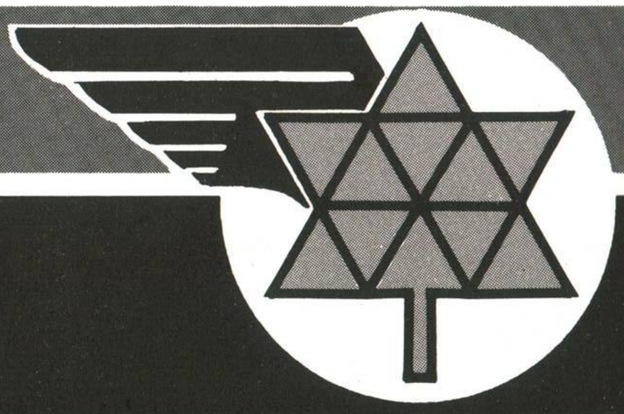
a day with the GOLDEN CENTENNAIRES

un jour avec les PALADINS DU CENTENAIRE

CO-SPONSORED BY

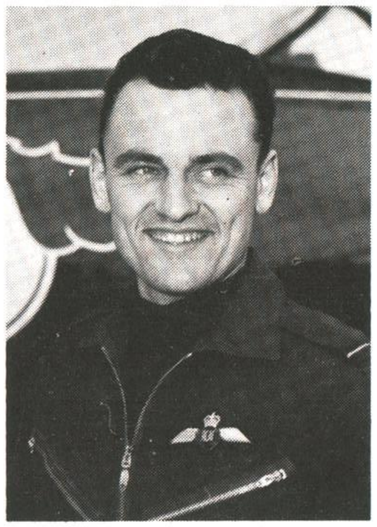
TORONTO REGION R.C.A.F. ASSOCIATION
EX-AIR FORCES PERSONNEL

RENEW YOUR CONTACTS
P.O. BOX 33, DOWNSVIEW, ONT.



Un hommage des Forces armées canadiennes au Canada pour son centenaire. Des démonstrations effectuées par des avions d'entraînement de la première guerre mondiale, par des avions de chasse et d'interception supersoniques à réaction et par le Chevalier Rouge complètent la manifestation.

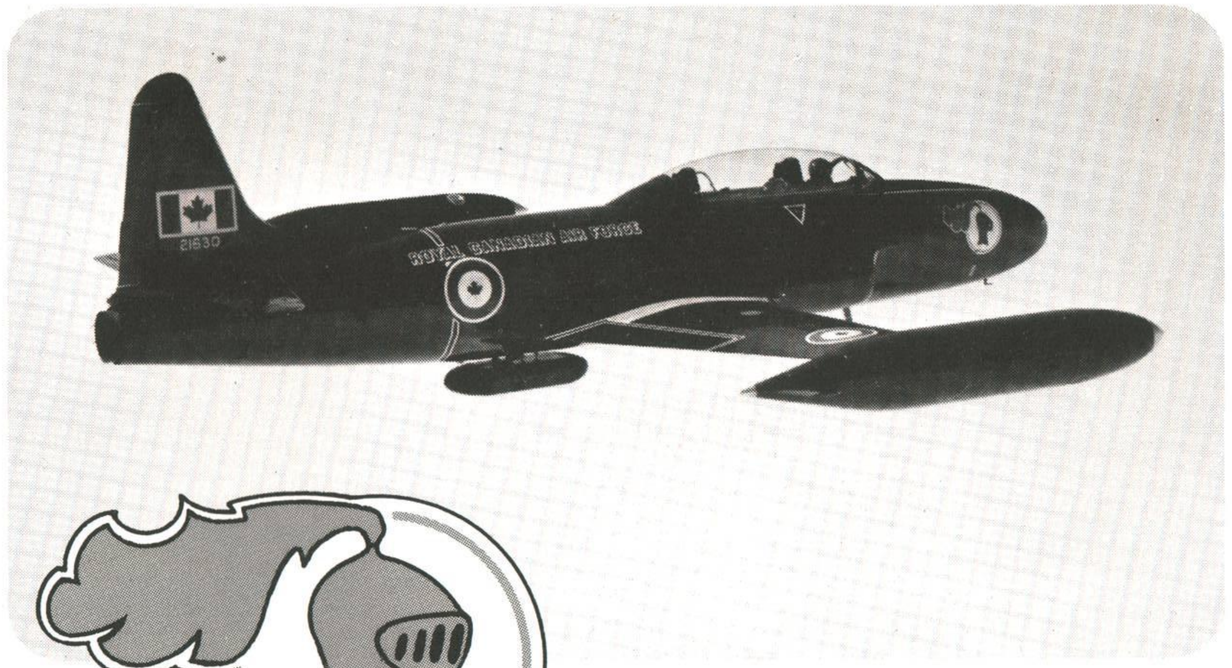
An Armed Forces aerial salute to Canada's centennial year. Demonstrations by World War I trainers, supersonic tactical and interceptor jets, and the Red Knight complete the display.



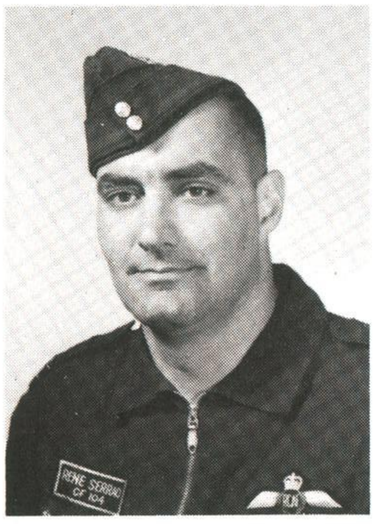
F/O R.E.M. ELLIS



F/L J.E. WATERS



RED KNIGHT
CHEVALIER ROUGE



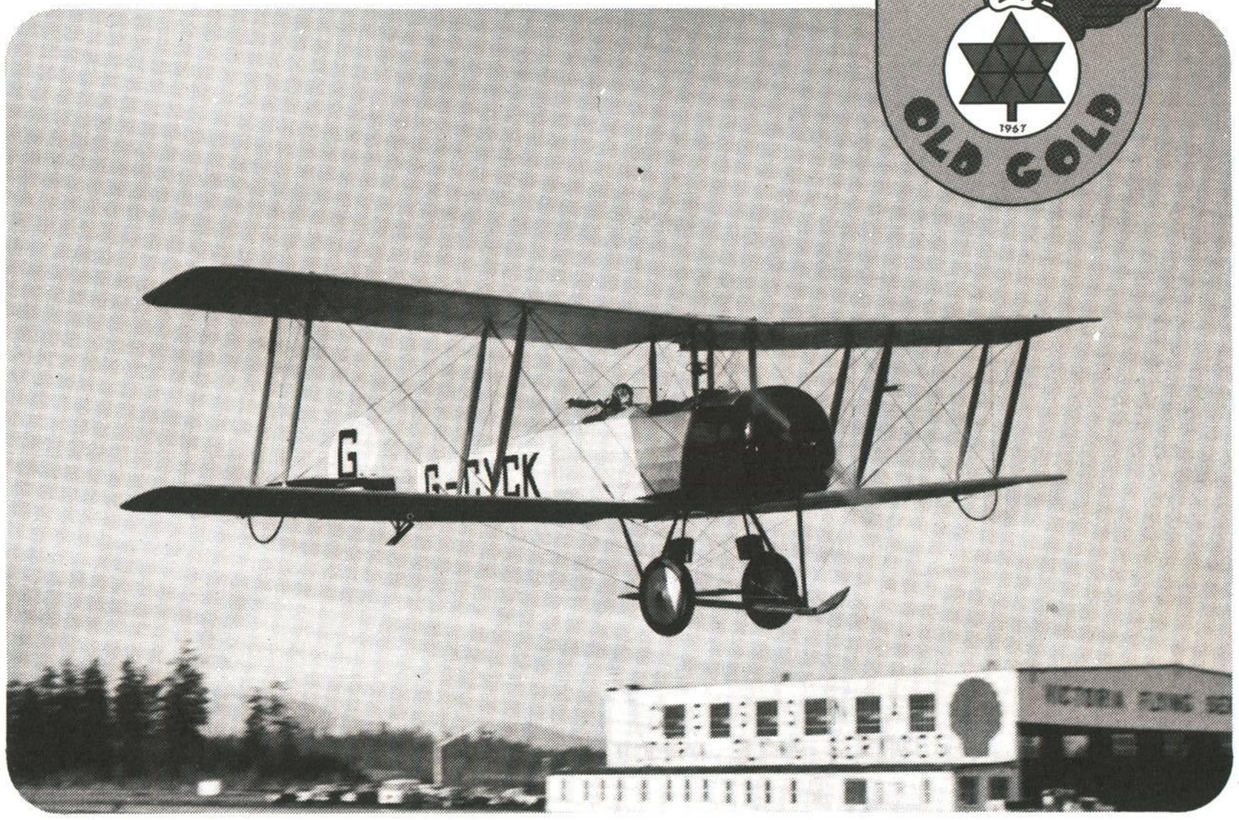
F/L D.R. SERRAO, CD



CF-104

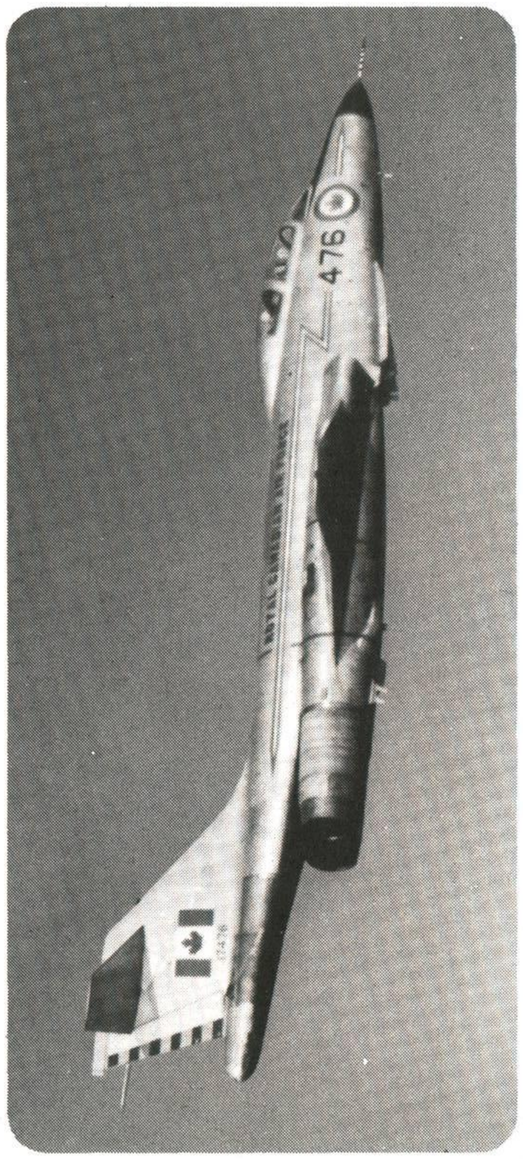
GOLDEN CENTENNAIRES
OLD GOLD
1967

AVRO 504K





F/L J.E. MILLER



CF-101B



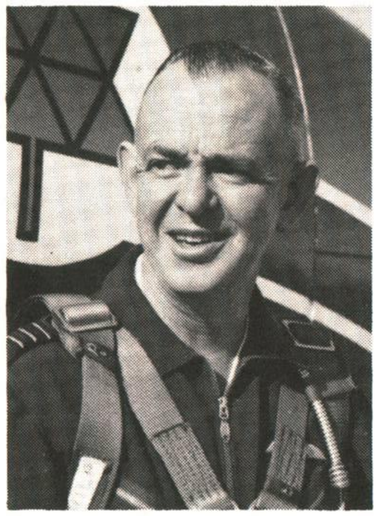
F/L G. GREFF, CD



F/L R.M. McGIMPSEY



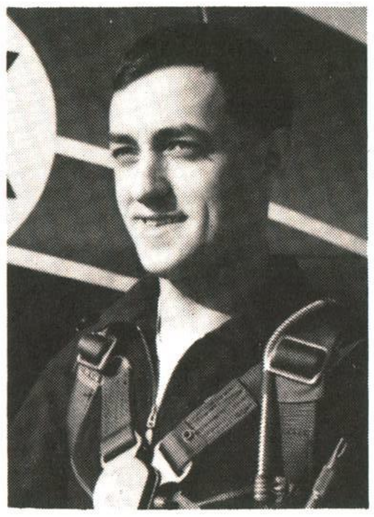
F/L G.A. BROWN, CD



W/C O.B. PHILP, DFC, CD



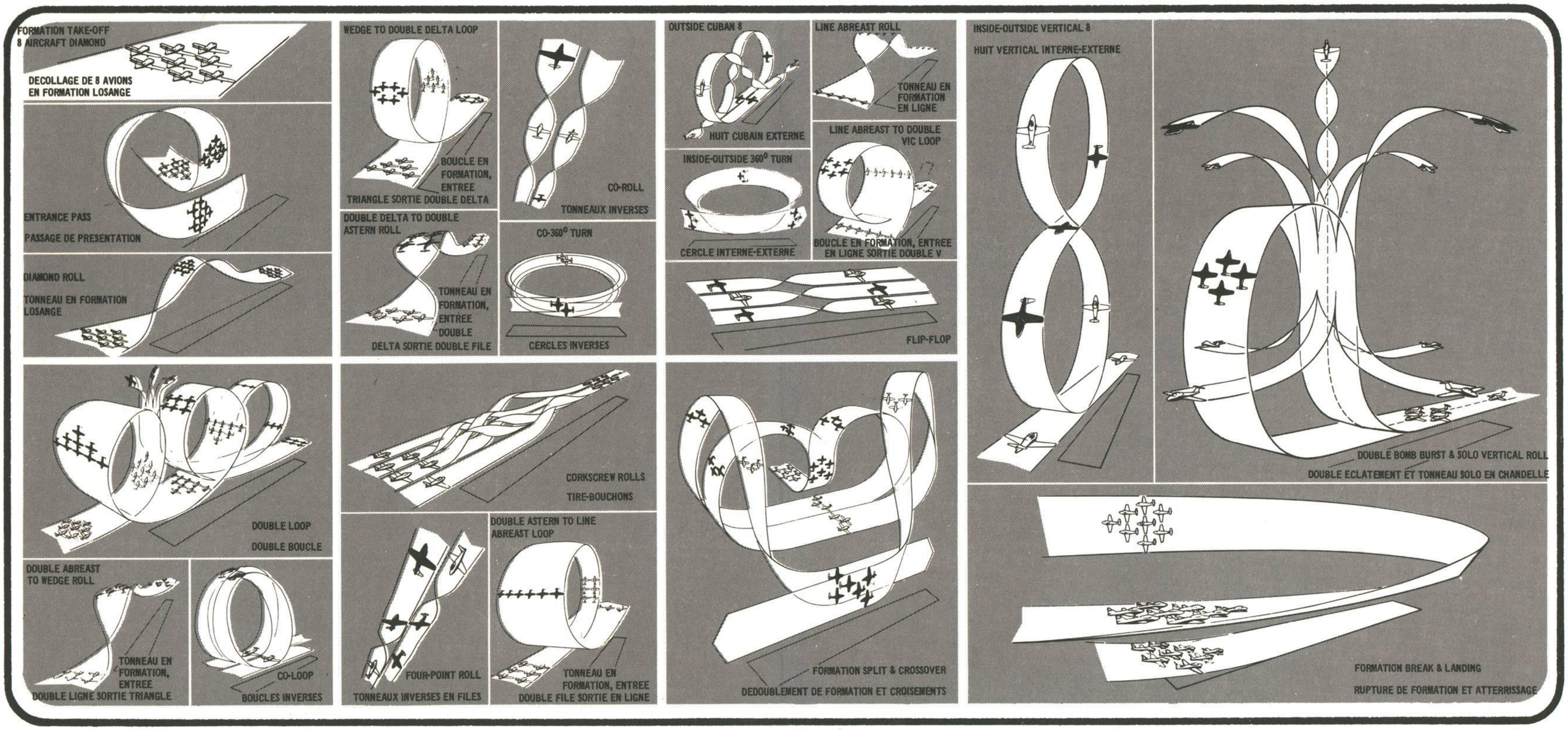
S/L L.J. HUBBARD, CD



F/L J.L.D. GAUTHIER



THE GOLDEN CENTENNAIRES • LES





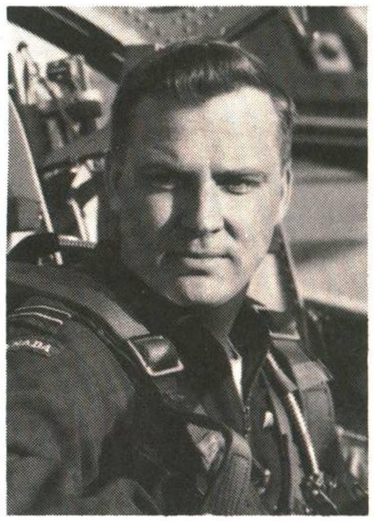
S/L C.B. LANG



F/L R.W. SLAUGHTER



F/L T.P. HINTON

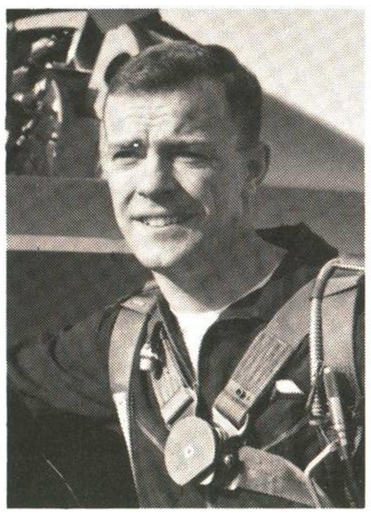


F/L J.M. SWALLOW

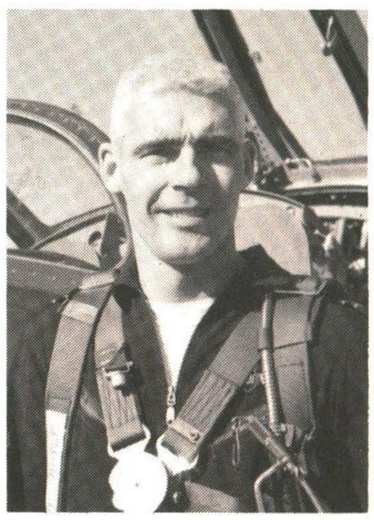


F/O J.M. McKAY

PALADINS DU CENTENAIRE



S/L R.C. BENNETT, CD

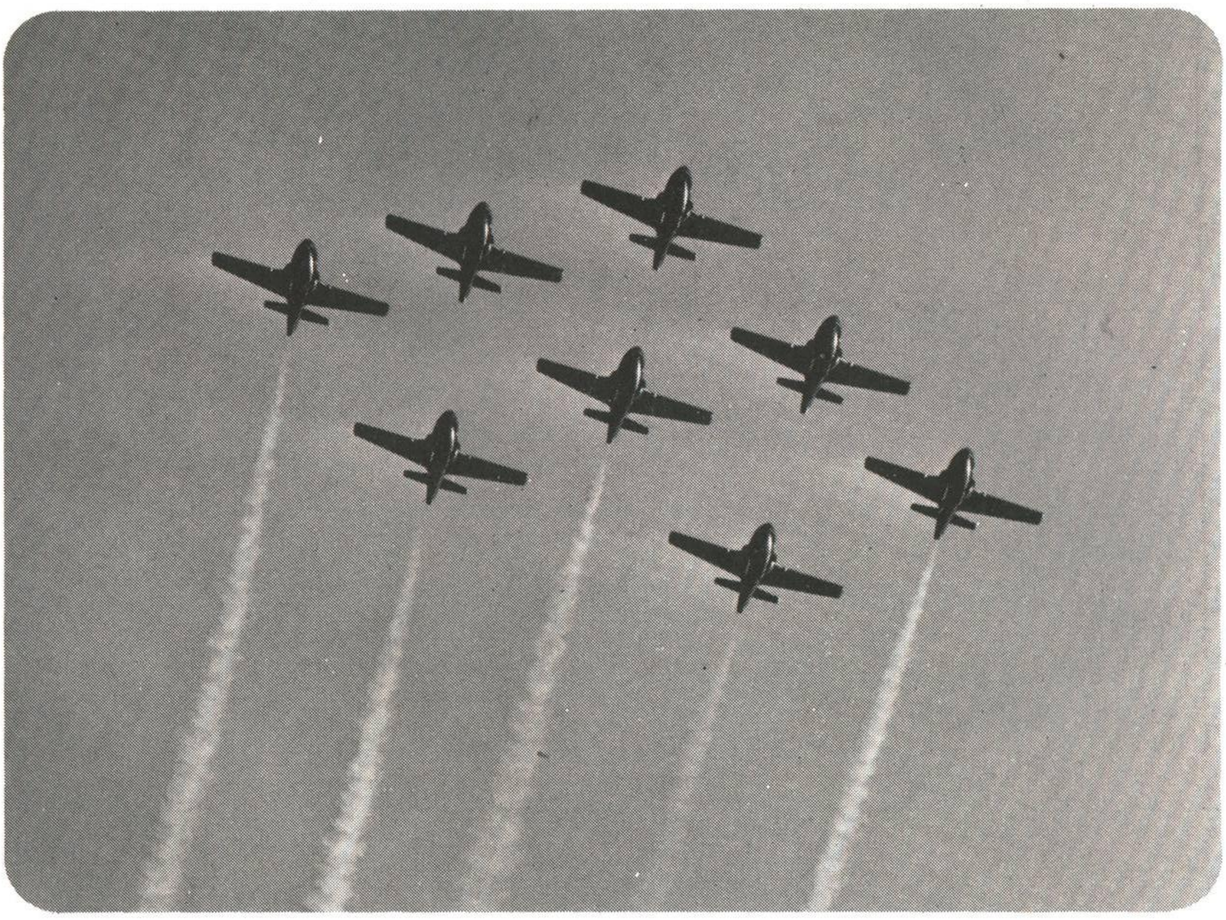


S/L B.K. DOYLE, CD



S/L R.C. DAGENAIS





Compliments of:
LOCKHEED AIRCRAFT CORPORATION OF CANADA LIMITED
DE HAVILLAND AIRCRAFT OF CANADA LIMITED

Les vingt-deux exercises de voltige en formation qui sont illustrés ici sont les activités de tous les jours des Paladins du Centenaire et de leurs CL-41 Tutor à réaction. Depuis le 28 avril, où des centaines de milliers de personnes pourront suivre leurs évolutions qui viendront rehausser l'éclat de l'ouverture officielle de l'EXPO 67, jusqu'à leur exhibition qui en marquera la clôture, le 27 octobre, ils auront accompli un périple de 100,000 milles et fait admirer leur virtuosité dans cent villes du Canada. Dans la plupart de leurs manifestations, on pourra voir le contraste entre les antiques biplans et les avions supersoniques CF-104 Starfighter et CF-101B Voodoo. Des numéros de voltige en solo seront présentés par deux des Paladins du Centenaire et par le Chevalier Rouge sur son avion de perfectionnement à réaction écarlate T-33.

La parfaite coordination des manoeuvres exécutées par les pilotes n'évoque qu'une faible partie du travail collectif auquel ils sont astreints. De nombreux mois d'entraînement intensif ont précédé la tournée qu'ils vont entreprendre et cet entraînement va se poursuivre pendant la tournée, les jours où ils ne feront pas de démonstrations. Bien que leurs prouesses aériennes soient stupéfiantes, ce ne sont pas des pilotes de voltige professionnels. Ce sont des pilotes militaires de carrière bénévoles qui ont été choisis pour montrer au public la valeur des Forces Armées canadiennes.

The twenty-two formation aerobatic manoeuvres illustrated depict an almost daily routine for the Golden Centennaires and their CL-41 Tutor jets. From April 28th when they entertain hundreds of thousands as a highlight of the official opening of EXPO67 until they appear at its closing ceremonies October 27th, they will have travelled 100,000 air miles visiting 100 centres throughout Canada. The vintage biplanes and the contrasting supersonic CF-104 Starfighter and CF-101 Voodoo appear at most of the displays. Solo aerobatic demonstrations are given by two of the Golden Centennaires, and by the Red Knight's scarlet T-33 advanced jet trainer.

The synchronized performances of the pilots tell only a small part of their collective story. Many months of concentrated training precede this tour, and practices continue on days when no demonstrations are scheduled. Although this aerial show is breath-taking, the performers are not stunt pilots. They are professional military flyers who volunteered and were selected to demonstrate to the public the competence of the Canadian Armed Forces.

Imprimé au Canada

Printed in Canada

437 (YORK) WING

NEWSLETTER

R.C.A.F. ASSOCIATION

CANADA'S GOLDEN CENTENNAIRES will be at 437 York Wing MARCH 1, 8 pm.

W/C. O. B. Philp
Commanding Officer
GOLDEN CENTENNAIRES



COME AND HEAR WING COMMANDER O. B. PHILP, FORMER BURMA FLYER (436 SQUADRON) TELL AND SHOW HOW CANADA'S CENTENNIAL "GOLDEN CENTENNAIRES" WERE FORMED TO HELP CELEBRATE CANADA'S 100TH BIRTHDAY.

BRING ALONG A FRIEND AND ENJOY AN EVENING WITH 437 WING AND THE "GOLDEN CENTENNAIRES".

REFRESHMENTS SERVED

All Ex-Air Force Types are Welcome at the Social Centre

RCAFA - 1107 AVENUE ROAD.

MARCH 1, 8 PM

Thousands: 26

Golden Centenaire = GC
Red Knight = RK

627
35

Type	Serial	c/n	T.O.S.	S.O.S.	Previous	Subsequent	Disposition	Remarks
	000							
Tutor CL41	001	1001	16.12.63				CAF	
" "	002	2	20.1.64				CAF	
" "	003	3	11.2.64				CAF	
" "	004	4	19.2.64			702B	Cl 29.11.65	
" "	005	5	5.2.64				CAF	
" "	006	6	4.11.64				CAF	
" "	007	7	29.5.64				CAF	
" "	008	8	26.5.64	13.11.70		—	CAF	Cat A Moose Jaw
" "	009	9	24.5.64				CAF	
" CL41	010	1010	2.6.64				CAF	
" "	011	1	22.6.64				CAF	
" "	012	2	15.6.64				CAF	
" "	013	3	30.6.64				CAF	
" "	014	4	12.12.64				CAF	
" "	015	5	25.6.64				CAF	
" "	016	6	306.64	28.1.74		114016	CAF	Cat A 19.12.73 Moose Jaw
" "	017	7	17.8.64				CAF	
" "	018	8	9.7.64				CAF	
" "	019	9	9.7.64				CAF	
" CL41	020	1020	26.8.64				CAF	
" "	021	1	21.8.64				CAF	
" "	022	1022	6-8-64	18-8-65			W/O	Cat A 28.7.65 Moose Jaw
" "	023	3	12.8.64				CAF	
" "	024	4	17.8.64				CAF	
" "	025	5	23.9.64				CAF	
" "	026	6	26.8.64				CAF	
" "	027	7	16.9.64				CAF	
" "	028	8	17.9.64	27.10.76		114028	CAF	Cat A 31.5.76 Moose Jaw
" "	029	9	4.9.64	24.11.75		114029	CAF	Cat A 28.5.75 Moose Jaw
" CL41	030	1030	23.9.64				CAF	
" "	031	1	1.9.64				CAF	
" "	032	2	15.10.64				CAF	
" "	033	3	4.9.64				CAF	
" "	034	4	22.12.64				CAF	
" "	035	5	29.9.64				CAF	
" "	036	6	9.9.64				CAF	
" "	037	7	23.9.64				CAF	
" "	038	8	16.10.64				CAF	
" "	039	9	29.9.64				CAF	
" CL41	040	1040	6.10.64				CAF	
" "	041	1	16.10.64				CAF	
" "	042	2	15.10.64				CAF	
" "	043	3	16.10.64				CAF	
" "	044	4	16.10.64				CAF	
" "	045	5	26 8.64				CAF	
" "	046	6	19.10.64				CAF	
" "	047	7	20.10.64				CAF	
" "	048	8	4.11.64				CAF	
" "	049	9	23.10.64				CAF	

Thousands: 26

2 FTS Moose Jaw. Not Published

Type	Serial	c/n	T.O.S.	S.O.S.	Previous	Subsequent	Disposition	Remarks
	050	1050	6.11.64				CAF	
	051	1	29.10.64				CAF	
	052	2	3.10.64			A720	CAF	
	053	3	21.11.64				CAF	
	054	4	12.12.64				CAF	
	055	5	25.11.64				CAF	
	056	6	30.10.64				CAF	
	057	7	17.11.64				CAF	
	058	8	27.11.64				CAF	
	059	9	17.11.64				CAF	
	060	1060	14.9.66	✓			CAF	
	061	1	25.11.64	13.7.67			W/O	Cat A 2 FTS
	062	2	12.12.64				CAF	
	063	3	12.12.64				CAF	
CL41	064	4	2.12.64			A713	CAF	
	065	5	2.12.64				CAF	
	066	6	15.12.64				CAF	
	067	7	15.12.64				CAF	
	068	8	18.12.64				CAF	
	069	9	21.12.64				CAF	
	070	1070	21.12.64				CAF	
TUTOR	071	1	6.1.65				CAF	
	072	2	6.1.65				CAF	
	073	3	8.1.65				CAF	
	074	4	8.1.65	11.12.75		114074	CAF	Cat A 21.5.75 Moose Jaw
	075	5	19.1.65				CAF	
DAIR	076	6	19.1.65			A721	CAF	
	077	7	27.1.65				CAF	
	078	8	20.1.65				CAF	
	079	9	20.1.65				CAF	
CANA	080	1080	27.1.65				CAF	
	081	1	3.2.65				CAF	
	082	2	1.2.65	1.9.77		114082	CAF	Cat A 16.7.77 Moose Jaw
	083	3	3.2.65				CAF	
	084	4	11.2.65				CAF	
	085	5	11.2.65				CAF	
	086	6	11.2.65	30.12.71		114086	CAF	Cat A 3.12.71 Moose Jaw
	087	7	23.2.65				CAF	
	088	8	24.2.65	1.9.77		114088	CAF	Cat A 16.7.77 Seattle, Wa
	089	9	24.2.65				CAF	
	090	1090	9.3.65				CAF	
	091	1	24.2.65				CAF	
	092	2	9.3.65				CAF	
	093	3	11.3.65				CAF	
	094	4	11.3.65				CAF	
	095	5	17.3.65				CAF	
	096	6	17.3.65			A718	CAF	
	097	7	19.3.65				CAF	
	098	8	19.3.65				CAF	
	099	9	24.3.65				CAF	

Thousands: 26

Not Published

Type	Serial	c/n	T.O.S.	S.O.S.	Previous	Subsequent	Disposition	Remarks
CL41 TUTOR CANADAIR	100	1100	25.3.65				CAF	
	101	1	30.3.65	11.12.68			CAF	
	102	2	8.4.65				CAF	
	103	3	15.6.65	11.12.68		—	CAF	Cat A Moose Jaw
	104	4	22.6.65				CAF	
	105	5	15.6.65				CAF	
	106	6	8.4.65				CAF	
	107	1107	22.6.65	24.6.66			W/O	Cat A Moose Jaw
	108	8	30.6.65				CAF	
	109	9	7.7.65				CAF	
	110	1110	23.7.65				CAF	
	111	1	16.7.65	24.3.66			W/O	Cat A Moose Jaw
	112	2	30.7.65				CAF	
	113	3	30.7.65				CAF	
	114	4	13.8.65				CAF	
	115	5	17.8.65				CAF	
	116	6	26.8.65				CAF	
	117	7	1.9.65				CAF	
	118	8	26.8.65				CAF	
	119	9	31.8.65				CAF	
	120	1120	8.9.65				CAF	
	121	1	23.9.65				CAF	
	122	2	10.9.65		GC		CAF	
	123	3	23.9.65	26.10.76		114123	CAF	Cat A 11.5.76 Moose Jaw
	124	4	16.9.65				CAF	
	125	5	29.9.65				CAF	
	126	6	14.10.65				CAF	
	127	7	30.9.65	18.10.77		114127	CAF	Cat A 20.3.72 Moose Jaw
	128	8	30.9.65				CAF	
	129	9	1.10.65				CAF	
	130	1130	6.10.65	20.1.71		114130	CAF	Cat A Moose Jaw
	131	1	14.10.65				CAF	
	132	2	19.10.65				CAF	
	133	3	1.11.65	13.11.70		—	CAF	Cat A Moose Jaw
	134	4	22.10.65				CAF	
	135	5	15.12.65				CAF	
	136	6	12.11.65	28.1.74		114136	CAF	Cat A 22.8.73 Moose Jaw
	137	7	19.11.65	14.6.74		114137	CAF	Cat A 26.2.74 Moose Jaw
	138	8	7.12.65				CAF	
	139	9	20.12.65				CAF	
	140	1140	20.12.65				CAF	
	141	1	1.1.66				CAF	
	142	2	20.12.65				CAF	
	143	3	29.12.65				CAF	
	144	4	29.12.65				CAF	
	145	5	5.1.66				CAF	
	146	6	12.1.66				CAF	
	147	7	20.1.66		GC		CAF	
	148	8	12.1.66				CAF	
	149	9	1.2.66				CAF	

Not Published

38

Thousands: 26

Type	Serial	c/n	T.O.S.	S.O.S.	Previous	Subsequent	Disposition	Remarks
Tutor CL41	150	1150	1.2.66				CAF	
" "	151	1	11.2.66		GC		CAF	
" "	152	2	4.2.66		GC		CAF	
" "	153	3	8.2.66		GC/RK		CAF	
" "	154	4	18.2.66	17.10.69	GC/RK	—	CAF	Cat A (R.K. Portage
" "	155	5	22.2.66		GC		CAF	
" "	156	6	24.2.66				CAF	
" "	157	7	11.3.66	8.1.70		—	CAF	Cat A 30.7.69 Moose Jaw
" "	158	8	2.3.66				CAF	
" "	159	9	8.3.66				CAF	
" CL41	160	1160	15.3.66				CAF	
" "	161	1	28.3.66				CAF	
" "	162	2	28.3.66				CAF	
" "	163	3	28.3.66				CAF	
" "	164	4	2.4.66				CAF	
" "	165	5	28.3.66				CAF	
" "	166	6	30.3.66				CAF	
" "	167	7	18.4.66				CAF	
" "	168	8	21.4.66				CAF	
" "	169	9	2.4.66				CAF	
" CL41	170	1170	15.7.66	15.7.66	✓	—	W/O	Cat A 15.7.66 Canadair
" "	171	1	19.5.66				CAF	
" "	172	2	14.5.66				CAF	
" "	173	3	25.4.66				CAF	
" "	174	4	11.5.66				CAF	
" "	175	5	12.5.66		GC		CAF	
" "	176	6	19.5.66	23.9.67	GC		W/O	Cat A 15.2.67 Comox
" "	177	7	26.5.66				CAF	
" "	178	8	26.5.66				CAF	
" "	179	9	22.7.66	20.10.73	GC	114179	CAF	Cat A - .8.73 Moose Jaw
" CL41	180	1180	9.8.66		GC		CAF	
" "	181	1	4.8.66		GC		CAF	
" "	182	2	26.9.66	26.9.69		—	CAF	Cat B Mt. View
" "	183	3	4.8.66	18.11.72	GC	114183	CAF	Cat A 16.6.72 Moose Jaw
" "	184	4	25.8.66				CAF	
" "	185	5	22.8.66	16.5.67		—	W/O	Cat A 10.10.66 Portage
" "	186	6	19.9.66	16.11.66		—	W/O	Cat A Moose Jaw
" "	187	7	22.9.66				CAF	
" "	188	8	20.9.66				CAF	
" "	189	9	20.9.66		GC		CAF	
Tutor CL41	190	1190	28.9.66				CAF	
	191							
	192							
	193							
	194							
	195							
	196							
	197							
	198							
	199							

TAIL #	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	COMMENTS
114147	•	•	•	•	•	•															c
151	•	•	•	•	•	•															c
152	•	•	•	•	•	•															c Sent to Camp Borden after '76 season. 'Structurally Unsound.'
153	•	•	•	•	•	•															c Ex-Red Knight aircraft. Sent to camp Borden after '76 season. 'Structurally Unsound.'
180	•	•	•	•	•	•															c
181	•	•	•	•	•	•															c
183	•	•x																			c Crashed 10 June '72, Trenton, Ont. Opposing Solos mid-air. Capt Waterer killed.
122		•	•	•	•	•															c Said to be one of the fastest-rolling Tutors built. Later destroyed in a 2CFFTS accident.
155		•	•	•	•	•															c
175		•	•	•	•	•															c
179		•	•x																		Crashed 14 July '73, Moose Jaw. Bird strike. Capt Stef safely ejected.
083			•	•	•	•															
003				•	•	•															
030							•	•	•	•	•	•	•	•	•						
036							•	•	•	•	•	•	•	•	•	•	•	•	•t		Converted to tanker March '89.
043							•	•	•	•	•	•	•	•	•	•	•				
055							•	•	•	•	•	•	•	•	•	•	•	•	•	•	
082							•x														Mid-air with 088, 16 July '77, Paine Field, WA. Capt Sorfleet ejected safely.
088							•x														Mid-air with 082, 16 July '77, Paine Field, WA. Capt Beaullieu ejected safely.
114							•	•	•	•	•	•	•	•	•	•	•				
118							•	•x													Crashed 3 May '78, Grand Prairie, Alta. Horizontal stabilizer bracket failed. Capt deJong killed.
129(t)							•	•	•	•	•	•	•	•	•	•x					Crashed 17 June '86, Medicine Hat, Alta. Transit mid-air. Capt Curran ejected safely.
132**							•x														Crashed 24 June '77, Moose Jaw. Bird strike. Capt deJong ejected safely. Borrowed 2CFFTS Tutor.
163							•	•	•	•	•	•	•								
164(t)							•	•	•	•	•	•	•	•	•	•	•	•	•	•	Converted to smoker, Feb. '89.
177							•	•	•	•	•	•	•	•	•	•	•				
178							•	•	•	•	•	•									
105								•	•	•	•	•	•	•	•	•					
110								•	•	•	•	•	•	•	•	•	•	•	•x		Mid-air with 098, 3 Sept '89, Toronto. Maj Dempsey safely ejected.
049									•	•	•	•	•	•	•	•	•t	•	•	•	Converted to tanker in '87.
190											•	•	•	•	•	•	•	•			
098													•	•	•	•	•	•	•x		Mid-air with 110, 3 Sept. '89, Toronto. Capt Antaya killed.
041															•	•	•	•	•	•	
108																•	•	•	•	•	
023																	•	•	•	•	
037																	•	•	•	•	
052																	•	•	•	•	
100																	•	•	•	•	
115																	•	•	•	•	
046																		•	•	•	
080																		•	•	•	
011																		•	•	•	
075																				•	
084(t)																				•	

NOTE: *T-33 133275 was flown as a support aircraft by Snowbirds Coordinators in '73, '74, '75 and '76.*

*All Tutor tail numbers begin with '114.'

**Not assigned to 431 Sqdn. Borrowed 2CFFTS aircraft.

c = ex-Golden Centennaires aircraft.

t = tanker

x = crashed

Total number of aircraft flown: 43 Snowbirds Tutors, 1 2CFFTS Tutor, 1 T-33.

TAIL #	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	COMMENTS
114147	•	•	•	•	•	•															c
151	•	•	•	•	•	•															c
152	•	•	•	•	•	•															c Sent to Camp Borden after '76 season. 'Structurally Unsound.'
153	•	•	•	•	•	•															c Ex-Red Knight aircraft. Sent to camp Borden after '76 season. 'Structurally Unsound.'
180	•	•	•	•	•	•															c
181	•	•	•	•	•	•															c
183	•	•x																			c Crashed 10 June '72, Trenton, Ont. Opposing Solos mid-air. Capt Waterer killed.
122		•	•	•	•	•															c Said to be one of the fastest-rolling Tutors built. Later destroyed in a 2CFFTS accident.
155		•	•	•	•	•															c
175		•	•	•	•	•															c
179		•	•x																		Crashed 14 July '73, Moose Jaw. Bird strike. Capt Stef safely ejected.
083			•	•	•	•															
003				•	•	•															
030							•	•	•	•	•	•	•	•	•						
036							•	•	•	•	•	•	•	•	•	•	•	•	•t		Converted to tanker March '89.
043							•	•	•	•	•	•	•	•	•	•	•				
055							•	•	•	•	•	•	•	•	•	•	•	•	•	•	
082							•x														Mid-air with 088, 16 July '77, Paine Field, WA. Capt Sorfleet ejected safely.
088							•x														Mid-air with 082, 16 July '77, Paine Field, WA. Capt Beaullieu ejected safely.
114							•	•	•	•	•	•	•	•	•	•	•				
118							•	•x													Crashed 3 May '78, Grand Prairie, Alta. Horizontal stabilizer bracket failed. Capt deJong killed.
129(t)							•	•	•	•	•	•	•	•	•	•x					Crashed 17 June '86, Medicine Hat, Alta. Transit mid-air. Capt Curran ejected safely.
132**							•x														Crashed 24 June '77, Moose Jaw. Bird strike. Capt deJong ejected safely. Borrowed 2CFFTS Tutor.
163							•	•	•	•	•	•	•								
164(t)							•	•	•	•	•	•	•	•	•	•	•	•	•	•	Converted to smoker, Feb. '89.
177							•	•	•	•	•	•	•	•	•	•	•				
178							•	•	•	•	•	•									
105								•	•	•	•	•	•	•	•	•					
110								•	•	•	•	•	•	•	•	•	•	•	•x		Mid-air with 098, 3 Sept '89, Toronto. Maj Dempsey safely ejected.
049									•	•	•	•	•	•	•	•	•t	•	•	•	Converted to tanker in '87.
190												•	•	•	•	•	•	•			
098														•	•	•	•	•	•x		Mid-air with 110, 3 Sept. '89, Toronto. Capt Antaya killed.
041																•	•	•	•	•	
108																	•	•	•	•	
023																		•	•	•	
037																		•	•	•	
052																		•	•	•	
100																		•	•	•	
115																		•	•	•	
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080																			•	•	
011																				•	
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c = ex-Golden Centennaires aircraft.

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x = crashed

Total number of aircraft flown: 43 Snowbirds Tutors, 1 2CFFTS Tutor, 1 T-33.

13 Sep 94

FAX TO: Ralph Leonardo, National Aviation Museum,
voice: 993-7194
fax: 990-3655

FROM: Sgt S.B. Sauvé, CF Photo Unit,
voice: 991-9389,
fax: 990-9047

Number of pages - 1

Ralph:

The Snowbird serial numbers (I don't have the team number match-up) for this year are:

114011
114012 - just given to team as an extra
114041 - 'tanker' conversion with long range fuel tanks
114049 - 'tanker' conversion with long range fuel tanks
114052
114075
114076
114078 - designated as a solo aircraft (for stress monitoring)
114080
114084 - designated as a solo aircraft (for stress monitoring)
114100
114108
114115
114164
114188

Note: all other team aircraft carry smoke tanks and system, which are visibly different (shorter) from the long range tanks. (I didn't know that!)

I hope you enjoy receiving this information as much as I have sending it to you.

cheers,

Ron Wylie's friend has complete engineering information on Tutor received from Convair 19 Apr 74 to build model.

Includes all contours on all parts as well as modifications and full size G. A.

NEWS BUREAU

CANADAIR LIMITED • MONTREAL

BACKGROUND MATERIAL

June 1, 1962

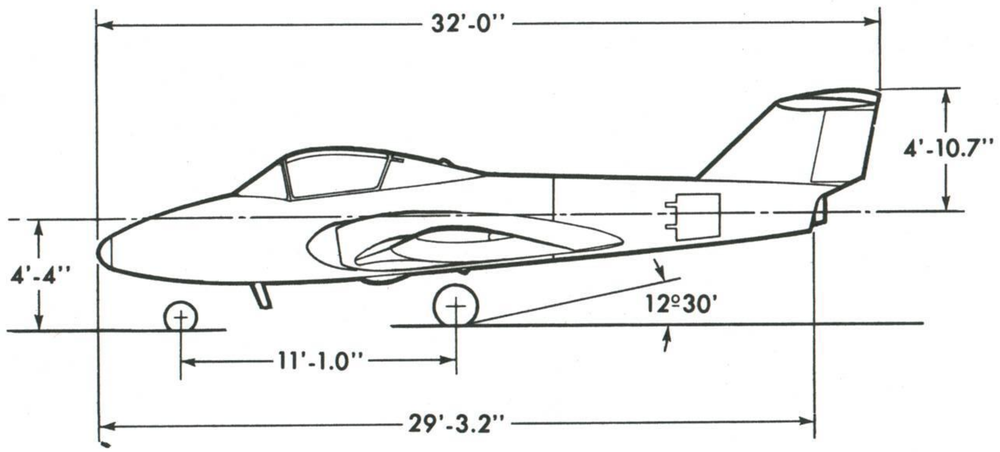
CANADAIR'S JET TRAINER

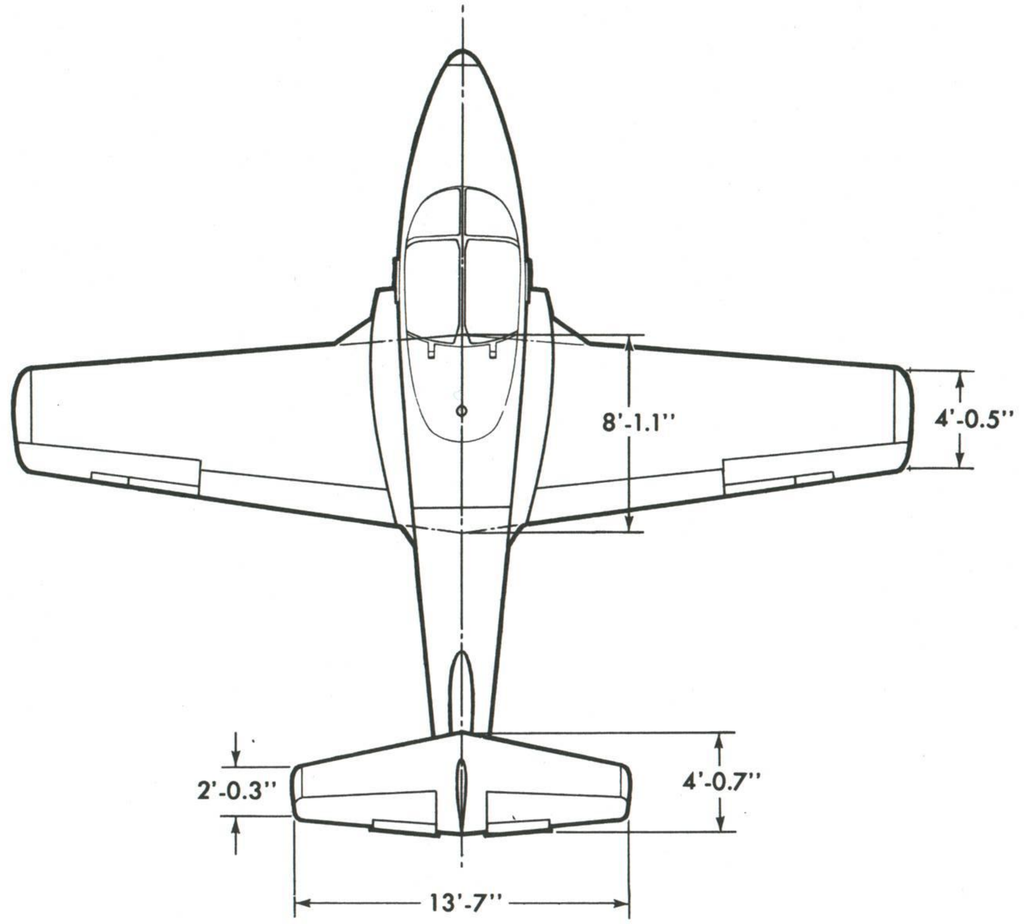
Fresh thinking is the keynote of the Canadair CL-41A jet trainer which has been developed as a company-financed venture to replace obsolescent piston-engined primary and basic trainers, and expensive-to-operate jet-powered advanced trainers. The first production model of the CL-41A for the Royal Canadian Air Force will roll off the assembly line in the Fall of 1963.

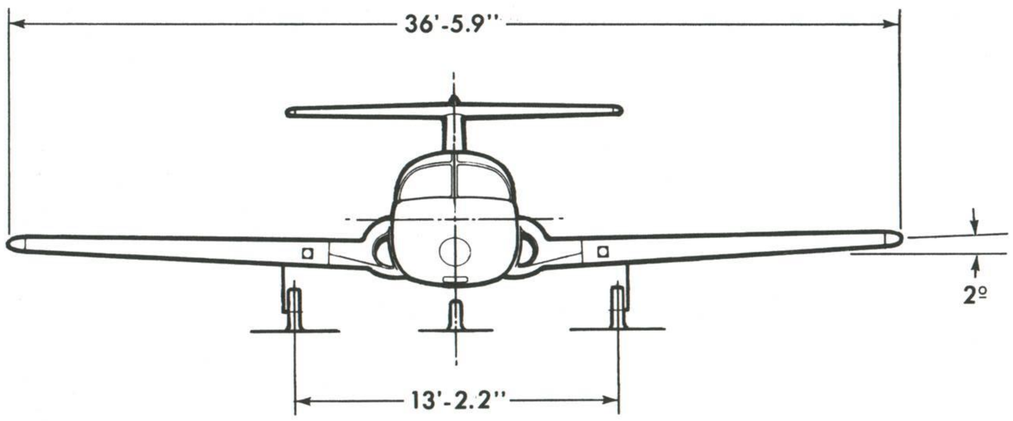
The CL-41 is a two-seat jet trainer which takes the pilot through the primary and basic stages of instruction right up to advanced level. Side-by-side seating is an additional advantage over the tandem seating of present R.C.A.F. trainers and has aided Canadair in quickly developing the CL-41R advanced systems trainer version which has excellent prospects of export sales to Europe.

Starting in 1955, Canadair laid down the design of a jet trainer aimed at meeting future needs of the R.C.A.F. Training Command. Two prototype CL-41s were built and the first flight was on January 13, 1960. Following an initial flight development program, a demonstration tour of Europe was made in the late summer of 1961 during which it was announced that 190 CL-41s would be procured for the R.C.A.F.

- more -







CANADAIR CL-41

Right from the start, the opinions of test-pilots and service engineers were incorporated in the design, in addition to invaluable advice sought from the R.C.A.F. on the requirements for an ideal trainer. A Canadair test-pilot was assigned to the project team and has worked with it right through to the successful first flight and subsequent flight-test program. As a result of this logical approach, many features have been adopted in the interests of straightforward flying qualities, added flight safety, structural ruggedness, crew comfort and vision, and ease of maintenance.

Performance Details

The Canadair CL-41A is a two-seat pilot trainer powered by a General Electric CJ610-1B (J85) turbojet engine. It is the first subsonic trainer to take advantage of the new generation of lightweight turbojet engines with high thrust/weight ratios. Wing span of the CL-41A is 36 ft. 5.9 in. (11.13 m.), fuselage length is 32 ft. 0 in. (9.75 m.) and gross weight is 7,270 lb. (3,352 kg.).

The performance spectrum of the CL-41A ranges from a level speed of 486 m.p.h. (782 km.p.h.) at 30,000 ft. (9,140 m.) to a sea-level stalling speed of only 80 m.p.h. (130 km.p.h.). Rate of climb is 4,250 ft./min. (21.6 m./sec.) at sea-level. Time to climb is 4.6 minutes to 15,000 ft. (4,572 m.). This attractive performance is obtained with the 2,700 lb. (1,231 kg.) max. continuous thrust of the CJ610-1B.

LEADING DIMENSIONS

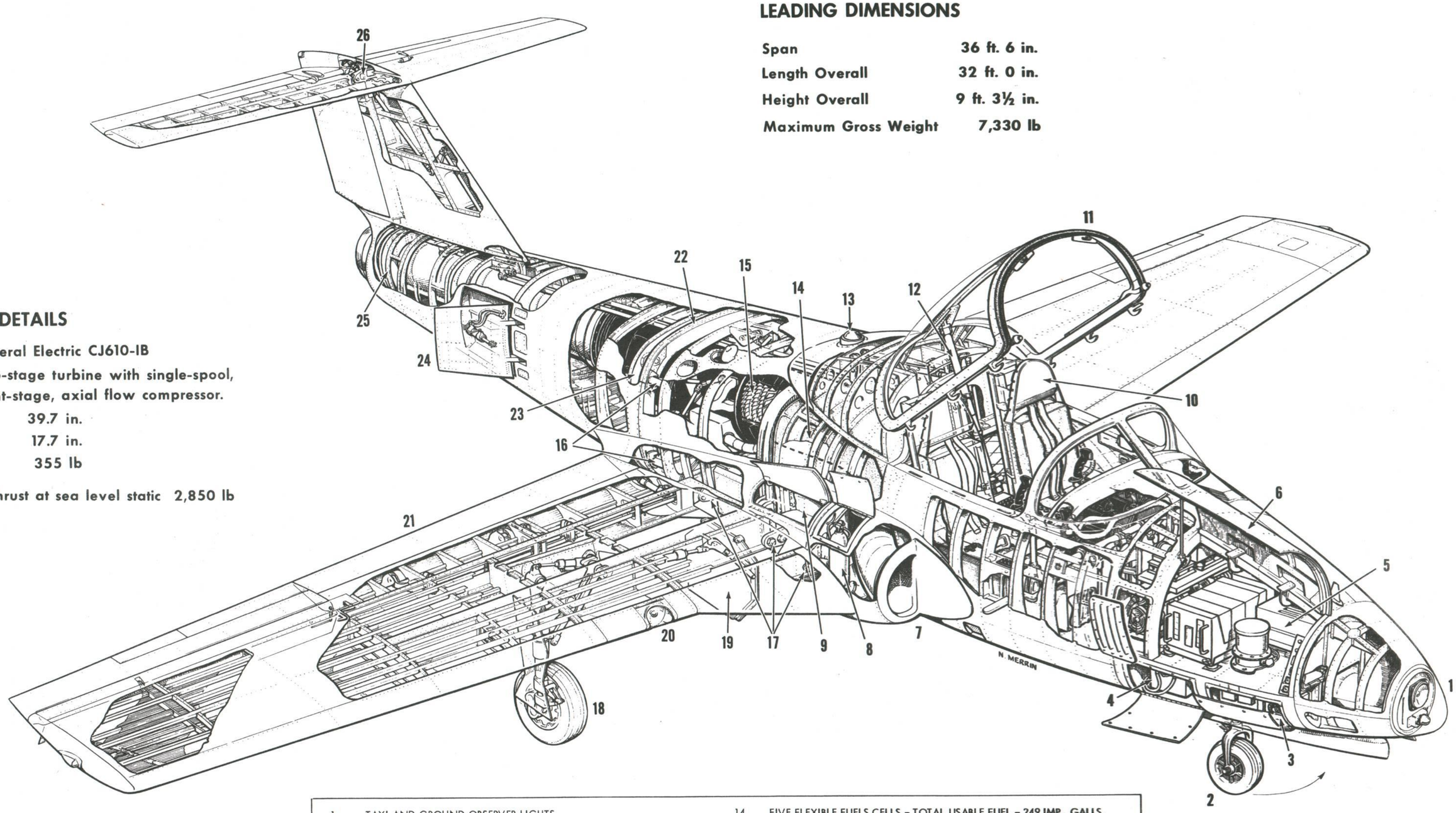
Span	36 ft. 6 in.
Length Overall	32 ft. 0 in.
Height Overall	9 ft. 3½ in.
Maximum Gross Weight	7,330 lb

ENGINE DETAILS

Type: General Electric CJ610-1B
Two-stage turbine with single-spool, eight-stage, axial flow compressor.

Length	39.7 in.
Diameter	17.7 in.
Weight	355 lb

Take-off thrust at sea level static 2,850 lb



1	TAXI AND GROUND OBSERVER LIGHTS	14	FIVE FLEXIBLE FUELS CELLS - TOTAL USABLE FUEL - 249 IMP. GALLS.
2	FORWARD RETRACTING, STEERABLE NOSE WHEEL	15	ENGINE COMPARTMENT - ACCESS FROM BELOW
3	ELECTRICAL RELAY PANELS - ONE EACH SIDE	16	ENGINE BEARERS
4	28 VOLT, 22 AMP/HR. NICKEL - CADMIUM BATTERY - ONE EACH SIDE	17	WING TO FUSELAGE ATTACHMENT POINTS
5	ELECTRONIC EQUIPMENT COMPARTMENT	18	MAIN LANDING GEAR
6	ELECTRONIC COMPARTMENT ACCESS - ONE EACH SIDE	19	MAIN LANDING GEAR DOOR - CLOSED WHEN GEAR IS LOCKED DOWN
7	ENGINE AIR INTAKE	20	LANDING LIGHT - ONE EACH WING
8	HIGH PRESSURE GASEOUS OXYGEN BOTTLE - ONE EACH SIDE	21	SINGLE SLOTTED FLAPS - HONEYCOMB PANEL
9	PERSONAL BAGGAGE STOWAGE	22	FUSELAGE BREAK - DETACH REAR FUSELAGE FOR ENGINE REMOVAL
10	WEBER UPWARD EJECTION SEATS	23	REAR FIREWALL
11	ELECTRICALLY OPERATED, JETTISONABLE CANOPY	24	AIR BRAKE
12	CANOPY OPERATING AND EJECTION MECHANISM	25	VERTICAL STABILIZER ATTACHMENT BULKHEAD AND TAIL PIPE SUPPORT
13	ANTI-COLLISION LIGHT - UPPER AND LOWER	26	HORIZONTAL STABILIZER ATTACHMENT POINTS

CL-41A

Automatic pressurization and air conditioning are provided so that the instructor and student can fly for extended periods at heights up to 40,000 ft. (12,192 m.) and beyond. Norman endurance is more than two hours.

An unusual feature of the CL-41 is the "T-tail", with the horizontal stabilizer mounted on top of the fin. This arrangement is a desirable feature for training aircraft because the vertical tail surfaces are not blanketed by the tailplane during violent maneuvers and the rudder is particularly effective for spin recovery.

Rapid recovery from spinning is also aided by location of the fuel in the fuselage near the center of gravity. This avoids the adverse effects of high rolling and yawing inertia, and the problems of fuel asymmetry experienced with aircraft whose fuel is distributed in the wings.

Safety features of the CL-41A include ejection seats; a limit speed of 200 m.p.h. for operation of undercarriage and flaps, which is high relative to the stalling and operating speeds of this type of aircraft; a windshield of "bird-proof" glass; an "annunciator panel" with individual lights to warn of fire, electrical failure, overheating or similar dangers; simple, manually operated flying controls; structure with longitudinal beams to withstand crash-landing, including the cockpit region stressed to 32 'g'; a single fuel tank of five interconnected crash-resistant cells, to avoid the need for fuel-management; and a steerable nosewheel, which is a great asset on icy runways.

- oOo -



CANADAIR CL-41 jet trainer is adaptable to four different makes of turbojet engines without structural modifications. Royal Canadian Air Force advised and coordinated with Canadair on design, which also covers RAF and USAF specifications.

Turbojet CL-41 Covers Full Training Span

By Robert I. Stanfield

Montreal—First design details of Canadair's new side-by-side CL-41 jet trainer point to a rugged, flexible airplane capable of covering the full span of student training—from primary through advanced instruction—at speeds ranging from 65 kt. (stall) to 500 kt. or Mach .8 (limit dive).

The CL-41 will be the first all-Canadair designed aircraft produced by this subsidiary of General Dynamics Corp. It was designed on a private venture basis in which, from its inception, the company has benefited by advice from the Royal Canadian Air Force.

Airplane will be powered by the 436-lb. (guarantee weight) Pratt & Whitney prototype JTC12A-2 engine, which develops 2,900 lb. of thrust but will be "derated" to 2,400 lb. for the CL-41. Canadair feels that by reducing the power it will prevent a too-steep curve for the student pilot; that at 2,400 lb. of thrust there will still be a good power margin plus availability of engine's full thrust and growth potential. JT-12 production engines, available next year, will develop 3,000 lb. of thrust, which is expected to increase to 3,300 lb. by December, 1961.

Canadair also says the reduction to 2,400 lb. will increase the margin between cruise and critical speed, increase the time interval between cruise and critical speed, increase the engine's initial overhaul period to about 900 hr. (Pratt & Whitney specifies an initial 600-hr. overhaul life for the JTC12A-2), and reduce the specific fuel flow.

The company will accomplish the power reduction by controlling the fuel flow, via throttle positioning on the engine itself. By adjusting the throttle linkage the engine will be delivering 94% power when the tachometer reads 100% in the cockpit.

Thrust Rating

At 2,400 lb. thrust—which is both military (takeoff) and maximum continuous (normal) rating—specific fuel consumption is .840 lb./hr. lb. thrust. At 90% normal rating (maximum cruise) and 75% normal rating (normal cruise) the specific fuel consumption is .820 and .815 lb./hr. lb. thrust, respectively.

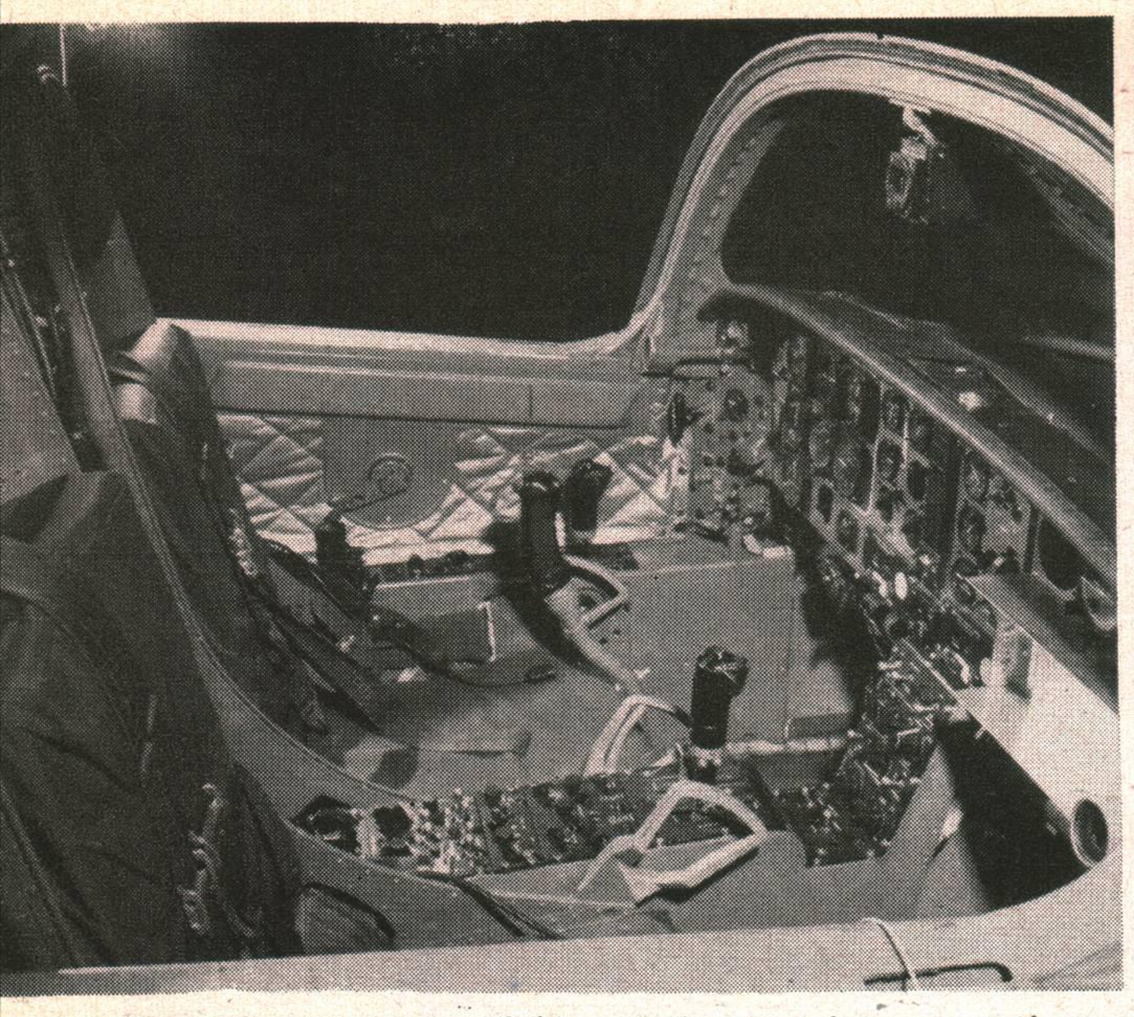
The CL-41 also is adaptable—without any structural modifications—for the following engines: the Armstrong Siddeley Viper ASV.11 of 2,460 lb. thrust, the General Electric J85 of about 2,500 lb. thrust, and the Rolls-Royce RB.145 of 2,750 lb. thrust.

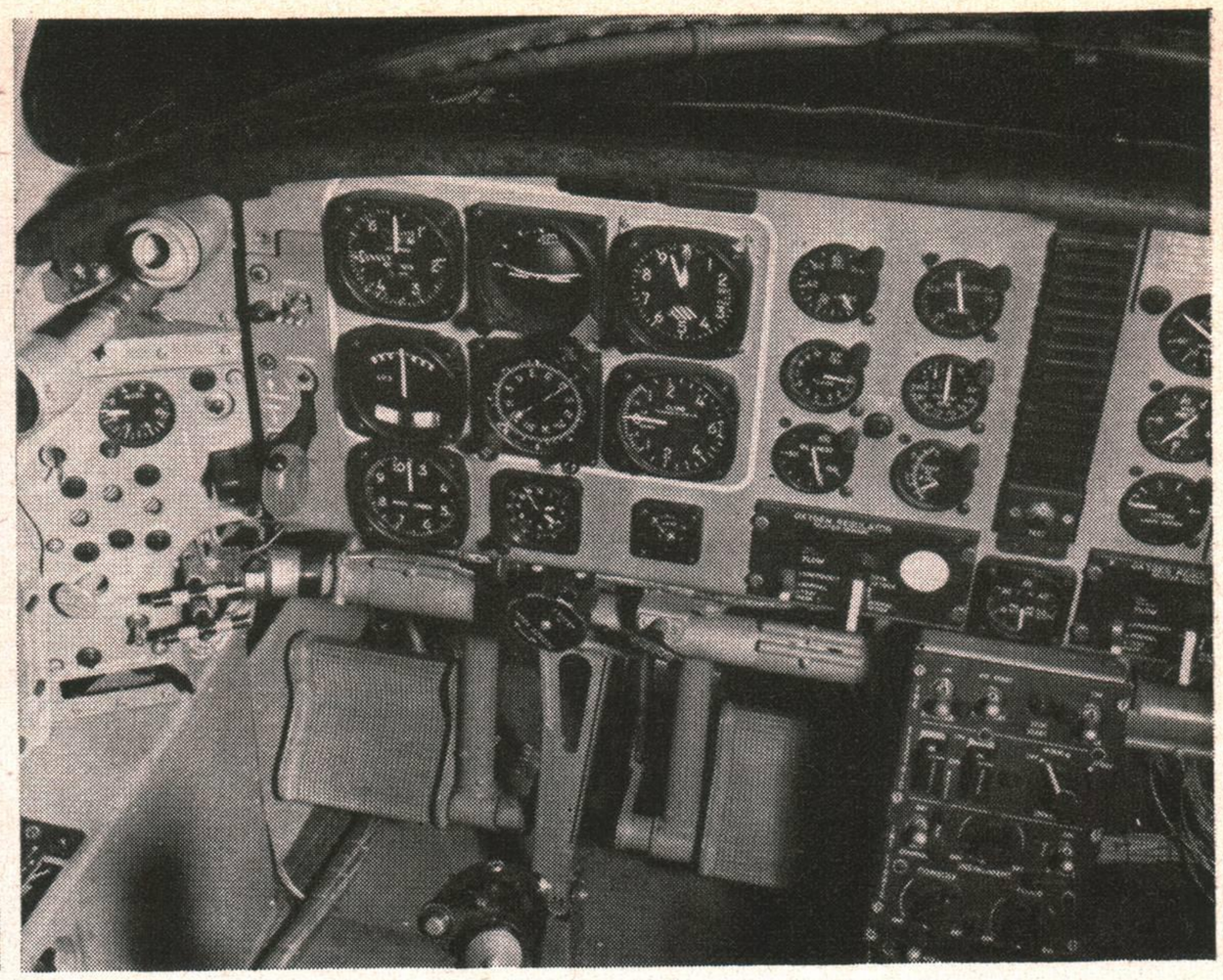
Tailored to runways of less than 5,000-ft. length, the CL-41 in size and weight is comparable to the old piston-engine AT-6 advanced trainer. Span of the jet trainer is 36 ft. 4 in.; length is 32 ft.; over-all height is 9 ft. 4.5 in. Design and landing gross weight is 6,500 lb. But here the comparisons end.

Key performance and design features of the CL-41 include:

• **Takeoff-landing capabilities.** Takeoff distance, over 50 ft., sea level, is specified as 1,830 ft. Landing distance from 50 ft., sea level, at half-fuel weight (5,700 lb.) is 1,920 ft. Canadair says the CL-41 will reach (following takeoff) 600 ft. by the time it passes the end of a 5,000 ft. runway, thus accelerating takeoff traffic at training bases.

• **Climb-speed-range.** Trainer has a climb rate specified as 4,100 fpm. at sea level, 2,000 fpm. at 20,000 ft., 1,400 fpm. at 30,000 ft. Time to climb to 15,000 ft. is stated as 5 min.; to 30,000 ft., 11.7 min. Service ceiling is 44,500 ft. Range on internal fuel (plus 10% reserve) is 800 naut. mi.; with underwing tanks, 1,050 naut. mi. Maximum level speed at 30,000 ft. is 412 kt. TAS (true air speed). Typical training mis-





CENTER CONSOLE (left) contains test instrumentation and radio channel selectors. **Pilot's instrumentation layout is at right.**

Canadair CL-41 Specifications

Span	36 ft. 4 in.
Length, over-all	32 ft.
Height, over-all	9 ft. 4.5 in.
Design and landing gross weight	6,500 lb.
Max. takeoff gross weight	6,600 lb.
Usable fuel (1,750 lb. JP-4)	270 gal.
Auxiliary fuel (two 73-gal. underwing tanks)	146 gal.
Wing:	
Total area	220 sq. ft.
Airfoil section (root)	NACA 63A014
Airfoil section (tip)	NACA 63A212
Incidence, root	1 deg.
Incidence, tip	0 deg. 30 min.
Sweepback (35% chord)	0 deg.
Aspect ratio	6.0
Ailerons:	
Total area (aft of hinge)	18.5 sq. ft.
Span (each) in per cent of wing semi-span	40%
Deflection	±16 deg.
Flaps (single-slotted):	
Span in per cent of wing span	46%
Deflection	40 deg.
Speed brake:	
Projected frontal area	3.4 sq. ft.
Deflection	50 deg.
Horizontal tail:	
Total area	41.3 sq. ft.
Incidence	−1 deg.
Deflection (elevator)	25 deg. up, 10 deg. down
Vertical tail:	
Total area	17.47 sq. ft.
Rudder area	6.0 sq. ft.
Deflection (rudder)	±25 deg.
Landing gear:	
Main wheels	20 x 4.4
Nose wheel	5.00 -- 5
Track, main wheels	158.74 in.
Wheelbase	133.25 in.
Turning circle diameter	37 ft.

Engine: Pratt & Whitney JTC12A-2 (engine develops 2,900 lb. of static thrust but has been derated to 2,400 lb. thrust for the CL-41).

	Jet Thrus (lb.)	Specific Fuel Consumption (lb./hr. lb. thrust)
Military rating (takeoff)	2,400	.840
Normal rating (maximum continuous)	2,400	.840
90% normal rating (maximum cruise)	2,160	.820
75% normal rating (normal cruise)	1,800	.815

sion endurance is about 2 hr. 28 min.

• **Flight consistency.** Internal fuel (270 gal.) is concentrated in the CL-41 fuselage, in five interconnecting bladder-type cells. No cockpit fuel management is necessary. Fuel, located over the center of gravity, means little trimming is required for aerobatics. Dry wings also afford consistent spin characteristics. Speed brakes (3.4 sq. ft.), extending from aft sides of fuselage, negate against exceeding limit dive speed. Ultimate maneuvering load factor is 11 g. Gear and flap retraction speeds (175 kt.) are nearly three times the stall speed. Flap extension speed is 145 kt.

• **Protective areas.** Two underfloor longitudinal skid beams, designed for a vertical load of 8g, run from the nose section aft to the center of the fuselage section. The fuel area is designed for an ultimate load factor of 24g. All heavy equipment structure (engine, battery, radios, etc.) is designed for 16g. To prevent anything from behind coming in, the cockpit area is designed for 32g. Most major lines (controls, wiring, etc.) run through the unpressurized, protected tunnel formed by the two skid beams. Laminated windshield is designed to withstand the impact of a 2-lb. bird at 200 kt. EAS.

• **Cockpit and pressurization.** Roomy cockpit is 55 in. wide, sill-to-sill (explaining capability of installing fuel in fuselage, plus any of four engines). Airplane is designed for ground-level ejection seats; the prototype uses Weber seats (the same as installed in USAF's Cessna T-37 trainer). Pressurization, at 3 psi., commences at 8,000 ft. altitude. Cabin altitude at 20,000 ft. would be 12,000 ft.; at 38,000 ft. it would be 20,000 ft. Cabin altitude at 44,500 ft. would be 25,000 ft.

• **Maintenance ease.** About 90% of the

aircraft is accessible without ladders. Hinged doors at waist-level provide access to the radio-avionic bay in the nose section. Hinged doors in the unpressurized tunnel along fuselage underside allow access to controls and wiring runs and hydraulic piping. "Wet" runs go down the left side of the aircraft, "dry" runs down right side, allowing work on both sides without interference. Doors on the fuselage underside aft of the rear spar provide access to the engine. The rear fuselage section can be quickly removed for major inspections and engine changes. Seats can be removed with canopy raised about 110 deg. Total access panels number 45.

Two Prototypes

Canadair has built two prototypes. The first of these, now undergoing ground runs, will make its initial flight under civil license on or about Dec. 15. Engines for these aircraft will be loaned by the Canadian Pratt & Whitney Division of United Aircraft Corp., which participated in the design of the JT12 at the U.S. Pratt & Whitney facilities at East Hartford, Conn., where the engine is produced. The second engine is scheduled for delivery to Canadair sometime this month.

Most immediate customer possibility for the CL-41 is the RCAF, which advised and coordinated with Canadair on the design of the trainer. The design also covers USAF and RAF military specifications. While Canadair is not overlooking a commercial adaptation of the CL-41, its initial concern is procurement of military orders.

Since the trainer was developed on a private venture basis, Canadair controls the rights to license it around the world.

The company is in the position —under current planning—to effect foreign deliveries by the end of 1961, and is equipped to produce 10 to 15 aircraft per month.

Basic airplane flyaway price would approximate $160,000, inclusive of basic instrumentation and radio-navigation equipment, but less engine. Including the powerplant, cost could approximate $195,000-$200,000. Price would vary with engine type and systems mated with a particular engine. Canadair can make available two models for price competition—the "de luxe" CL-41A and, using the second prototype, an "economy version" CL-41B.

The former, which will be powered by the JTC12A-2, will be completely equipped, including nose-wheel steering, student's blind-flying panel, airspeed indicator and Machmeter, engine air intake screens, complete radio-navigation equipment, etc. The "B" version, powered, for instance, by the Viper ASV.11, would not include these items except that the airspeed and Mach number would be combined in a single instrument (Smith's) and radio-navigation equipment would be minimized. Accessories would be at the option of the purchaser.

Fuselage of the CL-41 is all metal,

Canadair CL-41 Performance

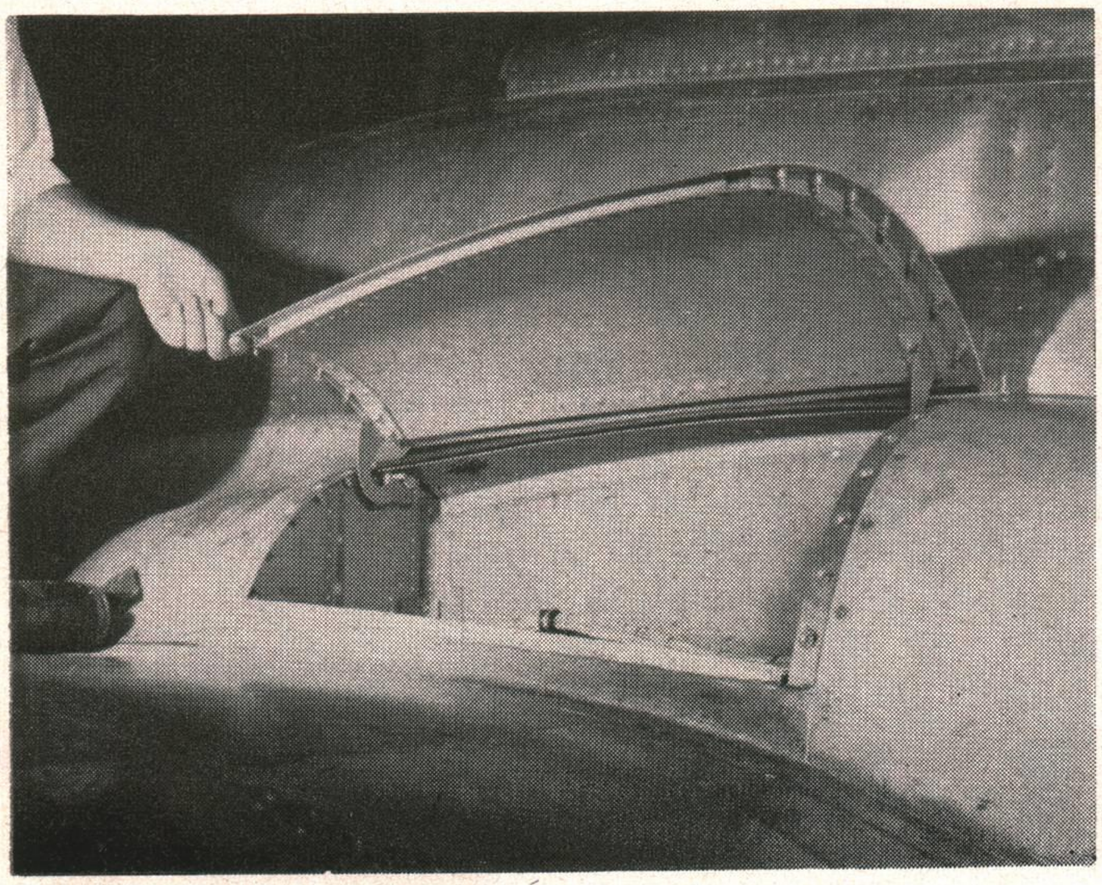
Design and landing gross weight	6,500 lb.
Maximum takeoff gross weight	6,600 lb.
Takeoff distance (to 50 ft., sea level)	1,830 ft.
Landing distance (from 50 ft., sea level)	1,920 ft.
Rate of climb, (sea level)	4,100 fpm.
Rate of climb (30,000 ft.)	1,400 fpm.
Time to climb to 30,000 ft.	11.7 min.
Range (internal fuel only, plus 10% reserve)	800 naut. mi.
Maximum range (including two 73-gal. underwing tanks)	1,050 naut. mi.
Service ceiling	44,500 ft.
Maximum level speed (sea level)	385 kt. TAS
Maximum level speed (30,000 ft.)	412 kt. TAS
Limit dive speed	500 kt. EAS
Limit Mach number	Mach .80
Stalling speed (landing configuration)	65 kt. EAS
Limit flight load factor (maneuver)	+7.33 to −3.00
Limit flight load factor (gust)	+6.38 to −4.38

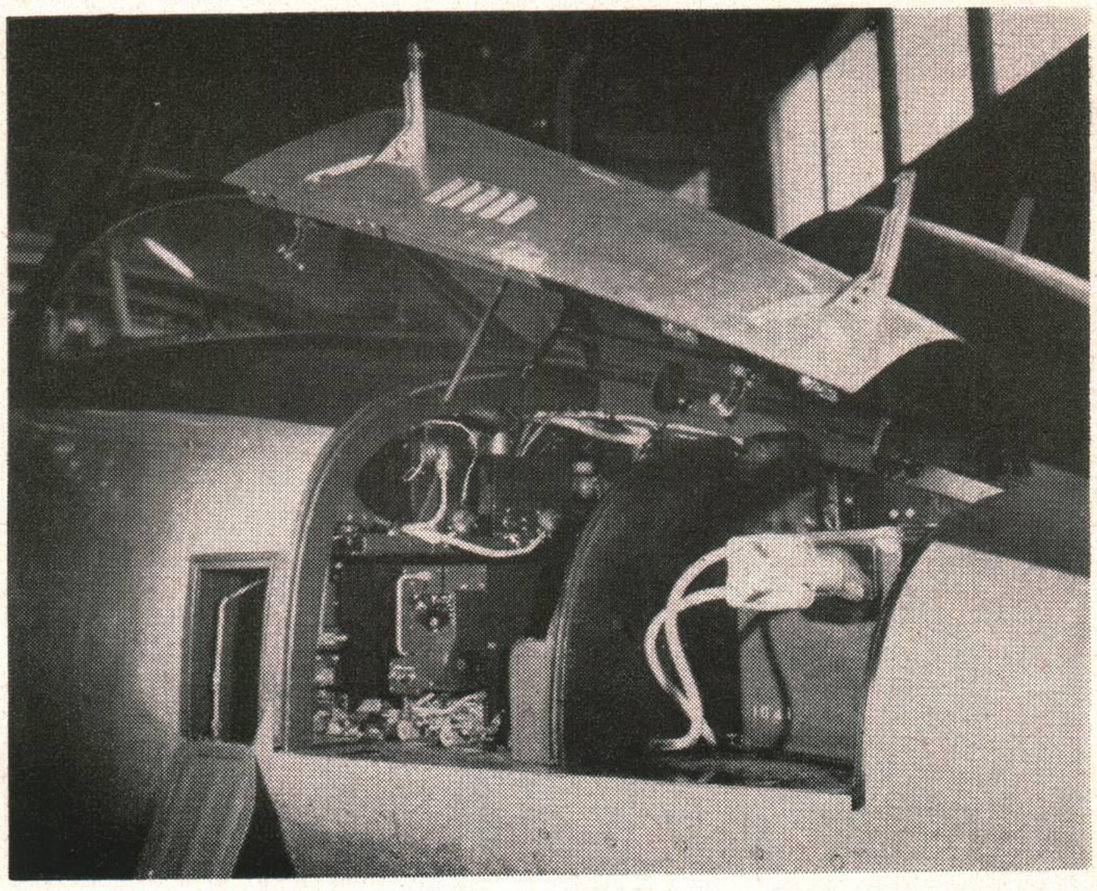
Maximum Range Mission:

Range (internal fuel only)	800 naut. mi.
Cruise altitude	38,000 ft.
Average cruise speed	311 kt. TAS
Total time	2 hr. 25 min.
Landing reserve (10% internal fuel)	175 lb.

Typical Training Mission:

Start, taxi, takeoff	5 min.
Climb to 15,000 ft.	5 min.
Medium and steep turns (15,000 ft.)	10 min.
Stalls and recoveries	5 min.
Forced landing practice	12 min.
Return to base (sea level)	5 min.
Circuits and landings	42 min.
Reserve (stand-off at 5,000 ft.)	64 min.
Total time	2 hr. 28 min.





STORAGE space for personal equipment is provided near wing roots (left). View at right shows layout of radio and avionics gear in the trainer's nose section.



BENDIX RED BANK ANNOUNCES NEW FACILITIES for research, development and production in Safing, Arming, and Fuzing Systems and Components. As systems increase in complexity the need for higher precision in safing, arming, and fuzing grows. To meet this need, Bendix Red Bank Division has created a new department exclusively devoted to design, engineering, and production techniques for these vital systems. ■ This "Special Products Department" is staffed by engineers selected for special abilities in this field. Environmental test equipment and precision tooling enable swift, accurate transition from design to product. Fresh approaches to design and production problems are encouraged by environment conducive to creative thinking. Performance-proved production resources back up new ideas. ■ Since 1941, Bendix Red Bank has grown from a maker of simple electrical devices to a producer of complex electrical and electronic systems. This is added assurance that here your most complex safing, arming, and fuzing problems will receive knowledgeable attention from fundamental analysis through final production.

SPECIAL PRODUCTS DEPARTMENT

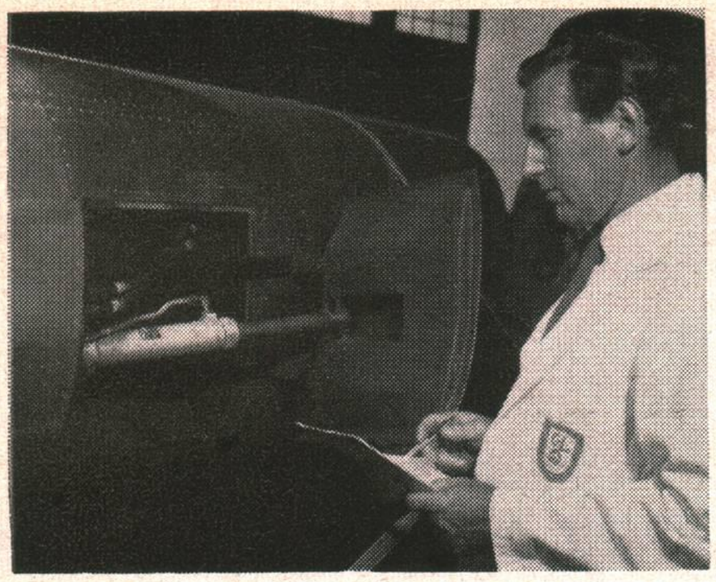
Red Bank DIVISION

EATONTOWN, NEW JERSEY

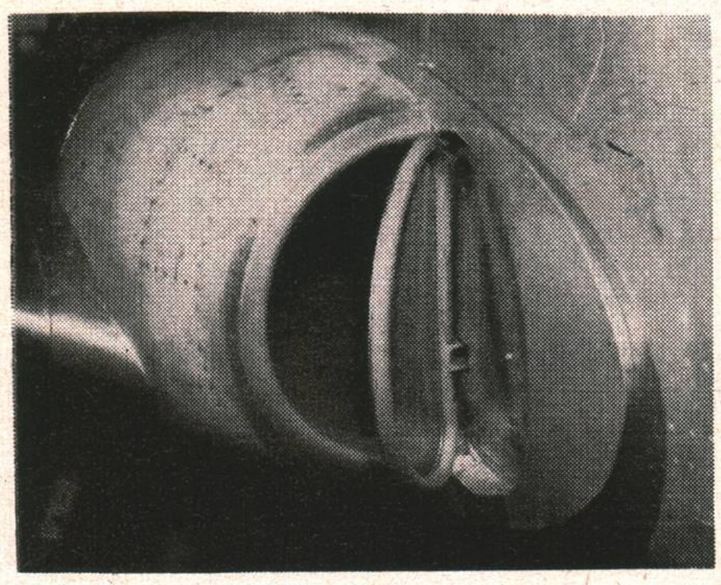
Bendix

AVIATION CORPORATION

West Coast Office: 117 E. Providencia, Burbank, Calif. • Export Sales & Service: Bendix International, 205 E. 42nd St., New York 17, N. Y.
Canadian Affiliate: Aviation Electric, Ltd., P. O. Box 6102, Montreal, Quebec.



SPEED BRAKE closeup is at top. Debris guard for engine intake duct (below) is in partially open position. Screen is closed on the ground, retracts when gear goes up.



semi-monocoque, and is constructed from aluminum alloy formed frames, bulkheads and skins, with longitudinal beams underneath and four extruded longerons. Rear section, with empennage, is detachable. Wing loads are distributed into the fuselage at front, main and rear spar wing attachment bulkheads. Vertical fin loads are transmitted by integrating the fin spars into the fuselage structure. Bracing structure at engine trunnion positions carries thrust, inertia loads from engine.

Canopy Structure

Canopy structure is of extruded and formed framed sections and two formed acrylic panels, hinged at the aft end. Pressure seals are attached to boundary frames. Canopy is held in closed position by three hooks in each sill and is further supported by a ledge at the windshield hoop frame. Minimum downward vision over the nose, in static ground position, is 11.5 deg. Canopy, jettisonable from either seat, is normally opened and closed by an electrical actuator; a mechanical standby system is manually operated.

Nose section contains electronic and oxygen equipment. Access doors opening on both sides of the nose section top also give access to stowed electrical equipment and the battery.

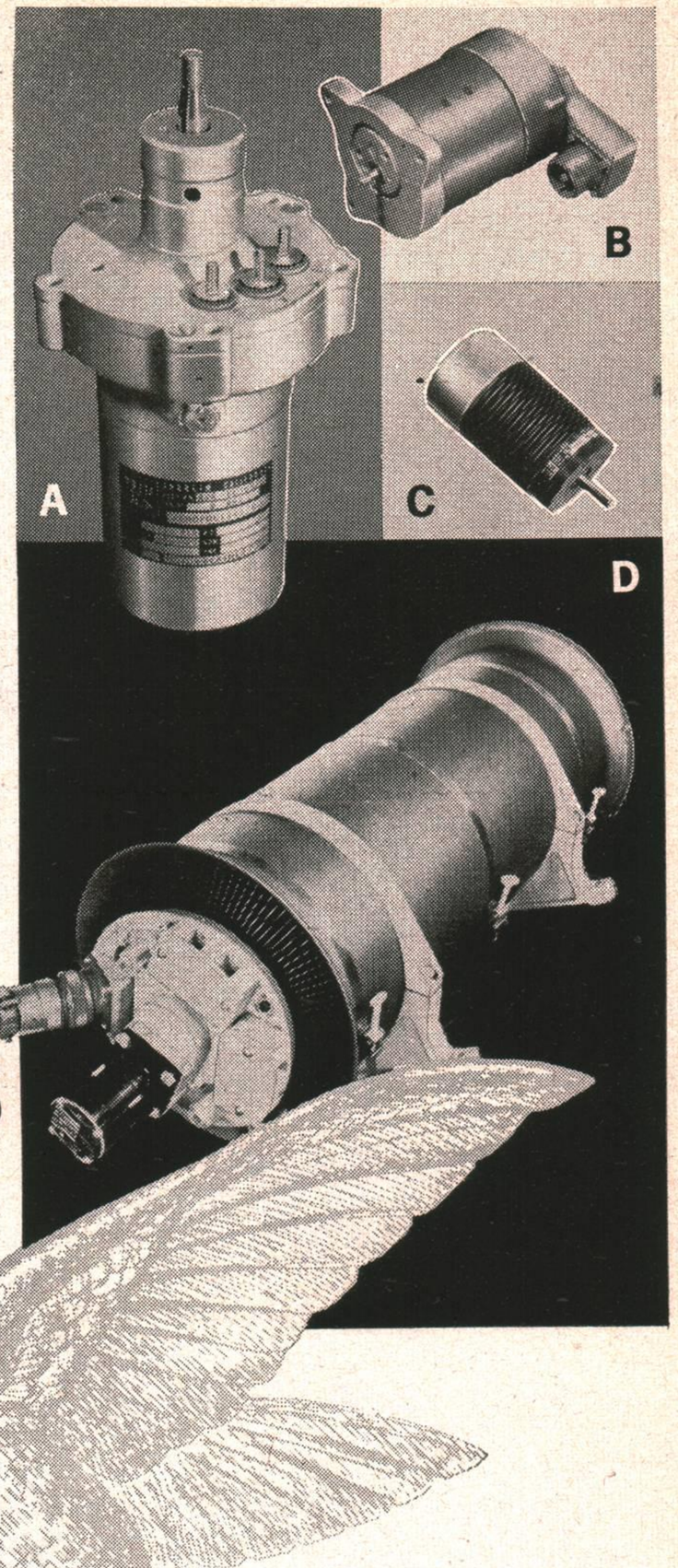
Wing is of a single main spar and stressed skin design supplemented by two auxiliary spars providing attachment for leading and trailing edge assemblies. The three spars and skin panels form a two cell box primary

A Emergency Feathering Torque Motor: 92 inch pounds torque, weighs 7.2 lbs., continuous duty, 400 cycle AC.

B Auxiliary Motor: 2.25 HP, weighs 3.9 lbs., intermittent duty, 28 volt DC.

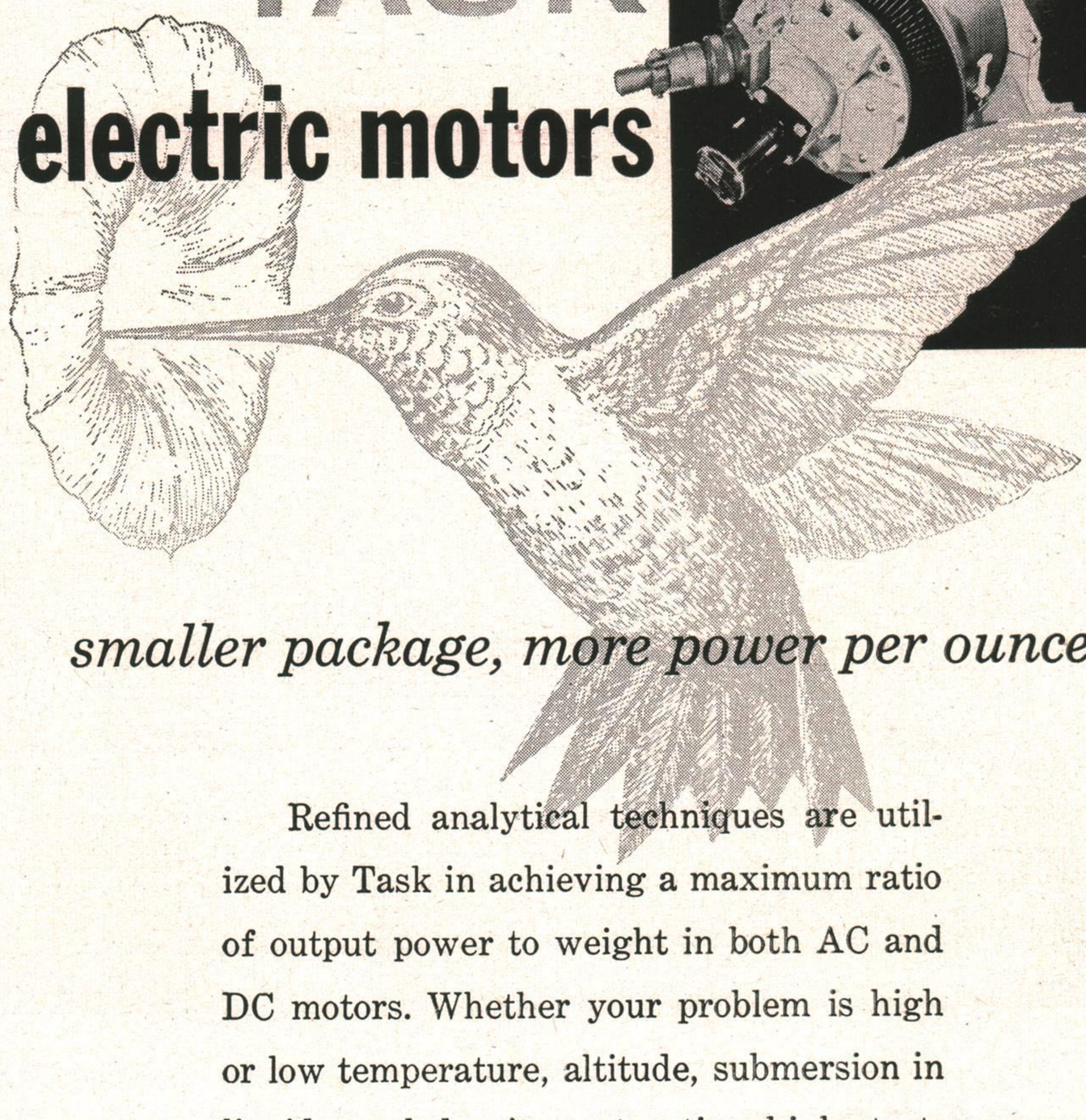
C General Purpose: 0.14 HP, weighs 15 oz., continuous duty, 400 cycles AC.

D Helicopter Prime Mover: 240 HP, weighs 188 lbs., continuous duty, 400 cycle AC.



TASK

electric motors



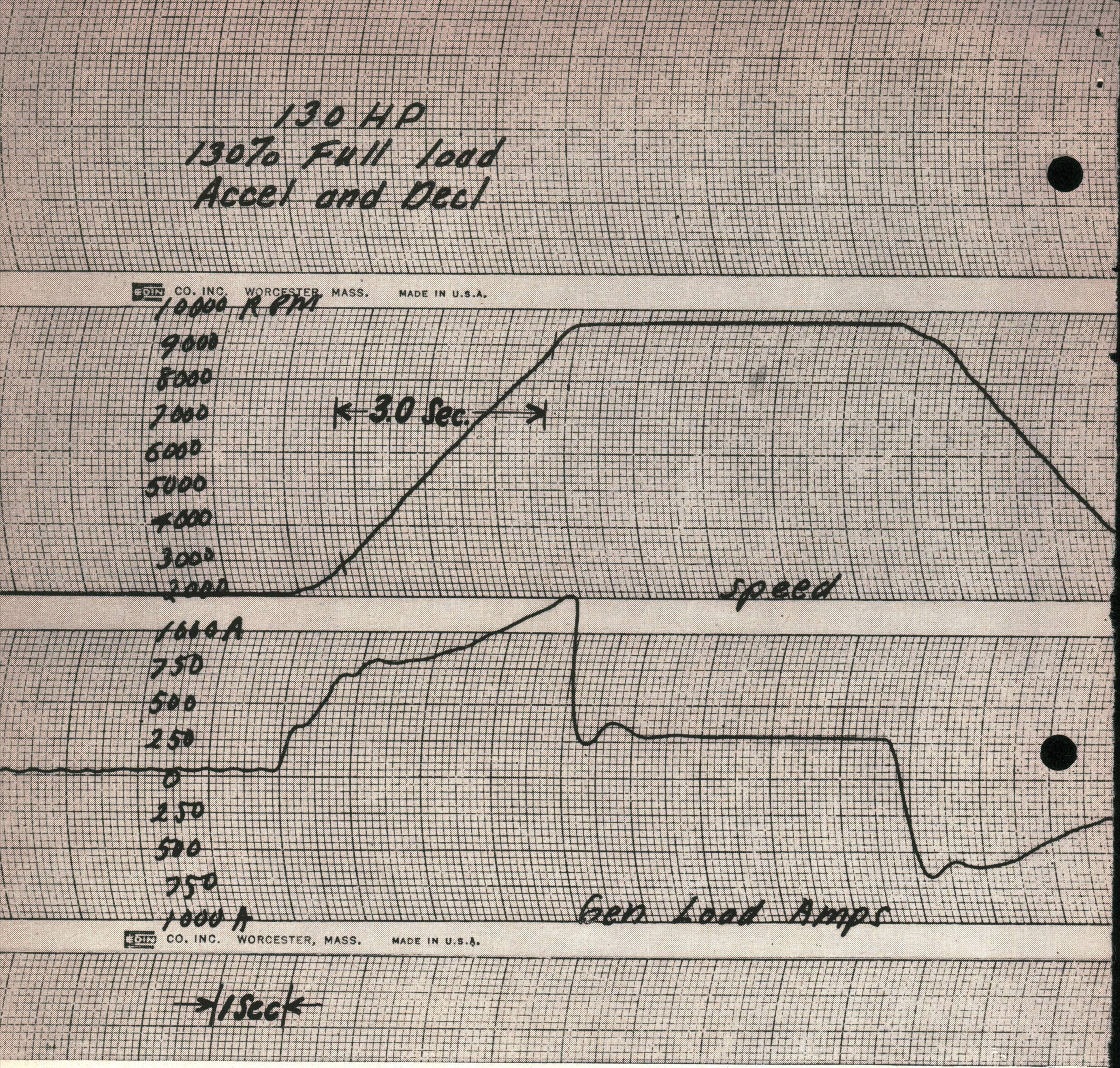
smaller package, more power per ounce

Refined analytical techniques are utilized by Task in achieving a maximum ratio of output power to weight in both AC and DC motors. Whether your problem is high or low temperature, altitude, submersion in liquids, sealed unit construction, high starting torque, high rotational speeds, or geared drives... Task can build you a better motor, faster. Write for further details.



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1009 EAST VERMONT AVENUE, ANAHEIM, CALIFORNIA



2000 RPM/second at 130% full load...

This is the performance that the Westinghouse test stand installation at North American Aviation, Columbus, gives time after time.

Other outstanding performance characteristics of this dual 100/200 hp test installation are:

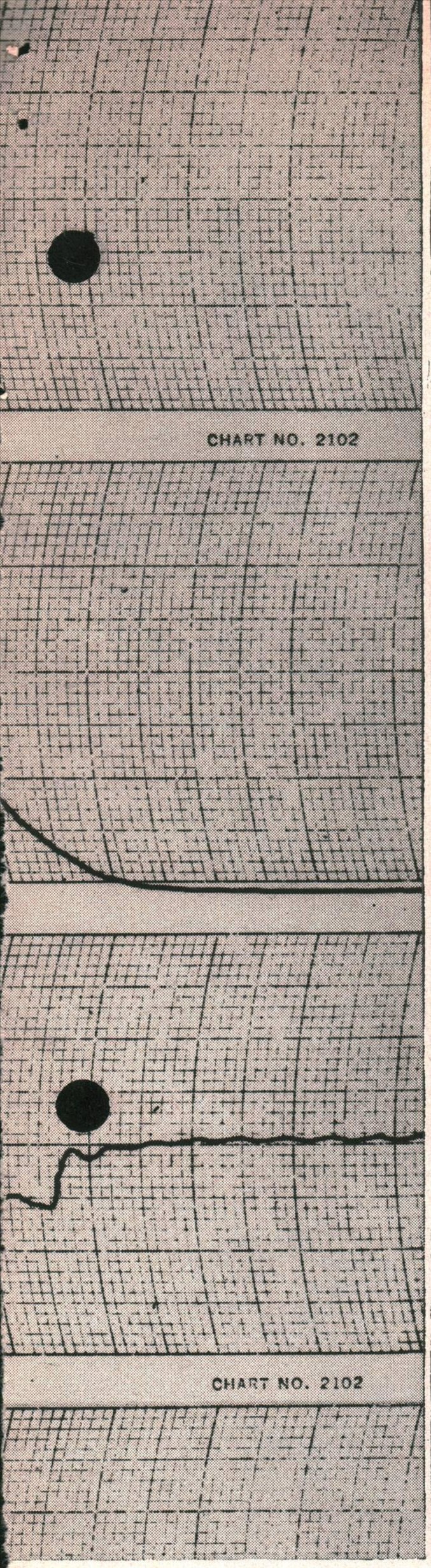
Speed adjustments: from 100 to 11,000 rpm
Speed deviation: 100% load change—not over 1%
200% load application—not over 2%
Recovery time: 200% load application — not over two seconds
Drift: ± 0.25% in eight hours
For overload testing, 150/300 hp is available for five minutes, 200/400 hp for five seconds.

Outstanding features include:

Two output gear boxes each provide 100 hp for their respective AND pads (dual or single mount).

Twin-drive systems operate independently, or they can be combined for 200 hp delivery from the gear box at either end.

For testing alternators or for complete aircraft/missile electrical systems, Westinghouse test stands permit accurate simulation and evaluation of voltage regulation, transient response, overload capacity, paralleling operations and shock loading.



One of two control consoles of the North American Aviation, Columbus, alternator stand showing one main drive motor and speed increaser with incoming switchgear and motor control centers in background.

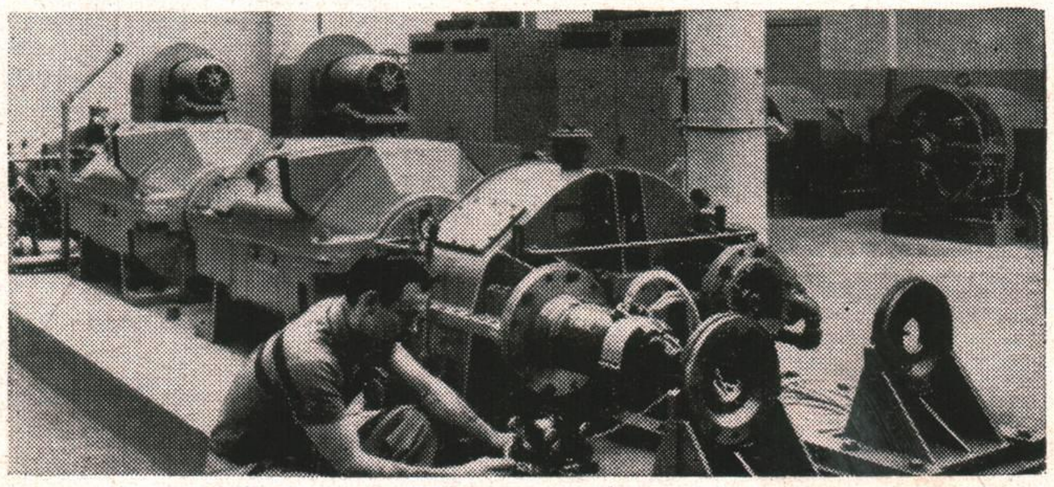
using Westinghouse alternator test stands

Take advantage of this Westinghouse ability to design, develop and install a guaranteed-performance unit for your production development programs for fuel pumps, alternators and complete electrical systems. Contact your Westinghouse sales engineer or write: Westinghouse Electric Corporation, P. O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

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Complete dual end d-c drive showing two of four AND pads with aircraft alternator being prepared for testing. Main motor generator sets and dual test-drive control in background. J-92007



PROBLEM:

DESIGN AN ECONOMICALLY SOUND HEAVY-CARGO HELICOPTER

That's the challenge which has been answered by Hiller's tip turbo helicopter concept.

The Hiller engineering and manufacturing team has spent almost a decade perfecting the tip driven helicopter concept. Design studies, economic analyses, and theoretical advances, backed by data from thousands of hours of tip jet helicopter flight tests, point to this inescapable fact: that to satisfy all major design criteria **tip power must be used . . . and turbojet engines must supply that power.**

The Hiller tip turbo concept guarantees the most sought after characteristic in 25,000 lb. gross weight and **up** configurations — a high payload-to-gross weight ratio. Because the need for heavy and complex gear trains has been eliminated, weight is drastically reduced and development and manufacturing costs are brought — for the first time — down to sensible levels.

Tip power precludes the need for engine torque compensation and associated large tail booms and drives. Tip-mounted engines permit new freedom in the design of fuselage and cargo space configurations. Turbojet engines provide the range and low fuel consumption rates needed to make tip power economical. And the engines are in effect weightless . . . they replace the blade tip weights needed to keep coning angles down.

The need for heavy cargo and crane helicopters is growing. Hiller technology is ready **now** with the practical solution.

HILLER
AIRCRAFT CORPORATION
PALO ALTO, CALIF. • WASHINGTON, D.C.
ADHESIVE ENGINEERING DIVISION, SAN CARLOS, CALIF.

structure. Left-hand and right-hand boxes are attached to fuselage sides by bolts located in the top and bottom caps of the main spar and by single bolts at the front and rear spars.

Detachable tip of the 30-in. span is fitted outboard of the outer aileron hinge rib. Aileron movement is 16 deg., up and down. Construction of the wing is of aluminum alloy formed parts, aluminum alloy skins and extrusions. Wing trailing edges are of honeycomb construction; main wing panels are chemically milled. Lower cap of the main spar is constructed from two separate extruded angles to preclude the possibility of fatigue cracks propagating across the complete spar cap section.

Wing vertical bending loads are carried by the main spar and top and bottom skin stringer panels and are transmitted to the fuselage by the main spar fittings. Vertical shear and torsion loads are carried by the torsion boxes formed by the spars and skin panels and transmitted to the fuselage through the main spar fitting. Drag shear moment is transmitted to the fuselage through the front and rear spar fittings.

Single-slotted flaps, maximum deflection 40 deg., extend from the inboard end of the aileron to the fuselage. Flaps are attached to the wing by three hinges, and actuated at the central hinge. Mechanical interconnection ensures synchronized deflection.

The tail group consists of a one-piece horizontal stabilizer, a two-piece elevator, vertical fin and rudder. Stabilizer is of stressed-skin box design comprising a forward and aft shear web, a center shear web in the inboard section, chemically milled skins and close spaced ribs. Spar caps consist of double light alloy angles, reinforced by aluminum alloy straps toward the root ends. Stabilizer is attached to the top of the fin by a two-bolt fitting on the center spar and a single bolt fitting at the center of the front spar.

Spin Tests

Initial Canadair design had horizontal stabilizer and elevators in normal position, but wind tunnel tests showed the airplane wouldn't spin. Moving the stabilizer midway up the vertical fin did produce a spin, but an inconsistent one. The company then chopped off the top of the cruciform, leaving the horizontal tail high, but this reduced directional stability. In the final configuration, in which the chord of the vertical fin was increased, tunnel tests indicated good directional stability and good consistent spin characteristics, AVIATION WEEK was told.

CL-41 elevator sections are all-metal, with a single spar and full-depth metal honeycomb sandwich material aft of the spar, reinforced by chordwise ribs near the hinge points. Elevator sections are interconnected by a torque tube and attached to the stabilizer by two hinges on each side. Elevator control movement is 25 deg. up, 13 deg. down. Balance tab and trim tab both move 10 deg. up, 30 deg. down.

The all-metal fin is of two-spar design with chordwise ribs, built in permanently to the rear fuselage. Rear spar caps are of multiple construction. Leading edge is attached to the fin box at the front spar; a portion is detachable for access to elevator controls. Two hinges provide for rudder attachment.

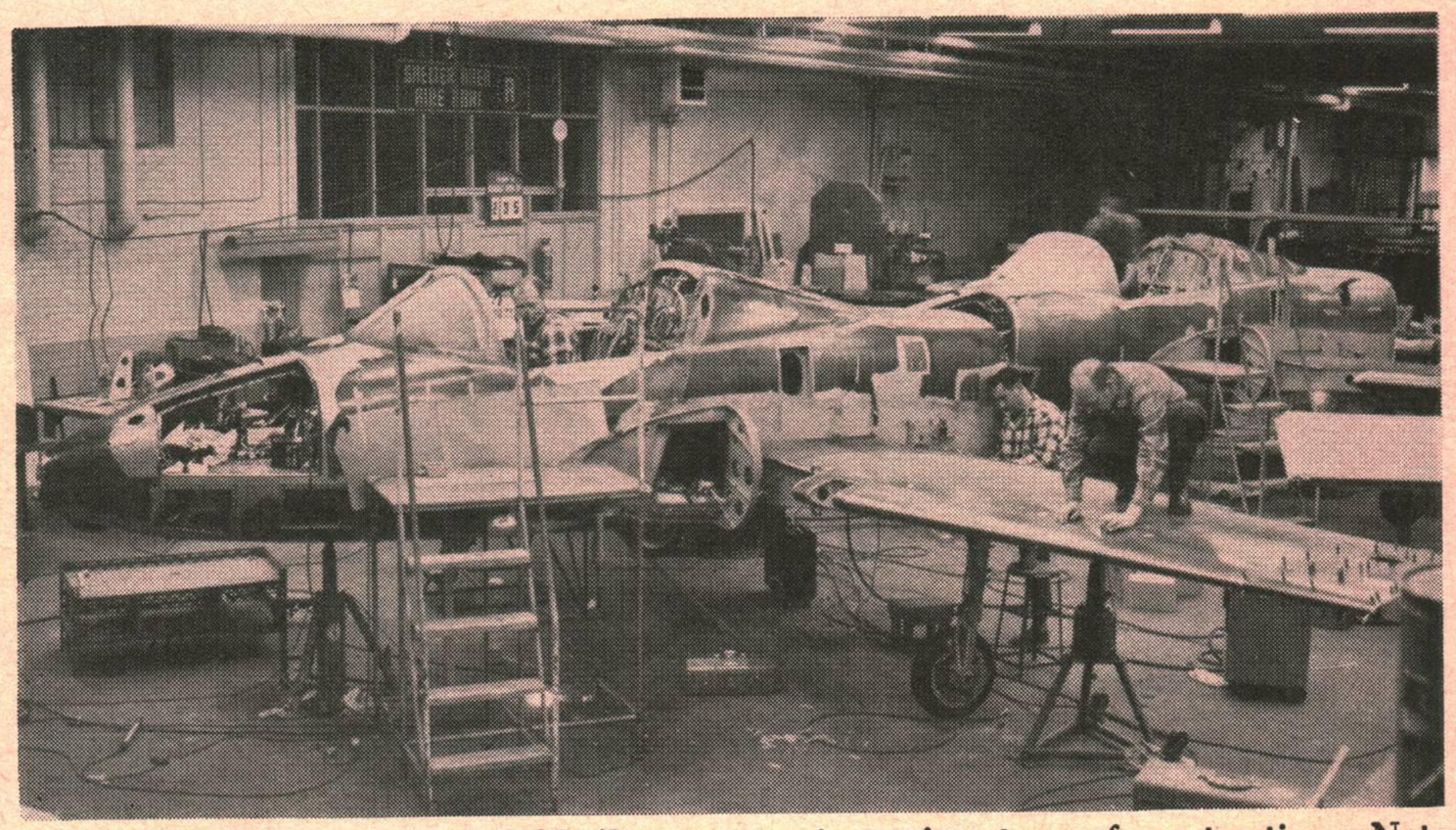
Rudder Construction

Rudder is of aluminum alloy construction with a single spar, stiffened panels and chordwise ribs. Rudder movement is 30 deg., left and right. A ground-adjustable tab is provided on rudder trailing-edge lower section, within easy reach of ground personnel.

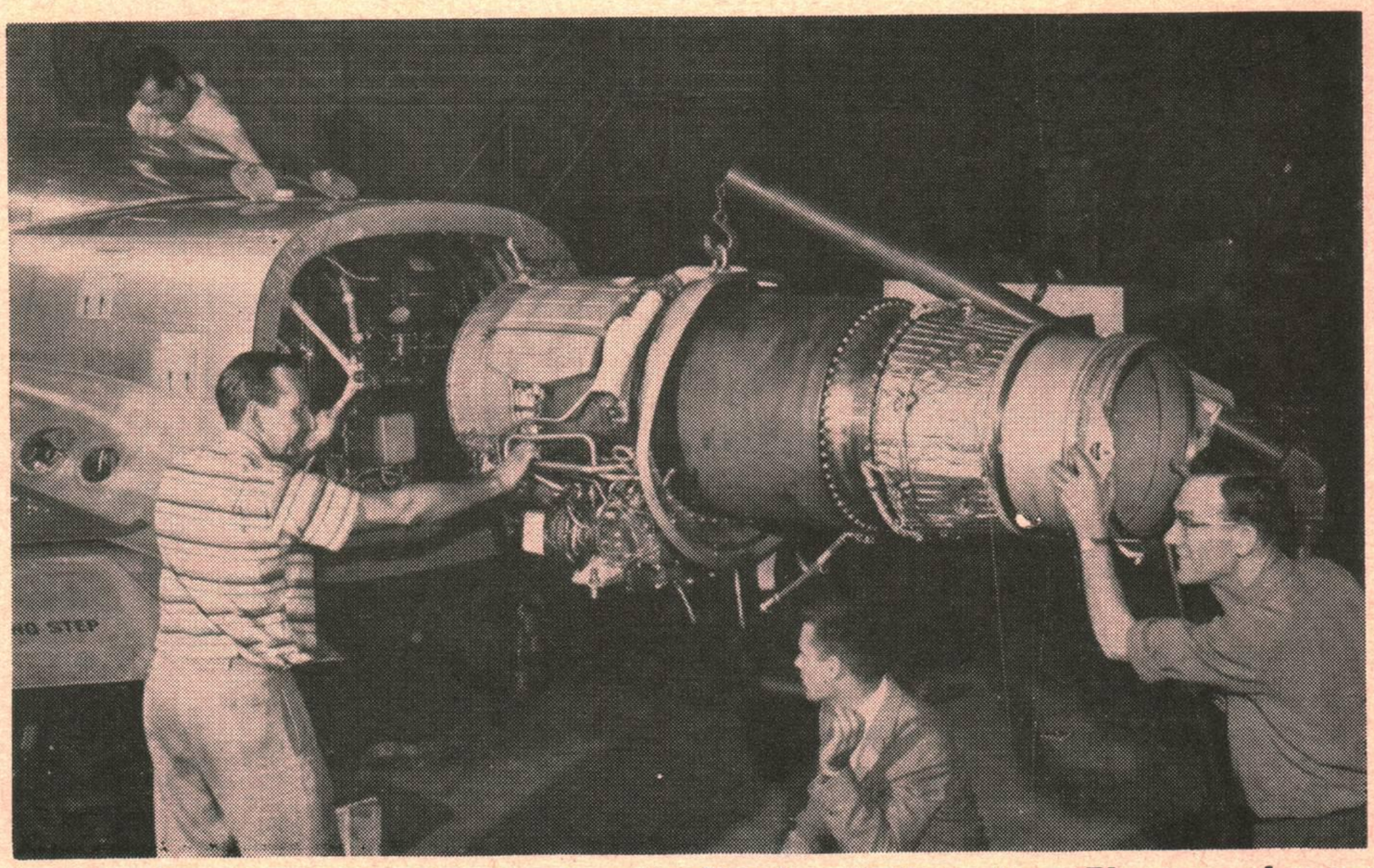
Landing gear also is similar to that of the Cessna T-37, with nose wheel derived from a design of Jarry Hydraulics, Montreal, for the Avro CF-105 (a combination nose wheel steering and shimmy dampener), but miniaturized. Main gear retracts inboard into the wing between the main and rear spars. Nose wheel retracts forward into the fuselage nose section.

Each main gear consists of an upper drag brace and cylinder assembly and a lower piston and axle assembly which carry vertical and drag loads. Nose gear consists of an upper drag brace and cylinder assembly; lower piston and fork assembly carries vertical and side loads. Torque links prevent relative rotation of the shock strut barrels except through the steering mechanism. The nose wheel rotates, with rudder pedal pressure, up to 45 deg. from neutral, corresponding to a turning circle of 37-ft. diameter.

The airplane is equipped with dual controls. Primary flight control systems



PRODUCTION view shows two CL-41 prototypes in varying stages of construction. Note large-size inspection panels and radio access door in nose section.



TECHNICIANS install Pratt & Whitney JTC12A-2 turbojet engine. Plane can also use Armstrong Siddeley Viper, General Electric J85 and Rolls-Royce RB.145 engines.



Johns-Manville Announces... MIN-K LAD INTERLOK

. . . a new structural system interlocking Min-K insulation and high-temperature reinforced plastic

Missile experience shows that in certain heat control situations no one material will perform as well as two (or more)—*an insulation with protective high-temperature facings.*

Problem is how to effectively combine these materials into a structurally strong unit? The answer is Min-Klad Interlok—a new structural system that interlocks Min-K insulation and reinforced plastic, metal or other high-temperature facings.

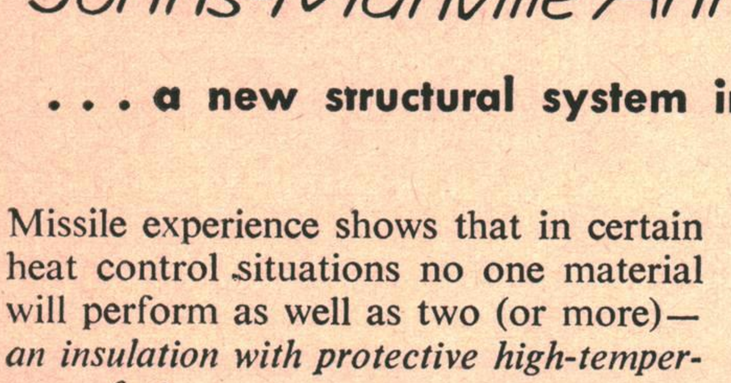
The result: one product that gives the missile designer every advantage of high-temperature plastic or metal foil—strength, toughness, rigidity! Erosion resistance! High heat capacity!

. . . plus the outstanding advantages of Min-K insulation—an insulating core that has the lowest thermal conductivity available for service temperatures up to 2000°F steady-state, and higher for transients. Min-K's thermal conductivity is actually lower than the molecular conductivity of still air.

Wide range of facings

For the hot face, the missile designer can specify Min-Klad Interlok in a wide variety of heat-resistant and/or ablating materials—asbestos-phenolic (ARP-40), and similar reinforced plastics, as well as stainless steel and other heat-resistant metal foils and meshes. For some requirements, the cool face can be made of a different material—for example, one that offers characteristics required for bonding or fastening to other surfaces and parts.

Like all J-M Aviation insulations, Min-Klad Interlok is factory-fabricated to your specifications into external skin panels, heat shields, cylindrical liners or component housings of any shape or size. Write today for technical specifications. Address Johns-Manville, Box 14, New York 16, New York. In Canada, Port Credit, Ontario.



1) Outer facing, 2) Interlocking web, 3) Core, any one of several Min-K formulations, and 4) Inner facing.



All the above components combine to provide a custom-made structural strong insulating system.

JOHNS-MANVILLE JOHNS-MANVILLE JM PRODUCTS

are push-pull or torque tube type. Control sticks are fitted with USAF B8-A type hand grips, incorporating trim and nose-wheel steering operating switches. Pedals are adjustable, with 7-in. travel.

The single turbojet engine is installed in the fuselage center section, aft of the wing main attachment structure. Left and right hand engine air intake duct, with air entry forward of the wing root leading edge, passes into the fuselage immediately aft of the cockpit rear pressure bulkhead and join to form a single air intake duct immediately forward of the engine. The tailpipe is contained within the rear fuselage section.

Engine Supports

The engine is supported at the main trunnions by a tripod structure attached to the main fuselage frames. An auxiliary vertical support is provided near the engine intake face. Mounting provides for angular and fore and aft adjustment. Firewalls isolate engine compressor and accessories section from the fuel tank compartment and from the hot section of the engine.

Five rubberized fabric "crash resistant" fuel cells, interconnected to provide single tank operation, hold a total of 270 gal. of fuel. One cell is installed in the fuselage immediately aft of the cockpit rear pressure bulkhead; two are installed in the fuselage between the wing front spar and the main spar frames; two are installed, one at each side of the fuselage, immediately behind the wing main spar frame. The collector tank sits in the lower section of the fuselage between the center cells. One "negative g" boost pump ensures uninterrupted fuel flow, including inverted flight for a period of not less than 15 sec.

Refueling is accomplished from the wing walkway without the use of a ground stand. Flush type gravity filler assembly, with provisions for draining off spilled fuel, is provided on the left-hand side of the CL-41, about 2 ft. aft of the cockpit. The system accepts a minimum refueling rate of 60 gal. per min.

Flight Instruments

Flight instruments provided with the CL-41A include gyro-magnetic heading indicator (with ADF and Tacan pointers); Tacan distance measuring indicator; altimeter, airspeed, attitude, rate of climb, turn and bank indicators; accelerometer, Machmeter and clock. Dual instrument includes the heading indicator, and altimeter, airspeed, attitude, rate of climb and turn and bank indicators.

The CL-41 uses a closed-circuit constant pressure hydraulic system with a nominal operating pressure of 1,500 psi.

The system operates these subsystems: landing gear and doors, wing flaps, speed brakes, intake screens, nose-wheel steering. An independent unboosted system operates the wheel brakes.

The airplane is equipped with a 28-v.d.c. and a 115-v. 400-cycle a.c. electrical system. Primary power system comprises a main bus, powered by the generator or a ground energizer, a battery bus powered by the battery (24-v., 36 amp.-hr.), and an emergency bus powered either by generator or ground energizer normally and by battery under emergency conditions.

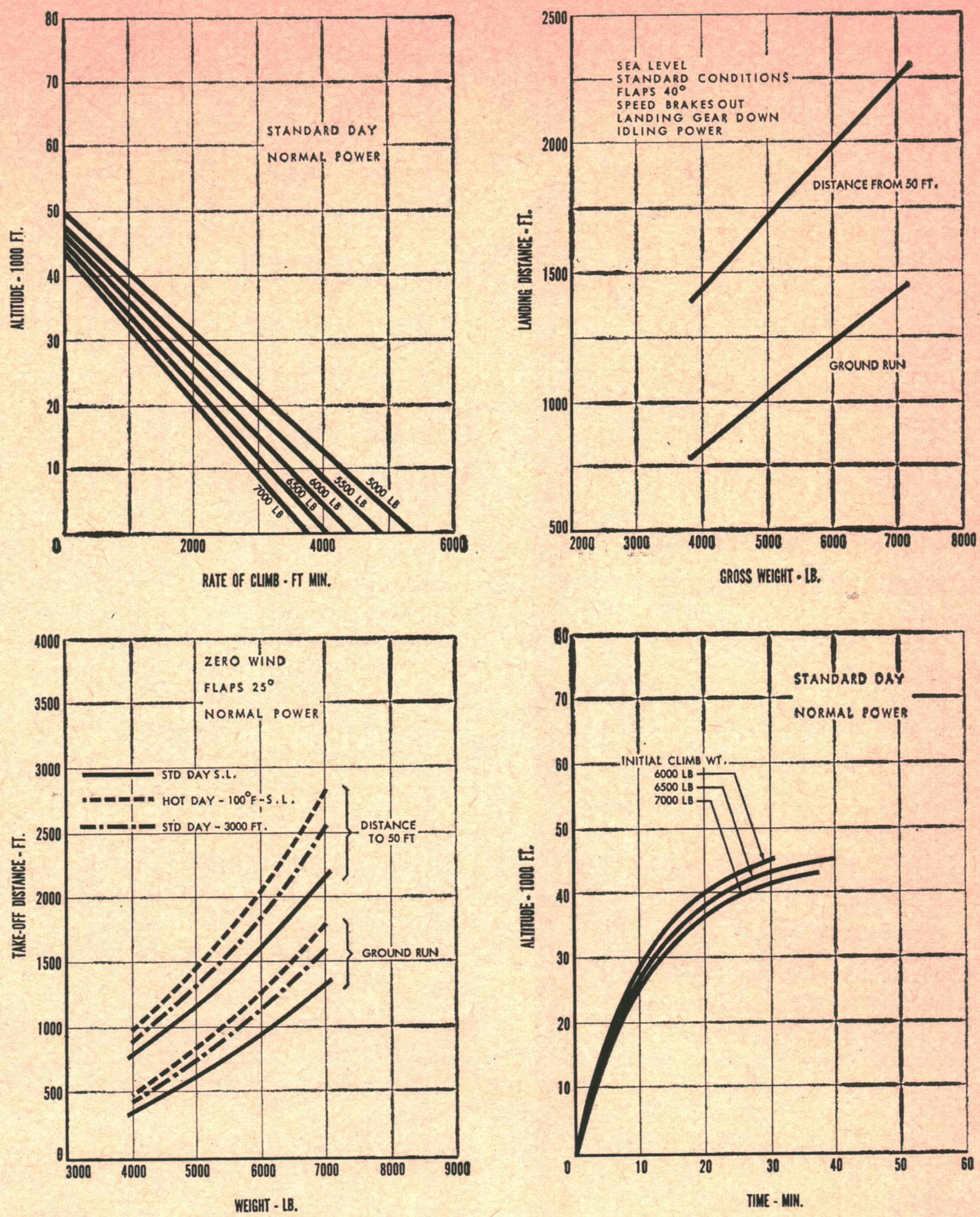
Two 250-watt fixed landing lights are installed in transparent portions of the wing leading edge. One 150-watt fixed taxi light is installed in the fuselage nose. An amber 32-candlepower light sits in the transparent nose cone, indicating to a ground observer when the landing gear is down and locked. External power receptacle is installed on the right side of aircraft, above the trailing edge section of the wing. Cockpit seats are adjustable over a 5-in. vertical range and are designed for back-type parachutes.

Cockpit air conditioning system is supplied by air from the engine compressor. A turbofan cooling unit is positioned in the forward part of the first engine zone.

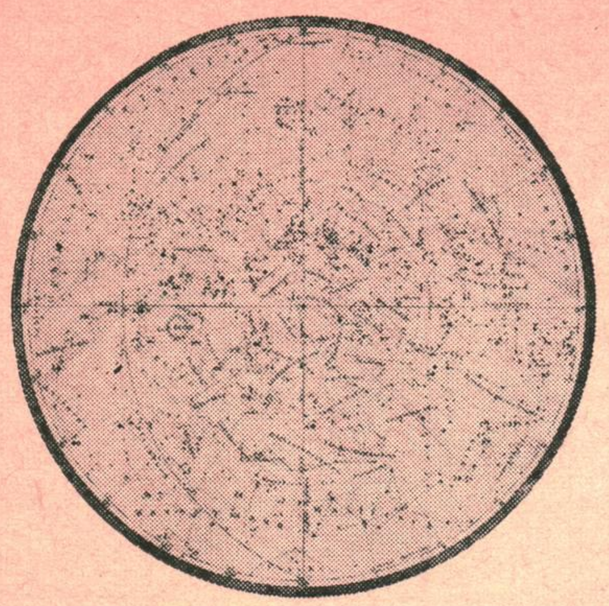
Cooling System

Bleed air is cooled by an expansion turbine and via ambient air drawn through a heat exchanger by the fan portion of the cooling unit. Cockpit temperature is limited to a maximum of 200F (93C). Ram air outlets provide unpressurized ventilation air in event of air-conditioning system malfunction.

Cockpit is not pressurized from sea level to 8,000 ft. Beyond this altitude cockpit pressure is maintained until a maximum cockpit to ambient differential pressure of 3 psi. shall be reached, which is maintained to a service ceil-



PERFORMANCE charts detail rate of climb (top left); landing distances (top right); takeoff distances (lower left) and time to climb (lower right).



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Santa Monica, Calif.

ing of 44,500 ft. Air pressure is controlled through a pressure regulator and limited by a relief valve in the forward pressure bulkhead.

Pitot-static system is electrically anti-iced. Windshield and forward 18 in. of the canopy can be de-misted and defrosted internally by air tapped from the air conditioning system and controlled to a temperature of 250F (121C). A manually operated switch controls supply of anti-icing warm air to the engine air intake.

USAF Studies T-38 Maintenance Time

Los Angeles—Study by U.S. Air Force has disclosed that the Northrop T-38 Talon supersonic trainer will require less than 14½ hr. of maintenance for each flying hour, Northrop Corp.'s Norair Division reports. Air Training Command is scheduling 14.3 maintenance hours per flying hour, and the figure is expected to diminish further once ATC maintenance crews become familiar with the airplane.

In view of this study, Northrop expects its N-156F fighter, sister ship to the Talon, to have maintenance time close to the predicted 21.5 hr.

The maintenance study was based on three factors:

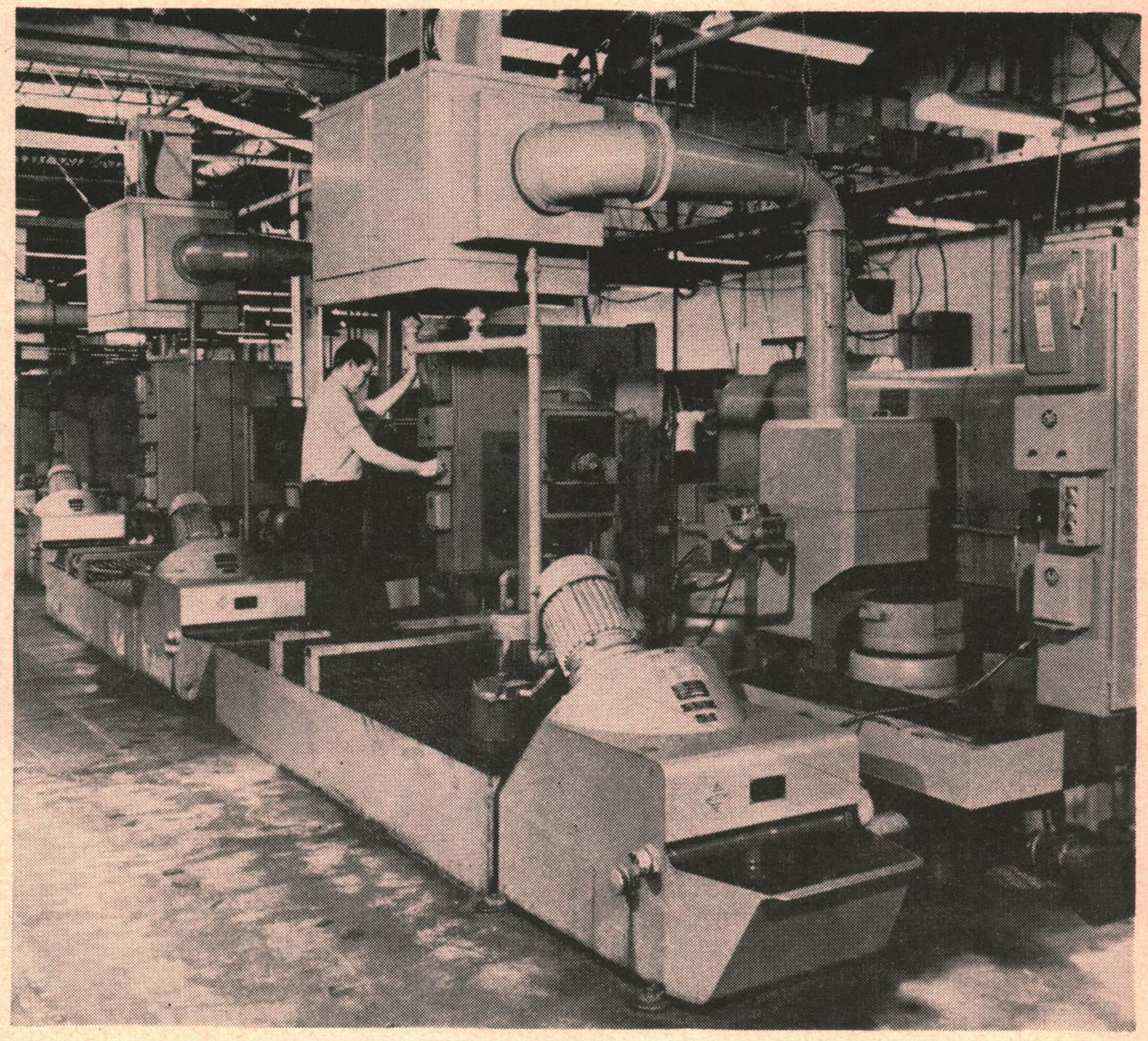
- **Experience** with the Lockheed T-33 trainer.
- **Familiarity** with twin-engined aircraft
- **Experience** in introduction of new aircraft in existing squadrons.

ATC program scheduled 60 flying hours per month for each Talon. Comparison between T-38 and T-33 performance shows that the Talon requires approximately 3½ hr. more maintenance than the single-engined T-33.

Northrop presently is conducting a flight test program at Edwards AFB, Calif., with the T-38 and has logged about 100 hr. since airplane's first flight. The N-156 is undergoing a simultaneous flight test program at Edwards.

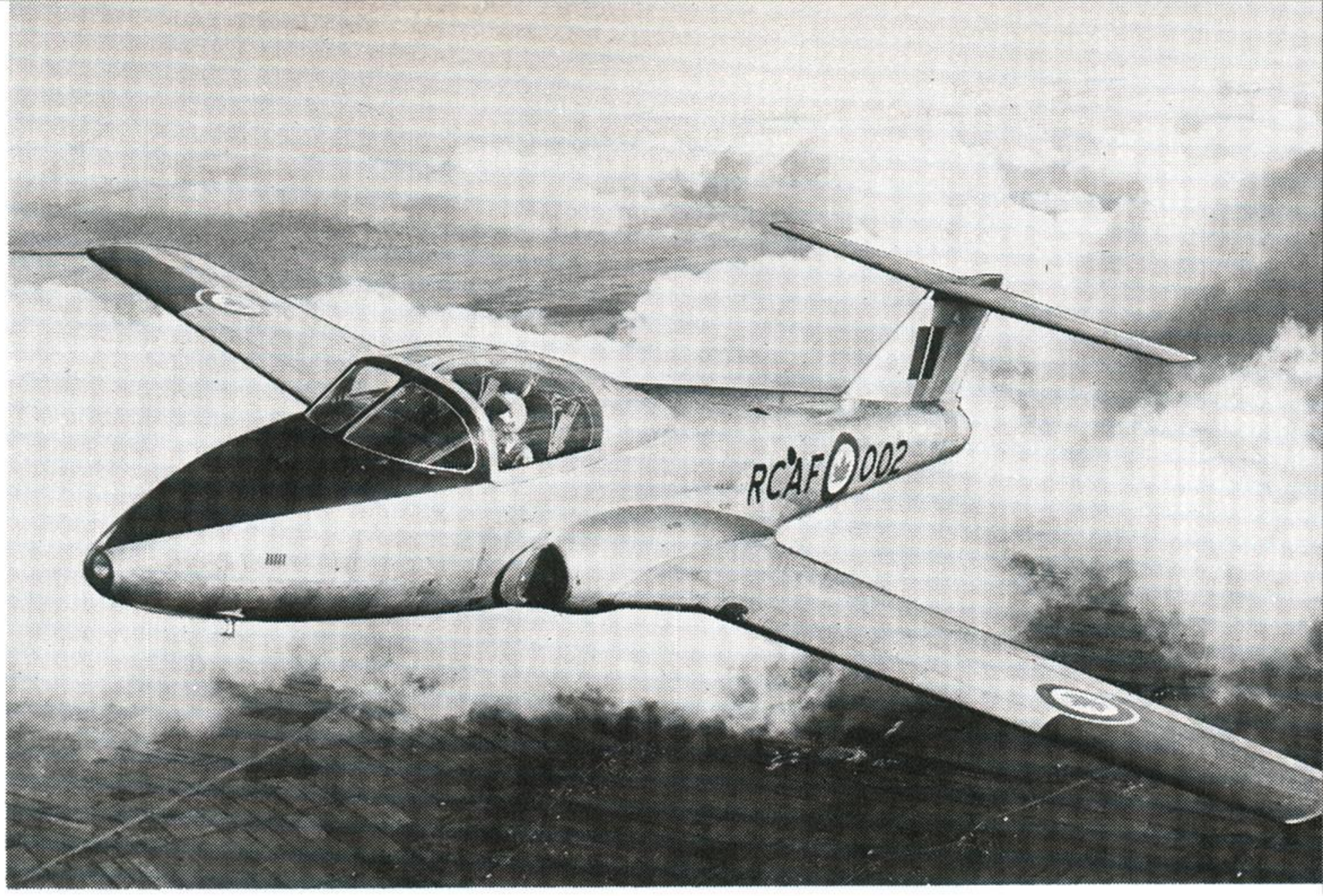
P&W Orders Blade Moment Balances

Dynametrics Corp. of Burlington, Mass., will design, develop and manufacture four blade moment balances for Pratt & Whitney Division of United Aircraft Corp. under a $55,000 contract. Instruments will be used to evaluate jet engine turbine blades. As each jet engine turbine blade is inserted into a blade-holding fixture, the instrument sets an automatic counter corresponding to the measured moment and stamps an appropriate code on the blade.



Lycoming Installs Coolant Clarifier

High capacity centrifugal coolant clarifier for use in grinding turbine blades for turbojet engines has been installed at Avco Corp.'s Lycoming Division, Poughkeepsie, N. Y. Clarifier is built by De Laval Separator Co. and is called "Turbomatic." Major advantage, Lycoming says, is in elimination of scratches from abrasives in coolant.



CL.41 Trainer: Canadian designed and built, it means work for many in this country

AVIATION EQUIPMENT

Never Say Die

Aviation Equipment's Joe Lehman doesn't give up easily. For nearly two years he has been bending every effort to get the General Electric J85/CJ610 Jet Engine specified for Canadair's new CL41 trainer plane.

Day and night he and his associates have lived with this marketing project; and even when the first prototypes were already flying with a competitor's engine he didn't give in. He almost maintained a shuttle service between Boston and Montreal, where the negotiations were taking place.

This month, all those who worked on the project (including President Smith) had the satisfaction of seeing their efforts pay off. Some 190 of Canadair's revolutionary new type trainer planes are being ordered by the RCAF for delivery starting in the summer of 1963. They will be powered by GE-J85/CJ610 Jet Engines made in Canada under a licensing agreement arranged through CGE. The engine contract is a multi-million dollar order.

Rugged and versatile, the single-engine CL41 is the only plane of its kind in service today. Instructor and student sit side by side, an arrangement that allows pilots to start out their flying instruction on jets and stay with jets right through their training (instead of starting off on propeller planes as now).

This GE engine is in the 3,000 pound thrust class and has a proven history behind it. It is smaller and lighter than that offered by competition. Yet it has the highest thrust-to-weight ratio of any engine in production today. Furthermore, it can be made in Canada as part of a firm production program by a company already highly experienced in the field. These favourable points, along with many others, were continually hammered home by our Aviation Equipment people in their presentations.

The plane itself will be made at Canadair in Montreal and the engine at Orenda Ltd., near Toronto. CGE plants may also be taking part: such as fuel control equipment from Peterborough, thermocouples from Ward St., electronics from Royce.

Because of its many advantages, the plane has a large export potential. Interest has already been stirred up in Sweden, West Germany, Australia, New Zealand and South Africa. This could swell the order to many times its present size, and mean even greater employment for Canadian factories.



Mr. DeMarco, Salesman Lee: and a contract that means better living for more people

CUSTOMER RELATIONS

Solid in Ajax

As "Progress" went to press, TDO's Marsh Lee (RMDO Sales) was reporting progress of a different kind. He had just signed up the V.V. DeMarco Properties Ltd. for 400 Bronze Medallion homes, the first phase of a major development at Southwood near Ajax, Ontario (25 miles east of Toronto).

All of these homes will have 100 amp service and will be using CGE materials exclusively, including wiring devices, lighting, wire and cable, entrance panels and a number of "extras" such as door chimes. Each home will include a CGE built-in range.

DeMarco Properties are planning on an eventual 3,000 homes to serve this growing industrial community. About a thousand people a day go into Ajax to work. Furthermore, Southwood will be very handy for those working at General Motors in nearby Oshawa.

The homes will include the most modern concepts of interior decoration and living facilities. All five model homes will be completely equipped with our major appliances, Tv and Hi-Fi.

Jet Age Service

Last year's move to combine Western Ontario District and Toronto District brought many headaches for Wholesale Department. High on the list was customer service; obviously, the new setup had to be one that would bring a minimum of disruption to our customers.

Customers felt that way too. Previously, they were ordering their workaday needs from the CGE sales office at London, Windsor, Hamilton, Sarnia and so on. Any item that was out of stock locally could usually be obtained from Hamilton Warehouse in a couple of days or so. Under the new setup, they would be serviced from Toronto, in some cases more than 200 miles away.

Ontario District's answer to the problem has been "overnight shipment", a

the engines are in the right place



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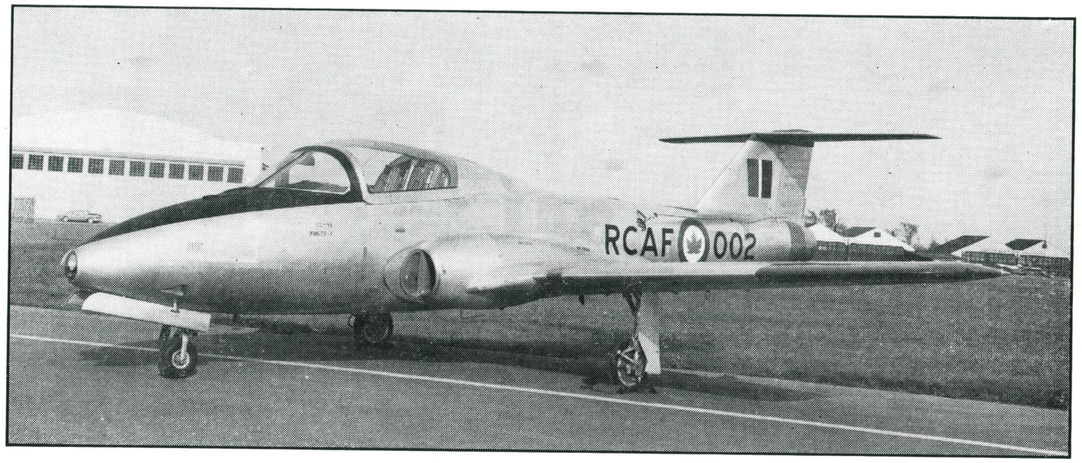
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TGA AT 640



CL-41

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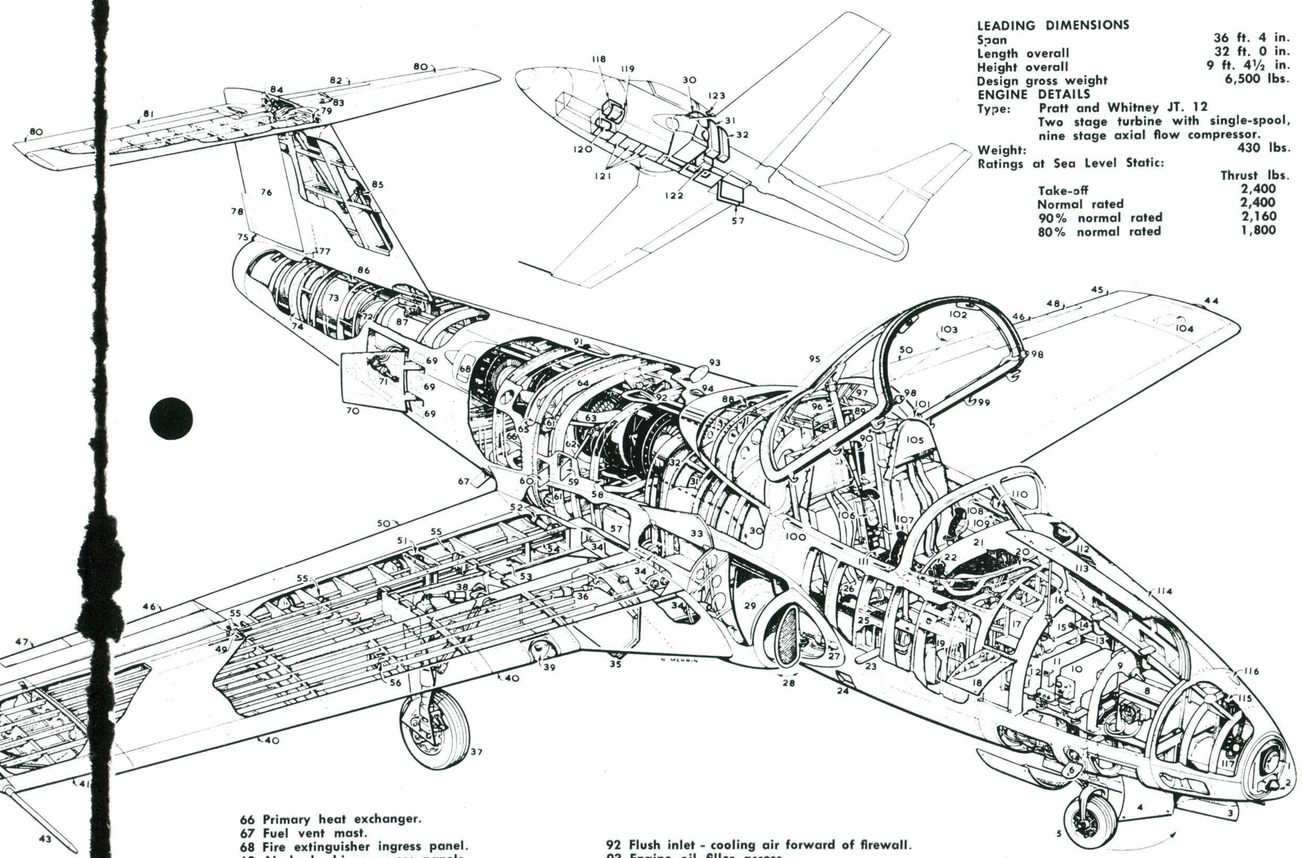
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2 Ground observer light.
3 Nose wheel doors.
4 Access to D.C. relay panel and battery drain.
5 Forward retracting, steerable nose wheel.
6 Liquid oxygen filler.
7 Liquid oxygen converter.
8 24 volt, 36 ampere/hour battery.
9 Electrical main distribution panel.
10 17L - 7 type V.H.F. transmitter.
11 51X - 2 type V.H.F. receiver.
12 51Y - 1 type V.H.F. receiver.
13 Gyro control unit.
14 Gyrosyn amplifier type A2.
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25 R. H. Console electrical controls.
26 Utility cockpit light.
27 Debris screen actuator.
28 Air intake debris screen - operated by 27 in conjunction with undercarriage.
29 Air intake.
30 Forward fuel cell.
31 Centre fuel cells.
32 Rear fuel cells.
33 Personal baggage stowage access - each side.
34 Wing to fuselage attachment points.
35 Main landing gear door - closed when undercarriage locked down.
36 Main landing gear door actuator.
37 Main landing gear - Goodyear brakes.
38 Main landing gear actuator.
39 Landing light - one each wing.
40 Detachable leading edge panels.
41 Detachable wing tip.
42 Tip access panel.
43 Pitot/static tube.
44 Wing navigation lights.
45 Ailerons.
46 Aileron spring tabs - solid honeycomb construction.
47 Aileron trim tab - R.H. ground adjusted.
48 Aileron trim tab - L.H. electrically operated.
49 Aileron shroud access panel.
50 Single slotted flaps - honeycomb panels.
51 Flap actuator.
52 Flap interconnect actuator.
53 Flap shroud access panels.
54 Aileron control and interconnect rods.
55 Aileron control rod bell cranks and idlers.
56 Attachment point for external stores.
57 Engine access doors.
58 Pressure differential regular/shut-off valve.
59 Jet start external power receptacle.
60 Ground power receptacle.
61 Engine bearing strut hinge points.
62 Engine bearing struts.
63 Compressor bleed duct.
64 Fuselage break - detach rear fuselage for engine removal.
65 Aft firewall.



66 Primary heat exchanger.
67 Fuel vent mast.
68 Fire extinguisher ingress panel.
69 Air brake hinge access panels.
70 Air brake.
71 Air brake actuator.
72 Tail pipe support ring.
73 Tail pipe.
74 Vertical stabilizer attachment bulkheads.
75 Tail navigation light.
76 Rudder.
77 Rudder bottom hinge.
78 Rudder bend tab.
79 Horizontal stabilizer attachment points.
80 Elevators - solid honeycomb construction.
81 Elevator gear tab - starboard only.
82 Elevator trim tab.
83 Elevator trim tab actuator - port only.
84 Elevator control lever.
85 Elevator controls.
86 Rudder controls.
87 Elevator/rudder control rod idlers.
88 Elevator/rudder control rod levers.
89 Elevator/rudder control rod bellcranks.
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91 Flush inlet - cooling air aft of firewall.
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93 Engine oil filler access.
94 Upper position light.
95 Electrically operated, jettisonable canopy.
96 Canopy actuating and jettison mechanism.
97 Canopy hinges.
98 Canopy de-mist disconnect points.
99 Canopy latching hooks - engaging with rollers at location 100 when canopy closed.
100 Canopy roller slots.
101 Canopy seal disconnect.
102 Rear view mirrors.
103 Sense antenna.
104 Flux valve access.
105 Ejection seats.
106 Fire extinguisher.
107 Control columns.
108 Cabin air distribution.
109 Canopy manual operation - accessible from outside.
110 Magnetic stand-by compass.
111 Centre console - electrical/radio controls.
112 Windshield de-frost - hot air outlets from heat and vent system.
113 Electrical/radio compartment access door.
114 Nose stowage access door.
115 Brake fluid reservoir and pressure transmitter.
116 Brake fluid reservoir access.
117 Nose wheel steering selector valve.
118 Secondary heat exchanger.
119 Secondary heat exchanger access.
120 Cooling turbine.
121 Underside access panels, facilitating easy access to flying controls, hydraulic and electrical lines and heat and vent ducting carried in unpressurized tunnel under cockpit floor.
122 Fuel collector tank, incorporating negative "g" boost pump. Fuel is contained in five interconnected cells 30, 31, & 32. Total usable fuel capacity - 250 Imperial gallons.
123 Fuel filler access.

LEADING DIMENSIONS

Span	36 ft. 4 in.
Length overall	32 ft. 0 in.
Height overall	9 ft. 4½ in.
Design gross weight	6,500 lbs.

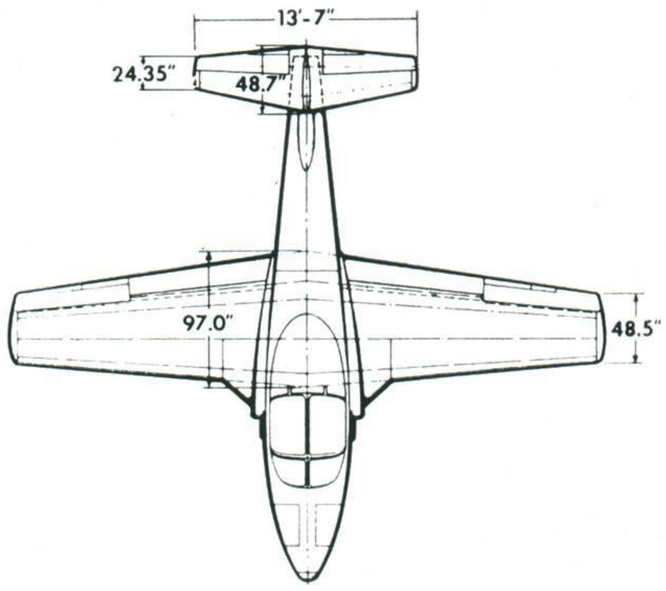
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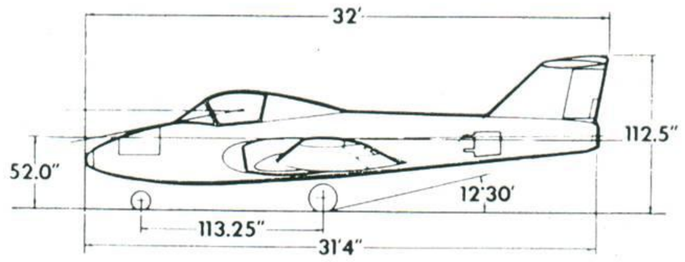
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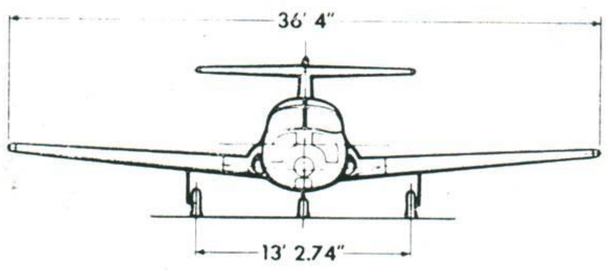
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Ratings at Sea Level Static:

	Thrust lbs.
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An interesting design aspect of the CL-41 is the "T" tail. Canadair says that for trainer aircraft this is a desirable feature because the fin is not blanketed by the tailplane during violent aerobatic maneuvers and the rudder is particularly effective for spin recovery.

Exhaustive spinning model tests have shown that the CL-41 design satisfies both the British (RAE) and the U.S. (NASA) design spinning criteria. Particular attention has been given in the aerodynamic design to ensure that spin recovery will be quick and straight forward.

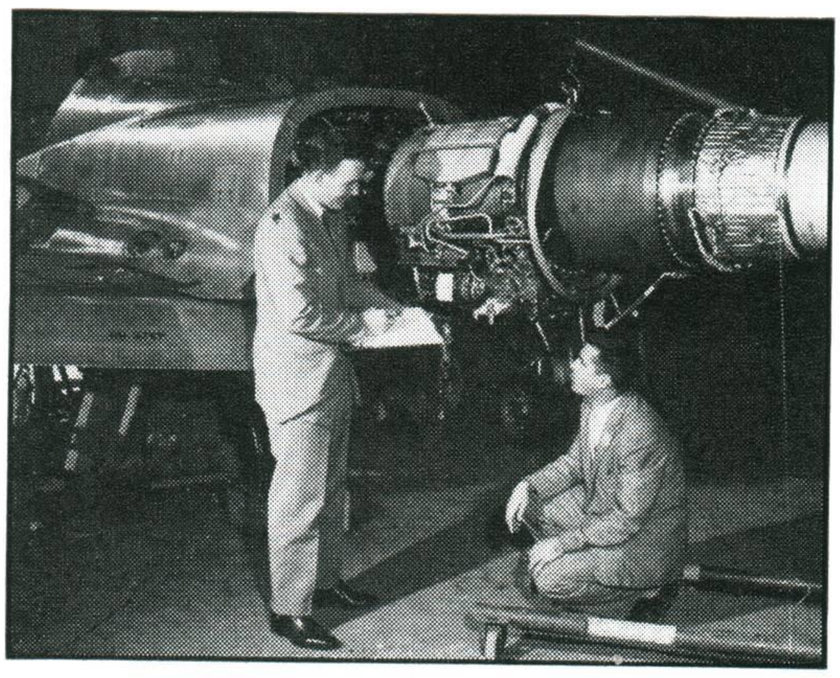
Internal Fuel: In many aircraft the distribution of fuel in the wings results in marginal spin and recovery characteristics because of the high rolling and yawing inertia and problems of fuel asymmetry to be overcome. The CL-41 carries all its fuel near the centre of gravity in crash-resistant fuselage cells functioning as a single tank which avoids these undesirable effects.

The ability to store all internal fuel within the fuselage, thus enabling the foregoing desirable side effects, is made possible by the very roomy fuselage resulting from the side-by-side seating. This same roominess also make possible the installation without structural modification of any of three optional engines (Armstrong Siddeley Viper, 2460 lb. th.; GE J-85, 2500 lb. th.; Rolls-Royce RB.145, 2750 lb. th.)

Safety features in the CL-41 include ejection seats (Weber in the prototypes, same as used in the Cessna T-37); a limit speed of 175 kt. for operation of undercarriage and flaps; air intake debris guards hydraulically operated and extended when the undercarriage is down; a bird-proof windshield; an "enunciator panel" in the centre of the instruments with flashing lights to warn of fire, electrical failure, overheating or similar dangers; manually operated flying controls; inherently good ditching characteristics; a structure with two underfloor longitudinal skid beams designed for a vertical load of 8G; cockpit region stressed to take crash accelerations of 32G.

Flight Time: At time of writing, the first flight of the CL-41 was scheduled to take place towards the end of this month. Ground run tests had been completed with an engine cleared only for that purpose. Since then engines cleared for flight had been delivered by Canadian Pratt & Whitney (which is loaning the powerplants for the prototoypes to Canadair) and installation was proceeding.

Obviously, the RCAF is Canadair's prime prospect as a customer for the CL-41, but the company is also looking abroad. Since the airplane is an original design and a private venture, Canadair is in a position to sell license rights anywhere in the world. Basic price on Canadair-produced airframes complete with basic instrumentation and radio and navigation equipment, less engine, will be approximately $160,000. The complete airplane ready to fly away will be in the $195,000-$200,000 range. Depending on customer requirements and desires, a "de luxe" version, the CL-41A, and a more spartan economy model, the CL-41B, will be available. The first prototype is fitted out to represent the first and the second prototype answers the description of the latter.



CL-41 fuselage breaks at wing trailing edge to permit engine installation or removal. Engine shown here is a ground run version.

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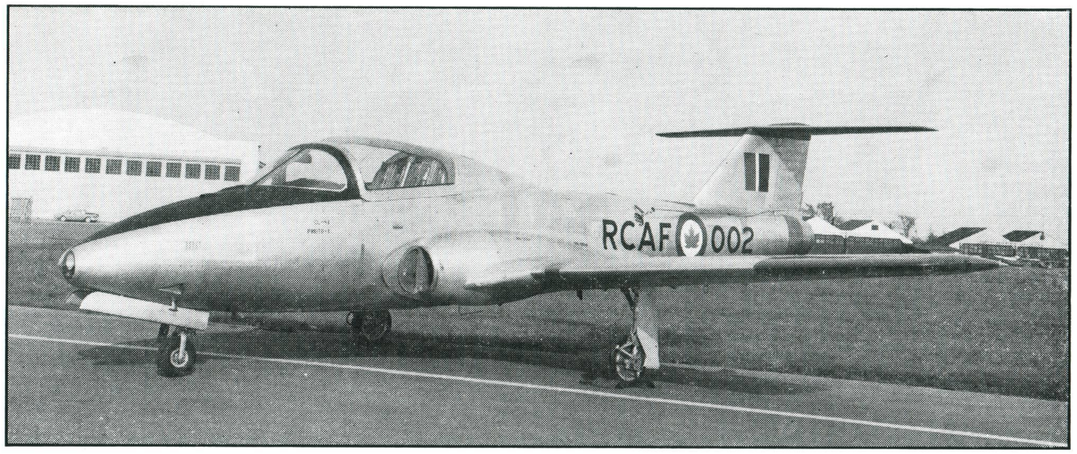
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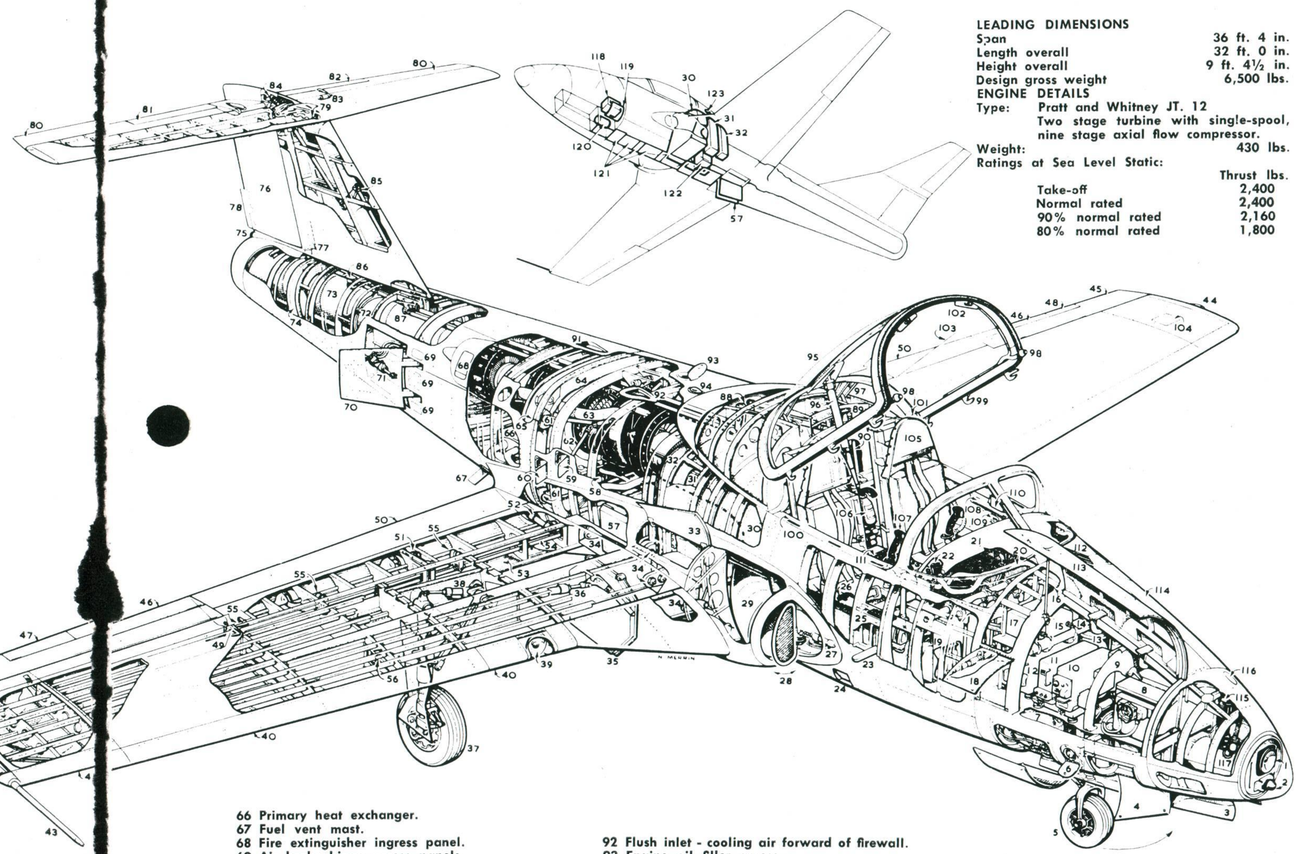
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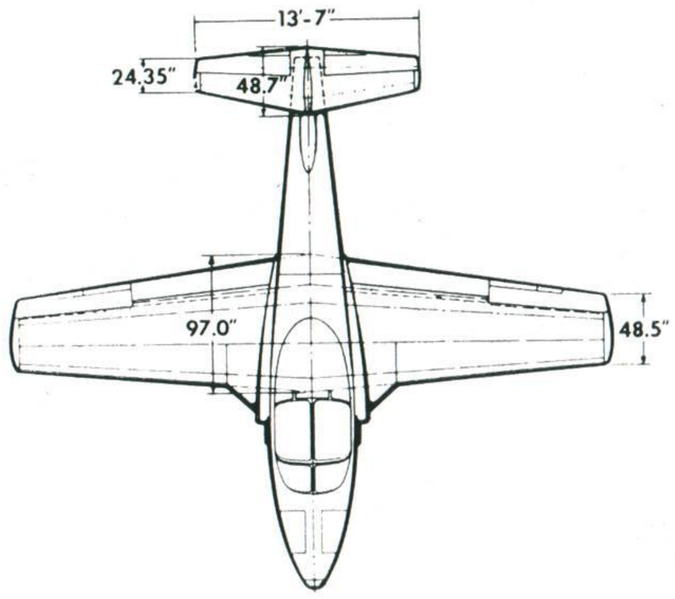
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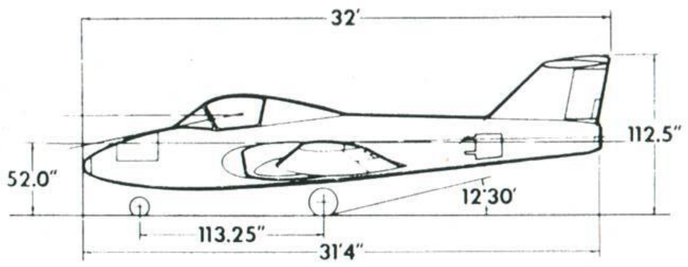
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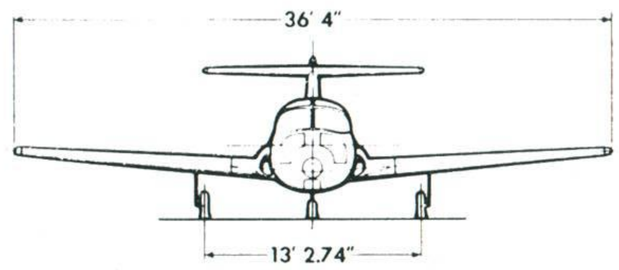
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Automatic pressurization and air conditioning is provided. Instructor and student can fly for extended periods at heights up to 18,000 ft. without using oxygen and up to 38,000 ft. (cabin altitude 23,000 ft.) with oxygen.

An interesting design aspect of the CL-41 is the "T" tail. Canadair says that for trainer aircraft this is a desirable feature because the fin is not blanketed by the tailplane during violent aerobatic maneuvers and the rudder is particularly effective for spin recovery.

Exhaustive spinning model tests have shown that the CL-41 design satisfies both the British (RAE) and the U.S. (NASA) design spinning criteria. Particular attention has been given in the aerodynamic design to ensure that spin recovery will be quick and straight forward.

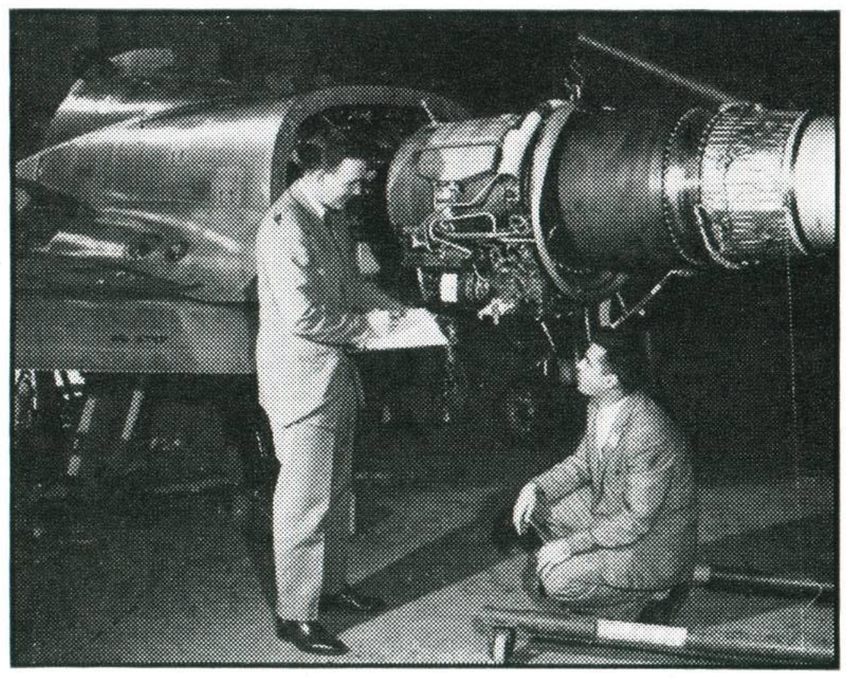
Internal Fuel: In many aircraft the distribution of fuel in the wings results in marginal spin and recovery characteristics because of the high rolling and yawing inertia and problems of fuel asymmetry to be overcome. The CL-41 carries all its fuel near the centre of gravity in crash-resistant fuselage cells functioning as a single tank which avoids these undesirable effects.

The ability to store all internal fuel within the fuselage, thus enabling the foregoing desirable side effects, is made possible by the very roomy fuselage resulting from the side-by-side seating. This same roominess also make possible the installation without structural modification of any of three optional engines (Armstrong Siddeley Viper, 2460 lb. th.; GE J-85, 2500 lb. th.; Rolls-Royce RB.145, 2750 lb. th.)

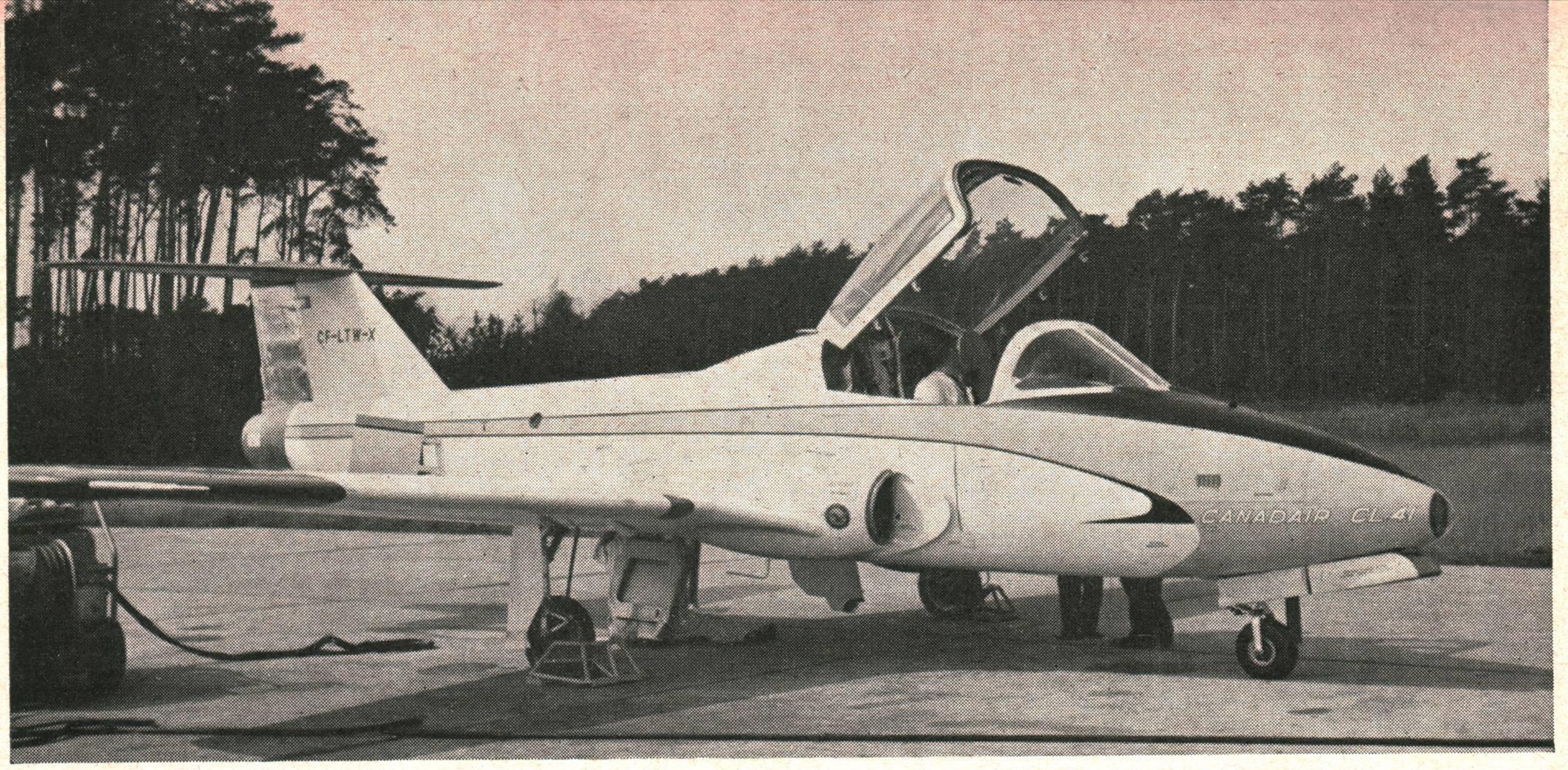
Safety features in the CL-41 include ejection seats (Weber in the prototypes, same as used in the Cessna T-37); a limit speed of 175 kt. for operation of undercarriage and flaps; air intake debris guards hydraulically operated and extended when the undercarriage is down; a bird-proof windshield; an "enunciator panel" in the centre of the instruments with flashing lights to warn of fire, electrical failure, overheating or similar dangers; manually operated flying controls; inherently good ditching characteristics; a structure with two underfloor longitudinal skid beams designed for a vertical load of 8G; cockpit region stressed to take crash accelerations of 32G.

Flight Time: At time of writing, the first flight of the CL-41 was scheduled to take place towards the end of this month. Ground run tests had been completed with an engine cleared only for that purpose. Since then engines cleared for flight had been delivered by Canadian Pratt & Whitney (which is loaning the powerplants for the prototoypes to Canadair) and installation was proceeding.

Obviously, the RCAF is Canadair's prime prospect as a customer for the CL-41, but the company is also looking abroad. Since the airplane is an original design and a private venture, Canadair is in a position to sell license rights anywhere in the world. Basic price on Canadair-produced airframes complete with basic instrumentation and radio and navigation equipment, less engine, will be approximately $160,000. The complete airplane ready to fly away will be in the $195,000-$200,000 range. Depending on customer requirements and desires, a "de luxe" version, the CL-41A, and a more spartan economy model, the CL-41B, will be available. The first prototype is fitted out to represent the first and the second prototype answers the description of the latter.



CL-41 fuselage breaks at wing trailing edge to permit engine installation or removal. Engine shown here is a ground run version.



Photograph copyright "The Aeroplane and Astronautics"

Flying the Canadair Trainer

No. 104 in the Series by John Fricker

CANADAIR'S CL-41 is a new attempt to provide an "all-through" jet trainer, and, from the recent interest displayed by the R.C.A.F., one which seems likely to meet the challenge of this difficult specification with rather more success than its predecessors. Although laid down and designed in close collaboration with the R.C.A.F., the CL-41 is entirely a Canadair private venture, aimed at a wider market than merely national requirements. The European section of this market is currently being more intensively explored by the prototype CL-41, which is visiting Sweden, Germany, the Netherlands, Belgium and Switzerland, after teams from these and other countries had been to Canada for a preliminary evaluation.

Since its first flight on Jan. 13, 1960, the CL-41 has completed well over 200 hours in the air, in the hands of 60 or so pilots from many different countries. Its flight development has been achieved with an almost complete lack of modification and an unusually high degree of serviceability.

An R.C.A.F. evaluation team was able to take over after it had completed only 20 hours' flying, and put in a further 12 hours within four days. After that, it seemed to be a question not of whether the R.C.A.F. would have the CL-41, but rather a case of when and how many.

The answer seems to be: soon, and a couple of hundred to start with, probably including some of the advanced CL-41R version, carrying the electronics of the CF-104 or F-104G. Between them, the CL-41A and the CL-41R should be able to handle all but the operational stages of pilot training, and even these are catered for by the projected CL-41G. All CL-41s have a 500-lb. pick-up point beneath each wing for the attachment of drop tanks for ferrying, and these may be replaced by more offensive stores, in conjunction with cockpit sighting and selection equipment. The CL-41G has an additional under-fuselage attachment point, and a max. weight of 9,800 lb.

After spending a couple of days with the CL-41 prototype, still in its experimental civil markings, CF-LTW-X, at Frankfurt before its European tour, and enjoying an extensive exploration of its handling, I gained a clearer picture of its situation in the international trainer market. This was helped by a study of the CL-41 specification requirements, which set out "the attainment of an aeroplane safe throughout its flight envelope in the hands of student pilots in the initial stages of training."

It was to be docile and easy to handle, especially at low speeds near the ground, in the take-off and landing phases, and yet must have a design diving speed high enough to demonstrate and experience the effects of compressibility. The CL-41 meets these requirements with a sea-level stalling speed of only 75 m.p.h., and yet will achieve 475 m.p.h. in level flight at 30,000 ft. It can be dived to an E.A.S. of 500 knots, which becomes the Mach limit of 0.8 at around 30,000 ft.

No marked trim changes were to be apparent at least up to M=0.75, and the stall was to be mild enough, after adequate warning, for simple recovery by inexperienced pilots. Spin requirements were to Spec. MIL-S-25015 for Cat. 2 (primary training) aircraft, and the CL-41 meets both British and American criteria in this respect. Straightforward spinning characteristics were ensured by the selection of a T-tail, giving a completely unblanketed rudder, and the stowage of all fuel in fuselage tanks close to the C.G.

Stability and control were to conform to both trainer and fighter classes, in Spec. MIL-F-8785 (ASG) with unboosted controls. An ultimate manœuvring load factor of 11*g* was specified, to provide an ample margin for aerobatic training, while, for safe belly-landing and ditching capability, the cockpit structure was to withstand an ultimate load of 32*g*. The cockpit and centre fuselage are built up on two very strong beams and, coupled with the slow-speed handling of the CL-41, give a forced-landing capability which permits the use of very light, simple and unsophisticated ejection seats.

This simplicity is inherent in the CL-41 airframe, which nevertheless uses one or two novel techniques. These are principally concerned with the use of chemical milling and honeycomb sandwich construction in appropriate areas for the optimum structural efficiency and long service life. All the control surfaces, for example, except the rudder, and the single-slotted flaps, are built-up from honeycomb sandwiches for stiffness, and have the minimum of internal structure.

The prototype CL-41 employs moulded glass-fibre for part of the cheek intake ducts, which are guarded against debris ingestion on the ground by retractable mesh screens, operating in conjunction with the undercarriage. Powerplant is a Pratt & Whitney JT12 (J60) turbojet, which develops 3,000 lb. s.t. at its military rating, but in the CL-41 is throttle-stopped at 95% r.p.m., to deliver 2,400 lb. thrust. This means that a similar figure can always be guaranteed for take-off, in tropical or high-altitude conditions, while the conservative rating gives the new JT12 (the CL-41 was the first aircraft solely powered by this engine) an initial overhaul life of some 800 hours.

The CL-41 was designed for the Fairchild J83, which was cancelled along with its missile, and the GE J85 was also considered before installation of the J60-P. A happy marriage has undoubtedly been achieved between engine and airframe, and the JT12 has proved particularly uncritical in relight performance. The air-start button on the throttle may be pressed at any r.p.m., after a flame-out, and at a wide range of airspeeds. The CL-41 was also designed with the installation of the B-S Viper or the Rolls-Royce R.B.145 in mind as alternative powerplants.

After a thorough briefing on the design and development of the Canadair trainer from tactical aircraft sales director Hedley Everard, I climbed into the left-hand Weber ejection-seat of CF-LTW-X at Frankfurt/Rhein-Main alongside test pilot Ian MacTavish. First impression of the CL-41 is the remarkable roominess of its broad cockpit, accentuated by the remoteness of the sharply raked front screen, which, with the instrument panel, is set far forward.

The rear part of the canopy opens clamshell fashion via an electric jack, and provides excellent cross-visibility from either seat. This overcomes about the only objection that can be offered against side-by-side seating, which has always been popular with the post-War R.A.F., and now seems to be finding favour internationally. The CL-41 offers full duplication of controls and flight instruments for both occupants; the only exception is the undercarriage lever, reached from both seats.

Instrument layout is not yet finalized, but the present arrangement seems satisfactory. Some of the instruments them-

(*Continued on page 333*)

Picture at the top of the page shows the prototype CL-41 jet trainer at the start of its European tour. The inner leading-edge extension is to delay the initiation of compressibility effects.

The Fighting Services

Battle of Britain Displays

FORMATION aerobatics will be the highlight at many displays to be held on Battle of Britain day, Saturday, Sept. 16, when 16 R.A.F. stations will be "at home" to the public.

The Fighter Command aerobatic team—the "Blue Diamonds" of No. 92 Squadron (Sqn. Ldr. B. P. W. Mercer)—flying 12 Hunters, is to give three displays. Operating from R.A.F. Waterbeach, the team will open with a 10-minute show at Gaydon at 14.05 hrs.; it will be over Biggin Hill at about 15.40 hrs. and will land there after its display. Later the team will take off and fly back to Waterbeach for its third show.

Based at Coltishall, the Lightning F.1 team of No. 74 Squadron (Sqn. Ldr. J. Howe) will also be at Biggin Hill for an eight-minute display, and individual Lightnings will be demonstrated at Abingdon, Waterbeach, Waddington, Finningley and Cottesmore. Biggin Hill will also see the Central Flying School team of four Jet Provost T.3s led by Flt. Lt. F. Brambley, which will later give another performance at Tangmere.

Four Hunters from No. 229 Operational Conversion Unit, Chivenor, will provide shows at St. Athan and their home base; Gaydon, St. Athan and Colerne will each have a display by four Vampires of the Central Flying School, and another four Vampires from No. 1 F.T.S., Linton-on-Ouse, will perform at Leuchars and Middleton St. George. Three Jet Provosts from No. 2 F.T.S., Syerston, will also fly at these two stations.

Yet another team to be at Biggin Hill is a four-Vampire formation from No. 5 F.T.S., Oakington. This school will also have teams giving shows at Valley and Aldergrove. The aerobatic team of the R.A.F. College, Cranwell, composed of three Vampires, will fly at Cottesmore, Waddington and Finningley. A team of three Meteors from the R.A.F. Flying College, Manby, will give shows at Tangmere and Colerne.

Chipmunks are also to be seen in formation flying and aerobatic displays. Three from the University of London Air Squadron, White Waltham, will demonstrate at Waterbeach; three from Liverpool U.A.S. will be at Abingdon; the Birmingham U.A.S. will put up three at Tangmere, and three from Leeds U.A.S. are to perform at Middleton St. George. Four Chipmunks from St. Andrews U.A.S. will be at Leuchars.

Individual displays by Hunters of the 2nd Tactical Air Force, Germany, will be given at Coltishall, Waddington and Cottesmore, and the veteran Hurricane and Spitfire are to fly at Waddington, Cottesmore, Waterbeach and Coltishall.

Eight Royal Navy Scimitars from R.N.A.S. Lossiemouth are to give an aerobatic display at Gaydon, and the U.S.A.F. team of Super Sabres—the "Skyblazers"—will provide 10-minute displays both at Biggin Hill and Coltishall. Other U.S.A.F. contributions to the day's flying will include two Super Sabres from Lakenheath at Valley, Aldergrove and Leuchars, and two Voodoos from Bentwaters will fly at Biggin Hill, Tangmere, Abingdon, St. Athan and Chivenor.

The Battle of Britain Week London exhibition will be held in the Air Ministry, Whitehall, and outside in Richmond Terrace. It will be open daily from Saturday, Sept. 9, to Sunday, Sept. 17, from 10.00 hrs. to 19.00 hrs.

A new feature of the exhibition this year will be the display of the Schneider Trophy won by the R.A.F. High Speed Flight in 1927 and 1929 and finally in 1931. Another highlight will be the reproduction of a complete Fighter Command sector operations room as manned in the Battle. The static display will include a Hurricane, two Spitfires, Hunter, Javelin, Jet Provost, Firestreak AAMs and a Bloodhound SAM. There will be exhibits of equipment and a general photographic exhibition.

Continued Success

THE R.A.F. Reserves Club in South Street, Mayfair, has once again had a successful 12 months. In the Annual Report it is recorded that the club has just completed its thirteenth year, and in providing first-class amenities for its members at most reasonable subscription rates, has succeeded in the most important of its original intentions—that of keeping alive the spirit of friendship which originated during the War years.

Membership of the club is not confined to serving and ex-R.A.F. members. There is keen interest and support from the aviation industry generally, and from those with any interest in flying in the widest sense. Several organizations connected with the profession are also associated with the club, and members of the airborne forces are also to be seen using the club's headquarters.

Although there is a large membership, the committee is willing to accept a limited number of new members upon application.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. F. D. Hughes, D.S.O., D.F.C., A.F.C., and Wg. Cdr. G. C. Cairns, A.F.C., to the Department of the Chief of the Air Staff.

Bomber Command: Wg. Cdr. G. A. Martin, D.F.C., A.F.C., to Headquarters as Deputy Senior Personnel Staff Officer; Wg. Cdr. W. E. D. Makin, D.F.C., to R.A.F. Driffield, as Senior Technical Officer; Sqn. Ldr. A. Barrell, M.B.E., to R.A.F. Gaydon, as Chief Ground Instructor, with the acting rank of Wg. Cdr.

Fighter Command: Wg. Cdr. D. R. Wilson to the Central Fighter Establishment for operational duties.

Transport Command: Wg. Cdr. J. J. Barr to No. 47 Squadron, R.A.F. Abingdon, to command.

Flying Training Command: Wg. Cdr. J. H. King to the R.A.F. Selection Board, Cranwell, as Deputy President.

Technical Training Command: Wg. Cdr. C. W. Thompson to No. 1 Radio School, R.A.F. Locking, as Educational Specialist in the Apprentice Radio Training Wing.

Maintenance Command: Gp. Capt. S. J. Bryant to No. 7 Maintenance Unit, R.A.F. Quedgeley, to command.

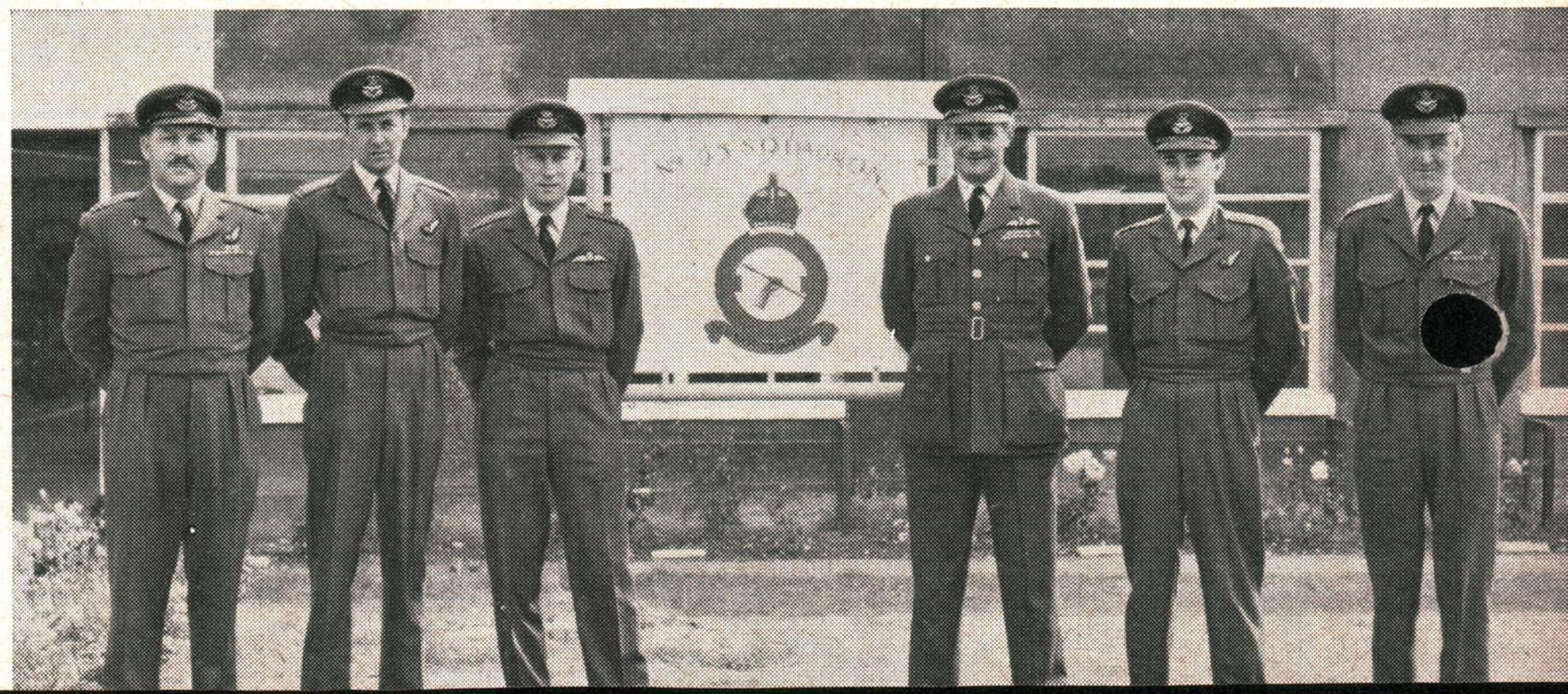
Royal Air Force, Germany: Gp. Capt. J. O. Gale to Headquarters as Senior Equipment Staff Officer; Gp. Capt. P. de L. Le Cheminant, D.F.C., to R.A.F. Geilenkirchen, to command.

Near East Air Force (Cyprus): Wg. Cdr. O. B. Parker to Headquarters as Command Armament Officer.

Far East Air Force: Wg. Cdr. K. Lister, D.F.C., to Headquarters as Deputy Senior Personnel Staff Officer.

Other Appointments: Wg. Cdr. G. H. Smith-Parr to Allied Air Forces Central Europe, for airfield engineering duties; Wg. Cdr. F. N. Brinsden to Melbourne, Australia, for duties with the United Kingdom Research Supply Staff.

CANADIAN SHOW.—As recorded in our previous issue, three Victor B.1s of No. 55 Squadron, R.A.F. Honington, left the U.K. on Aug. 27 to fly to Canada to take part in the Canadian International Air Show at Toronto on Sept. 1 and 2. Here the C.O. and force commander, Wg. Cdr. R. G. Wilson (fourth from left) is seen with his crew: (l. to r.) Flt. Lt. E. Butcher (A.E.O.); Flt. Lt. P. G. Cullen (nav./plotter); Flt. Lt. A. D. Stracey (co-pilot); Flt. Lt. D. A. Schofield (nav./radio); and the Squadron Engineering Officer, Flt. Lt. C. B. H. McNiven.



(*Continued from page 332*)

selves might be more advanced for F-104 conversion, but whatever changes are made, the layout will continue to include the current annunciator panel. This is a long strip of warning lights providing illuminated legends in conjunction with flashing and clicking master warning and caution bars to give itemized indication of fire, electrical failure or similar dangers.

On a centre console are starting, electrical and radio controls, together with the duplicate throttle and flap levers. Hydraulically operated, the flaps have a three-position quadrant, with 25° and 45° extensions. The dual control columns have the standard U.S.A.F. B8-A handgrips, bristling with switches and selectors, but only the trim thumb button and another little button for nosewheel steering are currently in use. Rudder pedals and toe brakes on each side are suspended to leave a completely clear floor, and are quickly adjustable for leg length.

Back-type P9B-1 parachutes are employed with the Weber seats, which have a two-second harness unlock after ejection. Initial actuation of the side triggers blows off the canopy, which may alternatively be penetrated. It has been jettisoned inadvertently from 10,000 ft. from the prototype CL-41, to which it is still fitted, having been recovered, miraculously, completely undamaged.

Starting the P. & W. J60 could not be simpler. Turning on the master switch also energizes the single booster pump in the collector tank for the five fuel cells, and actuates the low pressure cock. There is no other control or selector for the fuel, which totals 250 Imp. gal. A quick flip of the starter switch initiates the light-up sequence, the only other necessary action being to bring the throttle out of its cut-off detent to idle as the engine is wound up electrically to 10% r.p.m.

Idling setting of 40% gave a comfortable taxi speed for the long, long trail back alongside Frankfurt's 11,800-ft. runway. It also resulted in a slightly stiff finger from holding down the nosewheel steering button which actuates the front leg hydraulically, through 45° each side of centre, according to rudder pedal displacement.

This is the system used by the Sabre and other American fighters and is positive and convenient, if a little elaborate. Its use in the CL-41, which has a turning circle of 37 ft. diameter, is justified on the score of both training experience and the degree of directional control it gives on ice-covered runways compared with differential braking.

The alternative method is available if required, and the hydraulic disc brakes of the CL-41 are quite potent. A smooth ride is conferred by the 11 ft./sec. undercarriage, despite the 135 p.s.i. main tyre pressures. The mainwheels are of very thin section compared with the nosewheel, which has a relatively dumpy 65 p.s.i. tyre. With its 13.2 ft. track, the low-slung CL-41 is very stable on the ground, where its behaviour is typically tractable.

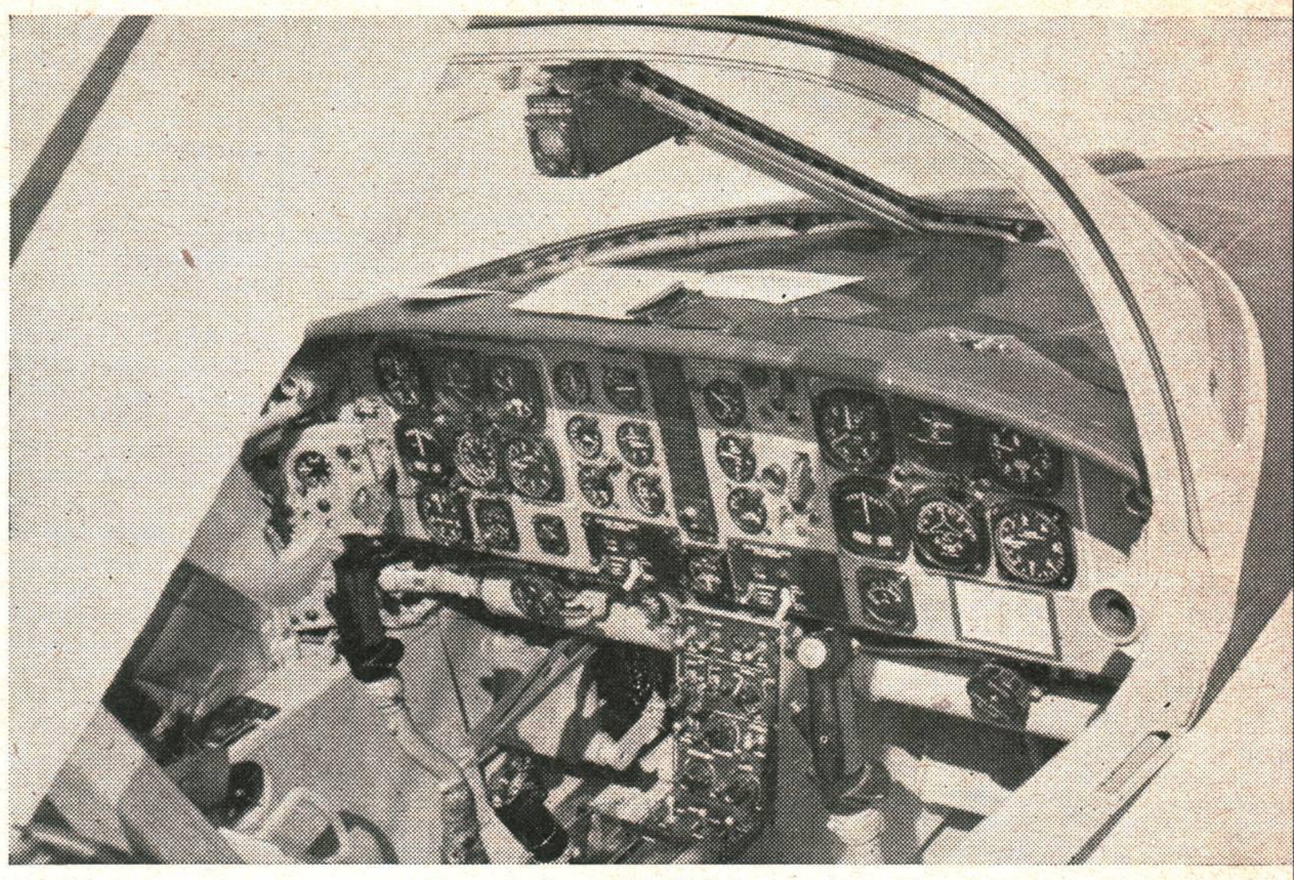
Pre-take-off checks include a blip of the stick switch for neutral elevator trim, indicated by a green strip at the bottom of the annunciator panel, which should otherwise be "clean," and visual observation of centralized aileron trim. The port aileron has a trim surface in addition to a spring tab, while at the moment the starboard aileron has a geared tab. Geared tabs have been tried on both ailerons, but since the present arrangement comes within 0.1 of the required U.S.A.F. rolling criterion of 0.9 radians/sec., with stick forces of less than 25 lb., the final solution will probably be wider span spring tabs on each side.

Aileron and elevator trim control from the stick thumb switch may be overridden in the event of a runaway by individual selectors on the left of the cockpit. Experience with T-33s and Sabres has shown Canadair that most malfunctions occur in the stick circuit, which is subject to constant movement, but the out of trim forces in the CL-41 are never very large.

As the J60 has a completely automatic fuel control, the throttle may be banged open at any speed for take-off, with the engine following briskly from idling to full power in less than six seconds. Ian MacTavish recommended using nosewheel steering for only the first few yards, since it is fairly sensitive, even at low speeds. A jab or two of toe brake is all that is then necessary if the CL-41 starts to wander, until the rudder becomes effective in the region of 50 knots. Acceleration is pleasantly rapid, and slight aft stick pressure at 65 knots starts taking the weight off the nosewheel prior to a more decisive rotation at 85 knots.

It was hot and calm (30° C and 4 knots) at Frankfurt at the time of my flight, but the CL-41 soared skywards with the aid of take-off flap and had a couple of hundred feet by the time we passed the end of the long runway. Leaning on the brakes to stop the wheels spinning, I retracted the gear, but there was no noticeable change of trim until I brought the flap up. The nose then had to be held down a little to maintain the initial climb speed of 180 knots.

There seems to be much less free airspace in central Germany even than in England, and we had to hold the CL-41



Photograph copyright "The Aeroplane and Astronautics"

Layout of the roomy cockpit of the prototype CL-41 is not necessarily representative of production aircraft, although few changes are likely to be made. The annunciator strip may be seen in the centre of the panel.

down at first to 2,000 ft. until clear of the Frankfurt zone. I throttled back slightly from max. power of 95%, which can, of course, be maintained indefinitely with the derated engine, and we steamed off southwards through the cloudless haze towards Worms.

Given clearance to climb, I opened up to full power, and with the excess urge from our cruising speed, we zoomed up to an indicated 5,000 ft./min. ascent for a minute or two, before the climb fell to around a consistent 3,000 ft./min. We were given by control a maximum ceiling of 15,000 ft. which was reached in about five minutes.

The CL-41 takes only 12.3 min. to reach 30,000 ft. and, of course, is pressurized for operation at that height. Pressurization starts at 8,000 ft., where the cabin pressure remains until the maximum differential of 3 p.s.i. is achieved. This is not until about 20,000 ft., so we were very comfortable at our controlled height.

I felt immediately at home in the CL-41. Apart from the comfort of the roomy and air-conditioned cockpit, control response and harmonization felt just right and the J60 was clearly a smooth, willing and obedient source of power. Canadair seem to have gained what they were after with the ailerons, which are crisp and responsive after moderate breakout forces, their only slight lack of positivity being in stick centring. I overcame a slight tendency to over-control laterally within a couple of seconds of becoming airborne, which seems to indicate that the CL-41 should provide a useful introduction to the more potent power controls of operational fighters.

As one would expect, stability was about neutral laterally and just positive longitudinally, while I detected a slight tendency to tailwag in the more turbulent air lower down. It was a rare thrill to get back to a "tigerish" aeroplane after a long spell on the more opulent and sedate American executive types, but the CL-41, despite its willingness to be thrown about, lost very little by comparison in low-speed handling.

I started off at 15,000 ft. with a clean stall, but after throttling back and raising the nose, we soon found ourselves at 16,000. Speed decayed very slowly, but eventually, at about 83 knots on the drum-type sensitive A.S.I., a rattling buffet brought the starboard wing down into a stall.

Because of the T-tail, there is virtually no stall warning, which was also the case in the "all-down" configuration. Flap and undercarriage limit speeds have deliberately been placed at a high 175 knots, to give inexperienced students time to sort things out, and all that was necessary after lowering the full 45° of slotted flap was a blip of aft trim to relieve the nose-down tendency. The all-down stall was almost identical to the first type, except that the speed indicated around 73 knots.

We then had about 1,100 lb. of fuel on board, having started with 200 gal. At Ian MacTavish's suggestion, I continued in a gliding turn with the CL-41, after it was cleaned up, and steepened it from an airspeed of 110 knots until once again a washboard judder and a starboard wing drop indicated its desire to roll out of the bank. It could not have been more gentlemanly.

Next on the programme were spins. The CL-41 has completed its preliminary spin schedule at forward and aft C.G.s, clean, dirty and with pro- and anti-spin aileron. Only with

full aft C.G. and aft trim will it not recover from the spin if left to its own devices. It has completed more-than-20-turn spins from above 30,000 ft., where its entry is of a text-book nature, although lower down it has the typical rough and oscillatory autorotation of most jet aircraft. Its next sequence will be the exploration of inverted spins.

I tried two spins to the right, using full right rudder and hard-back central stick coincident with the clean stall. The CL-41 rolled over to the right quite gently, to the accompaniment of a great deal of buffet, especially on the rudder. On the first occasion, I used insufficient foot load to counteract rudder buffet, and the CL-41 recovered by itself after a turn or so.

A more determined effort got us into a brisk autorotation the second time, at a steep angle and fairly consistent pitch attitude. Opposite rudder and central stick stopped the rapid rotation in about a turn, and recovery from the ensuing dive was gentle. We then found ourselves at about 10,000 ft., having started at 15,000.

I do not often get the opportunity to practise aerobatics, especially in jets, but the CL-41 is very kind to one's diffident attempts. Rolls, of course, are simply a matter of putting the stick over in the required direction at about 200 knots, and only a little more finesse is required for loops. A gentle dive to 270 knots, with firm forward stick pressure against the increasing speed, and then relax to let the CL-41 fly itself round at about $3\frac{1}{2}$-4 *g*, resisting the temptation to pull the suddenly light stick back at the top, where we have about 100 knots; a little more *g* in the ensuing dive, and then lose some of your speed in an effortless upward roll.

In something like a CL-41, and on a day like this, one wonders why pilots get paid for flying.

Plenty of fuel left for a couple of circuits, if control are kind to us (as indeed they have been), so air-brakes out for a let-down, and back to the beacon. Perhaps the only suggestion of disappointment throughout the flight at this point: operating the air-brake switch on the throttle seems to produce no noticeable deceleration, buffet or trim change. They must be working, since we are descending rapidly without exceeding about 250 knots, but Canadair are well aware of this deficiency, and the air-brakes in production CL-41As are to be doubled in effectiveness.

No room for a Mach run on this flight, but the prototype has been up to 0.75 without compressibility troubles, and is currently cleared for 0.7M for demonstrations. The design 0.8M will be achieved as the flutter envelope is extended, with the aid of the R.A.E.'s little rocket "bonkers" in the tail, for excitation.

Back in the circuit, there is no trouble in getting down to flap and gear speeds after throttling back, and then gradually getting slower from the initial 175 knots, to reach about 120 on base leg. Apart from the rather thick windscreen arch, runway visibility is excellent, and low-speed control ample to reduce to 95 knots on finals. Engine response is good to adjust the rate of sink, and with full flap the aim is to arrive at 85 knots for the flare-out.

Elevator is ample at this stage, and the usual tendency, because of the low-slung undercarriage, is to flatten-out fairly high. I conformed to this pattern, but it was just a question of holding the attitude and letting the CL-41 sink obligingly on to its soft oleos. Air brakes were left out, since they are the lateral fuselage type and do not affect control or ground proximity, and the CL-41 can overshoot with everything down plus full aft trim as well. Brakes are effective, and on reaching the end of the roll, nosewheel steering can be engaged for the turn-off.

After more than an hour in the CL-41, I was convinced that it more than meets its specification, and is a sound concept, soundly engineered. If this specification results in an aeroplane that seems supremely easy to handle and is unprecedentedly forgiving, then this is presumably the way that military types are developing. The very high sink rates at low airspeeds of some of the more advanced operational aircraft, however, will need some pre-familiarization, but this will presumably be done at the operational stage in the two-seat adaptations.

With a basic cost of $200,000, in round figures, and relatively low operating expense, the CL-41 should certainly offer an economical prospect for many stages of training, and is thus likely to be of considerable interest to many of the smaller air forces.

Leading Particulars

Dimensions.—Span, 36 ft. 4 in.; length, 32 ft.; height, 9 ft. 4 in.; gross wing area, 220 sq. ft.; track, 13 ft. 2 in.

Weights.—Empty, 4,859 lb.; crew, 400 lb.; fuel (247 gal.), 1,927 lb.; oil, 14 lb.; gross weight, 7,200 lb.; overload gross, 7,650 lb.

Performance.—Max. level speed, sea level, 385 knots; at 30,000 ft., 412 knots; cruising speed, 85% power, 300 knots; initial climb, sea level, 4,100 ft./min.; at 30,000 ft., 1,400 ft./min; service ceiling, 44,500 ft.; stalling speed, 65 knots E.A.S.; take-off to 50 ft., 1,830 ft.; landing from 50 ft., 1,920 ft.; range with 175 lb. reserve fuel, 800 n.m.; endurance, 2 hr. 25 min.; typical training mission, 2 hr.

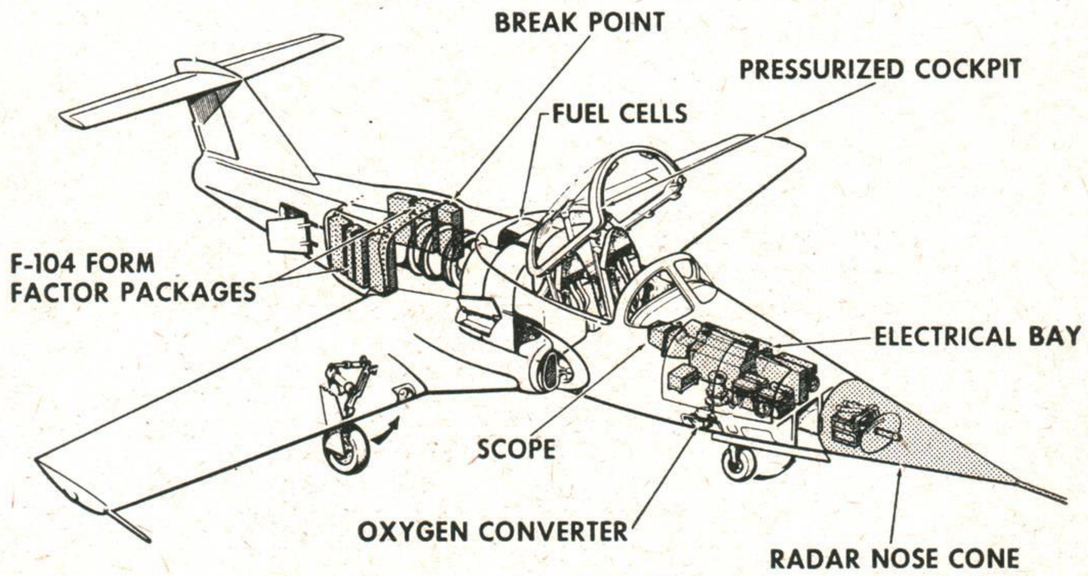
Systems Familiarization for the F-104

THE need for a two-seat trainer with the weapons systems electronics of the F-104G supersonic strike fighter is illustrated by the fact that current flight instruction on the radar equipment is given in a venerable and converted DC-3. It is, of course, possible to use the two-seat F-104F version for this mission, but both initial and operating costs tend to take a large slice of the overall training budget. By using a subsonic systems trainer, for which Canadair have developed the CL-41R, NATO air forces operating the F-104G have the opportunity of effecting substantial economies in aircraft and support requirements without compromising efficiency.

Carrying the same complex electronic equipment as the F-104G and using the characteristically long nose radome, the CL-41R is half the cost of an advanced trainer for a similar rôle, and one-third the cost of a flying classroom type aircraft. Basic airframe cost of the CL-41R has been quoted as around $225,000, or, in round figures, some $500,000 with full electronic packages. In fuel consumption, the CL-41R costs $12.40 an hour, compared with $46 for an advanced trainer and $112 for the F-104F/G. Similarly, a survey of maintenance man-hours per flight hour shows that the CL-41R requires four man-hours compared with 21 for an advanced trainer and 45 hours for the F-104G.

Structural integrity of the CL-41R provides a fatigue life of over 5,000 hours, even when the aircraft is operated continuously at altitudes below 500 ft. The small trainer can operate within a large spectrum of the F-104 mission capability, having manœuvring load factors comparable with operational aircraft and providing economical instruction in inertial navigation as well as pilot-proficiency checks at squadron level. The CL-41 can use small airfields; it has side-by-side seating with a central radar scope; and has self-contained facilities for engine starting and warm-up of electronic equipment.

Equipment common with the F-104G comprises NASARR Model R24A radar system, nose radome and pitot-static boom; inertial navigation system LN-3; UHF radio ARC-552/AIC-18; TACAN; selective identification feature; air data computer; UHF



communications antenna system; and standard form factor packages (carried in rear-fuselage bulges) of F-104 electronic equipment. The NASARR monopulse radar system performs the functions of air-to-air search, air-to-air blind acquisition and automatic tracking; ground mapping, contour mapping, terrain avoidance and air-to-ground slant ranging.

The CL-41R advanced systems trainer has a similar performance to the 475-m.p.h. CL-41A, although its gross weight is increased from 7,200 lb. to 7,870 lb. If required, improved performance is available by the use of the full 3,000-lb. military thrust rating of the Pratt & Whitney JT-12 turbojet. This gives the CL-41R a maximum level speed of 512 m.p.h. at 20,000 ft., reduces the time to 20,000 ft. to 6 min. and increases the sea level climb to 4,700 ft./min.

Length of the CL-41R is 40 ft. 7 in. Limiting load factors are +5.3 and −2.1 *g*, and maximum Mach number, 0.8.

Development of the new version of the CL-41, which is being studied with interest by the Canadian and German Governments, among others, is a logical step for Canadair. The basic CL-41A has reached an advanced stage of development, and the first Canadair-built CF-104 was rolled out on Mar. 27. Two hundred CF-104s are on order for the R.C.A.F. in Europe, and Canadair is building many other Starfighters in the form of knock-down components for NATO and export production.



CANADAIR CL-41 is a primary and transitional trainer, designed for clean stalls, automatic spin recovery and low landing speed.

Aviation Week Pilot Report:

CL-41 Trainer Meets Demands Over Wide

By Larry Booda

Montreal—Canadair CL-41A jet trainer—forgiving of error in its low speed regime—can be used for primary training of fledgling pilots, yet still is hot enough at higher speeds to serve as a transitional aircraft for the advanced student or the experienced pilot.

This versatility was demonstrated when an AVIATION WEEK pilot flew the airplane at Cartierville airport here where the plant of Canadair, Ltd., a subsidiary of General Dynamics Corp., is located.

Royal Canadian Air Force requirements dictated a broad mission spectrum, which design engineers have in substantial measure incorporated into this two-place, side-by-side, single-engine aircraft.

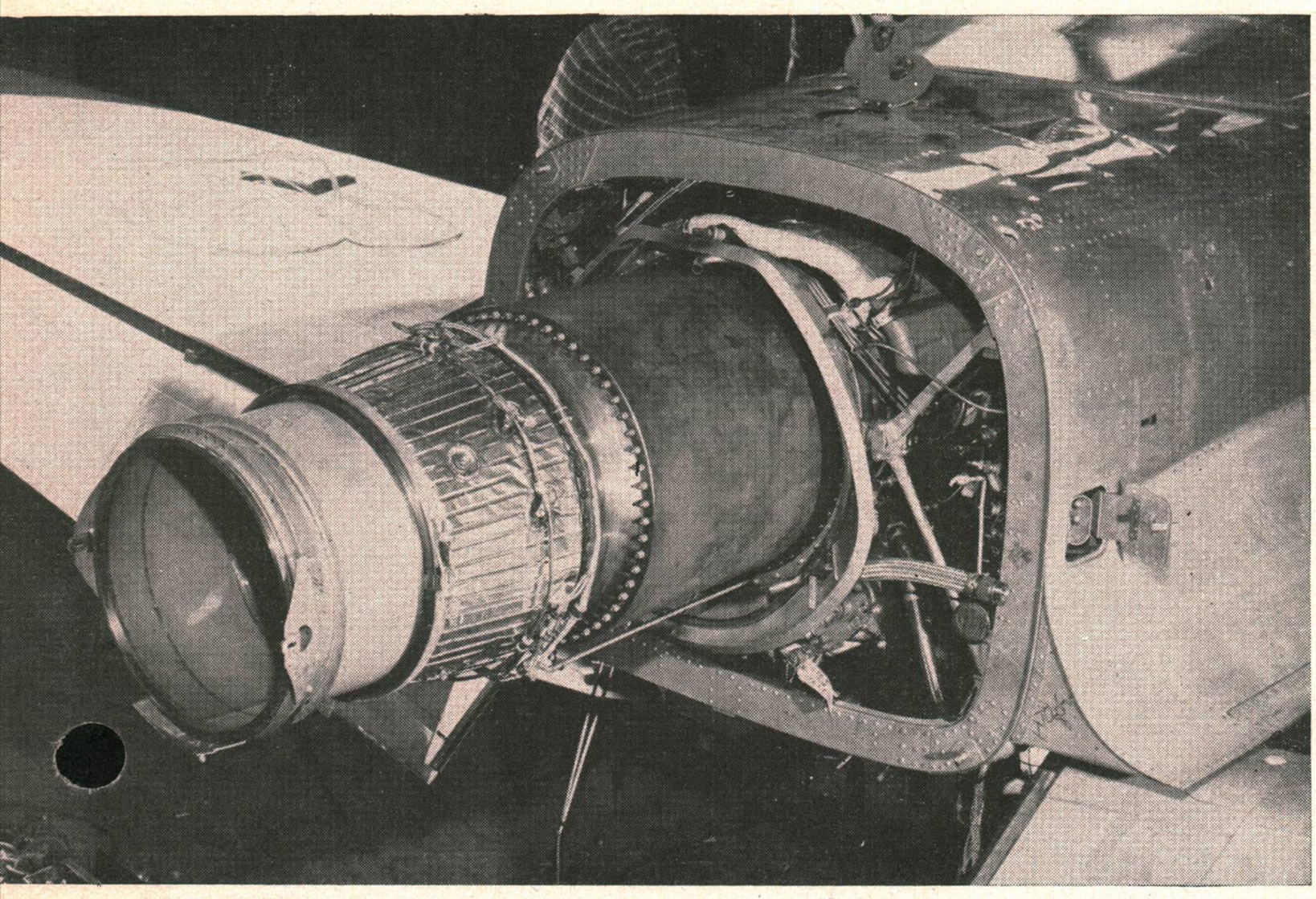
For training of the primary or basic student, the CL-41 offers:

- **Full stall** combined with the ability to keep wings level with the ailerons while the rudder is centered.
- **Entry into spin** only by deliberate application of required control forces and automatic recovery when controls are freed except under non-standard trim and loading conditions.
- **Landing at moderate speeds** with eye level close to the ground for better height judgment.
- **Standard techniques for performance** of low speed acrobatics.
- **Side-by-side seating,** permitting the student to observe control movements while the instructor is demonstrating maneuvers.
- **Economical operations** below 15,000 ft. Low altitude fuel consumption of many jets is high, prohibiting low altitude missions.

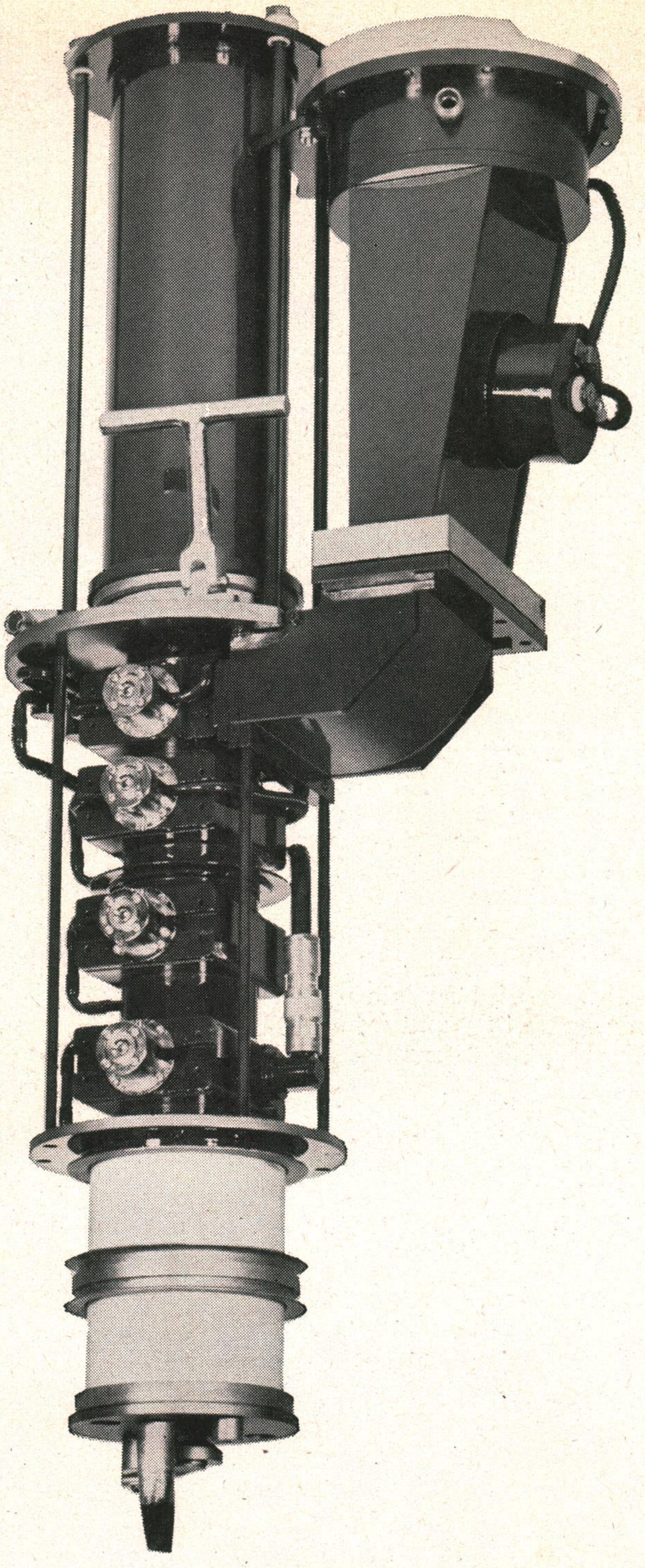
For the advanced student or for pilots whose experience has been in propeller-driven aircraft, the CL-41 offers the following:

- **Sufficiently high subsonic speeds** to demonstrate the effects of compressibility.
- **Standard responsiveness** in performing high speed aerobatics.
- **Ability to withstand** and demonstrate high positive and negative accelerations.
- **Aerodynamic characteristics** of the "clean" aircraft and training in the use of speed brakes.
- **Familiarization** with the use of protective helmets, oxygen masks and cockpit pressurization.
- **Jet engine operation,** including introduction to the relatively slow power response after rapid throttle opening when compared with reciprocating and turboprop engines.

In order to fill a gap in the training spectrum prior to introducing pilots to operational types of aircraft, the RCAF has specified development of the CL-41R, a version of the basic air-



TAIL SECTION may be removed rearward to permit engine work to be done.



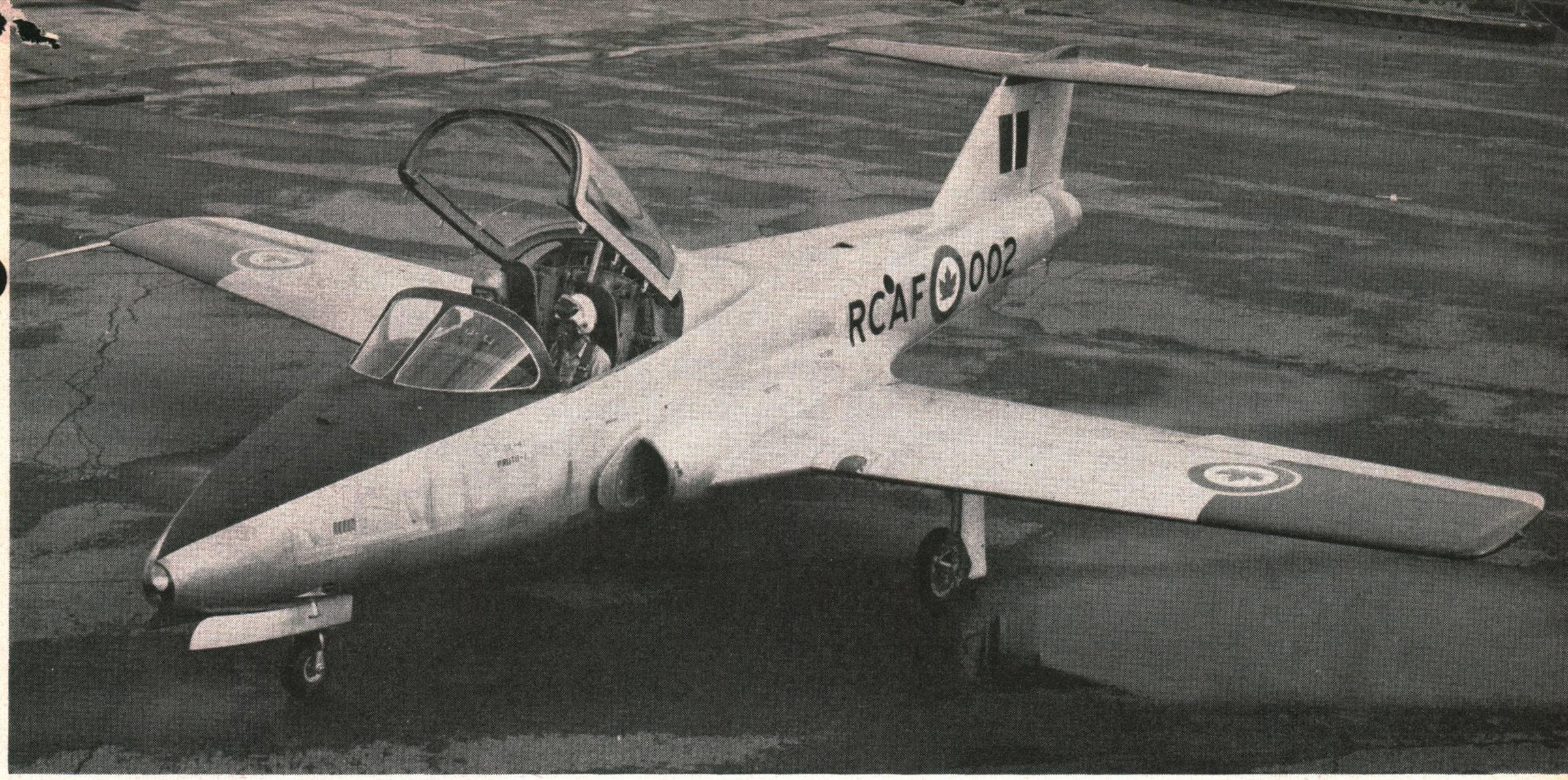
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ROYAL CANADIAN AIR FORCE has ordered 190 of the single-engine trainers and NATO and non-NATO nations have shown interest.

Speed Range

craft which will carry the radar and other electronics gear of the Lockheed F-104 and the Canadair CF-104 fighter aircraft. In this configuration, it will serve as an intercept trainer.

Thus it is possible that, in the future, many RCAF fighter pilots will have flown only the CL-41 before reaching combat units.

Canadair Sales Effort

At present, Canadair is assured of selling 190 of the jet trainers. Beyond that, the company has made a major sales effort in Europe, where the engineering test model, its development program completed, was flown by pilots of the air forces of several NATO nations. Pilots of the U. S. Air Force and U. S. Navy also have flown it.

The CL-41 now is in the plant having changes incorporated in it which will appear in the production model. Target price is less than $200,000.

Powerplant for the CL-41 is the Pratt & Whitney JT12A-5 (J60) axial flow turbojet which is designed to produce 2,900 lb. of static thrust at sea level, military rating. For this installation, however, a stop limits engine speed to 95% rpm. or approximately 2,400 lb. thrust. With this conservative limitation, prolonged running of the engine at high rpm. will not be possible. This type of operation further permits 800 hr. engine time before the first overhaul.

Alternate engines are the Bristol Siddeley Viper, General Electric J85 and Rolls-Royce RB.145.

The most unusual features of the CL-41 are its low slung appearance and T-empennage configuration. Highest part of the aircraft is the top of the vertical stabilizer which is 9 ft. 3¾ in. off the ground. The bottom of the nose portion rests only two feet above the ground.

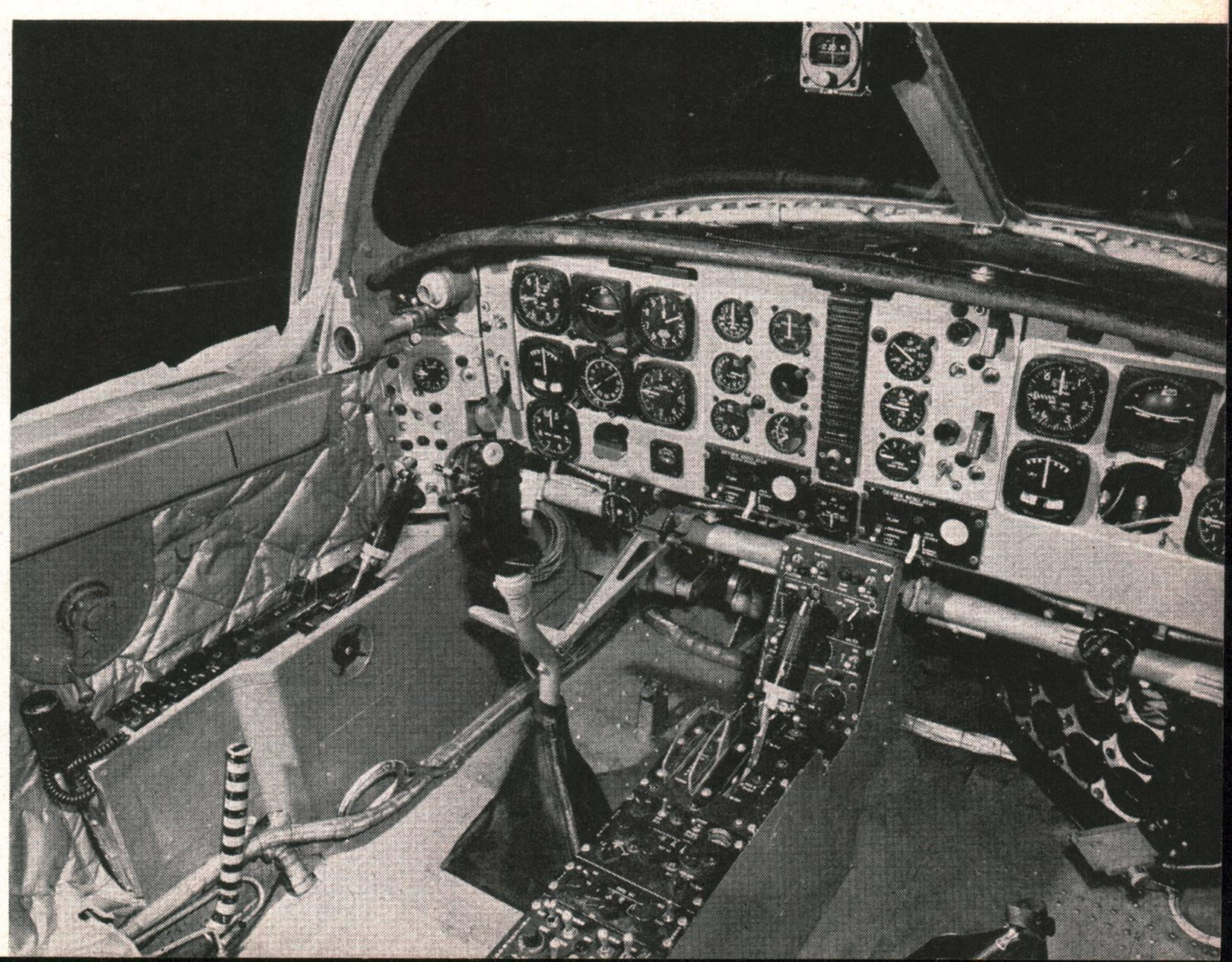
Span of the unswept wing is 36 ft. 4 in. and the length of the aircraft is 32 ft. Main landing gear tread is 13 ft. 2.5 in. and the wheel base is 11 ft. 1 in. Gross weight is 7,300 lb.

Hydraulically operated speed brakes are located on each side of the fuselage below the leading edge of the vertical stabilizer. Screens covering the divided air inlet ducts in fairings at the leading edge of the wing root, the landing gear, flaps and canopy also are hydraulically operated. Ailerons, rudder and elevators are of aluminum alloy construction. In addition, the trailing edges of the ailerons are made of full depth honeycomb.

No highly specialized gear was required for flight in the CL-41. For the AVIATION WEEK flight, a standard light flight suit was worn and was comfortable in the 43F weather. A protective helmet with attached oxygen mask and a P9B-1 back parachute completed the outfit. The aircraft has connections for an anti-g suit.

Entry into the cockpit was made from each side by means of two retractable steps. The instructor may occupy

DUAL FLIGHT instruments are placed in front of both pilots' seats with engine instruments centered. There are no overhead controls.



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the left seat with beginning students and move to the right after the student has mastered operation of the principal controls.

The two Weber ejection seats are separated by a narrow central console in the roomy cockpit. In this instance both pilots weighed more than 190 lb. yet were able to operate the aircraft without interference to arm or leg movements.

Flight controls are identical for both positions. Control sticks are mechanically interconnected by push-pull torque tubes and are topped by the USAF B-8A type hand grip which incorporates buttons for nose wheel engagement, elevator and aileron trim and intercom.

Rudder pedals are the toe brake type and are adjustable by means of a small wheel located under the instrument panel on each side.

The flight group of instruments is directly in front of each position. Included are an airspeed indicator, attitude indicator, altimeter, vertical speed indicator, heading indicator, turn and bank indicator and machmeter. A standby magnetic compass is installed on the center beam of the windshield.

The center panel contains a percentage type tachometer, exhaust temperature, exhaust pressure ratio, fuel quantity, oil pressure, oil temperature, flap and hydraulic pressure indicators and fire extinguisher actuator switches. Below the center panel are separate oxygen regulator panels. The oxygen system is the liquid type with a capacity of 5 liters.

The forward part of the center console holds the engine master, starting, anti-icing, start-stop, inverter, cockpit lights, battery and generator switches.

To the right of the right hand seat is a fuse panel.

Automatic direction finder, interphone, VHF and air conditioning and circuit breaker panels are located behind the throttle and flap controls of the right hand seat.

To the left of the left side pilot's position is the master throttle which incorporates a detent at the engine idle position to prevent inadvertent shutting off of the engine fuel. Beside it is the flap control.

At the top of each throttle is a two position speed brake control button.

Behind the throttle on the left side are elevator and aileron alternate trim controls and a canopy declutch and hand crank for alternate operation. Forward of the throttle on the vertical panel are the landing gear handle, the canopy actuating switch, canopy jettison switch, demist and defrost switch, landing gear override switch, hydraulic emergency selector, landing and taxi lights switch, accelerometer and drag chute release and jettison switch. The emergency hydraulic hand pump is on the floor and located to the left of the left hand seat.

The Weber ejection seats are adjustable up and down. Sequence for ejection includes:

- **Raising a handle** on either pilot position jettisons the canopy and locks the shoulder harness.
- **The seat** can then be fired by a trigger. It is not possible to squeeze the trigger until the canopy jettison handle is raised nor can the shoulder harness be unlocked.
- **As the seat leaves** the aircraft, the M-12 initiator is triggered and one second later actuates the release of the safety belt. The ability to unlock the seat harness is unaffected by the automatic features.
- **As the pilot separates** from the seat the rip cord of the parachute, which is fastened to the left lap belt, is pulled automatically.
- **When the seat is ejected** the anti-g suit, oxygen hose, microphone and headset connections are automatically broken at one fitting.

Only one unfavorable feature about the ejection seat installation was noted. If the legs are outstretched or are off center at the time of ejection, they could be injured. No stirrups are provided.

Engine starting procedure is simple. When the master switch is turned on, a booster pump located in the collector sump for the five fuel cells is started. The starter switch is actuated by pulling out the knob to unlock and depressing it to start the engine turning over. At 10% rpm., the throttle is pulled out of idle cutoff past the detent into the idle position starting the idle flow of fuel to the engine.

If a hot start is indicated by the temperature gauge, the throttle is again

CL-41 Specifications

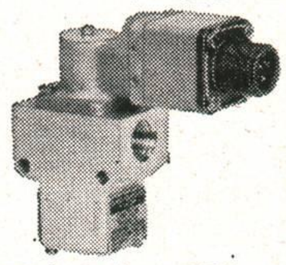
Wing span	36 ft. 4 in.
Length	32 ft.
Height (tail)	9 ft. 3¾ in.
Height (canopy)	7 ft. 2 in.
Ground clearance	1 ft. 9¾ in.
Horizontal stabilizer width	13 ft. 7 in.
Cockpit width at canopy sill	4 ft. 3 in.
Cockpit width at consoles	3 ft. 11¾ in.
Seat spacing	2 ft. 2 in.
Normal mission gross weight	7,300 lb.
Ferry mission with drop tanks	8,460 lb.
Empty weight	4,870 lb.
Fuel, internal	1,440 lb.
Fuel, external	967 lb.
Fuel	JP-4
Alternate	JP-1
Emergency	Gasoline
Maximum cruise speed	418 kt. TAS at 30,000 ft.
(Note: no reduction for turbulence)	
Rate of climb, initial	3,650 fpm.
Rate of climb, 30,000 ft.	1,200 fpm.
Time to climb to 30,000 ft.	14.5 min.

measurement and control

of pressure and differential pressure

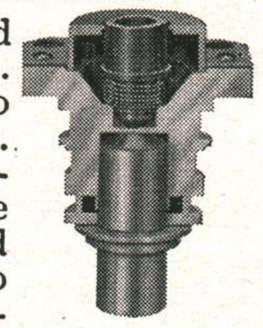
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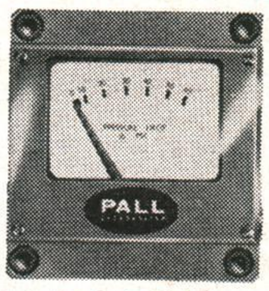
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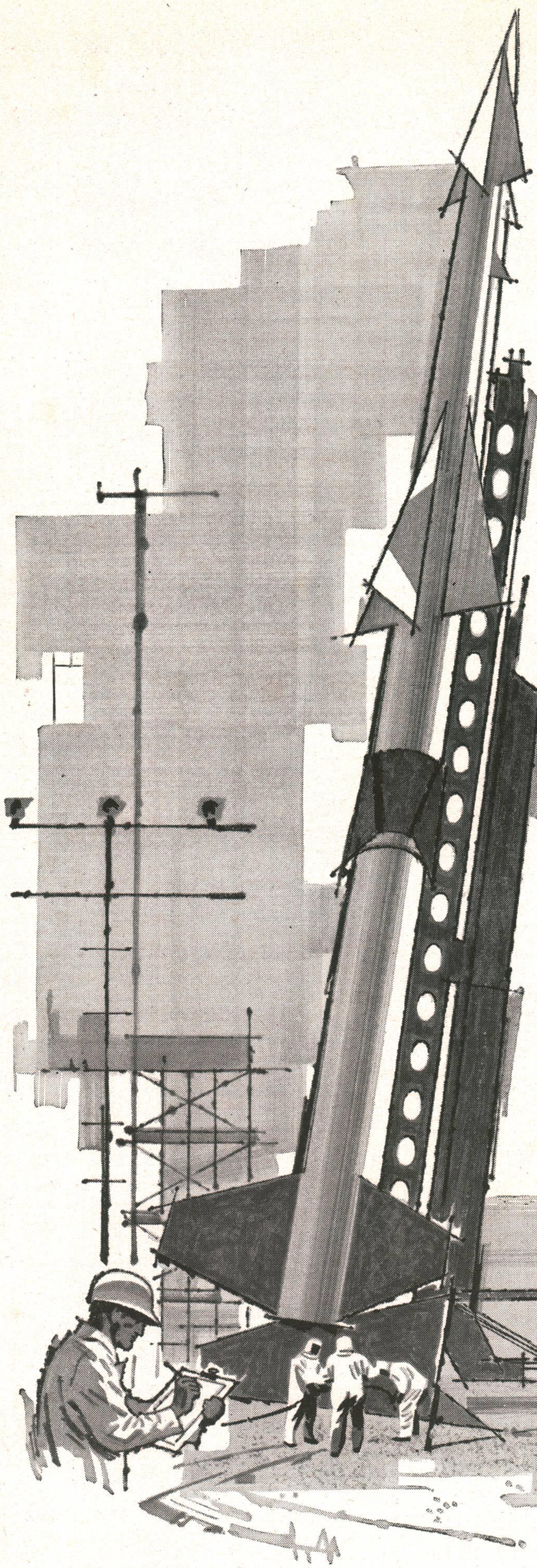
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moved to the cutoff position. Idle rpm. is normally 40% or over. In this instance it was 43%.

To begin taxiing, a slight advance of the throttle was necessary followed immediately by retarding it to the idle position. This setting is sufficient to maintain a taxiing speed of approximately 20 kt.

Steering normally is done by the hydraulically powered nose wheel. This is engaged by pressing a button on the stick. The rudder remains engaged through a throw of 45 deg. each side of center. The aircraft can turn in a circle of less than 40 ft.

It takes a conscious effort to keep the nose wheel engagement button depressed and over an extended taxiing period this can result in a tired thumb. Steering can be done by differential braking also.

This type aircraft normally would not need power steering. The RCAF, however, took into account operating conditions over long winter months when differential braking is ineffective on ice and both impacted and soft snow.

Cockpit Height

When taxiing the CL-41 for the first time, the pilot is impressed with the closeness of the cockpit to the ground. This peculiarity is amplified during takeoff and landing maneuvers.

The brakes, steering, flight instruments, demist and deice operation, ADF and anti-g suit, if worn, are checked while taxiing.

The pre-takeoff check list includes the hydraulic pressure, harness, control trim, throttle friction, fuel, flaps setting, speed brakes, gyros, switches, controls, canopy and annunciator panel.

A full power turnup was quickly accomplished, during which all engine instrument readings were checked for normal indications.

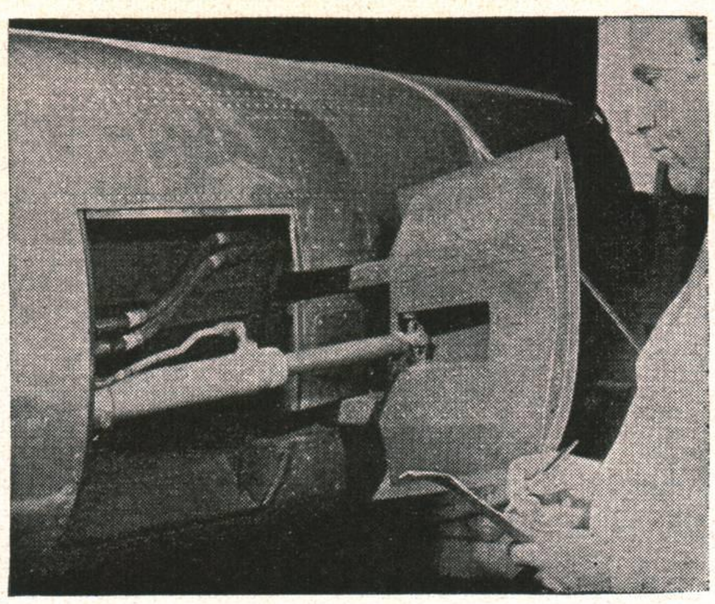
Takeoff power application can be slow or rapid. It was eased on for the first takeoff. The greatest surge of power was noticed in the last inch of the throttle throw.

Assistant Chief Engineering Test Pilot Ian MacTavish explained that he normally took off with the nose wheel steering engaged for the first 40 or 45 ft. This was done but was not needed because a 10 to 12-kt. wind was coming directly down the runway.

Rudder control was noted at about 50 kt. Slight back pressure was applied to the stick at this point, but was not immediately effective. Between 70 and 85 kt. the nose wheel came off rapidly and rotation was checked in a mildly nose high attitude. Airspeed built up rapidly as the landing gear was raised.

At 110 kt. the flaps were raised, necessitating a slight change in elevator trim nose up.

It was at this point that the visibility advantages of the CL-41 became apparent. Downward visibility was almost vertical because the seat is ahead of the wing and horizontal sight sweeps through 300 deg.



LARGER SPEED BRAKES are planned for production models of the CL-41.

Optimum climb speed is 175 kt. Initial rate of climb is 3,650 fpm. Rate at 30,000 ft. is reduced to 1,200 fpm. Time to climb to that altitude is 12.3 min.

Air work was first on the schedule. Since aerobatics must be performed during conditions of full ground visibility, the air corridor was limited to an off airways area about 20 by 50 mi. in size.

The rpm. was reduced to 85% at 12,000 ft. Straight and level flight at this setting produced an indicated airspeed of 212 kt., which was computed to be 268 kt. true airspeed.

Shallow turns to the left and right were made and altitude was easily maintained. Then steep turns were tried. Maintaining altitude during the latter was not as simple at first until the proper amount of back stick pressure was determined. Acceleration forces in these turns were mild, not more than 2g at any time. Tendency was to gain altitude in left turns and lose altitude in right turns.

Stall Performance

Stalls were tried next. In the clean condition and the throttle in idle position, speed decayed slowly in a slight nose up attitude. The nose was raised to about 20 deg. As the stick came all the way back and the indicated airspeed was 85 kt. there was some stick shake but the full stall came suddenly. With the rudder centered and the stick all the way back there was still enough aileron control to keep from dropping off on one wing. The nose dropped but then came up again.

Stalls with the landing gear and flaps down and speed brakes extended were similar, but the warning came sooner. The stall under these conditions was at 73 kt. Only slight forward motion of the stick was required to terminate the stall in both the dirty and clean conditions.

Production models of the aircraft will have a stick shaker installed as a stall warning device.

The stall curve is not as broad as that of many other training aircraft, but it is more honest than operational aircraft. It compares closely with the North American/USAF T-6.

Rolls with the nose slightly high at the beginning and an indicated airspeed of 200 kt. were tried to the right and the left. At this speed top rudder had to be applied in the vertical position.

Rolls at higher airspeeds were not tried but were described as being similar to the aileron rolls of the Lockheed T-33.

Spins to the right and left must be entered deliberately, with the stick full back in a stalled condition and using full rudder. Recovery can be speeded by reversing controls, but this isn't needed. The CL-41 will recover from spins of its own accord when the controls are released.

No rudder control is necessary as the airspeed slows at the top of the loop as is the case with a propeller-driven aircraft. Keeping the aircraft level with the horizon while upside down at the top of the loop is difficult, since the wings are behind the pilot.

Control Surfaces

Control forces of the CL-41 are not light. Neither are they as great as found in large aircraft lacking control boost. All the surfaces are moved by means of push-pull rods or torque tubes and there is no servo boost. If static and dynamic stability were sacrificed forces would permit finger tip control, but the aircraft would not be forgiving of lack of attention with the beginning student.

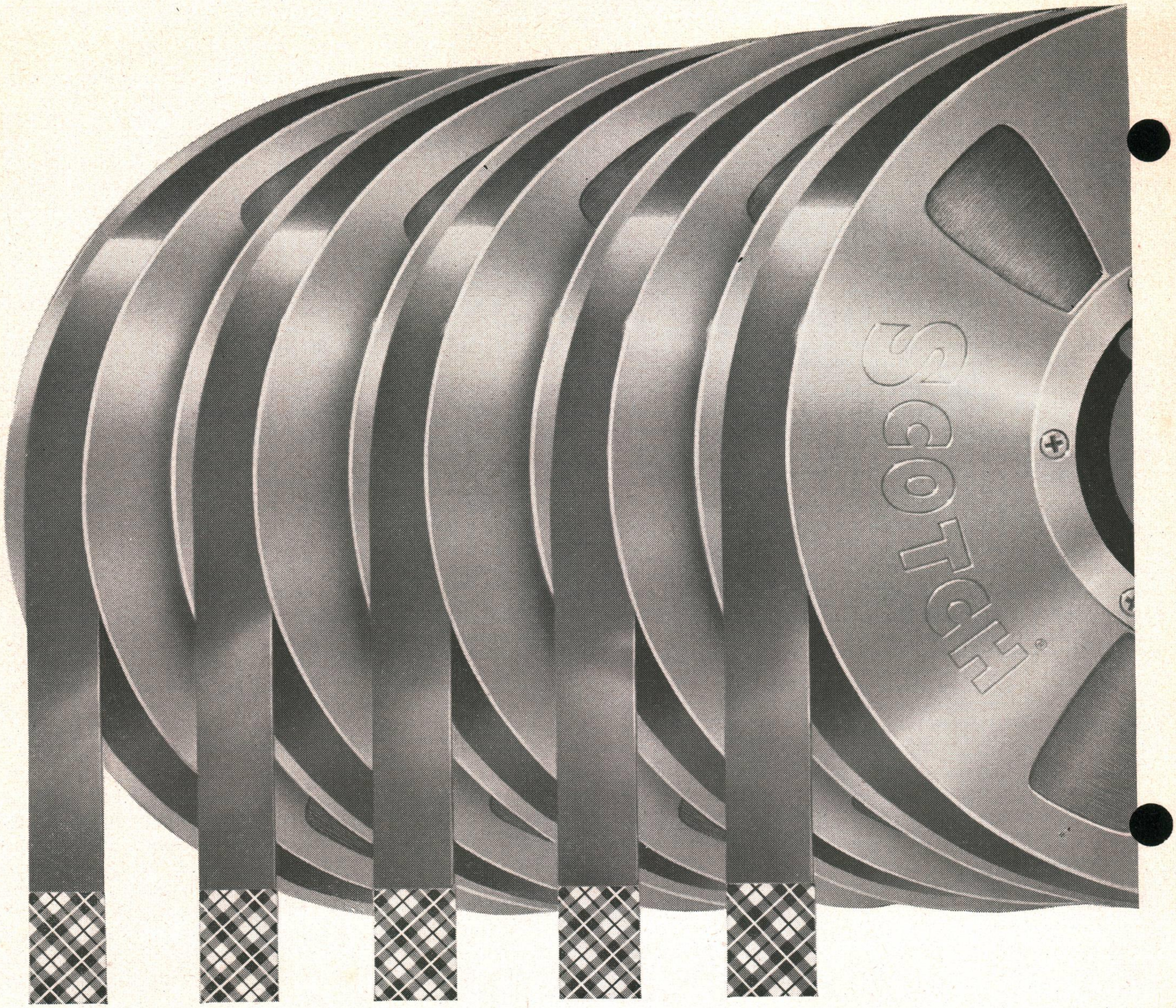
Pressurization of the cabin begins at 8,000 ft. It remains at this altitude pressure until 3 psi. differential is reached, somewhere around 20,000 ft. The cabin was comfortable despite an outside temperature of −30C.

The main runway at Cartierville has been lengthened to 8,800 ft. to accommodate the CF-104 which Canadair is building.

Traffic pattern for Runway 10 was set up downwind at 1,000 ft. after a pass up the duty runway.

Speed brakes were extended first and the landing gear was lowered when the airspeed was below 175 kt. Preferably, this is at 160 kt. The downwind leg was flown at 135 kt. Turning base leg, with rpm. set at about 68%, half flaps were set and descent was begun. Elevator trim adjustments in the nose up direction were necessary with flaps down.

Approach visibility is excellent and lineup with the runway offered no problems. The final straightaway was entered at 115 kt. and the over-the-fence speed



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was 95 kt. The CL-41 was leveled off about 20 ft. in the air, which, MacTavish explained, was the standard reaction of pilots who are accustomed to having cockpits sit higher off the ground. Nevertheless, the aircraft forgave this misjudgement and landed smoothly in spite of a higher sink rate than desirable.

A running takeoff was made, with only throttle advance, flap change from full-down to half and speed brake retraction necessary while on the runway.

As a test, the brakes were applied on the final landing. Action was positive and not sensitive since they are unboosted.

The canopy cannot be opened at speeds greater than 40 kt. because of the danger of it blowing off.

Engine shutdown is done simply by slipping the left hand throttle around the detent to the idle cutoff position.

The JT12 engine operating limitations are few. At 95% rpm., maximum exhaust gas temperature is 538C, while oil pressure can be 45 psi, ±5 psi. Oil temperature for all powers can vary from 40 to 120C.

Maximum allowable exhaust temperature at starting is 635C.

While undergoing accelerations, such as in tight turns, the maximum time allowed is two minutes, the maximum exhaust temperature is 666C and the oil pressure limit is the same as for maximum continuous power. Minimum oil pressure allowed is 35 psi. while idling.

The engine is not designed for extended negative g conditions because oil ceases to flow to some bearings above 3F and fuel flow ceases under 3F. Negative g can be imposed a maximum of 15 sec. at 3F and above, and 12 sec. from −65F to 3F.

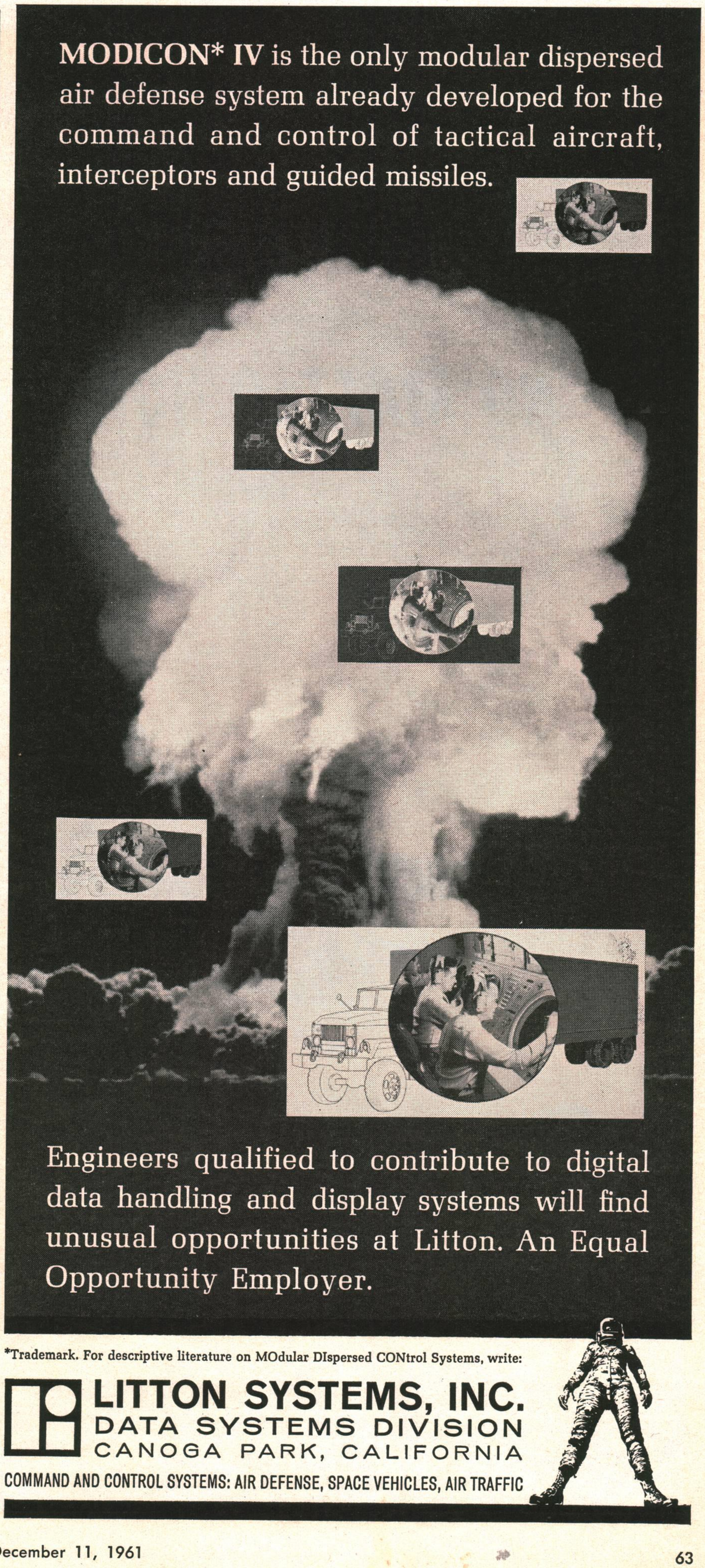
Diving Speed

The limiting diving speed of the CL-41 is 500 kt. equivalent airspeed and the limiting Mach number is 0.8, which is 500 kt. EAS at 3,000 ft.

Positive g limit is 7.33. The negative limit is 3g. All the limits apply up to a weight of 6,500 lb. Maximum landing gross weight is 6,300 lb., but the controlling factor is the landing gear and not the airframe.

A hydraulic system hand pump is available in the event of engine driven pump failure. If there is a leak in the system there is enough fluid remaining in the tank below the standpipe level to allow the landing gear to be lowered with the hand pump.

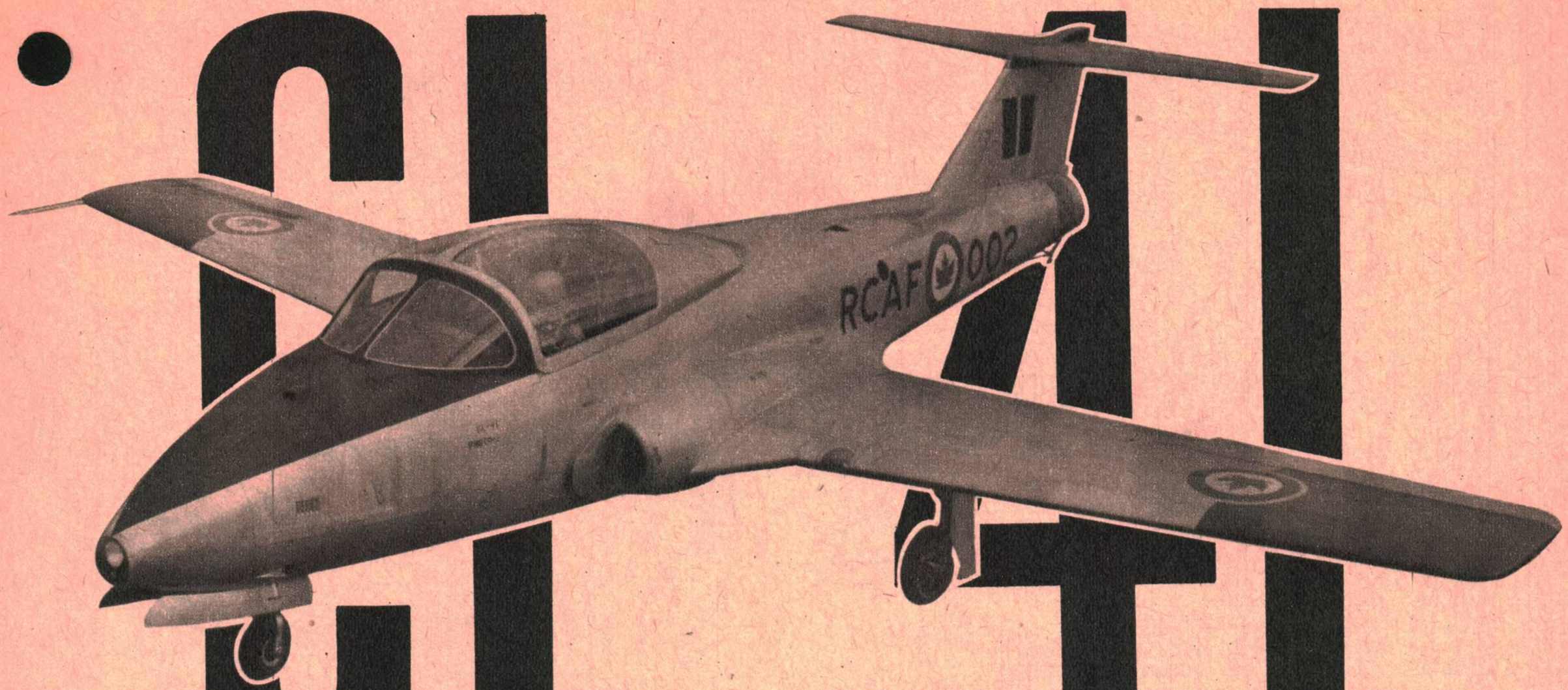
The aircraft is stressed to 8g vertical and 24g forward, which permits wheels up landings in terrain rougher than agricultural fields. In the event of engine fire on the ground there are spring loaded doors where carbon dioxide hoses can be inserted.



GOODYEAR

NO MATTER HOW "HOT" THE SHIP...





CL-41

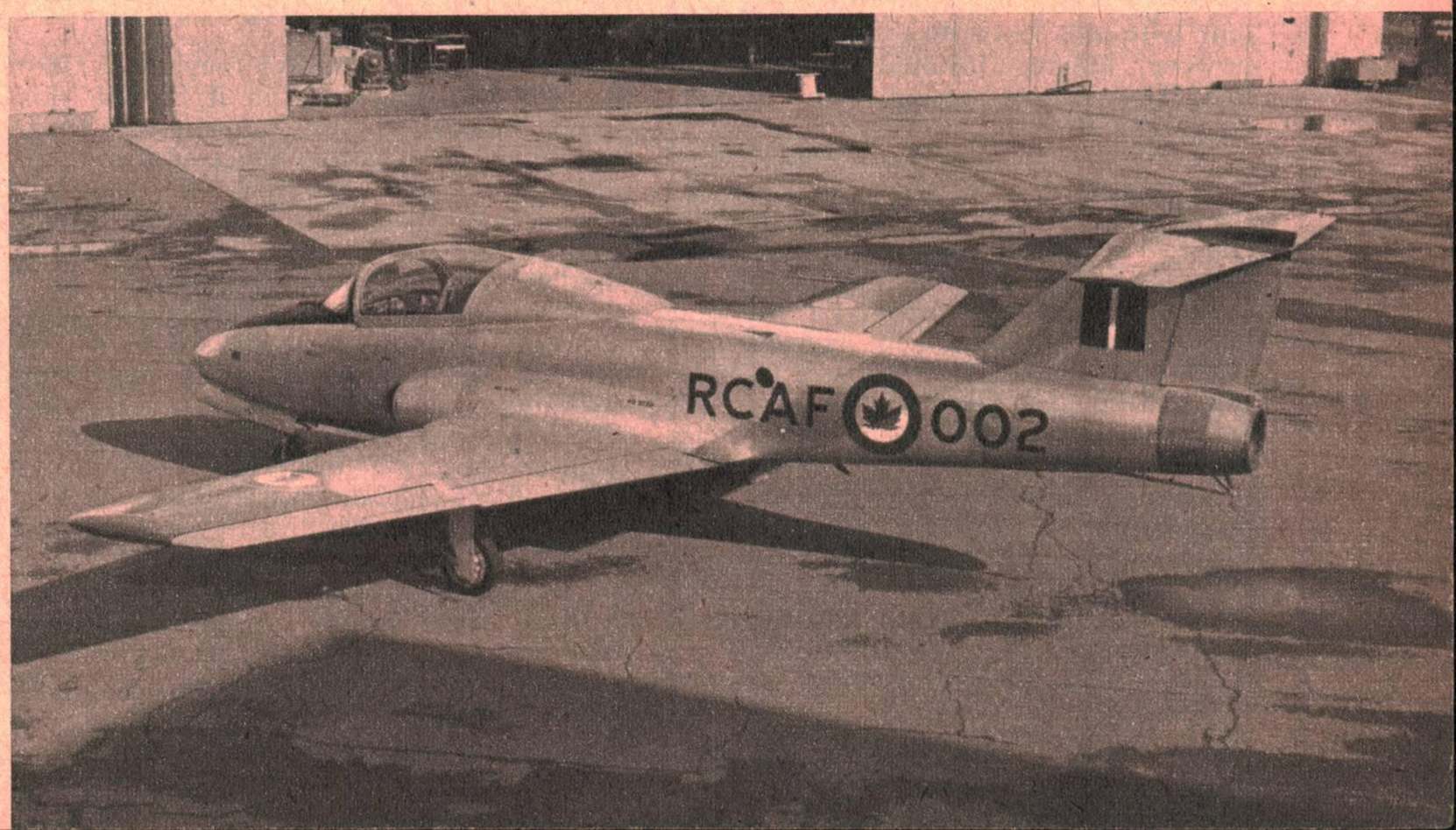
-Canada's New Trainer

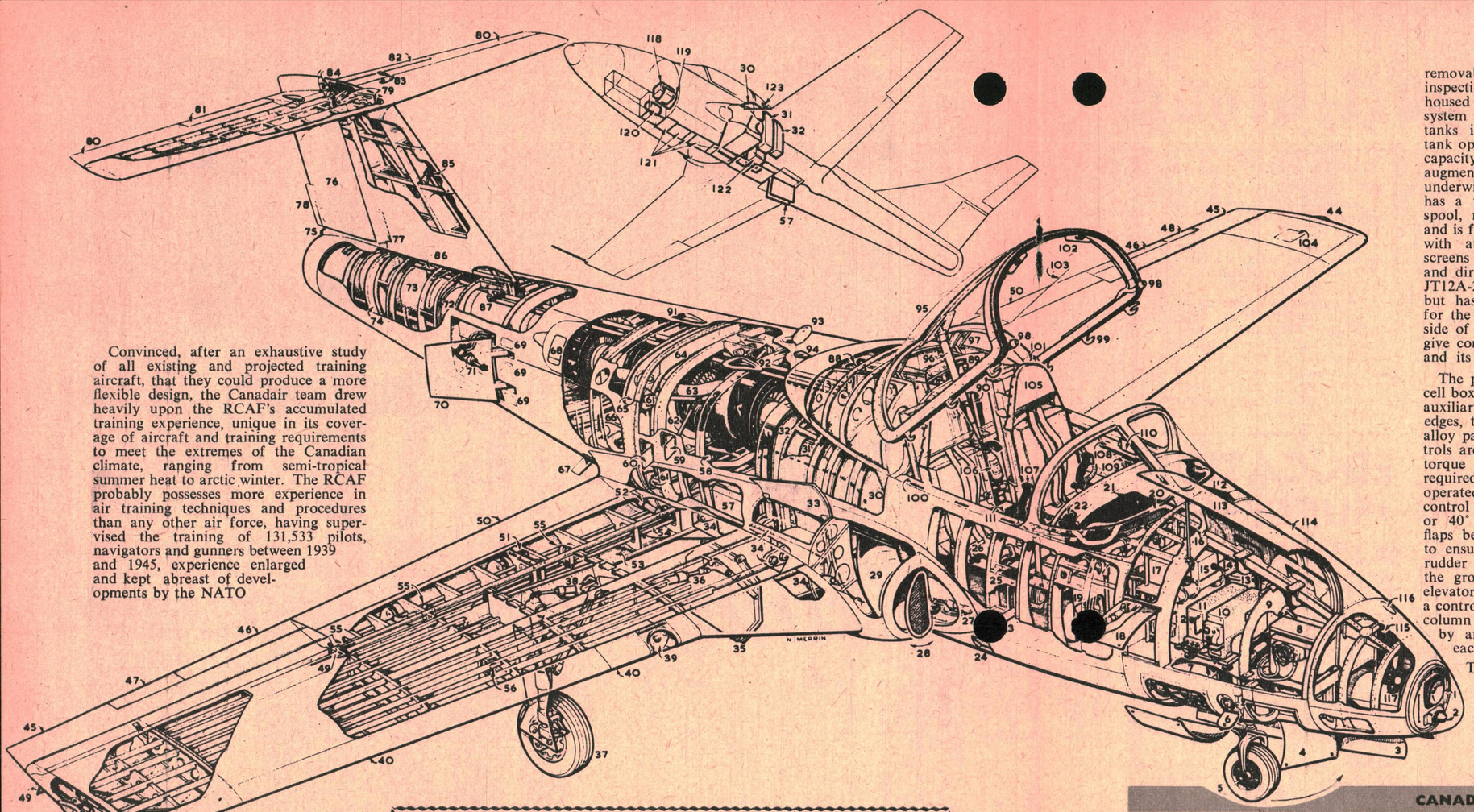
THE recent début of Canada's new CL-41 jet trainer is of considerable significance, for it is the first aircraft of wholly original Canadair design to be built. The firm of Canadair Limited is the largest airframe-manufacturing concern in Canada today. Sixteen years of age in May, Canadair was formed in 1944 to take over the operation of a government-owned plant at Cartierville, just outside Montreal. The new concern commenced operations by evolving the CL-2 and CL-4 transports by combining the DC-4 fuselage with DC-6 wings and undercarriage and Rolls-Royce Merlin 620 engines. The CL-2 was delivered to the RCAF as the C-54-GM and to Trans-Canada Airlines as the DC-4M-1 and -2, and the improved CL-4 was produced for BOAC and Canadian Pacific Air Lines.

In the years that followed, Canadair produced no fewer than 1,815 CL-13 Sabres under North American licence, the last 760 of these being adapted to take the Canadian Orenda turbojet, and 656 CL-30 Silver Star trainers, a version of Lockheed's T-33A modified to take the Rolls-Royce Nene 10. In the meantime, the company was busily evolving the CL-28 Argus maritime reconnaissance aircraft, a unique hybrid in which a fuselage of Canadair design was married to American engines and the wings, tail surfaces, flight controls and undercarriage of the Bristol Britannia transport.

Today, with Argus production nearing completion, the Cartierville assembly lines are becoming increasingly occupied with the CL-66, or Canadair 540, the Canadair CV-440 airframe matched to Napier Eland 504 turboprops, the CL-44-6 and CL-44D-4, " stretched " developments of the basic Britannia airframe with Rolls-Royce Tyne turboprops for the RCAF and for the Flying Tiger Line, Seaboard and Western Airlines and Slick Airways, and the CF-111, a licence-built version of the Lockheed F-104G Starfighter. Now, after sixteen years of manufacturing and adapting other company's designs, Canadair has produced its first original design—the first project the company has undertaken entirely at its own expense.

There can be no doubt that there exists a highly lucrative potential market for economical jet basic trainers, but it is a competitive market, and, therefore, Canadair has placed accent on versatility in its CL-41, which has been designed to satisfy both British and U.S. criteria which, in some respects, differ appreciably. In external appearance, the CL-41 bears quite a close resemblance to the USAF's Cessna T-37, but it has substantially more power available than the American trainer, utilising the first of the new generation of small, high performance jet engines now being evolved in the USA. In fact, the CL-41 is considerably more powerful than any other trainer in its class.





Convinced, after an exhaustive study of all existing and projected training aircraft, that they could produce a more flexible design, the Canadair team drew heavily upon the RCAF's accumulated training experience, unique in its coverage of aircraft and training requirements to meet the extremes of the Canadian climate, ranging from semi-tropical summer heat to arctic winter. The RCAF probably possesses more experience in air training techniques and procedures than any other air force, having supervised the training of 131,533 pilots, navigators and gunners between 1939 and 1945, experience enlarged and kept abreast of developments by the NATO training scheme whereby students from all the NATO countries learned to fly at RCAF schools. Canadair was not content with this pool of experience alone, however, having consulted the USAF and U.S. Navy at early stages in the project's development.

Initial design studies for the CL-41 were prepared several years ago under the direction of W. K. Ebel, Canadair's engineering vice-president, and E. B. Schaefer, the chief engineer, and the construction of two prototype airframes had reached an advanced stage by mid-1958 when the USAF withdrew its backing for the Fairchild J83 turbojet which had been selected for installation in the CL-41. The cancellation of the J83 represented a serious blow to Canadair's project, and the two completed airframes stood idle at Cartierville, awaiting alternative power plants. After considering a variety of small turbojets, including the General Electric J85, the Rolls-Royce R.B.108 and the Armstrong Siddeley Viper, the Pratt and Whitney JT12 (J60) was finally selected, and it is with this engine installed that CL-41's test programme has now commenced.

CL-41 SPECIFICATION—Power Plant : One Pratt and Whitney JT12A-2 turbojet with a maximum continuous thrust of 2,400 lb. **Estimated Performance :** Maximum speed, 443 m.p.h. at sea level, 474 m.p.h. at 30,000 ft. ; initial climb rate, 4,100 ft./min. ; climb rate at 30,000 ft., 1,400 ft./min. ; time to 30,000 ft., 11.7 min. ; service ceiling, 44,500 ft. ; range (internal fuel), 920 mls. at 358 m.p.h. at 38,000 ft., (two 62.5 Imp. gal. drop tanks) 1,210 mls. **Weights :** Design loaded, 6,600 lb. ; maximum, 7,700 lb. **Dimensions :** Span, 36 ft. 4 in. ; length, 32 ft. 0 in. ; height, 9 ft. 4½ in. ; wing area, 220 sq. ft.

In designing the CL-41, the Canadair team found themselves in agreement with the designers of the Hunting Jet Provost and Cessna T-37 in their choice of side-by-side seating, this arrangement conforming with the majority of civil and military aircraft, ensuring the instructor has unrestricted vision at all times, offering safer night flying with no reflection and no peering over the side during take-off and landing, and enabling the student to learn by directly studying the instructor's actions.

The cockpit has sufficient width to provide ample room for both instructor and pupil, and flight instruments are fitted on both the port and starboard sides of the panel, with engine and miscellaneous instruments mounted centrally so that they can be easily read from either seat. A UHF transmitter-receiver system and an interphone system are installed with controls at both port and starboard seats, and the cockpit is fully pressurised from 8,000 feet to the trainer's service ceiling. The vertically-adjustable ejection seats are designed for back parachutes, and provision is made at the base of each seat for a seat-pack survival kit and bale-out oxygen bottle. The escape system automatically jettisons the cockpit canopy prior to seat ejection, but in the event of a failure the seats can be ejected through the canopy.

The CL-41's fuselage is an all-metal semi-monocoque structure, the nose, cockpit and centre sections constituting a single unit, with the rear section being removable for engine change or major inspection purposes. All fuel cells are housed in the centre fuselage, the fuel system comprising five crash-resistant tanks interconnected to provide single tank operation, and having a total usable capacity of 125 Imp. gal. These may be augmented by two 62.5 Imp. gal. underwing auxiliary tanks. The JT12A-2 has a two-stage turbine with a single-spool, nine-stage axial-flow compressor, and is fed via wing root intakes equipped with automatically-operated retractable screens which prevent ingression of gravel and dirt from the runway surface. The JT12A-2 normally develops 2,900 lb. s.t. but has been derated to 2,400 lb. s.t. for the CL-41, and doors on the underside of the fuselage aft of the rear spar give complete access to the power plant and its associated equipment.

The primary wing structure is of two-cell box type with a single main spar and auxiliary spars at leading and trailing edges, the whole covered by aluminium alloy panels. All the primary flight controls are operated by push-pull tubes or torque tubes, and power boost is not required. The flaps are hydraulically operated and provision is made on the control quadrant for selection of 0°, 25°, or 40° deflection, port and starboard flaps being mechanically interconnected to ensure synchronised operation. The rudder trim tab is adjustable on the ground only, and the aileron and elevator tabs are operated by means of a control switch mounted on each control column grip. The air brakes are controlled by an electrical switch mounted on each power control lever.

The undercarriage is of particularly rugged construction, being designed to withstand the hard usage that may be expected in the earlier stages of flying training. The wide track of the main members and the long wheel base may be expected to provide adequate stability on the ground. The main members retract hydraulically into wing wells, and the nosewheel retracts forward into a well in the extreme nose.

The CL-41's high maximum level speed of 474 m.p.h. will enable the pupil to experience realistic conditions in high speed navigation, and the estimated stalling speed of 75 m.p.h. should provide an ample safety margin for him to experience low speed flying characteristics. The CL-41 will be capable of a diving speed of 576 m.p.h. and Mach 0.8, providing the pupil with some knowledge of compressibility effects, and the ultimate manoeuvring load factor of 11 *g* will provide ample *g* margin for aerobatic training. A particularly useful feature of the CL-41's characteristics is its short take-off and landing performance, take-off to clear a 50-ft. obstacle at sea level and design gross weight being effected in 610 yards, landing distance from 50 ft. being 640 yards, permitting the trainer to operate from relatively small airfields.

The CL-41 can be readily adapted to undertake gunnery and armament training, close-support, or NATO-type policing roles, and will maintain a high level of performance while carrying external stores such as a pair of pods each containing two 0.5-in. machine guns and their ammunition, a pair of bombs up to 500-lb., rocket pods or napalm tanks.

The RCAF has not yet announced its decision on the question of all-through jet training, and it has for long been felt that the future of the CL-41 in Canadian service at least depended greatly on the outcome of the RCAF's deliberations on manner versus unmanned interceptors. Now that the decision to replace the CL-13 Sabre with the CF-111 Starfighter has been taken, the chances of a CL-41 production order from the RCAF are undoubtedly brighter, and the future of this new Canadian venture will be watched with more than casual interest.

CANADAIR CL-41 — CUTAWAY KEY

1. Taxi light.
2. Ground observer light.
3. Nose wheel doors.
4. Access to D.C. relay panel and battery drain.
5. Forward retracting steerable nose wheel.
6. Liquid oxygen filler.
7. Liquid oxygen converter.
8. 24 volt, 36 ampere/hour battery.
9. Electrical main distribution panel.
10. 17L—7 type V.H.F. transmitter.
11. 51X—2 type V.H.F. receiver.
12. 51Y—1 type V.H.F. receiver.
13. Gyro control unit.
14. Gyrosyn amplifier type A2.
15. AM300/A1C type A.F. amplifier.
16. Heat and vent regulator and shut-off valve.
17. AM142/A1C type mixer amplifier—two units.
18. A.D.F. receiver access door.
19. Dual control rudder pedals.
20. Heat and vent ducting.
21. Main instrument panel.
22. Throttle lever and flap control—one each centre and left hand consoles.
23. Retractable footstep.
24. Kick-in step.
25. R.H. console electrical controls.
26. Utility cockpit light.
27. Debris screen actuator.
28. Air intake debris screen—operated by 27 in conjunction with undercarriage.
29. Air intake.
30. Forward fuel cell.
31. Centre fuel cells.
32. Rear fuel cells.
33. Personal baggage stowage access—each side.
34. Wing to fuselage attachment points.
35. Main landing gear door—closed when undercarriage locked down.
36. Main landing gear door actuator.
37. Main landing gear—Goodyear brakes.
38. Main landing gear actuator.
39. Landing light—one each wing.
40. Detachable leading edge panels.
41. Detachable wing tip.
42. Tip access panel.
43. Pitot/static tube.
44. Wing navigation lights.
45. Ailerons.
46. Aileron spring tabs—solid honeycomb construction.
47. Aileron trim tab—R.H. ground adjusted.
48. Aileron trim tab—L.H. electrically operated.
49. Aileron shroud access panel.
50. Single slotted flaps—honeycomb panels.
51. Flap actuator.
52. Flap interconnect actuator.
53. Flap shroud access panels.
54. Aileron control and interconnect rods.
55. Aileron control rod bell cranks and idlers.
56. Attachment point for external stores.
57. Engine access doors.
58. Pressure differential regulator/shut-off valve.
59. Jet start external power receptacle.
60. Ground power receptacle.
61. Engine bearing strut hinge points.
62. Engine bearing struts.
63. Compressor bleed duct.
64. Fuselage break—detach rear fuselage for engine removal.
65. Aft firewall.
66. Primary heat exchanger.
67. Fuel vent mast.
68. Fire extinguisher access panel.
69. Air brake hinge access panels.
70. Air brake.
71. Air brake actuator.
72. Tail pipe support ring.
73. Tail pipe.
74. Vertical stabilizer attachment bulkheads.
75. Tail navigation light.
76. Rudder.
77. Rudder bottom hinge.
78. Rudder bend tab.
79. Horizontal stabilizer attachment points.
80. Elevators—solid honeycomb construction.
81. Elevator gear tab—starboard only.
82. Elevator trim tab.
83. Elevator trim tab actuator—port only.
84. Elevator control lever.
85. Elevator controls.
86. Rudder controls.
87. Elevator/rudder control rod idlers.
88. Elevator/rudder control rod levers.
89. Elevator/rudder control rod bellcranks.
90. Elevator/rudder control rods.
91. Flush inlet—cooling air aft of firewall.
92. Flush inlet—cooling air forward of firewall.
93. Engine oil filler access.
94. Upper position light.
95. Electrically operated, jettisonable canopy.
96. Canopy actuating and jettison mechanism.
97. Canopy hinges.
98. Canopy de-mist disconnect points.
99. Canopy latching hooks.
100. Canopy roller slots.
101. Canopy seal disconnect.
102. Rear view mirrors.
103. Sense antenna.
104. Flux valve access.
105. Election seats.
106. Fire extinguisher.
107. Control columns.
108. Cabin air distribution.
109. Canopy manual operation—accessible from outside.
110. Magnetic stand-by compass.
111. Centre console—electrical/radio controls.
112. Windshield de-frost.
113. Electrical/radio compartment access door.
114. Nose stowage access door.
115. Brake fluid reservoir and pressure transmitter.
116. Brake fluid reservoir access.
117. Nose wheel steering selector valve.
118. Secondary heat exchanger.
119. Secondary heat exchanger access.
120. Cooling turbine.
121. Underside access panels.
122. Fuel collector tank.
123. Fuel filler access.

Specialist Transport Group

Tactical operations force forms link with Army

A SPECIALIST tactical transport Group is to be set up shortly to plan and control all tactical transport operations, particularly those concerned with Army support. The new Group will be known as No. 38 Group, a title made famous in the war years for its airborne and Army support roles. The Headquarters will be near the HQ of Transport Command at Pewsey, Wiltshire.

Specialist Army officers will be attached to the Group to give close liaison in organising transport of soldiers and their equipment. The Group will have available an expanding force of tactical and short range aircraft coming into service. An Army exercise "Red Banner" was held in October to test ability to supply forward battle areas. During the exercise Transport Command landed or dropped by parachute, 1,650 men, 10 vehicles with trailers and 363 tons of stores. 16 helicopters supplied the 3,000 troops involved.

SERVICE NEWS

WINDFALL

● *Twenty-one V-Bomber men, members of a radio servicing flight at RAF Lindholme, near Doncaster, flew into London on October 6 to collect pools winnings of £252,075. The lucky syndicate consists of two officers, one WO, three sergeants, four corporals, eleven aircraftmen and four civilians. All the men intend to continue in RAF service.*

GIVING THE BIRD!

● The Air Ministry are beginning a series of experiments with sound amplifiers which, it is hoped, will keep airfield runways clear of birds. The "feathered friends" are often a hazard to aircraft during take-off and landing.

The apparatus consists of six 8 ft. high loudspeaker assemblies, two amplifiers and a tape recording unit. The loudspeakers will be placed along the length of the runways and will broadcast recordings of the alarm or warning cries of certain common species of birds.

RAF in ANTARCTICA

Pilots, aircraft and ground crews in survey

THE research ship "John Biscoe" has arrived at Deception Island in the Antarctic with scientists and technicians of the Falkland Islands Dependencies Survey on its annual voyage from England.

An RAF advance party is on board. Their task is to clear an airstrip on Deception Island for use by aircraft, which will carry skis in addition to wheels. Later two Royal Air Force pilots and three ground servicing NCOs will join the expedition. Their task will be to operate two aircraft (a Beaver and an Otter) for air reconnaissance and photography and for flying vital stores and supplies in support of the geological and topographical survey parties which the expedition will be sending out into the snowy wastes. The aircraft can accomplish in a few hours what, by any other method, would take weeks. Although the Otter and Beaver will remain in the Antarctic for five years, the RAF men will be relieved at intervals.

HISTORICAL DEPARTMENT

● RAF Chivenor is being "written up" by Flt. Lt. B. M. Burley. Photos and information on early days needed. Address: RAF Chivenor, Barnstaple, Devon.

● RAF Thorney Island is 21 years old this year. Flying Officer D. Barnes is compiling a record of this station and would welcome information and photographs. Address: RAF Thorney Island, Emsworth, Hants.

RECRUIT SCHOOL

SINCE November 20 all new recruits into the RAF will receive their eight weeks' basic training at RAF Bridgnorth, Shropshire, now the only Recruit Training School for the Service.

Three years ago there were five stations for recruit training. Hednesford, Padgate and West Kirby were closed in turn and last month the school at RAF Wilmslow dismissed its last intake. Since 1945 Wilmslow has "processed" 100,000 recruits at a rate of 51 intakes a year.

INVENTOR'S AWARD

● *Corporal David Street, aged 21, an Air Wireless Fitter, has been awarded £20 for the invention of an item of equipment for testing the radios which are fitted to each crew position in some multi-seat aircraft.*

AIR PHOTO MUSEUM

The RAF School of Photography has formed a small historical section and museum to mark its silver jubilee in 1967. So far the School has been able to obtain certain early gear for its museum such as cameras used in the R.E.8, Bristol Fighter, D.H.9A and other aircraft of the first world war.

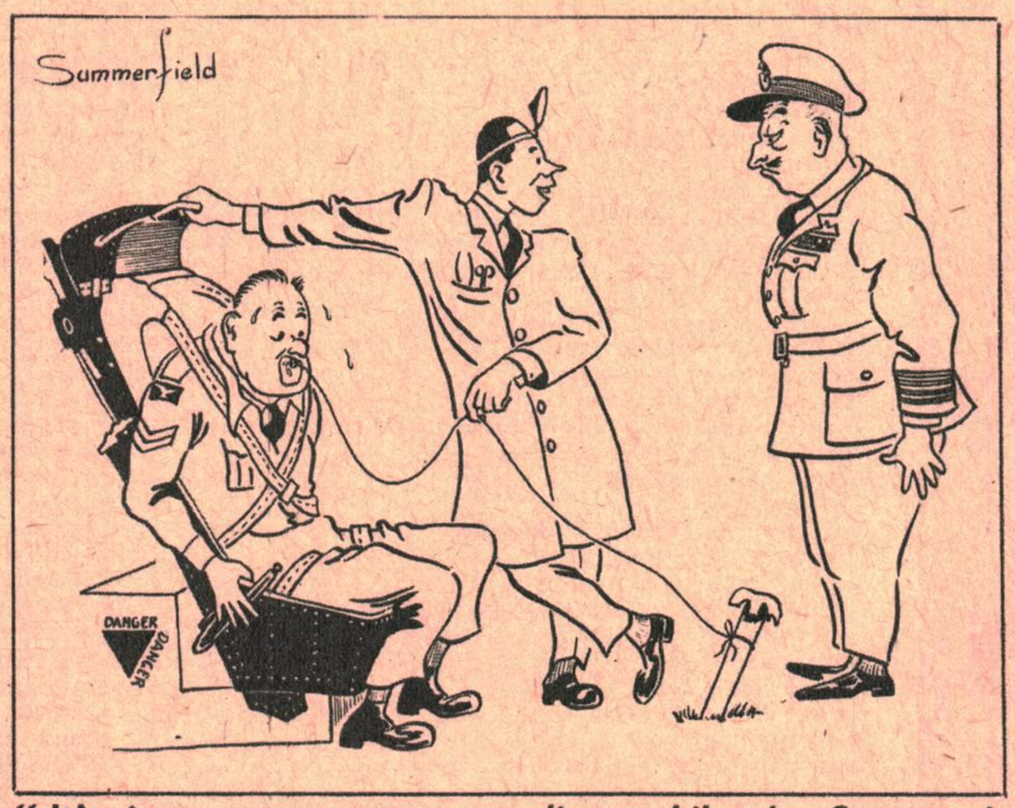
The search continues for evidence of the first steps in aerial photography. Prints have been presented of views of Paris taken by a balloonist in 1886, but it is believed that aerial photography was first practised in the American Civil War of 1861-65.

EDUCATION SUCCESSES

OUT of 4,331 servicemen and women from the RAF who sat for their General Certificate of Education last year, 2,875 have passed. Since the introduction of the GCE (Forces Scheme) in 1953, 41,372 officers, airmen and airwomen have entered for the examination. Of these 27,713—almost 67 per cent—have been awarded certificates: Already it is estimated that another 3,000 Service candidates are preparing for the next examination this winter.

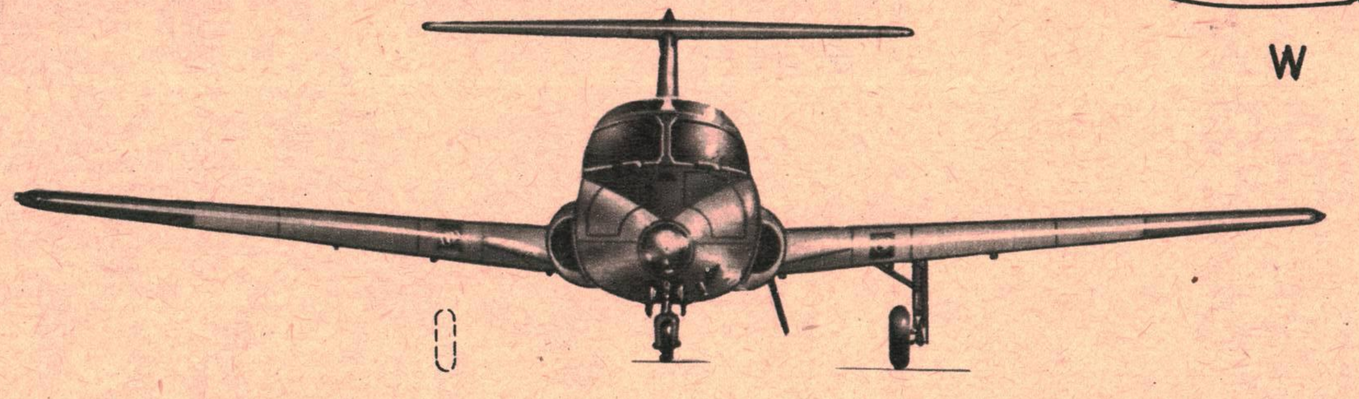
Top Candidate

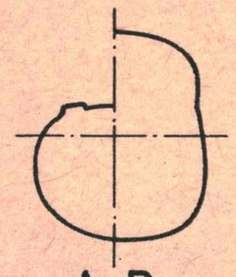
Most successful RAF candidate in the summer examinations was 42-year-old Warrant Officer Kenneth Bryant of Bognor Regis who left school 27 years ago. WO Bryant wins the Curtis Memorial Prize for his success. Asked how he felt about taking an examination in a number of school subjects when in his forties, WO Bryant said: "It was one of the hardest things I have ever done—but it was well worth it."

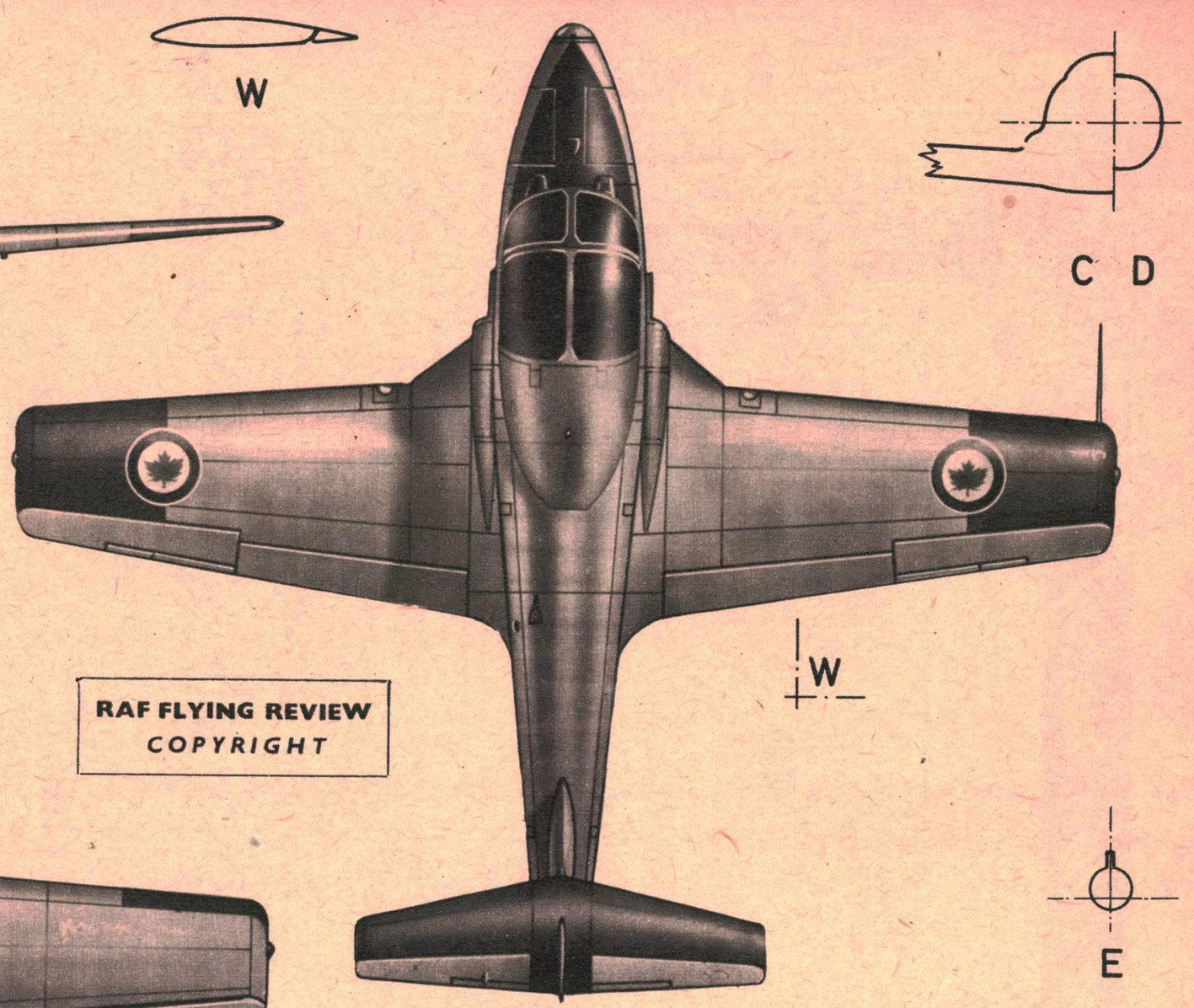


"It's just a temporary expedient while the Surgery is being re-decorated!"

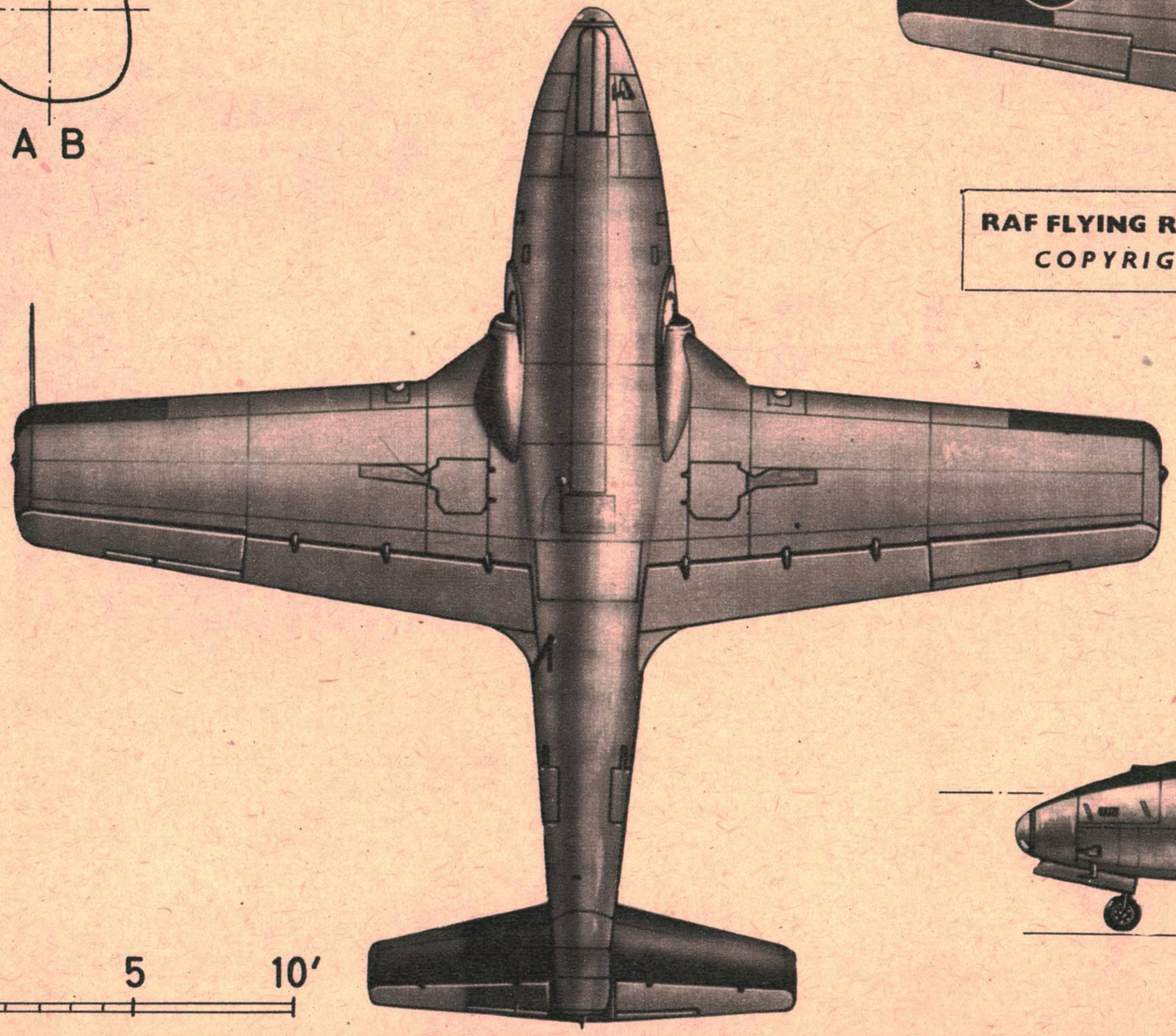
CANADAIR CL-41

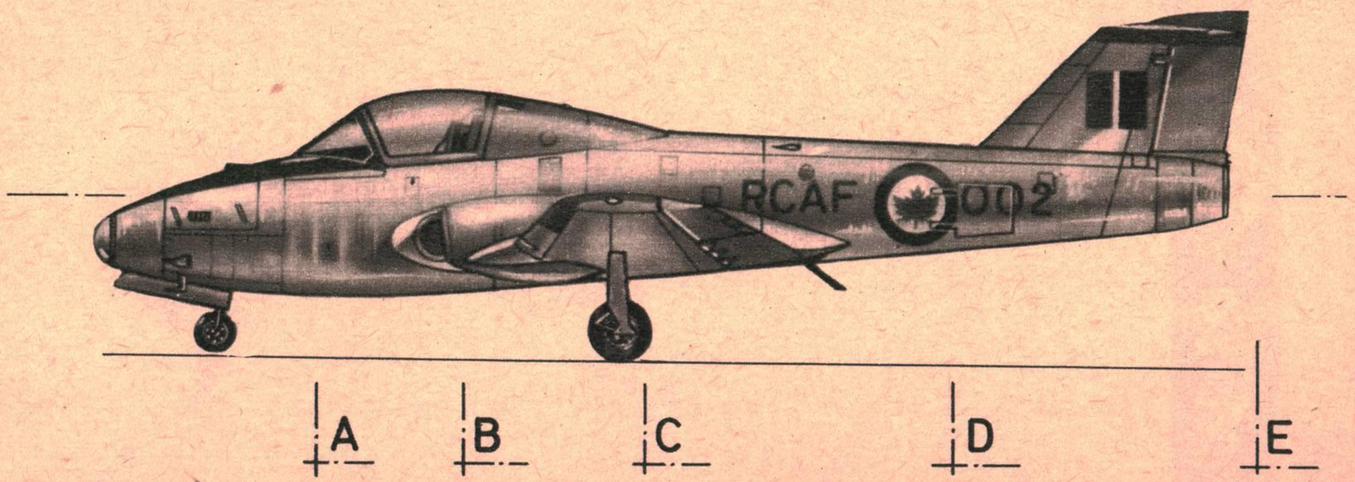




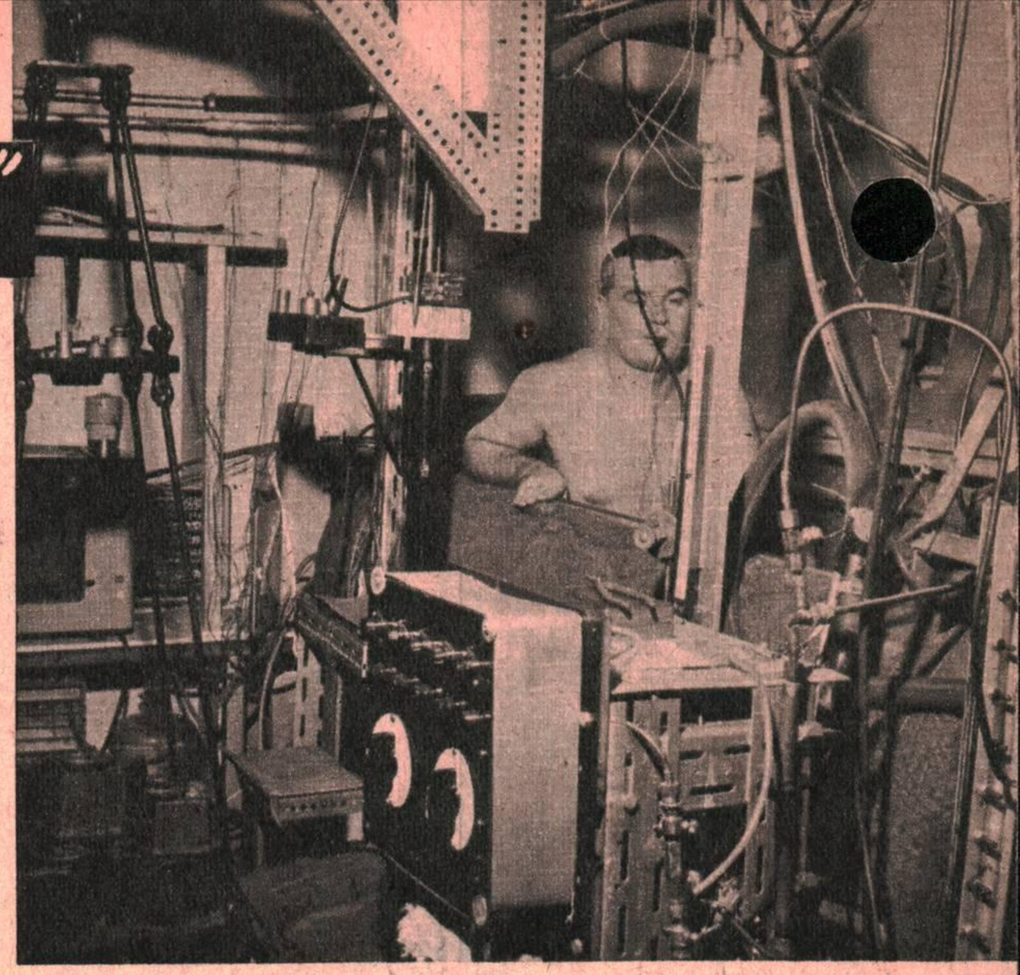


RAF FLYING REVIEW
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Doctors lives have been risked"



Calorimeters for measuring human heat content can be simple affairs—or like this one

they get there. By sitting here, sweating it out in flying gear, they will have in advance, first-hand knowledge of some of the problems encountered by the pilots they will be working with."

Decompression chambers form a vital piece of apparatus for the IAM and, as may be expected, there are several at Farnborough. The most advanced of these will simulate altitude of up to 100,000 feet, which, as far as breathing problems are concerned, is tantamount to outer space. Inside this chamber, a complete cockpit can be rigged up so that oxygen masks and pressure suits can be given a thorough and realistic testing before being tried out in aircraft.

Discomfort

With its smaller equipment, the IAM could undoubtedly make even the most seasoned bad weather flyer cry for mercy. Perhaps he would survive the turntable and be ready for more. There would be the "bumps machine" he could try. This is a pilot's seat fixed to a rig driven by an eccentric cam. Bumps of varying degrees of severity, similar to those experienced in turbulent air, can be simulated while the unfortunate guinea pig is given a variety of tasks to do, such as keeping a wandering spot of light central in a circle with the aid of a control column, or centralising the needles on a bank of nine dials. As the "pilot" strives to centralise the needles against the bumps, so a doctor at another control panel can set them off-centre again.

Even if our mythical bad-weather hero pronounced his readiness for still more punishment after this, I guarantee that he will have had enough after trying a more advanced type of turntable devised by the IAM.

This consists of a stretcher-like framework to which a man can be strapped. He can then be tilted feet upwards or head upwards, revolved horizontally, or turned over longitudinally. And all three movements can be made at once. I am told that it is not pleasant riding on this machine. I believe that to be an understatement.

But you must not imagine for one minute that the Institute of Aviation Medicine is a glorified fairground with the staff having perpetual free rides. Aviation medicine is a serious and vital science. No experiment is made unless there is a very good reason for doing it. It is no exaggeration to state that doctors at Farnborough have in some cases risked their lives. No man runs that sort of risk lightly.

The apparatus most reminiscent of the fairground is probably the centrifuge. I watched one experiment on this, and I would like you to compare it with a fun-fair.

It was a run being made for a short time to the comparatively low acceleration of 4 *g*—quite sufficient to make the subject most uncomfortable. The object of this experiment was to study how well the subject's heart could cope with the stress imposed on it by the increased *g*.

Measurements had to be made from a needle in an artery, and any doctor will tell you that it is far from easy to get into an artery in any part of the anatomy. The easiest place is in the forearm, and so the needle had to go in there.

Then, slowly and carefully, it had to be threaded along the artery until the best position was found. It was a process which took some time, because the slightest mistake could force the needle out of the artery. And then the business would have to start all over again. It was also somewhat painful.

The doctor who was the guinea-pig in this experiment was already seated in the gondola of the centrifuge ready for the run which would be made as soon as the needle was properly placed. But he had to sit there for many minutes and endure the discomfort while a colleague carefully probed his artery.

It was some time before the jacks were taken out from under the gondola, the centrifuge chamber cleared and the *g* run begun. I looked down from the observation chamber as the long arm moved slowly forward and then with breath-taking suddenness accelerated to 4 *g*. In a few seconds the run was over, the data necessary had been recorded. The guinea-pig medical officer was pale when he stepped out, but perfectly cheerful.

It is unlikely, however, that he thought of the centrifuge as part of the fun of the fair.

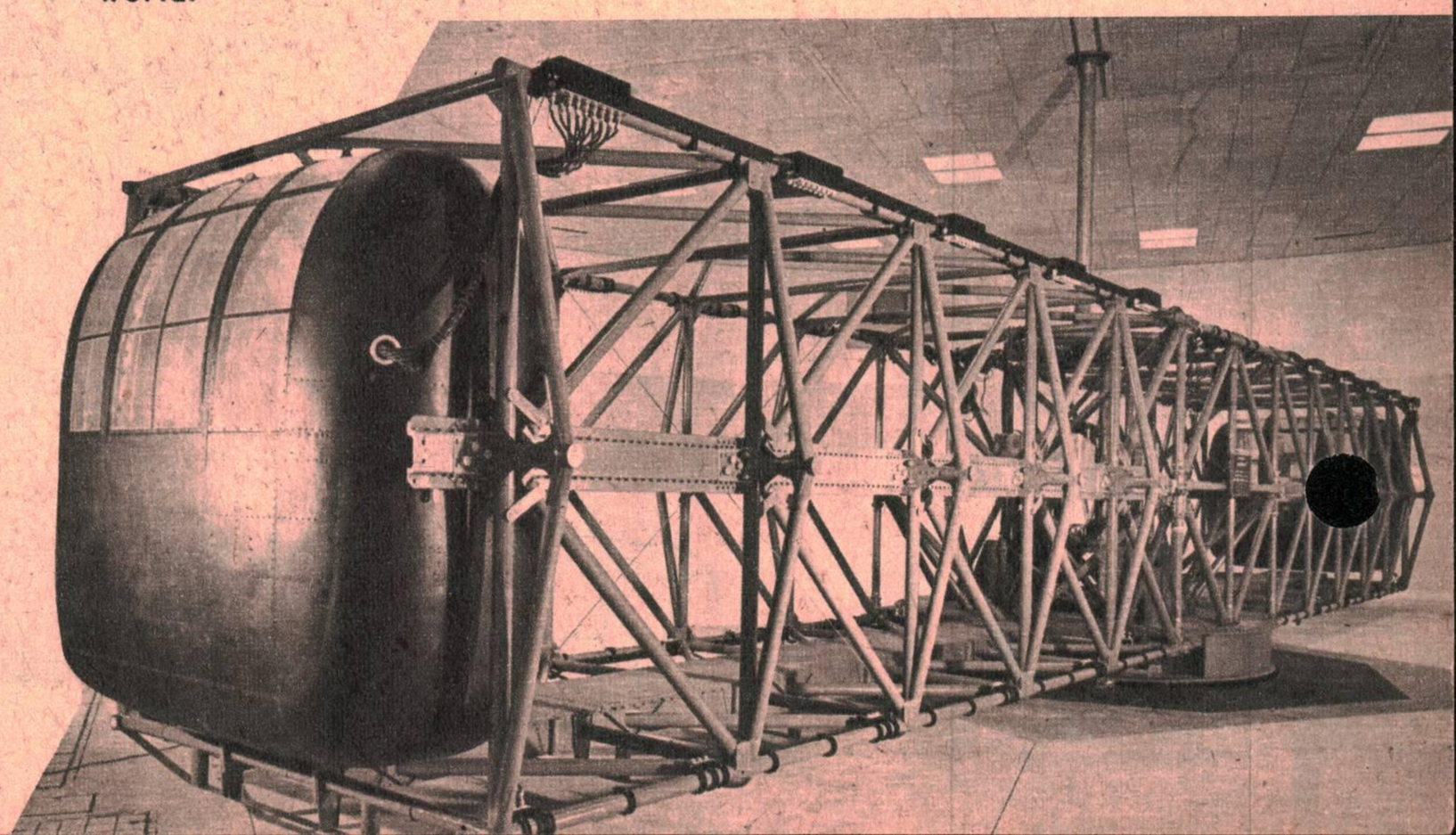
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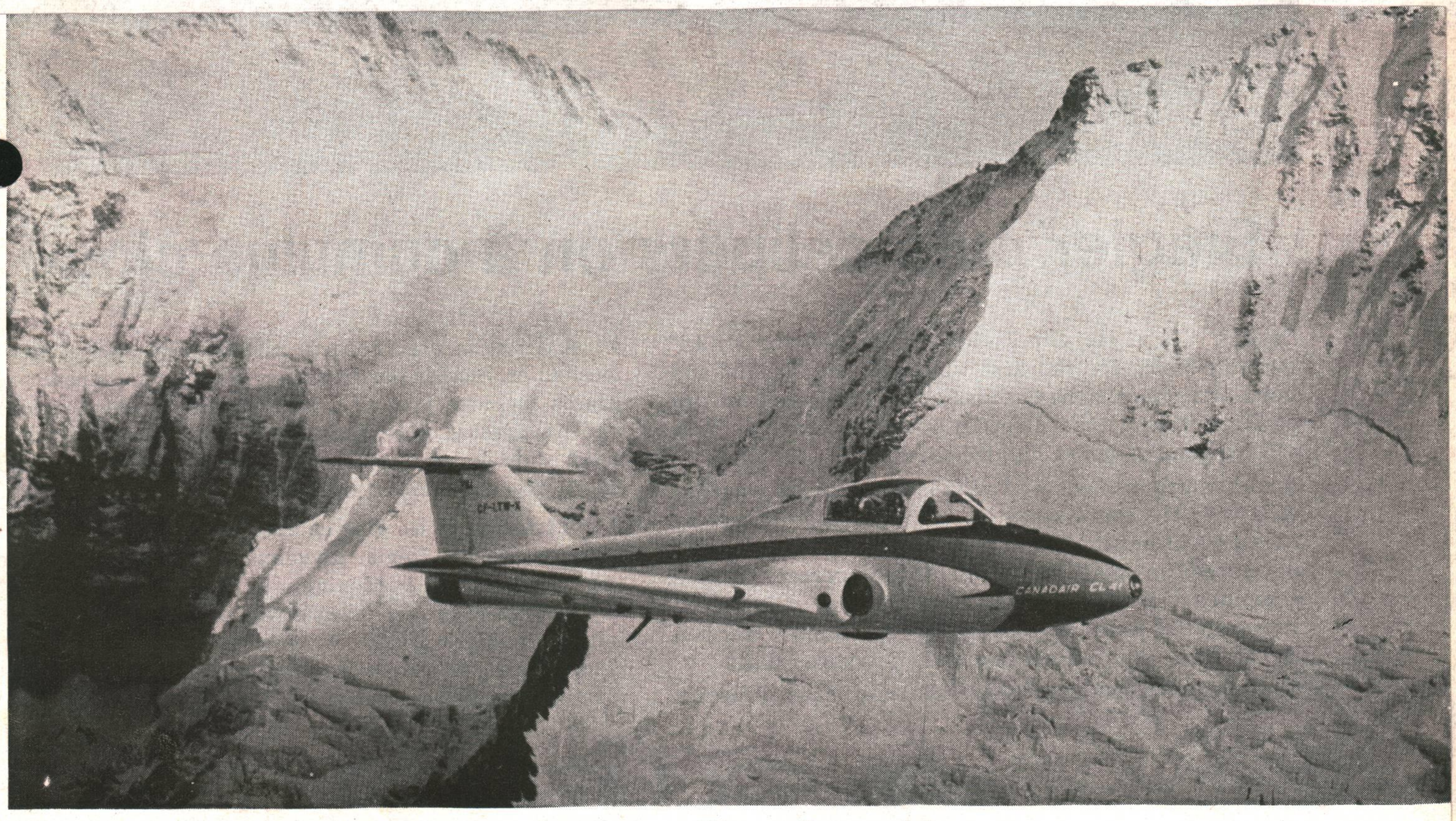
THIS then is the Institute of Aviation Medicine today—a comparatively small body of men who are quietly and efficiently conducting a vast amount of successful research into the many medical problems of modern aviation. But what of the future?

At the moment, space travel is not on their programme. "The reason," says Air Commodore Stewart, "is simply that Britain has no official plans to send a man into space and, so far as the RAF is concerned, our task is to investigate the problems of aviation." But if space research should be required, the IAM will doubtless take it in its stride. ●



Multiple turn-table (left) is not for those with weak stomachs. Farnborough centrifuge (right) is second largest in the world.





CL-41 Jet Trainer Flies Over Alps

Canadair CL-41 jet basic trainer was photographed by Swiss air force while flying over the Alps during the aircraft's recent tour of Europe. The two-seat trainer, powered by a Pratt & Whitney JT12 turbojet engine, has been ordered by the Royal Canadian Air Force. The trainer recently reached Mach .775 in level flight, exceeding the RCAF requirement of Mach .75 (AW Nov. 13, p. 23).



CANADAIR CL-41 DEMONSTRATOR, CF-LTW-X, is shown at a European air base during its recent sales tour of the Continent. Prospects of foreign sales are said to be good. The Canadian Government has ordered 190 of the basic jet trainers for service beginning in 1963 with Training Command, RCAF.





PREVIEWING THE CL-41

THE latest in a series of new aircraft to carry the RCAF roundel is an *ab initio* jet trainer, the Canadair CL-41. When this aircraft is phased into service the RCAF will be able to conduct an all-jet training program.

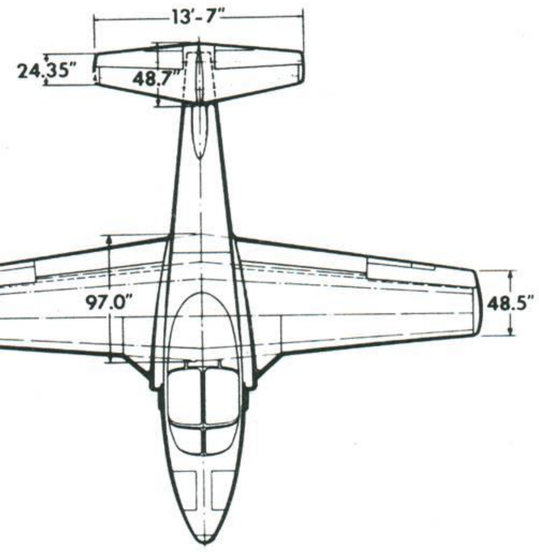
In his announcement concerning the CL-41, the Hon. D. S. Harkness, Minister of National Defence, stated that the aircraft were being purchased for the RCAF from Canadair Ltd. and would be received by 1963. The CL-41 will replace both the *Chipmunk* and the *Harvard* in the regular RCAF training system. The latter aircraft has been a standard RCAF trainer for more than 20 years. Before selecting the CL-41 as a basic trainer, RCAF evaluation teams tested several other aircraft.

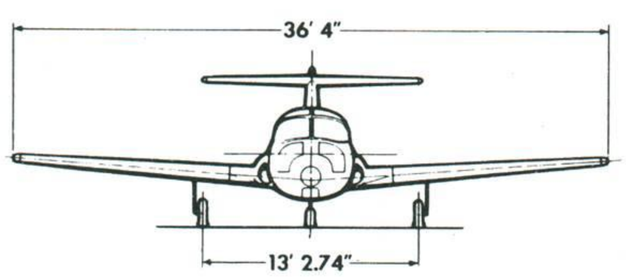
For 16 years the Canadair plant has been manufacturing aircraft under licence or modifying existing designs. The CL-41 is the company's first completely original aircraft. The engines for the RCAF's aircraft have not yet been announced.

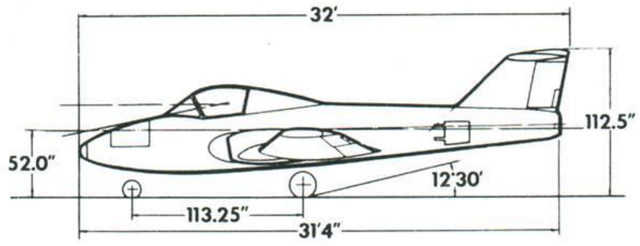
The CL-41 has side-by-side seating. This provides the instructor with excellent visibility at all times. The aircraft has two sets of flight instruments but engine instruments are centrally located so that they are readily visible from either seat. Pressurization will maintain cockpit pressure equivalent to 25,000 ft. at an altitude of 41,000 ft.

The aircraft has a training mission endurance of about two hours including a thirty minute stand-off reserve. The fuselage is of all-metal construction with the nose, cockpit and centre sections forming one unit and the rear section being removable for engine change or major maintenance.

The aircraft has a maximum level speed of about Mach .72, or 420 knots, at 30,000 feet altitude and has a maximum diving speed of about Mach .8. The aircraft is designed to have good handling characteristics at low speeds while the relatively high speed will give students a chance to experience high speed and high altitude navigation and jet operating techniques from the outset of their training. The CL-41's diving speed will also introduce embryo pilots to the problems of compressibility. However, the trainer was designed with student pilots in mind, so it is an easy aircraft to fly throughout its flight envelope.







NORTH OF 74

Story by

SQUADRON LEADER R. M. BOWDERY

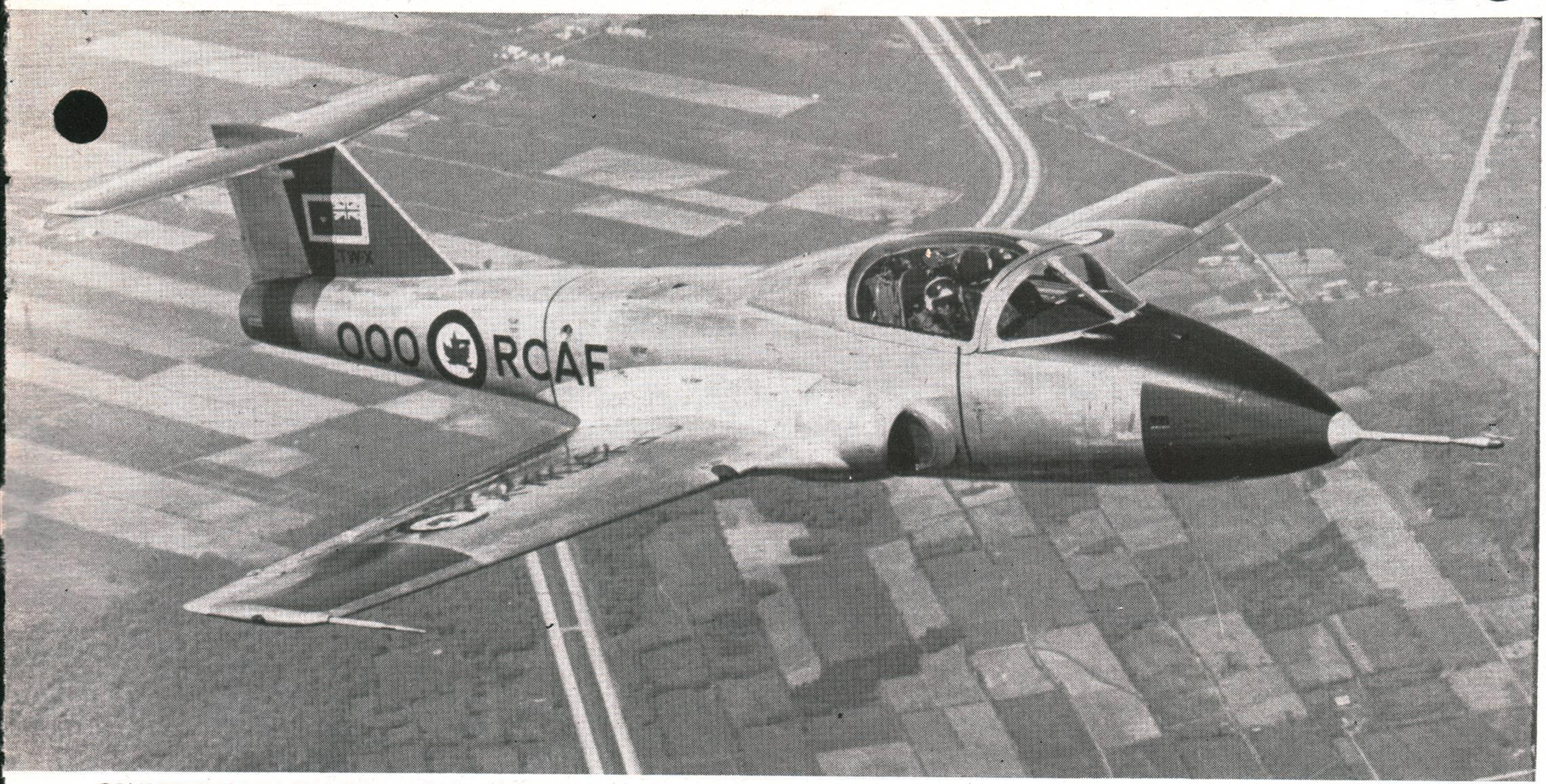
Photos by

CORPORAL W. WHITEHEAD

EACH DECEMBER RCAF aircraft fly over Canada's northern units to airdrop panniers of Christmas mail and supplies to snowbound Arctic weather stations.

The Christmas airdrop, called "Operation Santa Claus", is carried out by Air Transport Command during the full moon period and is, this year, scheduled to begin 20 December. Drops will be made at Isachsen, Alert, Mould Bay and Eureka. All of these stations are well north of 74° N. Latitude, and are under the velvet of total darkness from early December until early February.

The sound of aircraft engines sends the men at the weather stations into hurried activity. Previously prepared "torches", 45 gallon drums full of gasoline and old crankcase oil, are quickly lit and the lights of all available vehicles pinpoint the drop area. Panniers are pushed out of the rear of *Flying Boxcar* or *Hercules* aircraft and gently float to earth under the canopies of time-expired personnel chutes.



CONVERSION PACKAGES are being developed for Canadair's CL-41A jet trainer, shown in Canadian Air Force markings, to give it counter-insurgency and photo-reconnaissance capabilities.

CL-41A Designed for COIN, Recon Flights

By Donald E. Fink

Montreal—Weapons and photographic packages, which will make possible conversion of the CL-41A jet trainer to photo-reconnaissance or counter-insurgency fighter configurations in 12 hr., are under development by Canadair, Ltd.

Canadair, a subsidiary of General Dynamics Corp., is looking to newly emerging African nations with limited budgets as its best prospective customers, since the CL-41 would give them a training aircraft which could be quickly converted for combat operations with limited additional expense.

Canadiar also is attempting to interest U. S. and European military officials in a production version of the counter-insurgency configuration. Possibility of shifting production of any U. S. military orders to General Dynamics facilities in the U. S. is being considered by Canadair, reversing the trend of previous U. S.-Canadian aircraft programs, such as that of the F-104G which is being built at Canadair.

Performance envelope of the two-place CL-41A, which has side-by-side seating, lends itself to the multiple mission requirement, according to the company. Top speed is 486 mph. at 15,000 ft. and stalling speed is 80 mph. Range on internal fuel, which is carried in fuselage tanks behind the cockpit, is 660 naut. mi. Takeoff gross weight is 7,260 lb. and takeoff distance required to clear a 50-ft. obstacle on a standard day is 2,030 ft. Powerplant is the J85-Can-40, 3,000-lb. thrust General Electric engine, built under license by Orenda Engines, Ltd.

Counter-insurgency version will be designated the CL-41G. Conversion package will be designed for rapid installation so that line maintenance crews, informed of a mission requirement in the afternoon, can have the trainers ready to perform for morning attack missions.

G model conversion packages will include:

• **External wing stores racks** which will be suspended from wing ribs just outboard of the main landing gear. Attachment points presently are capable of handling 500-lb. loads through 4g maneuvers, but will be strengthened to carry 750 lb. Wing-carried armament will include two standard 750-lb. napalm bombs or two General Electric armament pods carrying a single 50 cal. M-3 machine gun and an assortment of 2.75 rockets and small bombs.

• **External centerline stores rack** mounted on the double skid beams which extend along the bottom of the fuselage. A 1,000-lb. capacity rack can be attached to the skid beams without extra strengthening. A variety of weapons, including napalm bombs, 1,000-lb. bombs or a larger GE armament pod can be carried on the centerline rack. The centerline armament pod probably will be a larger version carrying a single 50-cal. machine gun and a large amount of ammunition for extended strafing operations. Additional ammunition storage space also will be provided in the personal equipment storage space which was built into the engine intake fairing at the wing root. Provision will be made to feed the ammunition to the centerline pod to further increase its capability.

• **Two 96-gal. capacity tip tanks** which will give the G model a loiter mission capabilty of about 2½ hr. at a cruise speed of 148 mph. and limited dash speeds of 450 mph., a 210-naut.-mi. radius of action on penetration missions and a 1,726-naut.-mi. ferry range. Tip tanks also will improve wing aerodynamic efficiency and will act as endplates to break up wingtip vortices.

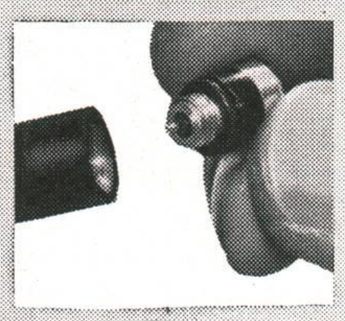
• **Laminated Doron armor plates** cover-

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A tiny Beckman Sensor—the only one of its size accurate and reliable enough to monitor partial pressures of oxygen in closed atmospheres—travels inside the pilot's face mask or pressure helmet. Long before he detects any change in oxygen, the Sensor triggers a warning system that lights, alarms, or even speaks—telling him to take corrective action immediately.



The tiny Beckman Sensor shown here weighs a scant 2 grams, but withstands 50 g's as well as severe vibration. Working on an electrochemical process, response is rapid. In less than one second it detects a change in the oxygen partial pressure. The electrolytic cell that does the work lasts up to three months. Easily calibrated in air, it can be replaced in seconds.

This is the kind of physiological monitoring hardware that has come to be expected from Beckman. For more than a quarter of a century Beckman has been testing, proving, *delivering*. With twenty-five per cent of its sales in the medical field, Beckman is solving such problems for the U.S. space agencies and its military services, the RAF, and RCAF. When it comes to *your* space-age medical problems, Beckman is one of the most qualified companies in the world. For complete information on Beckman Bioastronautics, write to Dept. M.

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ing the pressure bulkhead behind the cockpit, the floor and the back of the instrument panel. Armor, which weighs only 138 lb., will protect the crew from small arms ground fire during low level missions. Armor can be made in snap-on panels, but the company would prefer to install it permanently during aircraft manufacture, since the weight penalty would be insignificant when the aircraft is being used solely for training.

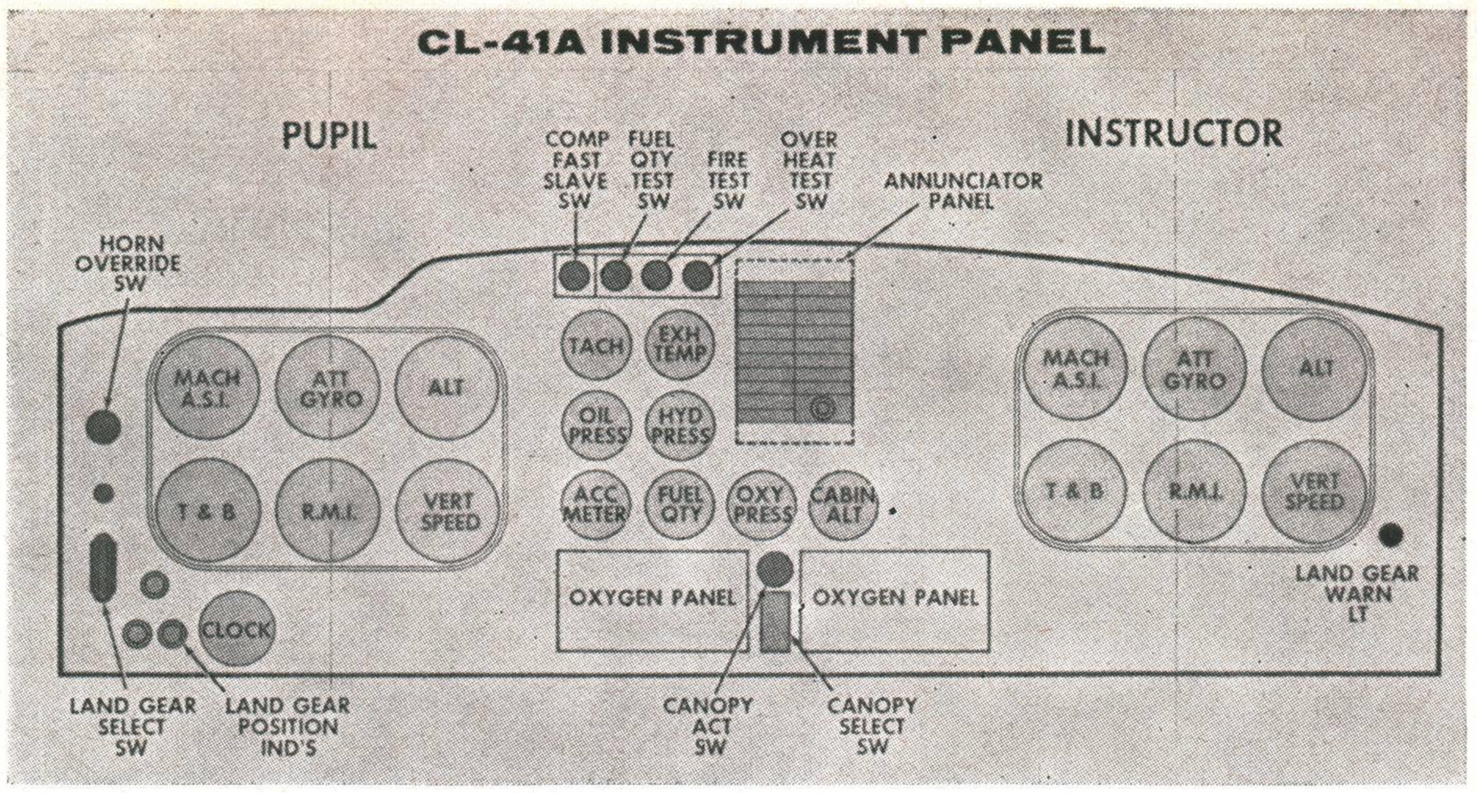
• **Interchangeable G model** instrument panel which has a simple reflector sight mounted in front of the pilot, an armament control panel and a terrain avoidance indicator. To speed the conversion from trainer to fighter configuration, two instrument panels will be supplied with each aircraft. To switch from the A to the G version, the A panel will be removed and the basic flight instruments will be taken from it and installed in a G panel, already equipped with the additional instruments required for the attack mission. While this is being done, the weapons racks will be attached to the aircraft. The G panel will then be installed in the aircraft.

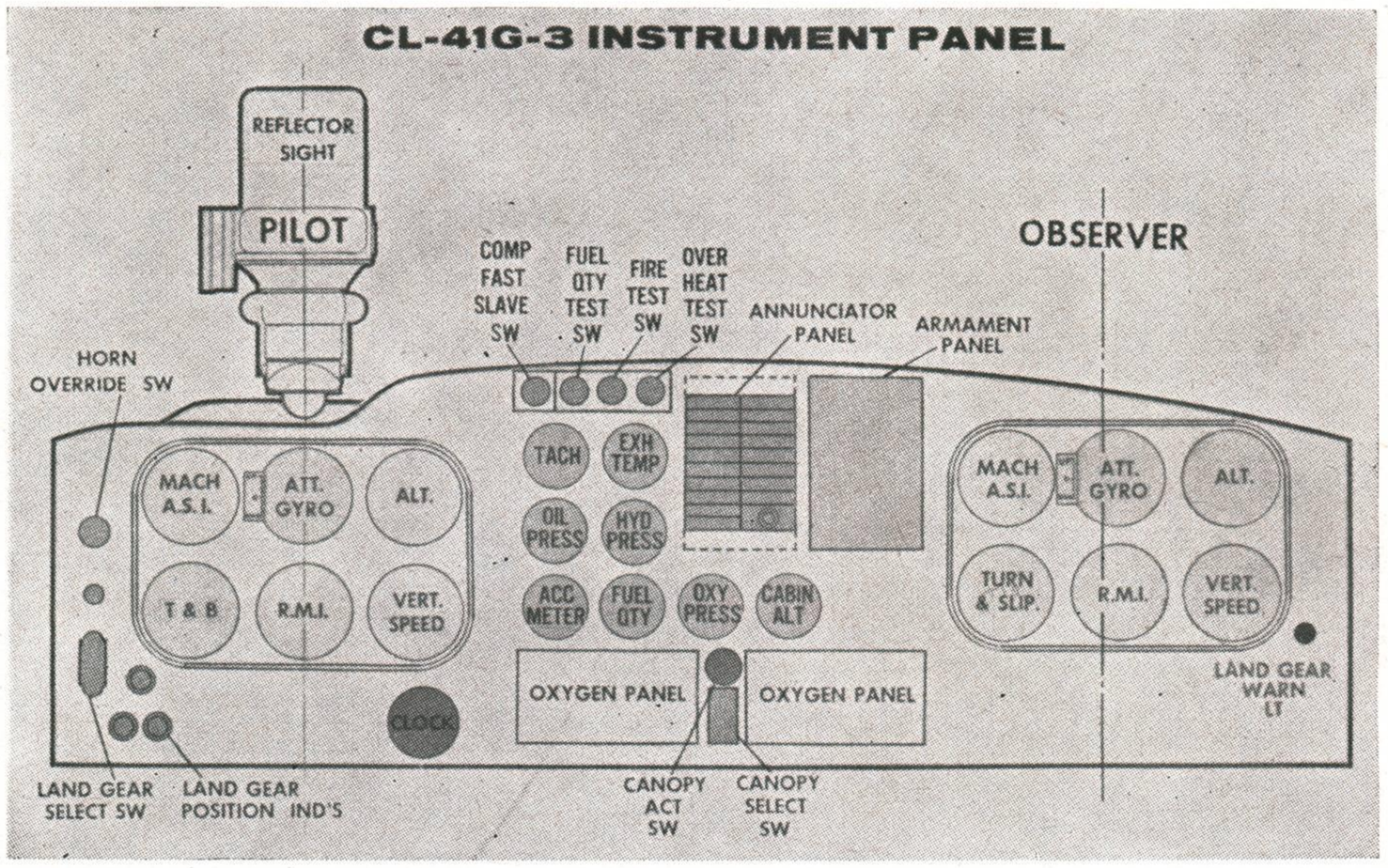
• **Removable nose cone** which will contain a General Dynamics Corp. terrain avoidance package and additional navigational instruments for IFR operations. Nose cone on the A version will be an empty metal shell. Terrain avoidance system is a simple device which displays aircraft altitude with an indicator on a vertical scale. Prior to a mission, the pilot programs the desired altitude into the device and follows the indicator, which stays centered as long as he remains at the proper altitude. When the indicator rises, indicating higher terrain ahead, the pilot knows he must climb. Terrain avoidance gear will make possible all-weather and night operations.

• **Rocket flare packages** which will fit into aft fuselage "saddlebag" compartments and will make possible ground attack or photo-reconnaissance missions at night. High-illumination flares, which can be fired forward to light the area ahead of the aircraft, will make it possible for the pilot to illuminate a target and attack it on the same sweep.

Attack profiles developed for the counter-insurgency version, which will have a maximum gross weight of 9,164 lb., call for a variety of approaches to target areas, with the final sweep being made at altitudes of 300 ft. and speeds of 400 to 450 mph. This speed and altitude range was chosen to give the pilot optimum protection from ground fire and yet give him time to select his targets.

Attack missions could be flown with a one or two-man crew. The second crewman could serve as a combination copilot, navigator and observer. During loiter or observation missions, stable flight could be maintained at about 97 mph. with full external stores and 50% fuel.





DIAGRAMS SHOW interchangeable instrument panels for CL-41 conversion packages.

Provision also has been made to adapt the CL-41G for short airfield tactical support operations (SATS) being developed by the Marine Corps (AW Dec. 24, p. 67). Catapult and holdback attachments can be provided on the centerline skidbeam with no major modification. Takeoff distance of 500 ft., clearing a 50-ft. obstacle, is anticipated with the G version at its maximum gross weight.

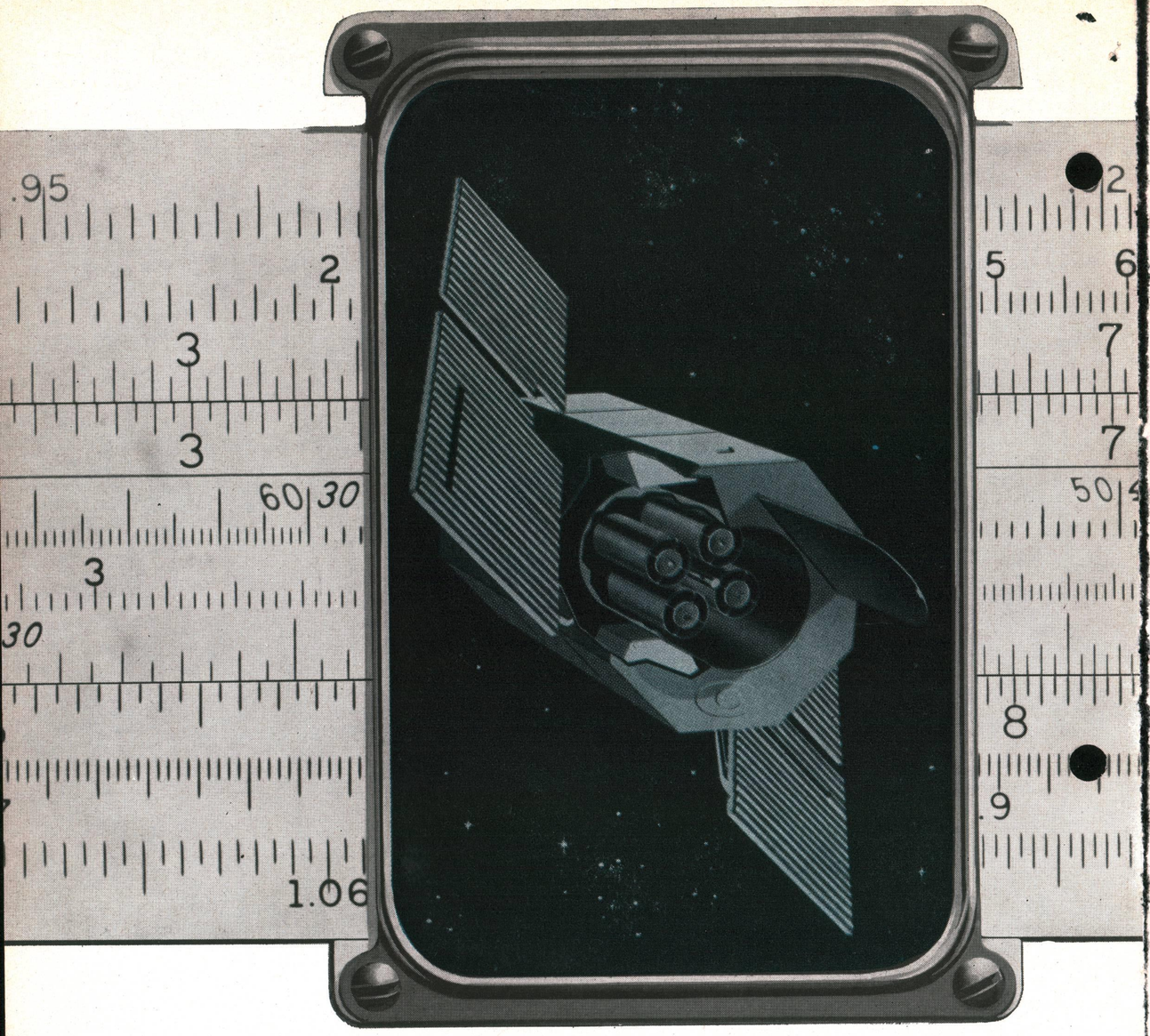
The same J85 powerplant will be used on all configurations, but an afterburner will be provided as optional equipment to give added power boosts during operational missions.

CL-41PR photo-recon conversion will be performed in the same manner as the G conversion. Packages will be designed for installation in less than 12 hr. Included will be camera packages for the nose or the centerline stores rack, tip tanks and underwing tanks mounted on the wing stores racks and a separate instrument panel with a camera control unit and a Tacan navigational device.

Camera packages will carry a variety of cameras built by W. Vinten, Ltd., of London. A vertical-oblique package containing three Vinten F-95 cameras will be designed for quick installation in a compartment just behind the nose wheel well. A quick-attach belly pod with two Vinten S-70 vertical cameras is being developed primarily for use on reconnaissance training flights, but it could be used on operational missions.

The four external fuel tanks will give the CL-41PR a mission endurance of over 4 hr. Typical photo-recon missions also will be flown at 300 ft. and in the 400- to 450-mph. range. At this altitude and speed, a pilot could photograph a strip of terrain over 4,000 ft. wide with the three-camera nose package. Camera speed will be a constant four frames a sec. with a 60% overlap of coverage. Missions could be flown alone or with an observer in the right seat.

Cost of the CL-41 and its conversion packages will vary depending on the number of mission capabilities and the amount of extra equipment desired. Price of the basic CL-41A trainer will be $250,000. Price of the same aircraft



EMR electro-optics make space television as versatile as a slide rule

EMR progress in electro-optical techniques may soon transform satellite-borne television into a basic tool for space research.

Special developments for Project Celescope, the Smithsonian Astrophysical Observatory's portion of the NASA Orbiting Astronomical Observatory, are typical of EMR's achievements. For Celescope, EMR has developed an ultraviolet television photometric system of unmatched versatility. Consider these features:

New developments in UV techniques. Large precision optics, coupled with highly sensitive UV television detectors, will give astronomers their first comprehensive all-sky stellar survey in four broad UV bands ranging from 3000 Å to 1100 Å. EMR's electro-optical technology will compile UV profiles of more than 100,000 stars into a new map of the heavens. Hot stars down to 12th magnitude will be observed in a one-year earth-orbit program.

Choice of digital or analog TV. The EMR system permits accurate real time data acquisition by the use of digital television techniques coupled with PCM transmission. Remote operation is provided by digital storage of the TV data, followed by PCM transmission on command. A conventional, slow scan analog TV mode is also provided.

Flexible command and control system. EMR equipment permits manual operation of the four camera system via ground commands; automatic remote operation via on-board stored commands; or automatic real time operation via ground computer command-control.

Unprecedented reliability. There is better than 95% probability that Celescope's electronic system and at least one TV camera link will operate successfully for one year in orbit.

Difficult problems in surveillance or reconnaissance, long-range restricted bandwidth video systems, and electro-optical measurements in any part of the spectrum are EMR specialties.

Whatever your need in electro-optics, investigate the outstanding capabilities available at EMR. For details, write to . . .

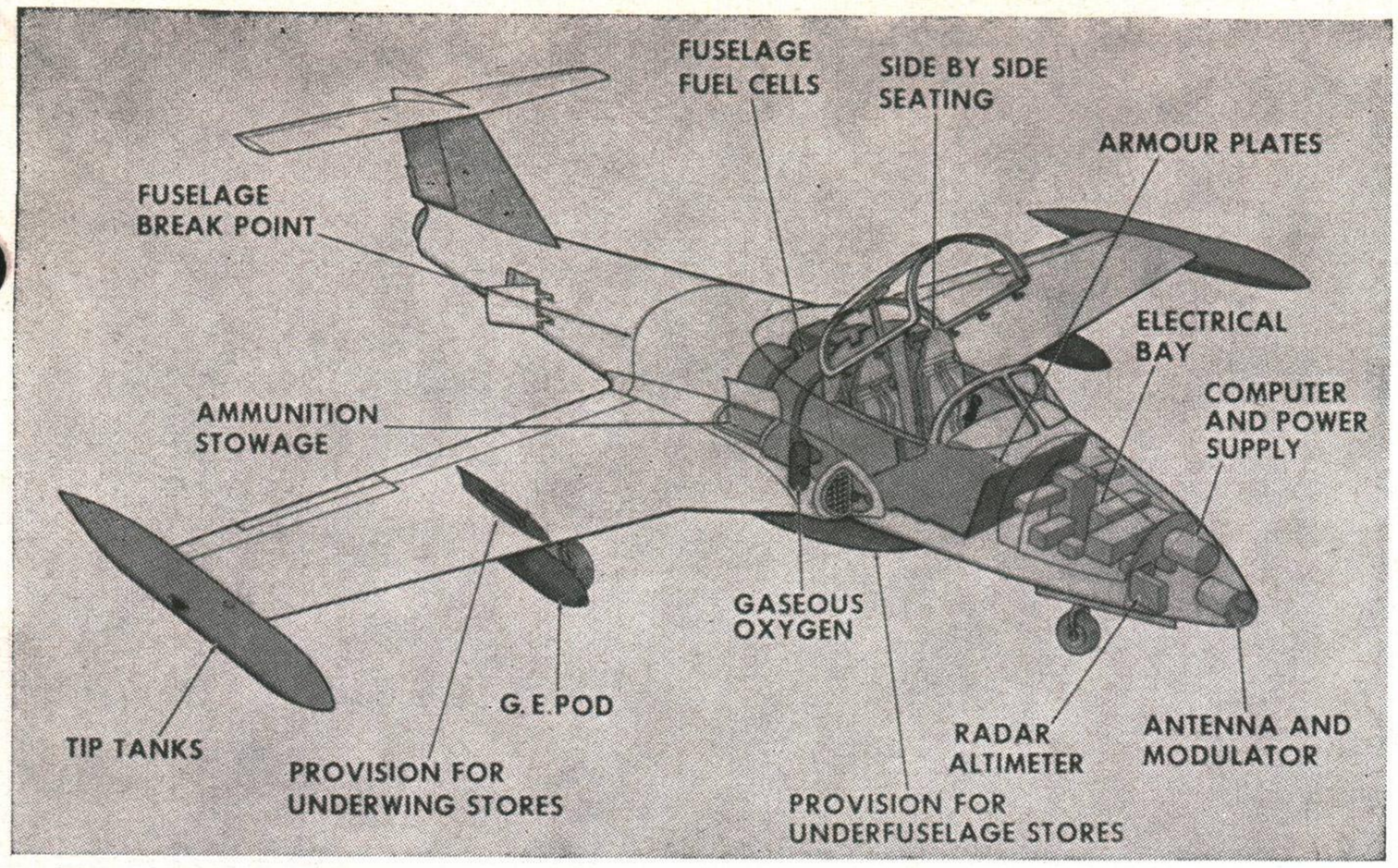
ELECTRO-MECHANICAL RESEARCH, INC.

Systems Division **Sarasota, Florida**

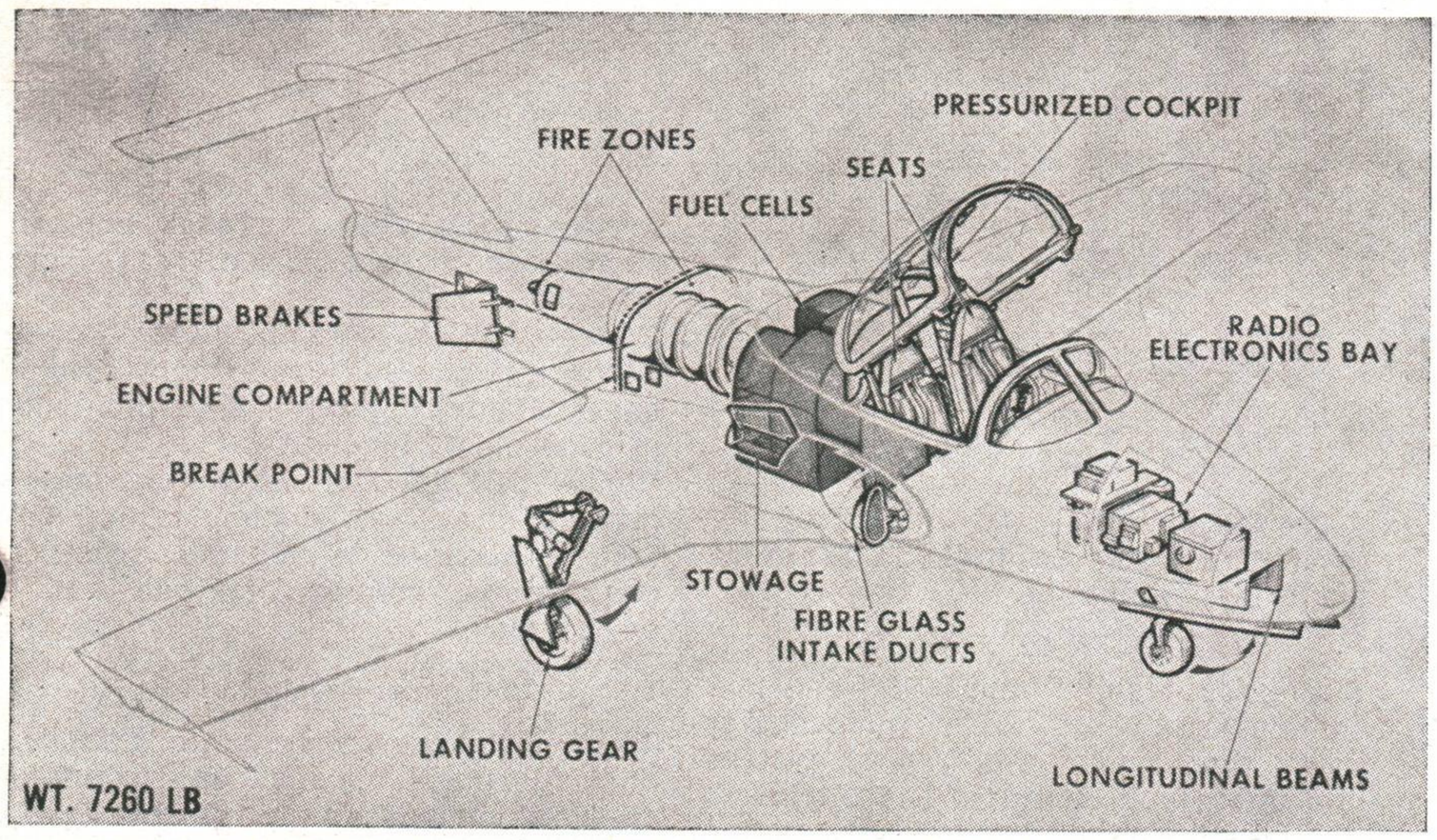
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Here is a completely new concept in liquid level sensing. United Control's unique Thermal Point Sensor, now in production, offers greater reliability and simplicity, less instrument weight and power consumption, and lower cost to any vehicle utilizing a cryogenic propellant than ever before. The secret is a seldom-used thermal-electric principle, adapted for the first time to liquid instrumentation. This principle allows United Control to measure propellant level on board to an accuracy of 0.03 inch . . . assure propellant utilization accuracies of better than 0.1% . . . and trigger an engine cut-off signal in less than 10 milliseconds. □ United Control has the time-tested capability to produce complete systems for determining propellant utilization, precise propellant residuals, and for providing telemetry and slosh instrumentation. In propellant management, as in the many hundreds of control systems that bear the UCC trademark, reliability means success. For additional data on the revolutionary 2543-1 Thermal Point Sensor, or any of the family of flight, propulsion, temperature and environmental controls, and accessory systems and components, call United Control: serving the aerospace industry—



CL-41G COUNTER-INSURGENCY configuration will carry 750-lb. gun pods under wings.



BASIC CL-41 AIRFRAME features unitized design and side-by-side seating.

that has been adapted for conversion will be slightly higher to cover the cost of additional attachments and instruments and the testing required to meet military specifications on armament performance.

Definite plans have not been made on how many different CL-41 packages Canadair will offer prospective customers, since each order may vary with the customer's requirements. The interchangeability of components will permit factory production of any one of the three configurations, however, without the conversion capability.

Versatility of the basic CL-41 design has been demonstrated with the CL-41R advanced systems trainer—one of two prototypes currently being flown by Canadair. The CL-41R has an F-104G nose section filled with the Lockheed NASARR electronics system and carries the NASARR electronics packages in the aft fuselage "saddlebag" compartments.

First CL-41G conversion probably will be made in late July on the R version prototype. The other prototype, an A model trainer, is committed to an extended test program for the Canadian Air Force, which has purchased 190 of the aircraft for its training fleet.

The R model prototype also is committed to a Canadian Air Force test program to check out the F-104G systems installations, but it should be released by May. After a two-month tour of Europe, during which Canadair will demonstrate the advanced systems trainer to NATO nations re-equipping with the F-104G, the R prototype will be returned to Canada for conversion.

In addition to its versatility, the CL-41 has other basic features which Canadair thinks suit it for operations in remote areas where counter-insurgency missions will be flown. These include the following:

• **Rugged Airframe,** which is designed for a 15,000-hr. lifetime with rough handling. It also has a mechanical control linkage which is less susceptible to failure and which gives the pilots a positive feel of the aircraft.

• **Maintainability,** aided by the low-slung configuration which puts a majority of the aircraft's systems within reach of a man standing on the ground. Aft fuselage disconnects and slides back, giving clear access to the engine and its accessories. Other subsystems are grouped in easy-to-reach compartments. Four maintenance manhours are required for every hour of flight, giving the CL-41 an hourly operating cost of about $42, based on an annual utilization of 500 hr. This cost excludes depot maintenance and electronics system repair.

• **Mobility,** made possible by the modular construction which permits disassembly of the aircraft into four main pieces; the main fuselage and powerplant, the wing assembly, the rear fuselage and the tail plane. Ten men can assemble the CL-41 for flight in 10 hr. Components are easily crated for air shipment.

Boeing Uses Epoxy Tape in 727 Fuselage

Boeing Co. is using epoxy tape which cures at room temperature to improve load distribution in 727 transport body splices and doublers and to reduce the need for increased skin thickness in some areas.

Tape adhesive, developed to Boeing specifications by Shell Chemical Co., of Pittsburg, Calif., is called Epon Adhesive 927.

Epon 927 consists of an epoxy resin and a curing agent impregnated into 0.005 in. glass cloth tape. Impregnated tape is overlayed with polyethylene film and refrigerated immediately after manufacture. Tape is shipped in dry ice and held to −10F after arrival. Storage life is about 46 days.

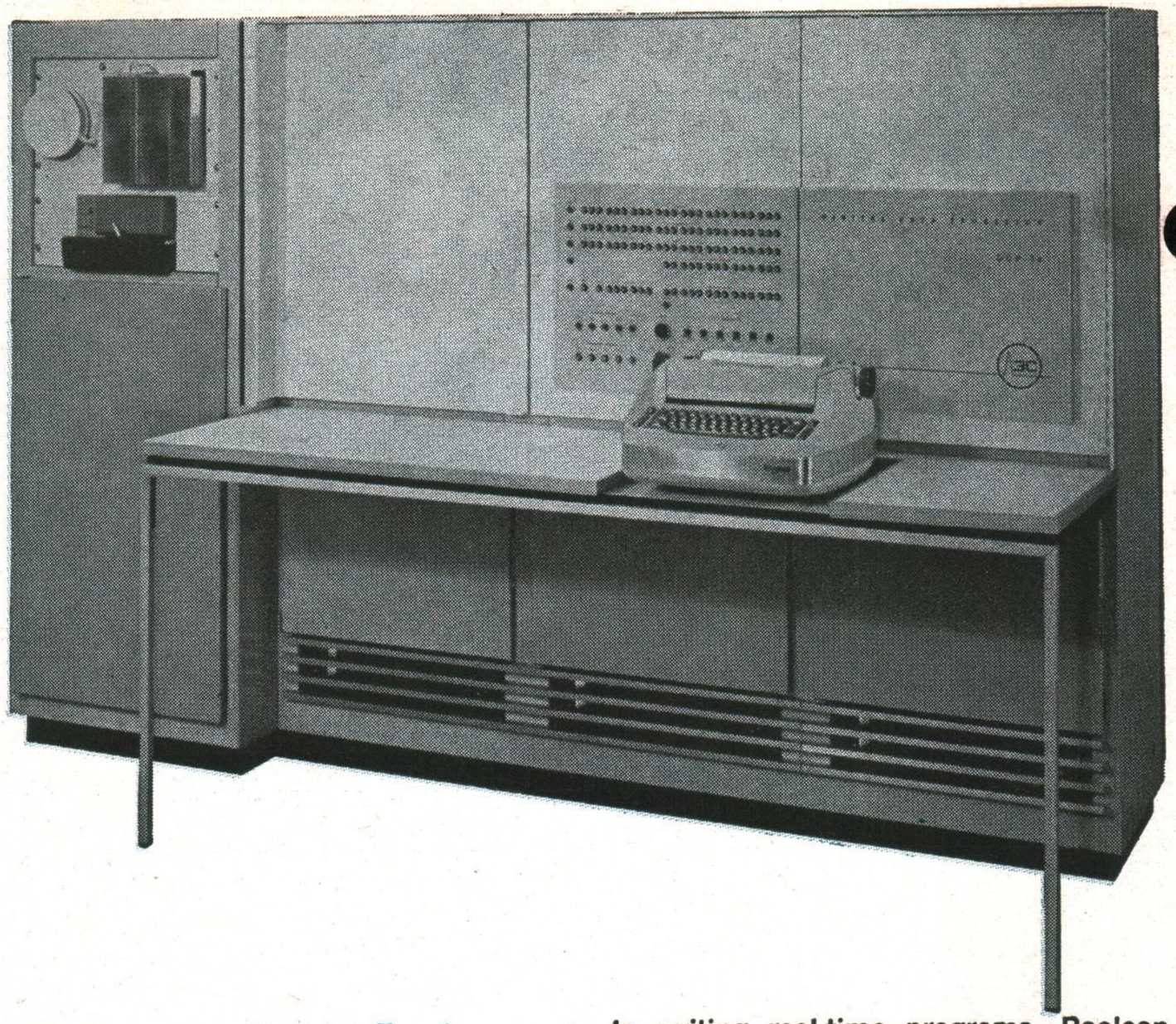
Tape adhesive is sandwiched between the overlap in fuselage body splices before riveting. Boeing says adhesive bonding of body splices coupled with riveting will result in higher strength-to-weight, better fatigue resistance and fuselage pressure sealing, and aerodynamically smoother skin.

Adhesive is also used for rivetless bonding of doublers used as tear stoppers and for bonding bulkhead doublers and reinforcements.

In use, metal surfaces to be bonded are chemically cleaned and coated with a liquid adhesive well in advance of tape application.

For bonding tear stoppers to fuselage sections, doubler is laid over tape which is trimmed to conform to it. Doubler is then bonded full length to aluminum-clad alloy body skins. Entire assembly is vacuum bagged and cured at room temperature for up to three days. Assembly can also be heat cured at 190F for 90 min.

$87,000



***DDP–24 IS NOT** designed to be all things to all people. **DDP-24 IS** a fast digital computer, versatile, a sophisticated "component" built to move in company with a precision team in complex real-time on-line configurations. Equally comfortable performing off-line engineering and scientific computations. Reliable? Very.**

DDP-24 pays for itself on a diet of challenge. DDP-24 hardware, comprehensive software, user services and options belong in the hands of qualified professionals who know their applications and how to evaluate a computer against these selected applications. Under these conditions DDP-24's are a lot of computer for the money.

DDP expanded to 24 bits
Faster arithmetic unit
Comprehensive software

DDP-24 is a parallel 24-bit word, core memory, sign-magnitude, binary, general purpose computer, with indexing and indirect addressing. Instruction repertoire includes multiply and divide, load and store, shifting, logical, jump, index, and input/output. Standard memory capacity is 4096 words (optionally expandable).

Simplicity, maintainability, user convenience are factors of design. Regulated power supplies and power failure protection preserve integrity of computation. Ready and interrupt modes give DDP-24 master or slave relationship with external equipment. Optional independent memory banks and fully buffered channels give true input, output, and compute overlap.

SPEED

Computation rate is 100,000 additions per second. Multiplication takes 31 microseconds, division 33 microseconds. Times include instruction and operand access. Other arithmetic speeds:

Add floating point	125μ/secs. max.
Multiply floating point	99μ/secs.
Add double precision fixed	55μ/secs.
Add double precision floating	181μ/secs.
Multiply double precision fixed	263μ/secs.
Multiply double precision floating	371μ/secs.

Core memory cycle time is five microseconds with three microsecond access. Input and output can occur asynchronously and be interleaved with processing at transfer rates up to 166,000 24-bit words per second.

INPUT-OUTPUT

Strong input-output capabilities enhance communication with surrounding equipment; offer unique freedom of system implementation. Standard DDP-24 incorporates an eight-bit I/O character buffer register and channels, a 24-bit parallel input channel, a 24-bit parallel output channel, sixteen lines for external sense inputs, eight output control pulse lines, and four interrupt lines capable of asynchronous operation with the associated four basic input-output channels. Standard I/O equipment: typewriter, paper tape reader, punch.

SOFTWARE

Programming software provided with the DDP-24 is comprehensive; satisfying professional programmers writing complex routines, mathematical analysts, and the occasional user. Fortran II, DAP, and DIP are modular, patterned after SHARE, easily adapted to specific hardware configurations. Diagnostics for rapid isolation of programming and system faults are included. Also provided: mathematical subroutines, number conversion, memory dump, library routines, master executive program, load program, and computer exercise routines.

Fortran II compiler permits investigation and development of math models prior to writing real-time programs. Boolean augmentation and macro calls are provided.

DAP — DDP-24 Assembler Program — with one-to-one and one-to-many assembly, facilitates tight real-time programs in convenient language.

DIP — DDP-24 Interpretive Program — permits users with minimum programming experience to generate scientific computation routines after only half a day's study.

OPTIONS

To offer still greater system adaptability and functional capabilities, extensive standard options and peripheral equipment are available for the DDP-24:

☐ core memory expansion to 16,384 words, with special expansion 32,768 words. (directly addressable) ☐ additional index register ☐ word forming buffers ☐ character I/O buffer registers ☐ interrupt lines ☐ eight level hardware interrupt priority system ☐ additional sense lines ☐ output control pulses ☐ parallel I/O channels.

I/O control units for maximized interlace and truly simultaneous operation:

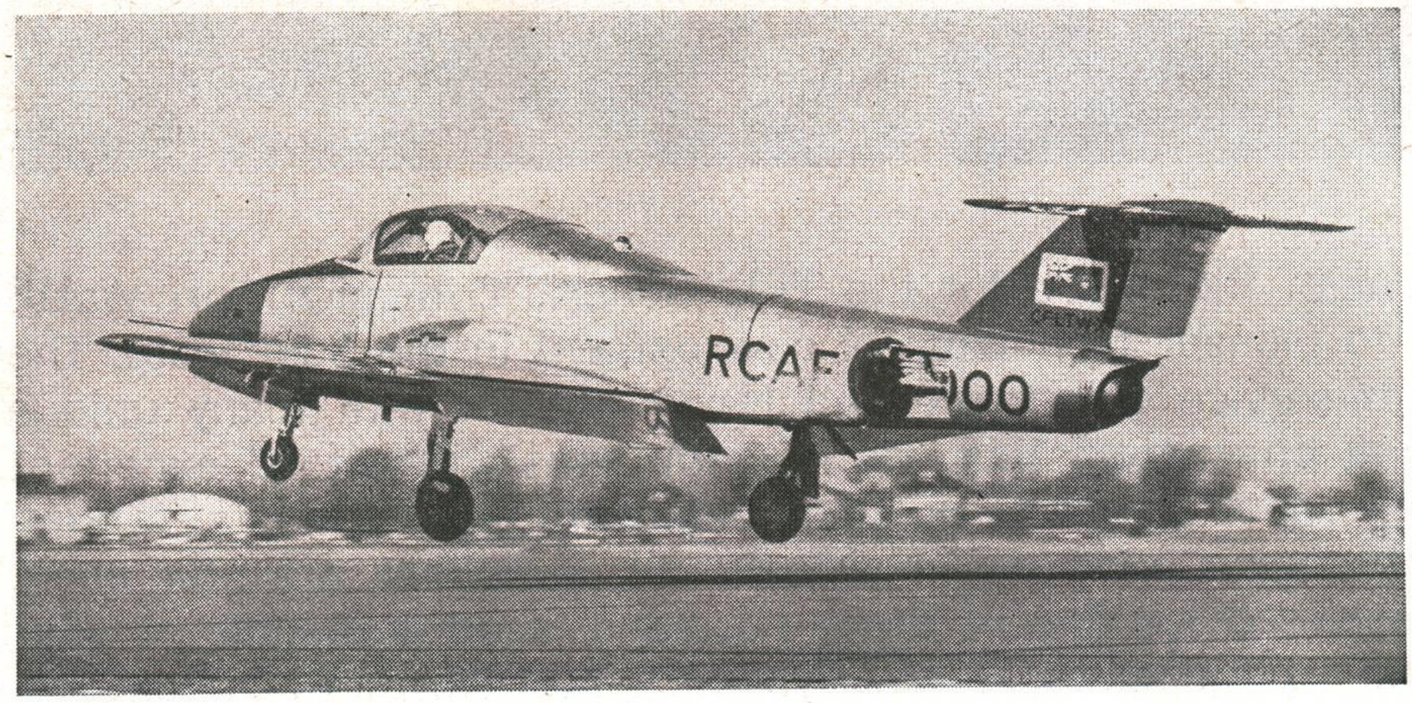
☐ direct memory access control unit with unlimited channels ☐ fully buffered I/O control unit with unlimited channels.

Peripheral equipment optionally available: Magnetic tape control and transport units, A/D, D/A converters, card adapter, high speed line printer and adapter, digital plotter and adapter. Digital Resolver, satellite computer, increases DDP speed up to 10 times for algebraic and trigonometric functions. Other peripheral requirements can be fulfilled. Write for the full story.

**Design is typical 3C. Modular construction is with S-PAC digital logic modules. Based upon a million PAC-hours of life test without failure the DDP-24 calculated MTBF is over 4000 hours.*

COMPUTER CONTROL COMPANY, INC.

OLD CONNECTICUT PATH, FRAMINGHAM, MASS. • 2251 BARRY AVENUE, LOS ANGELES 64, CALIF.



CL-41A Flies With J85 Engine

First flight of a Canadair CL-41A fitted with General Electric J85 turbojet engine took place recently. Other modifications on the aircraft are larger air brakes and a cut-away fuselage tail cone to save weight. Engines are being built under license by Orenda Engines, Ltd. CL-41R trainer also is being fitted with the J85. Original powerplant for the aircraft was the Pratt & Whitney JT12A.

AVIATION WEEK and SPACE TECHNOLOGY, December 17, 1962

114000	Tutor CT114	General Electric J85-CAN-40 (one)	
CF REGISTRATION NUMBER	MAKE AND MODEL	ENGINE TYPE	MANUFACTURERS No.

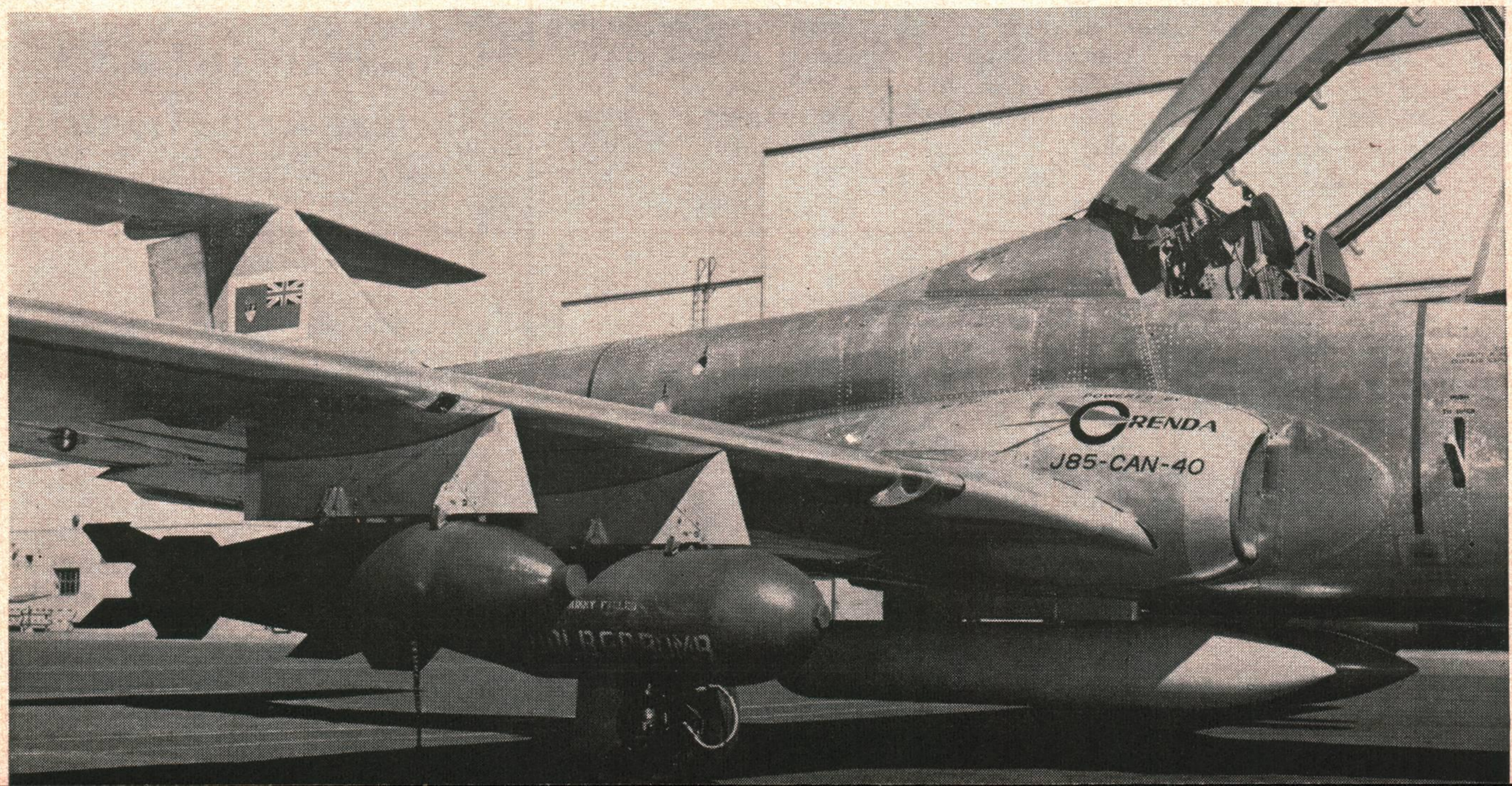
UNIT ENTRY AT	DATE	QTO No.	CD No.

TRANSFERS			TRANSFERS		
DATE	QTO No.	TO	DATE	QTO No.	TO
LOCATION	: CFB PORTAGE main gate				
MOUNT	: PEDESTAL				
HISTORY	: Commorates two pilots who died with the Centenaires.				
	This A/C was produced by Canadiar, Specially instrumented but never delivered				
	to DND . It was donated to CFB Portage la Prairie by Canadiar, thus the use				
	of the Dummy Serial 114000.				
Photo #	: N/A				

CFIA 385 (9-78)

CL-41G Carries Weapons, Removable Photo Packs

Canadair CL-41G, counter-insurgency version of the Canadair CL-41A Tutor jet trainer aircraft, is shown carrying two 250-lb. high-explosive bombs on the outboard wing pylons, two 500-lb. bombs on the inboard points and two General Electric rotating-barrel Minigun pods on the twin fuselage armament points. The CL-41G is a modified aircraft taken from the production line which is supplying the Royal Canadian Air Force with jet trainers. It is powered by a single General Electric J85-Can-40 turbojet engine, rated at 3,000 lb. thrust. Canadair also has developed removable photographic packages which will provide the G version with an attack/reconnaissance capability for counter-insurgency operations (AW Mar. 25, 1963, p. 61). The CL-41G, which made its first flight in July, currently is at Eglin AFB, Fla., where it is being put through Minigun firing tests (AW July 13, p. 36) as part of USAF's YAT-type counter-insurgency aircraft evaluation trials.



Goldwater Statement on Nuclear Weapons

Sen. Barry Goldwater has charged that under the present Administration policies, the U. S. deliverable nuclear capability will be cut 90% in the 1970s. The following analysis on which these charges are based was released by the senator Aug. 18 in Springfield, Ill.:

Based upon Pentagon press releases dated Apr. 14, 1964 and Aug. 11, 1964 and related newspaper articles.

Newspapers gave the following nuclear capacities. They are not quite correct but for comparison purposes are usable.

B-52—at least 24 megatons (up to 48 megatons)
Titan—less than 10 megatons
Minuteman—less than 1 megaton
Polaris—less than 1 megaton

JANUARY 1961	On Alert[1]		Total	
	Number	Megatonage	Number	Megatonage
Bombers (B-47-B-52)[2]	500	12,000	1,500	36,000
ICBM's[3]	5	50	5	50
Polaris	32	32	32	32
	537	12,082	1,537	36,082
NOW				
Bombers (B-47, 52, 58)[4]	540	12,960	1,080	25,920
ICBM's Titan-Atlas	205	2,050	205	2,050
Minuteman	600	600	600	600
	1,345	15,610	1,885	28,570
1970				
Minuteman	1,000	1,000	1,000	1,000
Polaris	656	656	656	656
	1,656	1,656	1,656	1,656

No mention is made by the Pentagon of Atlas and Titan in the 1970s. This confirms, from published appropriation hearings, that they are to be phased out.

Recent Pentagon statement (Aug. 11) states, "the net result of these changes has been a 150% increase in alert weapons and a 200% increase in alert megatons . . . (from 1961-Nov., 1964).

Figures however, show:

	1961	Now	% Increase
Alert weapons	537	1,345	125
Alert megatonage	12,082	15,610	30

Further it is stated, "As a consequence, by mid-1970 our missile force alone will contain more weapons on alert and as many megatons as did our entire bomber alert force in mid-1961."

	Number	Megatonage
Alert bomber force mid-'61	500	12,000
Missile force 1970	1,656	1,656

The statement is not true!

Also the statement contains the sentence, "added to this (the missiles) will be a large force of B-52s and B-58s." This statement already acknowledges the B-57s have been phased out. We know also there are no new procurements planned for B-52s and B-58s. Based upon normal attrition and obsolesence, the force will not be large, as indicated. Further there is talk of phasing out all bombers.

Considering a comparison of total bomber forces now and compared to a missile force in 1970, we have the following:

Total bombers—
B-47 600
B-52 630
B-58 80

1,310 × 24 megatons = 31,440
50% on alert = 15,720

1970 missile (per press release)
Minuteman 1,000
Polaris 656

1,656 × 1 = 1,656

Eliminating all bombers is a reduction of approximately 95%. The 90% figure therefore would allow a few bombers to continue (over 50).

Even comparing the total missile megatonage to the present alert bomber megatonage would be a reduction of more than 89%.

Notes: [1] *In accordance with McNamara all missiles are 100% on alert.* [2] *Less than 30% on alert—use 24 megaton per aircraft.* [3] *Use large Titan capability at 10 megaton.* [4] *Approx. 50% on alert.*

Navy Missile Target Awarded to Maxson

Navy has awarded a $13,189,223 follow-on production contract for Beech-developed AQM-37A air-launched missile target to Maxson Electronics Corp., Great River, N. Y.

The fixed-price contract covers procurement of more than 1,000 targets during a five-year period beginning Aug. 14. The contract has a first year value of $3,751,044.

Maxson was the lowest bidder in the competition among eight companies (AW Mar. 2, p. 23). Others included Aeronca Manufacturing, Beech, Emtex, Kaman Aircraft, Northrop, Raytheon and Sperry Farragut.

Beech won a joint USAF-Navy competition for the target, then designated XKD2B-1 on May 13, 1959. Current Beech contracts for the AQM-37A terminate in December, 1965.

Present indications are that the Navy has programed AQM-37A procurement needs through 1969 or 1970 at a rate of approximately 230 units per year. Current production rate at Beech is approximately 30 per month.

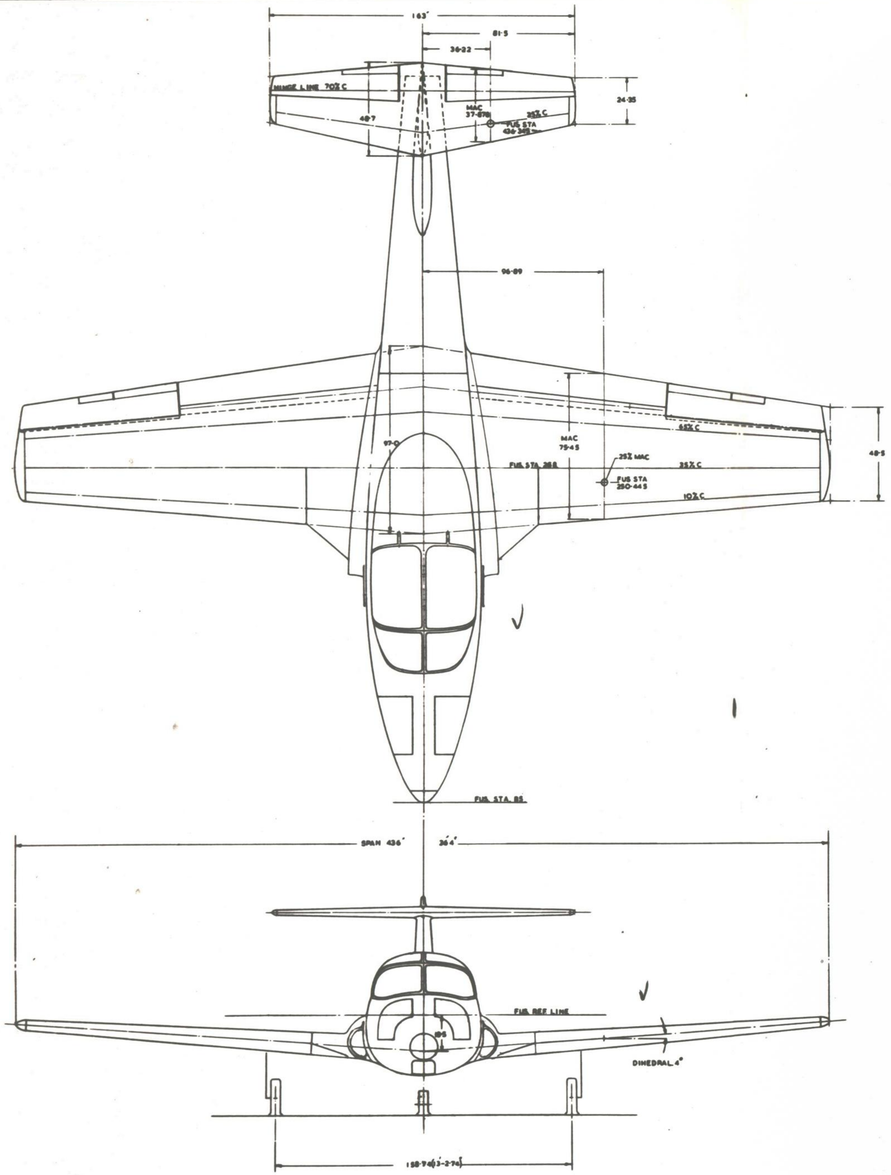
Beech has a total of about 400 personnel on the project, including engineering, production and administration. Although it is considered too early to determine the full effects of the contract loss on Beech personnel, indications are that most will be gradually absorbed into other Beech operations.

Maxson will produce and assemble the AQM-37A at its Old Forge, Pa., plant, where Bullpup air-to-surface missiles are also being produced. The company's sole-source, multiple-year contract for Bullpup production (AW June 29, p. 25) is considered a factor in Maxson's low bid for the AQM-37A, both in terms of experience and overhead.

Democrats Debate Nuclear Arms Control

Washington—Concern that someone besides the President of the United States might get his finger on the nuclear trigger dominated last week's hearings of the Democratic Platform Committee and of the Joint Congressional Atomic Energy Committee.

Defense Secretary Robert S. McNamara told the Platform Committee that "above all else" it should specify in its platform that the President of the United States and only he should exercise control over the use of nuclear weapons. "I consider the provision of this control to the President my most solemn obligation as Secretary of Defense," McNamara said.



GENERAL CHARACTERISTICS

DIMENSIONS:

SPAN	36 FT. 4 IN.
LENGTH OVERALL	32 FT
HEIGHT OVERALL	9 FT. 4½ IN

WEIGHTS:

DESIGN GROSS WEIGHT	6500 LBS

WING:

AREA (TOTAL)	220 SQ FT
AREA (OUTER PANEL)	90·6 SQ FT
AIRFOIL (ROOT)	NACA 63A014
AIRFOIL (TIP)	NACA 63A212
INCIDENCE (ROOT)	1°
INCIDENCE (TIP)	-0°·30'
SWEEPBACK (35% CHORD)	0°

AILERON

AREA (TOTAL AFT OF HINGE)	18·5 SQ FT
AREA AFT OF HINGE (EACH)	9·25 SQ FT
SPAN (EACH) IN % OF WING SEMI SPAN	40 %
DEFLECTION	±16°

FLAP

TYPE	SINGLE SLOTTED
SPAN IN % OF WING SPAN	46%
DEFLECTION	40°

SPEEDBRAKE:

PROJECTED FRONTAL AREA	3·4 SQ FT
DEFLECTION	50°

HORIZONTAL TAIL:

AREA (TOTAL)	41·3 SQ FT
AIRFOIL	NACA 64A010.
INCIDENCE	-1°
DEFLECTION (ELEVATOR)	25° UP, 10° DOWN

VERTICAL TAIL:

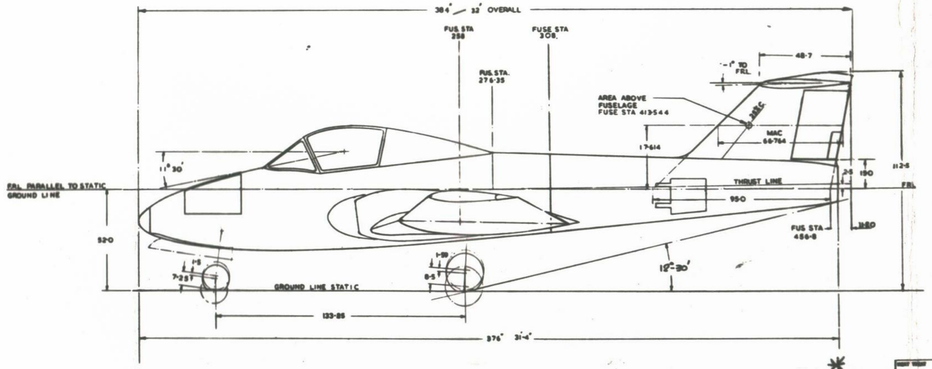
AREA (TOTAL)	17·47 SQ FT
AREA (RUDDER)	6·0 SQ FT
AIRFOIL (ROOT & TIP)	NACA 63A011
DEFLECTION (RUDDER)	± 25°

ALIGHTING GEAR:

MAIN WHEEL TIRE	20 X 4·4
NOSEWHEEL TIRE	14 X 5·0

POWER PLANT:

TYPE	FAIRCHILD, YJ 83-R-1



STOCK DISPOSITION SYMBOLS: 1 REWORK, 2 SCRAP, 3 NONE

REVISIONS	DISP.	REASON	EFF	CLASS	APPD
NC REVISED TO A/C SPECIFICATION REVISION	E.F.F. 1-27-65 3	RECORD CHANGE		3	
A					

41-00003

0 10 20 30 40 50 60 70 80 90 100

SCALE — INCHES

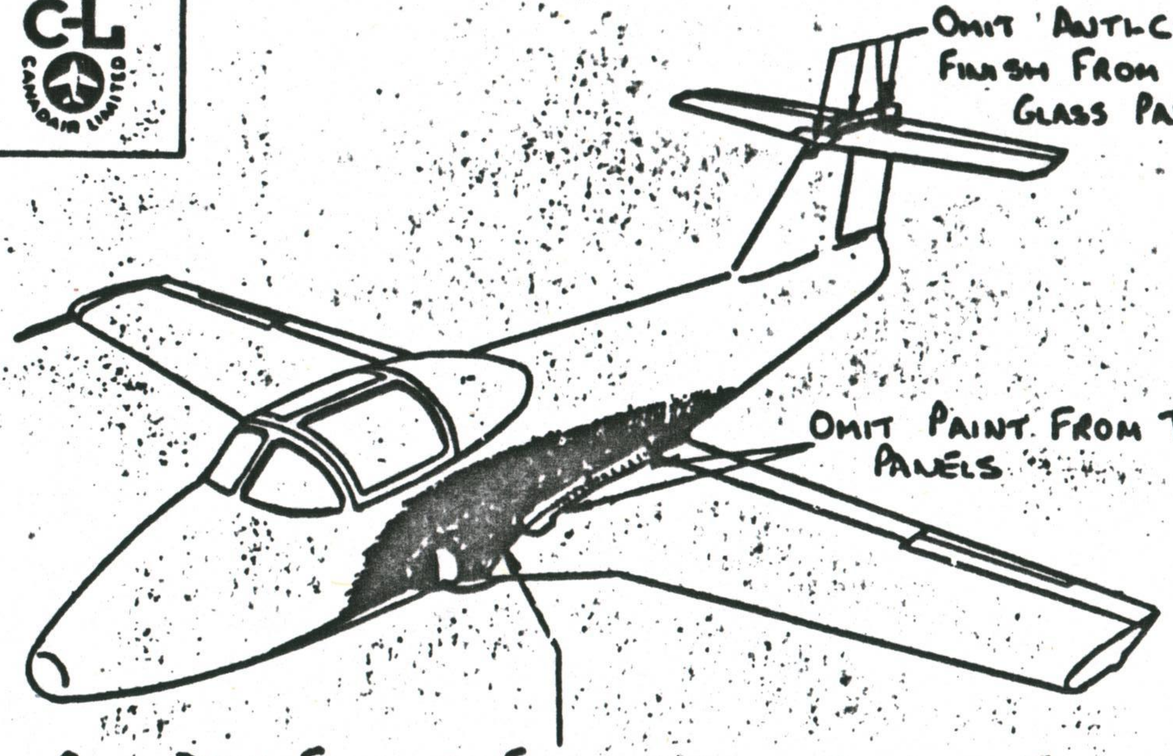
CANADAIR LIMITED — MONTREAL

3-VIEW GENERAL ARRANGEMENT

41-00003

C-L CANADAIR LIMITED

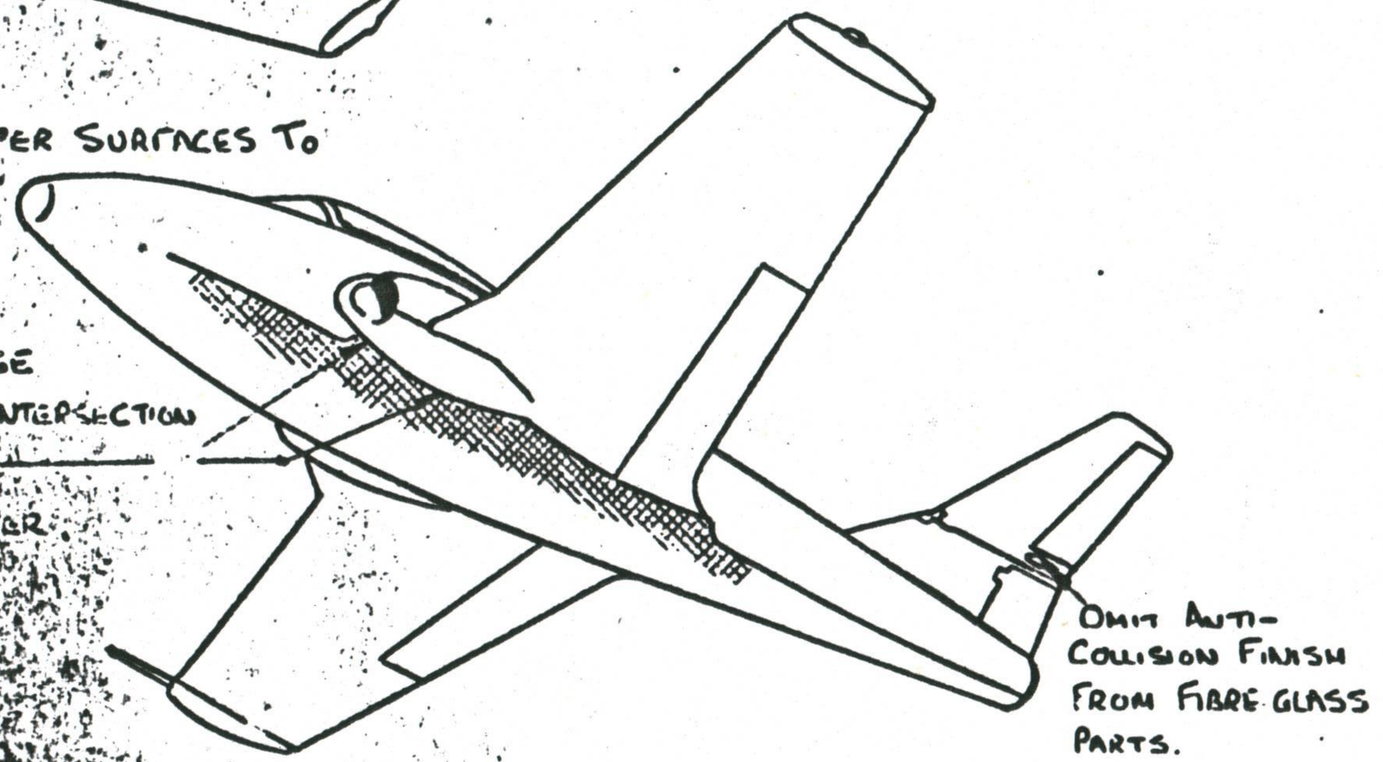
DRAWING No.	DWR.	
41G-48501	N.I.E.O.	1
	SHT. 2 OF 2	



OLIVE DRAB FINISH OF FUSELAGE UPPER SURFACES TO TERMINATE AT WING INTERSECTION APPROXIMATELY AS SHOWN.

EGGSHELL BLUE FINISH OF FUSELAGE UNDERSIDE TO TERMINATE AT WING INTERSECTION APPROXIMATELY AS SHOWN.

TERMINATE INBOARD OF INTAKE SHUTTER.



D.C.R. No.
41G-17128

THIS SHEET TO BE USED FOR 2ND & SUBSEQUENT SHEETS OF MULTI-SHEET E.O's & N.I.E.O's — SEE SHEET No 1 FOR ALL APPROVALS etc

C-L CANADAIR LIMITED	PART NAME: G.- A. EXTERNAL MARKINGS				MODEL: CL41G-5	SERV. EFFECT.: None	ENG. FUNC. NO.: 721	CLASS: /	DRAWING NO.: 41G-48501	Supp. or N.I.E.O. NO.: 1	
REQUESTED BY: ENG.	PREPARED: R.WYMAN	LIAISON:	CHECK:	GROUP LDR:	STRESS: N/A	EFFECTIVITY: A/C 2195 EXPERIMENTAL ONLY			NEXT ASSEMBLY: 41G-00001	SHT. 1 OF 2	
AUTHORITY: MCo 01415-100.	WEIGHTS: N/A	SECT. CHIEF:	APPROVED:	APPROVED:	RELEASE:	INTERCHANGEABILITY AFFECTED:	No		DISPOSITION OF STOCK: —	E.C.P. NO.: /	
									E.C.R. NO.: —	MOD SUM. NO.:	
										MASTER CHGE. NO.:	
										FTP AFFECTED:	No

THE EXTERNAL FINISH AND MARKINGS TO BE IN ACCORDANCE WITH THE FOLLOWING:

1. FUSELAGE, UPPER AND LOWER SURFACES TO OUTBOARD EXTENT SHOWN ON SHEET 2. CONTROL SURFACES; AILERONS, RUDDER AND ELEVATORS. RAIN EROSION FINISH AREAS. ALL INSTRUCTION AND ACCESS PANEL IDENTIFICATION STENCILS. MALAYSIAN REGISTRATION 'FM 1124' UNDER WINGS. PITOT STATIC TUBE. WING WALKWAYS. —— PER DWG 41G-48501

2. ANTI-COLLISION AREAS ON WINGS AND EMPENNAGE. —— PER DWG 41A-48500.

3. SPECIAL REQUIREMENTS:— OMIT NATIONAL EMBLEM FROM UPPER AND LOWER WING SURFACES AND EMBLEM AND REGISTRATION FROM VERTICAL STABILIZER. OMIT PAINT FINISH, OTHER THAN THAT SPECIFIED ABOVE, FROM UPPER AND LOWER WING SURFACES AND EMPENNAGE.

4. REMOVAL OF TEMPORARY FINISH:- ON COMPLETION OF TRIALS, TEMPORARY FINISH TO BE REMOVED PER MPS180-6 AND THE AIRCRAFT THEN COMPLETELY FINISHED TO DWG. 41G-48501.

REASON: (EXPLAIN FULLY BUT CONCISELY)	RELATED CHANGE:	D.C.R. NO.
TO SPECIFY TEMPORY FINISH REQUIREMENTS FOR FLIGHT TRIALS IN CANADA	NONE	41G 17128

F.7557 REV.4/68

C-L CANADAIR LIMITED	PART NAME: G.A. EXTERNAL MARKINGS.				MODEL: CL44G-5	SERVI EFFECT.: 2193 & 2195 *	ENG. FUNC. NO.: 729	CLASS:	DRAWING NO.: 41G-48501	E.O. NO.: A-10	
REQUESTED BY: ENG. DEPT	PREPARED: [illegible]	LIAISON:	CHECK:	GROUP LDR:	STRESS: N/A	EFFECTIVITY: 294, 296 & 5035.			NEXT ASSEMBLY: 41G-00001	SHT. 1 OF 1	
AUTHORITY: NRO CL44G5-100	WEIGHTS: N/A	SECT. CHIEF: Conen	APPROVED:	APPROVED:	RELEASE: 16 June 67	INTERCHANGEABILITY AFFECTED:			DISPOSITION OF STOCK: REVOKE CASE.	E.C.P. NO.:	
									E.C.R. NO.:	MOD SUM. NO.: / MASTER CHGE. NO.: / FTP AFFECTED: yes	

ON F/D, ZONE 5 - REF. EO A-7.

CHANGE OIL TANK FILLER DOOR STENCIL THUS:

OIL TANK USE ONLY TYPE 1 APPROVED OILS LISTED IN PSP-190	WAS	OIL TANK USE AEROSHELL TURBINE OIL 500.

* A/C 2191 & 2192 COMPLY WITH EO A-2 & NEED NOT BE REWORKED IN SERVICE.

** A STENCIL IS TO BE SUPPLIED TO THE SERVICE DEPT. FOR REWORKING A/C 2193 & 2195.

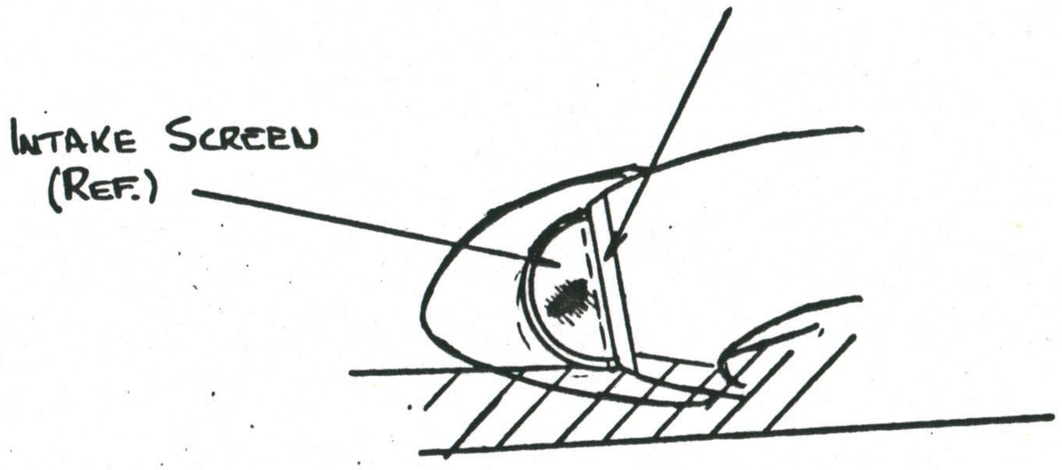
REASON: (EXPLAIN FULLY BUT CONCISELY)	RELATED CHANGE:	D.C.R. NO.
"ENGINE MFG. REQUEST. LUBRICATION OF ENGINE LUBE PUMP BEARING IS MARGINAL WITH TYPE 1 OILS. (REF GE TELEX NBR 15, 14 JUNE '67)	41G-60,001, EO A-15 FPD 5414922A, Amd A-6	41G 17168

F.7387 REV. 4/60

C-L CANADAIR LIMITED	PART NAME: G-A. EXTERNAL MARKINGS.				MODEL: CL41G	SERVI… EFFECT.: NONE	ENG. FUNC. NO.: 721	CLASS	DRAWING NO.: 41G-48501	E.O. OR NO.:	A-9
REQUESTED BY: ENG	PREPARED: R.WYMAN	LIAISON	CHECK	GROUP LDR	STRESS: N/A	EFFECTIVITY: A/C 2194 & SUBS.			NEXT ASSEMBLY: 41G-00001	SHT. 1 OF 1	
AUTHORITY: W.R.O. CL41G5-100	WEIGHTS: N/A	SECT. CHIEF	APPROVED	APPROVED	RELEASE: Aug 31/67	INTERCHANGEABILITY AFFECTED: NO			DISPOSITION OF STOCK: —	E.C.P. NO. / MOD SUM. NO. / MASTER CHGE. NO.	
									E.C.R. NO.: —	FTP AFFECTED: NO	

ON F.I.D.

ADD NOTE: OMIT PAINT FROM AIR INTAKE NOSE CASTING.



VIEW INB'D ON L.H. SIDE (TYP. BOTH SIDES)

REASON: (EXPLAIN FULLY BUT CONCISELY)	RELATED CHANGE:	D.C.R. NO.
TO DELETE PAINT AS POSSIBLE F.O.D. SOURCE FROM INTAKE DUCT.	NONE.	41G 17139

F.7387 REV. 4/66

C-L CANADAIR LIMITED	PART NAME: G.A. EXTERNAL MARKINGS				MODEL: CL-4165	SERV. EFFECT.: NONE	ENG. FUNC. NO.: 121	CLASS	DRAWING NO.: 41G-48501	E.O. NO.: A-8	
REQUESTED BY: ENG. (COVER)	PREPARED: CHARRON	LIAISON	CHECK	GROUP LDR	STRESS: N/A IC	EFFECTIVITY: RECORD CHANGE			NEXT ASSEMBLY: 41G-00001	SHT. 1 OF 1	
AUTHORITY: WRO CL-41G-5-106	WEIGHTS: N/A IC	SECT. CHIEF: Cohen	APPROVED	APPROVED	RELEASE: June 16/67	INTERCHANGEABILITY AFFECTED: NO			DISPOSITION OF STOCK: NONE	E.C.P. NO. / MOD SUM. NO. / MASTER CHGE. NO.	
									E.C.R. NO.	FTP AFFECTED: NO	

IN NOTES ADD NOTE 21 AS SHOWN:-

21. DO NOT PAINT SURFACES FINISHED WITH RAIN EROSION COATING.

REASON: (EXPLAIN FULLY BUT CONCISELY) TO CLARIFY DWG. TO SPECIFY OMISSION OF PAINTING TO APPLICABLE AREAS.	RELATED CHANGE: NONE	D.C.R. NO.: 41-17121

F.7557 REV. 4/66

C-L CANADAIR LIMITED	PART NAME	MODEL	SERV. EFFECT.	ENG. FUNC. NO.	CLASS	DRAWING NO.	E.O. NO.
	G.A. EXTERNAL MARKINGS.	CL41G -5	2191 & 2192	729		41G-48501	A-7

REQUESTED BY	PREPARED	LIAISON	CHECK	GROUP LDR	STRESS	EFFECTIVITY	NEXT ASSEMBLY	SHT. 1 OF 1
1. 2MAF * 2. ENG.					N/A	2193 & SUBS.	41G-00001	

AUTHORITY	WEIGHTS	SECT. CHIEF	APPROVED	APPROVED	RELEASE	INTERCHANGEABILITY AFFECTED		DISPOSITION OF STOCK	E.C.P. NO.	
HRO CLAGS -100	N/A				9 May/67	NO.		REWORKABLE.	MOD SUM. NO.	
								E.C.R. NO.	MASTER CHGE. NO.	
									FTP AFFECTED	yes

1. ON F/D, ZONE 5 - REF. EO A-2

CHANGE OIL TANK FILLER DOOR STENCIL THUS:

OIL TANK USE AEROSHELL TURBINE OIL 500	WAS	OIL TANK USE ONLY APPROVED OILS LISTED IN PSP-190

2. ON F/D, ZONE 11 - DETAIL "C" CHANGED THUS.

CANOPY & SEAT CATAPULTS CONTAIN EXPLOSIVE CHARGES. FOR RESCUE PULL-OUT TWO HOSES FROM SEAT DISCONNECT.	WAS	CANOPY & SEAT CATAPULTS CONTAIN EXPLOSIVE CHARGES FOR RESCUE CUT FLEXIBLE HOSES AT DECALS.

REASON: (EXPLAIN FULLY BUT CONCISELY)
1. *REQUESTED BY 2MAF - LETTER DATED 24TH APRIL 1967
2. BALLISTIC HOSES DIFFICULT TO CUT.

RELATED CHANGE:
41G-60,001, EO# A-14.
FTP 541A-922A, AM.#A5

D.C.R. NO.
41G-17103

F.7287 REV. 4/60

C-L CANADAIR LIMITED	PART NAME	MODEL	SERV. EFFECT.	ENG. FUNC. NO.	CLASS	DRAWING NO.	E.O. NO.	
	G.A. EXTERNAL MARKINGS.	CL41G	none	729		41G-48501	[redacted]	A-6

REQUESTED BY	PREPARED	LIAISON	CHECK	GROUP LDR	STRESS	EFFECTIVITY	NEXT ASSEMBLY	SHT. 1 OF 1
DEPT. 132	MMC				N/A	2191 & Subs.	41G-00001	

AUTHORITY	WEIGHTS	SECT. CHIEF	APPROVED	APPROVED	RELEASE	INTERCHANGEABILITY AFFECTED	DISPOSITION OF STOCK	E.C.N. NO.	E.C.P. NO.	MOD SUM. NO.	MASTER CHGE. NO.	FTP AFFECTED
WRO # 41G5-100	N/A				Issued Apr. 3567	no	NONE					no

A/C 2191 COVERED BY RR # 155197.

On face of Dwg. in GENERAL NOTES:

Change note △15 as shown below:

△15 Gloss Signal Red Enamel Color #9-2 per 1-GP-12B or
Color #537 per BS.381C:1964. (added)

REASON: (EXPLAIN FULLY BUT CONCISELY)	RELATED CHANGE:	D.C.R. NO.
COLOR SUPPLIED BY VENDOR COMPLIES WITH BS.381C.	None.	41G 17054

F.7587 REV.4/66

C-L CANADAIR LIMITED	PART NAME: G. A. EXTERNAL MARKINGS.				MODEL: CL-41G5	SERVI[illegible]FFECT.: NONE	ENG. FUNC. NO.: 721	CLASS:	DRAWING NO.: 41G-48501	E.O. OR REVISION NO.: A-5	
REQUESTED BY: PAINT SHOP R. TAILLON DEPT 192.	PREPARED: CUNNANE	LIAISON:	CHECK:	GROUP LDR:	STRESS: N/A	EFFECTIVITY: A/C 2191 & SUBS			NEXT ASSEMBLY: 41G-00001	SHT. 1 OF 1	
AUTHORITY: WRU CL-41G -5-100	WEIGHTS: N/A	SECT. CHIEF:	APPROVED:	APPROVED:	RELEASE: 19 Apr 67	INTERCHANGEABILITY AFFECTED: NO			DISPOSITION OF STOCK: NONE	E.C.P. NO.: / MOD SUM. NO.: / MASTER CHGE. NO.: /	
									E.C.R. NO.:	FTP AFFECTED: NO	IC

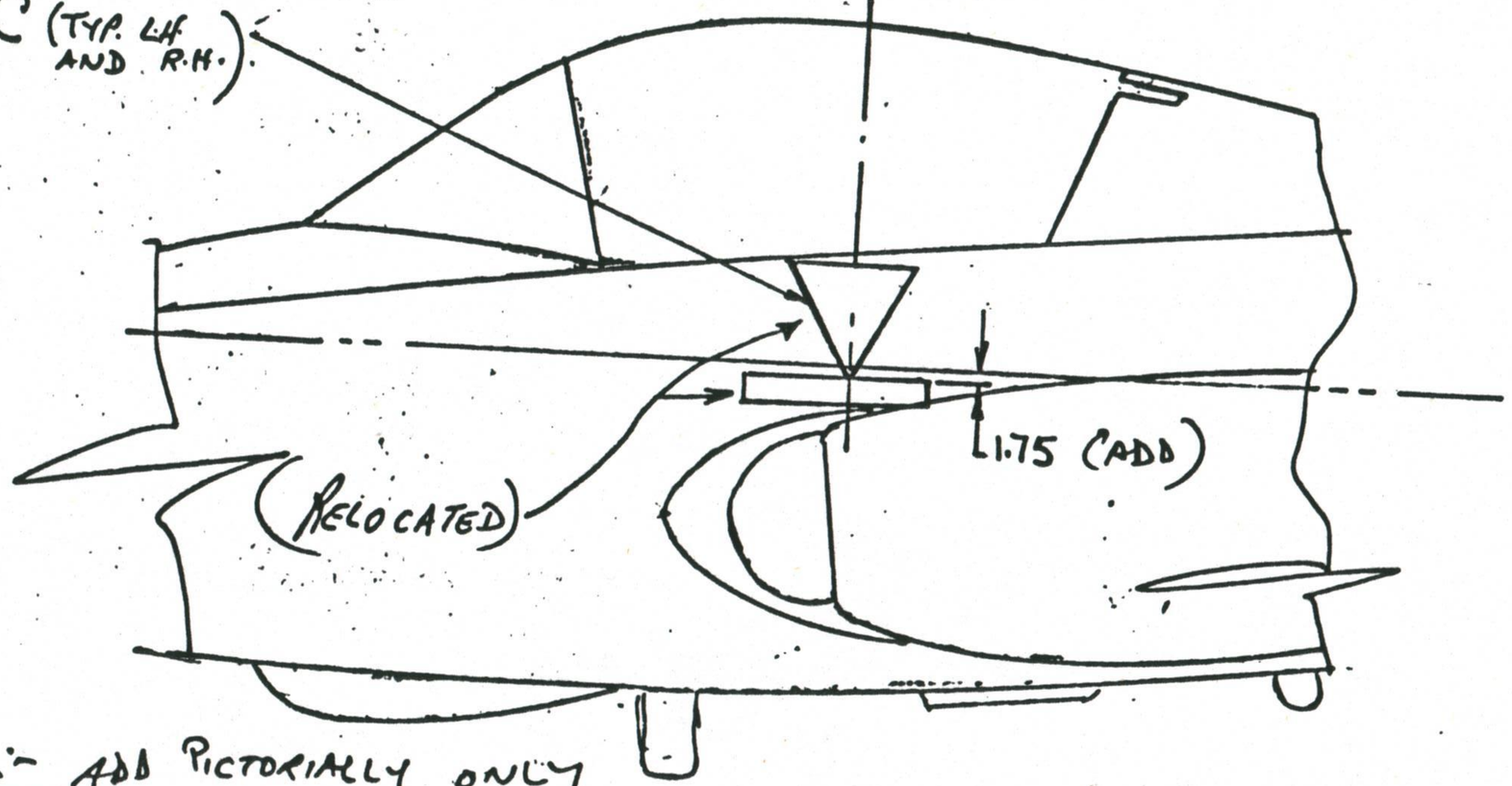
ON P/D, LH SIDE VIEW

A/C 2191 COVERED BY RR# 021940.

STA 205.5 (REF) WAS STA 206 (REF)

SEE DETAIL C (TYP. LH AND R.H.).

(SAME)



ON R.H. SIDE VIEW:- ADD PICTORIALLY ONLY

REASON: (EXPLAIN FULLY BUT CONCISELY)
PRODUCTION FACILITY:-
TO SUIT MARKING AS DONE:-

RELATED CHANGE: NONE

D.C.R. NO. 41-17049

F.7587 REV.4/66

C-L CANADAIR LIMITED	PART NAME	MODEL	SERV. EFFECT.	ENG. FUNC. NO.	CLASS	DRAWING NO.	E.O. OR M.C.O. NO.
	G. A. - EXTERNAL MARKINGS	CL-41G5	NONE	721		41G-48501	A-4

REQUESTED BY	PREPARED	LIAISON	CHECK	GROUP LDR	STRESS	EFFECTIVITY	NEXT ASSEMBLY	SHT. 1 OF 1
R. TAILLON DEPT. 132	CHARRON				N/A IC	~~PRELIM~~ PARTS MADE 2191 & SUBS (RU)	41G-00001	

AUTHORITY	WEIGHTS	SECT. CHIEF	APPROVED	APPROVED	RELEASE	INTERCHANGEABILITY AFFECTED		DISPOSITION OF STOCK	E.C.P. NO.	
WRO CL-41G-5-100	N/A IC	Cohen			[signature]	No		NONE	MOD SUM. NO.	
							E.C.R. NO.		MASTER CHGE. NO.	
									FTP AFFECTED	No IC

1/ ON F/D, ZONES 6 & 7, ON VIEW LOOKING AFT:-
AIRCRAFT TO BE PAINTED COLOR (9) EGGSHELL BLUE BELOW 60° TANGENT POINT AND COLOR (8) OLIVE DRAB ABOVE 60° TANGENT POINT. THE [redacted] UNDERSIDE OF HORIZ. STAB. TO BE PAINTED COLOR (9) EGGSHELL BLUE.
COLORS TO BE BLENDED OVER 1.00 WIDTH TYP.

WAS

AIRCRAFT TO BE PAINTED COLOR (9) EGGSHELL BLUE BELOW 60° TANGENT POINT AND COLOR (8) OLIVE DRAB ABOVE 60° TANGENT POINT, EXCEPT FOR UNDERSIDE OF HORIZONTAL STAB.
COLORS TO BE BLENDED OVER 1.00 WIDTH ALONG LEADING EDGE OF WING AND HORIZ. STAB.

2/ ON F/D, ZONES 4, 5 & 6, ON SIDE VIEW OF R.H. SIDE & SIDE VIEW OF L.H. SIDE;-
@ 60° TANGENT LINE (REF VIEW LOOKING AFT)
" BLEND OVER 1.00 WIDTH AT FUS. 60° TANGENT LINE (REFER TO VIEW LOOKING AFT) "

WAS

"

3/ ON F/D, ZONE 6, L.H. SIDE VIEW, TO NOTE "PAINT 8.00 NUMERALS - LAST TWO DIGITS OF REGISTRATION No. - COLOUR (12) WHITE (2) - FOR DIMENSIONS SEE DETAIL F[9]; - ADD NOTE "TOP EDGE OF NUMERALS MAY BE LOCATED CO-INCIDENT WITH LOWER EDGE OF HORIZONTAL NOSE STRAKES."

REASON: (EXPLAIN FULLY BUT CONCISELY)	RELATED CHANGE:	D.C.R. NO.
TO FACILITATE MANUFACTURING - TO REDUCE THE MASKING OPERATION FOR PAINTING.	NONE	41-17030

F.7387 REV. 4/66

C-L CANADAIR LIMITED	PART NAME: G.A. EXTERNAL MARKINGS				MODEL: CL-415	SERVICE EFFECT.: NONE	ENG. FUNC. NO.: 121	CLASS	DRAWING NO.: 41G-48501	E.O. NO.	A-3	
REQUESTED BY: ENG. (CONEA)	PREPARED: CHARROW	LIAISON	CHECK	GROUP LDR	STRESS: N/A IC	EFFECTIVITY: RECORD CHANGE			NEXT ASSEMBLY	SHT. 1 OF 1		
AUTHORITY: WRO CL-41G-5-100	WEIGHTS: N/A IC	SECT. CHIEF: Cohen	APPROVED	APPROVED	RELEASE: Jane Dean 5 Apr 67.	INTERCHANGEABILITY AFFECTED: No			DISPOSITION OF STOCK: NONE	E.C.P. NO. / MOD SUM. NO. / MASTER CHGE. NO.		
									E.C.R. NO.	FTP AFFECTED	No IC	

IN NOTES ADD NOTE 20 AS SHOWN

△20 FOR AIR INTAKE SCREEN FINISH SEE DRG. # 41G-35023.

ON F/D, ZONE 5, R.H. SIDE VIEW, ADD "△20" TO AIR INTAKE SCREEN

ON F/D, ZONE 6, L.H. SIDE VIEW, ADD "△20" TO AIR INTAKE SCREEN.

REASON: (EXPLAIN FULLY BUT CONCISELY)	RELATED CHANGE:	D.C.R. NO.
TO REFERENCE INTAKE-SCREEN COLOR. TO CLARIFY DWG -	NONE	41-16997

F.7587 REV.4/80

C-L CANADAIR LIMITED	PART NAME: G.A. EXTERNAL MARKINGS				MODEL: CL-41 G-5	SERVI... EFFECT.: NONE	ENG. FUNC. NO.	CLASS	DRAWING NO.: 41G-48501	E.O. NO.	A-2
REQUESTED BY: ENG.	PREPARED: A.	LIAISON	CHECK	GROUP LDR	STRESS: N/A R.	EFFECTIVITY: 2191 & SUBS. 2-347			NEXT ASSEMBLY: 41G-00001	SHT. 1 OF 1	
AUTHORITY: NEO CL41G5-100	WEIGHTS: N/A: A.	SECT. CHIEF: Coher...	APPROVED	APPROVED	RELEASE: Mar. 3 67	INTERCHANGEABILITY AFFECTED:	No.		DISPOSITION OF STOCK: REWORK	E.C.P. NO. / MOD SUM. NO. / MASTER CHGE. NO.	
									E.C.R. NO. ———	FTP AFFECTED	no R.

ON F/D, ZONE 5

CHANGE OIL TANK FILLER DOOR STENCIL THUS:

OIL TANK USE ONLY APPROVED OILS LISTED IN PSP-190.	HAS	OIL TANK USE AEROSHELL TURBINE-OIL 390 PER MIL-L-7808.

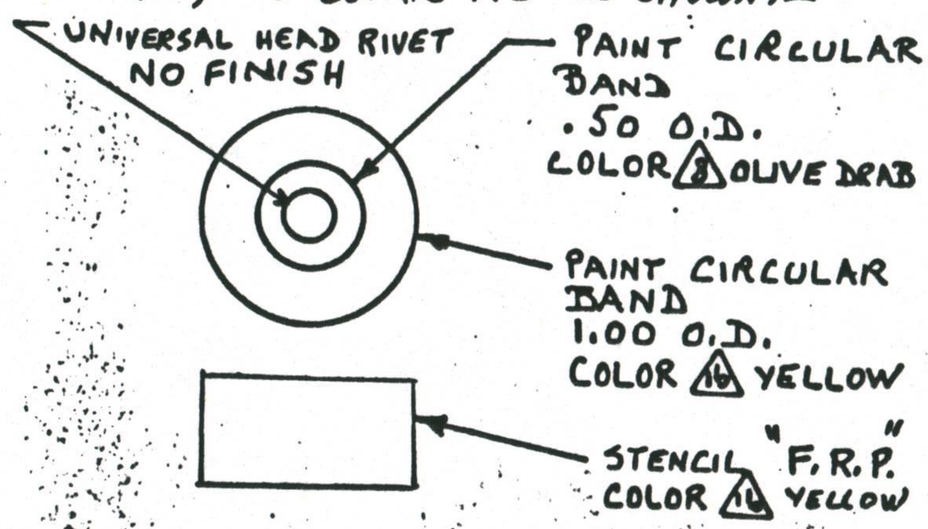
REASON: (EXPLAIN FULLY BUT CONCISELY)	RELATED CHANGE:	D.C.R. NO.
TO SUPPLY CORRECT SERVICING INFORMATION. USE OF TURBINE OIL 390 WOULD INVALIDATE G.E. Co. WARRANTY ON ENGINE.	41G-60,001 EO # A-10 FTP # 341A922A.	41G 16894

F.7587 REV. 4/60

C-L CANADAIR LIMITED	PART NAME: G.A. - EXTERNAL MARKINGS				MODEL: CL-41G	SERIES EFFECT.: NONE	ENG. FUNC. NO.: 121	CLASS:	DRAWING NO.: 41G-48501	E.O. OR NTT.E.V. NO.:	A-1
REQUESTED BY: (CONEA) ENG.	PREPARED: CHAMAN	LIAISON:	CHECK:	GROUP LDR:	STRESS: N/A	EFFECTIVITY: A/c 2191 & SUBS.			NEXT ASSEMBLY: 41G-00001	SHT. 1 OF 1	
AUTHORITY: WRD CL-41G-5-109	WEIGHTS: N/A	SECT. CHIEF: Cohen	APPROVED:	APPROVED:	RELEASE: 31 MAR 66	INTERCHANGEABILITY AFFECTED:	NO		DISPOSITION OF STOCK: NONE	E.C.P. NO.:	X
									E.C.R. NO.: —	MOD SUM. NO.:	
										MASTER CHGE. NO.:	7
										FTP AFFECTED:	NO

1/ ON F/D, ZONE 5 & 6, MAIN VIEW LH SIDE ONLY :- ADD "SEE DETAIL AB" @ F.R.P. & STA. 187.85 & @ F.R.P. & STA. 299.80.

ON F/D, ADD DETAIL "AB" AS SHOWN:-



DETAIL "AB"
(TYP. 2 PLACES)

2/ ON F/D, ZONE 7, ALTER AS SHOWN:-

"FUEL TANK
USE AVTUR
AEROSHELL 650
PER NATO SYMBOL
F-34
CONNECT GROUND WIRE
BEFORE REMOVING CAP."

WAS

FUEL TANK
USE AVTUR
AEROSHELL 650
PER NATO SYMBOL
F-35
CONNECT GROUND WIRE
BEFOR REMOVING CAP

REASON: (EXPLAIN FULLY BUT CONCISELY)	RELATED CHANGE:	D.C.R. NO.
1/ INTRODUCTION OF M.C. #7:- TO SIMPLIFY SIGHTING (ARMAMENT ALLIGNMENT) 2/ POSSIBLE LOSS OF AUX. FUEL SUPPLY AT ALTITUDE. SPECIFICATION REQUIREMENT.	41G-35011 EO NC-1	#1 — 16774

F.7557 REV. 4/66

canadair

PART NAME	MODEL	SERVICE EFFECT.	ENG. FUNC. NO.	CLASS	DRAWING NO.	~~STOP~~ OF N.I.E.O. NO.
G.A. EXTERNAL MARKINGS	CL-41A	RECORD CHANGE	767		41A-48500	3

REQUESTED BY	PREPARED	LIAISON	CHECK	GROUP LDR	STRESS	EFFECTIVITY	NEXT ASSEMBLY	SHT. 1 OF 1
C.F.	[illegible]		[illegible]		N/A	RECORD CHANGE	41A-00001	

AUTHORITY	WEIGHTS	DEPT. CHIEF	APPROVED	APPROVED	RELEASE	DISPOSITION OF STOCK	E.C.P. NO. / MOD SUM. NO. / MASTER CHGE. NO.
WRO MG-2365	N/A	[illegible]			DEC. 21.9.79	N/A	/

INTERCHANGEABILITY AFFECTED	NO	E.C.R. NO.	N/A	FTP AFFECTED	N/A

a) EO 05-195A-6A/173

C.F. T.O. b) C-12L-114-000/CF-384

AFFECTS THIS DRAWING AND SHOULD BE CONSIDERED BEFORE MAKING DESIGN CHANGES OR SUPPLYING PARTS.

NOTE: SPARE PARTS SALES TO ADVISE CUSTOMER AND ASCERTAIN IF MODIFICATION INCORPORATION IS REQUIRED ON SPARE PARTS.

THIS N.I.E.O. SUPERSEDES R.D.R. # E-100

REASON: (EXPLAIN FULLY BUT CONCISELY)	RELATED CHANGE:	D.C.R. NO.
TO AVOID INCOMPATABILITY DEVELOPING FROM THE FACT THAT THE DWG DOES NOT REFLECT C.F. ORIGINATED CHANGES	b) 41A-35007, NIEO #9	41A-15787

D. 8778

CANADAIR LIMITED MONTREAL

PART NAME	MODEL	SER. & EFFECT.	ENG. FUNC. NO.	CLASS	DRAWING NO.	E.O. OR [illegible] NO.
G.A. EXTERNAL MARKINGS	CL41A	A/C 1001 — 1190	743		41A-48500	E-3

REQUESTED BY	PREPARED	LIAISON	CHECK	GROUP LDR.	STRESS	EFFECTIVITY	NEXT ASSEMBLY	SHT. 1 OF 1
CANTECH DET R0713352 MAY 71	ZIELINSKI 12-5-71		C. MILLET		N/A WL	1 —	41A-00001	E.C.P. NO. 231

AUTHORITY	WEIGHTS	SECT. CHIEF	APPROVED	APPROVED	RELEASE	INTERCHANGEABILITY AFFECTED		DISPOSITION OF STOCK	MOD SUM. NO. —
WRD-CL41 - 5953	N/A WL	[signature] 12/5/71			[signature] 14 May 71		Yes	REWORKABLE	MASTER CHGE. NO. —
								E.C.R. NO. —	FTP AFFECTED YES

SAIA 727B AMB -4

WITH REF. TO E.O E-2 DELETE NOTE (14);

WHICH WAS "RENDER CANOPY SAFE BEFORE JACKING!!

REASON: (EXPLAIN FULLY BUT CONCISELY)

NOTE NOT REQ, SYSTEM REVISION. →

RELATED CHANGE:
K41A-58028 A-1
41A-50441 E.O A-7
41A-92001 NC-11

D.C.R. NO. 41-15483

F.7387 REV. 3/68

C-L CANADAIR LIMITED	PART NAME: G-AEXTERNAL MARKINGS				MODEL: CL41A	SERVI... EFFECT.: A/c 1001 To 1190	ENG. FUNC. NO.: 719	CLASS	DRAWING NO.: 41A-48500	E.O. OR ... NO.: E-2	
REQUESTED BY: C.A.F.	PREPARED: RWYMAN	LIAISON	CHECK: 60 N.L.W. 29-7-69	GROUP LDR	STRESS: N/A	EFFECTIVITY: A/c 1191 To 2190			NEXT ASSEMBLY: 41A-00001	SHT. 1 OF 1	
AUTHORITY: W.R.O. CL41 5939	WEIGHTS:	SECT. CHIEF:	APPROVED:	APPROVED	RELEASED: 6 Aug 69	INTERCHANGEABILITY AFFECTED:	YES		DISPOSITION OF STOCK: REWORKABLE	E.C.P. NO.: 231	
									E.C.R. NO.: —	MOD SUM. NO. / MASTER CHGE. NO. / FTP AFFECTED: YES	

ON BOTTOM VIEW. ZONE 3

AT WING JACKING POINTS - IMMEDIATELY ADJACENT AND INB'D OF EXISTING STENCIL - "JACK HERE"

AND AT NOSE JACKING POINT - IMMEDIATELY AFT OF EXISTING STENCIL - "JACK HERE"

(14) ADD STENCIL: "RENDER CANOPY SAFE BEFORE JACKING."

IN EFFECTIVITY BLOCK (14) CL41A A/C 1191 TO 2190 WAS (14) CL41A A/C 1191 & SUBS

REF TO E-1

REASONS (EXPLAIN FULLY BUT CONCISELY)
TO ADD WARNING REQUIRED AS RESULT OF MOD TO CANOPY ELECTRICAL SYSTEM

RELATED CHANGES: 41-15398
SEE DCRs 41-15399
41-15421
F.T.P. # 541A-727B-AMDT B-4

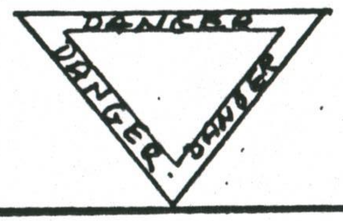
D.C.R. NO.: 41-15398

F.7557 REV. 4/68

C-L CANADAIR LIMITED	PART NAME: G.A. EXTERNAL MARKINGS				MODEL: CL-41A	SERV. EFFECT.: A/C 1001 TO 1190	ENG. FUNC. NO.: 721	CLASS:	DRAWING NO.: 41A-48500	E.O. NO.:	E-1
REQUESTED BY: ENG.	PREPARED: MICHNIEWICZ	LIAISON:	CHECK:	GROUP LDR:	STRESS: N/A	EFFECTIVITY: A/C 1191-2190			NEXT ASSEMBLY: 41A-00001	SHT. 1 OF 1	
AUTHORITY: W.R.O 41-557	WEIGHTS: N/A	PROJ. CHIEF:	APPROVED:	APPROVED:	RELEASE: 2 MAY 67	INTERCHANGEABILITY AFFECTED:	NO		DISPOSITION OF STOCK: NONE	E.C.P. NO.:	CL41A-218 F/UP
									E.C.R. NO.: —	MOD SUM. NO.: / MASTER CHGE. NO.:	
										F/P AFFECTED:	NO

ON F/D. ZONE 12, IN DETAIL OF END. FUS. LH. SIDE (8),
ADD CODE (13) TO "SEE DETAIL J"
ALSO ADD: (14) SEE DETAIL J'.

ON F/D. ADD DETAIL J', SIMILAR TO J, EXCEPT:



CANOPY SEAT CATAPULTS CONTAIN EXPLOSIVE CHARGES FOR RESCUE PULL OUT THO HOSES FROM SEAT DISCONNECT

DETAIL J' (14) (ADDED)

IN EFFECTIVITY BLOCK ADD:

(13)	CL41A	A/C 1121 TO 1190
(14)	CL-41A	A/C 1191 & SUBS

AT DETAIL J IN ZONE 12, CHANGE CODE NO.

(13) WAS (8)

REASON: (EXPLAIN FULLY BUT CONCISELY)	RELATED CHANGE:	D.C.R. NO.
DIFFICULT TO CUT BALLISTIC HOSES ON MODIFIED SEAT INSTALLATION.	NONE.	41A-15341