 10676

(This Document Contains 4 Pages.
This is Copy ____ of ____ Series ____)

CLASSIFICATION TYPE
(RD OR DI)

NAA–SR–MEMOs are working papers and may be expanded, modified, or withdrawn at any time, and are intended for internal use only.

THIS REPORT MAY NOT BE PUBLISHED WITHOUT THE APPROVAL OF THE PATENT BRANCH, AEC.

LEGAL NOTICE

UNCLASSIFIED

CLASSIFICATION LEVEL
(S, C OR U)

DO NOT REMOVE THIS SHEET

DISCLAIMER

ATOMICS INTERNATIONAL
A Division of North American Aviation, Inc.

TECHNICAL DATA RECORD

NAA-SR
TDR NO 10676

PAGE 1 OF 4

APPROVALS

M A Perlow

AUTHOR
J. R. Crosby (5)

DEPT & GROUP NO
722-22

DATE 1/27/65

GO NO 7561

S A NO 4571

TWR

TITLE
Emittance and Solar Absorptance Test-SNAP 10A, FS-4

SECURITY CLASSIFICATION

(CHECK ONE BOX ONLY)	AEC	DOD
UNCL.	X	
CONF.		
SECRET		

(CHECK ONE BOX ONLY)
RESTRICTED DATA ☐
DEFENSE INFO. ☐

AUTHORIZED CLASSIFIER SIGNATURE: M A Perlow DATE: 1-28-65

PROGRAM

SUBACCOUNT TITLE
FS-4 Acceptance Test

DISTRIBUTION
D/720-10 HQ 2
H.M. Dieckamp

D/722-22 SS 36
R.D. Keen
M.A. Perlow (2)
S. Sudar

D/722-23 HQ 2
D.S. Thompson
W.R. Vaughn
R.F. Wilson

D/722-24 SS 38
S.R. Rocklin

D/722-25 SS 37
G.L. Schmidt

D/722-26 SS 38
D.W. Staub
P.L. Soske

D/726-60 HQ 2
L.L. Bixson
R.M. Galantine
H. Moore
W.T. Morgan
R.M. Ohlenkamp
D.J. Sobo

STATEMENT OF PROBLEM

Determine the thermal emittance (ϵ) and solar absorptance (α_s) properties of the SNAP 10A, FS-4 system prior to NaK loading and after thermal reference test.

ABSTRACT

The thermal emittance and solar absorptance properties of the S10A, FS-4 system components have been measured at two time intervals 1) prior to NaK loading of the system and 2) subsequent to the thermal acceptance test. The results of these measurements are included herein. Results attained from measurement of the FS-3 system prior to NaK loading are included for comparison.

In brief, the metallic control surfaces, i.e., beryllium, stainless steel, and titanium, show approximately a 50% emittance increase following thermal test. The emittance properties of the AI93 and the Cr_2O_3 coating systems remained relatively stable. The solar absorptance of the AI93 on the T/E converter fins increased 25%.

I Introduction

In order to verify the integrity of the optical properties of the S10A thermal control coatings throughout various system handling and operational procedures, an optical property monitor program has been established. Sequence of measurements on the various systems is outlined on drawing 10FS-31005, Installation - Emissivity Coating.

In particular, optical measurements have been performed on the FS-4 system during two phases of vehicle integration and checkout. One measurement was performed prior to NaK loading and the second measurement was performed following the thermal acceptance test.

Seven distinct component surfaces are measured during this effort. These include:

1. T/E pump radiator fin
2. T/E converter radiator fin
3. Beryllium control drum
4. Reflector shim
5. Titanium support shell
6. Radiation shield container
7. Instrument compartment interior

II Discussion of Results

Table 1 outlines the thermal emittance and solar absorptance properties of the FS-4 thermal control coatings prior to NaK loading and following the thermal acceptance test. Included for comparison purposes are measurements performed on FS-3 prior to NaK loading.

The three metallic control surfaces (Items 3, 5 and 6) show approximately a 50% emittance increase after the thermal test. This is in agreement with visual observations particularly the titanium support shell which presently has a bluish coloration.

The thermal emittance of the AI93 coating on the T/E converter and pump fins remains stable as does the solar absorptance of the pump fins. The solar absorptance of the converter fins increased 25% following the thermal test. Visually, a definite discoloration of these fins has occurred. The system discoloration appears to result from a chimney effect contamination emanating from the region of the instrument compartment.

Prior to the thermal reference test, a high emittance ceramic coating was applied to the NaK return lines in the areas where the radiant ground test heaters are attached. Visual examination of this coating following the thermal test showed the integrity of the ceramic to be good. No spalling or cracking has occurred. The emittance of this coating was determined to be equal to 0.84.

III Test Procedure

The equipment and test procedure utilized for the thermal emittance and solar absorptance measurements are outlined in the following specifications:

NA0201-025 Thermal Emittance Measurement, SNAP 10A Flight Systems

NA0201-024 Solar Absorptance Test, SNAP 10A Flight Systems

IV Conclusions

Outgassing from the region of the instrument compartment and system operation at a controlled oxygen bleed is affecting the optical properties of the thermal control coatings. Primarily, this is evident on 1) metallic surfaces and 2) the solar absorptance property of the AI93 coating.

Surfaces requiring an extremely high emittance, e.g., the T/E pump and converter fins, are remaining stable.

TABLE I

Optical Properties of FS-4 and FS-3 Systems

Item	Component and Coating	Thermal Emittance			Solar Absorptance		
		FS-4 pre-NaK loading	FS-4 after thermal test	FS-3 pre-NaK loading	FS-4 pre-NaK loading	FS-4 after thermal test	FS-3 pre-NaK loading
1	T/E pump radiator fin (AI93)	0.94	0.95	0.89	0.40	0.41	0.35
2	T/E converter radiator fin (AI93)	0.94	0.92	0.89	0.39	0.50	0.35
3	Control drum - outer surface (beryllium)	0.09	0.13	0.09			
44	Reflector-outer surface (Cr_2O_3)	0.88	0.86	0.87			
5	Support shell (titanium)	0.11	0.17	0.14			
6	Radiation shield container (stainless steel)	0.24	0.34	0.25			
7	Instrument compartment interior (PT404A)	0.90	0.85	0.88			

NOTE: Measurements of the core vessel and the instrument compartment exterior could not be performed due to inaccessibility.