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FORM 1316A

CF-105

G. Emmerson May 31/55

ACCESS DOOR INVESTIGATION

1. INTRODUCTION

This report deals with the advantages and disadvantages of camlocked versus screwed access doors with particular emphasis being placed on those doors affected by a Daily Inspection.

It must be noted that the proposed Daily Inspection, is a preliminary one and will be affected by the release of additional information on the aircraft systems and by changes to the aircraft systems.

Figure I lists the doors involved, the reason for access, the time to remove and the time to reinstall the door. No attempt has been made to list a time for the actual inspection since this can only be determined under service conditions.

2. SPECIAL TESTS

2.1 Time to Remove and Install Screwed and Camlocked Panels

In order to establish a time base for Figure I, a sample panel was made up, 8 inches in diameter, which was fastened to a one foot square panel, both .064 in thickness, by means of six $\frac{1}{4}$ in. screws and anchor nuts. The panel was positioned in a manner, representative of the actual position on the aircraft. An ordinary Phillips head screwdriver was used. The results were as follows:

Time to Remove - 60 sec. for 6 screws (10 sec/screw)

Time to Install - 75 sec. for 6 screws (10 sec/screw + 25%)

In the case of the Camlock fastener, a test specimen furnished by the Camlock Company, provided means for establishing the following figures:

Time to Remove - 1 second per fastener

Time to Install - 1 second per fastener

2.2 Effect of Door Removal on Screwed Fastening

The panel used in para. 1 above, was used for establishing a proposed life for the screws and anchor nuts.

2.2 Cont'd

The panel was fastened and removed 40 times and the affect on the screws noted as below:

The screws were picked so that 1 ½ threads were exposed. A screw was considered unsatisfactory when it could be screwed in by finger pressure to the point where the end of the screw was flush with the top of the anchor nut.

The results were as follows:

No. cycles	Screws Unsatisfactory
20	3
40	6

3. FACTORS INVOLVED IN FIG. I

3.1 Time Base for Fig. I

	Screwed	Camlocked
Removal	10 sec/screw + 50%	1 sec/camlock + 50%
Installation	10 sec/screw + 75%	1 sec/camlock + 75%

From test in section 2.1, a figure of 10 sec/screw was used to remove a screw. 50% was added to cover personnel fatigue. An extra 25% was added for installation to cover time in getting threads engaged properly and in positioning panels.

The same percentage was added in the case of the camlocks for comparison although it is felt that it is rather pessimistic.

3.2 In all cases it is assumed that the same number of camlocks as screws would be used for the attachment of the panels.

4. COMPARISON

4.1 The pertinent features of the screwed panels are listed below.

(a) The time involved in removing screwed panels is roughly 10 times that taken to remove camlocked panels. See Fig. I.

(b) The danger of losing screws is always present when the panels are off for any length of time.

4.1 Cont'd

(c) Experience has shown that the usual necessity of having different length screws is detrimental both from a safety and a time standpoint. On both the Sabre and the CF100, screws that were too long caused damage to an air speed indicator and elevator booster respectively. If the screws are different lengths, they must be sorted separately for reinstallation.

(d) Experience has shown that screws have a habit of loosening in flight, particularly after many panel removals (See para. 2.2) and anchor nuts must be replaced at regular intervals (30 - 40 cycles). This does not necessarily represent 30 - 40 flights.

(e) In service, it has been found on many occasions that, rather than remove a screwed panel for inspection, the equipment behind the panel would be ignored. While this is a service problem, it should be considered as being detrimental from the company product point of view.

(f) The danger of cross threading and broken screws always exists and this could cause an aircraft to become unserviceable at a critical time.

NOTE All of the above features have been indicated by the RCAF, as giving serious trouble in the field.

4.2 Pertinent Features of the Camlocked Panels

(a) Although at this moment only a few preliminary tests have been carried out on the Camlock fasteners, it would appear that the Camlocks will not quite meet the loads specified by the manufacturer. The main concern appears to be an elongation of the hole in the joint, presumably induced by a groove in the bushing which is used to retain the fastener in the panel. However, additional tests have been organized to establish more definitely the strength of the Camlock fastener. It is important that tests are carried out with screws, using identical test joints and loading procedures, so that a fair comparison will be available.

Test results, to date, have not indicated that the Camlock fasteners are unsuitable for use on the CF105 access doors under discussion in this report.

4.2 Cont'd

(b) The stress office have expressed disapproval of the locking features of the Camlock fastener, based on the experience of the Lab personnel when working with the fasteners. It is the opinion of the Logistics Office that if normal care is taken with the fastener, it will function properly. This care amounts to no more effort than is involved with ensuring that a screw will not be cross threaded.

(c) From a weight standpoint, the use of the Camlock imposes a slight weight penalty.

Weight of ¼ N.A.S. screw with anchor nut	= .0329#
Weight of Camlock fastener with 3/8 dia. bushing	= .0316#
Saving in weight for 522 applications	= .678#

There would be a weight penalty due to the necessity of providing a larger landing strip for the camlock fastener.

5. CONCLUSION

5.1 It is submitted by this office that quick opening doors are an absolute must where they affect daily inspection.

5.2 It is recommended that the Camlock fasteners be not penalized on intuitive feelings regarding the security of the locking feature. With normal care, the latches are trustworthy. The significance of the weight penalty is appreciated but the importance of ready access is becoming more and more obvious when the role of the CF105 is taken into account.

5.3 It is recommended that tests on N.A.S. screws be carried on parallel to the Camlock tests, in an identical manner, in order to provide a scientific basis for comparison.

FIG. I - DAILY INSPECTION

No.	ACCESS	REASON FOR ACCESS	SCREWED PANEL		
			No. Screws	Removal Man x Minutes	Inst'n Man x Minute
1.	Electrical Access Door (Sta. 485 - 538)	To provide access to the electrical power panel, transformer rectifier units, ground fault relays, inertia switch, stable platform, in order to check security of attachment, security of electrical connectors. To check hydraulic & fuel system connections for leaks.	50	1 x 12	1 x 14
2.	#1 Service Door (Sta. 591 - 606)	To check hydraulic and fuel system in this area for leaks. To check operation of hydraulic pumps by means of a proposed control which allows one pump only to operate at a time. A warning light will indicate a pressure drop. Check control runs. Check gear box oil level and mechanical take off.	40	1 x 10	1 x 11
3.	#2 Service Door (Sta. 625 - 644)	To check pumps as in para. 2. To check F/C compensator levels. To provide access to ground hyd. power supply panel for flying controls. To check hyd. system in this area for leaks. Check control runs.	45	1 x 11.25	1 x 13
4.	#3 Service Door (Sta. 663 - 692	To check main flying control filters. Check hyd. system for leaks. Check control system for security.	65	1 x 16.20	1 x 18
5.	Hydraulics Access Door (Sta. 557 - 581)	To provide access to utility ground power supply panel. Check utility compensator level and utility system filter. Check this area for fuel system and hyd. system leaks. Check engine mounts.	60	1 x 15.00	1 x 17

FIG. I - DAILY INSPECTION

	SCREWED PANEL			CAMLOCKED PANEL			OTHER	
	No. Screws	Removal Man x Minutes	Inst'n Man x Minutes	No. Caml'ks	Removal Man x Minutes	Inst'n Man x Minutes	Type	Man Minutes
:tri- rect- ays, rm, .rical ic & eaks.	50	1 x 12	1 x 14.5	50	1 x 1.23	1 x 1.45		
ystem heck by hich te ill eck oil .	40	1 x 10	1 x 11.67	40	1 x 1.0	1 x 1.1		
ls. yd. em k	45	1 x 11.25	1 x 13.13	45	1 x 1.13	1 x 1.3		
or for	65	1 x 16.20	1 x 18.90	45	1 x 1.62	1 x 1.8		
el heck hyd. unts.	60	1 x 15.00	1 x 17.50	60	1 x 1.00	1 x 1.75		

FIG. I - DAILY INSPECTION

No.	ACCESS	REASON FOR ACCESS	SCREWED PANEL		
			No. Screws	Removal Man x Minutes	Inst'n Man x Minutes
6.	Fr. Engine Access Door L.H. & R.H.	To inspect for fuel and oil leaks. Drain combustion can collector tanks if applicable. Top up engine oil. Check wire locking and bonding for security and condition. Check piping for signs of fouling. Check inst'n of engine wiring and electrical components.	40 L.H. 40 R.H.	1 x 10.00 1 x 10.00	1 x 11.6 1 x 11.6
7.	Rear Engine Access Door L.H. & R.H.	Same or similar to para. (6) (Particular alloc. of equip't not finalized)	34 L.H. 34 R.H.	1 x 8.50 1 x 8.50	1 x 9.92 1 x 9.92
8.	Bottom Electronics Door (Sta. 255 - 292)	To provide access for missile pack electrical supply plugs. To check navigational equipment for security of attach't and connections.	54	1 x 13.50	1 x 15.7
9.	Air Conditioning Water Supply Access Panel	To replenish supply of water in boiler.	NOT FINALIZED YET.		
10.	Oxygen Access Panel	Replace liquid oxygen container and inspect installation.			
11.	Side Electronics Door (Missile Pack Aux.)	To check out missile electronic equip't by press-to-test buttons.	30	1 x 7.5	1 x 8.72
12.	Canopies	Cockpit access for function tests.			
13.	Radar Side Access Door (L.H. & R.H.)	To check out electronic "Black Boxes" by the press-to-test buttons.	30	1 x 7.5	1 x 8.72

FIG. I - DAILY INSPECTION

	SCREWED PANEL			CAMLOCKED PANEL			OTHER	
	No. Screws	Removal Man x Minutes	Inst'n Man x Minutes	No. Caml'ks	Removal Man x Minutes	Inst'n Man x Minutes	Type	Man Minutes
eaks. r e ity for 'n al	40 L.H. 40 R.H.	1 x 10.00 1 x 10.00	1 x 11.67 1 x 11.67	40 L.H. 40 R.H.	1 x 1.0 1 x 1.0	1 x 1.17 1 x 1.17		
not	34 L.H. 34 R.H.	1 x 8.50 1 x 8.50	1 x 9.92 1 x 9.92	34 L.H. 34 R.H.	1 x .85 1 x .85	1 x .99 1 x .99		
nt	54	1 x 13.50	1 x 15.75	54	1 x 1.35	1 x 1.5		
in	NOT FINALIZED YET.							
er							Latches	1 x 2.00
ic ons.	30	1 x 7.5	1 x 8.72	30	1 x .75	1 x .87		
ests.							Latches	1 x .50
k	30	1 x 7.5	1 x 8.72	30	1 x .75	1 x .87		

FIG. I - DAILY INSPECTION

No.	ACCESS	REASON FOR ACCESS	SCREWED PANEL			Ca
			No. Screws	Removal Man x Minutes	Inst'n Man x Minutes	
14.	Radar Nose	To check security and functioning of radar scanner and associated equipment.				
		TOTAL	522	1 x 129.95	1 x 152.07	

Daily Inspection

Time to remove and replace screwed panels = 1 x 4.6 hours = 5 x .94 hours.

Time to remove and replace camlocked panels = 1 x .46 hours = 5 x .09 hours.

FIG. I - DAILY INSPECTION

	SCREWED PANEL			CAMLOCKED PANEL			OTHER	
	No. Screws	Removal Man x Minutes	Inst'n Man x Minutes	No. Camlo'ks	Removal Man x Minutes	Inst'n Man x Minutes	Type	Man Minutes
ng							Latches	1 x 1.00
	522	1 x 129.95	1 x 152.07	522	1 x 12.53	1 x 15.20		1 x 3.50

rs = 5 x .94 hours.

urs = 5 x .09 hours.

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