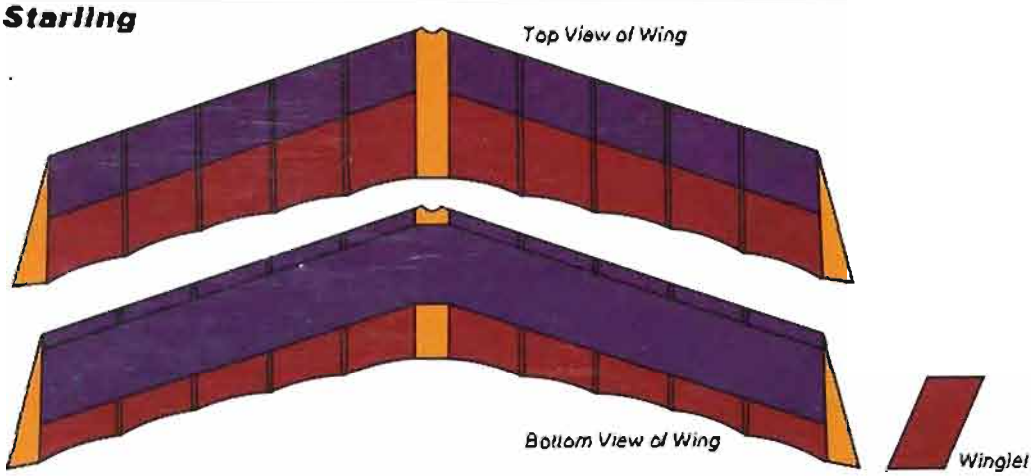
PTERODACTYL
Box 191
Watsonville, CA 95076

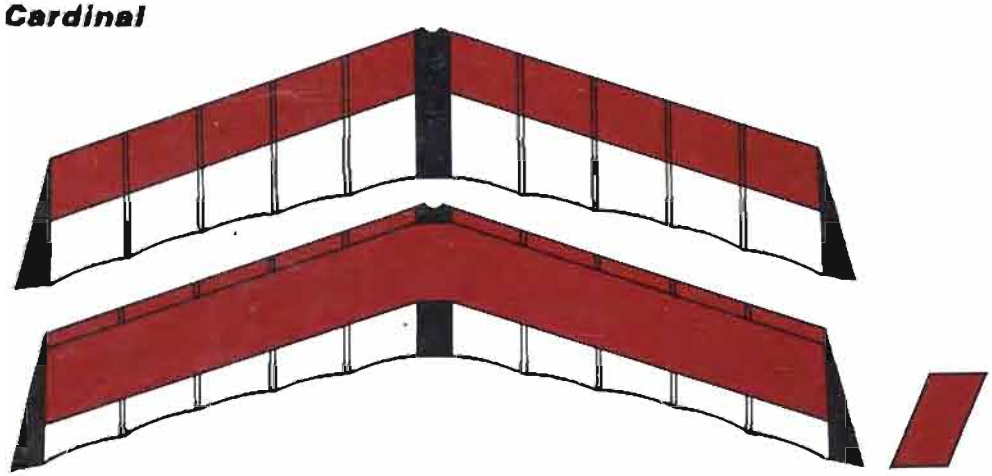
WING COLOR SPECIFICATIONS

STOCK COLOR WINGS

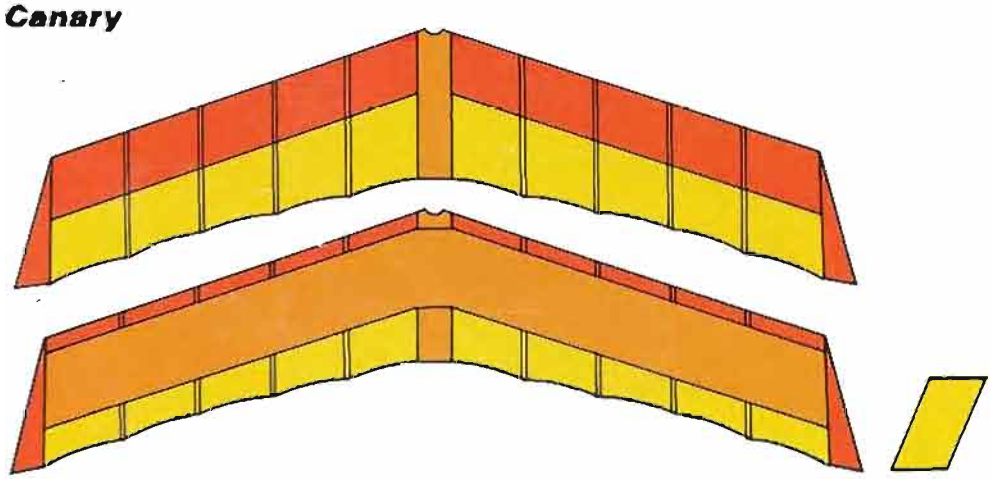
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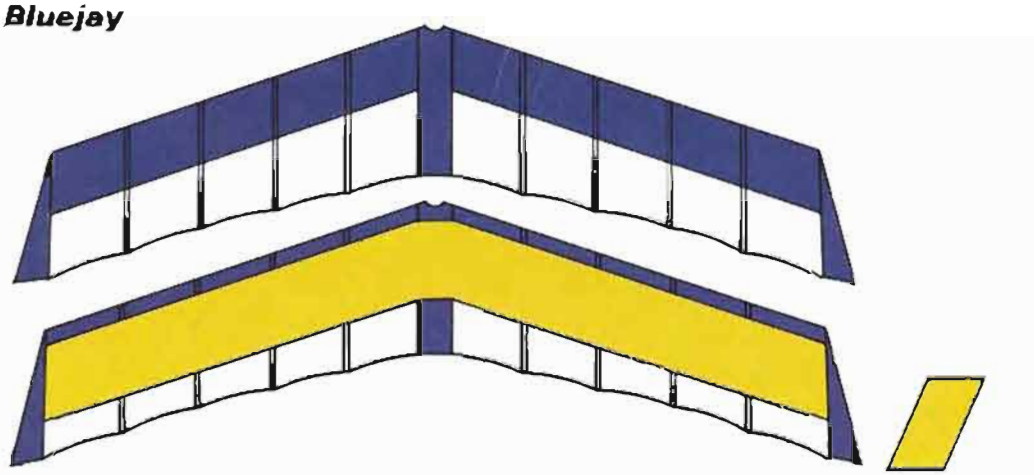
Cardinal



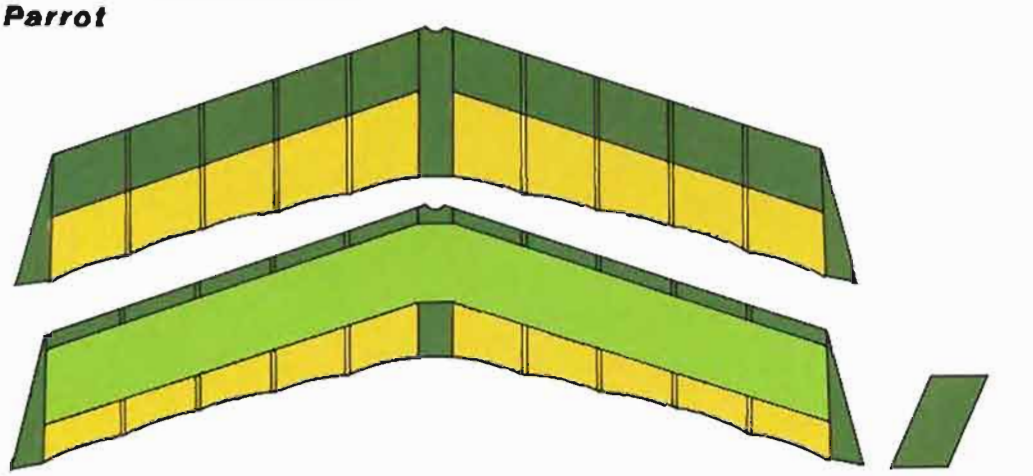
Canary



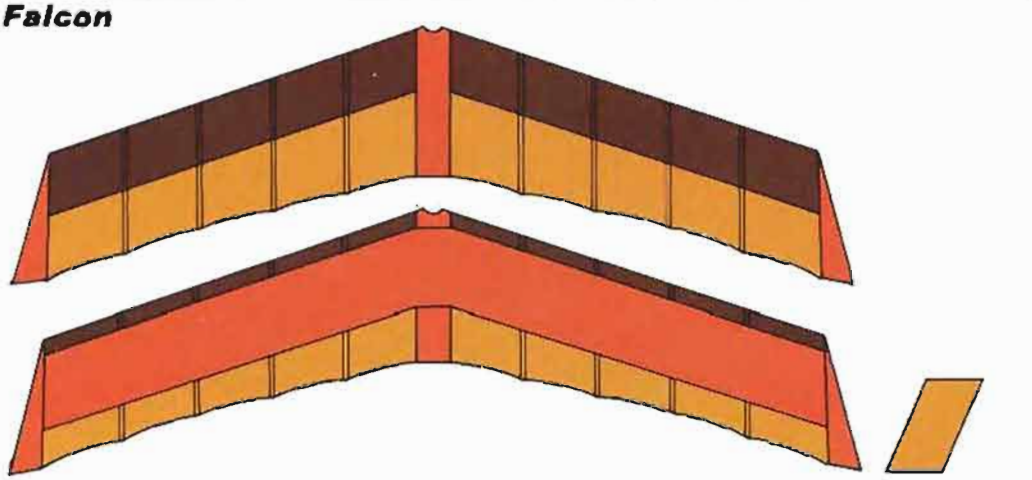
Bluejay



Parrot



Falcon



CUSTOM COLOR WINGS

1. Purple	6. Lime	10 White
2. Red	7. Green	11. Black
3. Orange	8. Blue	12. Dk. Brown
4. Gold	9. Lt. Blue	13. Lt. Brown
5. Yellow		

You may customize your Pterodactyl by combining the wing colors shown.

Please indicate your color selection on the AIRCRAFT ORDER FORM.

Fujiwe
Cuyuna
Serial NO. 19891
Model UL 430RR CDI N-5L



PTERODACTYL

GLOSSARY

PTERODACTYL
Box 191
Watsonville, CA 95076
408/724-2233



Here is your aircraft kit! Before you start to build it, please inventory the kit. If any parts are missing, you must notify your dealer within one week. Pterodactyl will ship (within 48 hours) one missing parts order per shipment prepaid. Any part requested after the one week period will be sent COD.

B/O on the parts list means that the part is back ordered and will be sent to you as soon as possible.

You will not need to remove the parts from the vacuum-packed boards to count them.

To help your dealer order any missing parts, please give him your name, aircraft serial number, the stock number, assembly number, and name of the missing part and the quantity, e.g. 3058, CN1, trailing edge tube, one and the checkers' name on the board or packing list.

Read the assembly instructions and construction notes, gather the necessary tools and assemble the kit as though your life depended on how well it was done!

We are constantly revising the assembly manual, and would appreciate your comments and suggestions for improvements, for instance, which steps did you find most difficult to do? Which parts of the instructions did you find hardest to understand and where do you think more illustrations would help? Did you need to use any of the extra parts provided (washers, nylocks, etc)? This will help us to correct the manual and parts list if necessary.

We hope you enjoy building, learning to fly, and flying your Pterodactyl. To get the most out of these experiences, don't try to rush through them. There are lots of pleasures to be earned here, including a real sense of personal accomplishment. We appreciate the opportunity to share these pleasures with you.

Edited by: Toni James
Copy by: Jack McCornack, Mik Hennessy,
Bill Pregler and Toni James
Drawings by: William Crary and Jean Schmidt
Photos and layout by: Bill Pregler

ASSEMBLY MANUAL CORRECTIONS - October 1, 1982

Section II-A, Drawing II-1
and Section II-B, Drawing II-10

REAR SPAR BRACKETS - AN3-24A bolt, plastic saddles, nylock.

ADD, 2 thick washers per bolt, under the head and nut.

Section II-C, Step #7 - 1st sentence should read:

Cut two lengths of exactly 156 1/4" each...

Drawing II-15 -Front Outboard Bottom Cable
-Cut 156 1/4" exact
-145" should be 144 1/4"

Section VII-A, step #1 - 1st sentence should read:

Drill 5/32" holes, 4" from each end...

PTERODACTYL PRICE LIST INDEX

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(C) Struts & Hangcages
(D) Ribs
(E) Connectors & Joiners
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(B) Cable Assemblies
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VI. PLATES AND GUSSETS

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(C) Nuts
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(G) Miscellaneous

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XII. PLASTIC PARTS

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XIV. PUBLICATIONS

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(C) Ptimes
(D) Misc. Printed Material
(E) Video Tapes
(F) Instructions

ABBREVIATIONS

AL	ALUMINUM
ALT6	6061-T6 ALUMINUM
ANC	ANODIZED CLEAR
ANG	ANODIZED GOLD
ASC	ASCENDER
ASSY	ASSEMBLY
CBL	CABLE
CRS	COARSE
D	DEGREES
EM	ENGINE MOUNT
G	GAUGE
GD	GRADE
GR	GEAR
HDW	HARDWARE
IB	INBOARD
I.D.	INNER DIAMETER
INSTR	INSTRUCTION
INT	INTERNAL
LF	LIGHT FLYER
LT	LEFT
MAN	MANUAL
OB	OUTBOARD
O.D.	OUTER DIAMETER
PFL	PFLEDGE
PH	PHENOLIC
PR	PAIR
PTG	PTIGER
PTR	PTRAVELER
RT	RIGHT
RTNR	RETAINER
SS	STAINLESS STEEL
ST	STEEL
STRBL	STEERABLE
WSH	WASHER
X FT	BY FEET
X IN	BY INCH
X YD	BY YARD

ASCENDER II PLUS PARTS LIST, SECTION IV, LANDING GEAR WITH STEERABLE NOSE GEAR

STOCK #	PART #	DESCRIPTION	TOTAL
8100		WHEEL ASSEMBLY 20"	2
8104	LG 1	INCLUDES: WHEEL, 20"	2
8108	LG 2	TIRE, 20"	2
8109	LG 3	TUBE, 20"	2
8088		WHEEL ASSEMBLY 16"	1
8092	LG 4	INCLUDES: WHEEL, 16"	1
8096	LG 5	TIRE, 16"	1
8097	LG 6	TUBE, 16"	1
8009	LG 7	AXLE ASSEMBLY, MAIN	1
8017		INCLUDES: 1 - 28 1/2" X 1 7/8" O.D.	1
8018		1 - 28 1/2" X 1 3/4" O.D.	1
8019		1 - 28 1/2" X 1 5/8" O.D.	1
8060	LG 8	MAIN GEAR CARRIER	2
8131	LG 10	SPRINGROD	2
2655	LG 11	CABLE, 3/32", COATED	32'
8041	LG 12	SHOCK CORD, 3/8" X 3'	2
II PLUS BOARD - LANDING GEAR I			
8010	LG 14	AXLE, FRONT, (STEEL)	1
8020	LG 15	AXLE, STUB, (STEEL)	2
8008	LG 16	AXLE JOINER, (STEEL)	2
8007	LG 17	SLEEVE, AXLE JOINER	2
1437	LG 18	FUEL LINE, 1/4" I.D.	25"
8130	LG 19	SPRINGROD ADAPTOR	2
4399	LG 20	THIMBLE, PLASTIC	2
1442	LG 21	HEAT SHRINK, 1/2" CLEAR	36"
II PLUS BOARD - LANDING GEAR II			
3775	LG 22	AXLE BRACKETS	2
8120	LG 23	WHEEL RETAINER	2
8123	LG 24	WHEEL SPACER, PHENOLIC	4
8125	LG 25	WHEEL CENTERING SPACERS	2
II PLUS BOARD - LANDING GEAR III			
1643	LG 29	BOLT, AN3-16A	2
2125	LG 31	BOLT, AN4-15A	6
2140	LG 32 **	BOLT, AN4-17A	2
2155	LG 33	BOLT, AN4-24A	2
2195	LG 34	BOLT, AN4-34A	2
1515	LG 35	NUT, 3/6", NYLOCK, FULL	2
2010	LG 36	NUT, 1/4", NYLOCK, HALF	4
2015	LG 37	NUT, 1/4", NYLOCK, FULL	8
2030	LG 38	WASHER, 1/4", I.D., THIN	6
2035	LG 39	WASHER, 1/4", I.D., THICK	14
2045	LG 40	WASHER, PLASTIC, 1/4" X 3/4" X .062	12
2850	LG 41	TANG, 18G, THIN FLAT	4
2855	LG 42	TANG, 18G, THIN BENT	6
2687	LG 43	THIMBLE, SS	10
2675	LG 44	SWAGE, 3/32"	24

Bucket Seat - Board I

2015	NUT, 1/4" FULL NYLOCK	1
2040	WASHER, 1/4" I.D. X 1 1/8" O.D.	2
2089	BOLT, AN4-7A	1
4010	BUCKLE	4
41250	NUT COVER, 1/4"	1
7050	BUCKET SEAT	1
7055	SEAT COVER	1
70790	SEAT SUPPORT WEBBING	1

SHOULDER HARNESS	1
SEAT (specify color)	1
SEAT BACK PADDING	2
HANG TUBE	1
FRONT STRUT (II + 2)	1
DIAGONAL BRACE (II + 2)	1
REAR BRACE	1
FRONT CROSSTUBE (w/sleeve & plug)	1
REAR CROSSTUBE (w/sleeve & plug)	1
SEAT BACK REST TUBE (passenger)	1
SEAT BACK REST TUBE (pilot)	1
CARRY-THROUGH SLEEVE (II + 2)	1
PUSHROD EXTENSION	1
PUSHROD JOINER	1
1/8" CABLE, COATED	40"
HARNESS COVER	5'
FOOTREST STRAP	48"
BUCKLE	2
BRACKET, CURVED BOTTOM (ext.)	5
BRACKET, FLAT BOTTOM	2
BRACKET, STAINLESS (1")	2
JOINER PLUG	2
SADDLE, AL. FOR 1 7/8" TUBE	2
SADDLE, AL. FOR 1 1/8" TUBE	1
BOLT, AN3-13A	2
BOLT, AN4-5A	2
BOLT, AN4-13	2
BOLT, AN4-14	2
BOLT, AN4-14A	1
BOLT, AN4-15	1
BOLT, AN4-15A	2
BOLT, AN4-16	4
BOLT, AN4-16A	1
BOLT, AN4-22	1
BOLT, AN4-23	1
BOLT, AN4-24A	6
BOLT, AN4-27A	1
NUT, 3/16" FULL NYLOCK	3
NUT, 1/4" HALF NYLOCK	5
NUT, 1/4" FULL NYLOCK	13
WASHER, 1/4" THIN	9
WASHER, 1/4" THICK	22
WASHER, PLASTIC, 1/4" X 3/4" X .062	8
WINGNUT	11
SAFETY RING	11
RIVET 1/8" X 5/16" POP AL	4
RIVET 1/8" X 5/16" POP SS	8
SWAGE 1/8"	4
THIMBLE	2
TANG, THICK FLAT (14G)	2
TANG, THIN FLAT (18G)	2
INSTRUCTIONS & DOCUMENTATION	1
WINGTIP_COUNTERWEIGHT ASSEMBLY	1
4190 Counterweight tube	1
4192 Counterweight end sleeve	2
4194 Counterweight sleeve plug	2
4196 Spacer sleeve 1" x 3/8" O.D.	2
2177 Bolt, AN4-30A	2
2010 Nut, nylock 1/4" half	2
2860 Tang, thin flat (14G)	2

SPOILER RETROFIT - PARTS LIST - May 10, 1983

A - SPOILERS

30480	Leading Edge, Spoiler	2
30490	Trailing Edge, Spoiler	2
30530	Ribs, 1/2" Wide	6
30540	Ribs, 1" Wide (for 1" tube)	4
31000	Poly-Fiber Fabric	3 yds.
31010	Poly-Tak	1 pt.
31020	Poly-Brush	1 qt.
40960	End Cap (for 1" .058)	4
42400	Rivet, Al, 1/8" x 1/4"	26
42510	Rivet, Al, 1/8" x 5/16"	22

B - SPOILER MOUNTING

15150	Nut, 3/16" Nylock, Full	4
15300	Washer, 3/16" Thick, St.	8
15450	Washer, 3/16" I.D. 7/8" O.D.	4
17300	Eyebolt, AN42B-22A	4
18150	Clevis Pin, 3/16" x 1/2"	4
20300	Washer, 1/4" Thin, St.	4
20870	Bolt, AN4H-5A	4
30210	Canard Control Arm	4
41200	Nut Cover, 3/16"	4
43750	Safety Ring	4

C - PEDALS

14370	Fuel Line, 1/4" I.D.	3 in.
14380	Clear Plastic Tube, 1" I.D. x 1" Long	2
20100	Nut, 1/4" Nylock, Half	4
20150	Nut, 1/4" Nylock, Full	2
20300	Washer, 1/4" thin, St.	2
20350	Washer, 1/4" thick, St.	12
20870	Bolt, AN4H-5A	2
21300	Bolt, AN4-16A	4
21550	Bolt, AN4-24A	2
30210	Canard Control Arm	2
30610	Pedal Tube	2
38670	Pedal Bracket	2
40970	End Cap (for 1 1/8" .058)	2
30445	Pedal Pad	2

D - CONTROL CABLES

15300	Washer, 3/16" Thick, St.	4
18170	Clevis Pin, 3/16" x 5/8"	2
18300	Clevis Pin, 3/16" x 1-3/8"	4
26500	1/16" Cable	32 ft.
26700	Swage, 1/16"	8
27100	Bushing, 1/16"	4
42310	Pulley	4
42750	Rivet, 5/32" x 5/8", St.	2
43700	Safety Wire	6 ft.
43750	Safety Ring	6

ASCENDER II PLUS PARTS LIST, SECTION I, CANARD.

STOCK #	ASSEMBLY #	DESCRIPTION	TOTAL
3060	CN 1	LEADING EDGE SPAR	1
3058	CN 2	TRAILING EDGE TUBE	1
3053	CN 3	RIB, 1/2" WIDE	4
3055	CN 4	RIB, 1" WIDE, CENTER	2
3054	CN 5	RIB, 1" WIDE, END	2
3100	CN 6	STITTS POLY FIBER	9'
3101	CN 7	STITTS POLY TAK	1 PT
3102	CN 8	STITTS POLY BRUSH	1 QT
II PLUS BOARD - CANARD			
1715	CN 9	EYEBOLT, AN42-13A	2
1515	CN 10	NUT, 3/16" NYLOCK, FULL	2
4240	CN 11	RIVET, 1/8" X 1/4", POP, AL	24
4241	CN 12	RIVET, 1/8" X 5/16", POP, AL	28
4096	CN 13	PLUG, FOR 1" X .058" TUBE	2
2087	CN 14	BOLT, AN4H-5A	1
4120	CN 15	NUT COVER, 3/16"	2
3021	CN 16	CONTROL ARM	1

ASCENDER II PLUS PARTS LIST, SECTION II, AIRFRAME.

3307	AF 1	FRONT SPAR ASSEMBLY	2
3317		INCLUDES: INBOARD SECTION	2
3322		MID-SPAR SECTION	2
3332		OUTBOARD SECTION	2
3372	AF 2	REAR SPAR ASSEMBLY	2
3387		INCLUDES: INBOARD SECTION	2
3392		MID-SPAR SECTION	2
3357		OUTBOARD SECTION	2
3252	AF 3	KEEL ASSEMBLY	1
3260		INCLUDES: REAR SECTION	1
3266		FRONT SECTION	1
1846	AF 4	CLEVIS PIN, 3/16" X 1 5/8"	1
3145	AF 5	KINGPOST	1
4570	AF 6	STRUT, FRONT	2
4576	AF 7	STRUT, MAIN	2
4578	AF 8	STRUT, REAR	2
4551	AF 9	HANG TUBE	2
7020	AF 10	BAG, COVER	1
3127	AF 11	COMPRESSION STRUT REAR, OUTBOARD (w/ guide)	2
3121	AF 12	COMPRESSION STRUT REAR, INBOARD	2
4568	AF 13	CARRY THROUGH, FRONT	1
4569	AF 14	CARRY THROUGH, REAR	1
2595	AF 15	SWEEP WIRE ASSY, INBOARD (with shackle)	2
2596	AF 16	SWEEP WIRE ASSY, OUTBOARD	2
6604	AF 17	ASSEMBLY MANUAL	1
6650	AF 18	FEDERAL AVIATION REGULATIONS	1
II PLUS BOARD - AIRFRAME I			
3920	AF 19	NOSEPLATE TOP, (with cable)	1
3915	AF 20	NOSEPLATE BOTTOM	1
3815	AF 21	NOSEPLATE SPACER BRACKET	2
3925	AF 22	GLIDER PLATE	6
3900	AF 23	BRACKET, KINGPOST	2
3945	AF 24	BRACKET, REAR SPAR, TOP	1
3940	AF 25	BRACKET, REAR SPAR, BOTTOM	1

3772	AF 26	BRACKET, CURVED BOTTOM (extrd)	18
3765	AF 27	BRACKET, FLAT BOTTOM	4
3852	AF 28	BRACKET, STAINLESS, FOR 1 1/8" TUBE	2
II PLUS BOARD - AIRFRAME II			
3135	AF 29	COMPRESSION STRUT, FRONT	4
3138	AF 30	SPRING, COMPRESSION STRUT	4
3148	AF 31	KINGPOST TOP	1
4135	AF 32	KINGPOST CAP (POLY BLACK, 1" I.D.)	1
2450	AF 33	PIP PIN	1
4325	AF 34	SADDLE, ALUMINUM, FOR 1 7/8" TUBE	4
4352	AF 35	SADDLE, PLASTIC, FOR 1 5/8" TUBE	4
4350	AF 36	SADDLE, PLASTIC, FOR 1" TUBE	2
1849	AF 37	PIN, CLEVIS, 3/16" X 1 7/8"	4
II PLUS BOARD - AIRFRAME III			
1655	AF 38	BOLT, AN3-22A	2
1657	AF 39	BOLT, AN3-24A	6
2088	AF 40	BOLT, AN4-6A	2
2120	AF 41	BOLT, AN4-14A	2
2124	AF 42	BOLT, AN4-15	2
2135	AF 43	BOLT, AN4-16	4
2130	AF 44	BOLT, AN4-16A	12
2140	AF 45	BOLT, AN4-17A	1
2155	AF 46	BOLT, AN4-24A	12
2160	AF 47	BOLT, AN4-25A	1
2165	AF 48	BOLT, AN4-26A	8
2170	AF 49	BOLT, AN4-27A	3
1515	AF 50	NUT, 3/16" NYLOCK, FULL	8
2010	AF 51	NUT, 1/4" NYLOCK, HALF	15
2015	AF 52	NUT, 1/4" NYLOCK, FULL	24
2020	AF 53	WINGNUT	12
II PLUS BOARD - AIRFRAME IV			
1525	AF 54	WASHER, 3/16" THIN	4
1530	AF 55	WASHER, 3/16" THICK	8
2030	AF 56	WASHER, 1/4" THIN	12
2035	AF 57	WASHER, 1/4" THICK	46
2045	AF 58	WASHER, PLASTIC, 1/4" X 3/4" X .062"	40
2060	AF 59	WASHER, PLASTIC, 1/4" X 1" X .031"	4
4240	AF 60	RIVET, 1/8" X 1/4", POP, AL	8
4251	AF 61	RIVET, 1/8" X 5/16" POP, SS	4
4259	AF 62	RIVET, 5/32" X 1/2" POP, ST	5
4375	AF 63	SAFETY RING	17
1800	AF 64	PIN, CLEVIS, 3/16" X 1/4"	2

ASCENDER II PLUS PARTS LIST, SECTION II, AIRFRAME - Rigging

2666	RG 1	CABLE, 1/8", COATED	60'
2655	RG 2	CABLE, 3/32", COATED	58'
2660	RG 3	CABLE, 3/32", UNCOATED	102'
II PLUS BOARD - RIGGING			
2850	RG 4	TANG, 18G, THIN FLAT	10
2855	RG 5	TANG, 18G, THIN BENT	8
2860	RG 6	TANG, 14G, THICK FLAT	6
2865	RG 7	TANG, 14G, THICK BENT	4
2670	RG 8	SWAGE, 1/16"	1
2675	RG 9	SWAGE, 3/32"	42
2686	RG 10	SWAGE, 1/8"	16
2687	RG 11	THIMBLE, SS	28
1442	RG 12	HEAT SHRINK, 1/2" CLEAR	95"
2720	RG 13	CABLE TENSIONER	4

ASCENDER II PLUS PARTS LIST, SECTION V, WING COVERING

3550	WC	1	WING COVERING (shipped seperately)	1
3700	WC	2	RIB SET	1
3695			INCLUDES: CAMBERED, 68 1/2"	2
3696			CAMBERED, 65"	2
3697			CAMBERED, 61 1/2"	2
3698			CAMBERED, 59"	2
3685			HALF REFLEX	2
3690			REFLEX	4
3680			DROOP TIP	2
3707	WC	3	TIP RIB ASSEMBLY, LEFT	1
3712	WC	4	TIP RIB ASSEMBLY, RIGHT	1
3801	WC	5	TIP RIB BRACKET, LEFT	1
3806	WC	6	TIP RIB BRACKET, RIGHT	1
3749	WC	7	SPACER TUBE, (1 3/4" O.D., 3/4" L) (on noseboom I board)	2
3745	WC	8	RIB PROFILE DRAWING	1
7035	WC	9	BAG, RIB	1
II PLUS BOARD - WING COVER				
4015	WC	10	SAIL STOP, NYLON, 1/8" X 1/4" X 5/16"	2
4020	WC	11	TIP RIB STOP, NYLON, 5/32" X 3/8" X 3/8"	2
4265	WC	12	RIVET, 1/8" X 1/2", POP, AL	2
4275	WC	13	RIVET, 5/32" X 5/8", POP, ST	2
4125	WC	14	COVER, 1/4" NUT	32
4120	WC	15	COVER, 3/16" NUT	14
4390	WC	16	SCREW, #10 X 5/8"	3
1655	WC	17	BOLT, AN3-22A	2
2153	WC	18	BOLT, AN4-23	4
2060	WC	19	WASHER, PLASTIC, 1" O.D., 1/4" I.D. X .031	8
2045	WC	20	WASHER, PLASTIC, 3/4" O.D., 1/4" I.D. X .062	4
1530	WC	21	WASHER, 3/16" I.D., THICK	4
1515	WC	22	NUT, 3/16, NYLOCK, FULL	2
2020	WC	23	WING NUT	4
4375	WC	24	SAFETY RING	4

ASCENDER II PLUS PARTS LIST, SECTION VI, CONTROLS - Nosebooms

4562	NB	1	NOSEBOOM TUBE	2
II PLUS BOARD - NOSEBOOM I				
4561	NB	2	NOSEBOOM SLEEVE	2
2650	NB	3	CABLE, 1/16"	18'
II PLUS BOARD - NOSEBOOM II				
4556	NB	4	MOUNTING TUBE, CANARD	2
4557	NB	5	MOUNTING TUBE SLEEVE, CANARD	2
4170	NB	6	CLEVIS	2
1815	NB	7	PIN, CLEVIS, 3/16" X 1/2"	2
1849	NB	8	PIN, CLEVIS, 3/16" X 1 7/8"	2
1650	NB	9	BOLT, AN3-21A	2
2153	NB	10	BOLT, AN4-23	2
1530	NB	11	WASHER, 3/16" I.D., THICK	4
1515	NB	12	NUT, 3/16", NYLOCK, FULL	2
2020	NB	13	WING NUT	2
4375	NB	14	SAFETY RING	6
2850	NB	15	TANG, 18G, THIN FLAT	6
2857	NB	16	TANG, 18G, 90 DEGREE BEND	2
2670	NB	17	SWAGE, 1/16"	16
2687	NB	18	THIMBLE, SS	8
1442	NB	19	HEAT SHRINK, 1/2" CLEAR	24"
4280	NB	20	RIVET, 1/8" X 5/8" PLAIN	2
4240	NB	21	RIVET, 1/8" X 1/4", POP, AL	2

ASCENDER II PLUS PARTS LIST, SECTION VI, CONTROLS - Stick and Pushrod

3031	CS	1	CONTROL PUSHROD	1
II PLUS BOARD - CONTROLS I				
3043	CS	2	CONTROL STICK TUBE	1
3044	CS	3	CONTROL STICK GRIP	1
3045	CS	4	CONTROL STICK CROSS TUBE	1
3024	CS	5	CONTROL POST TUBE	1
3862	CS	6	BRACKET, CONTROL POST	1
3032	CS	7	CONTROL PUSHROD END	1
3033	CS	8	CONTROL PUSHROD END JOINER	1
II PLUS BOARD - CONTROLS II				
1655	CS	9	BOLT, AN3-22A	1
2145	CS	10	BOLT, AN4-22A	1
2170	CS	11	BOLT, AN4-27A	1
2176	CS	12	BOLT, AN4-30	1
1515	CS	13	NUT, 3/16", NYLOCK, FULL	1
2010	CS	14	NUT, 1/4", NYLOCK, HALF	2
2020	CS	15	WING NUT	1
2030	CS	16	WASHER, 1/4" I.D., THIN	6
2047	CS	17	WASHER, PLASTIC 3/4" O.D., 1/4" I.D. X .031	2
2045	CS	18	WASHER, PLASTIC 3/4" O.D., 1/4" I.D. X .062	2
4375	CS	19	SAFETY RING	2
4251	CS	20	RIVET, 1/8" X 5/16", POP, SS	11
4265	CS	21	RIVET, 1/8" X 1/2", POP, ST	2
4096	CS	22	PLUG, FOR 1" X .058" TUBE	1
4075	CS	23	PLUG, FOR 1 1/2" X .049 TUBE	1
1825	CS	24	PIN, CLEVIS, 3/16" X 1"	1

ASCENDER II PLUS PARTS LIST, SECTION VI, CONTROLS - Winglets & Control Cables

3159	CC	1	WINGLET COMPLETE (shipped seperately)	2
2650	CC	2	CABLE, 1/16"	38'
II PLUS BOARD - CONTROLS III				
2670	CC	3	SWAGE, 1/16"	8
2710	CC	4	BUSHING, ST, FOR 1/16" CABLE	4
1800	CC	5	PIN, CLEVIS, 3/16" X 1/4"	2
1820	CC	6	PIN, CLEVIS, 3/16" X 3/4"	2
1825	CC	7	PIN, CLEVIS, 3/16" X 1" (on winglet)	2
4375	CC	8	SAFETY RING	6
2060	CC	9	WASHER, PLASTIC, 1" O.D., 1/4" I.D. X .031	2
2690	CC	10	STOP, CABLE, 1/16" (on winglet)	2

ASCENDER II PLUS PARTS LIST, SECTION VII, FINAL ASSEMBLY - Seat and Harness

7070	SH	1	SEAT (shipped with wheels)	1
7075	SH	2	SHOULDER HARNESS	1
7076	SH	3	SEAT ROPE	14'
4567	SH	4	SEAT BACK REST TUBE	1
1448	SH	5	SEAT BACK REST PADDING	1
II PLUS BOARD - SEAT				
4020	SH	6	STOP, NYLON, 5/32" X 3/8" X 3/8"	2
4096	SH	7	PLUG, FOR 1" X .058" TUBE	2
4275	SH	8	RIVET, 5/32" X 5/8", POP, ST	2
4240	SH	9	RIVET, 1/8" X 1/4", POP, AL	2

(Engine part shipped with airframe)

8596	EM	5	DIAGONAL BRACE	2

NICOPRESS HAND TOOLS FOR NICOPRESS OVAL AND STOP SLEEVES

# 17-BA	# 51-B4-887	# 51-F2-850	# 3-C-887	# 3-G9-950
# 17-B4	# 51-C-887	# 51-G-929	# 3-G-887	# 3-O-929
# 31-B	# 51-G-887	# 51-MJ	# 3-M-850	# 3-MJ
# 32-VC-VG	# 51-M-850	# 63V-XPM	# 3-P-850	# 3V-CGMP
# 33V-CGB4	# 51-P-850	# 64-CGMP	# 3-X-850	# 3V-F6-X-M
	# 51-X-850	# 63V-XPM/Cutter	# 3-F2-850	# 3V-XPM
		# 64-CGMP/Cutter	# 3-F6-950	

NICOPRESS BENCH TOOL HEADS

The heads used in bench tools are the same as the "heads only" of corresponding Nicopress hand tools as follows:

No. 510 Bench Tool Heads

# 51-B4-887 Head	# 51-M-850 Head	# 51-F2-850 Head
# 51-C-887 Head	# 51-P-850 Head	# 63V-XPM Head
# 51-G-887 Head	# 51-X-850 Head	# 64-CGMP Head
	# 51-O-929 Head	# 51-MJ Head

No. 510 Bench Tool Heads Are Completely Interchangeable With Each Other

No. 300 Bench Tool Heads

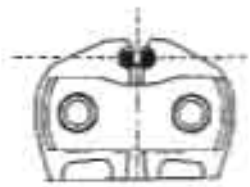
# 3-C-887 Head	# 3-X-850 Head	# 3-O-929 Head
# 3-G-887 Head	# 3-P2-850 Head	# 3-MJ Head
# 3-M-850 Head	# 3-F6-950 Head	# 3V-CGMP Head
# 3-P-850 Head	# 3-G9-950 Head	# 3V-F6-X-M Head
		# 3V-XPM Head

No. 300 Bench Tool Heads Are Completely Interchangeable With Each Other

MAKING EYE SPLICES WITH NICOPRESS OVAL SLEEVES

To make EYE SPLICES pull enough cable through the sleeve so that the end will still protrude after crimping. Line up the sleeve between the tool jaws as shown with the long axis crosswise to the jaws.





Tables which follow list the number of crimps required for each sleeve. Space crimps apart, as shown, except where overlapped crimps are specified. Overlapped crimps are specified for sleeves that need more than one crimp, but do not have room for two complete crimps. Overlapped crimps should compress all of the sleeve.

Proof testing is recommended whenever the possibility of personal injury or property damage exists.

LAP SPLICES can also be made with NICOPRESS Oval Sleeves. Usually 2 sleeves are needed to develop a full strength splice. A short space should be kept between the sleeves as shown.



NO. 33V-CGB4 TOOL AND NO. 32-VC-VG TOOL

CABLE SIZE	SLEEVE NUMBER	TOOL GROOVE	PRESSES REQ'D
3/64	18-11-B4; 28-11-B4; 428-1.5-VB4; 188-1.5-VB4	VB4	1
3/64	188-1.5-VB4	VB4	2 (Overlapped)
1/16	18-1-C; 28-1-C; 428-2-VC	VC	2
1/16	188-2-VC	VC	2 (Overlapped)
3/32	18-2-G; 28-2-G; 428-3-VG	VG	2 (Overlapped)
3/32	188-3-VG	VG	2

NO. 17-BA & NO. 17-B4 TOOLS

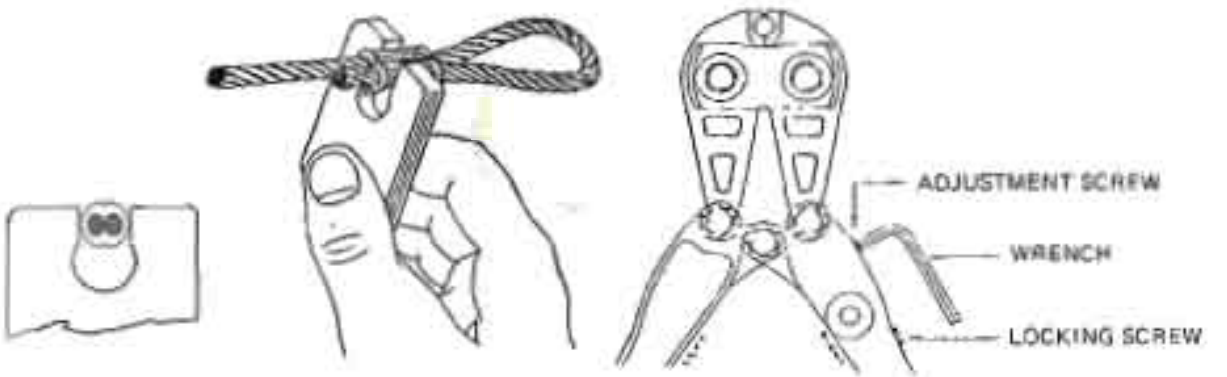
CABLE SIZE	SLEEVE NUMBER	TOOL NUMBER	PRESSES REQ'D
1/32	17-1-B; 27-1-B	17-BA	2
3/64	18-11-B4; 28-11-B4; 428-1.5-VB4	17-B4	2

THE NATIONAL TELEPHONE SUPPLY CO.
CLEVELAND, OHIO 44103 TELEPHONE (216) 361-6221

INSTRUCTION NO. 32
GENERAL REVISION MAY 1983

ADJUSTMENT, HAND TOOLS LISTED ON PAGE NO. 1

Check a crimped sleeve, as shown, with the go-type gauge provided. If pressed portion won't go into gauge, adjust tool as outlined below.



With handles open loosen locking screw with hex wrench one or two turns. Turn adjusting screw clockwise about 1/4 turn. Make a press and check with gauge. Repeat as needed until gauge passes over press.

When adjustment is correct, tighten locking screw.

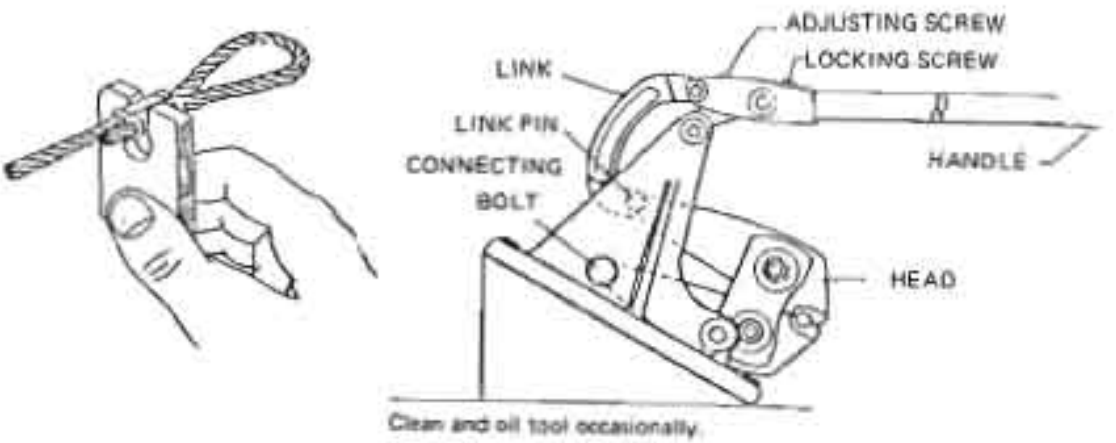
Clean and oil tool occasionally. Except for some spring at final closing, "empty" tool should work freely.

The No. 17-8A and the No. 17-84 tools are not adjustable.

NO. 300 BENCH TOOL AND NO. 510 BENCH TOOL ADJUSTING AND CHANGING HEADS

To remove the tool head: (1) Raise the handle to full open position, (2) Remove connecting bolt (see illustration), (3) Pull head out to expose link pin and remove it.

To install a tool head, follow the reverse of this procedure. Always check tool adjustment when changing heads (See below).



Clean and oil tool occasionally.

To make a satisfactory splice, it is important that the sleeve be fully and correctly pressed. To check this use the gauge furnished with the tool head on a sleeve which has been pressed, as shown above. If the sleeve will not enter the gauge freely, the tool needs to be adjusted. To adjust the tool, loosen the locking screw and turn the adjusting screw clockwise about 1/4 turn. Make a new press and check with the gauge. Repeat if necessary. After the adjustment is set correctly, tighten the locking screw hard to hold the setting.

ADJUSTMENT CAM	An aluminum fitting with an off center hole for the shaft of the driven pulley assembly. It is turned in the remote mount plate to tighten the belts. See drawing III#9.
AIR CLEANER	A green foam air filter with a spring inside which attaches to the carburetor with a large hose clamp.
AIR SPEED INDICATOR	Measures speed through the air, not to be confused with groundspeed.
ALTIMETER	Measures altitude.
ANTI-SWAY CABLE	Cables from the rear carry-through to the stub axle which hold the stub axle onto the springrods, which preload the springrod and which reduce the effect of crosswinds on takeoff and landing.
AXLES	Front: 7 1/2" of 7/8"O.D. steel tube with two holes. Main: 3 aluminum tubes inside each other, 28 1/2" long, with 2-1/4" holes 20 1/2" apart. One is 1 7/8O.D., one is 1 3/4"O.D. and one is 1 5/8"O.D. Stub: 7" of 7/8"O.D. steel tube.
AXLE BRACKET	See bracket.
AXLE JOINER	A 6" long, 1 1/8"O.D. steel tube with one 1/4" hole which joins the stub axle to the springrod.
AXLE JOINER SLEEVE	A 2 7/8" long, 1"O.D. tube which fits inside the axle joiner.
BAYONET CONNECTOR	Electrical connectors (male and female) which are attached with a crimping tool.
BELLCRANK	The short tube on the winglet to which the control cable attaches.
BEARINGS	Delrin (black plastic) 7/8"I.D., 1 3/16"O.D., 1/2" long.
BOLTS	Most of the bolts in the aircraft are AN3 or AN4. AN3's have a 3/16" diameter shank, AN4's have a 1/4" diameter shank. Use the AN chart to determine size. An "A" after the length number means it has no hole in the threaded end. (Remember, "A" stands for Absence of hole.) Engine Mount Bolt 7/16"x1 1/4" Eye Bolt 3/16" bolt with a special head with a 3/16" hole. Used on the canard (AN42-13A)and winglets. Drive Pulley Bolt 1/2"x1 1/2", grade 5 Muffler Mount Bolt 5/16"x 1 1/2" Pinch Bolt AN6-24A Prop Mount Bolt AN5-44A Remote Mount Plate Bolt 10MMx50MM

BRACKET

Altimeter Mounting Thin bent plate used to attach the altimeter to the throttle mount assembly.

Axle Small aluminum bracket curved to fit a 1" tube on one side and a 1 7/8" tube on the other side. See photo I-G.

Control Post Large aluminum bracket (cut from extrusion) which slides onto the hang tube to hold the control post. See photo G#1-N and drawing III#3.

Curved Bottom An aluminum bracket cut from an extrusion, it has 3 - 1/4" holes and is 1 1/8" inside (the curved base fits 1 7/8"O.D. tubing). Used to attach struts and landing gear to the hang cage, and compression struts to the spars. See photo G#1-J.

Flat Bottom Rectangular aluminum bracket (cut from extrusion) with a flat base, 1" inside. See photo G#1-E.

King Post Triangular aluminum plate with several bends, 2 - 3/16" holes and 3 - 1/4" holes. See photo G#1-A.

Muffler Mount A right-angled steel bracket with a large hole for the muffler damper rubber and a small hole for the engine mount bolts. See photo G#1-F.

Noseplate Triangular plates with bent corners and holes and slots. The top has a cable. See photo G#1-K & L.

Rear Spar A diamond shape - the top one has slots and the bottom one has holes. See photo G#1-A & B.

Spacer bracket (noseplate) Black plastic. See photo G#1-H

Stainless A bracket made from stainless steel plate, which wraps around a tube. One size fits 1" tube, the other fits 1 1/8" tube. See photo G#1-O.***

Tip Rib - 8" long, 1 7/8"O.D. tube with a large slot at one end. Used to attach the tip rib to the rear spar. See photo G#1-M.

BUSHING

It's round, steel, has a 3/16" hole in the center (for a clevis pin) and has a groove around the edge for a cable. It is used to connect control cables. See photo G#2-Q. (Plastic stops are called bushings in the parts list.)

BUBBLE PROTRACTOR

See tools.

CABLE

Stainless steel aircraft cable used for rigging, bracing and control cables. The control cable and noseboom cables are 1/16" diameter 7x7, the top rigging, inboard bottom rigging and outboard sweep

wires are 3/32" diam. 7x7, and the outboard bottom rigging and inboard sweep wires are 1/8" diam. 7x7. (7x7 means that each cable consists of 7 strands of 7 wires each.) The bottom rigging cables have a plastic coating.

CABLE CLIP — A plastic clip used to secure the throttle cable to a 1"O.D. tube.

CABLE CLAMP — Small steel fitting with a hole for a cable and a screw to clamp it.

CABLE HOUSING CLAMP — Plastic fitting which clamps around the throttle cable outer (or housing).

CABLE GUIDE — A nylon fitting on the outboard compression strut, through which the control cable runs.

CABLE STOP — Small copper cylinder swaged onto a cable end.

CABLE BUSHING — See bushing.

CABLE TENSIONER — A small, black, nylon block with two holes which fits onto the top rigging. Sliding the block away from the kingpost pulls the cables together and increases the tension.

CANARD — Forward mounted elevator.

Canard Leading Edge an 8' long, 1"O.D. tube with a 1 1/8"O.D. sleeve at the center.

Canard Trailing Edge an 8' long, 3/8"O.D. tube.

Canard Rib See Ribs.

CANARD MOUNTING TUBE — A 6" long 1/2"O.D. tube which supports the canard above the noseboom.

CANARD MOUNTING TUBE SLEEVE — A 5 1/2" long 5/8"O.D. tube which fits into the hole in the front of the noseboom to support the canard mounting tube.

CARBURETER MOUNTING FLANGE — A black plastic fitting with one large hole and two small ones, which attaches the carburetor to the intake manifold.

CARRY-THROUGH — A tube which connects the hang tubes.

Front A 25" long, 1"O.D. tube with a 1 1/8"O.D. sleeve full length.

Rear A 25" long, 1 1/8"O.D. tube.

The front one has the flying wires attached to the ends: the load on the cables is carried through the tube, hence the name.

CENTER RIB — See Ribs.

CLEVIS — An aluminum fork which fits into the end of a tube to connect to an eyebolt (using a clevis pin). See drawing VI#1.

CLEVIS PIN — A steel pin with a hole for a safety ring at one end. The other end looks like the head of a nail. (Size measured from the hole to under the head.)

COMPRESSION STRUTS — Struts which hold the spars apart.

Front — A short 1"O.D. tube with a smaller tube which slides inside. It is bolted into a bracket on the rear of the front spar with a spring. See drawing II#12.

Rear Inboard — A 26" long 1"O.D. tube with a hole at one end.

Rear Outboard — A 26" long 1"O.D. tube with hole at one end and a plastic cable guide at the other.

CONTROL ARM - CANARD — A solid 1/2"O.D. aluminum rod with flat sides at one end and a threaded hole at the other end, which bolts into the canard leading edge and connects to the canard pushrod. See drawing I#1.

CONTROL POST — A 7" long,1 1/2"O.D. tube which attaches to the bracket on the hang cage. The control stick and pushrod are attached to it. See drawing VI#3.

CONTROL POST BRACKET — See bracket.

CONTROL STICK — A 8" long 1"O.D. tube with a 5/8" hole near one end. The control stick crosstube fits in this hole, and the assembly bolts to the control post. See drawing VI#3.

CONTROL STICK CROSSTUBE — A 7" long 5/8"O.D. tube, used to attach the control cables to the control stick. See drawing VI#3.

CONTROL STICK GRIP — Rubber handle for control stick.

CRIMPING TOOL — See tools.

CURVED BOTTOM BRACKET — See bracket.

CYANOACRYLATE — See tools.

DAMPER CARRIER — A gold anodized aluminum angle 12" long with large holes at each end for the vibration dampers and 1/4" holes for the bolts which hold the engine plate. See drawing III#1.

DIAGONAL BRACE — A 35 1/2" long 1"O.D. tube with holes at both ends and a slot at one end which connects the engine main mount tubes to the top of the rear struts. See drawing III#3.

DIHEDRAL — The angle which determines how much higher the wingtips are than the keel.

DRIVEN PULLEY	See pulley.
DRIVER PULLEY	See pulley.
DROOP TIP	Short wing extensions which angle down from the wing-tips. See drawing VI#5.
DROOP TIP RIB	See rib.
END RIB	See rib.
ENGINE MAIN MOUNT TUBE	A 13" long 1"O.D. tube with 3 holes which supports the engine. See drawing III#1.
EYEBOLT	See bolt.
FLAT BOTTOM BRACKET	See bracket.
FLYING WIRES	Another name for the bottom cables, which connect the hang cage to the wing. They are stressed in flight, hence the name.
FORK LEG	A 29" long 1"O.D. tube with a hole at each end and a bend in the middle, which connects the front axle to the hang cage. See drawing IV#4.
FORWARD BRACE	A 12 3/4" long 1"O.D. tube with a 1/4" hole at one end between the main struts and the hang cage. See drawing III#4.
FRONT STRUT	See strut.
FUEL FILTER	See photo G#2-E.
FUEL HARNESS	A 22 1/2" long 1"O.D. tube with a threaded rod and tangs which supports the fuel tank.
FUEL LINE	Blue urethane tubing 3/16" and 1/4"I.D.
FUEL PUMP	See photo G#2-D.
GLIDER PLATE	A 2"x3" nylon plate 1/16" thick with 5 holes which fits inside the noseplate assembly. See drawing II#2.
HANG CAGE	The rectangular frame around the pilot. It consists of two hang tubes connected by carry-throughs. On early hang gliders the pilot hung by his armpits from these tubes (with no seat), hence the name.
HANG TUBE	A 1 3/4"O.D. tube with 1 7/8" sleeves and 1 1/8" holes at each end, overall length is 61 1/2".
HARNESS COVER	Spiral plastic strip used to hold the throttle cable and electrical wire together between the throttle and engine.
HEAT GUN	See tools.
HEAT SHRINK	Magic plastic which shrinks (when heated 300 - 400 degrees) around tangs and thimbles to protect the wing covering from abrasion when folded and to keep

	the thimbles from kinking on the tangs. It's not 100% foolproof, so inspect the thimbles during setup.
HORIZONTAL STRUT	See strut.
HOT KNIFE	See tools.
I.D.	Inside Diameter.
INBOARD	Closer to the center of the aircraft than outboard. See drawing II#8.
INBOARD REFLEX RIB	See rib.
JOINER	Axle joiner See axle. Pushrod joiner See pushrod.
KEARNY	See construction notes.
KEEL	The central tube to which the spars, kingpost and struts attach. See drawing II#8.
KINGPOST	A 41 1/4"long 1"O.D. tube with a hole and tube plug at one end. It supports the top rigging.
KINGPOST BRACKET	See bracket.
KINGPOST TOP	A fitting with slots for the top cables which fits into the top of the kingpost. See photo G#1-C.
LANDING WIRES	Or top rigging, connect the wing to the to the kingpost. They are loaded when landing (and while on the ground), hence the name.
LEADING EDGE	The forward edge of the wing; the front spar forms the leading edge. The forward edge of the canard, 8' of 1" tube, with a 1 1/8" sleeve and holes for the control arm.
MAIN AXLE	See axle.
MAINGEAR CARRIERS	'U' shaped 1"O.D. tubes which connect the rear axle to the hang cage. See drawing IV#3.
MAIN STRUTS	See strut.
MANIFOLD	The inlet manifold is already on the engine. The exhaust manifold is 'Y' shaped and chromed.
MUFFLER DAMPER	Rubber mouldings (male and female) used when attaching the muffler to the brackets on the engine mount plate.
MUFFLER MOUNT BRACKET	See bracket.
NICO	Another name for swage.
NOSEBOOMS	5' long, 1 3/4"O.D. tubes which extend forward from the hang cage to support the canard.
NOSEBOOM CABLES	1/16" cables which support the canard nosebooms from above and below.

NOSEGEAR	Front wheel assembly including the fork legs, front horizontal strut, etc. See drawing IV#4.
NOSEPLATE ASSEMBLY	Device which attaches the front spar to the keel. It slides along the keel when the aircraft is folded up. See drawing II#3. Consists of top and bottom aluminum plates with plastic brackets between them.
NUT COVERS	Small black plastic covers for bolt head and nuts. They protect the wing covering from abrasion when the aircraft is folded. 3/16" or 1/4".
NYLOCK	A nut with a built-in ring of nylon which locks onto the threads of a bolt. A half nylock is shorter than a full nylock. See photos G#3-A, B, C, D, E and F.
O.D.	Outside Diameter.
OUTBOARD	Further from the center of the aircraft. See drawing II#8.
PHENOLIC	A lightweight, brown plastic used next to the delrin wheel bearings.
PIP PIN	A 1/4"O.D. pin with a handle and pushbutton at one end, and locking balls at the other. Used to secure the noseplate at the keel. See drawing II#2.
POLY BRUSH	(Stitts) The type of dope used to seal the canard fabric before painting.
POLY FIBER FABRIC	(Stitts) A high quality dacron aircraft covering material. It is glued around the canard framework and tightened by applying heat.
POLY TAK	(Stitts) The cement used to glue the fabric to the canard frame.
PRIMER BULB	Rubber bulb used to 'prime' the fuel system before starting the engine. see photo G#2-A.
PROP	Slang for propeller.
PROP FACE PLATE	A 4" diameter, circular plate which bolts to the rear of the prop.
PROP SPACER PLATE	A black anodized circular plate with holes which fits between the prop and the driven pulley.
PULLEY	Driver Small black pulley wheel which bolts onto the crankshaft and drives the belts. Driven Large black pulley wheel which is driven by the belts. Pullstart Small pulley block which attaches to the keel so the pullstart handle can be pulled down from above the pilot.

PUSHROD

6' long, 1"O.D. tube with a slight bend at one end. It connects the canard to the control post. See drawing VI#2.

PUSHROD END

4 1/4" long, 1"O.D. tube with slot, connects to the top of the canard control arm.

PUSHROD JOINER

4" long piece of 7/8"O.D. tube which connects the pushrod to the pushrod end.

REAR SPAR BRACKET

See bracket.

REAR STRUT

See strut.

REFLEX

The upward curve in the outboard trailing edge which automatically pulls the nose up from a dive.

REMOTE MOUNT PLATE

Large gold anodized 1" thick plate which bolts to the rear of the engine and supports the driven shaft, "remote" from the engine, hence the name.

RIB

1/2"O.D. tube with bend and tongue-like plastic fitting at the front and a cap at the back. They slide into pockets in the wing covering.

#1 68 1/2" long
#2 65 " long
#3 61 1/2" long
#4 59 " long

Inboard reflex rib - 57", with bend at the back.

Reflex rib - 57", bigger bend at the back.

Tip rib - 56 3/8" long, 1"O.D. tube with fittings for winglet and droop tip. It tensions the wing covering when attached to the spars at the wingtip. The left has a black cap, the right has a gold cap.

Droop tip rib - 62" long with a plastic tongue at the front and a 90 degree bend at the rear.

CANARD RIBS - Made from thin aluminuim sheet.

1/2" rib - four of these connect the leading edge and trailing edge of the canard.

Center rib - connects the trailing edge to the 1 1/8" sleeve at the center of the leading edge. (1" wide)

End rib - 1" wide ribs connect the leading edge and trailing edge of the canard at the tips.

RIGGING

General term for structural cables.

RIVET

Most are 'pop' rivets which are set from one side by pulling a mandrel out through the head. See photos G#3-G, H, I, J, K, L and U.

DIAMETER	LONG
1/8" aluminum	1/4"
1/8" aluminum	5/16"

1/8" aluminum 1/2"
1/8" stainless 5/16"
5/32" steel 1/2"
5/32" steel 5/8"

1/8" plain 5/8"

SADDLE — A fitting which is flat on one side and curved on the other. Used when bolting a tube to something flat.

Black plastic - curve fits 1"O.D. tube
Black plastic - curve fits 1 5/8"O.D tube
Aluminum - curve fits 1 7/8"O.D. tube

SAFETY RING — Spring steel wire wound into a 1/2" diameter ring (like a key ring) used to hold clevis pins in place, and through the hole in the end of a bolt which is fitted with a wing nut, to stop the wing nut coming off.

SAFETY WIRE — Special stainless steel wire which is twisted tight around hose connections to secure them. See construction notes.

SEAT — Sling seat which attaches to the front carry-through and by rope to the keel. See drawing VII#1.

SEAT BACK REST — A 24" long 1"O.D. tube which fits inside the back of the seat and is suspended by rope from the keel.

SEAT PADDING — A 14 1/2" long piece of foam which fits over the back rest tube inside the back of the seat as a cushion.

SEAT ROPE — 14' length of rope, which supports the back of the seat from the keel.

SELF TAPPING SCREW — Coarse threaded screw, used to secure the wing covering to the airframe.

SHACKLE — A steel 'U' shaped fitting on the inboard sweep wire, which attaches to the bottom noseplate.

SHOCK CORD — Rubber strands enclosed in a nylon sheath, used for front landing gear suspension, where the cable from the front forks attaches to the rear axle.

SHOULDER HARNESS — Helps restrain the pilot in negative G situations or accidents. Also allows the pilot to support the weight of the aircraft when foot launching.

SLEEVE — A short tube which reinforces another tube (inside or outside) where holes are drilled. The spar sections (1 3/4"O.D.) meet inside sleeves (1 7/8"O.D). See axle joiner sleeve, canard mounting tube sleeve.

SPACER BRACKET — See bracket.

SPACER PLATE (PROP) — See prop spacer plate.

SPAR

The basic structural tubes which form the wing. The front and rear spars are made from 1 3/4"O.D. tube, with 1 7/8"O.D. sleeves where the sections join. See drawing II#8.

SPRINGROD ADAPTOR

Plastic cylinder, 4 1/4" long, 1 1/2"O.D. with angled hole for springrod.

STAINLESS BRACKET

See bracket.

STOPS

A short plastic tube or cylinder (or bushing) which is riveted to a tube. See photos G#2-R, S and T.

Sail stop 1/8"I.D.x1/4"O.D.x5/16" long
Tip rib stop
Rope stop ——> same 5/32"I.D.x3/8"O.D.X3/8" long
Throttle stop
Cable stop See cable.

STRUT

Front 49" of 1"O.D. gold tubing with a 1/4" hole at one end.

Main 57" of 1 1/8"O.D. gold tubing with bends at both ends, with two holes in the top and one in the bottom.

Rear 48" of 1 1/8"O.D. gold tubing with bends at both ends, with two holes in the top and one in the bottom.

Horizontal 19" of 1"O.D. tube, which fits between the fork legs.

STUB AXLE

See axle.

SWAGE

A small soft metal sleeve (cross-section like figure 8) which is clamped onto cables to hold them together. Also called nicos or ovals.

SIZES
1/16" for control cable and noseboom wires.
3/32" for rigging and bracing cables.
1/8" for outboard bottom rigging cables.

SWEEP

The angle the wings are swept back from a straight line perpendicular to the keel. See drawing II#8.

SWEEP WIRES

Diagonal bracing cables on the airframe which resist sweep loads (the forces pushing back on the wing) and whose lengths determine the angle of sweep, hence the name. See drawing II#8.

SWITCH

2 position switch, attaches to the throttle assembly, and turns the engine ignition system on or off.

TANG

Flat steel plates with 2 holes used to connect a cable to a bolt. See photos G#2-M, N, O and P.

Flat - thin 18 gauge
Flat - thick 14 gauge

Bent - thin 18 gauge
Bent - thick 14 gauge
Bent - 90 degrees 18 gauge

THIMBLE — A steel fitting used where cables attach to tangs or shackles to hold the cable in a curve rather than a sharp bend.

THROTTLE — An assembly which fits onto the hang tube. The lever on this assembly attaches to the throttle cable, which controls the slide in the carburetor. The switch is also mounted on this assembly.

THROTTLE CONTROL ARM — A 3 1/2" long piece of aluminum plate with 3 holes. See drawing III#6.

TIP RIB BRACKET — See bracket.

TRAILING EDGE — The edge of the wing covering at the rear of the wing. The ribs slide into their pockets through openings at the trailing edge.

VELCRO STRAP — Used to secure the throttle cable to the hang tubes.

VIBRATION DAMPERS — Used to isolate the engine vibrations from the airframe. They are rubber, with a square flange and a 1/4" tube through the center. Also see muffler dampers.

WASHOUT — The twist in the wing (held in by the rigging) which improves pitch stability and stall recovery.

WASHER

Plastic small black 1/4"I.D.x3/4"O.D.x0.62 thick
small white 1/4"I.D.x3/4"O.D.x0.31 thick
large black 1/4"I.D.x1"O.D.x0.31 thick

Steel 3/16" thin (1/32")
3/16" thick (1/16")
1/4" thin (1/32")
1/4" thick (1/16")
1/4"x1 1/8" engine mount
5/16" small and large
3/8" lock and flat
star washer
7/16" lock and flat

WHEEL CENTERING SPACER — A 1 7/8" long piece of 1"O.D. tube with a hole at one end.

WHEEL RETAINER — 1" long piece of brown phenolic plastic tube, 7/8"I.D. and 1 1/2"O.D. See drawing IV#8.

WHEEL SPACER — 1/4" long piece of phenolic. See drawing IV#6.

WINGNUT — A nut with ears or wings which is turned on by hand. It is always secured with a safety ring through the hole in the end of the bolt.

WINGLET — Control surface at the wingtip which attaches to the tip rib. Also called rudders because they steer the aircraft, or tip draggers because they work by creating drag at the wingtip. See drawing VI#5.

Aluminum f
attaches.

WINGLET POST — The 1"O.D. vertical tube around which the winglet turns. See drawing VI#7.

WIRE STRIPPER — See tools.

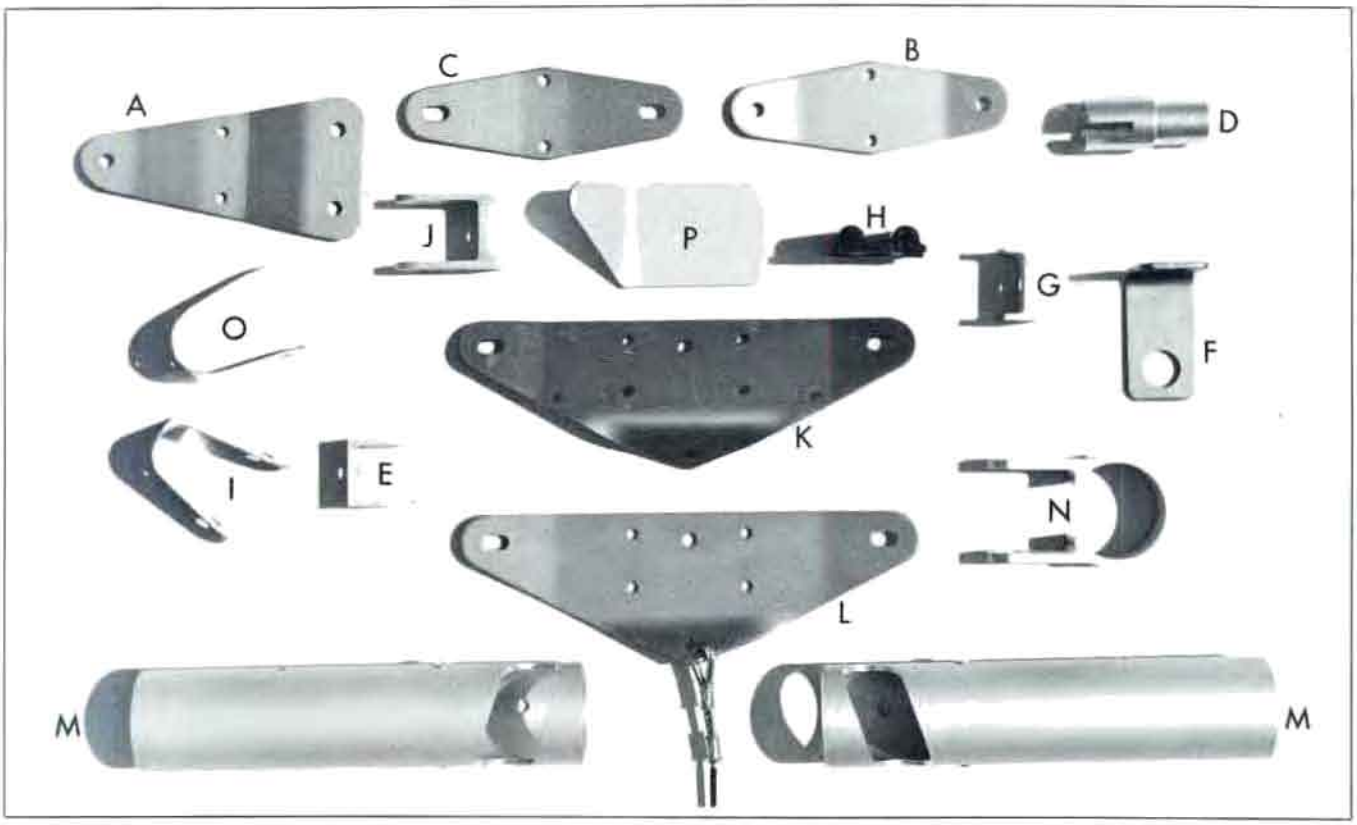
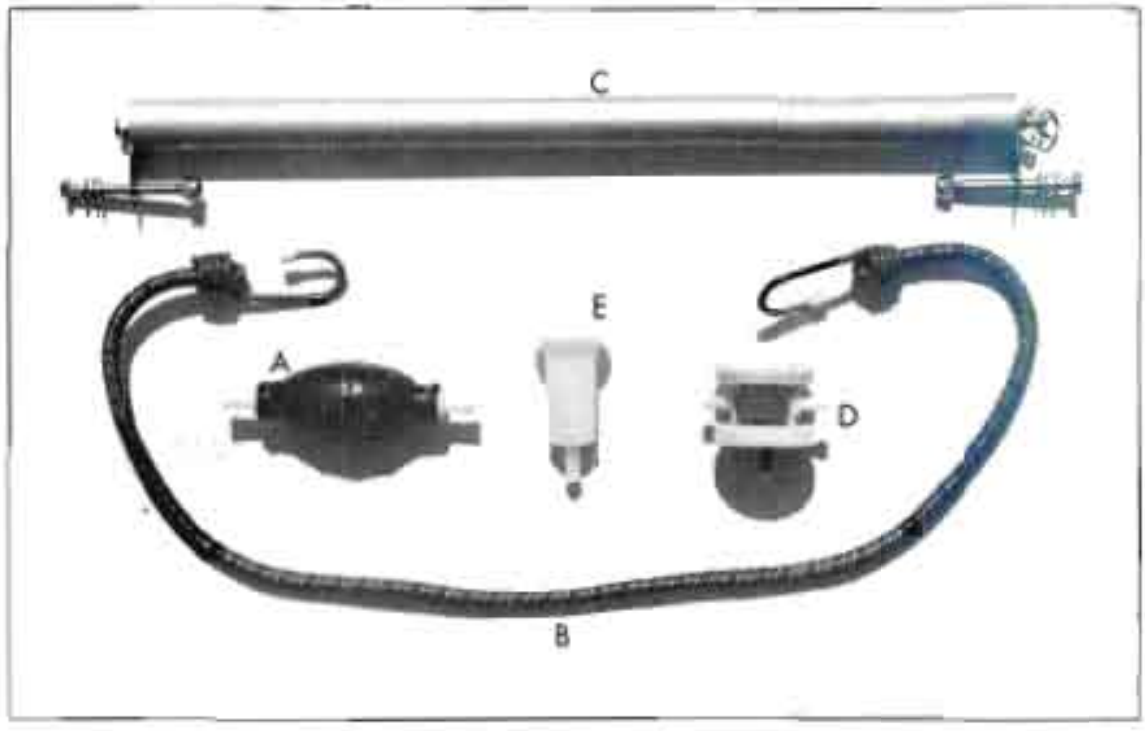


PHOTO G#1-A KINGPOST BRACKET
B REAR SPAR BOTTOM BRACKET
C REAR SPAR TOP BRACKET
D KINGPOST TOP
E FLAT BOTTOM BRACKET
F MUFFLER MOUNT BRACKET
G AXLE BRACKET
H NOSEPLATE SPACER BRACKET
I STAINLESS BRACKET 1"
J CURVED BOTTOM BRACKET
K NOSEPLATE BRACKET, BOTTOM
L NOSEPLATE BRACKET, TOP
M TIP RIB BRACKET
N CONTROL POST BRACKET
O STAINLESS BRACKET 1 1/8"
P ALTIMETER MOUNT BRACKET

PHOTO G#2

A PRIMER BULB
B FUEL BUNGEE
C FUEL HARNESS
D FUEL PUMP
E FUEL FILTER



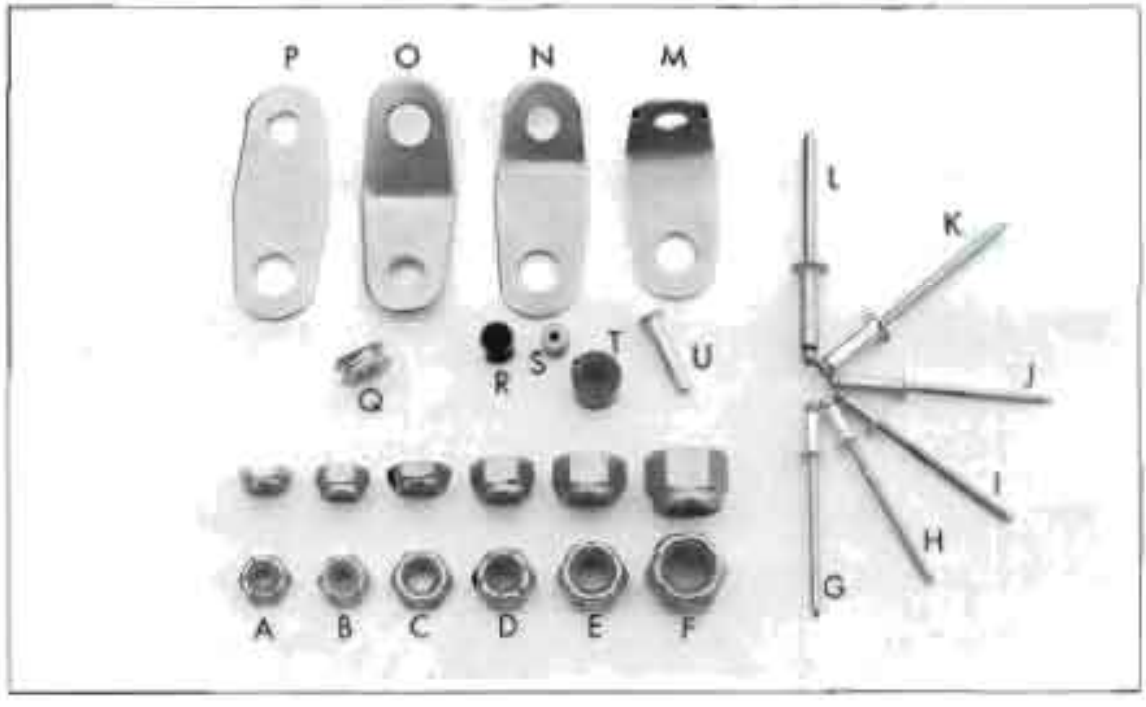


PHOTO G#3

A 3/16" HALF NYLOCK
B 3/16" FULL NYLOCK
C 1/4" HALF NYLOCK
D 1/4" FULL NYLOCK
E 5/16" FULL NYLOCK
F 3/8" FULL NYLOCK
G 1/8"X5/16" ALUMINUM RIVET
H 1/8"X1/4" ALUMINUM RIVET
I 1/8"X5/16" STAINLESS RIVET
J 1/8"X1/2" ALUMINUM RIVET
K 5/32"X1/2" STEEL RIVET
L 5/32"X5/8" STEEL RIVET
M 90 DEGREE BENT TANG
N THIN BENT TANG
O THICK BENT TANG
P FLAT TANG
Q CABLE BUSHING
R SAIL STOP
S CABLE STOP
T TIP RIB STOP, ROPE STOP
U PLAIN RIVET



PTERODACTYL

CONSTRUCTION NOTES

Some often used construction techniques are described here to avoid repetition in the text.

After you have inventoried your kit, leave the parts on the boards until needed.

In general, left and right, front and rear are used to mean as seen from the pilot's position, top and bottom mean on the completed aircraft.

You may finish a section of text to find that the part of the aircraft you have been working on does not look complete or you have some parts left over. Don't panic, we haven't left out some of the text. It will be completed in SECTION VII - FINAL ASSEMBLY.

CRIMP AND BAYONET CONNECTORS

These are used for electrical connections between the switch and the engine.

Strip about 1/4" of coating from the end of the wire, twist it a few times and thread it into the jaws of the connector. Squeeze tightly with the crimping tool, with the pointed side of the jaws pressing the rounded side of the connector.

Give the wire a few gentle tugs to make sure that the connector is secure.

The switch works by completing a circuit to stop the engine, so if one of your electrical connections fails, you cannot kill the engine with the switch. (For this reason, always adjust your throttle and the airscrew on the carb so that you can kill the engine with the throttle lever.)

DRILLING

Any power hand drill will do, although a variable speed drill is the easiest to use. Most of the holes you will be drilling are in tubes and a slowly turning bit is less likely to slip off the curve. Always use a punch to make a mark for the point of the drill bit for the same reason. Always position the hand which is holding the tube so that if the bit does slip off the tube, you don't drill your hand.

All holes should be exactly perpendicular to the long axis of the tube and should bisect the cross-section exactly. Move your head to watch the drill bit from both front and side as you drill to check. One way to be sure of a perfectly lined-up hole is to drill a small hole first, then enlarge the hole with a small round file (or by reaming with the drill bit) correcting any error as you do so. Repeat with the next size drill bit until the line is perfect, then run through the hole with the full size bit.

Where the text mentions drilling two holes "in line" this means that they should both start on the same straight line

along the surface of the tube. The drill bit making the second hole should line up perfectly with a bolt through the first hole (when viewed from the end of the tube) and both should be perpendicular to the tube.

HEAT SHRINK

Slide the heat shrink tubing onto the cable before the kearny and tang, because it's difficult to slide on later, over the tang. If you do forget and have to slide one over the tang, lubricate the inside of the tubing, push it on and use needle-nosed pliers to reach in and pull the tang through.

KEARNYS

Kearnys are electricians' split bolts, used here to clamp cables temporarily while adjustments are made. They are made of soft brass, so they won't damage the cable, although you can kink the cable if you seriously overtighten them.

They are available in a variety of sizes which we categorize by the size of the wrench necessary to fit the nut.

1/16" cable requires 7/16" size	(4 needed)
3/32" cable requires 1/2" or 5/8" size	(12 needed)
1/8" cable requires 5/8" size	(2 needed)

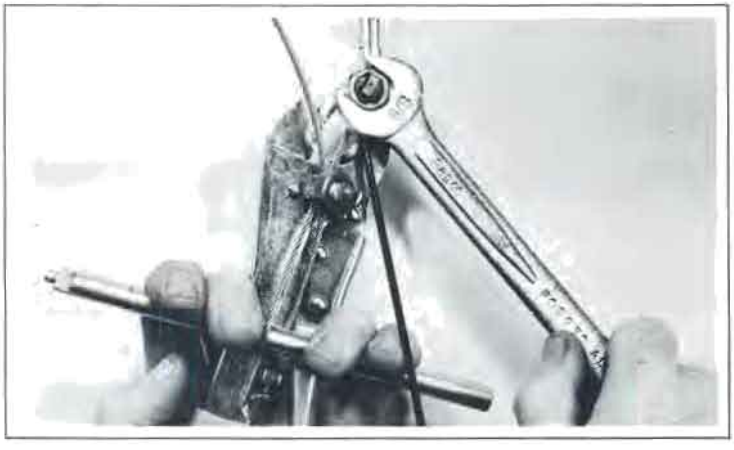
You will need a small pair of vise grips to hold the kearny while you turn the nut, and to push the kearny and swages toward the thimble.

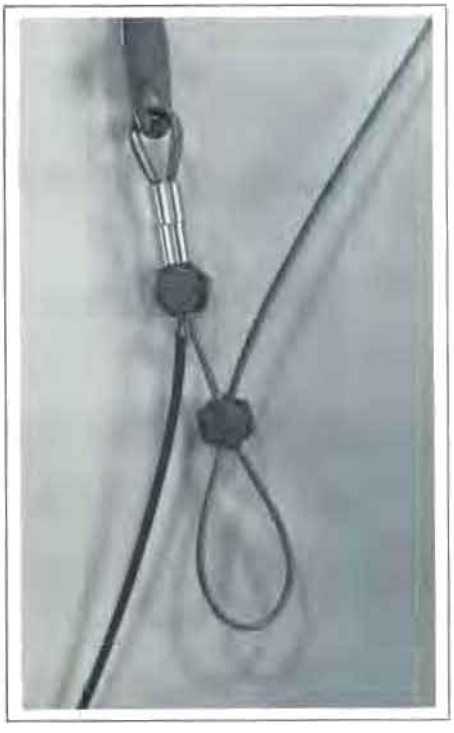
To tighten a cable, (with kearnys, swages etc. in position) first clamp the vise grips to the kearny. Wrap the loose cable end several times around one hand (a glove helps), and pull the cable tight. Then push the vise grips toward the tang with the thumb of the hand which is holding the cable and tighten the nut with the wrench. You need to be holding the cable in just the right place to be able to push the vise grips, a few practice pulls will determine where.



Small adjustments are easier to make if you overtighten the cable then slack off a little at a time until it's right. Hold the loose cable end tight and push the vise grips with one hand while you slowly loosen the nut with the other hand. You can allow the cable to slip around the thimble by allowing the hand holding the cable to move towards the vice grips. When the cable has moved far enough, tighten the kearny, making sure that the swage is touching the thimble. You can gauge the amount of the adjustment by making a mark across the cable and thimble on one side, and watching the separation between the marks as you allow the cable to move around the thimble.

If you have a few extra kearnys, you can make holding the cable end easier, using a kearny to make a loop beside the vice grips. Fit a handle to this loop (a short rod of wood or metal, even a long bolt will do) and hold the handle with the fingers of the same hand which is pushing the vice grips, while you loosen and tighten the nut with the other hand.





MARKING AND STRIPPING CABLES

To mark uncoated cables you will need a fine-pointed indelible felt pen, one of those which claim to leave "permanent" marks on glass or stainless steel. If you go shopping for one, cut a few inches from your coil of uncoated cable and take it along to check that the pen you buy works. Make a mark across the cable, allow it to dry, rub it lightly with your finger tips, then see if there is any mark left.

To mark coated cables, a white or yellow CHINAGRAPH pencil works best, but if you can't find one, you can stick a small piece of masking tape on the coating, using one side of the tape as a mark.

When you have made your mark, use wire strippers to cut and push the coating away from the mark (make sure that you are using the right hole in the stripper). To remove a short length of coating, use the wire strippers. For a longer length you can use a knife or blade to remove the coating from the section beyond 6" from the original mark, because this part will eventually be cut off (so any damage by the blade will not matter). Lay the cable on a board or table, lay the blade on the coating almost flat and pull the cable between the board and blade so that you cut a strip from one side. You can then peel back the remaining coating. The coating on the 6" section near the mark should then be pushed off carefully with the stripping tool, taking care not to nick or scratch the cable.

NUT COVERS

Nut covers come in two sizes, for 3/16" and 1/4" bolts. They are made to fit a full nylock, so when you fit them to a half nylock or the head of a bolt, you will need to cut them down (with scissors) to about 1 1/2 times the height of the nut or bolt head for a good fit.

Use one single drop of cyanoacrylate glue for each one. Squeeze one drop into the inverted nut cover and spread it around inside the nut cover with the spout of the glue tube or bottle. Then push and twist the cover hard onto the nut or bolt head, and twist it around a few times.

NYLOCKS

Nylocks are named for the ring of nylon built into the nut which locks onto the thread of the bolt. It is this nylon which keeps the nut in place, so you do not need to tighten them down hard as you would with nuts and bolts on a car. In fact, in many places damage will result if you do, you can easily squash a tube, making it oval, by overtightening.

The nylock can be turned onto the bolt by hand until the end of the bolt meets the nylon, when you will need wrenches. Continue to tighten just until you feel more resistance. By now, whatever you are bolting together should be secure, any tangs, brackets or tubes on the bolt should still turn, although with difficulty. Also, there should be at least one complete turn of thread showing through the nylon. This is to make sure that all the nylon is being used, and to enable you to check visually in your preflight check that the nylock has not loosened. If you do not have enough thread showing after tightening a nylock, check that you have the right bolt and hardware.

In many places, before fitting the nylock you can check that you have the right size bolt, washers and nylock by holding the nylock beside the exposed threads of the bolted assembly (with all hardware, washers, etc. in place) and estimating how much thread will show when you have fitted the nut.

Nylocks should only be used twice, maybe three times where there is no pull on the bolt.

Where the text mentions fitting a nylock finger tight this is because it may need to be removed later. The nylock should be turned on just until the end of the bolt contacts the nylon. It will be tightened properly later. (You can use a wing nut temporarily instead.)

When you are unbolting something to proceed to the next step (e.g. removing the struts from the keel, removing the forks from the hang cage) replace the bolt, washers, etc. in the bracket or tube where they were, they'll be easier to find later.

SAFETY WIRE

All fuel line connections must be safety wired to make sure that the noses do not pull away from the connectors. For each connection cut a 4" piece of safety wire, wrap it twice around the hose on the connector, just behind the ridge. Cross over the ends and twist them with pliers to tighten the loops around the nose until the wires begin to dig into the plastic. Cut the twisted wire ends about 1/2" from the nose, then use pliers to bend the cut end over toward the hose, so that you cannot cut yourself on the cut end.

Also, thread a 24" length of wire through the springs on the muffler and twist the ends together so that if a spring breaks, it cannot fall off and hit the prop. Also secure the head of the bolt which holds the canard control arm, by making a loop through the head of the bolt and around the control arm.

SPACE REQUIRED

For SECTION II - minimum 25'x12'x9' high. (You will not need the full wingspan, since you will be removing the spar end sections.)







For SECTION V - minimum 35'x12'x15' high. (You will be turning the complete wing over.) If you are using a space with a low ceiling and a car size door, don't fit the struts and hang cage before turning the wing over. Walk the wing outside, supporting the wingtips and nose. Turn it onto the nose and over, keeping the top rigging tight. Walk it back in, supporting the nose and the back of the keel. Hold the wing up high enough to fit the struts and hang cage.

For SECTION VI and SECTION VII - minimum 35'x18'x12' high. (The aircraft has the canard and winglets attached.)

STAINLESS BRACKETS

There are 10 stainless brackets on the aircraft, all are secured at the back with 1/8" stainless steel rivets. (Referring to the curve of the stainless bracket as the back is the one exception to the rule of using front and back in the text to mean from the pilot's position.) The brackets at the rear of the plane (engine mount and forward braces) have 3/16" bolts through the sides; the ones at the front (fork legs and base of main struts) have 5/32" steel rivets in the sides. They come in two sizes, to wrap around 1" or 1 1/8" O.D. tube.

Before fitting, hold each bracket hard against a 1" or 1 1/8" tube while you push the sides together evenly until they are parallel.

When its' location has been determined, the bracket is temporarily fixed with 1/8" aluminum rivets in the sides, while the 1/8" holes in the back are drilled out. Then the aluminum rivets are drilled out and the bracket removed to deburr the inside of the curve (use a half-round file). Make an alignment mark on the tube and bracket, so that you can put it back on the same way round (the brackets are not always symmetrical). Make sure that the inside of the curve is flush with the tube as you set the 1/8" stainless rivets. Bolt the tube (e.g. main mount tube, forward brace) into the bracket before you drill out the holes in the sides to fit the bolt or rivets.

SWAGING



A properly clamped swage is stronger than the cable it is securing, an improperly swaged one could prove fatal, so make sure to do it right!

The finished swage should measure less than 0.185" across (1/16" swage), 0.265" across (3/32" swage) or 0.355" across (1/8" swage). If it's not, adjust the swager. Checking the first few swages should be sufficient.

Always swage exactly in the center of the swage, with the long axis of the swage across the jaws.

Some swagers (e.g. #32 VC VG) have narrow jaws and require two presses to clamp the full length of a 3/32" swage. Most swagers require three presses to clamp a 1/8" swage.

The swage nearest the thimble should be clamped touching the ends of the thimble, this secures the thimble. When swaging

the bushings on the control cables, pull the bushing as close as possible to the swage before clamping.

The swage at the cut end of the cable should have about 1/32" to 1/16" of cable protruding, so that you can check on preflight that the cable has not pulled through the swage.

If you have never used swages before and you have your landing gear kit, prepare the landing gear cables as in Section IV step #I as practice, where slight errors are not so critical.

Some parts of the text begin - Swage a 6" loop.....(or 5"...or 4 1/2" loop).

Begin by making a mark 6" (or 5", or 4 1/2") from the end of the cable. On uncoated cable use your marking pen, on coated cable, use tape or CHINAGRAPH. Strip the coating from this 6" (or 5") of cable.

Thread on two swages and a tang (just swages for a bushing) and feed the cable back through the two swages. (The cable always goes through the large hole in the tang.) Fit the swage at the cut end in the jaws of the swaging tool. Line up the cut end with the mark on the cable (or the end of the coating), then pull the cables through the swage until the cut end protrudes about 1/16" and clamp the swage.

Fit a thimble or bushing in the loop of cable, fit the remaining swage in the jaws of the swaging tool, squeeze lightly to hold the swage, pull the cable tight so that the thimble or bushing is touching the swage, check that the swage is centralised in the jaws, then clamp.

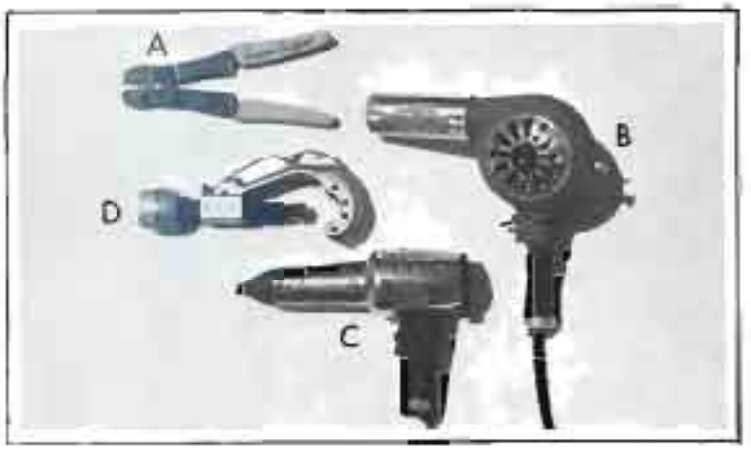
When swaging a cable end fitted with a kearny, fit the swage next to the thimble in the jaws, squeeze lightly, pull the cable so the swage touches the thimble, and clamp. Remove the kearny, cut the bare end (2" from the thimble on 1/8" cable, 1 1/2" on 3/32" cable, 1 1/4" on 1/16" cable) and clamp the other swage with the cut end just showing, holding the thimble so that the side-by-side cables between the swages are straight. (With the top rigging, check that you are cutting the right cable.) Cable stops (on the throttle cable and control wires) ensure that you still have some control even if the adjustment clamp should fail. Swage them as close to the adjustment clamp as your swaging tool will fit (1/4" to 1/2"), then trim off the excess cable.

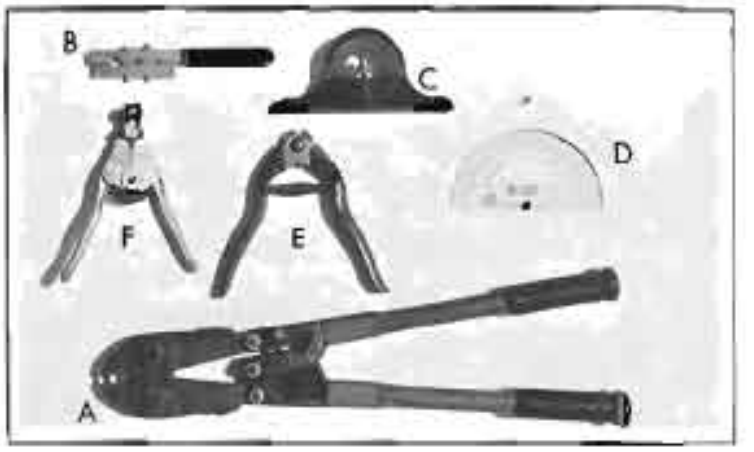
WASHERS

The washers used on a bolt are specified on the drawing. 'Thin' and 'thick' washer refer to steel washers, 3/16" or 1/4", depending on the size of the bolt. The steel washers fit on the outside of the bracket, under the head and nut of the bolt. The small plastic washers fit inside the bracket, except on the noseplate and rear spar bracket, where they go inside and outside the bracket. The large plastic washers are used with some of the flat bottom brackets to make them easier to turn when setting up and taking down the aircraft.

There are also 5/16", 3/8" and 7/16" washers used on the powerplant, most of them are shown in drawing III#9.

TOOLS AND MATERIALS





A. CRIMPING TOOL
B. & C. HEAT GUNS (EITHER TYPE WORKS FINE)
D. TUBE CUTTER (NO LONGER USED)

A,B. SWAGING TOOLS (BOTH TYPES CLAMP 1/16", 3/32" AND 1/8" SWAGES.)
C. PROTRACTOR, METAL
D. PROTRACTOR, PLASTIC
E. CABLE CUTTERS
F. WIRE STRIPPERS

These are the tools and materials you will need to assemble your kit. The average handyman will already have many of them. Your dealer will help you rent or buy the ones you don't already have.

ACETONE OR MEK	Needed when covering the canard, as thinner for Poly-Tak and for cleaning brushes and hands. (1 quart)
BRUSHES	Used in canard covering. Natural hair (the solvents dissolve most plastic brushes) 1/4" to 1/2" for Poly-Tak and 2" to 3" for Poly-Brush.
BUBBLE PROTRACTOR	A protractor with a spirit level for measuring washout. Plastic Has a larger scale and is slightly easier to read. Steel More durable. Even if you borrow all the other tools, you should buy a bubble protractor so you can check your washout frequently.

CABLE CUTTERS	It's worth using quality ones for a clean cut.
CRIMPING TOOL	An electricians' tool, used to fix crimp connectors and bayonet connectors. Cheap ones are made from thin sheet and don't work very well.
CYANOACRYLATE	A very strong, very concentrated glue used to fix nut covers. Sold under many names, e.g. Eastman 910 adhesive, Crazy Glue, Superglue. Read the warnings on the label, it really does glue fingers together! Use a tiny amount, if you use too much it won't stick.
DRILL	Any small power drill (1/4" or 3/8" chuck) is fine.
DRILL BITS	1/8" or #30, 5/32",3/16", 1/4". You may possibly need 3/32". (See section II - C#2)
FILE	All of the filing necessary can be done with a medium sized, rough, half-round file, but it's useful to have a small, fine file to smooth off afterwards.
GREASE	Small amount of thick grease needed for wheel bearings.
HAMMER	A regular steel head hammer is used to spread the ends of the plain rivets. A soft hammer (plastic or wood) is useful, but you can use a regular hammer and a piece of wood instead. Before using a hammer to force something which does not fit, try to figure out why it won't fit. Hammering a bolt through tubes and brackets will enlarge the hole and may damage the thread.
HEAT GUN	A device which blows hot air at 350 to 400 degrees (F), used to apply the heat shrink tubing to the ends of the cables.
HOT KNIFE	A converted soldering iron. File the orginal end to a round tapered point. A cheap, low power one is fine, if you use a larger one, do not allow it to get too hot. Try to melt the hole rather than burn it, it looks tidier. Be very careful, double check that you are melting the hole in the right place. It's very difficult to 'unmake' a hole.
IRON	Regular household iron (dry) used to shrink the canard fabric. Use an old one if possible since it will get messy and will be difficult to clean.
KEARNY	A brass split bolt used by electricians to clamp cables together, used here as a temporary clamp on rigging and bracing cables while making adjustments. See construction notes for amount and sizes.
MARKING PEN	Indelible felt pen. Chinagraph.

PLIERS	Regular square-jaw pliers are used to attach safety wire. Needle-nosed pliers are useful but not essential.
POP RIVETER	Used to set 1/8" and 5/32" pop rivets.
PUNCH	Use spring type or hammer type to mark the position of a hole before drilling. If you're economizing, use a sharpened nail.
SAWHORSES	Or something similar to support the keel (front and back) when you fit the wing covering. You will also need two more supports, e.g. cardboard boxes about 2 feet shorter to support the wingtips. The sawhorses are also useful when covering and finishing the canard.
SCISSORS	You will need scissors to cut the canard fabric. Also, if you can borrow some, use pinking shears to trim the final edge before glueing it down.
STRAPPING TAPE	Small roll of 1/2" to 1" strapping tape.
SWAGING TOOL	Used to clamp the swages on the cable. Two types are shown in the photo. The smallest is the least expensive but takes more time to use. The larger is easier to use. Other types of swagers only clamp one or two sizes.
SCREWDRIVER	One medium flat bladed, one phillips. (Also, a large screwdriver or chisel or wedge is needed briefly to spread the slot in the tip of the remote mount plate to insert the cam.)
TAPE MEASURE	The longest accurate measurement is about 13 feet, so you need a tape at least that long. The longer measurements, e.g. cutting top rigging cables (31' and 20') are approximate and can be measured in stages.
VISE GRIPS	Or locking pliers, small size, self-adjusting ones are the easiest to use.
WIRE STRIPPERS	Used to strip the plastic coating from the 3/32" and 1/8" cable. The jaws fit several sizes of cable, find the right ones and mark them with your indelible felt pen. Using a hole which is too small damages the cable.
WRENCHES	You'll need two 3/8", two 7/16" and two 1/2" wrenches and one each 5/8", 9/16', 3/8", 3/4". Or you can use a socket set, 3/8" - 3/4" and three open/ring wrenches 3/8", 7/16", 1/2". You will also need a 1 1/4" or large adjustable wrench for the adjustment cam, and a torque wrench on the powerplant.

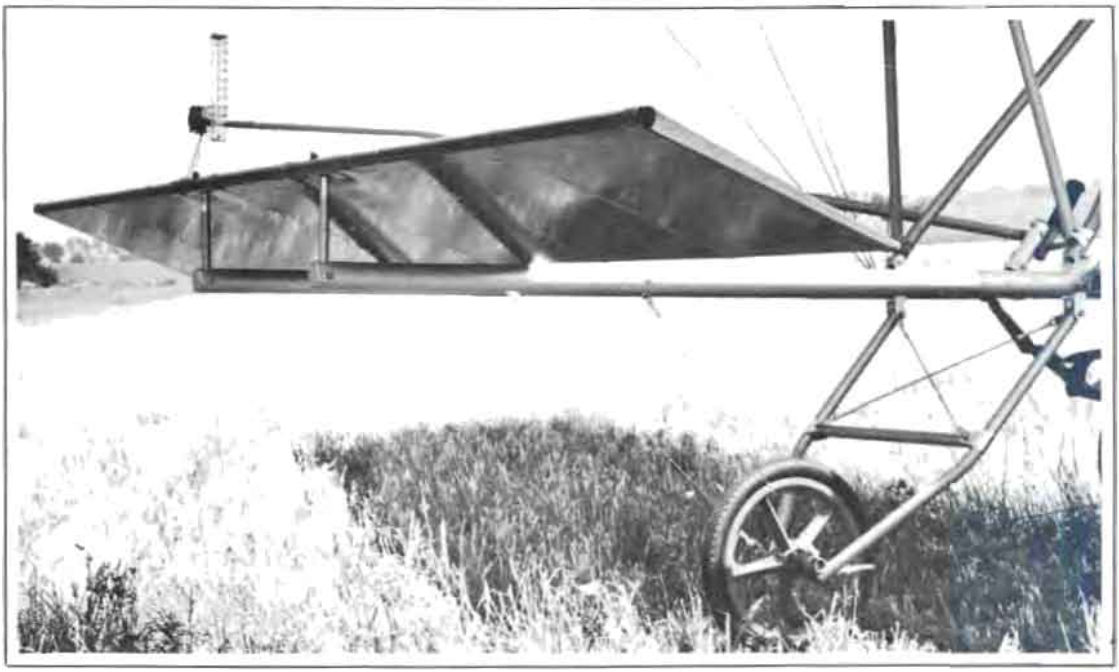


PTERODACTYL

SECTION I — CANARD

I A — FRAME

I B — COVERING



In this section you will build the canard frame, cover it with fabric, seal the fabric and paint it. You will start with the canard so that each coat of POLY-BRUSH or paint can harden while you build the rest of the aircraft.

Sometimes you will be working on the canard upside down. To avoid confusion, we use "top" and "bottom" to mean top and bottom on the completed canard.

SECTION IA — FRAME

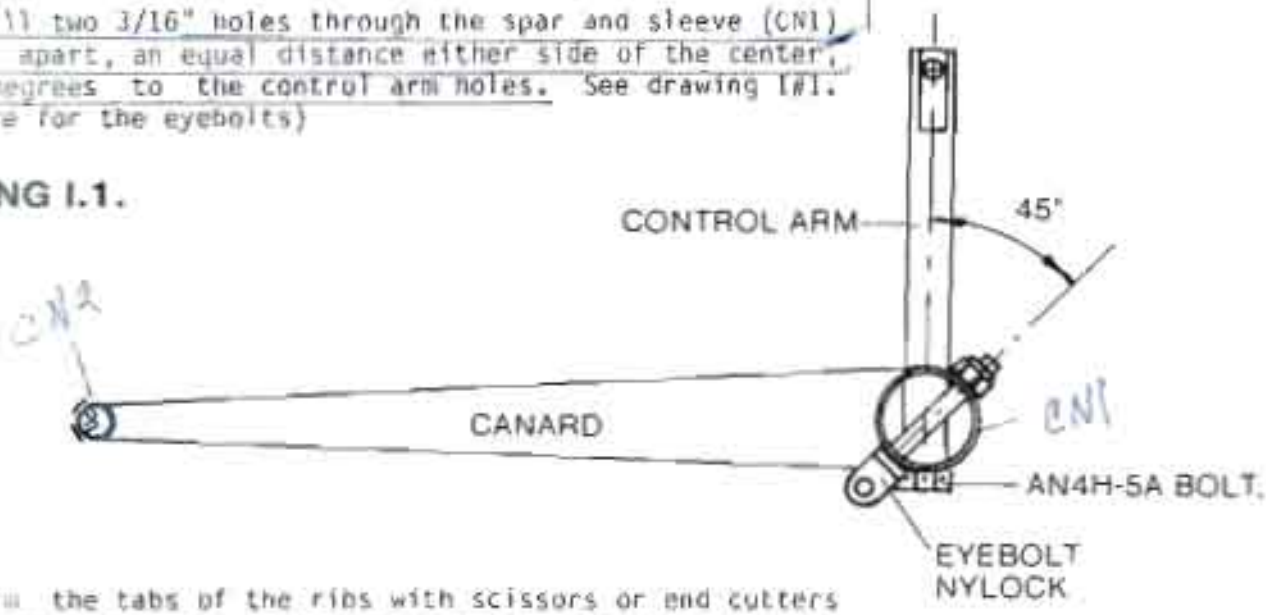
NOTES

You will need a flat surface (minimum 8' by 2') on which to build the canard frame. You can use bench, table or floor, but the finished canard will only be as straight and flat as the building surface.

1. Take the leading edge spar assembly (CN1). It has a 1 1/8" diameter sleeve with holes for the control arm (CN16) at one end. The 1/2" hole will be on top, on the right hand side for a right hand stick and on the left if you are left handed.

2. Drill two 3/16" holes through the spar and sleeve (CN1) 20 1/2" apart, an equal distance either side of the center, at 45 degrees to the control arm holes. See drawing I#1. (These are for the eyebolts)

DRAWING I.1.



3. Trim the tabs of the ribs with scissors or end cutters so that when they wrap around the trailing edge the tabs are offset, so the rivets don't touch inside the tube. See photos I-A and I-B.



I-A



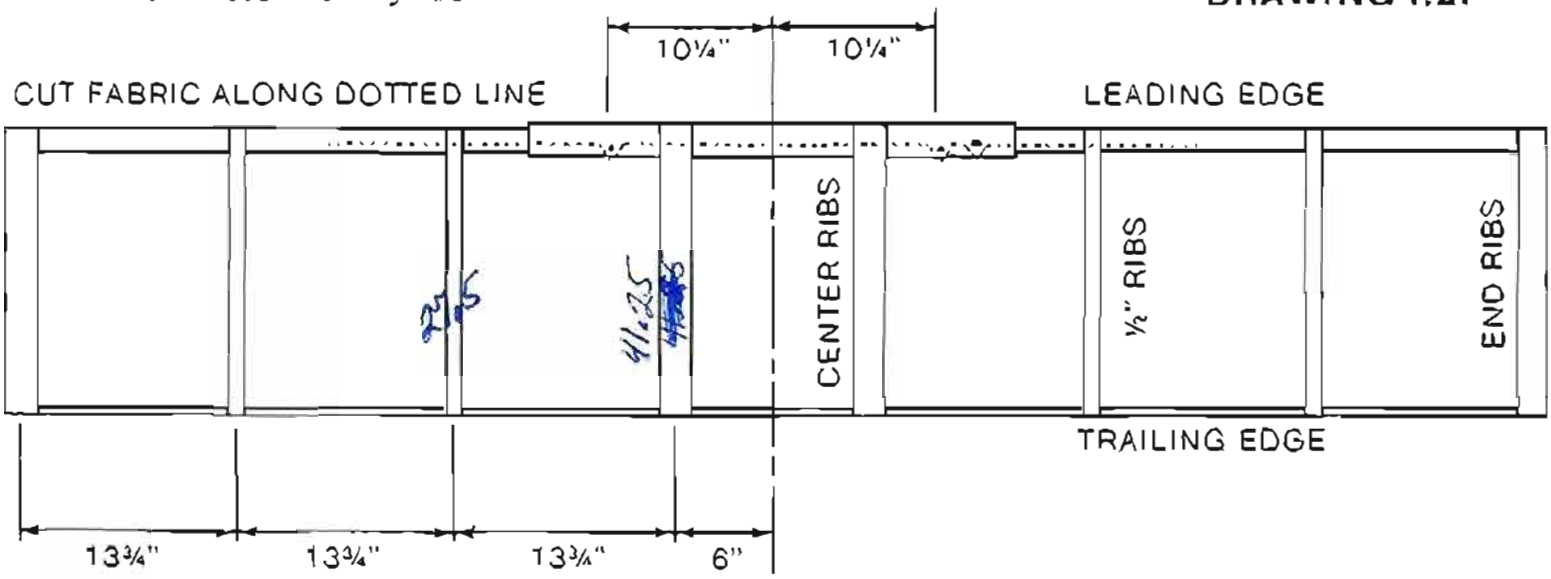
I-B

4. Lay the leading edge spar onto the flat surface, with the control arm sitting in the 1/2" hole on top. The two end ribs (CN5) fit flush to the ends. The two center ribs (CN4) fit 6" either side of the center line and the other four ribs are spaced evenly (13 3/4" centers) between center

NOTES

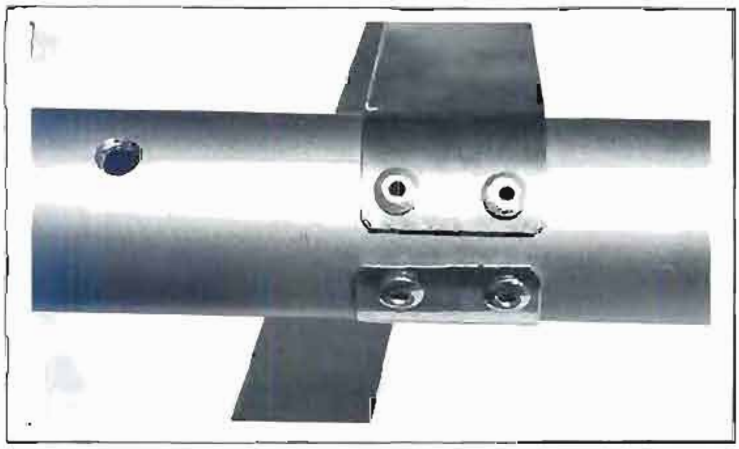
ribs and end ribs. Attach the narrow ribs with one 1/8"x5/16" aluminum rivet (CN12) each, and the wider ribs with two 1/8"x5/16" aluminum rivets, making sure that (a) the control arm is straight up, (b) the ribs are flat against the building surface, (c) the curved, cut edge of the rib is touching the spar and (d) the ribs are at 90 degrees to the spars. (Hold the tab down flush with the spar (using a screwdriver) as you drill.) This is easier if you have someone push the rib against the spar while you drill and rivet. See drawing I#2.

DRAWING I.2.

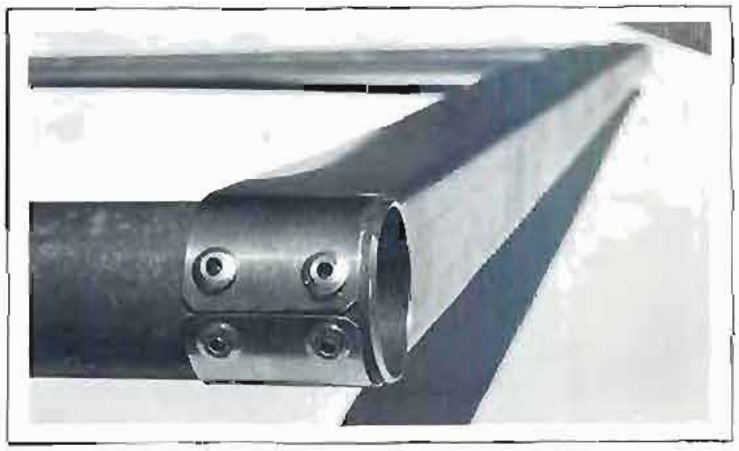


BOTTOM VIEW/NOT TO SCALE

5. Remove the control arm, turn the assembly over (gently), rivet the other side of each rib to the leading edge, rolling the spar up against the ribs, checking b), c) and d) as in step #4. See photos I-C and I-D.



I-C



I-D

6. Attach the trailing edge spar (CN2) the same way, using short 1/8" aluminum rivets (CN11) offset so they don't touch inside the tube.

7. File any sharp edges on the ribs, tabs and corners.

SECTION IB — COVERING

THE COVERING SHOULD BE DONE IN A WELL VENTILATED AREA. WHILE APPLYING POLY-BRUSH OR PAINT, IT IS STRONGLY ADVISED THAT YOU WEAR A PAINTERS MASK WHICH FILTERS ORGANIC VAPORS. YOU SHOULD NOT BE ABLE TO SMELL THE SOLVENTS THROUGH THE MASK.

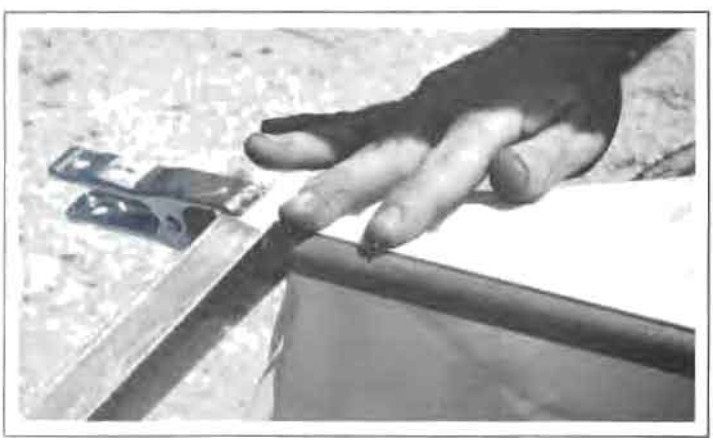
1. Clean the canard assembly with lacquer thinner, acetone or MEK. Cover all rivet heads and trailing edge ends with strapping tape. This tape protects the fabric from wearing at these points. See photo I-E.



I-E

2. Mix about 1/4 of the POLY-TAK supplied in a jar with an equal amount of MEK or acetone. (Mix more as needed.) Brush a layer of POLY-TAK fabric cement over all of the canard structure which will contact the fabric. That's the tops and bottoms of the ribs, the ends, and the outside of the leading edge and trailing edge. When this is dry, apply a second coat. Allow to dry. Remove any dry glue lumps, or they will harden and show through the fabric. (If the weather is damp, the POLY-TAK turns white on drying. Wait for better weather.)

3. Glue one edge of the fabric to the top of the leading edge spar with thinned POLY-TAK. Glue a six inch section at the center, pull the fabric tight toward each end, clamp (with spring clamps) or glue each end and glue the full length of the spar. Allow to dry about 15 minutes. About 6" will hang off each end. (Brush the glue onto the fabric (this activates the glue underneath), press down, and rub with your fingers until dry.) See photo I-F.



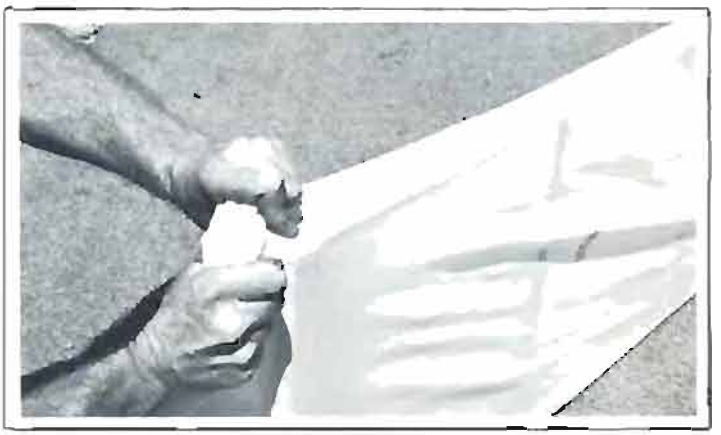
I-F

NOTES

4. Pull the fabric back snugly (smooth but not tight) and glue it around the trailing edge spar. Glue the center first, stretch the fabric along the spar, secure it at the ends, pull it snug around the spar and glue six to eight inch sections at a time. (When pulling and glueing, you can pull evenly by taking a straight, smooth piece of wood or metal about 12" long, wrapping the loose cloth around it and pulling around the spar. Brush the glue onto the cloth along the spar and rub until dry.) See photos I-G, I-H, I-I and I-J.



I-G



I-H



I-I



I-J

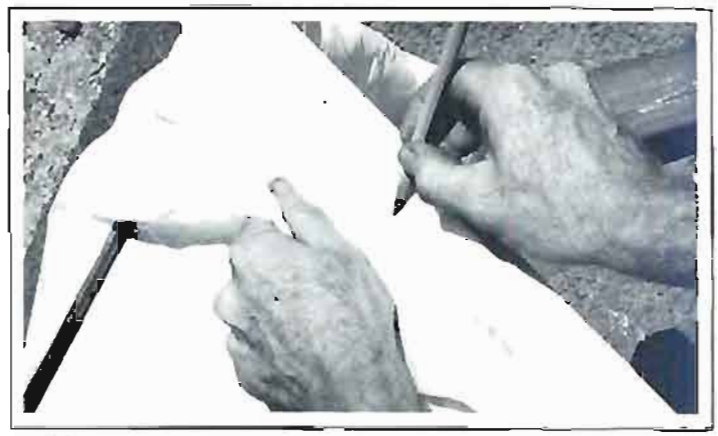
5. Lay the canard (fabric side up) on a table or bench with the end rib flush to the edge. Pull the fabric snug lengthways (and down around the end rib) and glue it to the bottom of the end rib (which is facing up). Repeat on the other end. Turn the canard over and trim the remaining

NOTES

fabric at the ends, leaving sufficent to cover the other two sides of each end rib. Make a cut in the fabric just behind the leading edge spar and another at the trailing edge. Fold this flap around the end rib and glue it to the other two sides. Do the same at the other end. (This glue does not need to be rubbed.) See photos I-K, I-L, I-M, I-N and I-O.



I-K



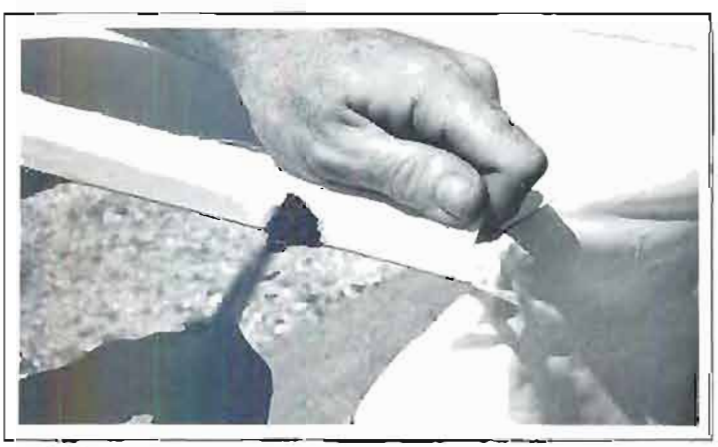
I-L



I-M



I-N



I-O

6. Take the remaining fabric and pull it snug around the leading edge. Glue it to the top and front of the leading edge spar (glue the center first, stretch along the spar, secure the ends and glue the full length). You will be

NOTES

gluing onto the fabric which you secured in step #3. See photo 1-P.



1-P

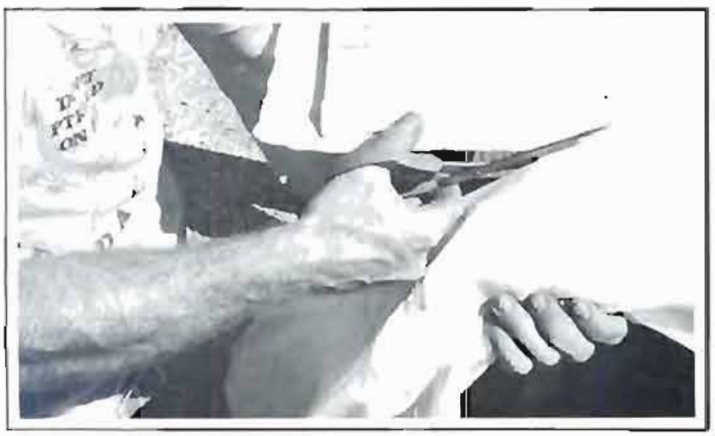
7. Pull the fabric snug lengthways, glue it onto the top of the end ribs and trim as in step #5. Trim off the leftover fabric along the bottom of the leading edge spar, leaving tabs as in drawing 1#2, so that the fabric is reinforced where the eyebolts go through it. Cut a few slits in the fabric at the end of the leading edge spar. See photos 1-Q, 1-R, 1-S and 1-T.



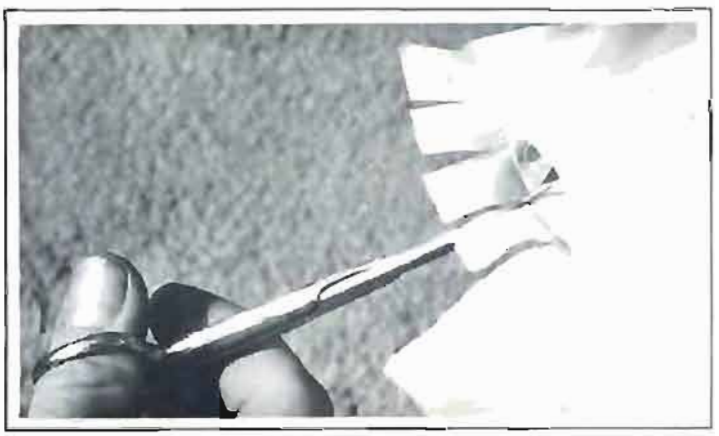
1-Q



1-R



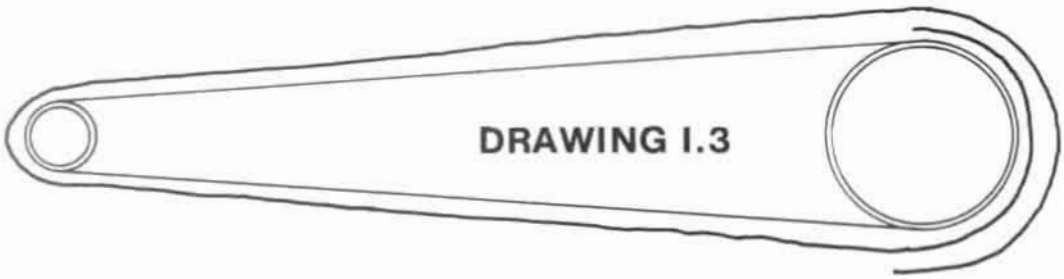
1-S



1-T

NOTES

8. Glue the fabric edges onto the leading edge spar and end ribs. Push the tabs on the end of the leading edge into the spar tube with a wet glue brush. (The cloth should now be overlapped around 180 degrees of the leading edge spar.) See drawing I#3.



DRAWING I.3

9. The fabric will need to be tightened. The best way is to heat it with an iron at about 250 degrees fahrenheit. Make smooth passes with the iron along and across the canard with the iron resting very lightly on the fabric. Repeat both sides. Gradually increase the temperature to tension the fabric as much as possible without bending the trailing edge or the end ribs more than a 1/4" out of line. Do not go above 350 degrees and keep the iron moving to avoid melting the fabric (four to seven inches per second). There may be some steam from the evaporation of the moisture in the fabric. Warning: The fabric melts at 375 degrees. Use tne tip of the iron (at 250-300) to smooth down the cut edges of the cloth, the corners and any wrinkles on the leading edge and end ribs. Do not use the iron flat on overlapped seams. (250 is a little above rayon, 350 is indicated as wool.) See photos I-U, I-V and I-W.



I-V



I-W



I-U

Glue the fabric down onto the center and the 1/2" ribs by brushing along the rib with MEK or acetone and rubbing until dry.

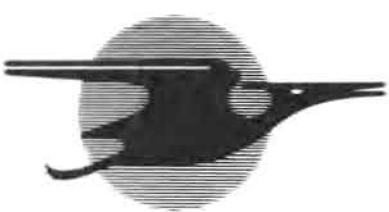
10. Cover the canard with a full even coat of POLY-BRUSH, full strength with brush or sponge. Fully saturate the fabric but don't use so much that it drips through to the other side. Only use a little on the brush or sponge at a time and work it into the weave. Allow to dry at least 24 hours before applying the second coat, full strength. Lay the canard flat, apply the second coat (and a third coat if necessary to fill the weave) liberally and quickly, one panel at a time, wiping any runs at the edges before the next panel. Brushing POLY-BRUSH which has started to dry will leave brush marks.

11. The canard is now airworthy but ugly. Painting not only makes it look better but helps protect the fabric and glue from ultra-violet damage. The least expensive finish is hardware store enamel or auto paint in spray cans, approximately three cans per coat. All coats must be the same brand of paint. (If you sand between coats, use 400 grit wet, and use great care around the rivet heads and ribs not to sand through the cloth.)

If you have access to a compressor and spray gun, you can make your canard really beautiful with conventional aircraft finishes. Completing the Stitts finishing process with Poly-Spray and Poly-Tone gives very good results. See your local Stitts dealer for information. There are urethane, acrylic and epoxy aircraft finishes which are also good looking and hard wearing. (You will need approximately one pint per coat.)

12. After the paint has hardened, push the tube plugs into the ends of the leading edge spar (you'll have to notch the plugs a bit to clear the rivets) and secure using two 1/8" aluminum rivets each. With your hot knife, soldering iron or Exacto knife, cut out the fabric where it covers the holes for the eyebolts and canard control arm. Fit the eyebolts and tighten the nylocks.

13. Drill a 3/16" hole, 5/16" from the top of the canard control arm. File the bottom of the control arm to fit the inside of the leading edge spar. Screw in the bolt (CN14) from the bottom of the spar. Secure with a loop of safety wire through the head of the bolt and around the control arm. Refer to drawing I#1.

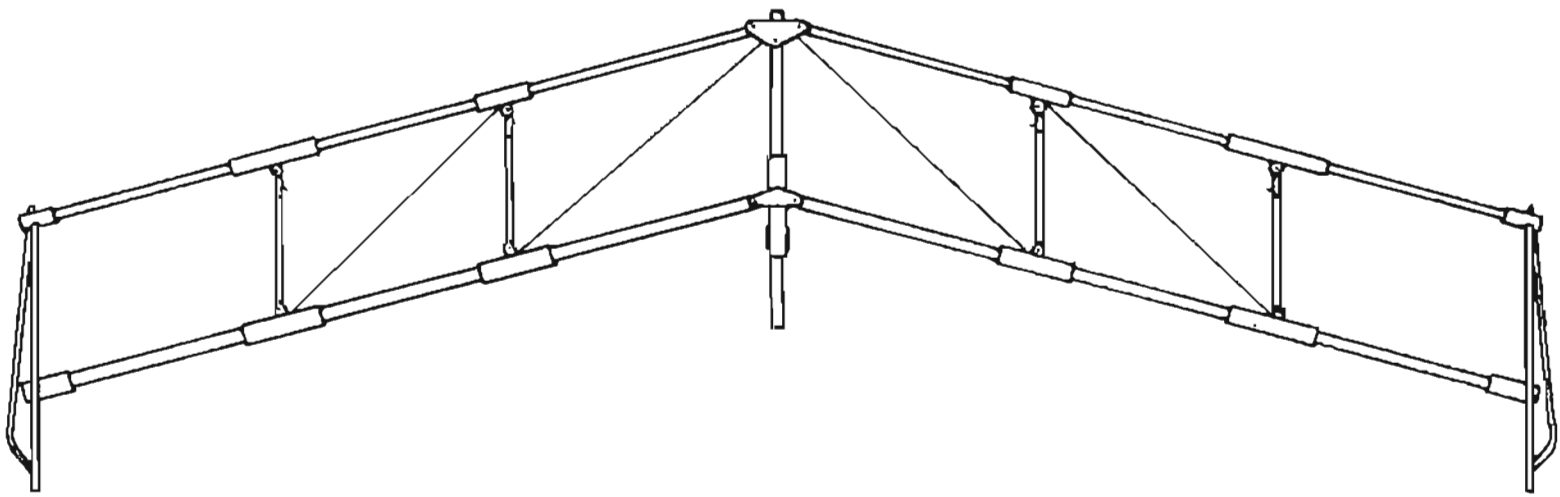




PTERODACTYL

SECTION II — AIRFRAME

II A — KEEL, STRUTS AND HANG CAGE
II B — AIRFRAME ASSEMBLY
II C — CABLE PREPARATION
II D — RIGGING



In this section you will assemble your keel, struts, hang cage, spars and rigging and set the washout.

The tools you will need are: bubble protractor, drill, 1/8", 5/32", 1/4" drill bits, half round file, indelible felt pen, kearnys (plus vise grips & wrench to fit), pop riveter, punch, swaging tool, tape measure, cable cutters, wire strippers and two 3/8" and 7/16" wrenches.

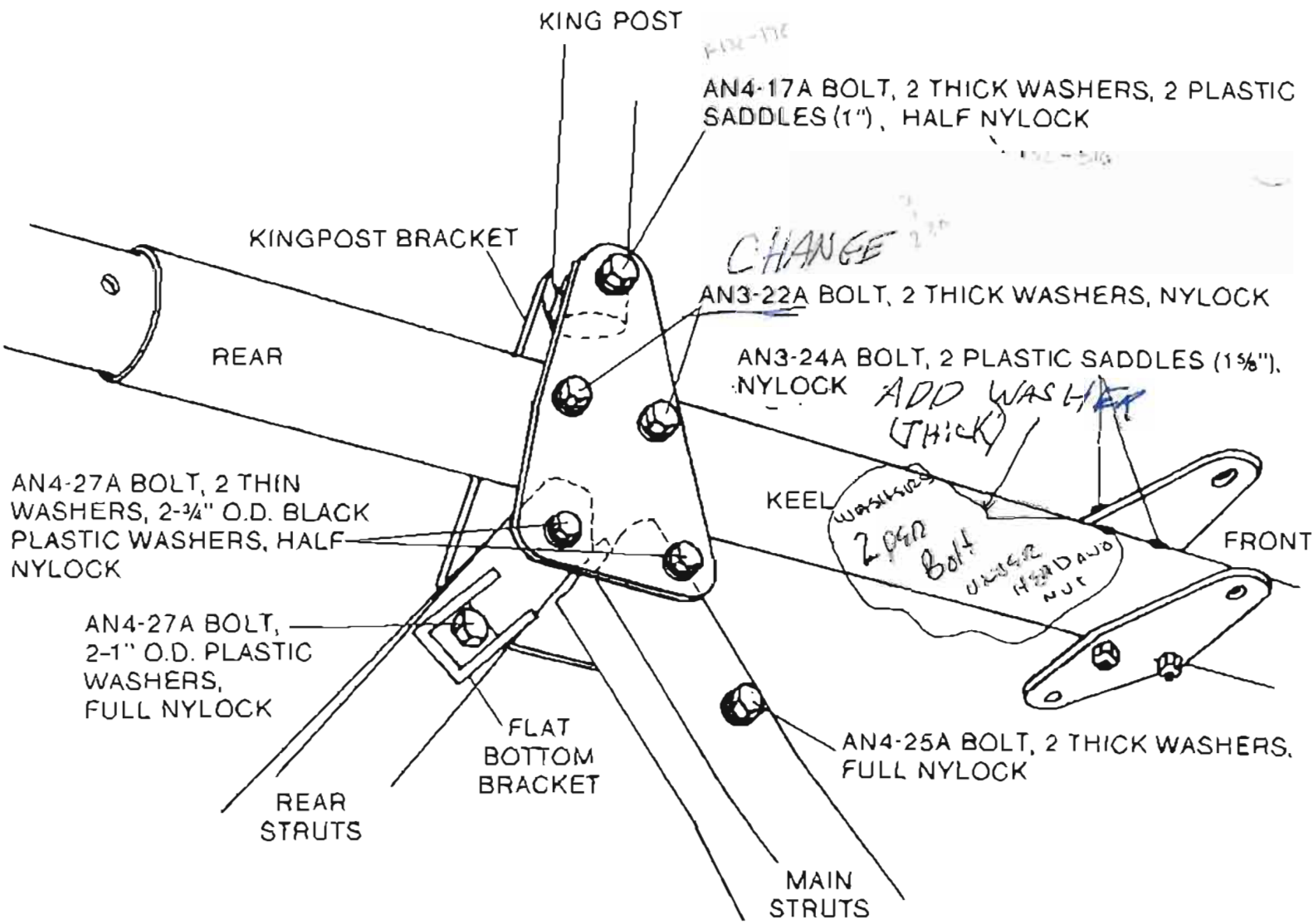
SECTION II A — KEEL, STRUTS, AND HANG CAGE

NOTES

1. Drill a 1/4" hole through the 1 1/2" O.D. rear section of the keel (AF3) 1/2" behind the 1 5/8" O.D. sleeved section of the keel, in line with the rear 3/16" holes. (The front of the keel is the gold anodized section.) This hole is for the overhead pull starter.

2. Bolt the rear spar brackets (AF24, 25) to the forward pair of 3/16" holes in the keel. The top rear spar bracket has slots and both top and bottom bracket tips curve upwards. (The top of the keel has the 1/16" cable at the front.) See drawing II#1. Refer to drawing II#10. Tighten the nylocks.

3. Bolt the kingpost brackets (AF23) to the rear pair of 3/16" holes in the keel. See drawing II#1. Tighten the nylocks.



DRAWING II.1.

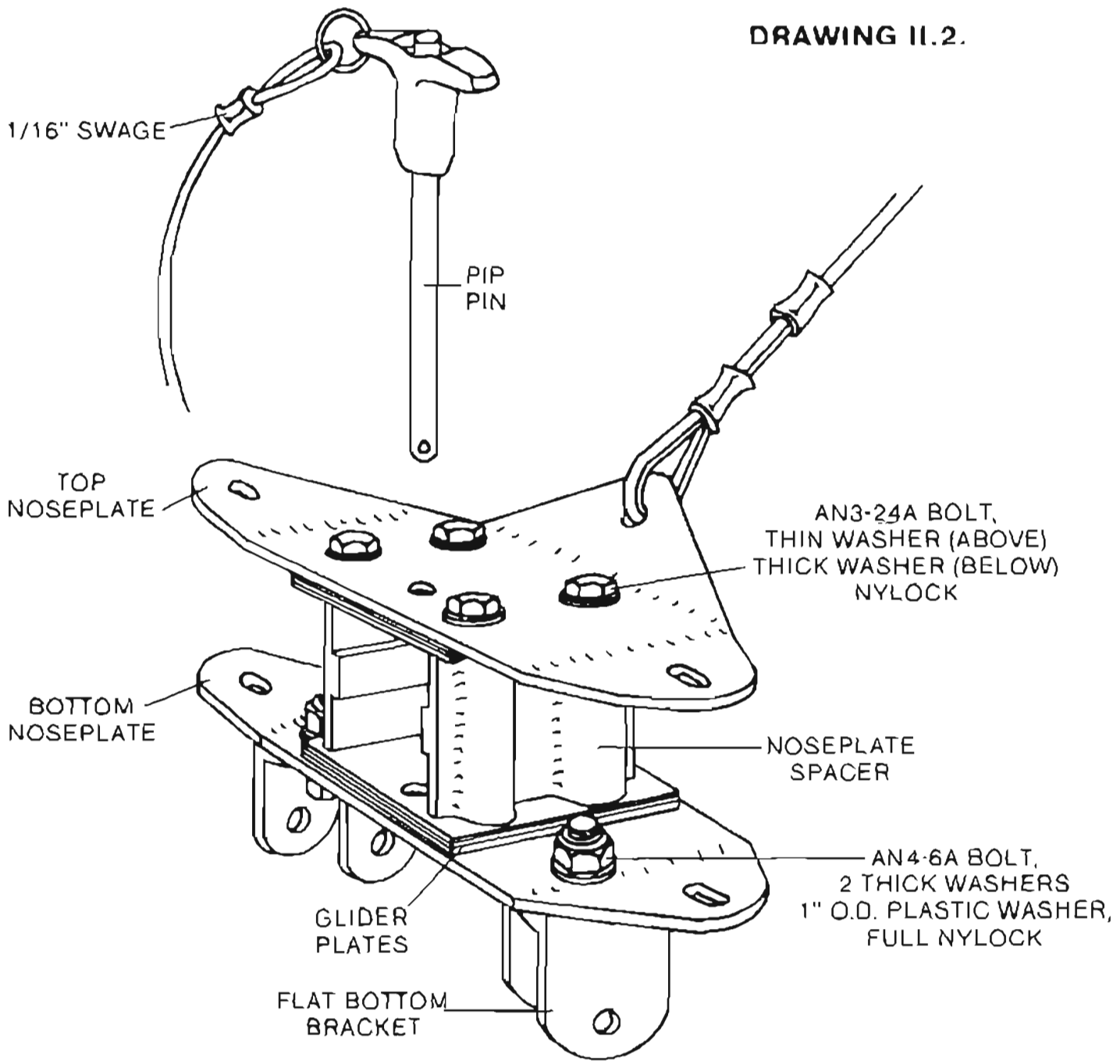
NOTES

4. Drill two 1/4" holes in the bottom noseplate (AF20), using template #1. Bolt two flat bottom brackets (with 1" O.D. plastic washers (AF59) between the brackets and the noseplate) to these holes, as in drawing II#2. Tighten the nylocks down then back off until you can turn the brackets by hand.

5. Bolt together the noseplate assembly. See drawing II#2. (also refer to drawings II#3 & II#9). Tighten the nylocks.

6. Remove the front section of the keel by removing the clevis pin. Attach the pip pin (AF33) to the 1/16" cable in the front of the keel with a 1/16" swage (RG8) by running the cable through the swage, through the ring on the pip pin and back into the swage. Make sure you have enough slack to remove the pip pin from the 1/4" hole in the keel. Clamp the swage with the bare end flush with the end of the swage.

DRAWING II.2.



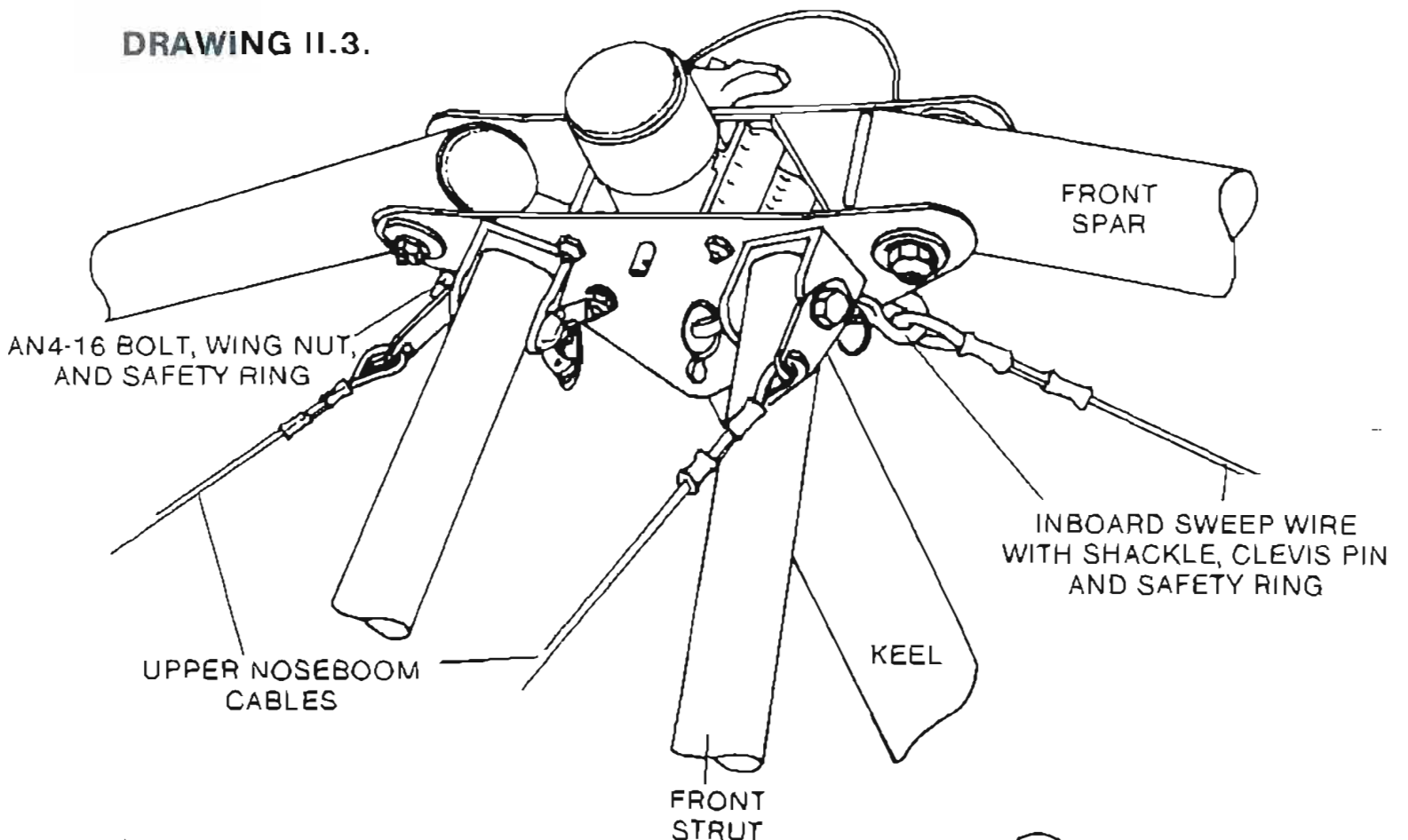
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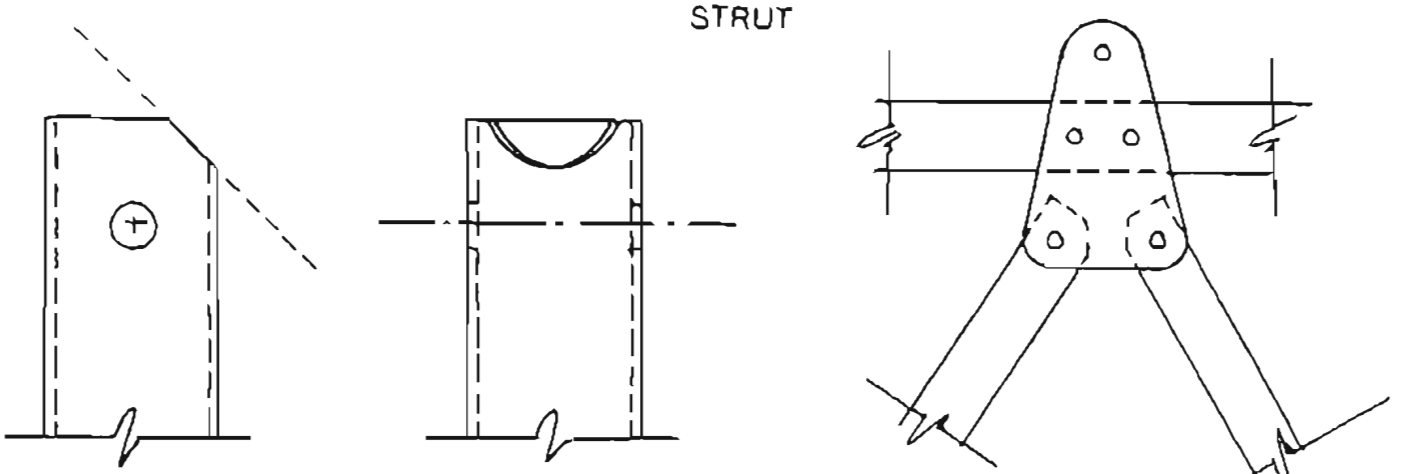
7. Slide the noseplate assembly onto the keel front section and insert the pip pin. Reassemble the keel.

8. File the top of each main and rear strut on one side as shown in drawing II#4. (The top of each strut has two holes and the bottom has one.) Filing the tops of the struts allows them to rotate inside the kingpost bracket.

9. Bolt each pair of struts together at the lower of the two top holes. (The brackets on the bolt holding the rear struts together are part of the engine mount.) Bolt each pair of struts to the kingpost bracket, main struts to the front hole, rear struts to the rear, with the filed ends facing each other. See drawing II#1.

DRAWING II.3.



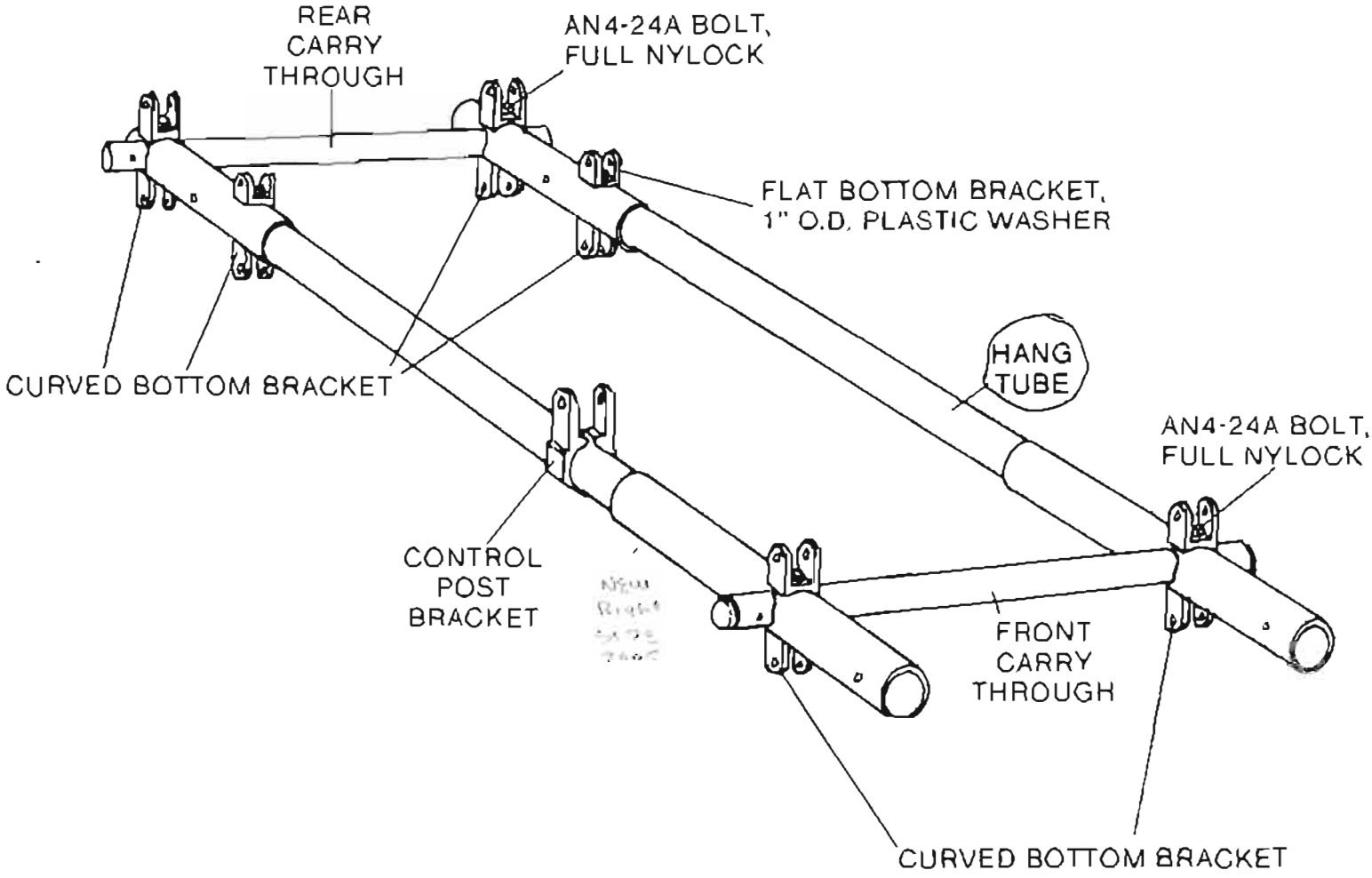


DRAWING II.4.

NOTES

10. Assemble the hang cage. First, remove the front sleeve from one hang tube (AF9) (by drilling out the 5/32" rivet). Slide the control post bracket (CS6) onto the hang tube and replace the sleeve, with a new rivet (AF62). This is now the right hand hang tube if you're right handed and vice versa.

Slide both the front (AF13) and rear (AF14) carry throughs into the 1 1/8" holes in the hang tubes (keeping the rivets on the bottoms of the hang tubes). If this is difficult, don't use force, remove the carry through and use a half-round file to enlarge the holes slightly. Line up the inboard 1/4" holes in the carry through with the 1/4" holes in the hang tube. Bolt the curved bottom brackets to the top and bottom of the hang cage, front and rear, as in drawing II#5. Tighten the nylocks.



DRAWING II.5.

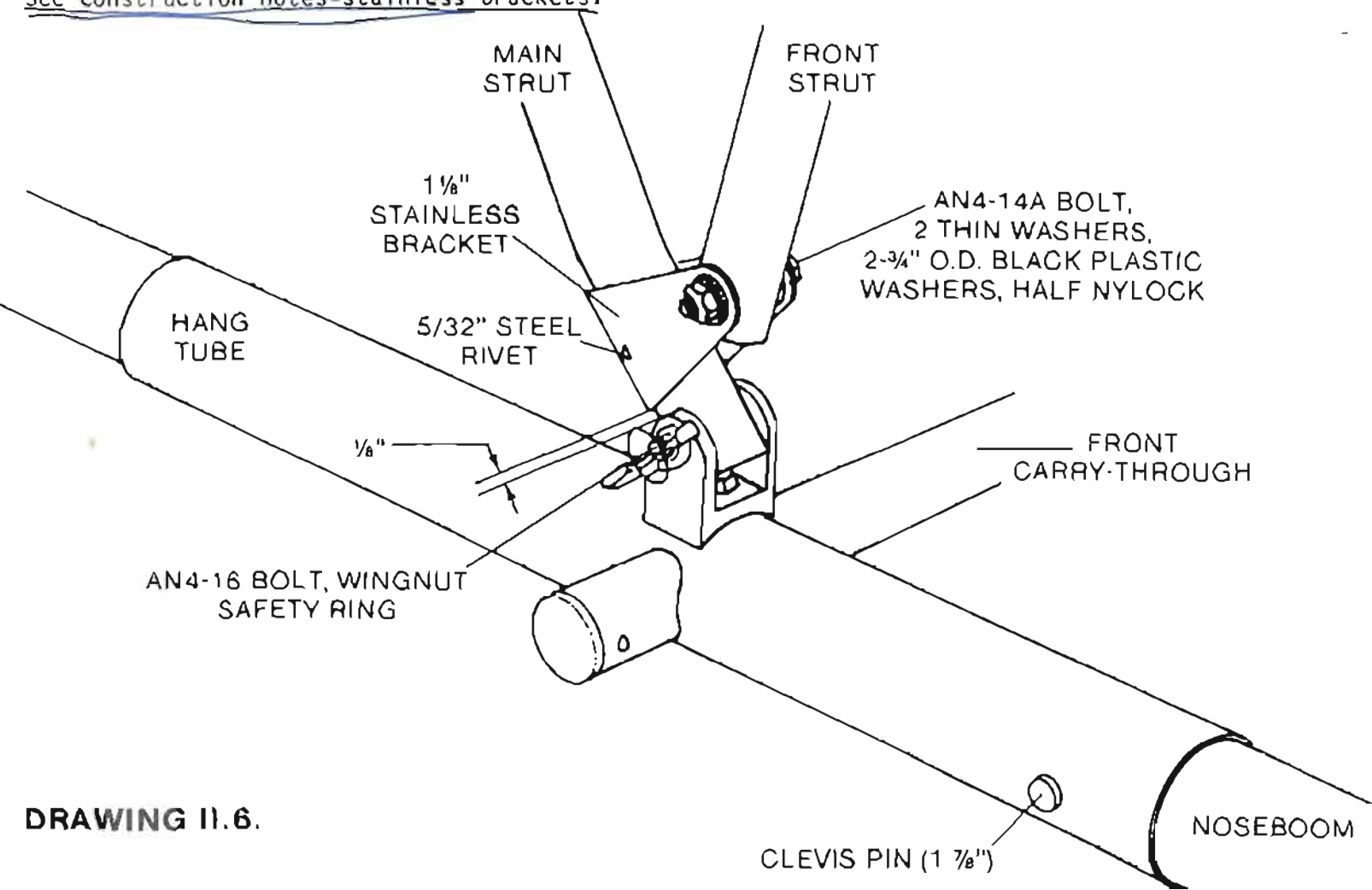
NOTES

11. Bolt the bottoms of the rear struts (the tops are attached to the keel) into the curved bottom brackets at the rear of the hang cage with the nylocks finger tight. Bolt the bottoms of the main struts into the curved bottom brackets at the front of the hang cage with wing nuts. See drawing II#6 & refer to drawing III#4.

12. Lay the front struts (AF6) in front of the hang cage, with the drilled ends toward the cage. Take a 1 1/8" stainless bracket (AF28) and hold this bracket (open end forward) onto the main strut below the bottom bend while you bolt the end of a front strut into this bracket (nylock finger tight) Repeat on the other side. See drawing II#6.

Lift the noseplate in one hand and the top of the front strut in the other and fit the front strut into the flat bottom bracket (under the noseplate) with the head of the bolt inside the tube. You will need to turn the bracket to do this. Repeat with the other front strut. See drawing VI#3.

13. Holding the stainless bracket 1/8" above the curved bottom bracket at the base of the main strut and flush to the back of the main strut, drill a 1/8" hole in each side of the main strut through the 1/8" holes in the sides of the stainless bracket and attach temporarily with 1/8" aluminum rivets (AF60). Repeat on the other side. See drawing II#6. See construction notes-stainless brackets.



DRAWING II.6.

NOTES

Unbolt the main struts from the curved bottom brackets on the hang tubes. Lift them up far enough to drill 1/8" holes into the back of the main struts through the 1/8" holes in the back of the stainless brackets. Drill out the 1/8" aluminum rivets on one stainless bracket, slide the stainless bracket off the bottom of the main strut and clean out any burrs between the tube and bracket. Replace it in the same position and install 1/8" stainless rivets (AF61) in the back of the bracket (make sure the inside of the bracket is flush with the back of the strut). Repeat on the other side. Drill out the holes on the sides of the stainless brackets with a 5/32" bit and install 5/32" steel rivets (AF62). (All drilling and riveting is done with the tops of the front struts in their brackets on the noseplate.)

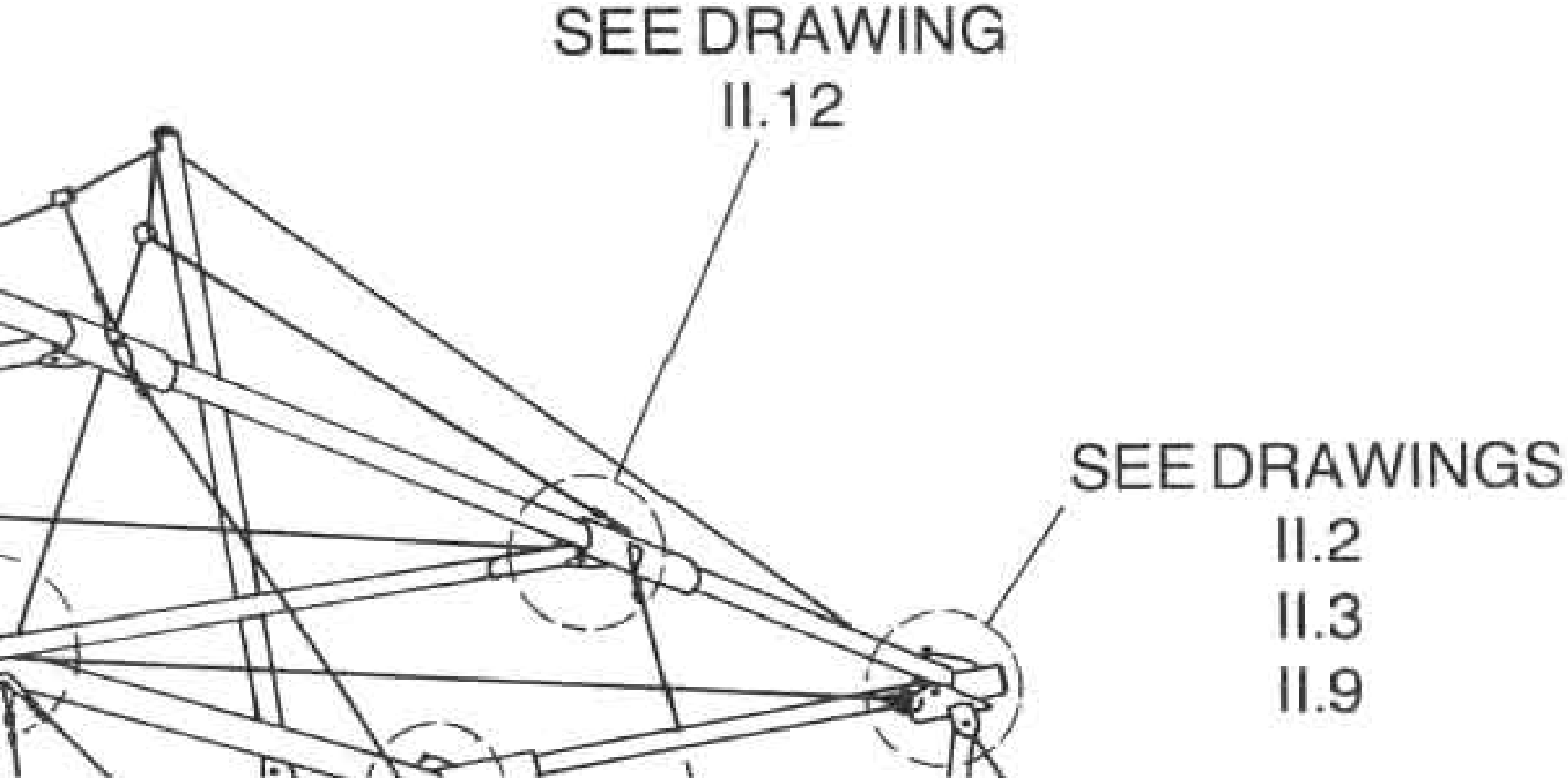
14. Replace the main struts in the curved bottom brackets on the hang cage with bolts and wing nuts. Tighten the nylocks on the bolts which hold the front struts in the stainless brackets. Holding the top of the front strut firmly into the flat bottom bracket with the edge of the tube touching the inside of the bracket and the head of the bolt, mark and drill a 1/4" hole in the side of the tube closest to the keel, using the bracket as a guide. Insert an AN4-16 bolt into this hole and use the bracket as a guide to mark and drill a 1/4" hole in the opposite side of the tube. Be careful not to touch the end of the bolt with the drill bit as you complete the second hole. Push the bolt through and fit a wing nut. Repeat with the other front strut. Refer to drawing II#3.

NOTE: IF YOU HAVE YOUR ENGINE MOUNT KIT, PROCEED TO SECTION III A and III B. WHEN YOU HAVE COMPLETED III B, CONTINUE STEP #15 BELOW.

15. Fold down the struts and keel. This is done by removing the bolts on the top of the forward struts and removing the struts from their brackets. Fold the forward struts back toward the main struts, while holding the noseplate up. Lower the keel gently, remove the bolts from the bottoms of the main struts, lift the struts out of the brackets, fold them forward and lower the struts and keel gently onto the hang cage.

NOTE: IF YOU HAVE LIMITED SPACE, YOU CAN PREPARE YOUR CABLES (SECTION II C) AT THIS STAGE.

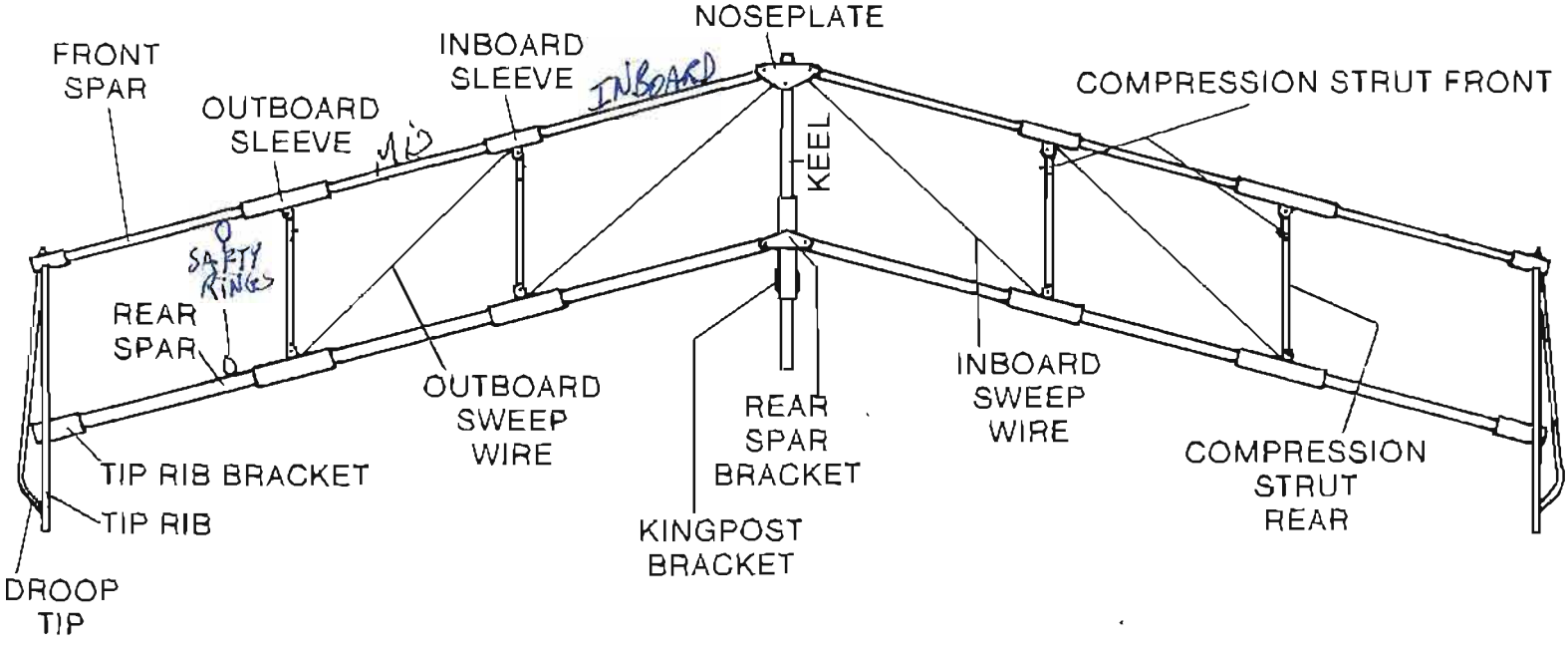
DRAWING II.7



SECTION II B — AIR FRAME ASSEMBLY

NOTES

1. Assemble the four spars (part numbers AF1, AF2). They are in three sections each, coded with letters and alignment marks. The center section is the longest, the inboard has a black cap at one end. The outboard section of the spar is attached with a 3/16" clevis pin (AF37) and safety ring. The head of the clevis pin should be on the front of the front spar and on the rear of the rear spar. Hold the inboard and midspar sections (and the inner plug) together temporarily with an AN4-24A bolt (AF46) and wing nut. Lay the spars and the keel (which still has the struts and hang cage attached) in positions shown in drawing II#8.

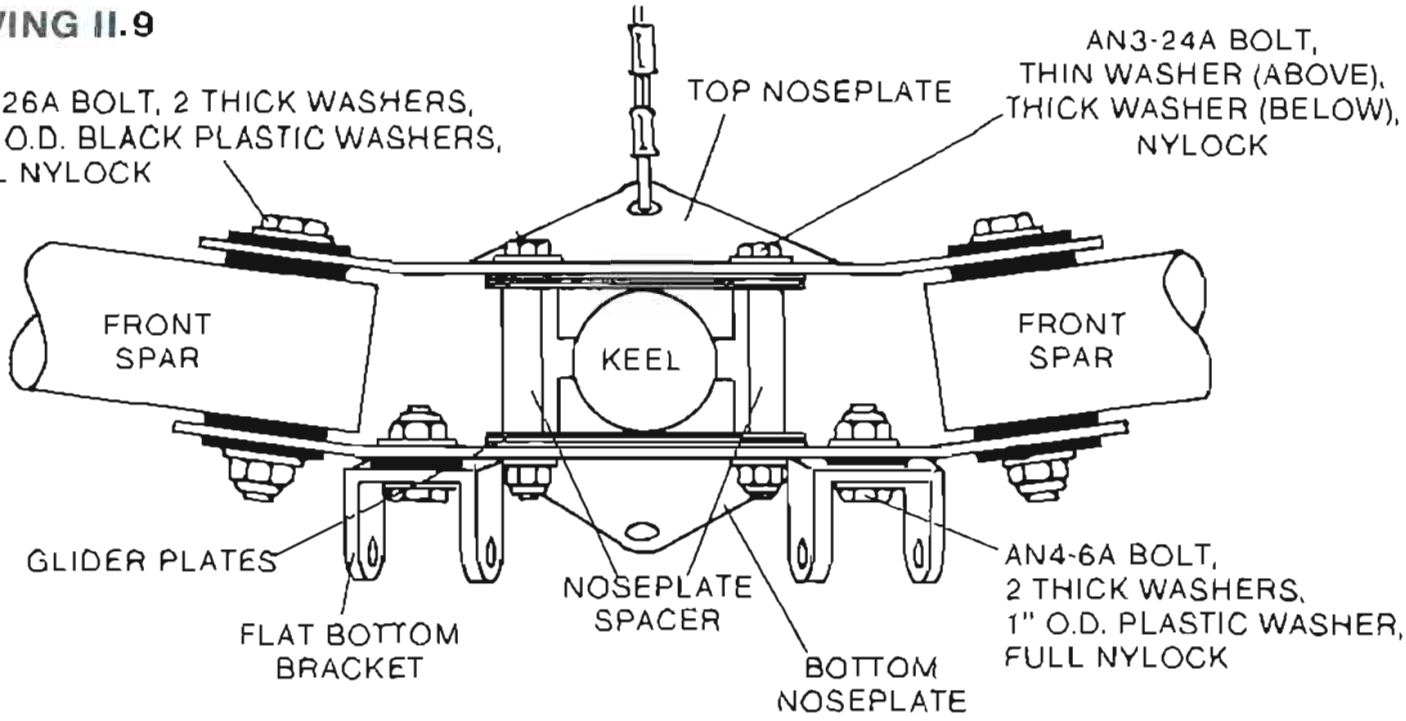


DRAWING II.8.

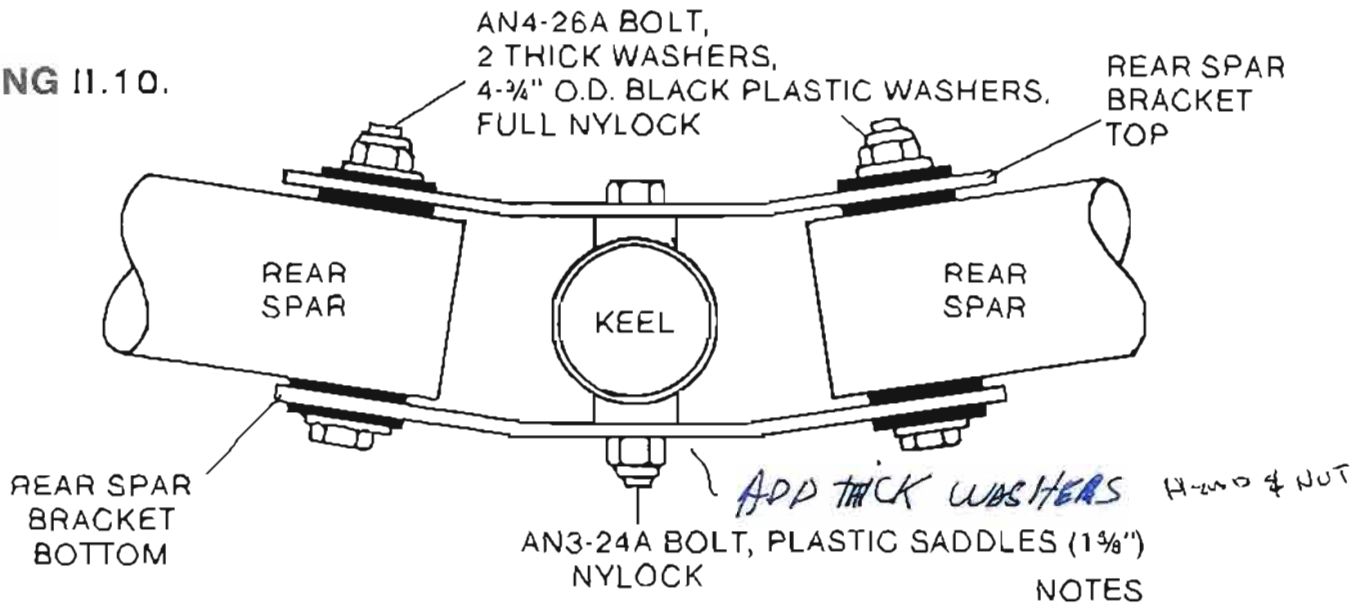
2. Bolt the front spars to the noseplate on the keel. The holes at the tips face to the rear. See drawing II#9. Bolt the rear spars to the rear spar brackets. See drawing II#10. Fitting the bolts and washers will be easier if the outboard end of the spar is raised about two feet. Don't overtighten the nylocks. The spar bolts must be free to move in their slots as you raise and lower the wings.

IF YOU HAVE LIMITED SPACE, REMOVE THE OUTBOARD SECTION OF EACH SPAR.

DRAWING II.9



DRAWING II.10.



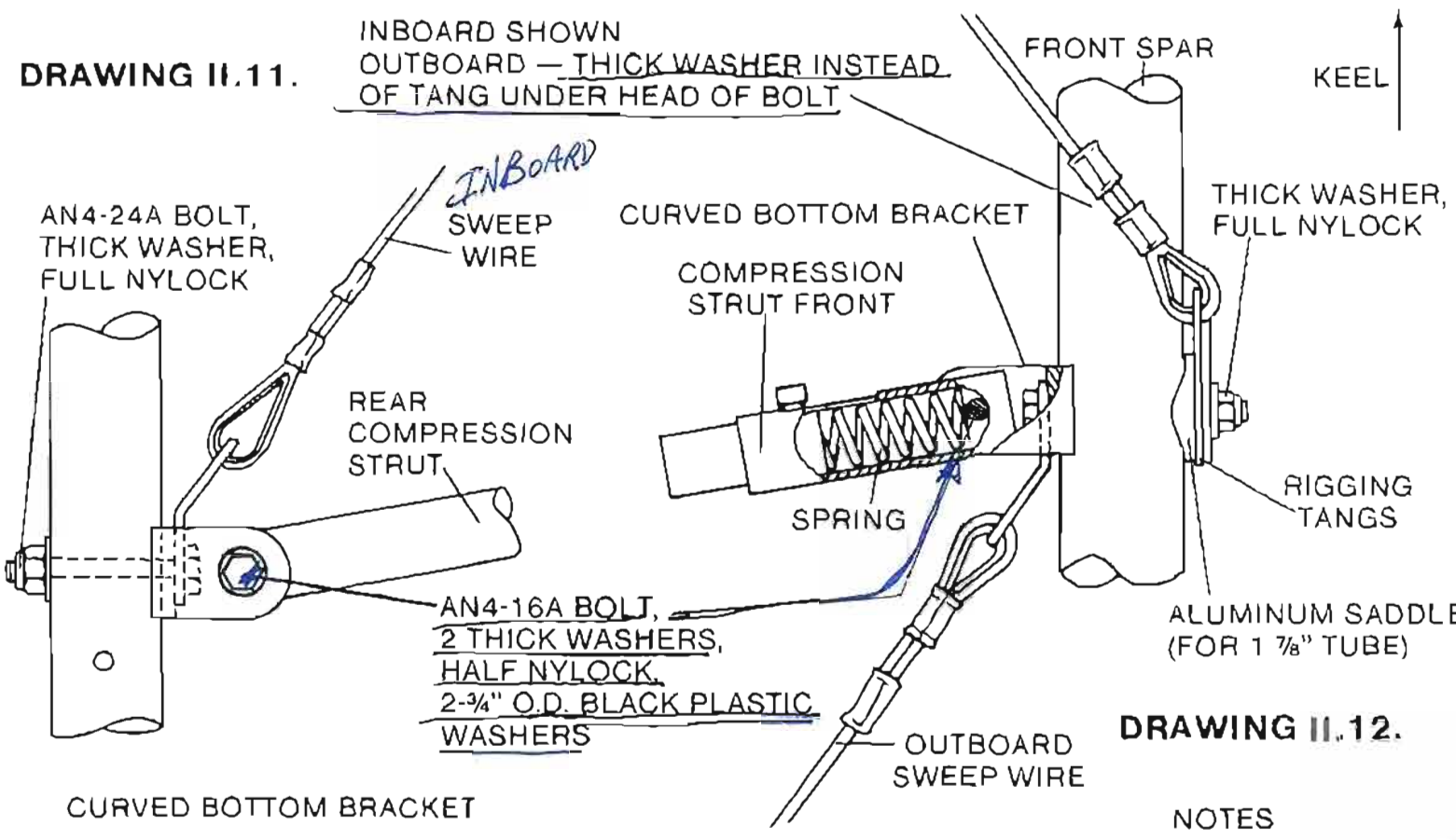
NOTES

3. Separate the pairs of sweep wires. The inboard sweep wires (AF15) have a shackle at one end and are made from 1/8" cable. The outboard sweep wires (AF16) have thick bent tangs at both ends and are made from 3/32" cable. Inspect the swages and shrink the tubing in position covering half the tang (or shackle), the thimble and the first swage.

4. Attach the shackle on the inboard sweep wire to the bottom noseplate with a clevis pin (AF64) and ring (the safety ring below). Refer to drawing II#3. Repeat on the other side.

5. The thick bent tang at the other end of the inboard sweep wire fits on the bolt in the horizontal hole in the rear spar, inside the curved bottom bracket. See drawing II#11 and refer to drawing II#8. Tighten the nylock on the rear of the spar. Bolt the inboard rear compression strut into the curved bottom bracket (bolt head down). Tighten the nylock gradually until the strut can rotate easily but will stay in any position you leave it. Repeat on the other side.

DRAWING II.11.



DRAWING II.12.

NOTES

6. Fit an AN4-26A bolt through the bent tang of the outboard sweep wire, through a curved bottom bracket, through the hole in the inboard sleeve in the front spar (from the rear) and fit a saddle (AF34) and wingnut onto the bolt at the front of the spar.

7. Fit a spring (AF30) into a front compression strut (AF29) and bolt it into the curved bottom bracket, bolt head down, as in drawing II#12. One end of the spring should touch the bolt, the other should touch the inside tube of the front compression strut. The plastic washers fit either side of the strut, inside the bracket. The handle on the inside tube should face the keel. Tighten the nylock as you did on the inboard rear compression strut.

8. The thick tang at the other end of the outboard sweep wire fits on the bolt in the horizontal hole through the outboard sleeve in the rear spar, inside the curved bottom bracket. Tighten the nylock on the rear of the spar. Bolt the outboard rear compression strut into the curved bottom bracket (with the bolt head down) with the plastic cable guide on the top. See drawing II#11. Tighten the nylock as in step #5. Repeat on the other side.

9. Bolt a curved bottom bracket to the rear of the outboard sleeve of the front spar as you did in step #6 (no tang). Bolt the front compression strut to this bracket as you did in step #7. Tighten the nylock, as in step #5, and repeat on the other side.

10. Join the compression struts by pushing back the lever in the front compression strut, lining the front assembly up with the rear compression strut and releasing the lever.

11. Bolt the kingpost (AF5) to the top of the kingpost bracket. See drawing II#1.

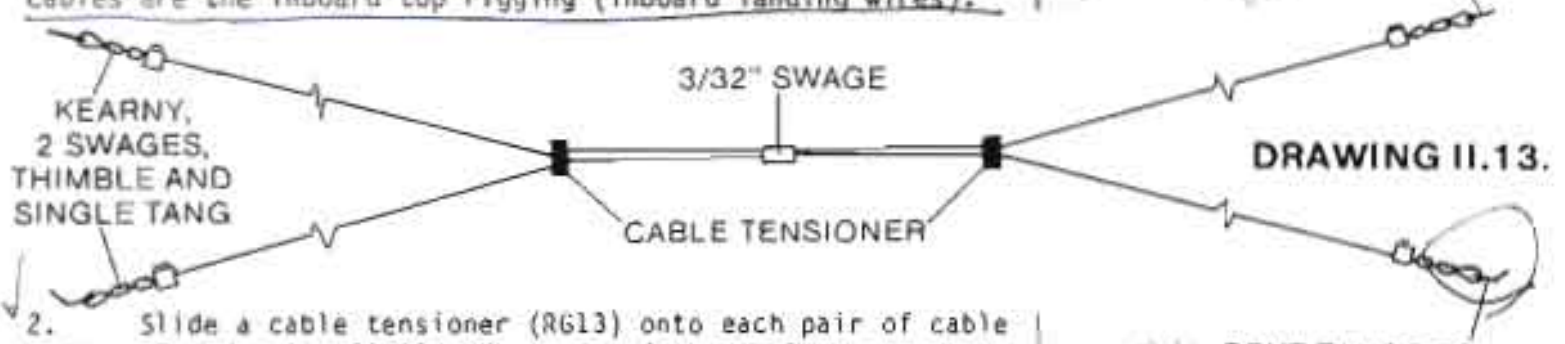
SECTION II C — CABLE PREPARATION

IF YOU HAVE YOUR ENTIRE KIT AND ARE NOT FAMILIAR WITH SWAGING, GO TO SECTION IV AND COMPLETE STEP #1 AS PRACTICE.

NOTES

2@31' 10 ABLE 6' SHORT
2@20'

1. Cut the 102' of 3/32" uncoated cable (RG3) into four lengths, two of 31 feet each and two of 20 feet each. Slide a 3/32" swage onto each pair of cables and swage them together side by side with the swage at the center. See drawing II#13. Clamp the swage. The 31 foot cables are the outboard top rigging (outboard landing wires), the 20 foot cables are the inboard top rigging (inboard landing wires).



DRAWING II.13.

2. Slide a cable tensioner (RG13) onto each pair of cable ends. See drawing II#13. The ends of the cable must not be frayed. If you have a bench grinder you can grind the cables to a taper which makes this step easier, if not you can countersink the hole slightly. If they are so tight that they untwist the cable as you slide them toward the swage, remove them and ream out the holes in the tensioner with a 3/32" drill bit until they slide smoothly but not easily. (The reason we cannot make the holes fit the cable precisely is the slight variation in cable thickness between batches.)

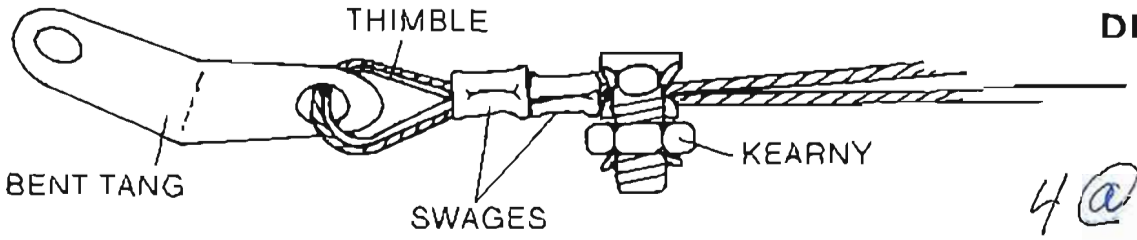
3. Mark the cables with an indelible felt pen at these distances from the outside edge of the central swage with the cable pulled snug. (Have your assistant hold the swage and tape end, or clamp them both to something rigid.)

front inboard	81 1/2"
rear inboard	78 1/2" REAR
front outboard	145 " FRONT
rear outboard	148 3/4"

4. Cut the heat shrink tubing (RG12) into twenty pieces of 3 1/4" each and eight pieces of 3 3/4" each. (The longer pieces are used on the 1/8" bottom cables.) You should always slide a piece of heat shrink tubing onto a cable before fitting a tang, swages, etc.

20@3¼"
8@3¾" 1/8" CAB/BOT.

5. Temporarily attach a tang to each cable end with thimble, kearny and two swages, after sliding on a piece of heat shrink. The cable goes through the large hole in the tang with the mark made in step #3 at the center of the curve of the thimble. See drawing II#14. The front cables have thin flat tangs. The rear cables have thin bent tangs. See drawing II#13. Tighten the kearnys with the thimble touching the first swage. Check that each length of cable has the same type of tang at both ends. Coil each set of cables and set them aside.

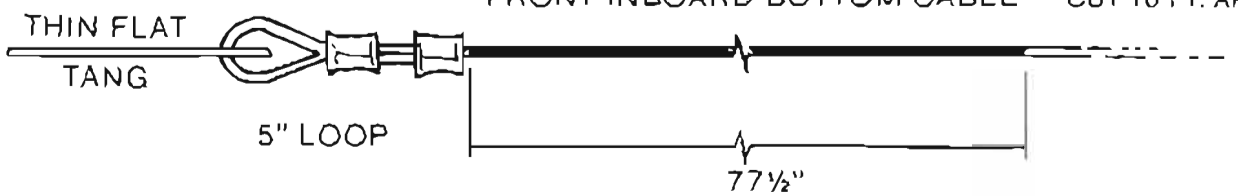


4 @ 10'
2 @ 9'

6. Cut the 58' of 3/32" coated cable (RG2) into six pieces, four of 10' each and two of 9' each. Strip 5" of coating from one end of each of these 6 lengths.

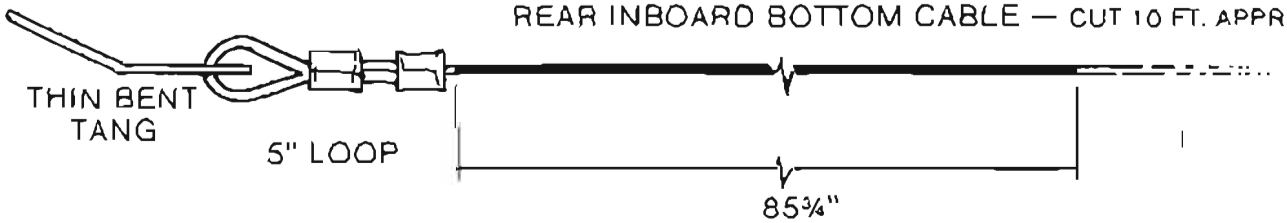
Swage a 5" loop, with a thin (18G) flat tang (RG4), a thimble (RG11) and two 3/32" swages (RG9) to the stripped ends of two of the 10' lengths. See construction notes-swaging. (The cable always goes through the large hole in the tang.) Measure and mark the coating on these cables 77 1/2" from the end of the clamped swage and strip the coating from the cable beyond this mark. See construction notes-stripping. These are the front inboard bottom cables. Label them by making a tab on the cable with a piece of masking tape, near the tang, and marking with your indelible pen.

FRONT INBOARD BOTTOM CABLE — CUT 10 FT. APPROX.



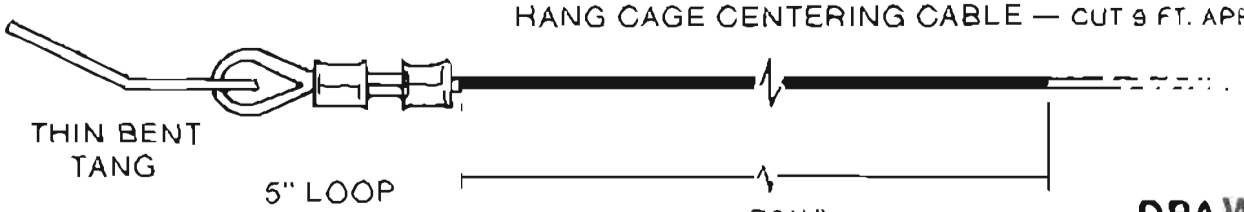
Swage a 5" loop, with a thin (18G) bent tang (RG5), thimble and swages to the stripped ends of the other two 10' lengths. Measure and mark the coating on these cables 85 3/4" from the end of the clamped swage and strip the coating from the cable beyond this mark. These are the rear inboard bottom cables. Label them.

REAR INBOARD BOTTOM CABLE — CUT 10 FT. APPROX.



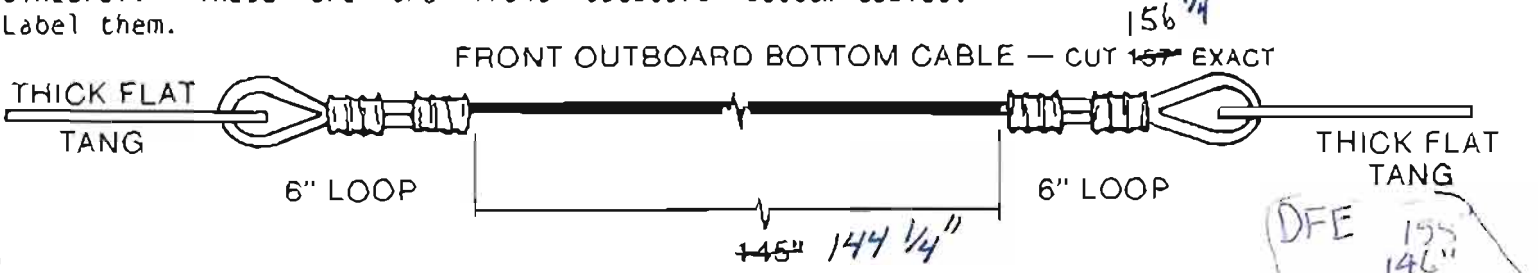
Swage a 5" loop, with a thin (18G) bent tang, thimble and swages to the stripped ends of the two nine foot lengths. Measure and mark the coating on these cables 72 1/2" from the end of the clamped swage and strip the coating from the cable beyond this mark. These are the hang cage centering cables. Label them. They will be used after the washout has been set.

HANG CAGE CENTERING CABLE — CUT 9 FT. APPROX.



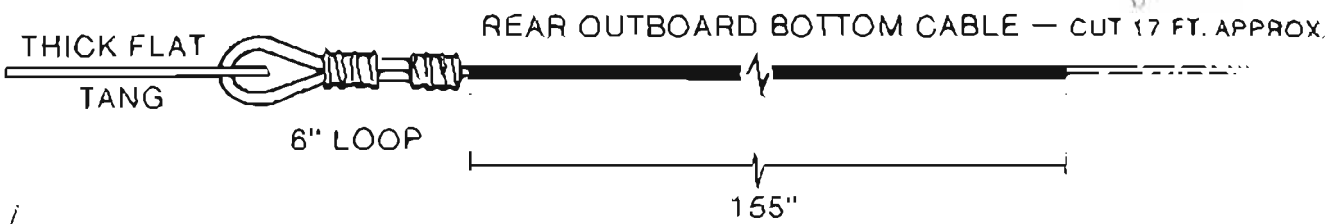
7. Cut two lengths of exactly ~~157"~~ 156 1/4" each from the coil of 1/8" coated cable (RG1). Strip 6" of coating from both ends of each cable, slide on two 3 3/4" pieces of heat shrink tubing, then swage a thick (14G) flat tang (RG6) to each end with a thimble and two 1/8" swages (RG1U). Make sure that both are exactly the same length, since they determine the dihedral. These are the front outboard bottom cables. Label them.

2@ 156 1/4" @ HANGE

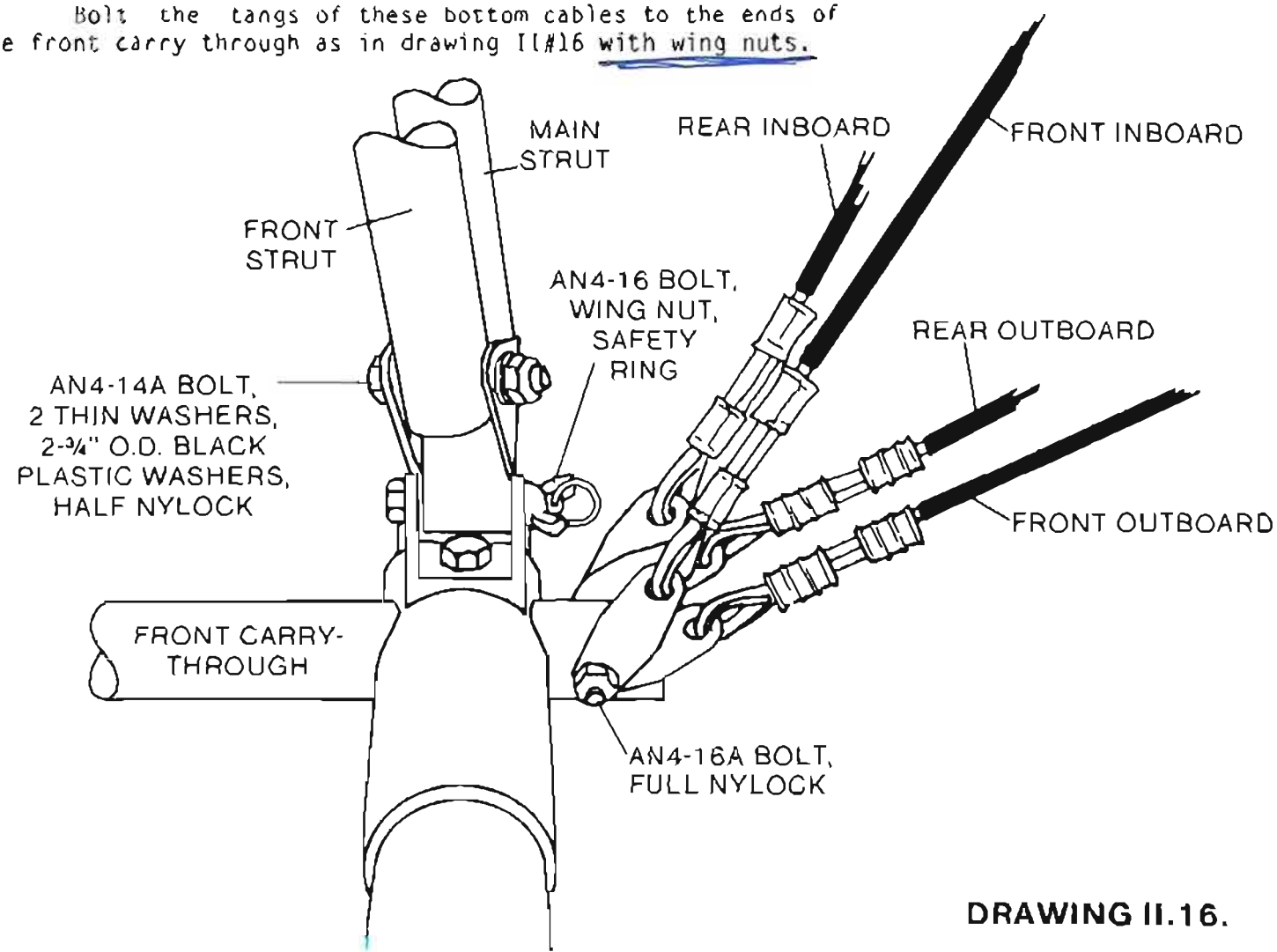


DFE 155 146" 154½ @

8. Cut the remaining 1/8" coated cable in half. Strip 6" of coating from one end of each length, and swage a thick (14G) flat tang to each of these bare ends with two 1/8" swages and a thimble. Measure and mark the coating on each cable 155" from the clamped swage, and strip the coating from the cable beyond this mark. These are the rear outboard bottom cables. Label them.



9. Bolt the tangs of these bottom cables to the ends of the front carry through as in drawing II#16 with wing nuts.



DRAWING II.16.

SECTION II D — RIGGING

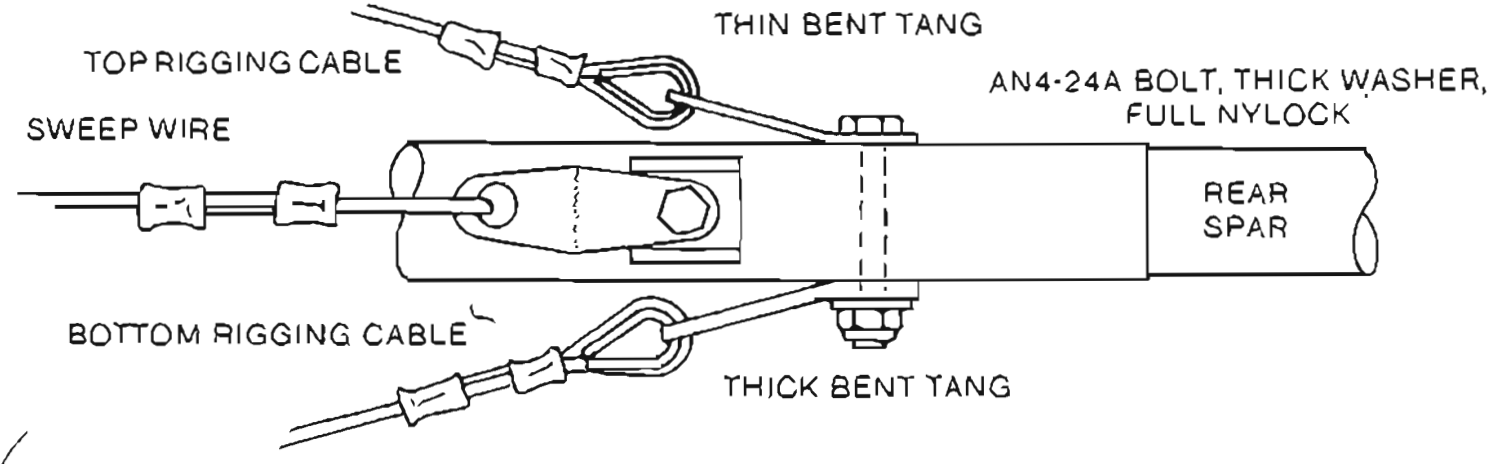
NOTES

1. Set the kingpost top (AF31) into the kingpost tube with the narrow, deeper slot running fore-and-aft, the wide slot side-to-side. Stand up the kingpost and put the cable from the top of the nose plate into the narrow slot. The brass colored stop sleeve should be inside the kingpost top. Put the inboard top cables into the side-to-side slot with the central swage inside the kingpost top. Attaching the top rigging to the airframe will be easier if you support the wing tips about 2' off the ground.

2. Attach the flat tangs of the front inboard top rigging to the bolts through the front spars at the inboard sleeves, in front of the saddles. Put a thin flat tang on to each of these bolts and replace the wing nuts. (The bolt fits the smaller of the two holes in the tang.) Refer to drawing II#12.

3. Attach the bent tangs on the rear inboard top rigging to the vertical hole in the rear spar with an AN4-24A bolt (AF46). Put a thick bent tang (RG7) on to the bolt under the spar with a wing nut. See drawing II#17.

DRAWING II.17.



4. Put the central swage of the outboard top rigging into the slot in the kingpost top. Fit the kingpost cap (AF32). Attach the flat tangs on the front outboard top rigging to the bolts through the front spars at the outboard sleeves, in front of the saddles. Fit the flat tangs of the front outboard bottom cables (which are attached to the carry through) onto these bolts and replace the wing nuts. Refer to drawing II#12.

5. Attach the bent tangs on the rear outboard top rigging to the vertical hole in the rear spar (at the outboard sleeve). Put a thick bent tang (RG7) onto to the bolt under the spar with a wing nut. See drawing II#17.

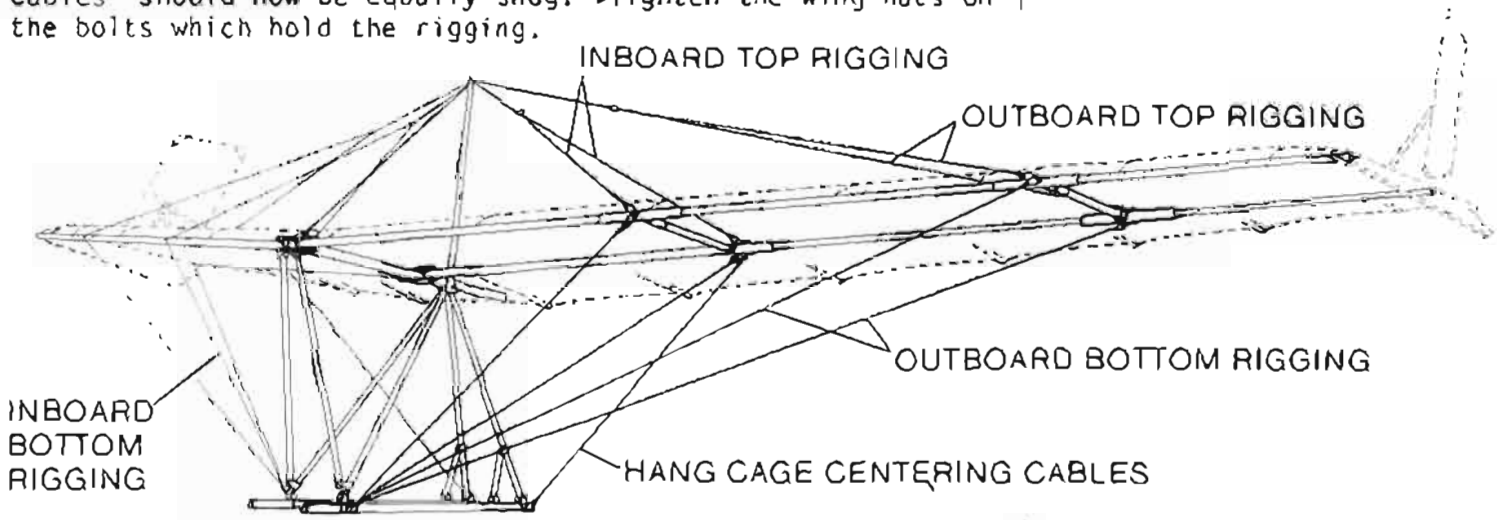
6. Set up the airframe. Lift the noseplate (with the back of the keel resting on the rear struts) until you can bolt the bottom of the main struts into their brackets on the hang cage. Swing the front struts forward and pull the noseplate down and bolt the front struts into their flat bottom brackets.

SET UP AIRFRAME

NOTES

7. Slide the cable tensioners up to the kingpost. Take the end of the inboard rear bottom cable, thread it through two 3 1/4" pieces of heat shrink, through a kearny and two swages, through the hole in the thick bent tang (under the rear spar) and back through the two swages and kearny. Fit a thimble, pull the cable tight (with the loose cable wrapped around your hand) and tighten the kearny (pushing the kearny towards the tang so that the swage touches the thimble). See construction notes - kearnys. Likewise attach the front inboard bottom cable to the flat tang at the front of the front spar at the inboard sleeve (after threading on two pieces of heat shrink). Tighten the cable until the front spar is approximately straight. Attach the rear outboard bottom cable to the thick bent tang under the rear spar (at the outboard sleeve) in the same way (using two 3 3/4" pieces of heat shrink). See drawing II#18. All cables should now be equally snug. Tighten the wing nuts on the bolts which hold the rigging.

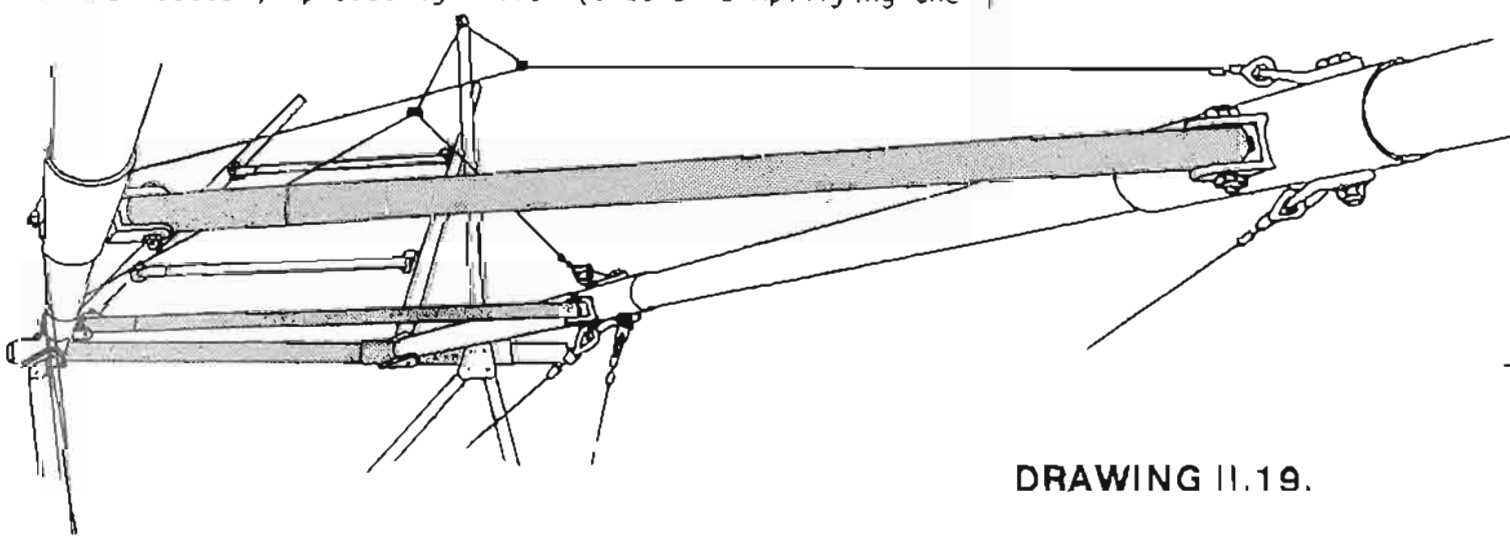
DRAWING II.18.



8. You are now going to set the washout. See drawing II#19.

This is a good time to explain washout. Be sure you understand it before you start. It's important that you do it correctly and accurately.

Take a look at your airframe and imagine it with the covering in place. Flying along with the hang tubes parallel to the direction of flight, the wind hits the wing from the bottom, producing lift (that's simplifying the



DRAWING II.19.

process a bit). The angle at which the wing meets the air is called the angle of attack. If the front of the aircraft is lifted higher and the wing tilted backward, pretty soon it stalls. The angle is too great to produce lift. If the middle of the wing (along the keel) stalls first, it stops lifting and drops down, that lowers the angle of attack and stops the stall. But if a wingtip stalls first, the aircraft will turn rapidly toward that wing and enter a spin. "Washout" is a term meaning twisting the wing nose down toward the wingtip. The purpose of washout is to make the angle of attack lower for the wingtips than the center of the wing, thus making the wing tend to stall center-first.

9. Make sure that the hang cage is steady on the ground, with all the brackets touching, not necessarily level, but steady. Remove the outboard sections of all four spars. DONE Adjust the front inboard bottom cables until the front spars aren't bowed up or down (they will bend back a little, this is for good wing covering tension along the front spar). Turn the wings of the wing nuts on the front spar until they are horizontal. Looking down the spar from the noseplate, the line from the two wing nuts should be half way between the top and bottom noseplates.

10. Adjust the inboard rear bottom cables until the wing at the inboard compression struts has approximately 1/2 degree lower angle than the keel. For example, if the keel were 5 1/2 degrees from the horizontal, the inner compression struts would be at 5 degrees. Lay a spar outboard section across the spars on each side, in line with the inboard compression strut, resting on the sleeves just outboard of the tangs. Measure the angle with the bubble protractor resting on top of this tube. (Measure the angle of the keel with the protractor on top of the front section of the keel.) Check that both sides are at the same angle by standing at one wing tip looking at both tubes, they should line up. If both sides (left and right) need adjusting, adjust the worst one first, then measure both.

11. Adjust the outboard rear bottom cables until the wing at the outboard compression struts has approximately 1 1/2 degrees lower angle than the keel. Use tubes for measurements and sighting as with the inboards. If the keel were 5 1/2 degrees, these would be 4 degrees.

12. Now you may need to adjust the top rigging. If any of the bottom cables are tighter or slacker than the others, for example, if the front outboard cables are slack, tighten the front outboard top cables. If the rear inboard bottom cables are very tight, slack off the rear outboard top cables. Always adjust both ends of a top cable an equal amount both sides eg. right rear inboard and left rear inboard to keep the wing symmetrical. Use the marks on the cable at the thimbles (which you put on in step #3, SECTION III C) to check the amount of the adjustment.

You should now have the front spars straight and the washout set approximately, with all the cables (including the sweep wires) snug and straight.

NOTES

13. Tighten the cables by sliding the tensioners away from the kingpost. Always hold the cables together below the tensioner to avoid enlarging the holes. The tensioners should be an equal distance either side of the kingpost, inboards 5" to 10", outboards 15" to 30" (if you need to slide the tensioners down much further than this, the top rigging is still too loose).

To reach the tensioners, use a step ladder or tip the wing over backwards (after removing the tubes), making sure that when you set it upright again, the hang cage is steady.

14. Sight along the front spars as in step #9 and adjust the bottom cables until the spars are equally straight. Measure the angle of the keel, and of the tubes resting on the spars at the inboard compression struts. Adjust the rear inboard bottom cables if necessary (as in step #10) until the difference is exactly 1/2 degree and check that the tubes line up exactly. Likewise adjust the rear outboard bottom cables until the tubes across the spars at the outboard compression struts are exactly parallel, and exactly 1 1/2 degrees less angle than the keel.

Slide the tensioners back up to the kingpost top while you adjust the cables. Slide them down to tighten the cables before measuring.

15. Double check your protractor readings by measuring from both sides of the aircraft. When everything is perfect, make sure the kearnys are tight. Measure any differences between the bubble protractor readings on the compression struts and the readings on the measuring tubes. Record these differences for future reference, as you will only be able to check washout on your completed aircraft from the bottoms of the compression struts.

IF YOU HAVE NOT COMPLETED YOUR ENGINE MOUNT, PROCEED TO SECTION III - A and B. AFTER FINISHING III - B, RETURN TO STEP #16 AND CONTINUE.

IF YOU NEED TO FOLD DOWN THE AIRFRAME BEFORE YOU WORK ON SECTION III -A, TIGHTEN THE KEARNYS. WHEN YOU SET THE AIRFRAME UP TO WORK ON THE ENGINE MOUNT CHECK WASHOUT ETC. TO BE SURE NO KEARNYS HAVE SLIPPED.

16. Fold the airframe down.

a) Slide the tensioners up to the kingpost.
b) Disconnect the inboard compression struts, folding the front assembly toward the keel and the rear compression strut away from the keel.
c) Disconnect the outboard compression struts in the same way while holding up the front spar.
d) Place the front spar on top of the rear spar and tie them together loosely.
e) Remove the bolts from the tops of the front struts and fold the struts back.
f) Lift the keel until the rear of the keel rests on the rear struts and unbolt and remove the main struts from their brackets on the hang cage.

g) Lower the airframe and struts gently, forward and down onto the hang cage.

h) Hold the noseplate as you remove the pip pin and lower the wings gently by allowing the noseplate to slide slowly back along the keel.

i) Push the noseplate further back along the keel until you can fold down the kingpost.

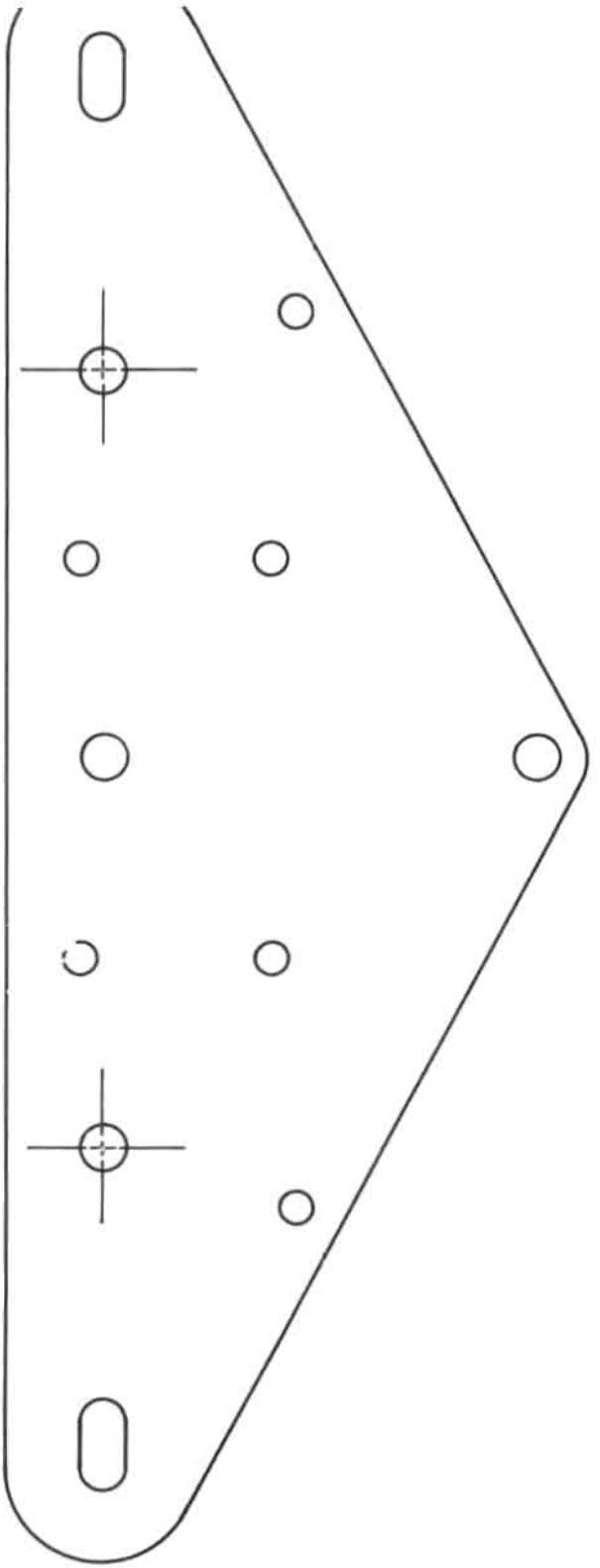
17. Label the outboard top rigging to show left and right. Repeat this with the inboard top rigging and the left and right bottom rigging. This is to make sure that the rigging is replaced correctly. Remove all the flat tangs from the front spars and replace the wing nuts. Remove the bent tangs from the rear spars and set the bolts aside. Unbolt the tangs of the bottom cables from the front carry through (replacing the tangs on the bolt and replacing the wing nut loosely)and remove the top cables from the kingpost top. Coil each set of rigging separately.

18. Remove the two bolts holding the main and rear struts in the kingpost brackets. Pull the hang cage and struts out from underneath the airframe and remove the rear struts from the hang cage. Set aside. Fold the spars back along the keel. Set aside.

19. At each tang, clamp the swage which is touching the thimble, remove the kearny, cut the loose end (1 1/2" from the thimble on 3/32" cable, 2" from the thimble on 1/8" cable) and clamp the second swage, with the cut end just showing, almost flush with the end of the swage. (Do not swage onto the plastic coating, cut it back carefully so that approximately 1/4" of cable is exposed outside the swage.)

20. On each cable, slide the heat shrink tubing over the swages onto the tang and shrink it in place with the heat gun, covering both swages and about half of the tang.

PROCEED TO SECTION III - C.



TEMPLATE #1

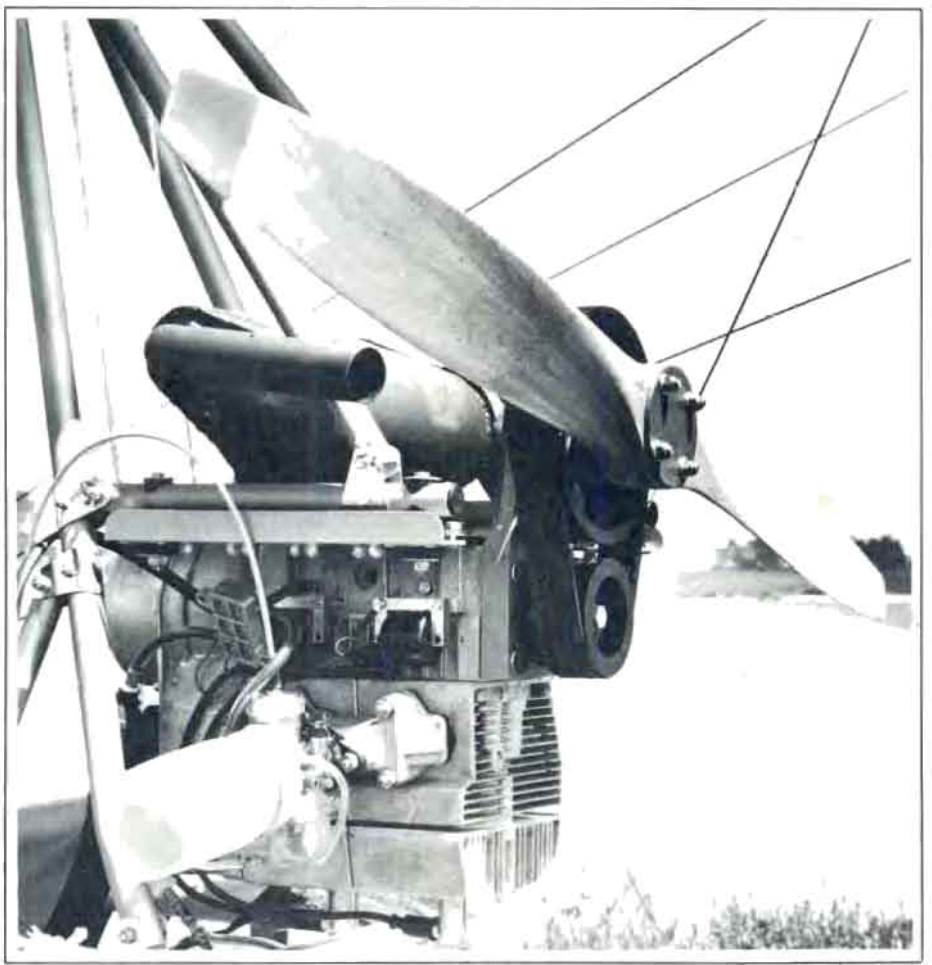


PTERODACTYL

SECTION 1
ENGINE

SECTION III — ENGINE

III A — ENGINE MOUNT
III B — ENGINE MOUNT FORWARD BRACING
III C — ENGINE PREPARATION
III D — ENGINE INSTALLATION

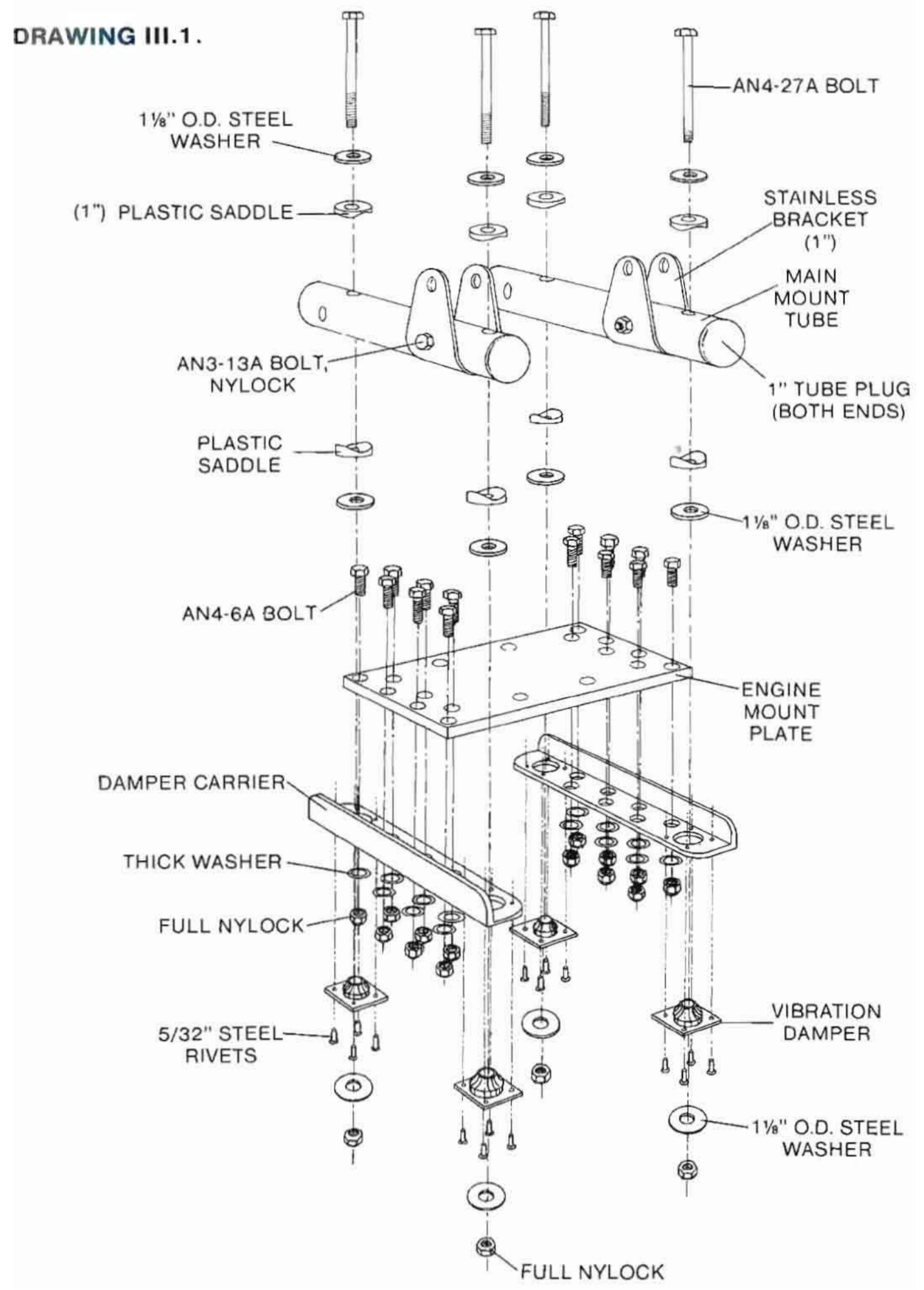


SERIAL #1981
430RR

In this section you will assemble the engine mount and forward braces and then attach the engine, reduction drive and related systems.

The tools you will need are: bubble protractor, cable cutters, crimper, drill, 1/8", 5/32", 3/16", 1/4" drill bits, half round file, pencil, pliers, pop riveter, wide screwdriver (or chisel or wedge), swager, tape measure, wrenches, two 3/8", two 7/16", two 1/2", one 9/16", one 5/8", one 3/4", one 1 1/4" (or large adjustable) and a torque wrench.

DRAWING III.1.



III A — ENGINE MOUNT

NOTES

In this section you will attach the engine mount plate and the tubes which support it so that the plate is level with the hang tubes.

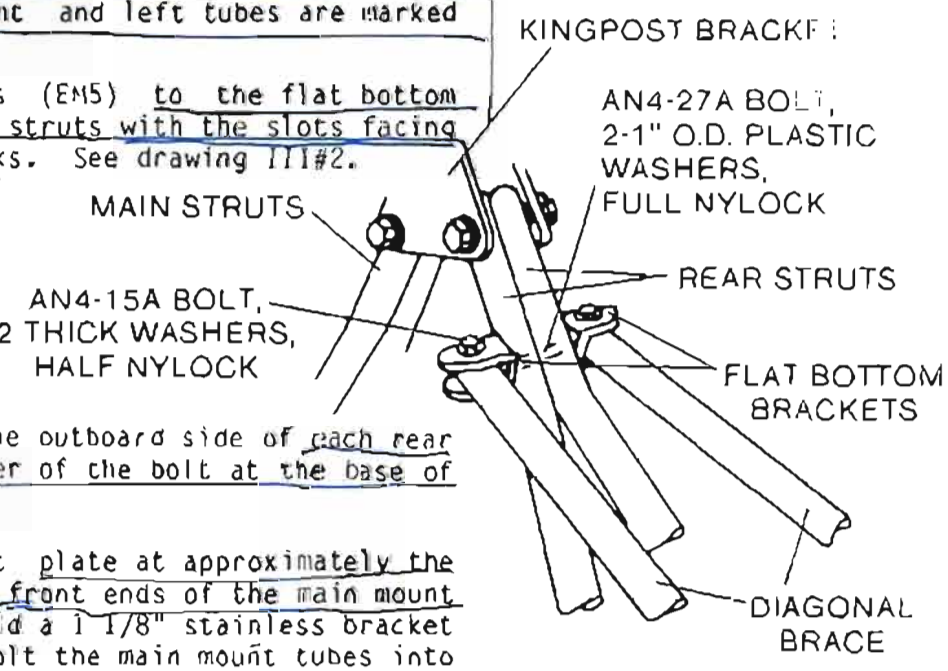
1. Rivet the vibration dampers (EM6) to the vibration damper carriers (EM2). One end of the vibration damper is 'pointed' more than the other. The pointed end goes through the hole in the vibration damper carrier. The flange of the damper should be on the bottom of the damper carrier. See drawing III#1. Use four 5/32" steel rivets (EM25) for each damper.

2. Bolt the engine mount plate (EM1) to the vibration damper carriers. Tighten the nylocks.

3. Fit plastic plugs (EM8) to both ends of each main mount tube (EM3,4) and secure them with one 1/8" aluminum rivet each (EM23). Bolt the main mount tubes above the vibration dampers with wing nuts. Right and left tubes are marked with an R and L.

4. Bolt the diagonal braces (EM5) to the flat bottom brackets at the top of the rear struts with the slots facing the brackets. Tighten the nylocks. See drawing III#2.

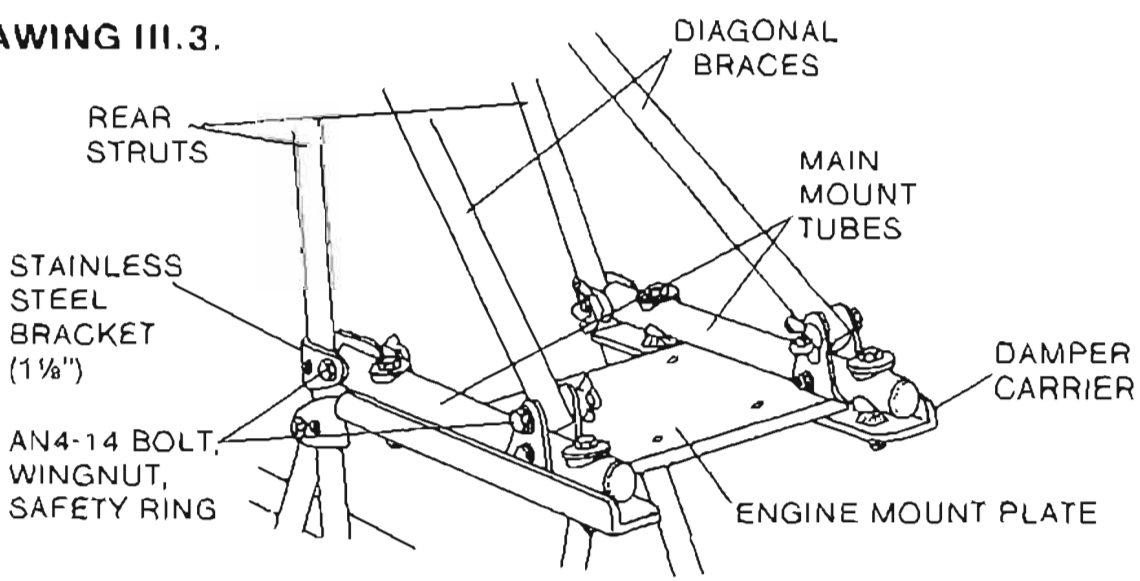
DRAWING III.2.



5. Make a pencil mark on the outboard side of each rear strut, 14 1/4" up from the center of the bolt at the base of the rear strut.

6. Support the engine mount plate at approximately the height of these marks with the front ends of the main mount tubes touching the struts. Hold a 1 1/8" stainless bracket (EM10) on each rear strut and bolt the main mount tubes into these brackets (with wing nuts). See drawing III#3.

DRAWING III.3.



NOTES

7. Fit a 1" stainless bracket (EM9) around the main mount tube between the dampers and bolt the bottom of the diagonal brace into this bracket with a wing nut. Repeat on the other side. See drawing III#3.

8. Hold the stainless bracket on the rear strut so the mark from step #5 is visible in the 1/8" hole in the side of the bracket. Holding the back of the bracket flush against the strut, drill through the hole in the side of the bracket, through the mark and through one side of the strut. Secure the bracket, temporarily, with a 1/8" aluminum rivet (EM23). Repeat at the mark on the other strut. Repeat at the other side of each bracket making sure that the inside of the bracket is flush with the tube.

9. Sliding the stainless brackets (which hold the diagonal braces) along the main mount tubes changes the angle of the engine mount plate. Slide each bracket along the main mount tube until the plate is parallel to the hang tubes (measure with the bubble protractor) making sure that the brackets are flush to the bottoms of the tubes. Drill and rivet them in place, temporarily, with one 1/8" aluminum rivet each, drilling through the existing holes on the sides of the stainless brackets.

10. Remove the engine mount assembly from the rear struts and diagonal braces. Remove the main mount tubes from the damper carriers.

11. With each of the four stainless brackets, drill two 1/8" holes into the tube through the two holes in the back of the bracket. Drill out the 1/8" aluminum rivets, clean out any burrs, replace the bracket in its original position and rivet it flush to the tube with two 1/8" stainless rivets (EM24). Drill out the holes in the sides of the brackets to 3/16" and fit 3/16" bolts. Refer to drawings III#1, III#3 and III#4. On the rear struts the nylocks go on the outside, on the main mount tubes the nylocks go on the inside. Tighten the nylocks. Bolt the main mount tubes back onto the damper carriers. Tighten the nylocks.

III B — ENGINE MOUNT FORWARD BRACING

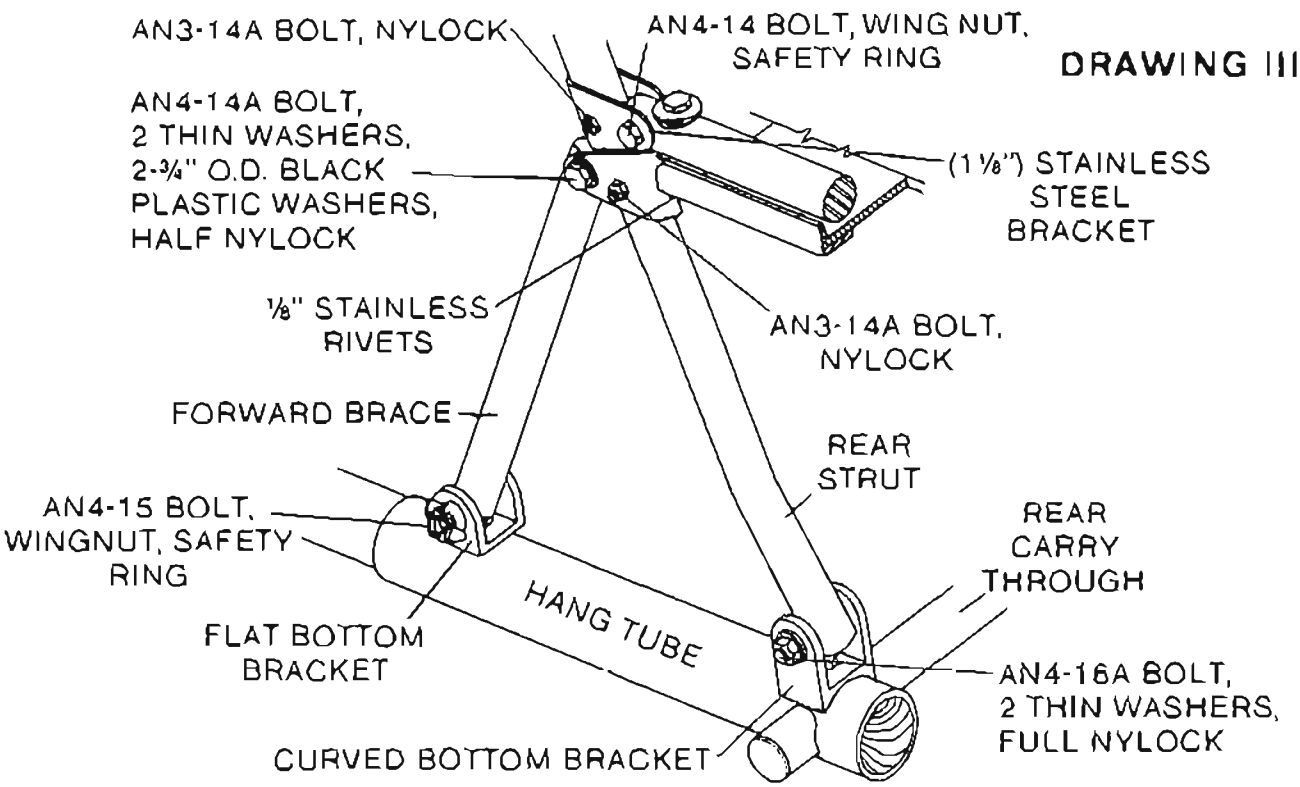
NOTES

1. Bolt the flat bottom brackets (FB3) with large plastic washers (FB14) underneath them, to the vertical holes in the hang tubes, 8" forward of the rear struts, with curved bottom brackets on the bottom of the hang cage. Tighten the nylocks so that you can turn the brackets by hand. Hold a 1 1/8" stainless bracket (FB2) onto the rear strut facing forward, below the existing stainless bracket. Bolt the forward brace (FB1) to this bracket with a wing nut. See drawing III#4 and refer to drawing IV#1 and II#5.

2. Turn the flat bottom bracket as needed for the other end of the forward brace to fit into it smoothly. Center the tube in the flat bottom bracket with about 3/16" clearance between the end of the tube and the inside of the bracket. This clearance is needed so that the tube will clear the head of the bolt when you fold it up. The end of the brace should stay in this position while you attach the stainless bracket to the strut.

3. Rivet and bolt the stainless bracket to the rear strut in the same way you did in Section III A. Replace the wing nut with a nylock and tighten it. Repeat on the other side.

4. Mark and drill a 1/4" hole through the lower end of the forward brace tube, using the hole in the flat bottom bracket as a guide so that the 1/4" hole in the brace is centered. Insert the bolt to check fit and remove. Fold the braces up against the rear struts.



DRAWING III.4.

GO BACK TO SECTION II O, STEP #15.

III C — ENGINE PREPARATION

NOTES

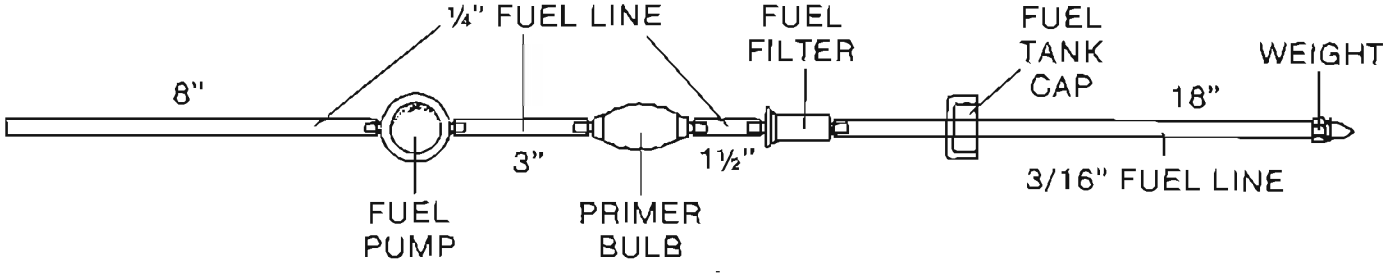
In this section you will assemble your fuel line, carburetor, throttle, switch, and pull starter.

FUEL LINE ASSEMBLY

1. Cut the 1/4" fuel line (FS6) into four pieces, one of 8", one of 3 1/2", one of 3" and one of 1 1/2".

2. Assemble as in drawing III#5 with the fuel pump (FS8), primer bulb (FS7) and filter (FS4). The primer and filter have arrows showing direction of flow. Identify the inlet and outlet of the pump. The 18" of 3/16" fuel line (FS5) fits on the inlet of the filter. Warm (with the heat gun, carefully) and lubricate tube ends which are difficult to fit.

3. Drill a 1/4" hole in the center of the fuel tank cap (FS9) and then a 1/8" vent hole about 1" from the edge. Cut the bare end of the 3/16" fuel line at 45 degrees and push it through the 1/4" hole in the cap (from the top) until you can grip the end with pliers. Pull through 15" of the tube. Make another 45 degree cut at the end of the tube, crossing the previous cut. This prevents the end of the tube sealing itself on the inside of the fuel tank.



DRAWING III.5.

4. Slide a 3/8" plain nut (FS10) onto the lower end of the fuel line. Secure it with a double loop of safety wire, 1" above the end (tight enough to be difficult to slide but not tight enough to restrict fuel flow). This weight holds the fuel line at the bottom of the tank. See construction notes - safety wire.

5. Attach the remaining 3 1/2" of 1/4" fuel line to the fitting on the side of the crankcase of the engine. Safety wire.

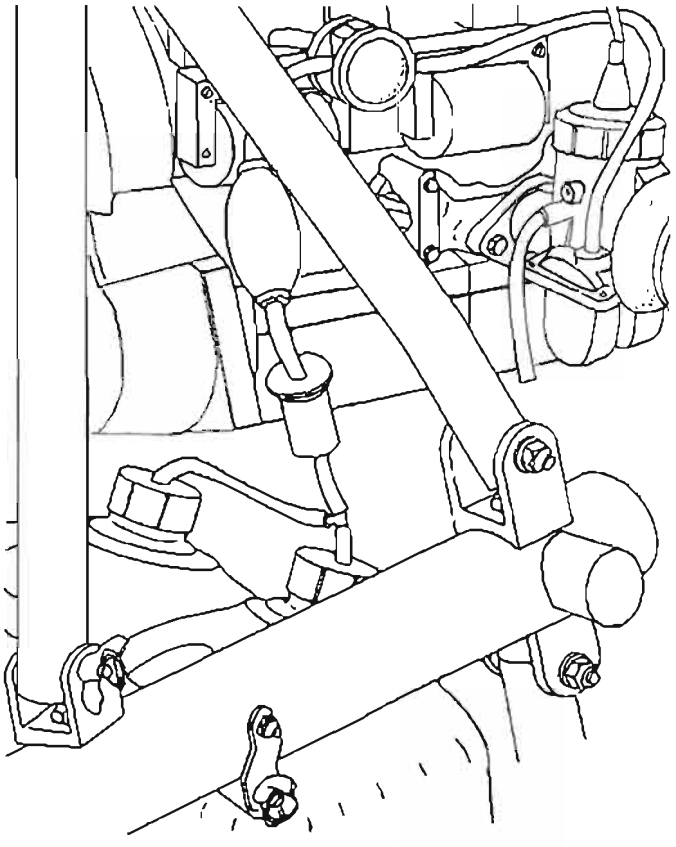
6. Safety wire all the other fuel line connections. (The fuel line will be connected to the carburetor and engine in SECTION VII - FINAL ASSEMBLY.)

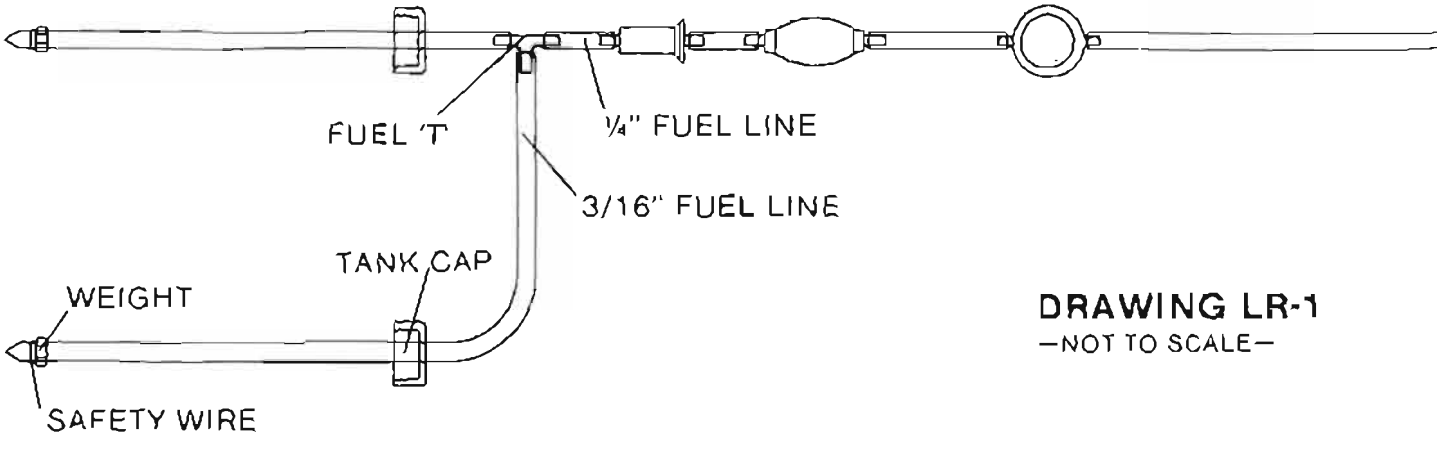
LONG RANG

1. Drill a 1/4" hole in the center of the fuel tank cap and then a 1/8" vent hole about 1" from the edge. Cut the bare end of the 3/16" fuel line at 45 degrees and push it through the 1/4" hole in the cap (from the top) until you can grip the end with pliers. Pull through 15" of the tube. Make another 45 degree cut at the end of the tube, crossing the previous cut. This prevents the end of the tube sealing itself on the inside of the fuel tank.

2. Slide a 3/8" plain nut onto the lower end of the fuel line. Secure it with a double loop of safety wire, 1" above the end (tight enough to be difficult to slide but not tight enough to restrict fuel flow). This weight holds the fuel line at the bottom of the tank.

3. Disconnect your existing 3/16" fuel line from the inlet of the filter. Fit the short length of 1/4" fuel line (1437) onto the filter inlet.





DRAWING LR-1
—NOT TO SCALE—

4. Fit the fuel 'T' into the other end of the short 1/4" fuel line and fit both lengths of 3/16" fuel line onto the 'T' as in drawing LR - 1. Safety wire the new fuel line connections.

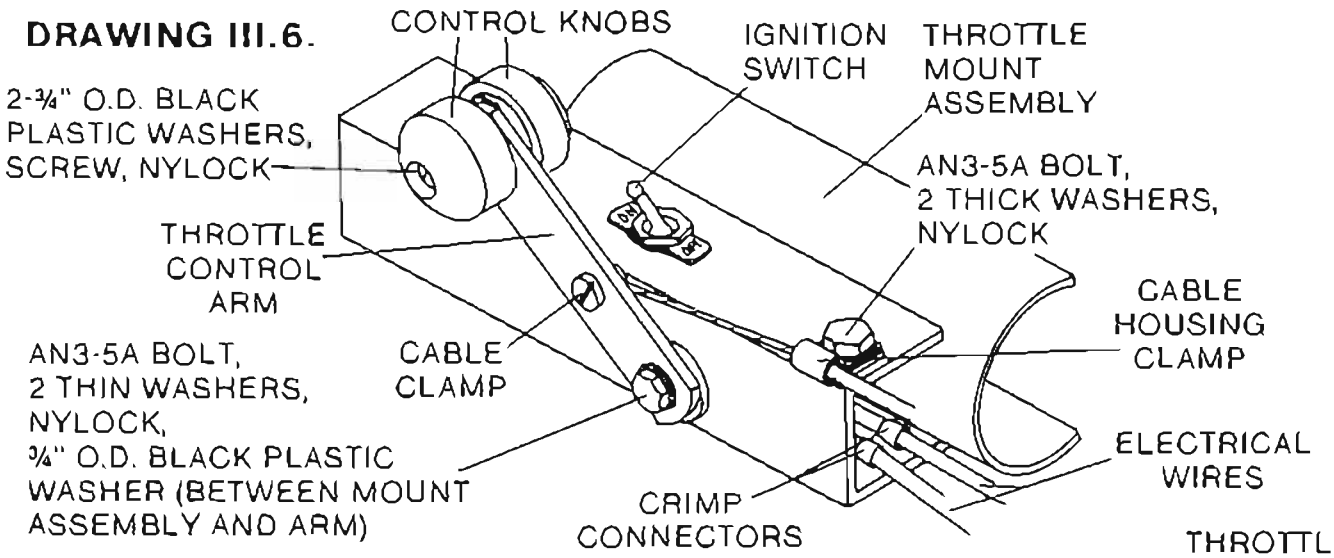
5. Fit both fuel tanks onto the fuel harness. Fit the ends of the fuel lines into the tanks (the shorter one goes into the left tank) and screw down the caps. Secure the tanks with the bungee.

Note: You must register your ultralight as an 'Experimental-Amateur Built Aircraft' to fly legally with 10 gallons of fuel.

NOTES

7. Before installing the switch (TC6) onto the throttle mount assembly (TC3), trim the wire so that the crimp connectors (TC23) will be inside the throttle mount assembly. Strip the ends of the wires from the switch and strip both wires at one end of the electrical wire (TC10) and connect them with the crimp connectors. File the alignment pin off of the "on - off" plate so that you can reverse the plate (normal on completes the circuit and kills the engine, normal off opens the circuit and allows the engine to run). Tighten down the switch. You'll only need one of the nuts to hold it in place. See drawing III#6. See construction notes - crimp connectors.

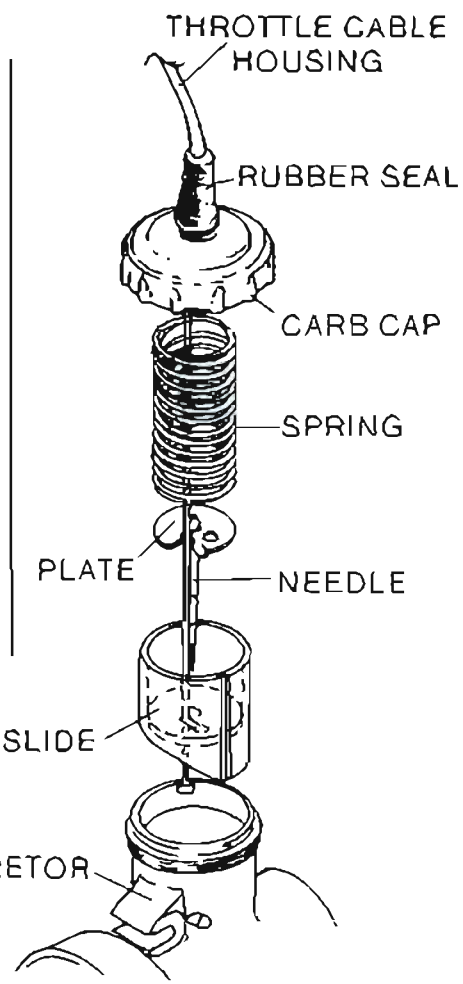
DRAWING III.6.



8. Fit a nylock (TC18) into one of the control knobs (TC5), and fit the control knobs to the control arm (TC4) with the screw (TC14) and washers (TC24). Attach the control arm to the throttle assembly and tighten the nylock so that the arm can move freely. Loosely attach the cable housing clamp (TC11).

9. Strip the ends of the electrical wire (TC10) and crimp on the male bayonet connectors (TC21). These will connect to the bayonet connectors on the engine in SECTION VII - FINAL ASEMBLY.

10. Unscrew the carb cap and remove the slide and spring. File the stop at the end of the throttle cable so that it fits into the hole in the slide. Thread the cable through the slide, through the spring and through the adjuster in the cap. Replace the needle, plate, slide and spring, and screw on the carb cap. Fit the rubber seal onto the end of the cable housing and thread the cable through the housing. See drawing III#7.



DRAWING III.7

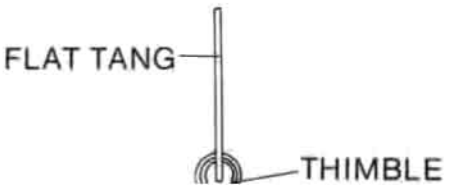
11. Push the cable clamp (TC12) into the hole on the control arm as shown in drawing III#6. You may have to file the hole slightly to ensure that the clamp can rotate freely within the hole. This is very important as it will prevent damage to the cable.

12. Run the throttle cable and housing through the cable housing clamp. Wrap a small piece of masking tape around the end of the housing before tightening the housing clamp to reduce the possibility of slippage. Tighten down the housing clamp. Run the cable through the cable clamp. Pull out all the slack and tighten the cable clamp. Turn out the airscrew on the carburetor until the slide touches the bottom. Check that the slide is at the bottom of the carburetor with the control arm back and the adjuster on top of the carburetor halfway out. Slide the cable stop (TC13) onto the end of the cable and swage it as close to the cable clamp as possible. Cut the end of the cable as close as possible to the cable stop. Check the slide and throttle lever for full smooth travel, and tighten the nylock at the bottom of the control arm so that the arm is not pulled back by the spring.

PULL STARTER

13. Swage the short 1/16" cable (PS2) which connects the pulley (PS1) to the tang (PS5) as in drawing III#8.

14. Pull out some rope from the pull starter, tie a slip knot about 3' from the end (to stop the rope from retracting) and remove the handle. Run the rope through the pulley and reattach the handle. Untie the slip knot and let the rope retract.



DRAWING III.8.

III D — ENGINE INSTALLATION

NOTES

In this section you will bolt the engine to the mount plate and attach the reduction system and the prop.

1. Attach the engine to the engine mount plate with four 7/16" bolts (PP12). Use lock washers (PP14) and flat washers (PP15) on the rear bolts and lock washers and muffler brackets (PP16) on the front bolts. Tighten the rear bolts to 40 ft./lbs.; leave the front ones finger tight, you will tighten them after fitting the muffler. Attach the carburetor mounting flange (PP9) to the intake manifold with the existing nuts and washers. Tighten them. See drawing III#9.

480 in/lbs

(SEE FOLD-OUT NEXT PAGE)

265 in/lbs

2. Bolt the remote mount plate (PP7) (with washers on both sides) to the engine block. Tighten the bolts to 22 ft. lbs.

3. Bolt the driver pulley (PP6) onto the shaft of the engine with the star washer (PP13) under the head of the bolt. You will torque it down later.

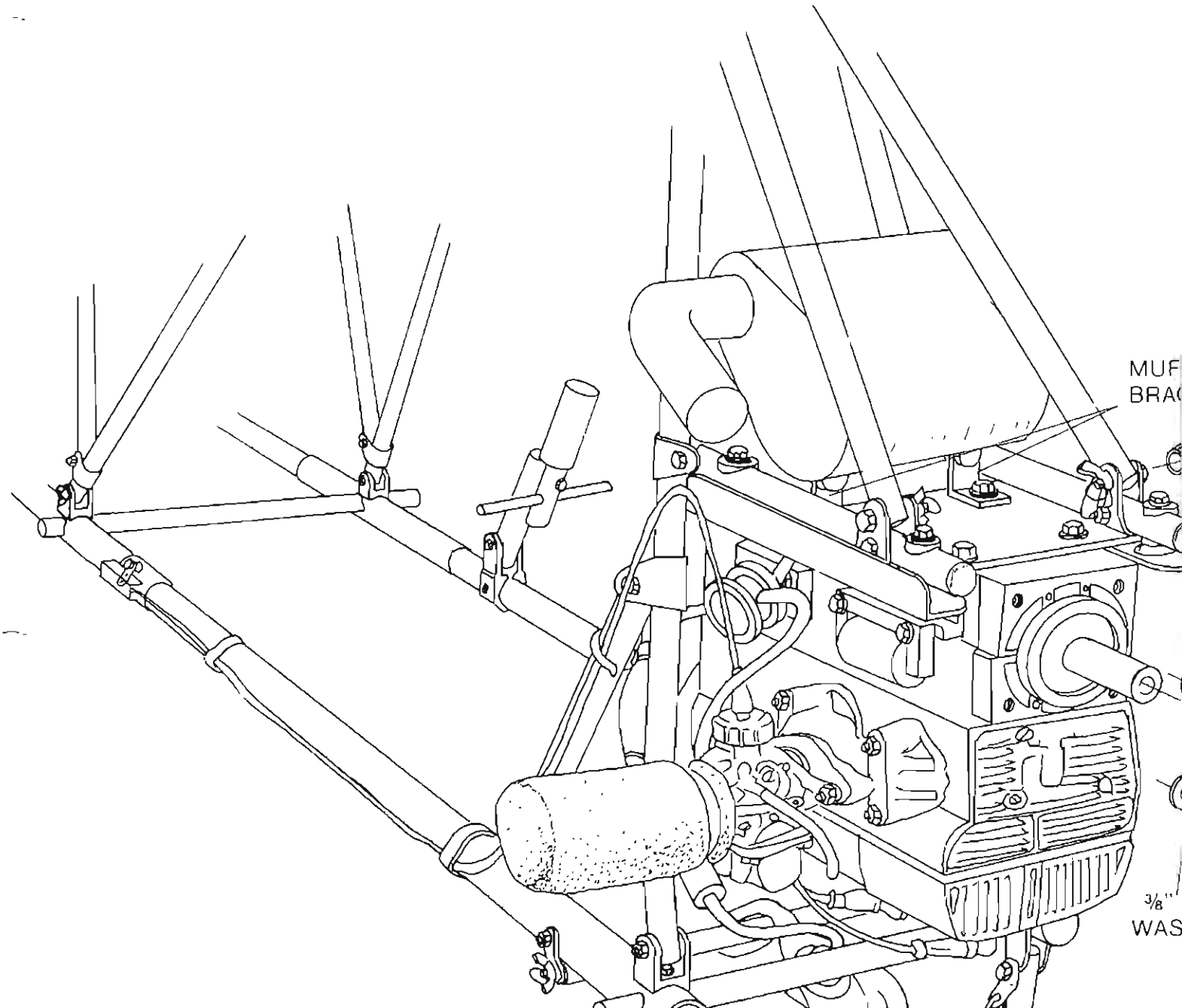
4. Slide the adjustment cam (PP25) onto the shaft of the driven pulley, shaft and bearing assembly (PP5), flush with the end of the shaft. Put this assembly into the hole in the remote mount plate. This should be impossible until you insert the blade of a rather stout screwdriver (or chisel or wedge) into the slot at the top of the plate and give it a decent whack with a rubber mallet to spread the plate a bit.

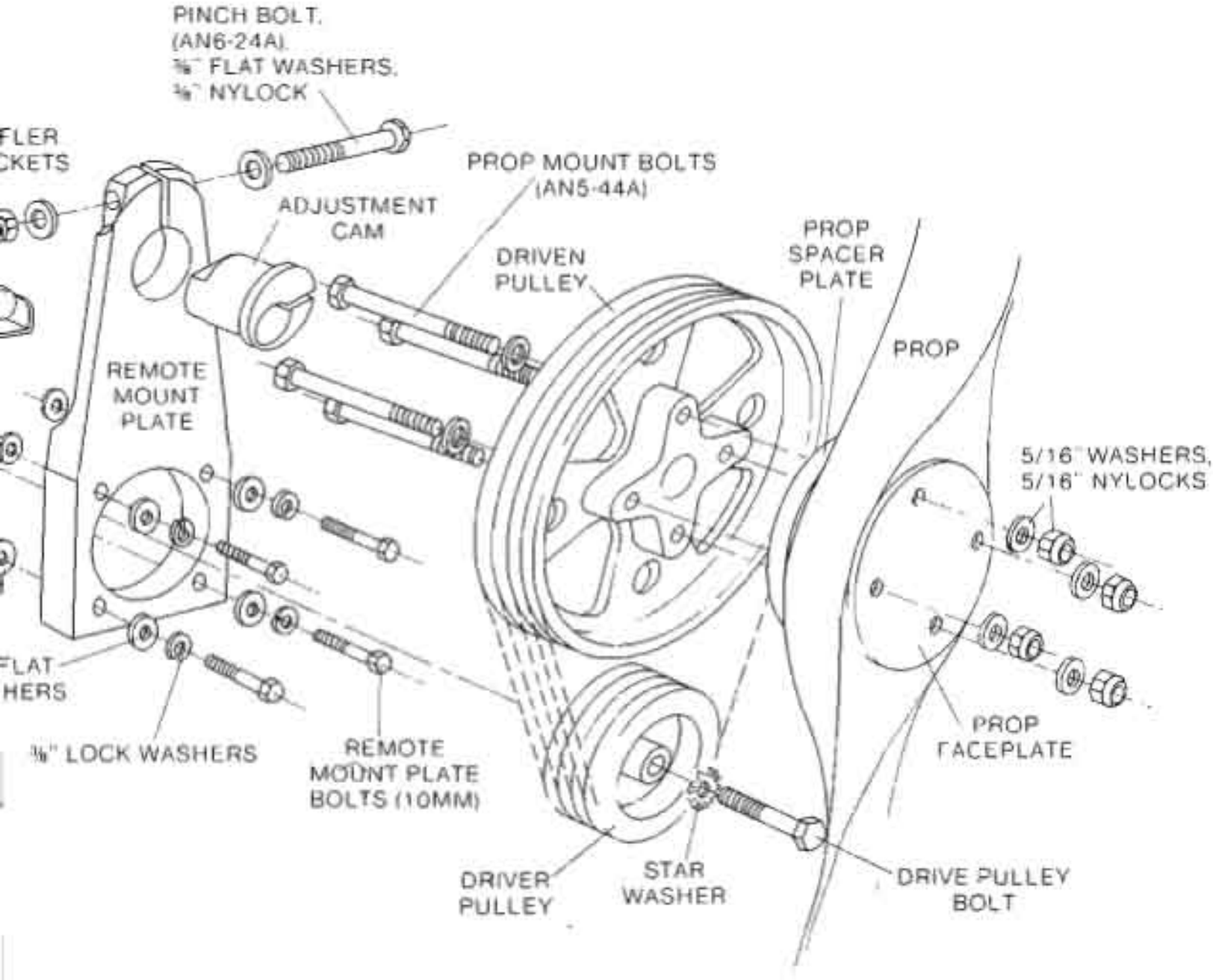
5. You will notice if you rotate the adjustment cam the two pulleys get closer together or further apart. This is how you adjust belt tension and also how you get the belts on in the first place, so now rotate the cam so the pulleys are close together and put the four drive belts (PP8) into their grooves on both pulleys. Don't use force or prybars, if you do, belt damage will result. Use your fingers and install them one at a time. Line up the manufacturers' marks on the belts so that you can check for belt slippage later.

180 in/lbs

6. Fit the prop mounting bolts (PP28) through the driven pulley from the engine side. Fit the prop spacer plate (PP24), prop (curved side of the blade forward) and faceplate (PP10). Tighten the nylocks to 15 ft. lbs., in a cross pattern a little at a time so the prop is held evenly.

7. Adjust the shaft in the adjustment cam and that assembly in the remote mount plate, so that a) the pulleys are as close to flush as you can get them (use a good straight edge to determine this) b) the belts are good and

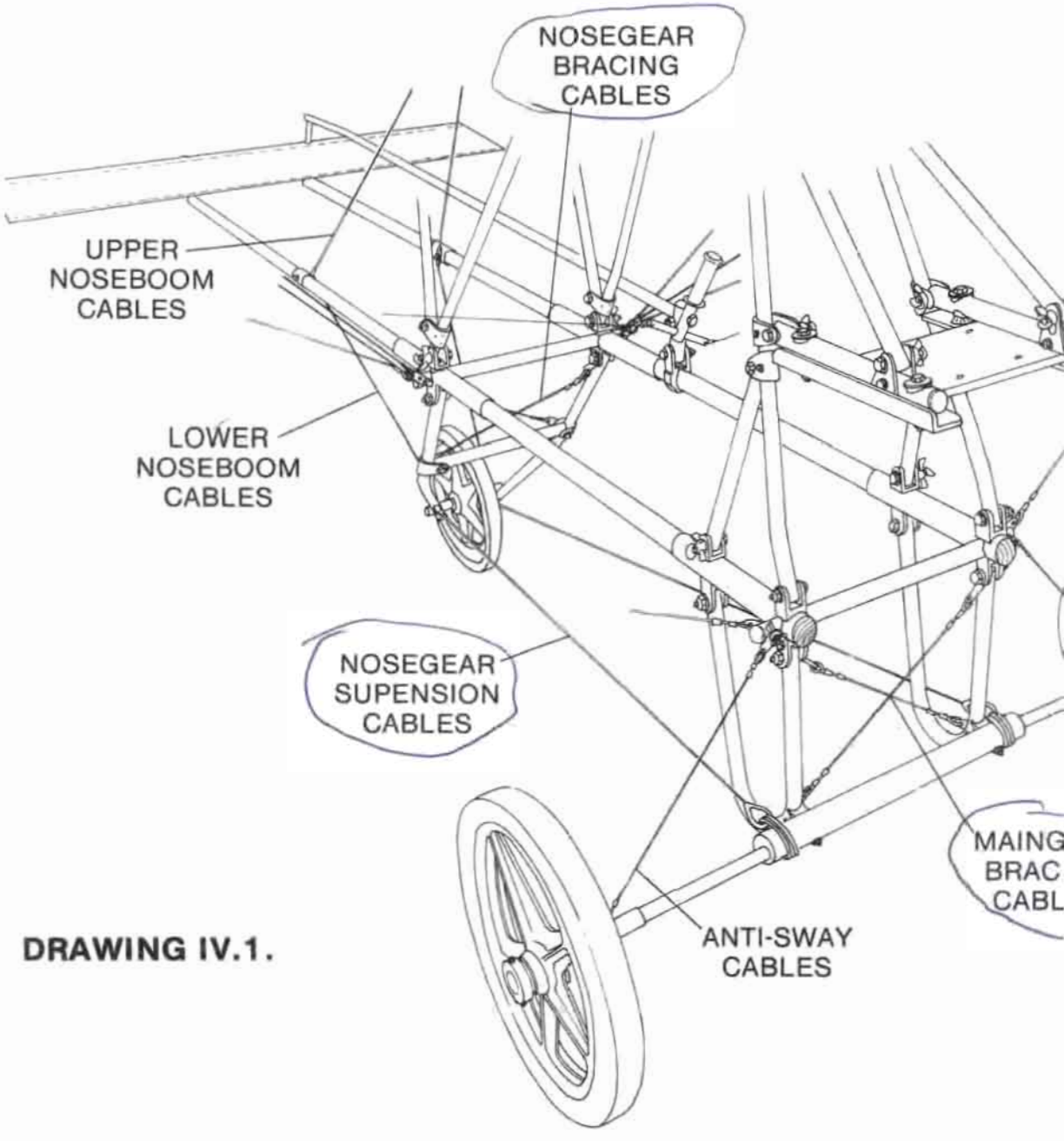

MUF
BRA
3/8"
WAS


PINCH BOLT,
(AN6-24A),
⅜" FLAT WASHERS,
⅜" NYLOCK
FLER
CKETS
PROP MOUNT BOLTS
(AN5-44A)
ADJUSTMENT
CAM
DRIVEN
PULLEY
PROP
SPACER
PLATE
PROP
REMOTE
MOUNT
PLATE
5/16" WASHERS,
5/16" NYLOCKS
FLAT
HERS
⅜" LOCK WASHERS
REMOTE
MOUNT PLATE
BOLTS (10MM)
PROP
FACEPLATE
DRIVER
PULLEY
STAR
WASHER
DRIVE PULLEY
BOLT

PTERODACTYL

SECTIO
LANDING GEAR

SECTION IV — LANDING GEAR



DRAWING IV.1.

In this section you will build the landing gear on the bottom of the hang cage.

The tools you will need are: bubble protractor, drill, 1/8", 5/32", 1/4" drill bits, half round file, heat gun, kearnys (and wrenches), wing nuts, pop riveter, swaging tool, tape measure, cable cutters, wire strippers, and two 3/8" and 7/16" wrenches. You will also need grease for the wheels.

SECTION IV — LANDING GEAR

1. Take the 32' of 3/32" coated cable (LG11) and cut off 2 pieces of 74" each and cut the remainder into six equal lengths (approx. 39" each). Take the cable from the noseboom parts (NB3), (and the thimbles (NB18), tangs (NB 5&16), swages (NB17) and heat shrink (NB19)). Cut the 18' of 1/16" cable into 4 pieces, 2 of 72" and 2 of 36". These 1/16" cables support the canard noseboons but since the lower ones attach to the front axle, it's easier to prepare them now. (Only the 74" measurement needs to be exact.)

Cut the 25" fuel line (LG18) into 8 pieces, 2 of 5" each, 4 of 3" each and 2 of 1 1/2" each.

Cut the 36" of heat shrink (LG21) into 10 pieces of 3 1/4" each and 2 of 1 3/4" each. Take the heat shrink from the noseboom parts and cut it into 8 equal pieces.

See construction notes - swaging.

Nosegear and Maingear Bracing Cables

Swage a 5" loop at one end of each of four of the 39" lengths of 3/32" coated cable using 2 swages (LG44), a thimble (LG43) and a flat tang (LG41). (The cable always goes through the large hole in the tang.) Mark and strip the coating from the other end as in drawing IV#2.

NOTES

2@ 74"
6@≈39

10@3¼
2@1¾

2@ 72"
2@ 36"

2@5"
4@3"
2@1½"

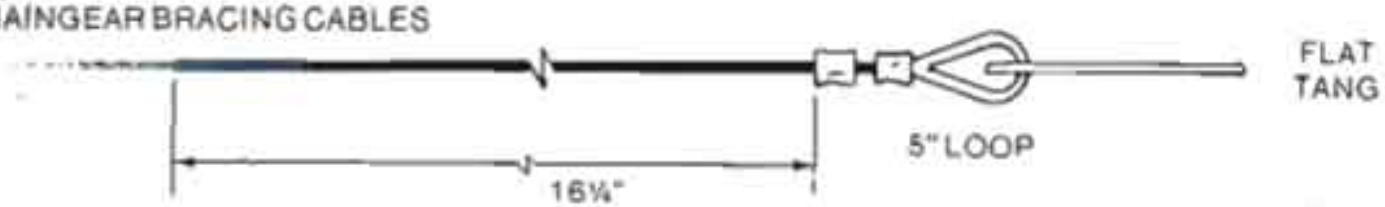
NOSEGEAR BRACING CABLES

QT 2

QT=2



MAINGEAR BRACING CABLES

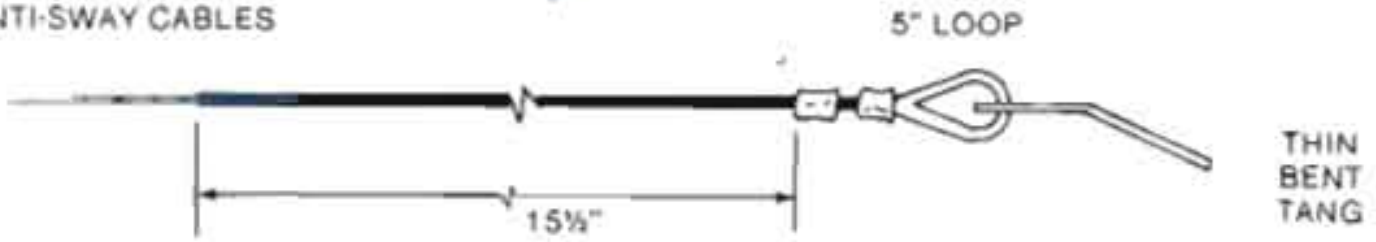


Anti-Sway Cables

Swage a 5" loop at one end of each of the other two 39" lengths of 3/32" coated cable, using 2 swages, a thimble and a thin bent tang (LG42). Mark and strip the coating from the other end as in drawing IV#2.

DRAWING IV.2.

ANTI-SWAY CABLES



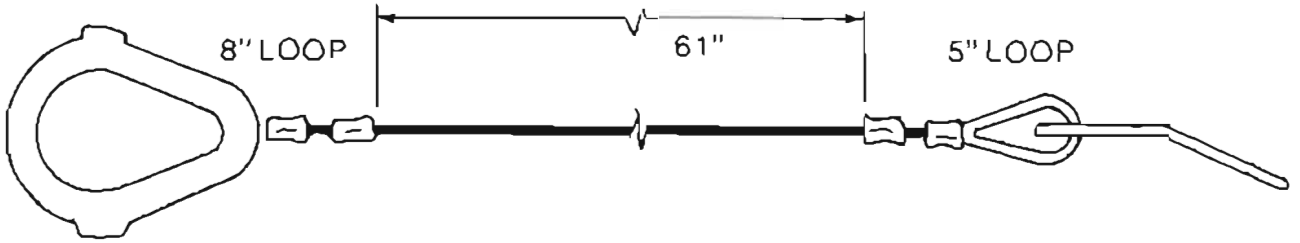
NOTES

HEAT SHRINK
2 3¼"
2 1¾"
FUEL LINE
3 1½"

Nosegear Suspension Cables

Swage a 5" loop at one end of each of the 74" lengths of 3/32" coated cable, using 2 swages, a thimble and a thin bent tang. Slide a 3 1/4" piece of heat shrink, a 1 3/4" piece of heat shrink and a 1 1/2" piece of fuel line onto the cable, in that order. Strip 8" of coating from the other end of each of these cables and thread the end through 2 swages and 5' of fuel line. Fit the fuel line around the large plastic thimble and thread the cable end back through the 2 swages. Clamp the swages as you did with the other cables, one flush to the end of the coating and one touching the thimble.

NOSEGEAR SUSPENSION CABLES

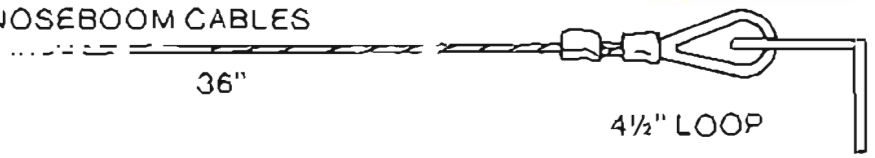


Noseboom Cables (upper and lower)

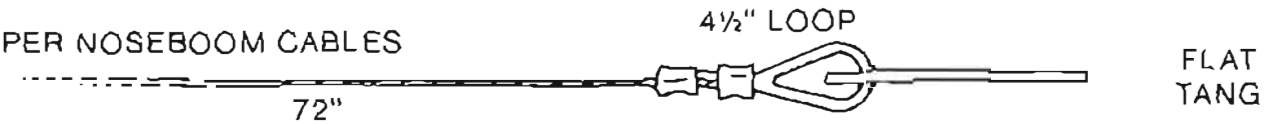
Swage a 4 1/2" loop to each of the 72" lengths of 1/16" cable with two 1/16" swages, a thimble and a flat tang each. Swage a 4 1/2" loop to each of the 36" lengths of 1/16" cable with 2 swages, a thimble and a 90 degree bent tang each.

DRAWING IV.2.

LOWER NOSEBOOM CABLES



UPPER NOSEBOOM CABLES



Heat a piece of heat shrink (from the noseboom parts) onto each of the 1/16" cables (covering both swages and half of the tang) and slide on and temporarily secure the other 4 pieces of heat shrink (e.g. with a piece of tape).

Heat a 3 1/4" piece of heat shrink onto the tangs of the anti-sway cables, then slide on and temporarily secure another piece of heat shrink to each cable.

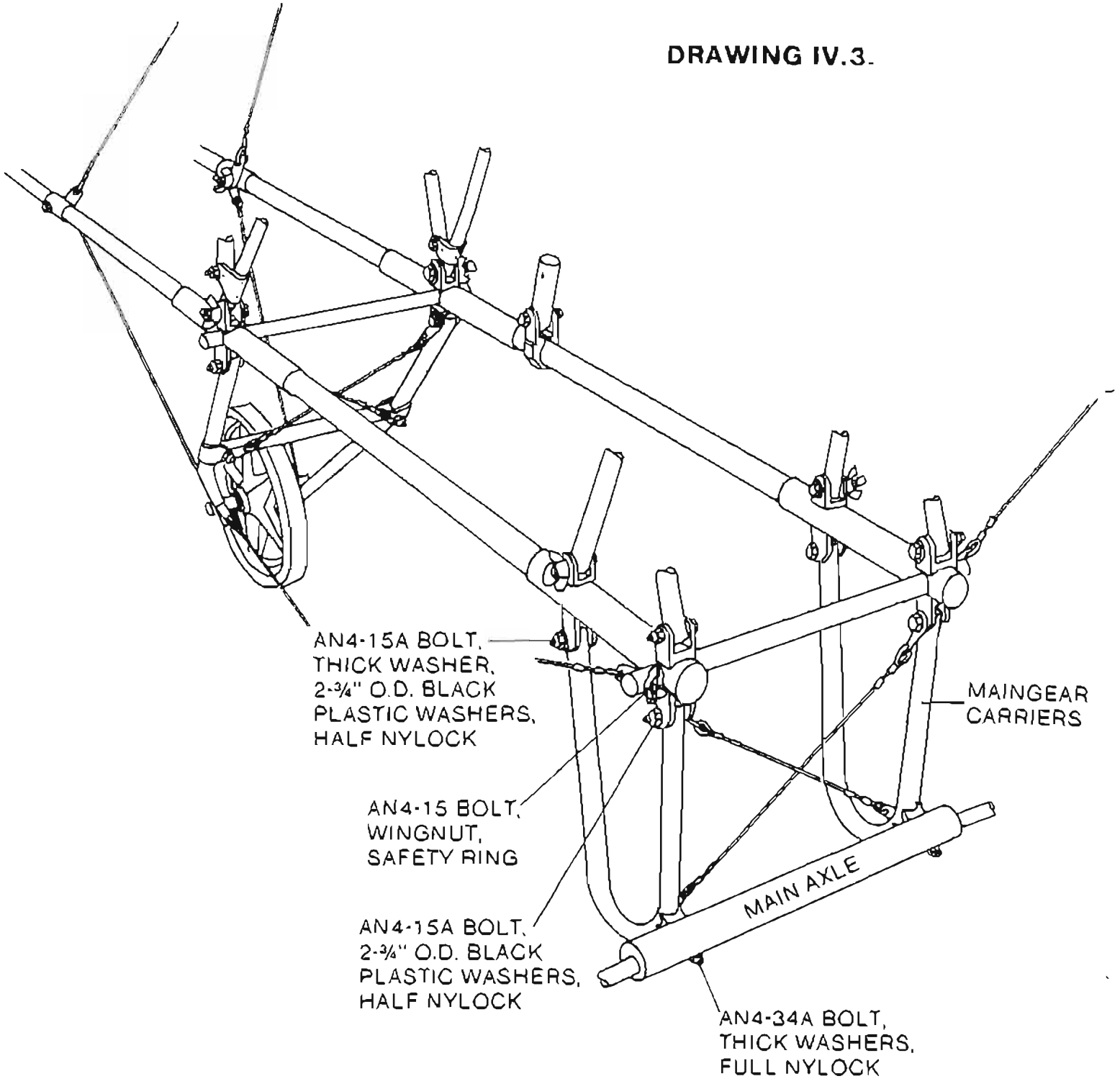
Heat the 3 1/4" pieces of heat shrink which are on the nosegear suspension cables onto the tangs.

2. Lay the inverted hang cage on the floor or a bench. Bolt the maingear carriers (L68) to the four brackets at the rear of the hang cage, with the holes in the curve to the rear. Bolt them to the forward brackets with nylocks finger tight; bolt to the rear brackets with a thin bent tang (under the head of the bolt, inside the hang cage) and a wingnut. See drawing IV#3.

NOTES

Bolt the main axle assembly to the maingear carriers with wingnuts, with the flat tangs of the maingear bracing cables under the heads of the bolts and axle brackets between the axle and carriers. Tighten the wingnuts to seat the axle brackets on the maingear carriers. Refer to drawing IV#5.

DRAWING IV.3.

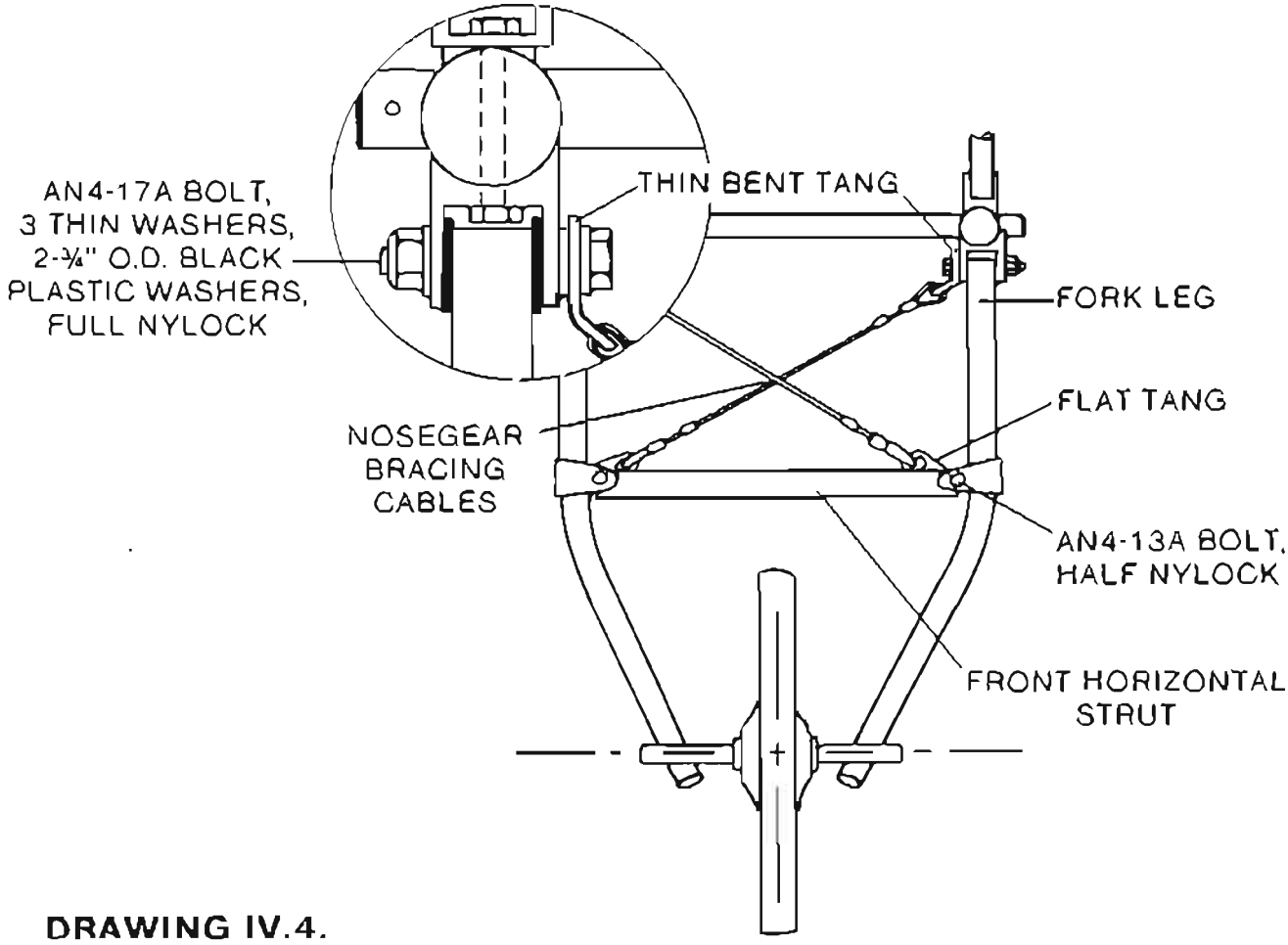


NOTES

3. Slide two 3" pieces of fuel line and two 3 1/4" pieces of heat shrink onto each cable. Connect them to the diagonally opposite thin bent tang with a kearny, two swages and a thimble. Tighten the cables and kearnys. Adjust the cables so that the carriers are square with the rear carry-through and main axle (measured with the bubble protractor).

When tightening the bracing cables (maingear and nosegear) unscrew the wingnut (on the bolt holding the thin bent tang) almost to the end of the bolt, tighten the cable and kearny, then tighten the wingnut.

4. Bolt the fork legs (LG9) to the forward brackets on the hang cage with wing nuts, with a thin bent tang and washers under the head of the bolt as in Drawing IV#4. Fold the fork legs onto the hang cage and bolt the front axle (LG14) to the top of the fork legs with wing nuts. (You will need to use 1/4" thick washers on the bolt to tighten the wing nut.) Refer to drawing IV#7.



DRAWING IV.4.

5. Measure and mark on the top side of each fork leg, 13 1/2" from the end of the tube in the bracket. Put the 1" stainless brackets (LG28) around the fork legs so that you can see the marks through the holes in the sides of the brackets. Hold the front horizontal strut (LG13) between the stainless brackets. With the brackets flush to the fork legs, mark the horizontal strut at the center of each of the 1/4" holes in the brackets. Remove the strut, drill 1/4" holes each end, centered and in line, 1/8" closer together than the marks, an equal distance from each end. Bolt the strut to the stainless brackets as in drawing IV#4 with wing nuts.

Locate the brackets at the marks and drill 1/8" holes into the fork legs through the back of the stainless brackets. Unbolt the strut, remove the brackets and clean out any burrs. Replace the brackets and strut in the same positions and secure with 1/8" stainless rivets (LG26). Drill 5/32" holes in the sides of the brackets and fit 5/32" rivets (LG27).

While you have the 5/32" bit in the drill, make a 5/32" hole in the hang tube (the one without the control stick bracket) on the outboard side, 2 1/2" behind the end of the front sleeve. You will use this hole to locate the throttle in SECTION VII B, step #9.

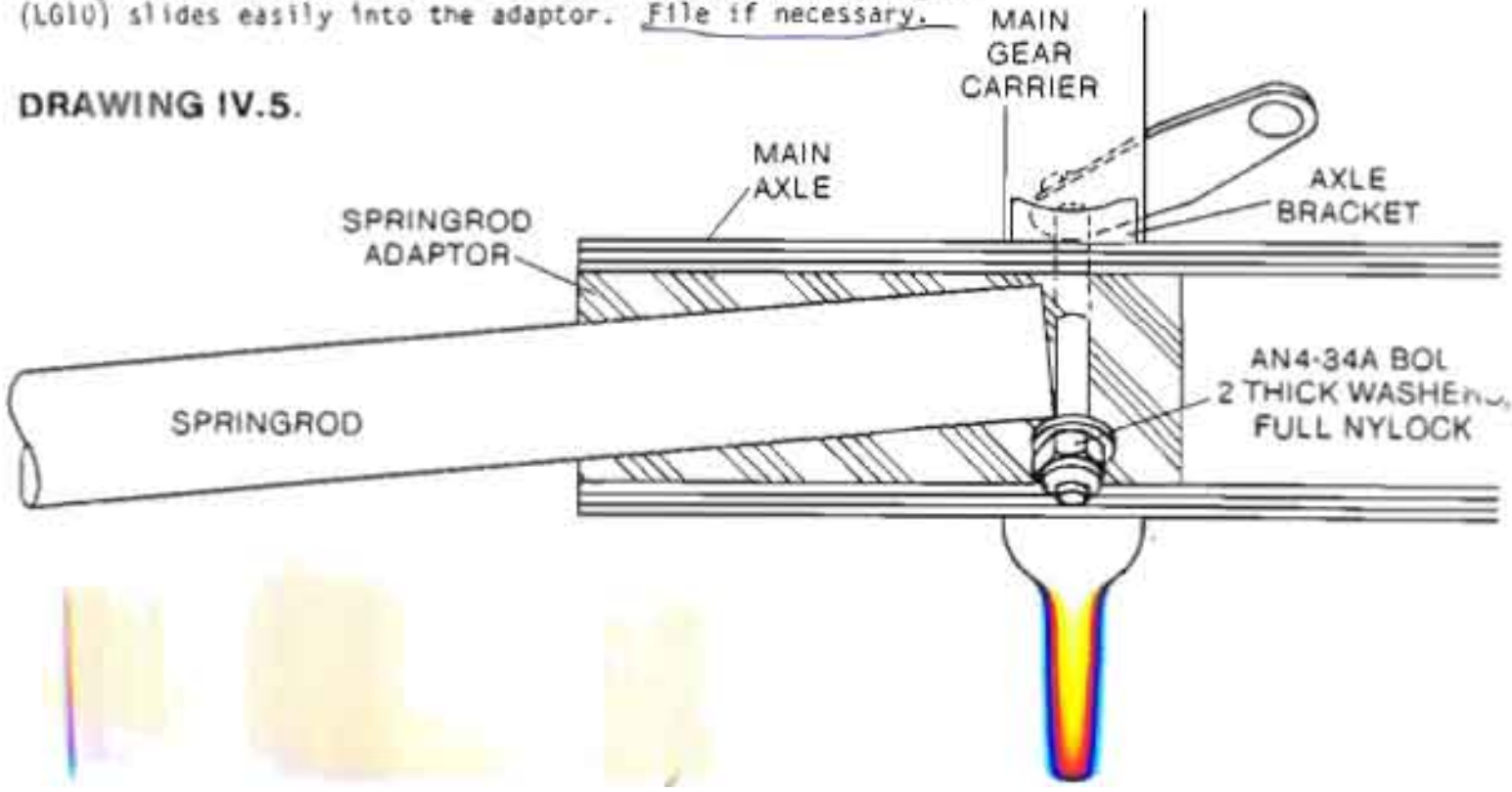
Also, while the 1/8" bit is handy, secure the plugs in the ends of the carry throughs with one 1/8" aluminum rivet each (AF60).

6. Put the flat tangs of the nosegear bracing cables onto the bolts which hold the strut with nylocks and tighten them. Attach the other ends of these cables to the bent tangs at the top of the front forks with kearnys, thimbles and swages. Adjust these cables so that the front axle is level with the rear horizontal strut when the forks are held forward at 45 degrees to the hang cage, in the position they will be in on the completed aircraft. Twist the forks to check that you have an equal amount of play either side of this level position (this play is your steering).

7. Fit the springrod adaptor (LG19) to the main axle. See drawing IV#5. First check that the adaptor slides easily into the end of the main axle and that the springrod (LG10) slides easily into the adaptor. File if necessary.

NOTES

DRAWING IV.5.



Make a mark (with indelible pen) on one end of each adaptor where the inside circumference is closest to the outside circumference. Make marks on the bottom of the main axle at the ends (remember it's upside down), and unbolt the axle from the carriers. Slide a springrod about halfway into each adaptor, slide an adaptor into each end of the main axle and line up the marks with the end of the adaptor flush with the end of the axle (both springrods point straight down, check that they are in line).

Use the existing holes in the axle as a guide to drill a 1/4" hole through each adaptor (drill one side, fit the bolt loosely, then drill from the other side). Do not drill through the springrod. Bolt the main axle (with adaptors still in place) back onto the maingear carriers. Tighten the nylocks. Remove the springrods and set them aside.

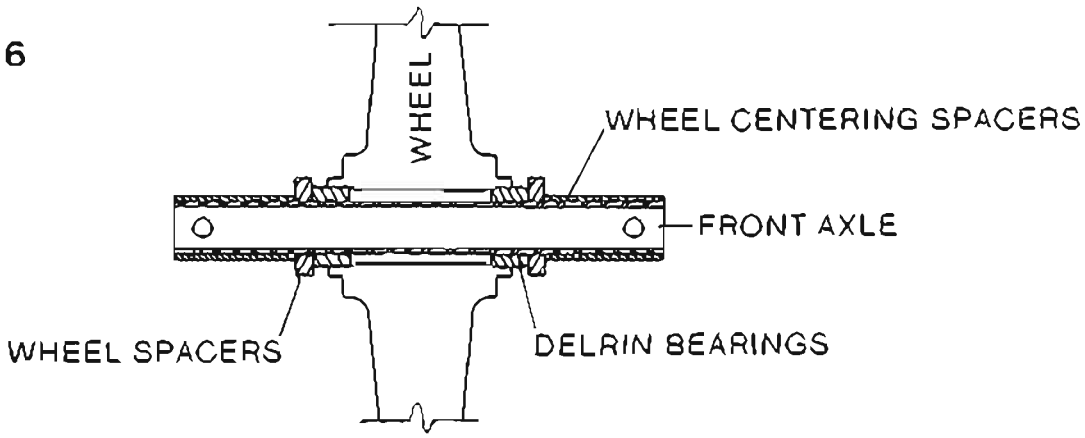
8. Remove the nosegear and maingear from the hang cage and swage the cables.

9. Mount all three tires and tubes. If you have never mounted a bicycle tire, here's how. Work one side of the tire onto the rim. Inflate the tube slightly. Put the tube into the tire and fit the valve stem through the hole in the wheel and screw on the cap. Work the other side of the tire on to the rim. It can be done without tools (but if you do have difficulty, spoon handles can be helpful). Inflate the tire to ten pounds and bounce it a bit to seat the tube and tire. Then inflate it to its full rated pressure, as written on the side of the tire and check to see that the edge of the tire is seated evenly.

Fit the delrin bearings (LG45) in each side of the wheels. (You will need to file off the burrs on each hub.) Seat them by tapping gently with a hammer. Grease the inside surface of each bearing.

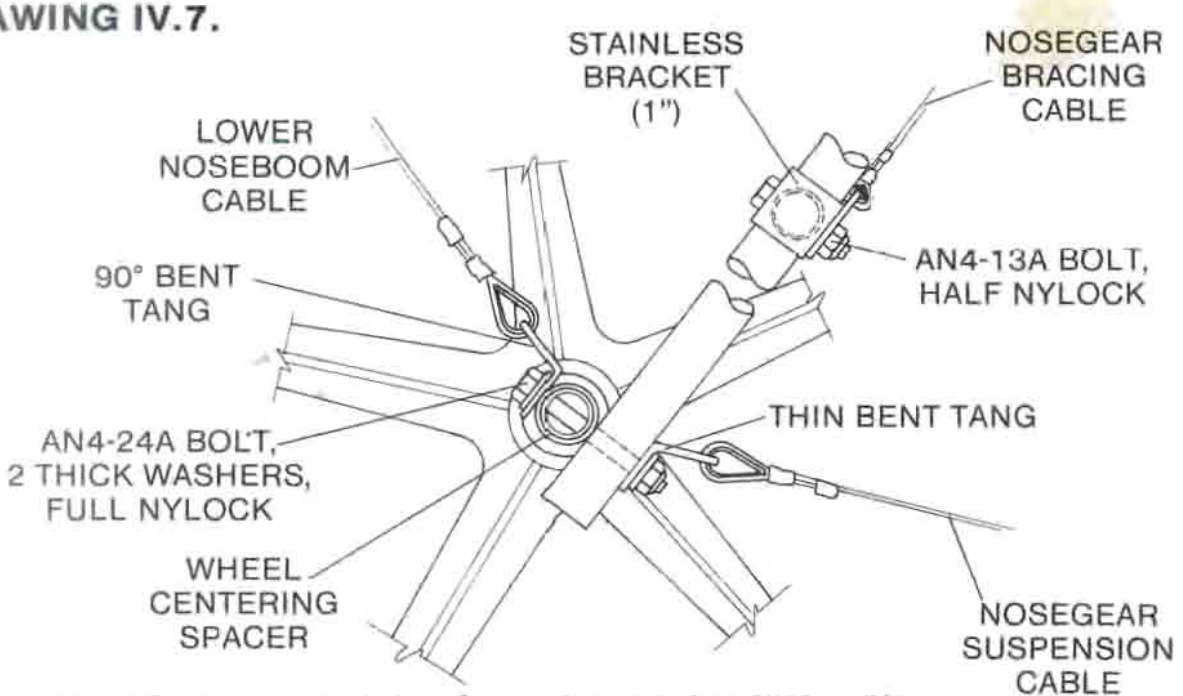
10. Remove the front axle from the fork legs and slide it through the bearings of the front wheel until the wheel is at the center of the axle. Fit a wheel spacer (LG24) and a wheel centering spacer (LG25) either side of the wheel. See drawing IV#6.

DRAWING IV.6



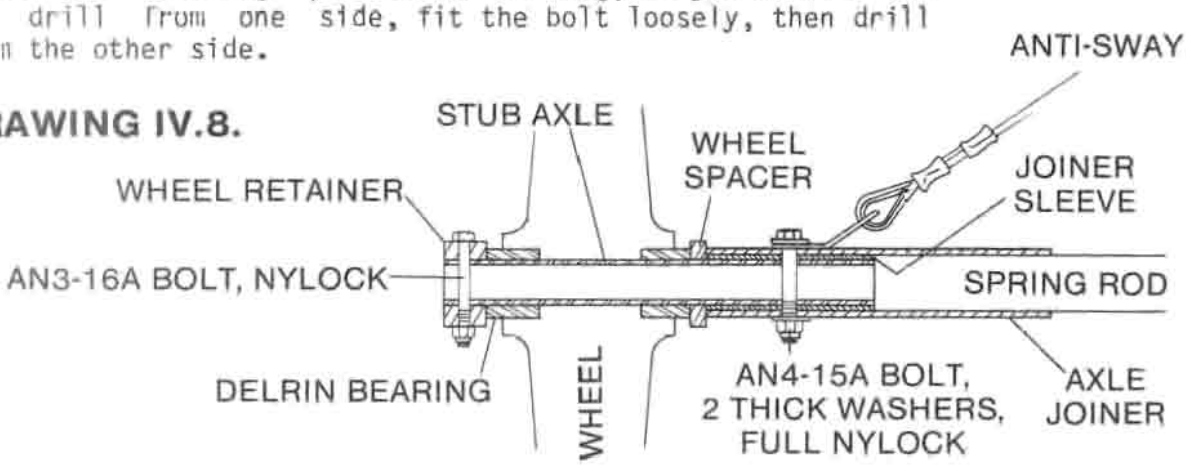
Bolt the front axle to the fork legs with the tangs of the lower noseboom cables and nosegear suspension cables on the bolts as in drawing IV#7. Tighten the nylocks.

DRAWING IV.7.



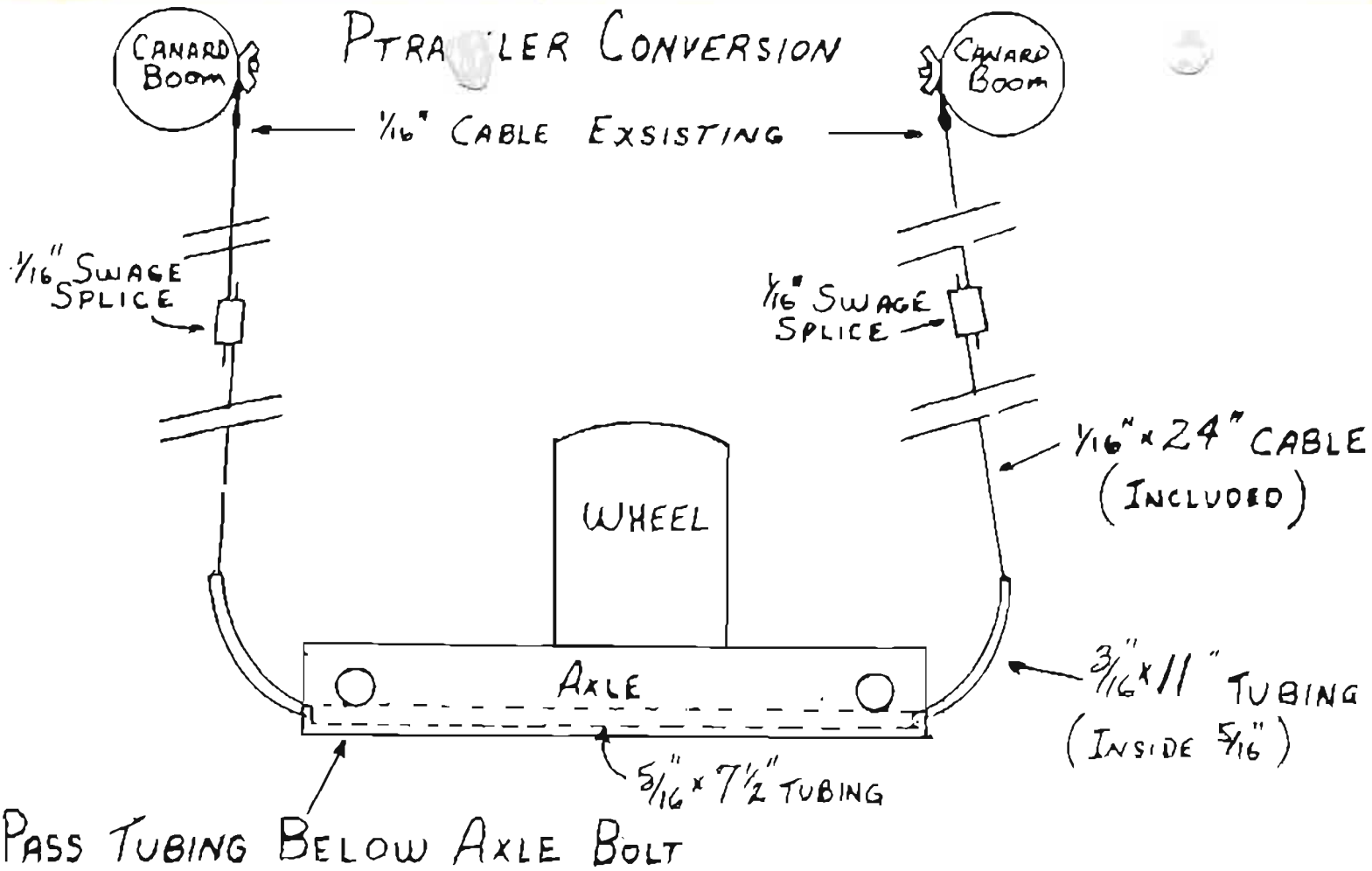
11. Assemble the rear stub axles. See drawing IV#8. Fit a wheel retainer (LG23) onto each stub axle (LG15). Drill a 3/16" hole through the center of the wheel retainer with the end of the axle flush with one side of the retainer. Remove the retainer, deburr the holes, replace and fit the bolt and nylock, finger tight. Slide the stub axle through the bearings of the rear wheel until the bearing touches the retainer. Slide a wheel spacer and joiner sleeve onto the inboard end of the stub axle with the spacer touching the bearing. The end of the sleeve should be flush with the end of the stub axle. Slide the joiner onto this assembly until it touches the spacer, with the 1/4" hole toward the wheel. Slide the springrod into the joiner to hold the joiner sleeve in place while you drill a 1/4" hole through the sleeve and stub axle (using the joiner as a guide) in line with the 3/16" bolt through the retainer. Make sure all parts are touching (as in the drawing) as you drill. You can drill from one side, fit the bolt loosely, then drill from the other side.

DRAWING IV.8.



Bolt the assembly together with the tang of the anti-sway cable under the head of the bolt. Tighten the nylock. Repeat with the other wheel and set them aside.

IF YOU DO NOT HAVE THE TIME OR SPACE TO DO SECTION V - WING COVERING, GO ON TO: SECTION VI - A, steps 1-3
SECTION VI - B, steps 1-3
SECTION VI - C, step 1


PTRAILER CONVERSION
CANARD BOOM
CANARD BOOM
1/16" CABLE EXSISTING
1/16" SWAGE SPLICE
1/16" SWAGE SPLICE
1/16" x 24" CABLE (INCLUDED)
WHEEL
AXLE
3/16" x 11" TUBING (INSIDE 5/16")
5/16" x 7 1/2" TUBING
PASS TUBING BELOW AXLE BOLT



PTERODACTYL

AIRCRAFT ORDER FORM

1. For Stock Color Wings
Enter name of stock color pattern here and do not use custom color section.

2. For Custom Color Wings
Fill in each of the six blanks with one of the thirteen colors: 1-Purple, 2-Red, 3-Orange, 4-Gold, 5-Yellow, 6-Lime, 7-Green, 8-Blue, 9-Light Blue, 10-White, 11-Black, 12-Dark Brown, 13-Light Brown. To avoid confusion, also write in the number of the color in the same blank.

A _____

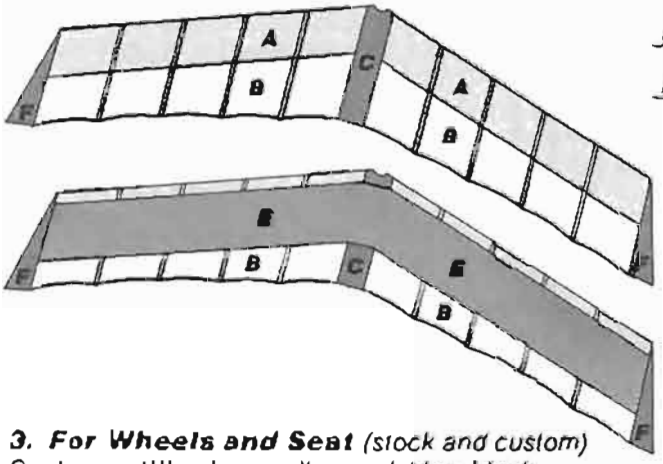
B _____

C _____

D _____

E _____

F _____



Top View of Wing



Winglet

Bottom View of Wing

3. For Wheels and Seat *(stock and custom)*
Circle one. Wheels — yellow, red, blue, black
Seat — yellow, red, blue, black.

Dealer name _____

Date _____

Pilot's Name *(please print)* _____

Address _____ **City** _____

State _____ **Zip** _____

Phone _____

Weight _____ **Age** _____

☐ **Ship surface**

☐ **Ship airfreight** _____
(nearest major airport)

Aircraft	
Accessories (list separately)	
Custom Color Fee (if applicable)	
Special Services (if applicable)	
Subtotal	
Tax	
Total	
Deposit (50% minimum)	

Shipping is COD
California residents add 6% sales tax

WARNING: *Flying is a dangerous activity and can result in injury or death even when engaged in under ideal circumstances. Pterodactyl is engaged in the manufacture and sale of ultralight flight equipment, and this equipment should only be used under proper conditions after proper instruction from an experienced flight instructor. Pterodactyl has no control over the use of this equipment, and persons using this equipment assume all risk of damage or injury. Pterodactyl disclaims any liability or responsibility for damages or injuries resulting from the use of this equipment.*

SALES CONTRACT: *All sales are final. Merchandise returns must be accompanied by written permission of Pterodactyl. Pterodactyl is not responsible for delays of shipment by carrier or for damages caused during shipment. Claims must be filed with carrier. Prices are FOB the factory in Watsonville, California. Prices and specifications may change without notice.*

Signature _____ **Date** _____

If purchaser is a minor, parent or legal guardian must sign above.

(To be filled in by dealer)

ACCESSORIES

	STOCK #	DESCRIPTION	PRICE	FACTORY USE ONLY
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
		TOTAL		

(ENTER TOTAL ACCESSORIES FRONT PAGE THIS FORM)

SHIPPING INSTRUCTIONS:

CONSIGNEE:

ADDRESS:

TOWN: STATE:

TEL: ( ) ZIP:

☐ DELIVER TO CONSIGNEE.

☐ HOLD FOR WILL CALL.

REMARKS:

☐ CASH ☐ FINANCE

TOTAL SALE PRICE	$
DOWN PAYMENT	
BALANCE DUE	
DEALER DISCOUNT	
FACTORY RETENTION	
PAYMENT DUE FACTORY	$

(IF FINANCED FILL IN BELOW)

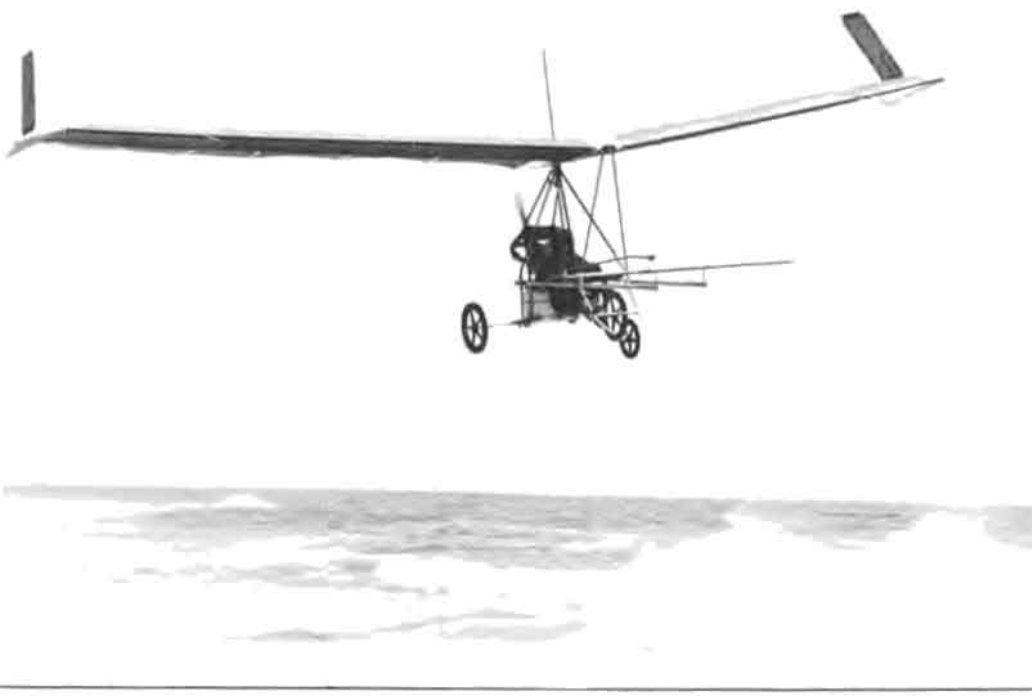
TOTAL SALE PRICE	$
DOWN PAYMENT	
BALANCE FINANCED	
INSURANCE (PLANE)	
INSURANCE (PILOT)	
MISC. CHARGES	
TOTAL BALANCE FINANCED	
TOTAL INTEREST	
FIN. CONTRACT TOTAL	$
NO. MONTHS FINANCED	
MONTHLY PAYMENT	
PAYMENT DUE FACTORY	$

FOR FACTORY USE ONLY

PLANE MODEL	$
ACCESSORIES	
TOTAL COST	
PAYMENT RECEIVED	
BALANCE DUE	

INSTRUCTIONS TO ACCOUNTING:

SECTION V — WING COVERING



In this section you will slide the wing covering onto the inverted airframe, spread the wings, tension the wing covering, fit the rigging, attach the struts and hang cage, turn the aircraft over and attach the hang cage centering cables and landing gear.

To turn the aircraft over, you will need lots of room and a minimum of two assistants. If you have to do this outside don't attempt it if it's windy. Try to complete this stage on carpet or lawn as concrete tends to scuff the wing covering. Keep your hands clean to keep the wing covering clean.

One important note: The wing is going to be upside down for a lot of this stage. To avoid confusion, we use 'top' and 'bottom' to mean top and bottom on the completed aircraft.

The tools you will need are: two sawhorses, two supports (eg. cardboard boxes) 20"-24" shorter than the sawhorses, drill, 1/8", 5/32", 3/16" and 1/4" drill bits, 'crazy glue' or any other brand of cyanoacrylate, phillips screwdriver, heat gun, hot knife, pencil, tape measure, kearnys (and wrenches), pop riveter, swaging tool, wire cutters, wire strippers and two 3/8" and 7/16" wrenches.

NOTES

1. Cover the tops of two sawhorses with towels or pieces of rug. Set the sawhorses about 12' apart and lay your folded airframe upside down across them. Check that the floor around the wingtips is clean.

2. Glue 1/4" nut covers (WC14) to: (a) the nylocks on the bolts holding the rear compression strut brackets to the spars; (b) the heads and nuts of the bolts holding the compression struts in their brackets and; (c) the heads and nuts of the bolts holding the spars to the keel. Glue 3/16" nut covers (WC15) to the heads and nuts of the bolts holding the kingpost bracket and rear spar bracket to the keel. Check all nylocks before covering.

3. Unfold the wing covering and open the velcro at the center. With the airframe and wing covering upside down, pull the wing covering onto the spars. The spars enter the wing covering through the center opening. The rear spar does not go into the pocket at the trailing edge, both spars go into the large opening. See photos V-A, and V-B.



V-A



V-B

NOTES

4. Slide the wing covering along the spars towards the keel. At the wingtips, pull the wing covering past the wingtips so that the spar ends are exposed. The front spar comes through an opening at the leading edge. The rear spar comes through an opening about 2/3 of the way back toward the trailing edge. See photos V-C, V-D and V-E.



V-C

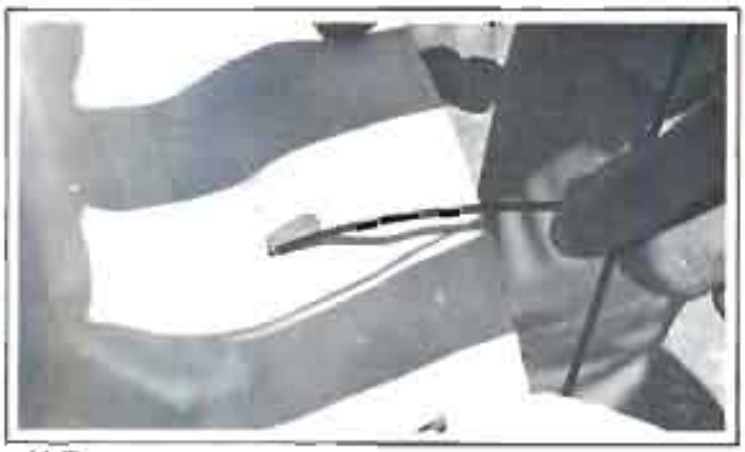


V-D



V-E

5. The king post, keel and the cable from the top nose plate have openings cut for them in the wing covering. The kingpost goes through the square hole, the keel goes through the long oval hole, and the cable through a small oval hole in the front. See photos V-F and V-G.



V-F



V-G

NOTES

6. Spread the wingtips a little and support them on the boxes, move the sawhorse which was supporting them up to support the back of the keel and tie the keel to the sawhorse to keep it from falling off. Spread the wings fully, pull the noseplate forward and insert the dip pin. (If this is difficult, check that the sweep wires are not tangled.) Tie the nose plate to the sawhorse. (If you have to move the aircraft around at this stage, make sure the wingtips don't fall off the boxes, as this would damage the spars.) See photos V-H, V-I, V-J, V-K and V-L.



V-H



V-I



V-J



V-K



V-L

NOTES

7. Attach the wing covering together at the center with Velcro and the sail straps. The sail straps should be tight enough to share the strain with the Velcro when the wing covering is pulled towards the wingtips. See photos V-M and V-N.



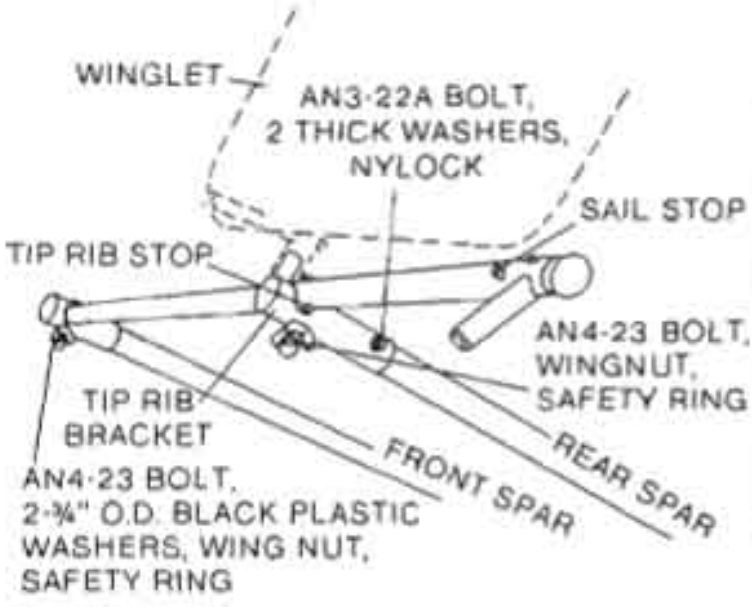
V-M



V-N

8. Before fitting them to the aircraft, bolt the right hand tip rib bracket (WC6) to the right hand tip rib (WC4). Mark and drill a 5/32" hole on the tip rib, in line with the bolt holding the bracket, behind the tip rib bracket so that the tip rib stop (WC11) will touch the bracket. Secure the stop with a long 5/32" rivet (WC13). Repeat with the left tip rib (WC3) and bracket (WC5). See drawing V#1. Unbolt them. See photo V-O.

DRAWING V.1.



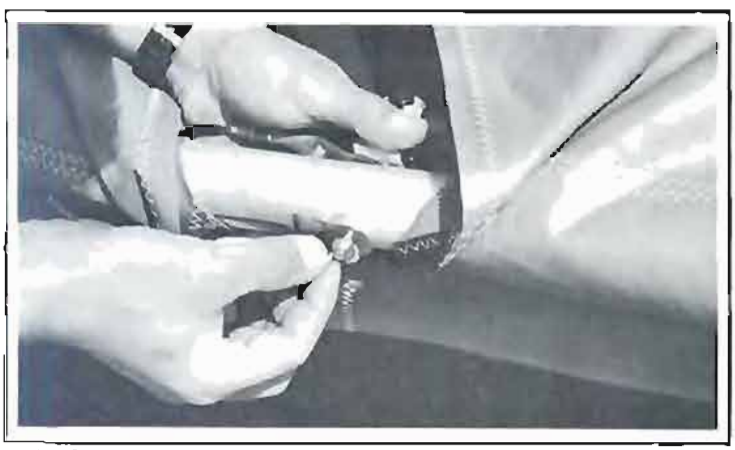


V-O

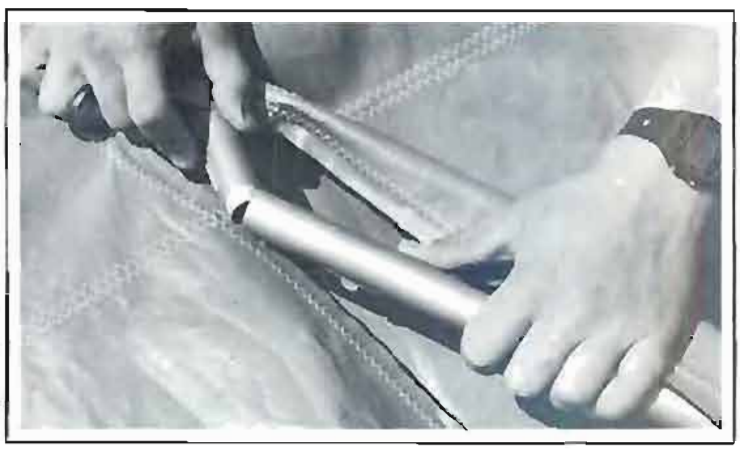
NOTES

9. Fit one of the spacer tubes (WC7) inside each tip rib bracket and slide these brackets onto the rear spars, with the slots facing the top of the wing.

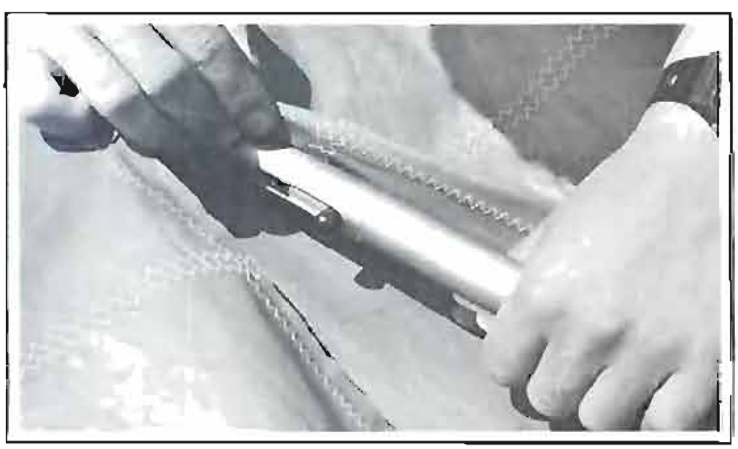
10. Spread the ends of the spars apart. At the leading edge, reach inside the zippers and remove the saddle and wing nut from each of the front compression strut bolts. Push the bolts into the spar so that the front end of the bolt is flush with the front of the spar. Join the front compression struts to the rear compression struts. At the front, the head of the bolt will be inside the front compression strut which will make it difficult to connect the front and the rear, but persevere. Thread a piece of twine or the tie which is wrapped around the ribs through the grommets at the tips of the front spars. This will be used later to pull the wing covering tight along the front spar. See photos V-P, V-Q and V-R.



V-P



V-Q

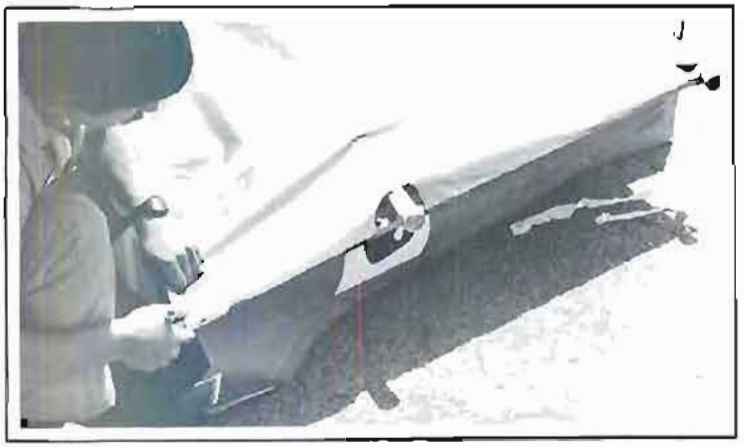


V-R

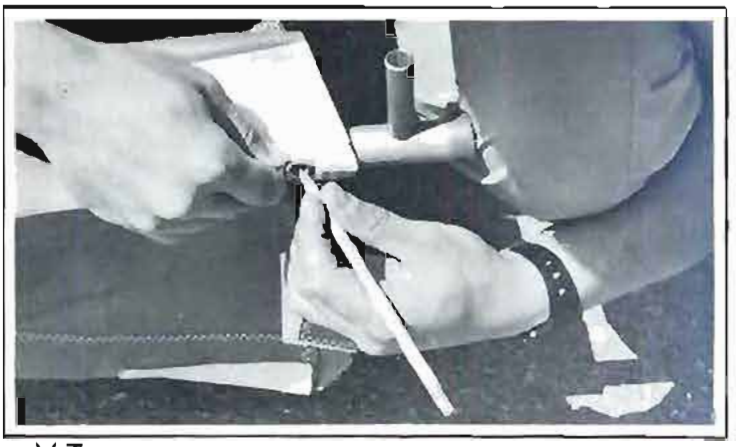
11. Slide the tip ribs into the wing covering from the back, over the top side of the tip rib bracket and rear spar, back into the wing covering and into the 1 1/8" hole in the back of the front spar. Check that the tube at the back of the tip rib (the socket for the droop tip) is pointing down and out. To determine the position of the sail stop on the tip rib, pull the wing covering back along the tip rib, with the tip rib at 90 degrees to the front spar. Holding the wing covering at the grommet with one hand and pushing the grommet towards the back of the tip rib, mark the tip rib through the center of the grommet with the other hand, while supporting the back end of the tip

rib. Slide the wing covering back, drill a 1/8" hole at the mark in line with the nylock of the bolt which holds the winglet plug further down the tip rib. Secure the sail stop (WC10) with a long 1/8" rivet (WC12). Repeat on the other side. Replace the tip ribs, fitting the grommets over the stops by pulling the wing covering tight as you did to make the mark. See photos V-S, V-T and V-U.

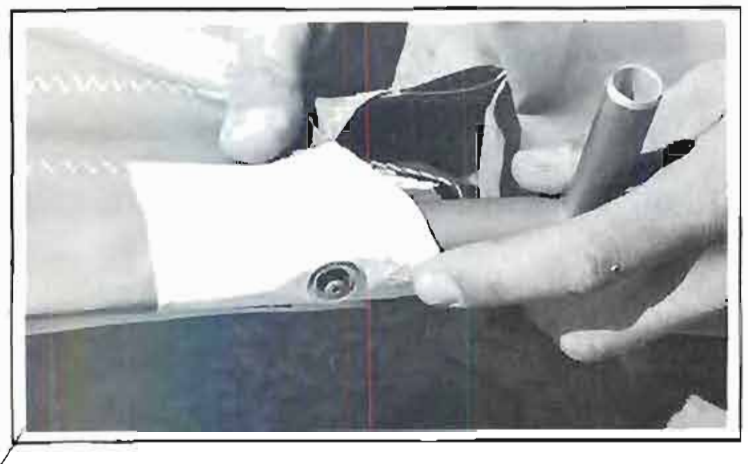
NOTES



V-S

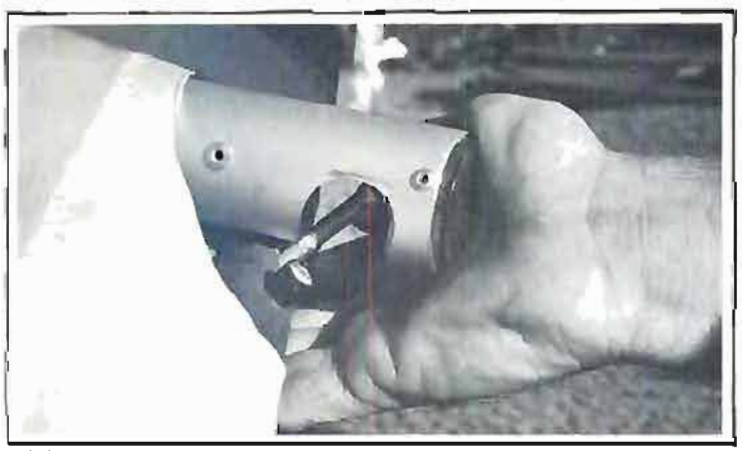


V-T



V-U

12. Bolt the tip rib into the slot in the tip rib bracket. This will be difficult but becomes easier with practice. Using the droop tip post for leverage, put the end of the bolt into the notch in the side of the slot, and roll the tip rib into the slot. Make sure the tip rib stop is behind the bracket. Pull the bolt part way out, rotate the rib, holding it down into the slot, until the bolt goes through the hole in the bracket, fit a wing nut and tighten by hand until the rib is seated in the slot. (If you have to use a wrench, be careful not to overtighten.) See photos V-V, V-W, V-X and V-Y. Also see FIELD ASSEMBLY.



V-V



V-W



V-X



V-Y

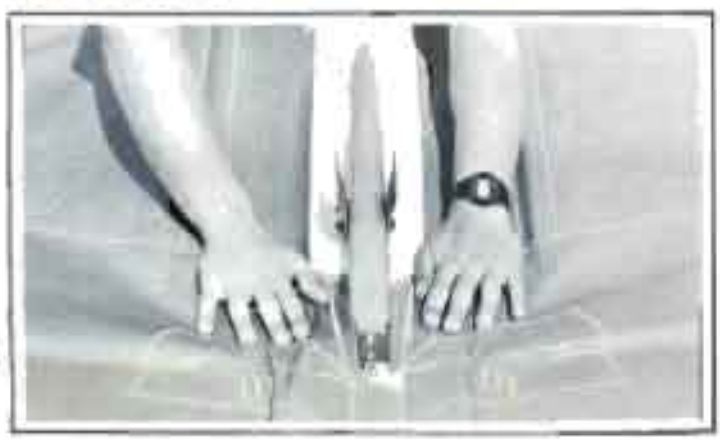
13. Identify and check the ribs using the rib drawing (WC8). Slide them into their pockets from the trailing edge. Rib #1 is next to the keel, #2 is the next outboard, etc. (If #1 is difficult to fit over the rear spar, fit #2 and #3 and then go back to #1.) The inboard reflex ribs go outboard of the straight ribs and the reflex ribs are the furthest outboard. See photo V-Z.



V-Z

14. Center the wing covering on the airframe (checking at the noseplate and kingpost) using tip rib and rib installation to pull the wing covering from side to side. With the ribs in place, mark through the grommet at the outboard end of the front spar. (while pulling the wing covering smooth along the front spar with the tie from step #10) on the outboard side of the hole. Pull the grommet clear (towards the end of the spar) while you drill a 5/32" hole in the front spar (at the mark) and install a self tapping screw (WC16) through the grommet. Repeat on the other side. Likewise, drill a 1/8" hole and install another screw in the keel through the grommet at the trailing edge, pulling the wing covering tight. See photos V-AA, V-BB, V-CC and V-DD.

V-BB

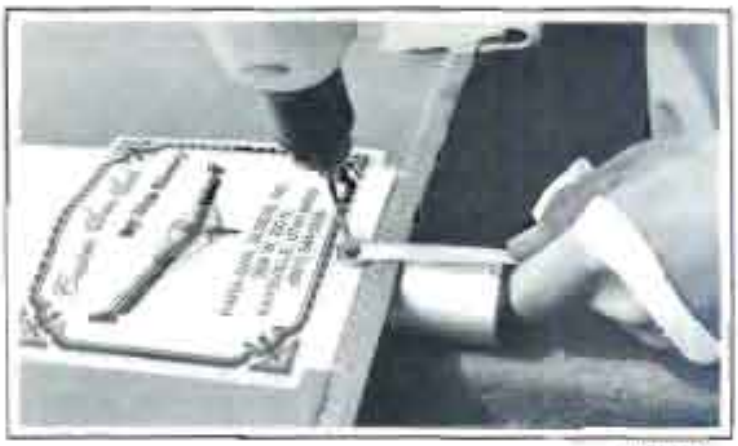


V-AA





V-CC



V-DD

NOTES

15. Plug in your hot knife. While it's heating up, go around the wing and find all the places where the rigging mounting bolts are going to go through the wing covering. There are two on each front spar (at the compression strut brackets) and four on each rear spar (two on top, two on the bottom). If you can't feel the holes in the tube, use a pin to locate them, and mark them with a pencil.

16. Use the hot knife to open the holes for the bolts on the front spar, just large enough for each bolt. Do be very careful, a slip with the hot knife can spoil your day. Disconnect the front compression strut, push the bolt through the front spar and fit the saddle and wing nut which were set aside in step #10. Connect the compression struts. See photo V-EE.



V-EE

17. Cut the holes in the wing covering for the rear rigging mounting bolts. Place the point of the hot knife into the bolt hole and turn it slowly, holding the wing covering onto the spar. This will give you a precise cut. Double check that you know where the hole in the spar is before using the hot knife. See photos V-FF and V-GG.

NOTES



V-FF



V-GG

18. Attach the rigging to the airframe, using full nylock nuts, finger tight. Fit the inboard top rigging first, then the outboard top rigging, then the bottom rigging. Fit large plastic washers (WC19) between the tangs and the wing covering on the rear spar. Refer to drawings II#12 and II#17. Fit the thin bent tangs of the hang cage centering cables (prepared in Section II, step 21) onto the bolts which hold the inboard rear bottom cables, after the thick bent tangs, before the nylocks. Refer to drawing II#18.

19. Get your assistants (minimum of two) to help you turn the wing over. Bolt the main and rear struts to the kingpost bracket, tighten the nylocks, bolt the hang cage to the struts and bolt the front struts to the noseplate. Have one assistant steady the hang cage. Put the cable from the noseplate into the kingpost top, then both the inboard and the outboard top rigging, and secure them with the kingpost cap. Fit the kingpost top into the kingpost. Check that the rigging is not tangled (top and bottom). Untie the wing from the sawhorses and move them out of the way, with your assistants steadying the tips and keeping the top rigging snug. Lower the noseplate to the ground, raise the back of the keel, then the kingpost, until the front of the hang cage is on the ground. Your assistants at the wingtips must keep the top rigging snug to avoid damaging the spars and brackets as you move the wing. Pull the back of the hang cage down until is is flat on the floor. Bolt the tangs of the bottom rigging to the front carry-through with your assistants pulling down on the compression struts. Tighten the nylocks on the carry-through and the rigging bolts. Pause to admire your handiwork.

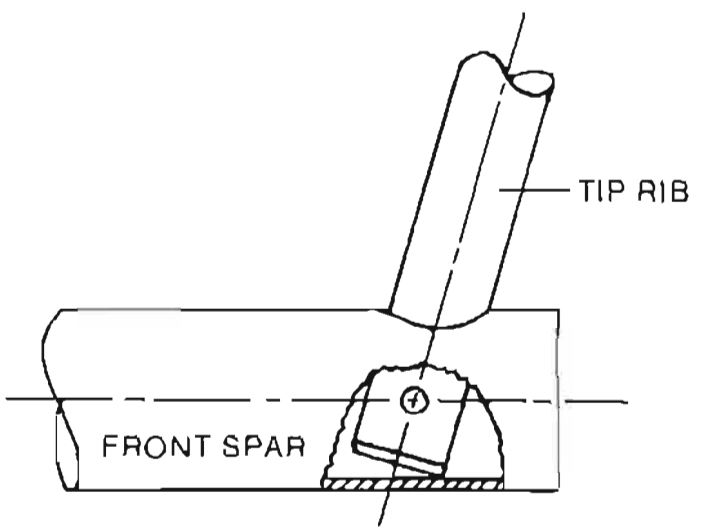
Slide the top tensioners down until the bottom rigging is tight. You'll note that due to the weight of the wing

covering they have to slide down a bit farther than they did when you were building the airframe.

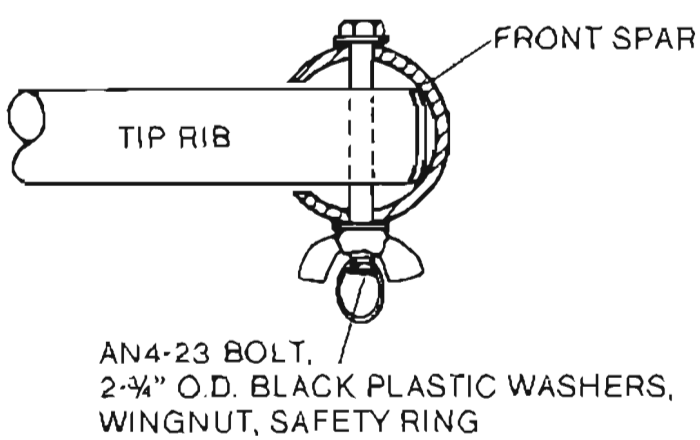
NOTES

20. Mark the position of the tip rib brackets on the rear spar, after checking (with your bubble protractor held against the bottom of the tip rib) that the washout is equal on both sides. You can move the tip ribs and their brackets around on the rear spars to equalize both sides. Take some stiff wire and wrap it around a short pencil to make a handle at 90 degrees to the pencil. Reach in and mark the rear spar through the holes in each side of the tip rib bracket (repeat on the other side). Remove the tip rib and reflex ribs, slide the wing covering back and drill a 3/16" hole through the spar at the marks, using the holes in the bracket as a guide. Bolt the bracket to the spar. Refer to drawing V#1 and VI#6. Tighten the nylock. Glue a 3/16" nut cover to the head and nylock. Repeat on the other side.

21. Remove the screw which holds the wing covering to the leading edge. Slide the wing covering back along the spars so that you can fit the tip rib to the bare spars. Mark on the top and bottom of the front spar points on a line which bisects both the tip rib and front spar. See drawing V#2. Drill a 3/16" hole through the top of the spar and the top of the tip rib. Drill another 3/16" hole from the bottom through the spar and tip rib. Run the drill bit through all four holes to enlarge them slightly and line them up. Drill through this straight hole with a 1/4" bit. Remove the tip rib. Slide the wing covering back and replace the screw. Repeat on the other side.



DRAWING V.2.



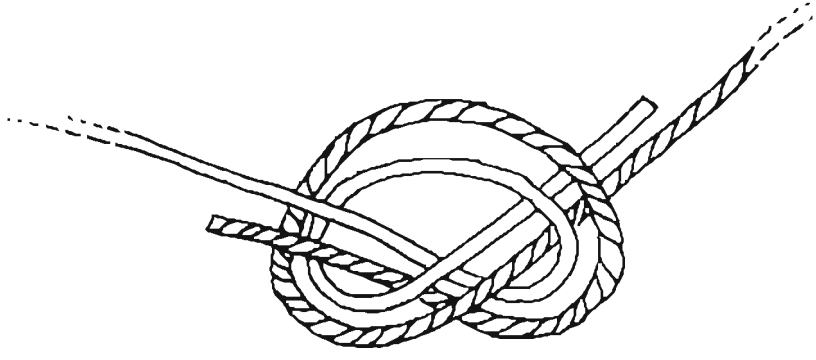
NOTES

22. Fit the droop tip to the tip rib. Slide both into the wing covering and bolt the tip rib in place. The front of the droop tip goes underneath the front spar. Fit the reflex ribs. Use your hot knife to make holes in the wing cover so that you can fit the bolt throught the front spar and tip rib.

23. Bolt a flat tang (RG4) to the front of each rear carry-through. Attach the hang cage centering cables (which are already bolted to the rear spars) to these tangs using a kearny, two swages and a thimble, after sliding on the heat shrink. Refer to drawing IV#3, IV#1 and II#18. Adjust the length of these cables until both are equal length and have slightly less tension than the bottom rigging. Unbolt the cables, clamp the swages, heat on the shrink tubing and replace them. The purpose of these cables is to keep the hang cage lined up with the rest of the aircraft. If they are too tight they will change the washout.

24. Bolt the landing gear to the hang cage. Tighten the nylocks. Refer to drawings IV#4 and IV#5. Swing the nosegear under the hang cage. Tie the shock cord (LG12) in three loops through the plastic thimble of the nosegear suspension cable, with the knot shown in drawing V#3. Repeat on the other side. Work these loops onto the ends of the main axle as in drawing IV#1.

25. With the nose wheel folded back and under, support the back of the hang cage high enough to install the rear wheels and spring rods. Fit them. Lift the front of the hang cage, fold out the nosegear, and adjust the loops of shock cord (by moving the knot) until the hang tubes are level with the ground when you sit with all of your weight on the front carry-through.

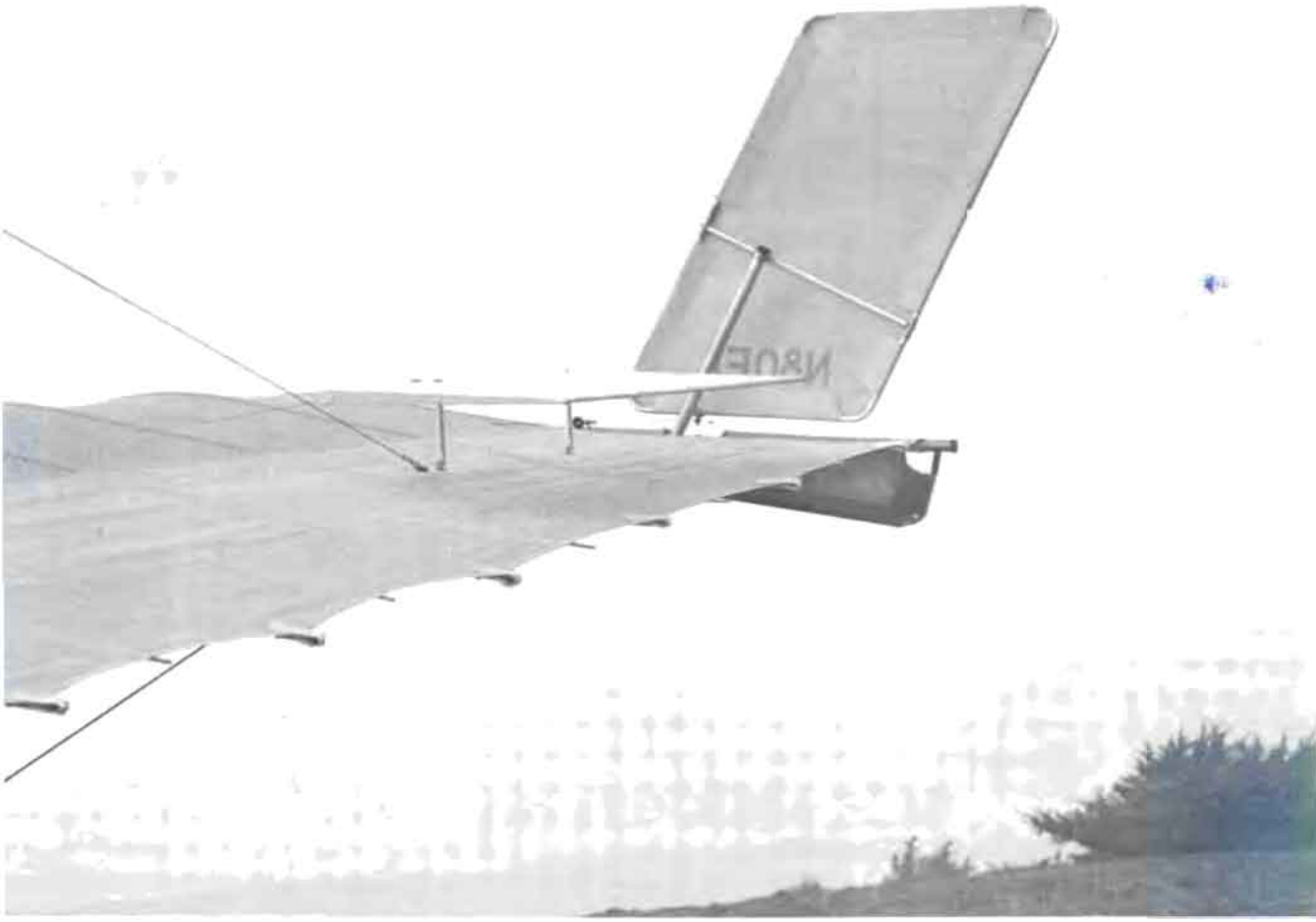


PTERODACTYL

SECTION VI
CONTROLS

VI

SPOILERON KIT



SECTION A — SPOILERONS
SECTION B — SPOILERON MOUNTING
SECTION C — PEDALS
SECTION D — CONTROL CABLES

To fit the spoilerons to the II+, you will first build the spoilerons (A) and mount them on the rear spar (B). Next you will assemble and mount the pedals (C) then fit the pulleys and connect the control cables (D).

The tools you will need are: cable cutters, drill, 1/8", 5/32" 3/16" and 1/4" drill bits, fine file, hacksaw or tube cutter, hot knife, iron, pop riveter, scissors, screwdriver, small kearnys (and wrenches), Superglue, swaging tool, tape measure, 3/8" and 7/16" wrenches and 1/4" or 1/2" (for glue) and 2" or 3" (for POLY-BRUSH) natural hair brushes. You will also need approximately one quart of acetone or MEK.

A. SPOILERONS

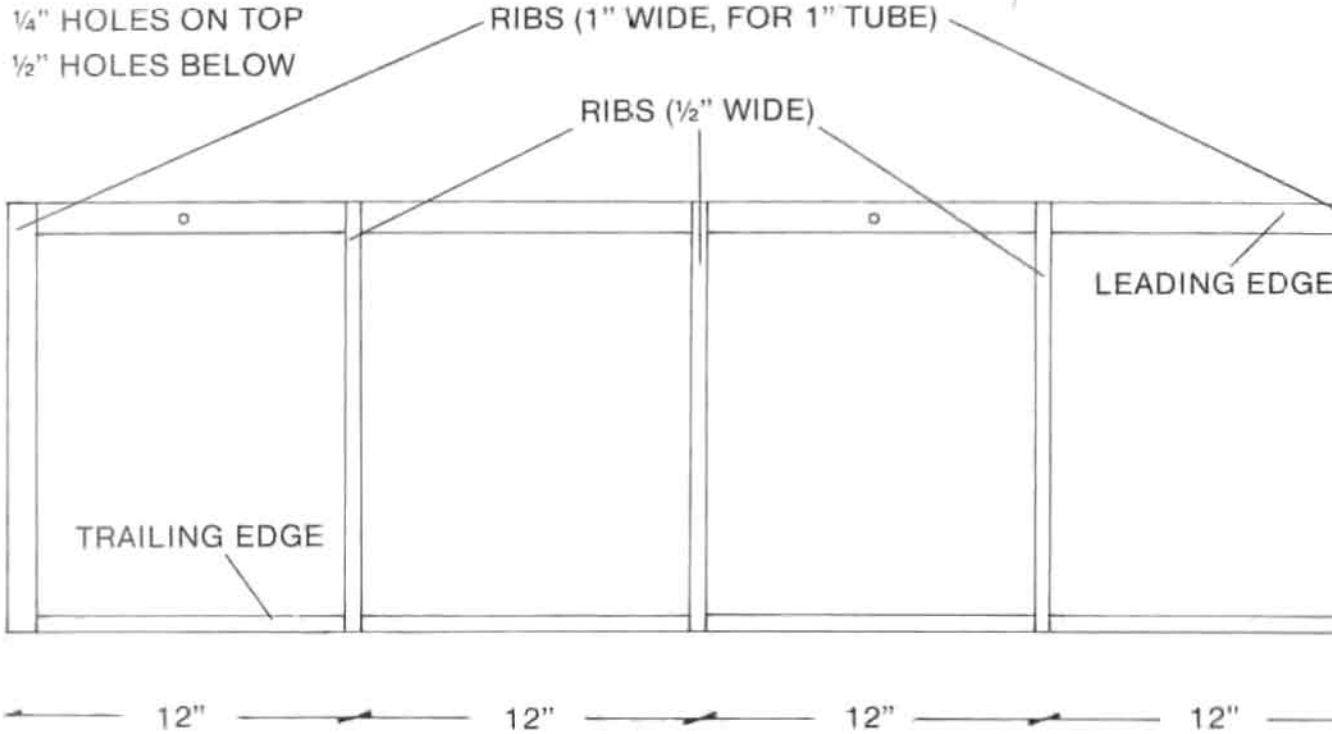
NOTES

1. Build the spoileron frames as shown in drawing SR #1, in the same way you built your canard in Section 1A Steps # 3 - 7 inclusive. Fit a canard control arm (3021) into one of the holes in the leading edge to make sure that the arm is at 90 degrees to the spoileron. Make one left and one right, see drawing SR #6. Unlike the canard, the 1/2" holes will be on the bottom of the leading edge.

2. Cut the fabric (3100) in half lengthways so that you have 4 1/2 ft. for each spoileron. Cover them as you did your canard (in Section 1B Steps # 1-8 inclusive) glueing to the top of the leading edge first. (The top of the leading edge has the 1/4" holes.)

3. Shrink the fabric, glue it down onto the ribs, and apply two coats of Poly-brush as in Section IB Steps # 9 and 10.

4. Paint the spoilerons and rivet end caps (4096) to the leading edges as in Section IB Steps # 11 and 12.



DRAWING SR-1

TOP VIEW — RIGHT HAND SPOILER

B. SPOILERON MOUNTING

NOTES

1. File and drill the four canard control arms (3021) as you did in Section IB, Step # 13 (drill the 3/16" holes 1/4" from the end of the arms) and bolt them to the spoileron leading edges with a thin washer (2030) under the head of each bolt (2087). See drawing SR #2. Secure them with safety wire. See construction notes - Safety Wire.

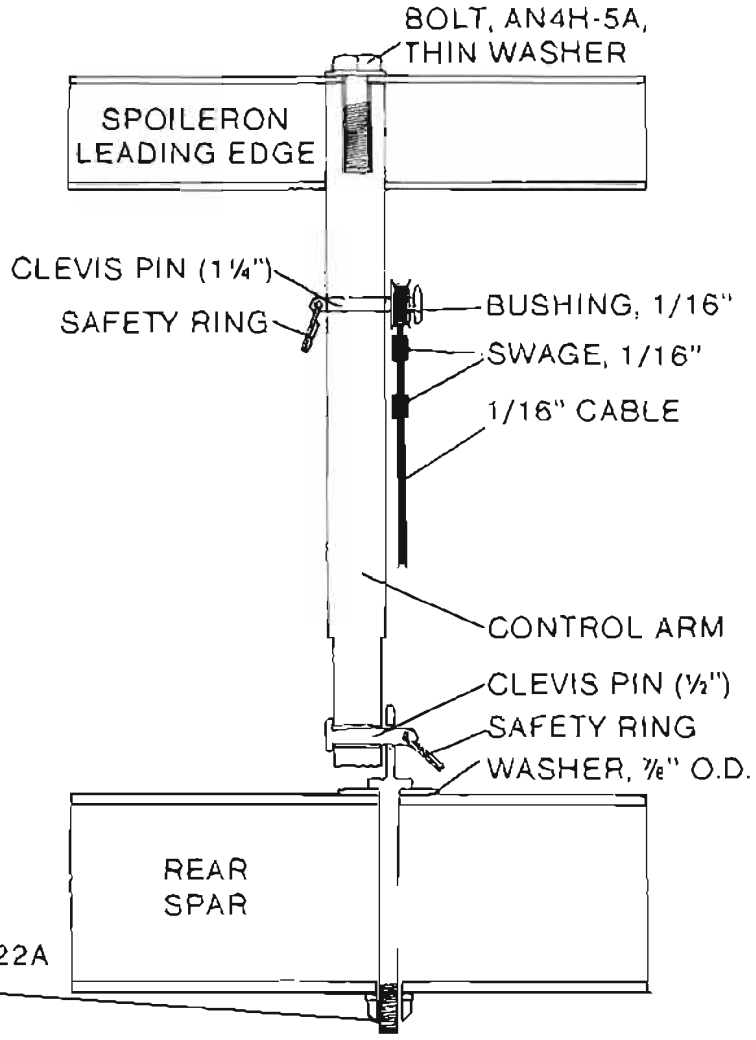
2½ & 26½

2. Drill vertical holes through the rear spar for the eyebolts which support the spoilerons. The holes should be in line with the outboard rigging bolt, 2 1/2" and 26 1/2" outboard of the center of the bolt. Mark the positions of the holes on the top of the wing covering and melt small holes at these points. Then mark, punch and drill the spars through the holes in the wing covering, checking that the holes are in line with the rigging bolt, perpendicular to the spar, and that they go through the center of the tube. Use the hot knife to tidy up the edges of the holes which the drill makes in the wing covering below the spar.

3. Fit the eyebolts (1730) as in drawing SR #2 and tighten the nylocks. Glue 3/16" nut covers onto the nylocks under the rear spar.

4. Mount the spoilerons to these eyebolts with clevis pins (1815) and safety rings as in drawing SR #2.

DRAWING SR-2



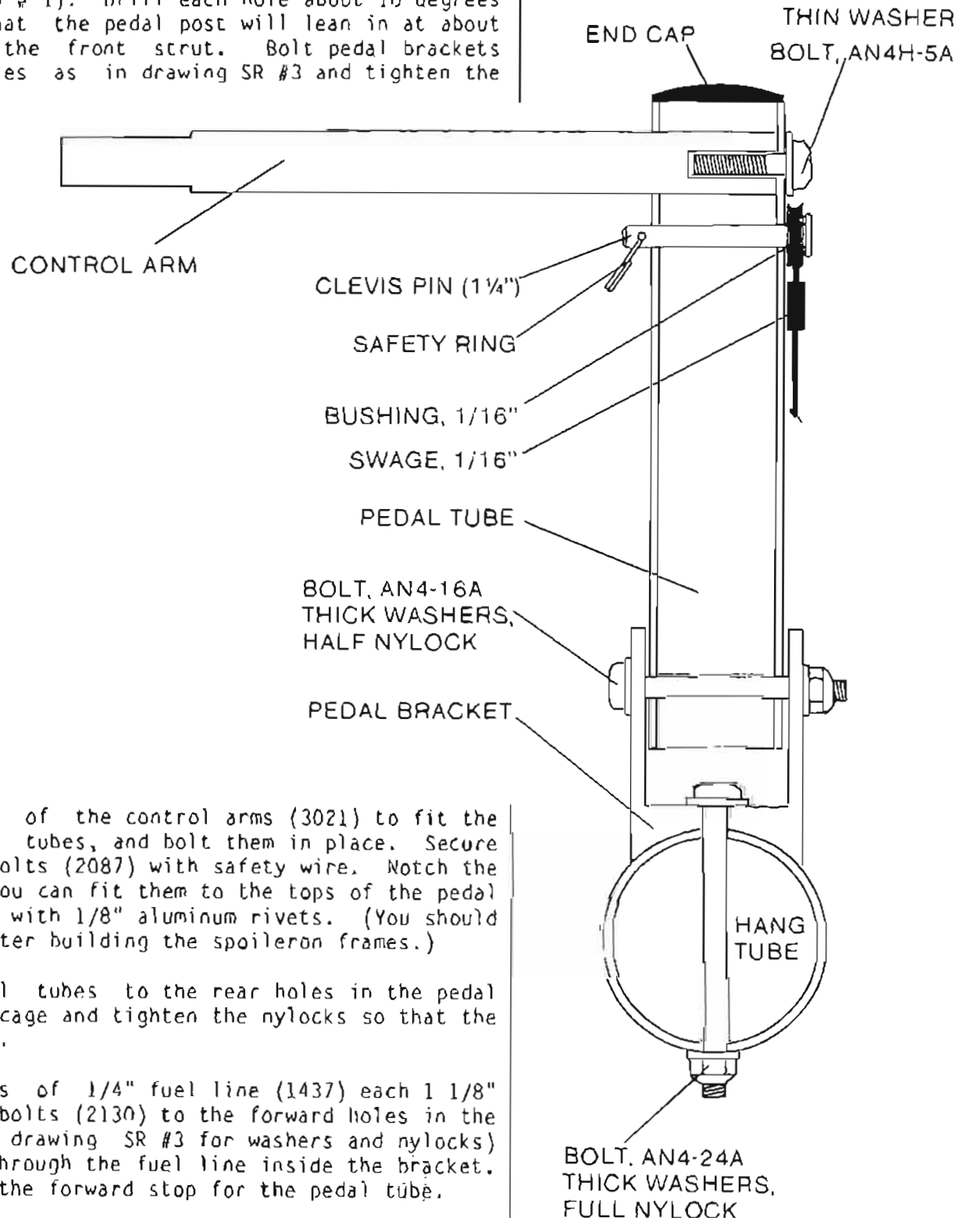
C. PEDALS

NOTES

1. Remove both nosebooms from the front of the hang cage. Cut off a 2" section from the rear end of each noseboom and deburr the cut edges. Use the nosebooms to push these 2" pieces back into the sleeves on the hang cage. Push them in so that you can fit the clevis pins through the nosebooms and sleeves.

2. Drill a 1/4" hole through each sleeve, 2 1/2" in front of the center of the front carry-through (passing through the 2" pieces from Step # 1). Drill each hole about 10 degrees off vertical, so that the pedal post will lean in at about the same angle as the front strut. Bolt pedal brackets (3867) to these holes as in drawing SR #3 and tighten the nylocks.

DRAWING SR-3



3. File the ends of the control arms (3021) to fit the inside of the pedal tubes, and bolt them in place. Secure the heads of the bolts (2087) with safety wire. Notch the end caps so that you can fit them to the tops of the pedal tubes and secure them with 1/8" aluminum rivets. (You should have some left over after building the spoileron frames.)

4. Bolt the pedal tubes to the rear holes in the pedal brackets on the hang cage and tighten the nylocks so that the tubes are free to turn.

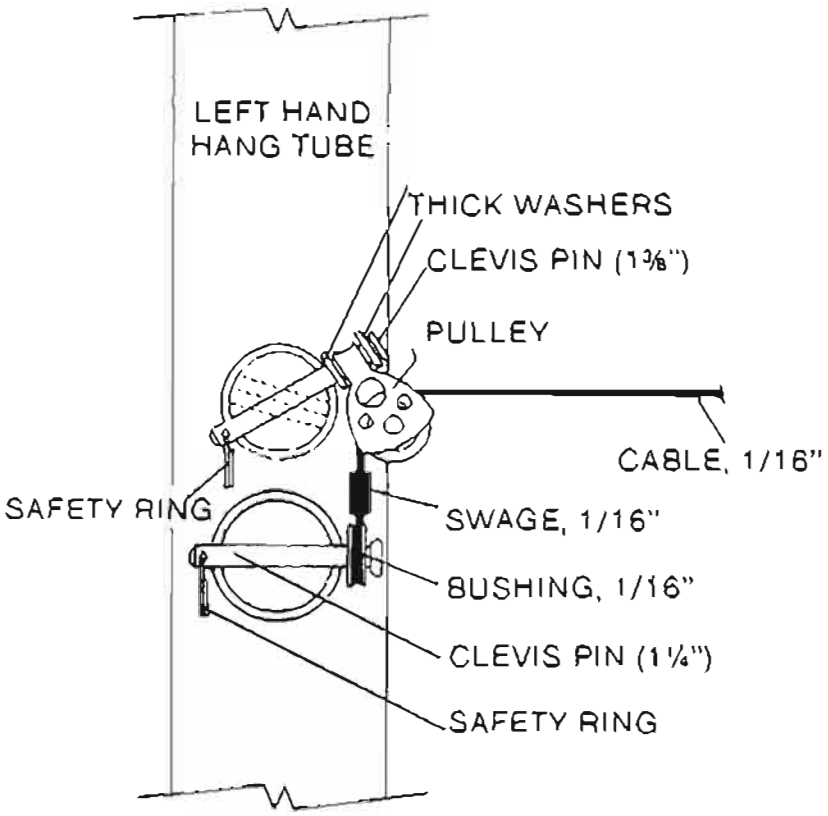
5. Cut two pieces of 1/4" fuel line (1437) each 1 1/8" long. Fit AN4-16A bolts (2130) to the forward holes in the pedal brackets (See drawing SR #3 for washers and nylocks) with the bolt going through the fuel line inside the bracket. This 'padded bolt' is the forward stop for the pedal tube.

D. CONTROL CABLES

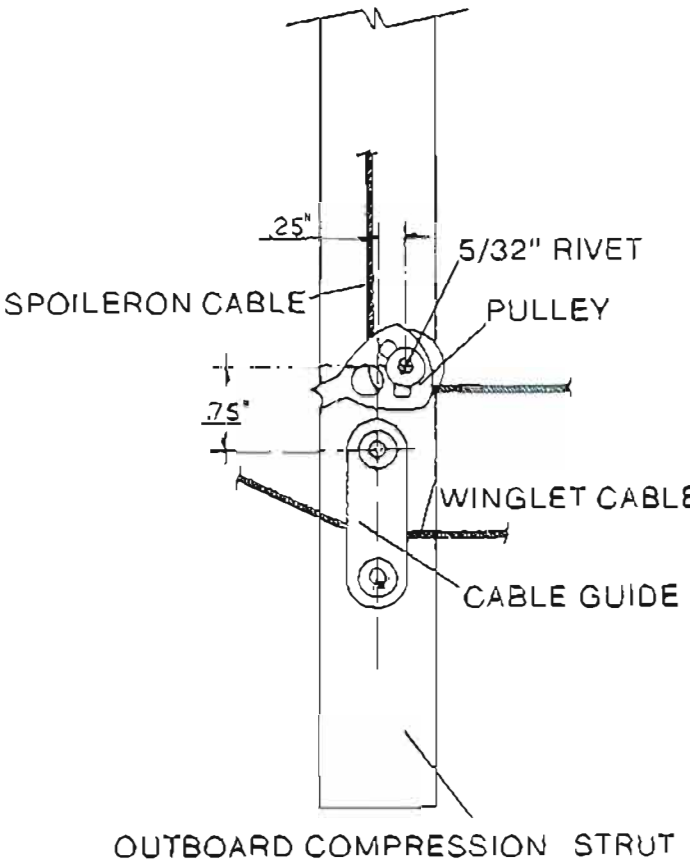
NOTES

1. Drill a 3/16" hole through each front strut, 2 3/4" above the bottom end of the tube at about 45 degrees to the existing holes in the struts, as in drawing SR #4. Fit the pulleys, using clevis pins (1830), washers (1530) and safety rings. Unbolt the top of each front strut and slide on a piece of clear plastic tube (1438). Slide it down the tube to the pulley. (It stops the pedal tube from wearing against the front strut.)

DRAWING SR-5



DRAWING SR-4



2. Unbolt and remove the outboard compression struts. Mark and drill a 5/32" hole in each strut, 3/4" behind the rear cable guide rivet, 1/4" around the inboard side of the tube from the center line of the cable guide. Make one left and one right. Rivet pulleys to these holes as in drawing SR #5.

3. Melt small holes in the top of the wing cover, 1" outboard of the outboard compression struts, 10" in front of the fabric edge (which is just in front of the rear spar).

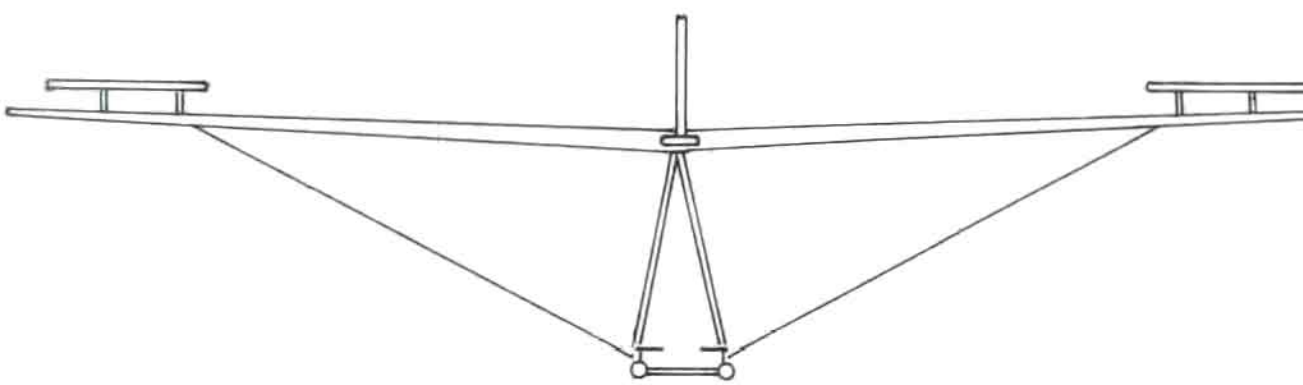
4. Mark the inboard post (canard control arm) of each spoileron so that you can drill a horizontal 3/16" hole through the post at 90 degrees to the compression strut, 1" below the spoileron leading edge. Remove the spoilerons to drill the holes. Fit a 1/16" bushing (2710) on the inboard side of each inboard post with a clevis pin (1817) and safety ring. Replace the spoilerons.

5. Cut the 32 ft. of 1/16" cable in half. Swage a 1/16" bushing (2710) to one end of each length, using one 1/16" swage (2670) each. Use clevis pins (1827) to attach these swaged bushings to the pedal posts. Run the cables through the pulleys, up through the holes in the bottom of the wing cover (with the winglet cables), through the pulleys on the compression struts and out through the holes in the top of the wing cover. Connect them to the bushings on the spoileron posts with two swages and a small kearny each.

6. Adjust the length of the cables using the kearnys so that the spoilerons are 'neutral' with the pedal tube back against the plastic tube on the front strut. (In the neutral position the spoilerons are in line with the rear of the second rib from the wingtip). Check (by looking from behind the aircraft) that the spoilerons are in line with each other. Clamp the swages.

7. Have someone operate the pedals while you use your hot knife to enlarge the small holes where the cables come through the top of the wing so that the cables will not rub against the wing cover.

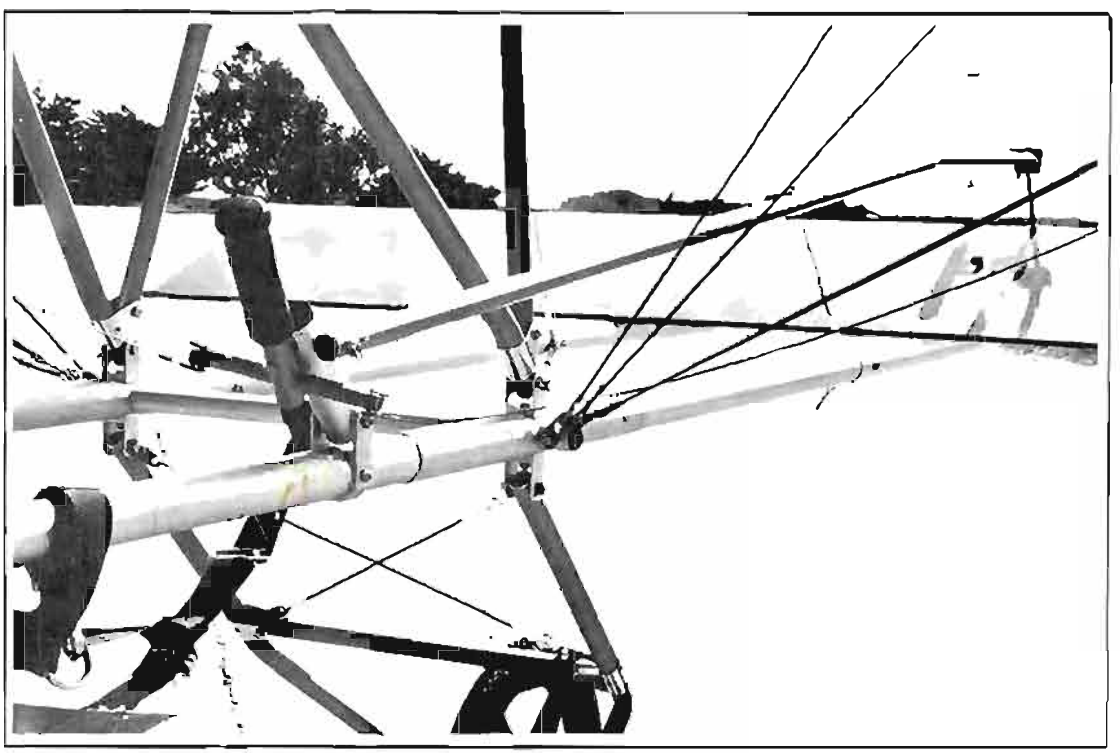
8. When folding down the aircraft, disconnect the cables from both pedal tubes and front struts.



DRAWING SR-6

ECTION VI — CONTROLS

SECTION VI A — NOSEBOOMS
SECTION VI B — CONTROL STICK
SECTION VI C — PUSHROD
SECTION VI D — WINGLETS / CONTROL CABLES



In this section you will prepare the nosebooms and control stick, mount the canard, pushrod and winglets and connect the control cables.

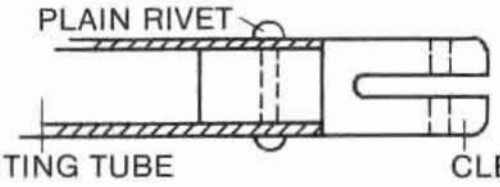
The tools you will need are: cable cutters, drill, 1/8", 5/32" & 1/4" drill bits, files, heat gun, hot knife, kearnys, pop riveter, punch, swaging tool, tape measure, two 3/8" and two 7/16" wrenches.

SECTION VI A — NOSEBOOMS

NOTES

1. Insert the canard pivot clevis (NB6) into the end of the canard mounting tube (NB4). Drill a 1/8" (or #30) hole through both, 5/16" from the top of the tube. Fit a plain rivet (NB20), place the head of the rivet on a solid object (eg. vice) and hammer the other end to spread it. Repeat. See drawing VI#1.

DRAWING VI.1.



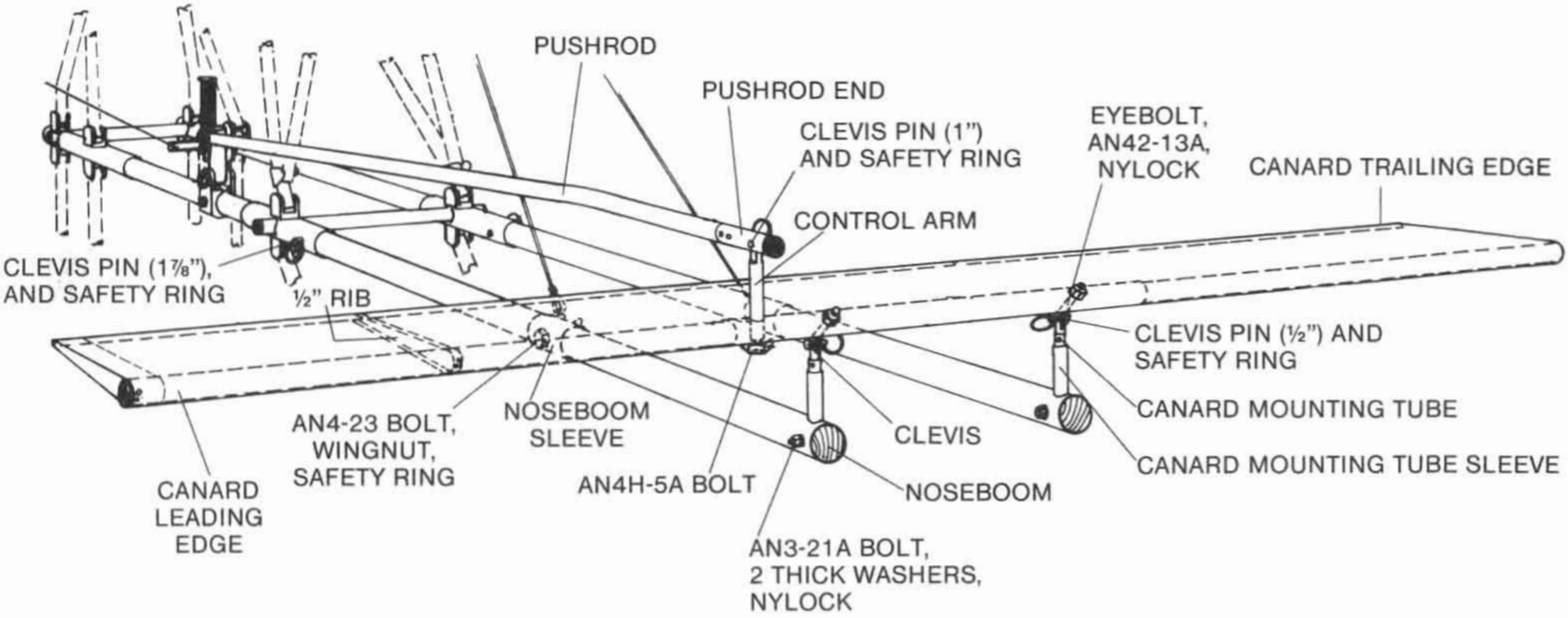
2. Fit the canard mounting tube sleeve (NB5) into the 5/8" hole in one end of the noseboom, right to the bottom of the hole. (You may need to use a soft hammer.) Repeat on the other noseboom and check that both sleeves are the same height. Slide the mounting tube into the sleeve and with the slot in the clevis exactly in line with the noseboom tube (and both the mounting tube and sleeve bottomed in the 5/8" hole) drill a 3/16" hole through the boom, sleeve and mounting tube, so that the hole goes through the center of the mounting tube. Fit the bolt through the noseboom and tighten the nylock. See drawing VI#2. Repeat with the other noseboom.

3. Slide a noseboom sleeve (NB2) onto the noseboom. Locate the center of the sleeve 24" from the front of the noseboom, secure it with a 1/8" aluminum rivet (NB21), 1" back from the front edge of the sleeve, on the side. Drill a 1/4" hole through the center of the sleeve (and the boom) at right angles to the canard mounting tubes (in line with the 3/16" hole at the front). Repeat with the other noseboom. Refer to drawing VI#2.

4. Slide a noseboom assembly into each hangtube. Attach the canard to the mounting tubes with clevis pins (NB7) and safety rings (NB14). Check that the canard moves up and down freely. With the canard mounting tubes vertical, the nosebooms firmly into the sleeves, and the canard level with the wing, drill a 3/16" hole horizontally through each hangtube and noseboom 2" back from the front of the sleeve. Secure with clevis pins (NB8) and safety rings. Refer to drawing VI#2.

When you remove the nosebooms later, be sure to remove any metal shavings from this drilling, or the boom would stick next time you fit it.

5. Attach the flat tang of the upper noseboom cable (prepared in Section IV, step #1) onto the bolt through the flat bottom bracket at the top of the front strut (on the outboard side of the bracket) with a wing nut. Refer to drawing II#3. Put the bolt into the 1/4" hole in the noseboom sleeve from the outside. Attach the upper noseboom cable to this bolt with a flat tang, thimble, small kearny and two swages. Repeat on the other side. Refer to drawing IV#3.


PUSHROD
PUSHROD END
CLEVIS PIN (1")
AND SAFETY RING
EYEBOLT,
AN42-13A,
NYLOCK
CANARD TRAILING EDGE
CONTROL ARM
CLEVIS PIN (1⅞"),
AND SAFETY RING
½" RIB
CLEVIS PIN (½") AND
SAFETY RING
CANARD MOUNTING TUBE
AN4-23 BOLT,
WINGNUT,
SAFETY RING
NOSEBOOM
SLEEVE
CLEVIS
CANARD MOUNTING TUBE SLEEVE
CANARD
LEADING
EDGE
AN4H-5A BOLT
NOSEBOOM
AN3-21A BOLT,
2 THICK WASHERS,
NYLOCK

DRAWING VI.2.

NOTES

6. Adjust the length of each upper cable so that with the cable snug the hang tubes and nosebooms are straight and the canard is level with the wing. Tighten the kearnys.

7. Attach the lower noseboom cables (which are already bolted to the front axle) to the bolt through the noseboom with a flat tang (on top of the flat tangs from the upper cables), thimble, small kearny and two swages.

8. Adjust the length of each lower cable so that, a) the front carry through is approximately 3" higher than the rear, b) the hang tubes and nosebooms are straight, c) the canard is level with the wing and d) the front wheel is in line with the hang tubes. Tighten the kearnys.

9. Unbolt the upper and lower cables from the nosebooms, clamp the swages, and fit the shrink tubing (the four pieces remaining from Section IV, step #1) with your heat gun. Replace the tangs on the bolts and fit the wingnuts.

SECTION VI B — CONTROL STICK

NOTES

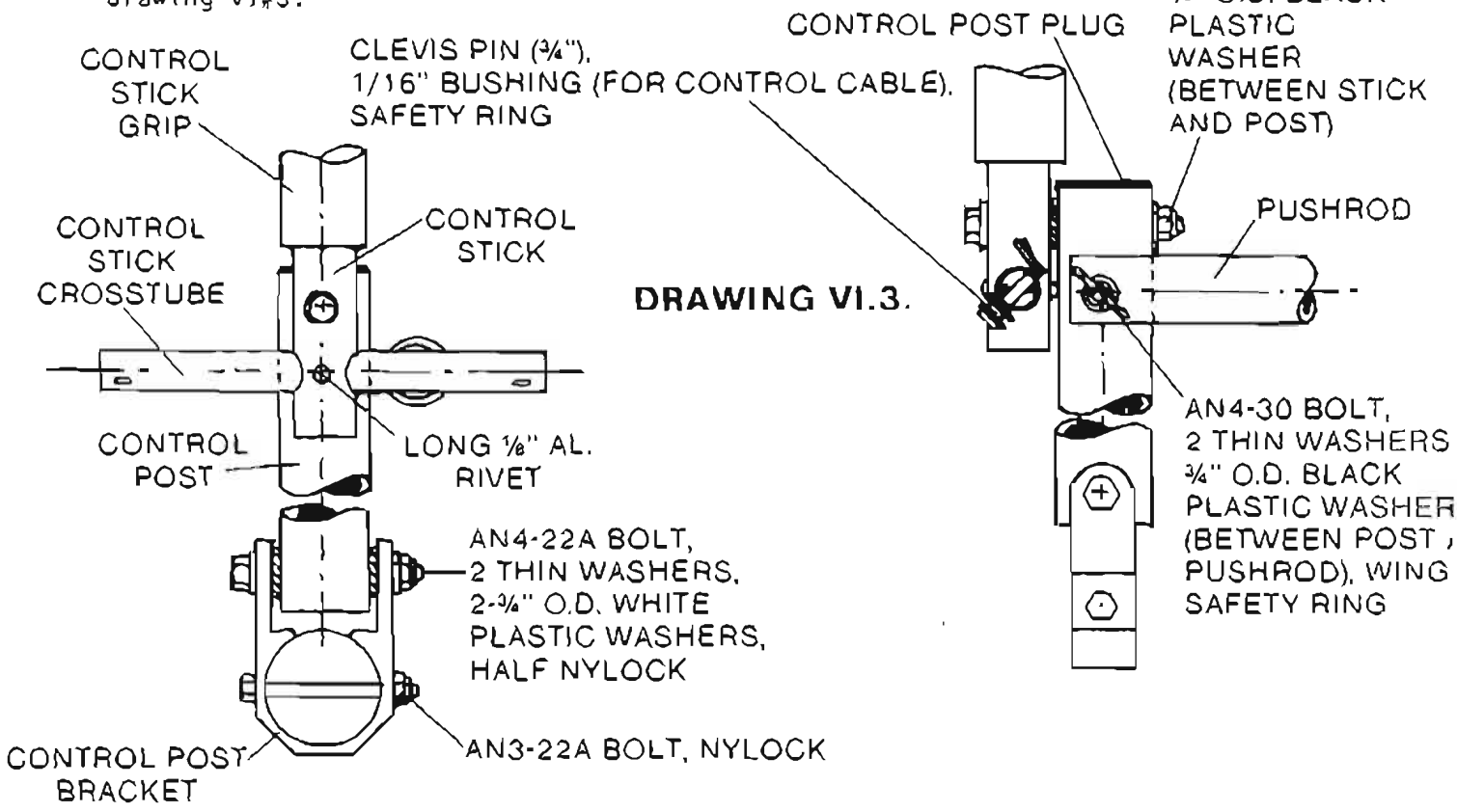
1. Drill a 1/4" hole, 1" from the existing 5/8" hole in the control stick tube (CS2) at 90 degrees to the larger hole. See drawing VI#3.

2. Drill two 3/16" holes in line 3/8" from each end of the control stick cross tube (CS4). Slide it into the 5/8" hole in the control stick tube, center it, and with the 3/16" holes at approximately 45 degrees to the control stick tube, drill and rivet both sides with long 1/8" aluminum rivets (CS21). Slide on the control stick grip (CS3). See drawing VI#3.

3. Drill two 1/4" holes in the control post tube, in line, one hole 9/16" from the bottom, the other 1" from the top. Now drill another 1/4" hole 1/2" from the top at right angles to the other holes. Fit the plastic plug (CS23) into the top of the post and secure it with two 1/8" stainless rivets (CS20).

4. Bolt the control post tube into the control stick bracket on the hang tube, with the nylock finger tight. See drawing VI#3. Holding the control post tube vertical and the control stick bracket 12 3/4" behind the front carry through (center to center), drill a 3/16" hole horizontally through the center of the bracket and hang tube. Fit the bolt and tighten the nylock. Tighten the nylock on the 1/4" bolt so that the post can move freely.

5. Bolt the control stick assembly to the control post, with the lower 3/16" holes in the crosstube to the rear. Tighten the nylock, allowing the stick to move freely. See drawing VI#3.



DRAWING VI.3.

SECTION VI C — PUSHROD

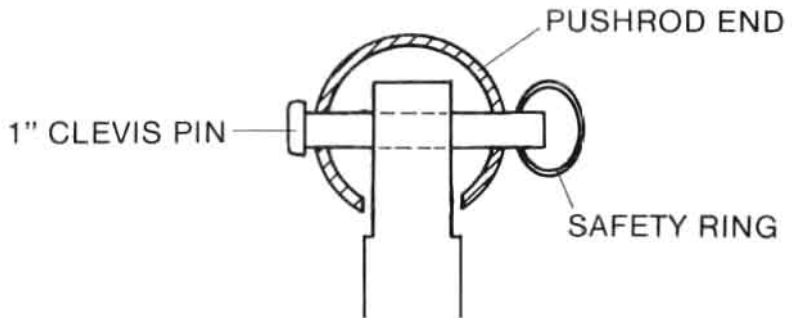
NOTES

1. Drill a 3/16" hole horizontally through the canard pushrod end (CS7), 1 3/8" from the end. The slot faces down. (After you drill through the first wall of the tube, you can use the canard control arm as a guide to drill through the opposite wall.) Use four 1/8" stainless rivets to secure the pushrod joiner (CS8) halfway inside the pushrod end with two rivets at 1/2" from the join and two at 1 1/2" (two on each side). Use one 1/8" stainless rivet to secure a tube plug (CS22) in the front of the pushrod end. Attach the pushrod end to the control arm on the canard with a clevis pin (CS24) and a safety ring. See drawing VI#4 and refer to drawing VI#2.

2. Drill a 1/4" hole, 1/2" from the rear end of the pushrod at 90 degrees to the line of the bend. Bolt this end to the side of the control post. Refer to drawing VI#3.

3. Slide the pushrod all the way onto the pushrod joiner and rivet the pushrod to the joiner with four 1/8" stainless rivets as in step #1 (two on top and two below). Refer to drawing VI#2. You can secure the pushrod to the joiner with one rivet on the top, and remove the pushrod assembly to drill and fix the other rivets.

DRAWING VI.4.



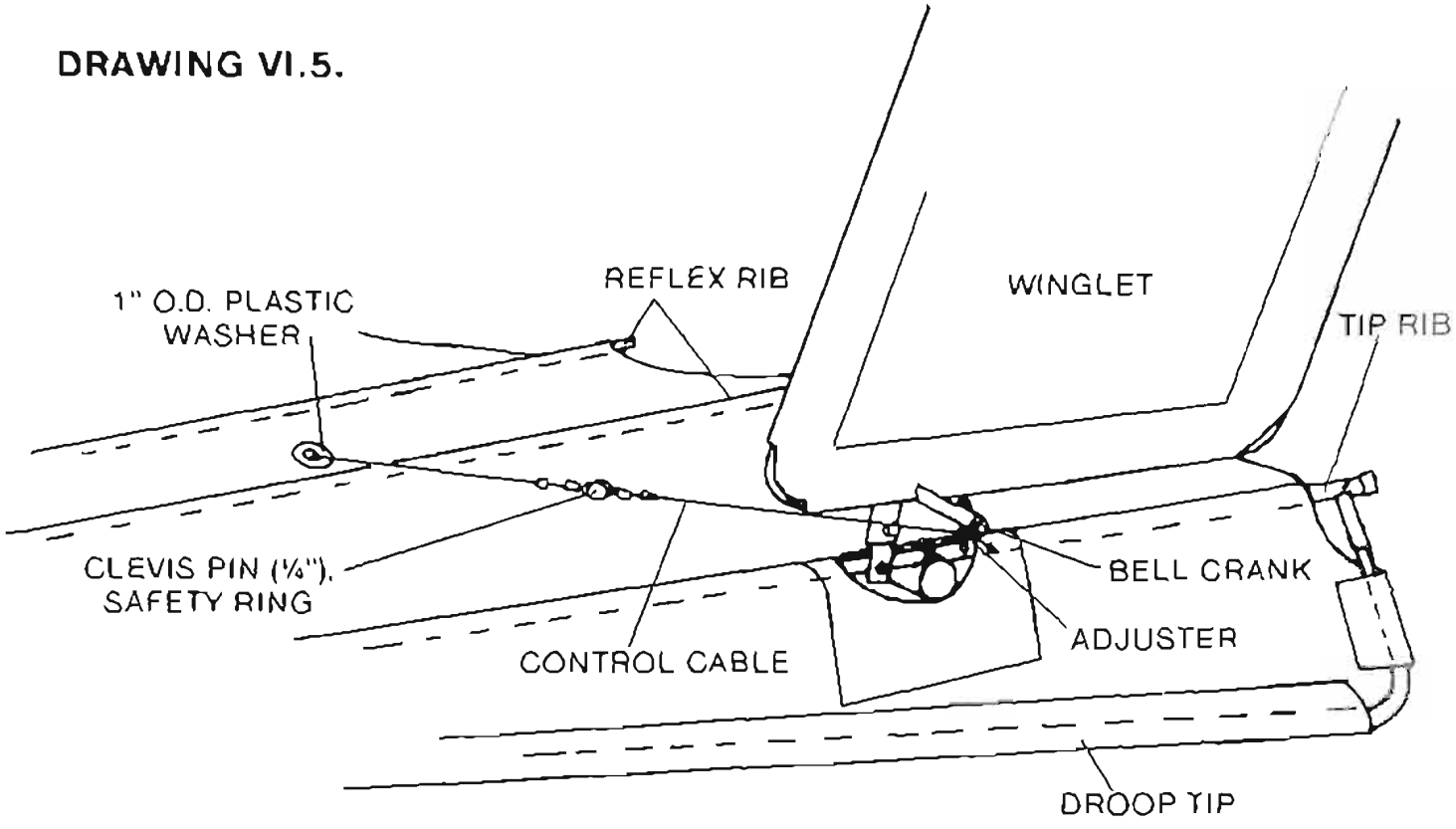
SECTION VI D — WINGLETS / CONTROL CABLES

NOTES

1. Plug in your hot knife. Cut out templates #2 and #3. Mark the positions of the holes on the top and bottom of the wing covering with a pencil. Melt the holes for the control cables. Cut the 1/16" cable (CC2) into two pieces, one of 18' 6" and one of 19' 6". Swage a cable bushing (CC4) onto one end of each with two swages (CC3).

2. Install the winglets (CC1) onto the tip ribs with a clevis pin (CC7) and safety ring each. (Check the nylocks which are already installed on the winglet post.) See drawing VI#5.

DRAWING VI.5.



3. There is a short piece of 1/16" cable already attached to the bellcrank on the winglet. Tighten the nuts on the adjuster on the bellcrank temporarily so that there are 10" of cable between the adjuster and the existing cable bushing.

4. Connect the shorter of the two control cables to the winglet on the same side as the control stick. The bushing on the control cable attaches to the bushing on the winglet cable with a 1/4" clevis pin (CC5) and safety ring. Thread the other end of the cable through a) a 1" O.D. plastic washer (CC9), b) the hole in the top of the sail, c) the plastic cable guide on the top of the outboard compression strut and d) the hole in the bottom of the sail. Repeat on the other side with the longer control cable.

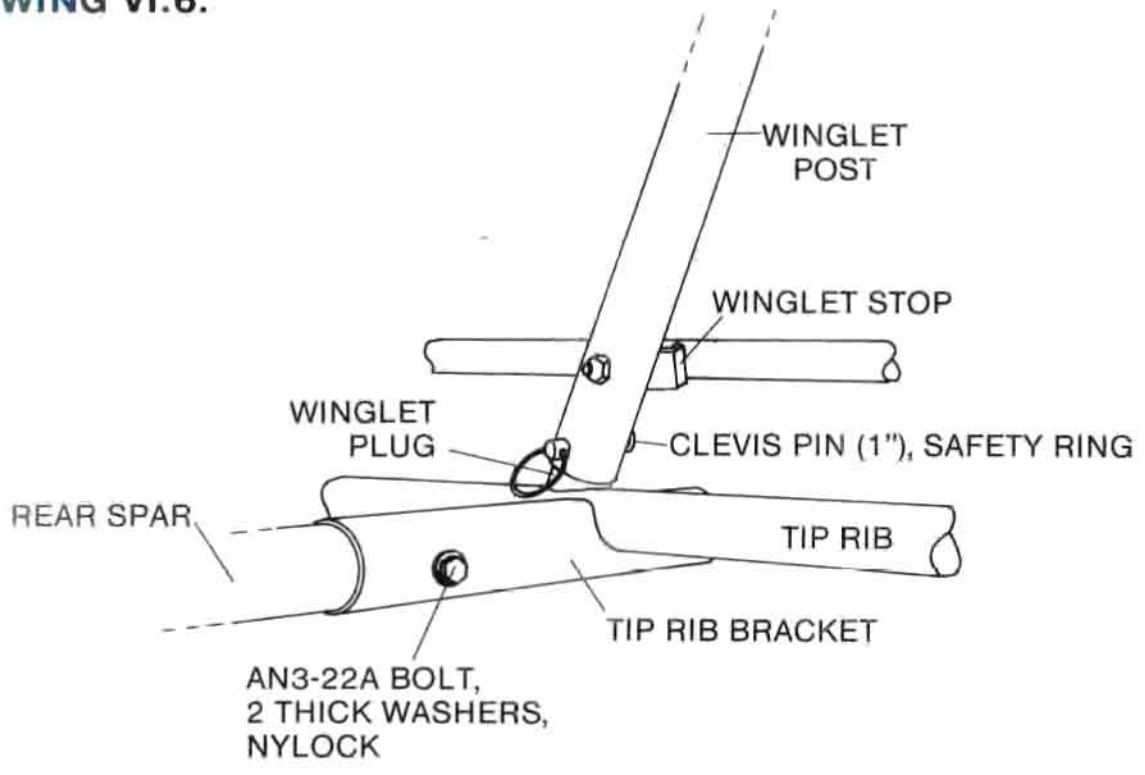
NOTES

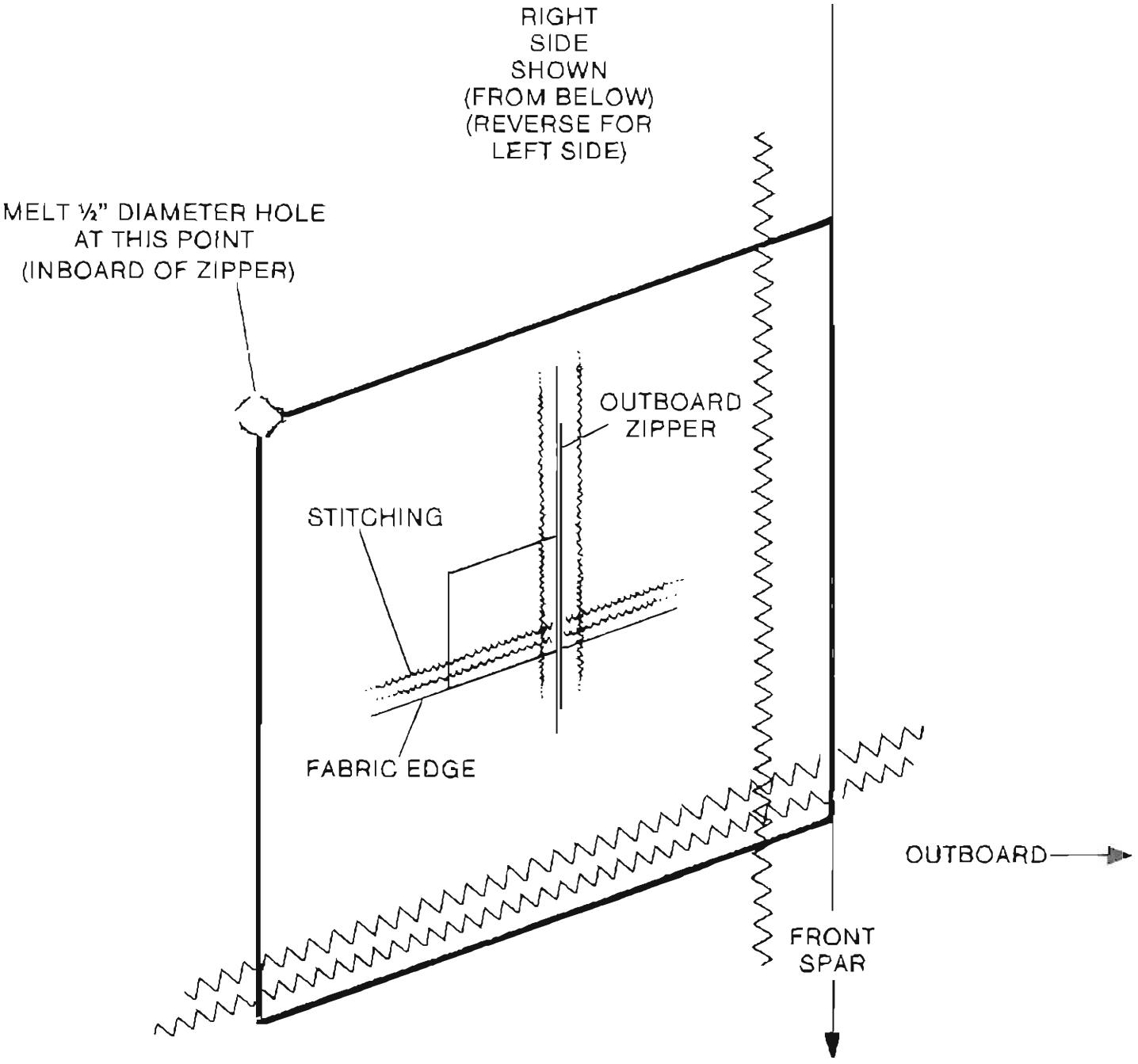
5. Connect the ends of these cables to the ends of the control stick crosstube with a clevis pin (CC6), cable bushing, two swages and small kearny each.

6. Use either an assistant or a clamp to hold each winglet back against its stop (the aluminum angle at the lower pivot point) while you adjust the cable (using the kearnys at the crosstube) so that the stick is vertical when the cable is snug. Repeat on the other side and clamp the swages.

7. Make any final adjustments (so that the cable is snug on both sides with the winglets against the stops and the control stick vertical) at the adjuster on the bellcrank. Tighten the nuts so the plastic washers begin to spread. (Tighten the nuts from both sides so as not to kink the cable.) Cut the excess cable 1/2" from the adjuster and clamp a cable stop (CC10) to the end of the cable.

DRAWING VI.6.




RIGHT
SIDE
SHOWN
(FROM BELOW)
(REVERSE FOR
LEFT SIDE)
MELT ½" DIAMETER HOLE
AT THIS POINT
(INBOARD OF ZIPPER)
OUTBOARD
ZIPPER
STITCHING
FABRIC EDGE
OUTBOARD
FRONT
SPAR

TEMPLATE #2

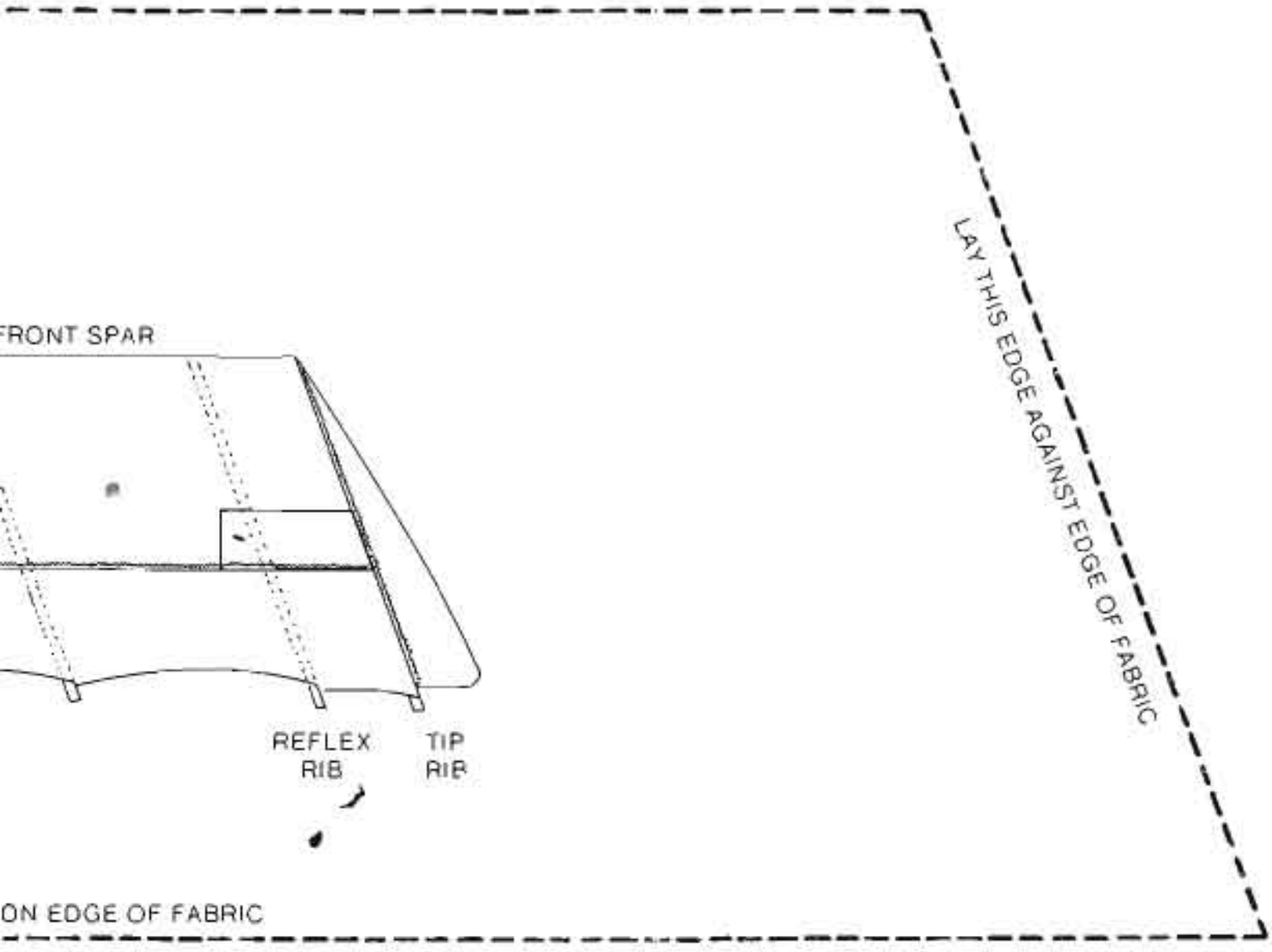


RIGHT SIDE SHOWN (REVERSE FOR LEFT SIDE)



MELT HOLE HERE

LAY THIS EDGE


FRONT SPAR
REFLEX RIB
TIP RIB
LAY THIS EDGE AGAINST EDGE OF FABRIC
ON EDGE OF FABRIC

TEMPLATE #3



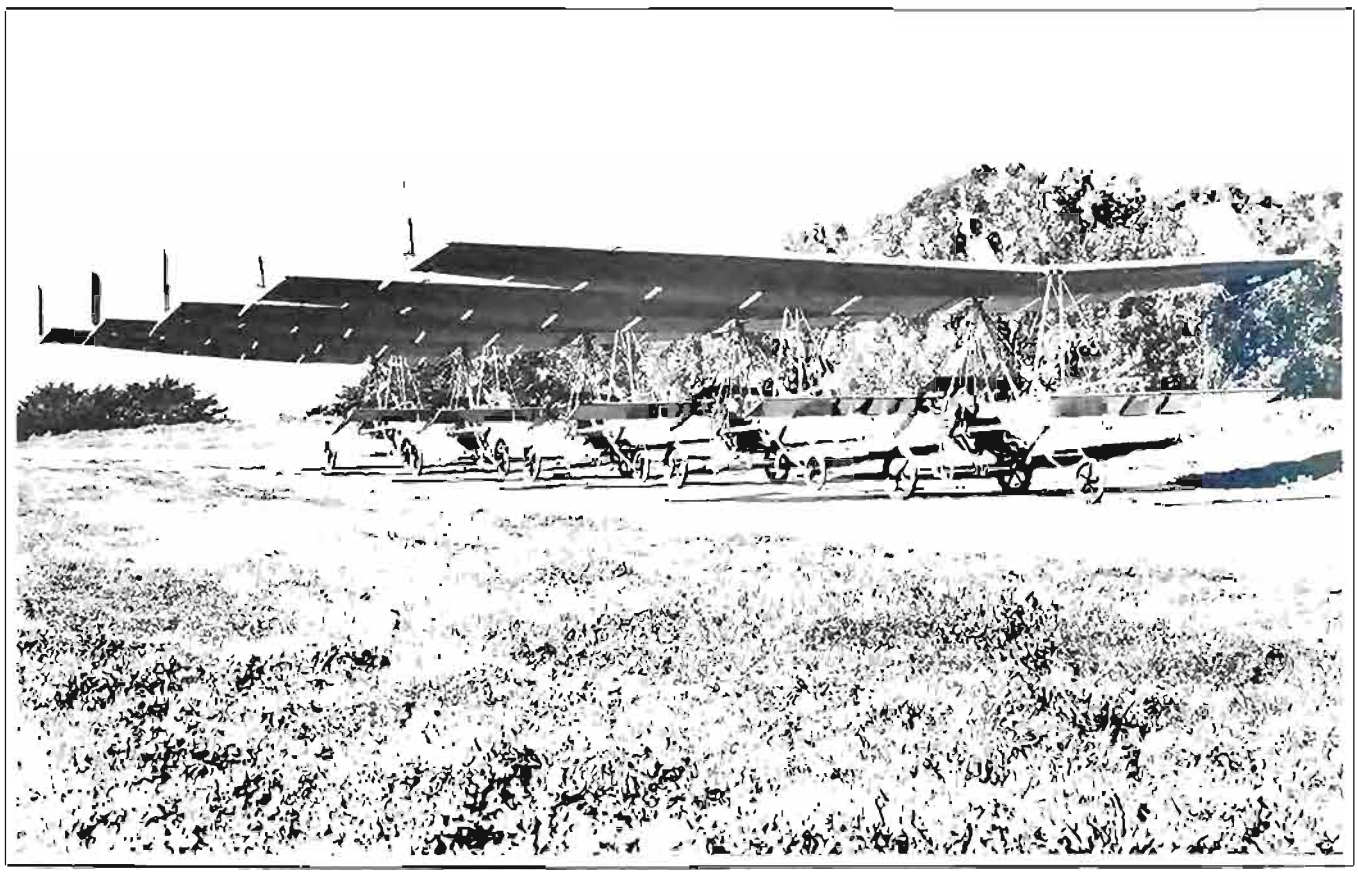
PTERODACTYL

SEC
FINAL ASSEMBLY

VIII

SECTION VII — FINAL ASSEMBLY

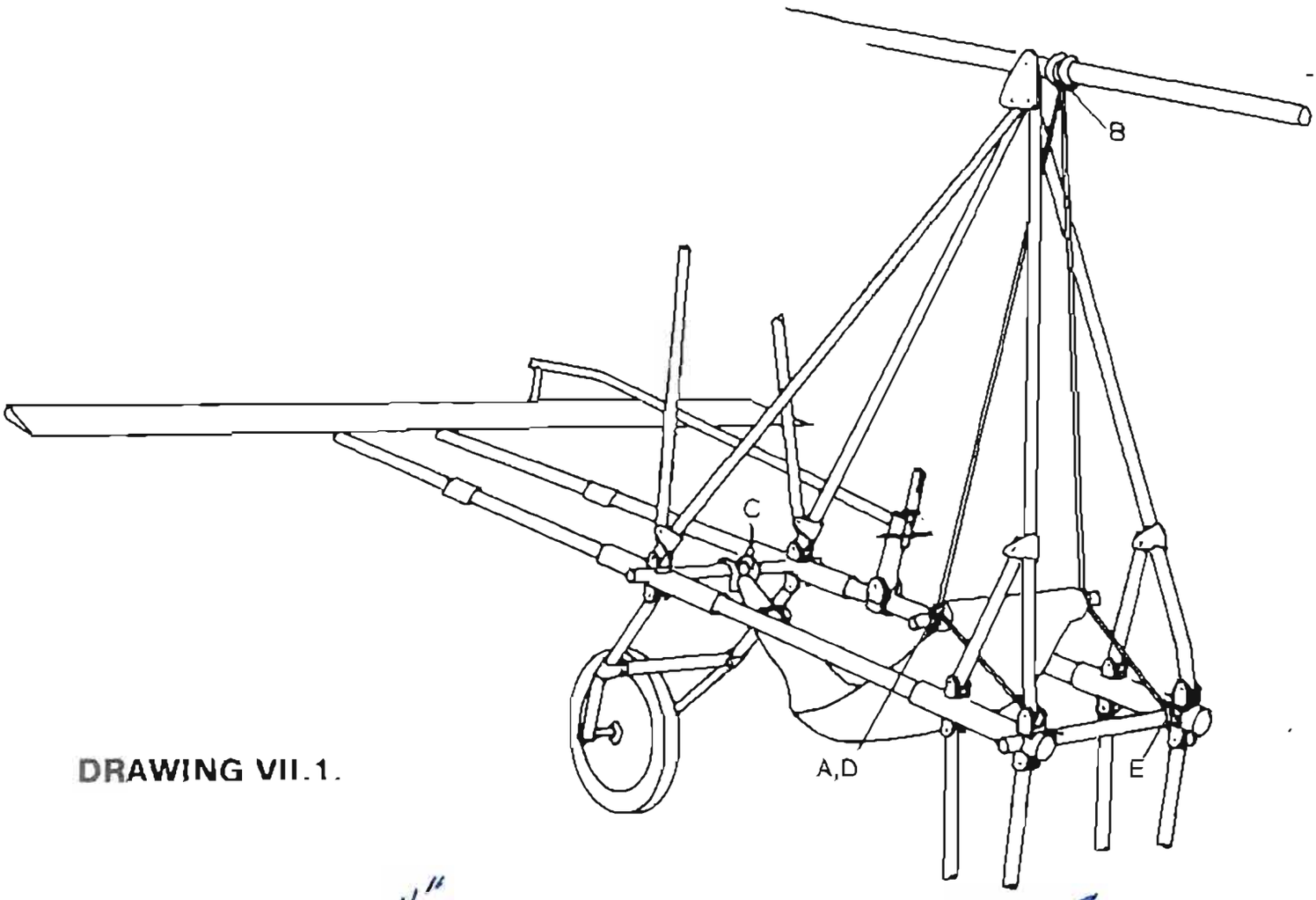
VII A — SEAT AND HARNESS
VII B — POWER PLANT INSTALLATION
VII C — FINAL INSPECTION



In this section you will install the seat and harness, engine and mount, muffler, anti-sway cables and fuel system and put the finishing touches on your beautiful bird.

The tools you will need are: cable cutters, drill, 1/8" and 5/32" drill bits, heat gun, pop riveter, pliers, phillips screwdriver, flat blade screwdriver, two 1/2", 7/16" wrenches and a torque wrench (with 5/8" socket).

VII A — SEAT AND HARNESS

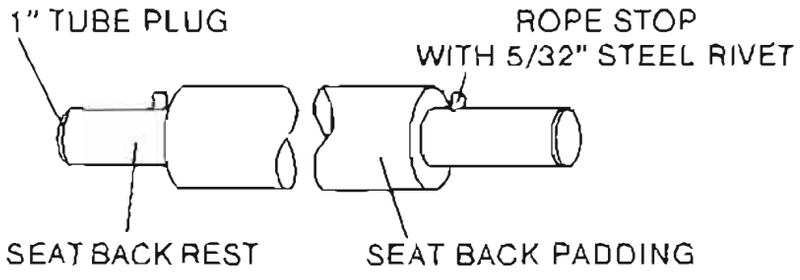


DRAWING VII.1.

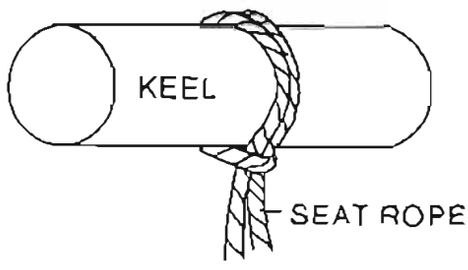
CHANGE

1. Drill 5/32" holes, ~~2"~~ 4" from each end of the seat backrest tube (SH4), in line, on one side and slide on the backrest padding (SH5). Rivet a rope stop (SH6) to each of these holes with a 5/32" rivet (SH8). Fit a tube plug (SH7) to each end of the tube and secure them with 1/8" aluminum rivets (SH9). See drawing VII#1-A.

2. Find the center of the seat suspension rope (SH3), and tie it to the keel as shown in drawing VII#1-B.



DRAWING VII.1.(A)



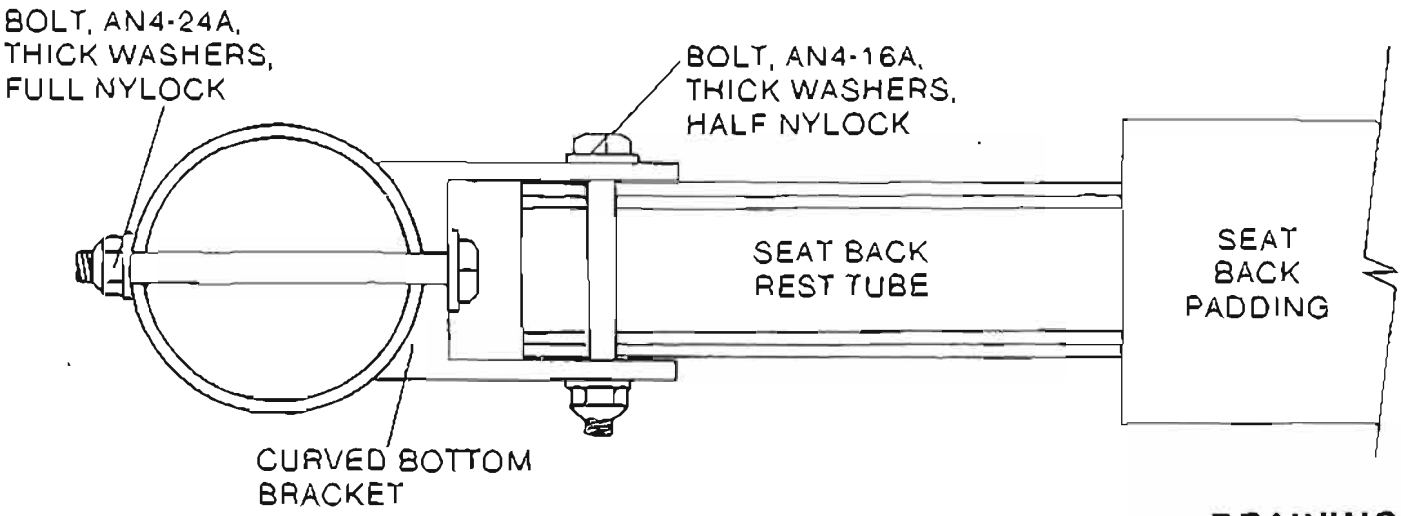
DRAWING VII.1(B)

BUCKET SEAT RETROFIT

NOTES

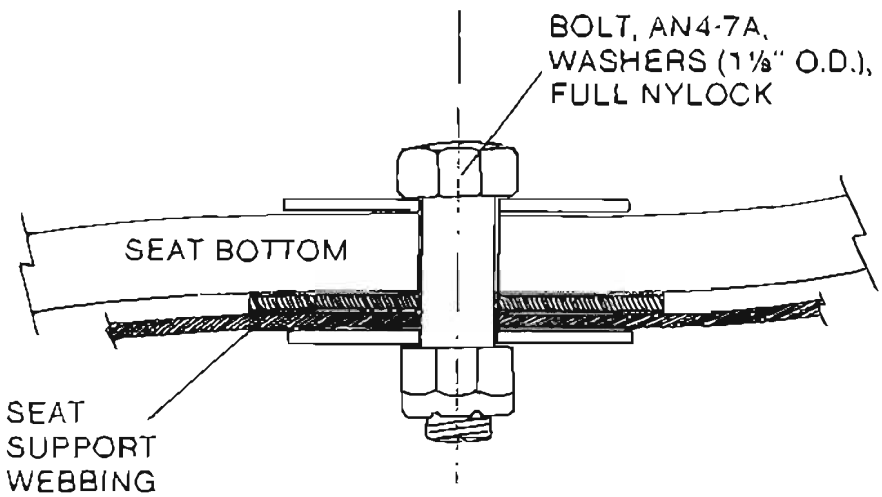
You will need your plane set up to fit the bucket seat but if it's not, you can fit the seat back to the hang cage and bolt the webbing to the seat, and then strap on the seat when you set up at the flying field.

1. Remove your original seat, seat back tube, rope and shoulder harness. (If you are fitting the bucket seat to an Ascender II+2, you already have the rigid seat back.) Drill 1/4" holes horizontally through the hang tubes 1/2" behind the front edge of the sleeve, in front of the forward brace. Bolt curved bottom brackets (3772) on the inside of the hang cage at these holes. Slide the seat back padding (1448) onto the seat back rest tube (4564) and bolt this to the brackets. See drawing BK #1. Tighten the nylocks.



DRAWING BK-1

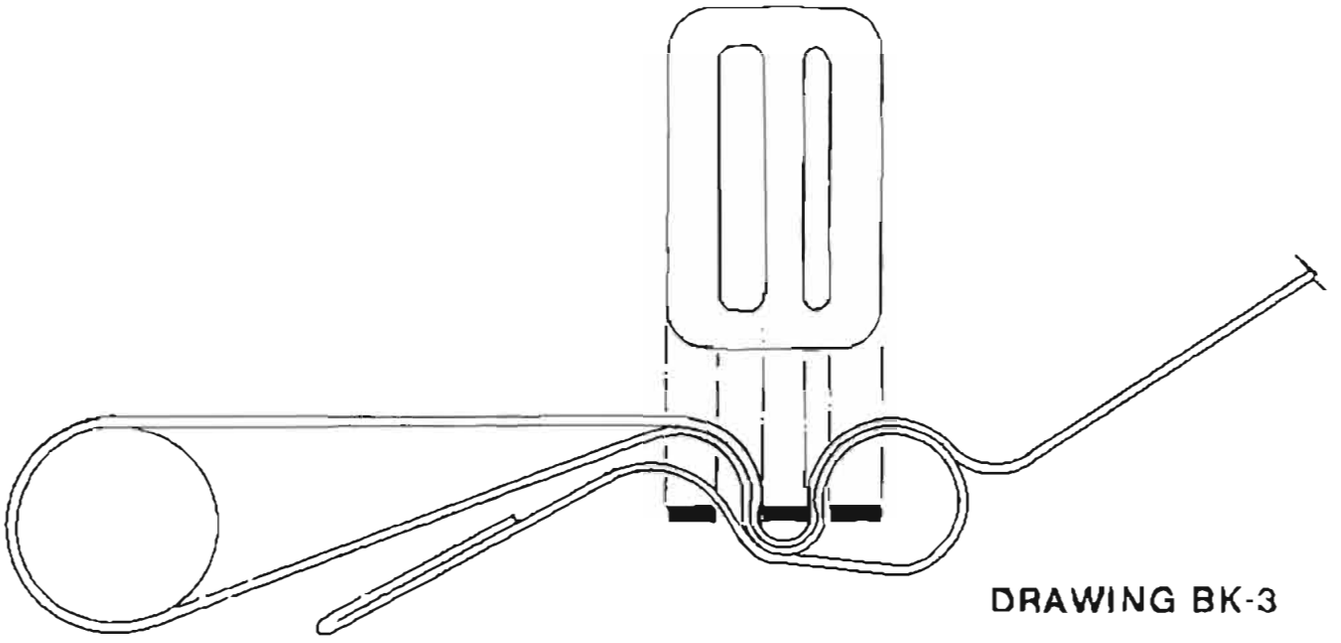
2. Drill a 1/4" hole through the center of the seat bottom, 14" behind the front edge (or 23" from the top of the back). Bolt the seat support webbing to the bottom of the seat as in drawing BK #2, with the longest strap to the front. Tighten the nylock.



DRAWING BK-2

NOTES

3. Fit the seat in the hang cage and support it about 14-15" above the ground while you connect the straps. Use the buckles as in drawing BK #3 to make loops around the hang tubes, front carry-through and seat back. Remove the supports.



DRAWING BK-3

Adjust the straps so that the back of the seat rests against the back rest and the lowest point of the seat is the same height as your original seat. (See Section VII A Step #4.) All your straps should have equal tension.

4. Glue a nut cover (4125) to the head of the bolt which holds the webbing to the seat. Fit the seat cover (7055) onto the seat. (You can add more foam inside the cover.) Refit your shoulder harness.

When you are satisfied that you have the straps adjusted comfortably, you can secure the strap ends by running them back through the buckles and taping down the loose ends.

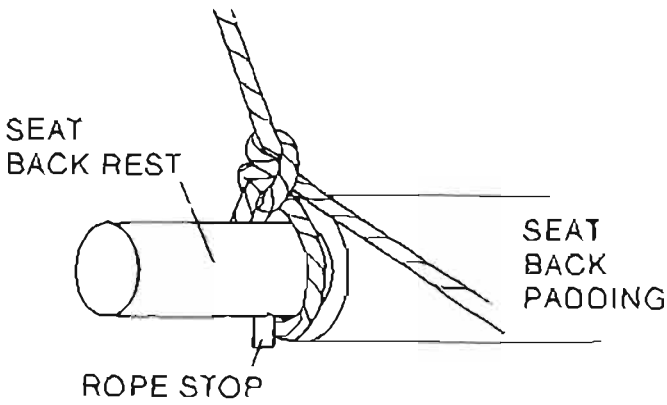
Heavyweight pilots may find the seat back rest position (established in Step # 1) too far forward, (i.e., too fast.) Move the seat back in 1" steps (by drilling more holes horizontally through the hang tubes) until the aircraft is trimmed for cruise (as you would adjust the rope from the rear carry-through to the swing seat.) (Drill no more than 1/2" behind the bolt at the base of the forward brace.)

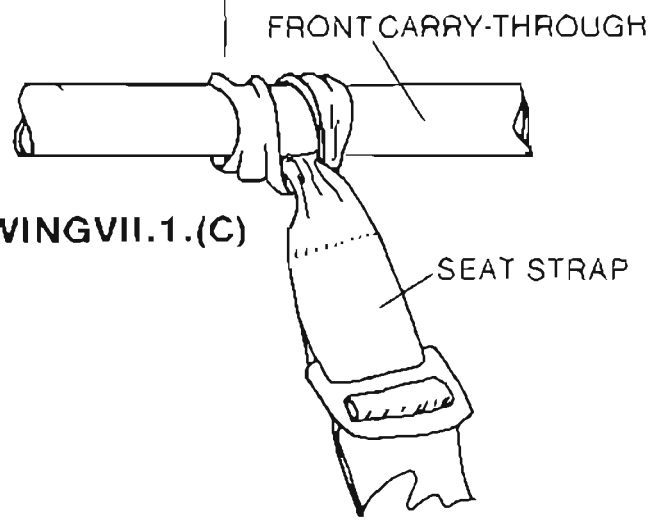
NOTE: When folding back the nosewheel for parking, you must first lift the bucket seat up through the hang tubes, turn it 90 degrees, and rest it on the hang tubes.

NOTES

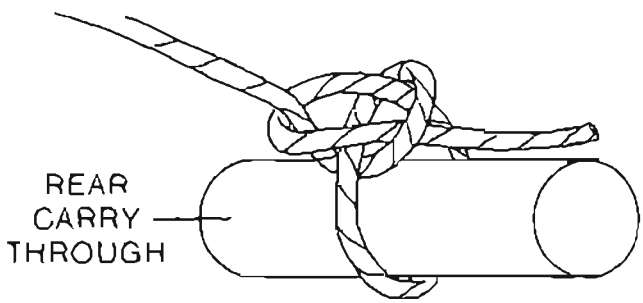
3. Attach the front strap of the seat to the front carry through. See drawing VII#1-C. Slide the backrest tube into the back of the seat. Tie the ropes around the seat backrest, inside the rope stops so that the seat backrest hangs approximately 3" above the hang tubes. See drawing VII#1-D. Tie the ends of the ropes to the rear carry-through with "bowline" knots as in drawing VII#1-E, so that the back rest is approximately 2 1/2" in front of engine forward braces. Refer to the TRAINING MANUAL, lesson 2, step #2.

DRAWING VII.1.(D)





DRAWINGVII.1.(C)

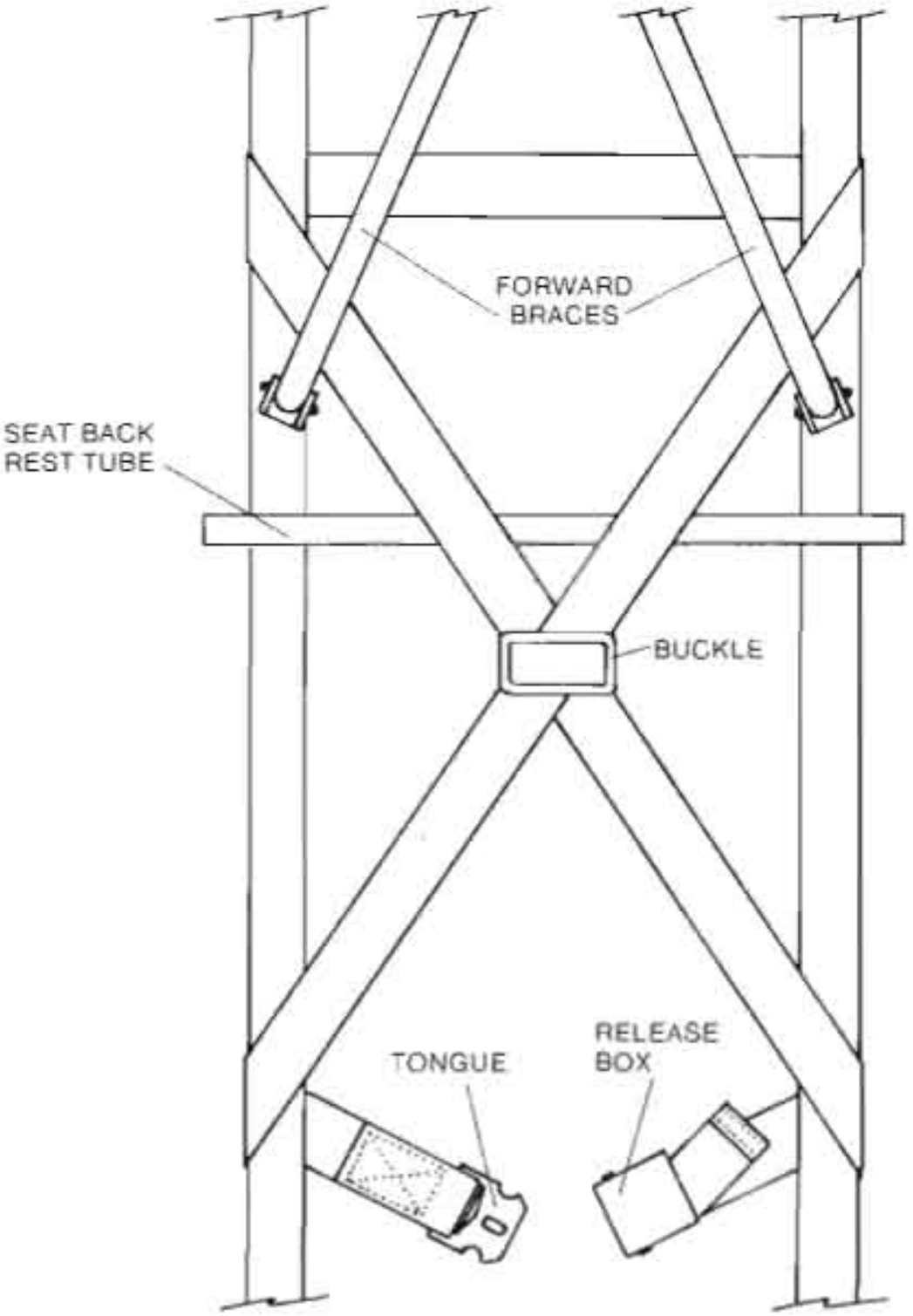


DRAWING VII.1(E)

4. Tighten the strap at the front of the seat so that when you climb in (you may pause here to indulge in flights of fancy) the lowest point of the seat is just above an imaginary line from the base of the maingear carriers to the front of the hang cage. With the seat at this height and your feet on the carry-through, even if you land badly enough to destroy both front and rear landing gear, your precious anatomy will still be off the ground. As you become more confident of your landing ability, you can lower the seat to suit your taste. In cruise flight, you will have one or both feet on the front horizontal strut.

5. Fit the shoulder harness (7075). Remove the release box from the end of the harness strap, noting how the strap is threaded around the sliding bar (you will be re-threading it later).

6. Position the buckle about 3-4 feet along the strap from the tongue. Rest the tongue on the seat and the buckle on the seat back rest. Feed the strap behind the forward braces and around the hang tubes as in drawing VII#2 (in front of the fuel harness). Thread the end through the buckle and then through the release box.



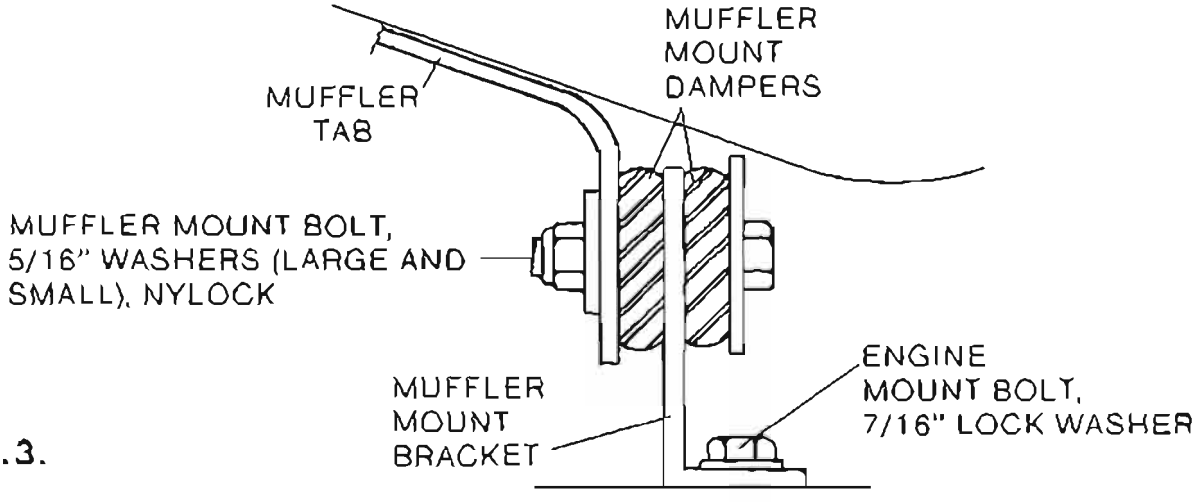
DRAWING VII.2.

VII B — POWER PLANT INSTALLATION

NOTES

1. Fold the nose wheel under after removing the lower noseboom cables from the bolts on the noseblooms. Lift the engine and mount by the damper carriers with the prop towards you and bolt the front of the main mount tubes to the brackets on the rear struts. (Take the weight of the engine on your knee with your foot on the rear axle.) Bolt the diagonal braces to the brackets on the main mount tubes.

2. Fit the muffler onto the exhaust manifold until the holes in the tabs on the muffler line up with the holes in the mounting brackets. Refer to drawing III#9. Bolt the tabs to the mounting brackets with the dampers (PP18,19) and washers (PP22,23) as in drawing VII#3, with the chopped side of the large washer upward. Tighten the lock nuts untill the dampers begin to spread. Tighten the engine mount bolts (which hold the muffler mount brackets) to 40 ft./lbs. (You may need to bend the tabs to make them parallel to the brackets. Make large radius bends.)



DRAWING VII.3.

3. Fit three springs at the join of the muffler and manifold. This will not be easy. Use pliers.

4. Pull out 3' of the pullstart rope. Attach the flat tang of the pullstart assembly to the hole in the rear of the keel with a clevis pin (PS6) and safety ring.

5. Attach the anti-sway cables (which are bolted to the stub axles) to the bolts through the end of the rear carry-through with a kearny, 2 swages, a thimble and a flat tang each. (You should already have a loose piece of heat shrink on each cable.) Adjust these cables so that they remain tight when the axle is loaded, with the pilot in the seat and the tank full, not so tight that you cannot remove and replace the tang on the bolt through the carry-though by pressing down with one foot on the end of the main axle. They should also be equal length, both sides.

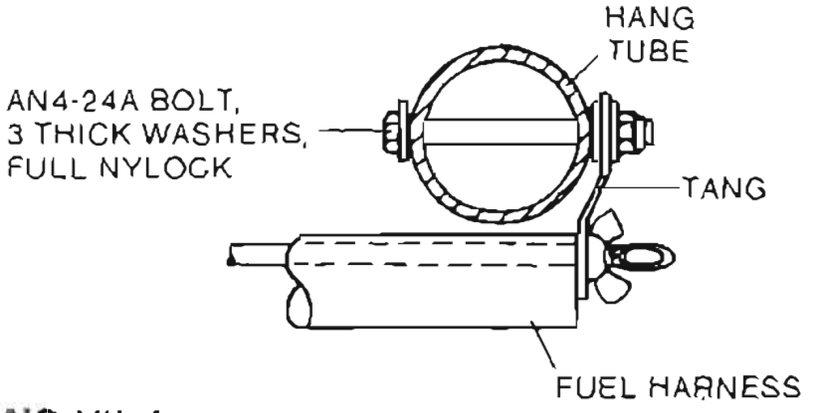
Remove the tangs from the carry-through, clamp the swages, heat on the shrink tubing, and bolt them back onto the carry-through.

NOTES

6. Slide the short piece of fuel line to the rear of the nosegear suspension cables and push it on over the swages. Slide the short piece of heat shrink tubing over this fuel line and heat it in place. This 'padding' stops the swages at the plastic thimble from scratching the maingear carriers when the shock cord stretches.

The short pieces of fuel line on the maingear bracing cables are to stop the fuel tank wearing against the tangs and thimbles. Make a slit (with a razor blade or Exacto knife) in each piece so that you can slide them over the swages to cover the edge of the tang or thimble which will touch the fuel tank. Slide a piece of heat shrink over each and heat it in place to secure.

7. Disassemble the fuel harness (FS2). Using pliers or vice, bend the flat tangs. Tighten the nylock onto the threaded rod. Bolt the tangs to the outside of the hang tubes. Tighten the nylocks until two threads are showing. See drawing VII#4. Refer to drawing III#9.



DRAWING VII.4.

8. Remove the cap from the fuel tank. Check that the inside of the tank is clean. Set aside the cap, you will need it when transporting your fuel tank. Place the tank between the maingear carriers with the opening facing toward the rear. Place the fuel harness tube through the tank handle, and lift the tank until you can slide the threaded rod through one tang, the harness tube and the other tang. Secure with a wing nut and safety ring.

Hook one end of the fuel tank bungee around the junction of the maingear bracing cables and stretch the bungee around the carriers and tank. Hook the other end to the cables and the other hook. The hooks should face to the rear so that they don't wear holes in the tank.

9. Push the carburetor into the mounting flange on the engine. Tighten the clamp. Rivet the stop (TC20) to the 5/32" hole in the side of the hang tube.

Wrap the harness cover (TC9) around both the throttle cable and electrical wire. Trim off any excess. Use the rounded end of each Velcro strap to make a small loop around the harness cover. Press the throttle assembly onto the front of the hang tube so that the stop fits into the hole on the inside of the curve.

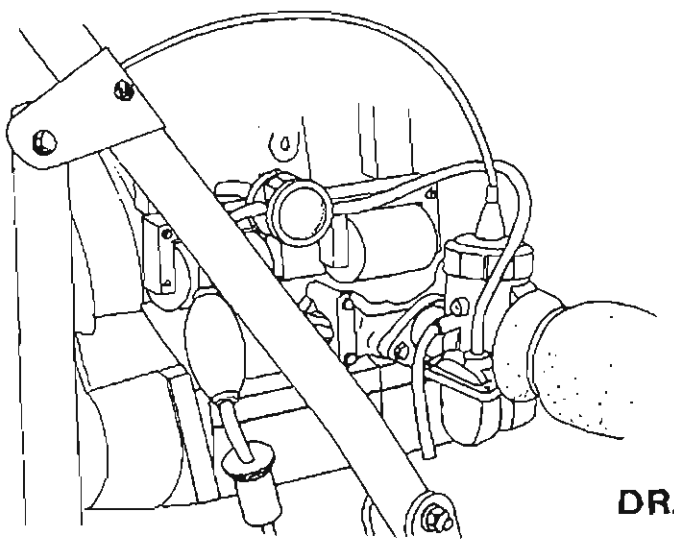
NOTES

Use the Velcro straps to secure the harness cover along the hang tube and secure the throttle cable to the forward brace with 2 cable clips.

Attach the wires from the switch to the wires from the engine.

Drill two 1/8" holes in the altimeter mount bracket (ST3) and the throttle assembly so that when you attach the altimeter, and push the throttle lever forward, your hand does not touch the altimeter. The holes should be 1" apart, in line with the switch. Use 1/8" aluminum rivets (ST4) to attach the bracket to the housing. Peel the backing paper from the foam strips and use them to secure the altimeter (ST2). See FIELD ASSEMBLY photo #30.

10. Attach the pulse fitting of the fuel pump to the tube from the crank case. Attach the fuel line from the outlet of the pump to the inlet fitting on the carburetor. Put the other end of the fuel line into the tank and screw the cap on. See drawing VII#5.



DRAWING VII.5.

11. Safety wire the remaining fuel line connections. Safety wire the springs on the exhaust manifold with a single loop of wire running through all three springs. Safety wire the bolt head under the canard leading edge with a loop through the bolt head and around the control arm. See construction notes - safety wire.

12. Attach the aircleaner to the carburetor intake with the spring on the carburetor. Tighten the clamp firmly with a screwdriver.

13. Uncover the spark plug holes and insert the spark plugs. Push and twist the plug caps onto the spark plugs firmly. Caution: Push them on, don't hammer them on. A solid swat with your fist can crack the insulator.

14. Check the nylocks on the bolts which hold the rigging to the wing and glue 1/4" nut covers to them. Check the nylocks and fit 3/16" nut covers to the eyebolts on the canard.

VII C — FINAL INSPECTION

NOTES

Take your assembly instructions and a pencil and double check each step. Read each instruction, look on the aircraft to see it was followed, check it off and go to the next instruction. Every bolt with a nylock nut must have thread showing through the nylon. Every bolt which doesn't have a nylock nut must have a wing nut and a hole in the bolt for a safety ring. Before flight each of these and every clevis pin must have a safety ring.

For easier installation you may bend 1/4" of one end of the safety rings out a bit on the ones commonly removed. These are the rings on the twenty wing nuts (two noseboom rigging bolts, two front strut top, two main strut bottom, one pushrod/control stick, two engine mount forward braces, four engine mount, one fuel tank carrier, two rear carry-through, four tip rib) and on the twelve clevis pins (one pushrod front end, two canard eyebolts, two noseboom clevis, two control stick cross tube, two winglet, two control cable at the winglet, one pullstart).

The remaining safety rings (four spar outboard sections, one keel front, two inboard sweep wires) should not be bent.

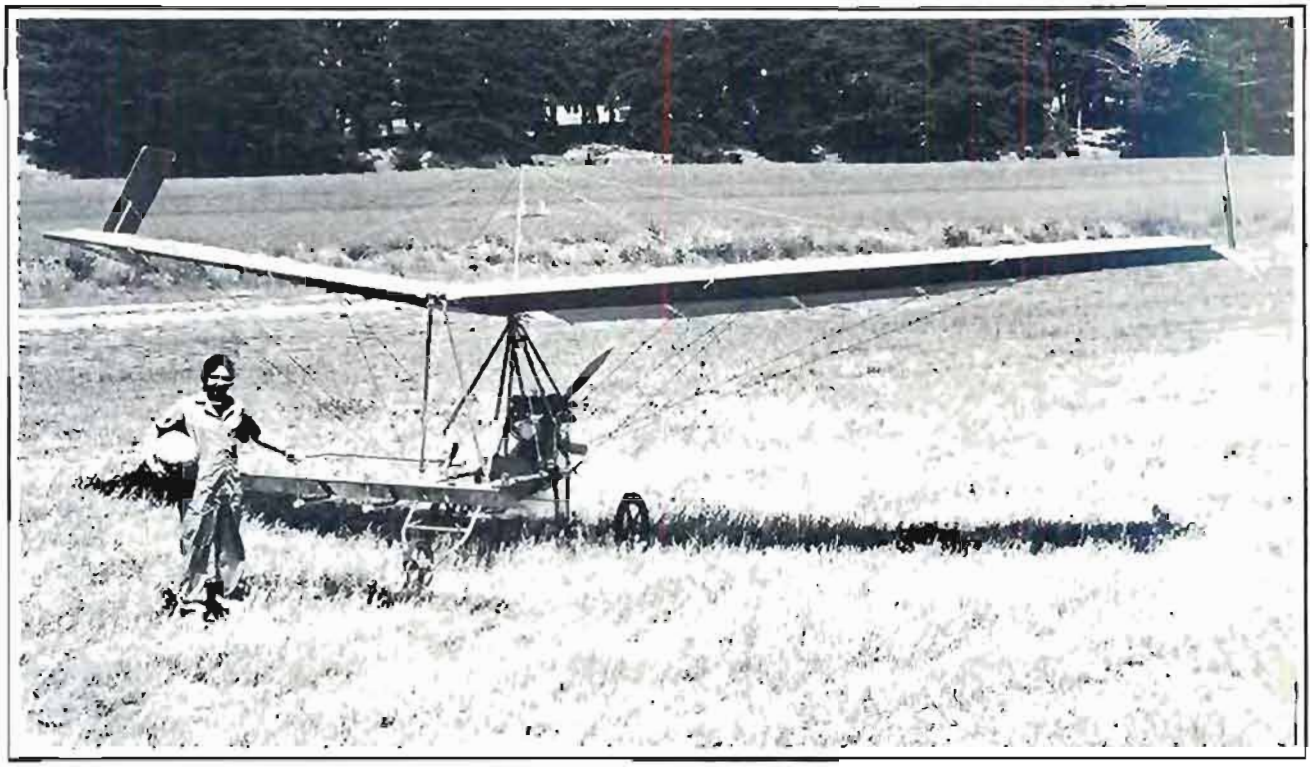
Inspect all tubing for dents. Look it over carefully. When you preflight you'll be seeing that it's still as good as new, so get a good impression of what it's like while it's new.

One more thing. Certificated aircraft get a complete inspection every hundred hours or every year, whichever comes first. It would be foolhardy to think your uncertificated aircraft can get by with less. A full inspection means disassembly, so don't throw out your assembly manual. And of course any aircraft deserves a full inspection if it's involved in an accident or other mishap (like dropping it off your roof rack). See maintenance.

PTERODACTYL

FIELD
ASSEMBLY

FIELD
0131



Before attempting to assemble or fly your Pterodactyl, please read this Assembly Manual and the Flight Manual completely. Doing so will save you time and (perhaps) trouble as well. These two booklets are designed as a set of guidelines to help you use your Pterodactyl "intelligently."

There is much truth in the pilot's axiom: "Safe flying is 10% skill and 90% preparation/judgement." Unfortunately skill can often develop more quickly than judgment; so the possibility of getting into "situations" can develop before we have the ability to make sound decisions regarding them. To achieve that 10%-90% balance, you will have to work hard at developing judgement while developing skill. This can be done by deliberately cultivating your judgement of winds, distances (takeoff-landing), elevations, etc. by becoming as knowledgeable as you can about your equipment, weather conditions, and flying. Never attempt a flight you cannot be certain of completing safely. Trusting yourself to know when to say "no" (in spite of what others say or do) is (in itself) a way of strengthening judgement.

Flying judgement actually begins on the ground from the moment you begin assembling your Ultralight. A properly assembled craft may sound ridiculously basic but the unfortunate statistics (over the years) have proven that most mistakes begin with the pilot overlooking such simple tasks as securing wingnuts or connecting control cables. Remember, it is because of the equipment (the aircraft) that you are allowed to venture into a realm otherwise inaccessable to man. This is true for other sports as mountain climbing, scuba diving, or skydiving. In all of these examples, it is because the equipment is used intelligently, correctly, and is in perfect operating condition, that the activity can be experienced in the first place. Again, preparation, beyond actual flight skills, is the basis for a successful flight. Planning and preparation put you in command and allow you to make the most of this rewarding experience known as flight - safely!

If you are new to this sport, you have much to learn. You can begin by reading basic texts about flying and weather, and also by taking flight instruction from a qualified instructor or school. Accordingly, as you (most likely) are inexperienced with a Pterodactyl, or are not familiar with this later version, please take time to read this manual completely. It is designed to save you time and money, as well as to avoid mistakes. Proper maintenance of the

equipment begins with treating it the way it was meant to be treated. It will also treat you according to how well you respect it. Remember, most problems arise due to pilot error! This includes flying in poor weather conditions, making bad decisions while flying, not maintaining your equipment or assembling incorrectly! Take the time to do everything correctly and you will not only become a good pilot but an intelligent pilot. And intelligent pilots are the ones who get everything there is to be had from this sport - namely fun!

The people who have put this manual together (collectively) have many years of flying experience; including many Transcontinental flights and stories that can keep a party going to the wee hours of the morning. When asked to help assemble this booklet, there was one theme that kept arising when discussing their personal equipment. "Respect" was repeated over and over.

Of the hundreds of pilots we have known through the years there were always the "Professionals" who understood that you have to "wine-and-dine" your portable airplane long before you ever get to fly. Aside from the beating a craft can take due to poor judgement on takeoff or landing, the next most inexcusable treatment is due to poor handing while transporting and setting up. These are the times when all good pilots literally pamper their equipment because they never want any unexpected surprises when they are flying. Unpadded car racks, dropping the wing, kinking cables or stepping on them, twisting tangs or thimbles, denting wing spars, etc. should be avoided at all times. Make a point of keeping your aircraft (it should have a personal name) as happy as possible.

We assume you have arrived at the flying site, have carefully taken the wing off the car, and have placed it on its' wheels with the nose into the wind. Refer to the following pictures and instructions and think about what you are doing. Each pilot will eventually develop his own techniques based on these guidelines - but always remember to "think" and not overlook anything. Each step leads to the next and never move onto another step until you have completed the one before you now.

---

1) Remove the cover bag, carefully place the front of the cage on the ground, and untie the sail. Be very careful not to step on any cables and be sure none are twisted or about to be snagged on any brackets.



2) Spread the wings, moving from one side to the other. Begin by carefully lifting up on the wing so as to clear all the cables from the hang cage, wheels, etc. and then moving outward. Again, make sure you don't snag any cables or the sail on any brackets or fittings. When walking the wings out, be certain to hold the leading edge and trailing edge together. Once the wings are spread, retie the spar tips together, leading edge on top of the trailing edge. This is to keep the Noseplate from getting bent!



3) Get ready to pull the noseplate forward. Begin by raising the kingpost. Next, raise the nose as shown and place the front of the keel against your knee. Be sure the wingspars are tied together! Always be very careful with the keel "snout" and avoid denting the tubing. Also be sure the wingspars are spread completely as it will help in the next step.



4) With your hands on the bottom plate, pull forward on the nose plate assembly. Be advised that some people have difficulty with this operation at first, especially with a new wing. As you pull forward the wing spars will rise and be supported by the kingpost ... so until the pip pin is inserted <u>you</u> will be holding that weight. With practice you will fully insert this pin the instant you have pulled the plates to the hole. If necessary, have a friend help until you develop a "feel" for this step. Take your time and also keep an eye on the wind. The "wing" is taking shape and gusts might get under it and cause problems. You might also want to slip a small board (or similar object) between the bottom of the keel and the two rear struts. This will keep the keel from slipping down between the two struts and stretching the sail.



5) Stop and walk around the wing to check for cable snags or twists. Next, raise the nose and pull the main struts out and down. Again, keep an eye on the spars (still tied) and the wind. Note board supporting keel.



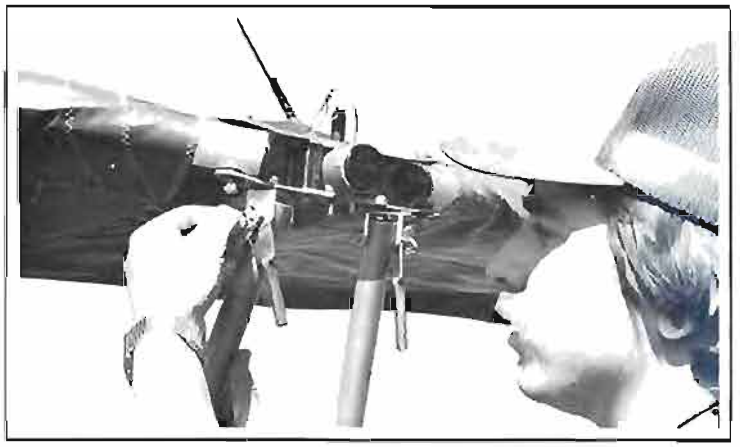
6) Connect the main struts to the front of the hang cage with the proper bolts. Make sure you complete this operation with the wing nuts <u>and safety rings</u> ! If there are any twisted thimbles or tangs, this step is very difficult and could lead to cable damage.



7) Swing the forward struts out and prepare to secure them to the noseplate. The weight of the wing will be against you here so note placement of the hands.



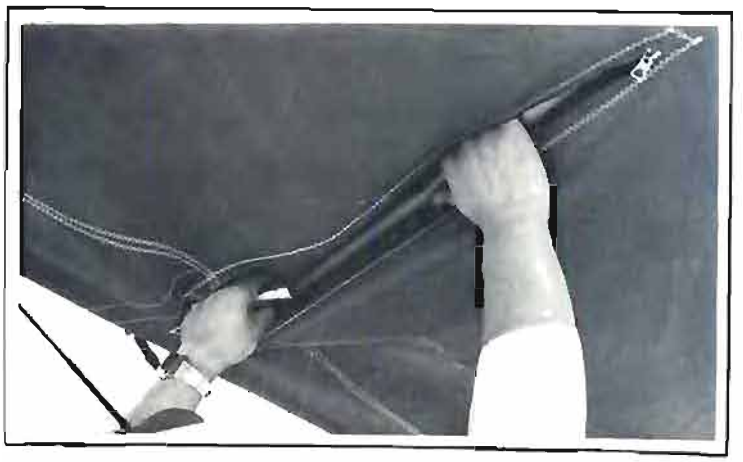
8) Connect the two forward struts with the proper bolts, wingnuts, and safety rings. Note the placement of the tangs of the upper noseboom cables.



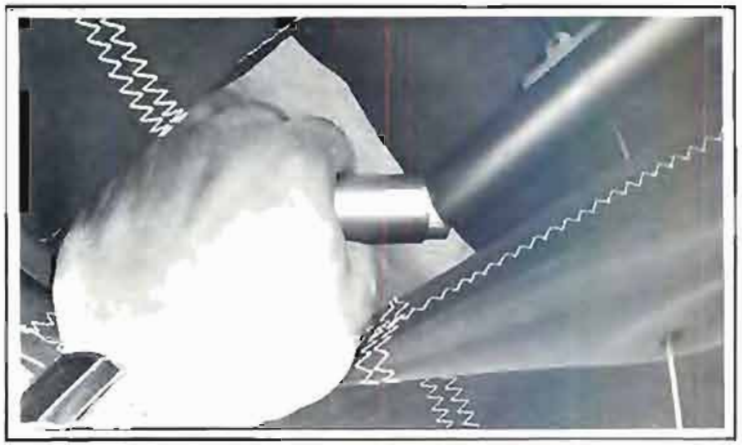
9) Go to the end of the wing and untie your ribbons that have been holding the two spars together. Make sure you do not drop the leading edge! Unzip the outboard compression strut zipper and prepare to connect the front and rear compression struts.



10a) Note placement of hands when connecting the front and rear compression struts. Pull back on the spring slide and match the edges of the tubes.



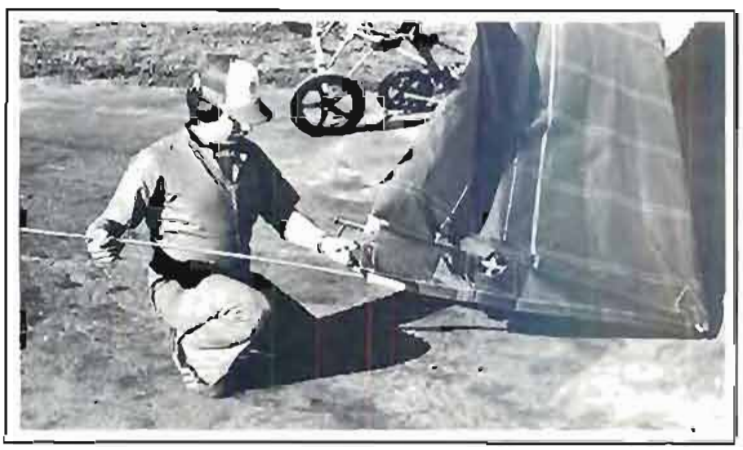
10b) Be careful here not to pinch your finger when straightening the strut into final assembly form. Once the edges are matched, the spring insert is back, simply pull (carefully) toward yourself, get the front and rear in line, and release the spring slide. Make sure the spring slide is completely inside the rear portion of the compression strut. Repeat this process on the other outboard strut, then connect both inboards. When working on the two outboard struts, check the control cables and outboard sweep wires. When on the two inboard struts check the inboard sweep wires. BEFORE CLOSING THE ZIPPERS, CHECK THAT ALL FOUR COMPRESSION STRUTS ARE PROPERLY ASSEMBLED!!!

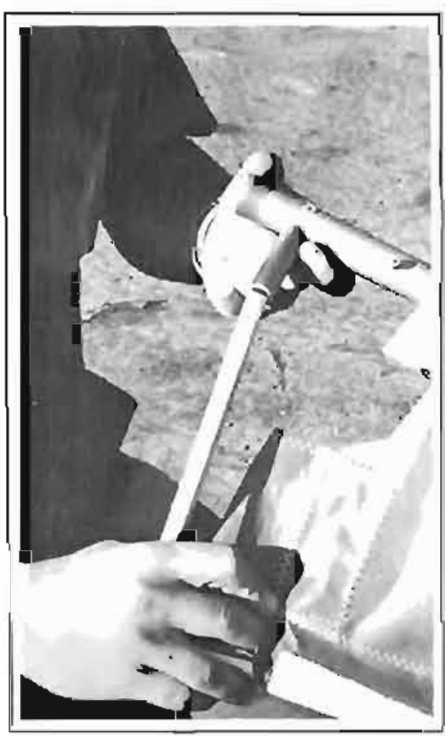


11) Next fit the two tip ribs and droop tips. Carefully rock the wing to one side (as shown) and sort the proper tip/droop ribs. Remember the droop tips will cant outward. Slide the tip rib into the pocket, over the top of the rear spar, and forward until it plugs into the hole in the leading edge.



12) Slide the droop tip in next, making sure the rib tip is under the leading edge.





13) Connect the tip rib and droop tip as shown. Make sure the droop tip is fully inserted into the 5/8" section of sleeving on the droop tip. Attach the sail by slipping the grommet over the sail stop located at the rear of the tip rib (with the tip rib at 90 degrees to the spars). If this isn't done now you will have to disassemble later as the sail will be too tight. See photo #14 for sail attachment.

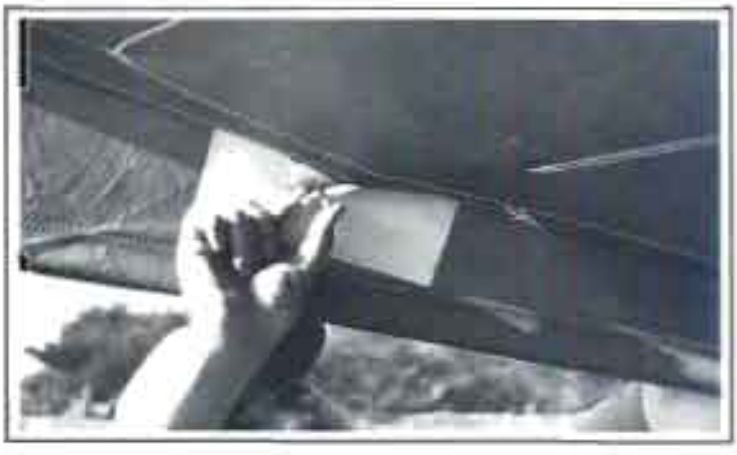
14) These next few steps are considered the most difficult for beginners until the proper technique is mastered. This is not to discourage you but to merely forewarn. Note the hand positioning ... here the heel of the right hand is about to push against the rear spar, the right hand fingers will be helping pull the tip rib to the slot, the left hand will be twisting the tip/droop assembly "down" in a clock-wise direction. Also note the tip rib bolt sticking out between the fingers on the right hand. Insert this bolt though the tip rib so that it sticks out about 1/2" on the other side. Catch the edge of the slot in the rear spar with this bolt.



15) Shown is the left side tip rib being inserted; the operation is the same as for the right. As you begin twisting, the aforementioned bolt will act as a catch to pull the rib down into the slot. Use your hand to help pull the rib down into the slot. The sail is very tight on a new wing so this can be difficult. Once the tip rib has been "pulled" into the slot completely, slowly rotate the rib back in the opposite direction so as to align the bolt holes.



16) Once the bolt holes are in alignment, you can push the bolt through, tighten the wingnut until the tip rib is seated in the slot, and fit the safety ring. In time the sail will loosen slightly, you will become more familiar with the operation, and this will no longer be a difficult operation.



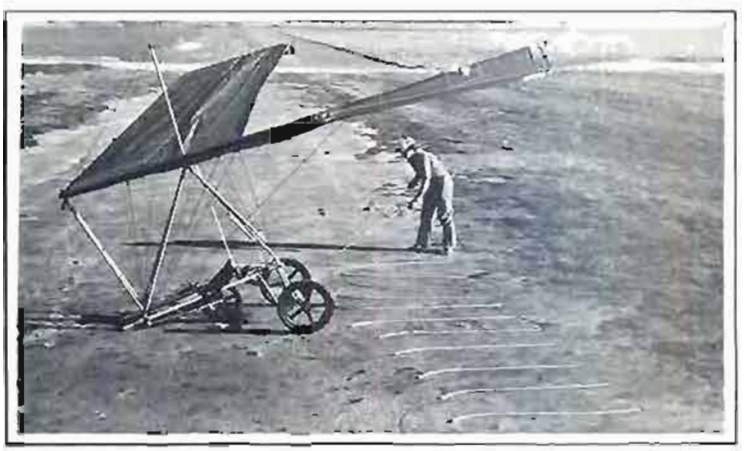
17) Insert the bolt through the front spar and tip rib, and fit the wingnut and safety ring.



18) Once the tip rib is inserted, pull the velcro strap across the back of the droop tip and secure. Repeat on the other side. Repeat steps 11-18 on the other wingtip.



19) Start sorting the ribs. You should always keep your ribs in a safe place to avoid their getting damaged. It is also a good idea to frequently check your ribs against the rib diagram to assure their proper shape. The longest ribs go to the center, the six reflexed ribs are at the tips. Two of the reflexed ribs have gold caps and go in the rib pocket that is third from the end. The four identical reflexed ribs with black caps go to the two outermost pockets. It is a good idea to sort the ribs and lay them carefully on the ground behind their respective pockets. Avoid stepping on them.



20) Begin to insert the ribs into the pockets, again longest to the center. The sail is gradually getting tighter and so use care not to force the ribs and possibly tear the sail. Sometimes the ribs will catch on the rear spar, hold the back of the rib down and ease it over the top of the spar. If the center ribs catch on the rear spar, fit the next ones, both sides, then return to the center. Work from one side to the other.



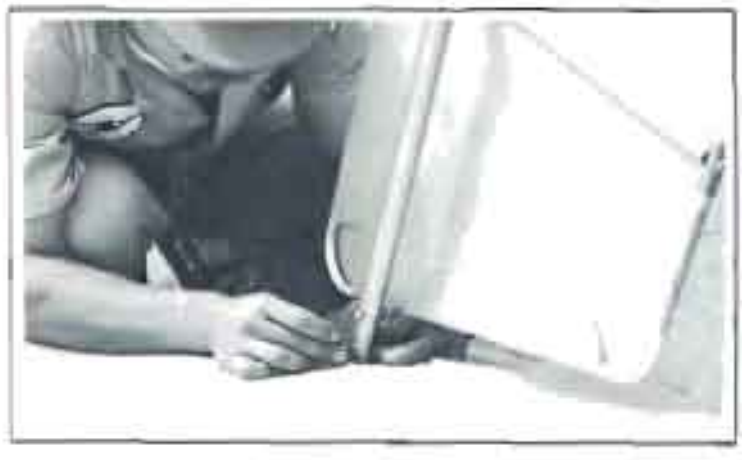
21) The last reflex ribs will require the most care when being inserted, again the sail is getting progressively tight. You might want to pull at the trailing edge of the sail while you gently push the rib into its' pocket.



22) Now is when you want to tighten the top rigging cable tensioners. If you do this too early it becomes difficult to get the ribs in. If you forget to loosen them later it is difficult to get the ribs out. Squeeze the two cables together before sliding the tensioner (when tightening or loosening) or you will gradually wear the holes larger. There are four of these tensioners, generally it is best to do the top (outboard) cables first. Slide them down until the bottom cables are equally tight, and the left and right tensioners are an equal distance from the kingpost.



23) Attach the winglets. Begin by sliding the winglet post onto the plug attached to the tip rib. Secure with the proper clevis pin and safety ring.



24) Attach the control cable with the proper clevis pin and safety ring. Check that the winglet moves freely, that the adjuster bolt on the bellcrank turns easily and that the control cable is not worn or frayed. Repeat on the other wingtip. Double check all the safety rings on both wingtips.



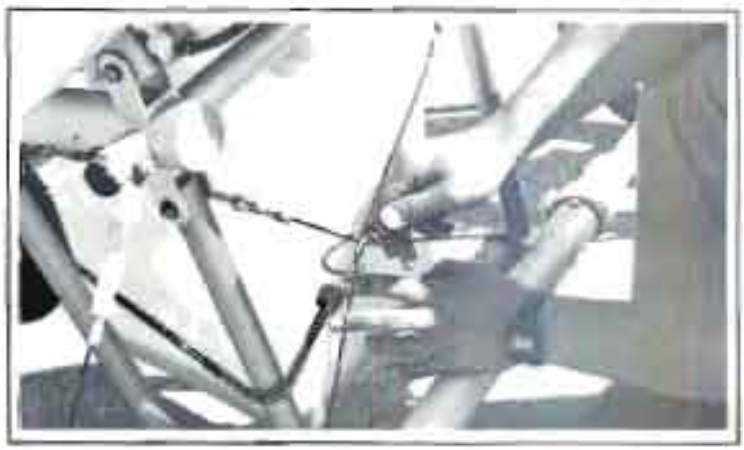
25) Now begins the powerplant installation. Begin by attaching the fuel tank (transport cap on) with the fuel tank harness. Pull the threaded rod out, slide the tube through the handle, raise the tank, and replace the threaded rod. After the end of this rod passes through the tang, secure it with the wing nut and safety ring.



26) Swing the two forward braces down and secure them to the hang cage. Make sure your shoulder harness is routed properly around the hangtube. Attach the braces with the proper bolts, wing nuts and safety rings.



27) Secure the tank with the large bungee cord to keep it from swinging about.



28) Attach the engine. Refer to the three photos. There are a number of techniques for this operation so find the one which works best for you. If you are tall enough, you can rest the engine on your knee with the foot of the same leg on the rear axle. As shown, this pilot had both bolts in his hand prior to picking up the engine. This way, as soon as the holes of the main engine mount tube match with the stainless brackets, the bolts can be inserted. Secure with the wing nuts and safety rings.



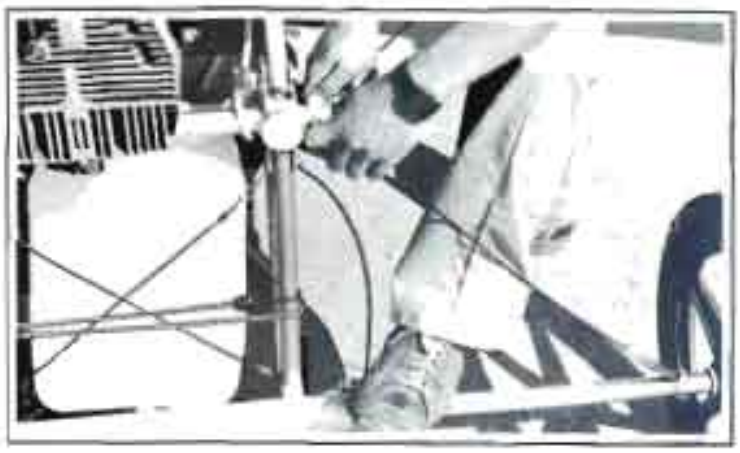




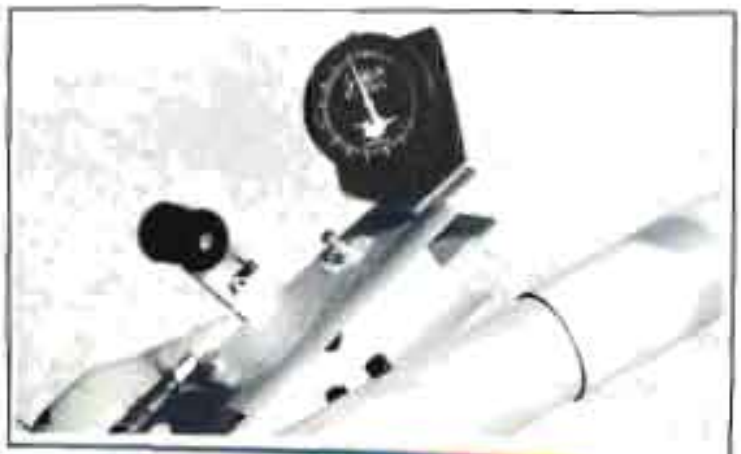
29) Swing out the two diagonal braces and secure them with the proper bolts, wing nuts, and safety rings. Again, notice the use of the knee in helping raise the engine to its' proper location.



30) Remove the gas cap and attach the fuel line. Begin by unwrapping the fuel line and inserting it into the tank, making sure it reaches all the way to the bottom of the tank. Tighten the cap.



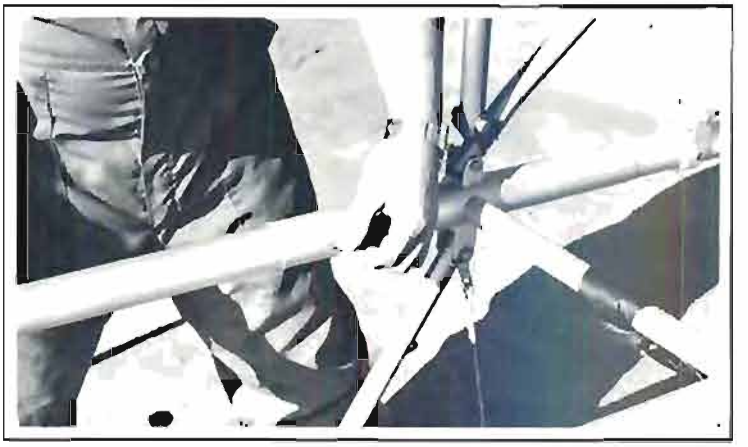
31) If you removed your wheels and springrods for transportation, fit the hangcage centering cables and anti-sway cables to the rear carry through. (Push down with your foot on the end of the main axle to fit the tang of the anti-sway cable to the bolt). Secure it with a wingnut and safety ring.



32) Unwrap the throttle cable and attach it to the hang cage.



33) Pull the starter rope out so it can be attached to the keel. Make sure the switch is off and there is no one standing around the prop. Pull it up to the keel and attach the tang with the proper clevis pin and safety ring. Position the handle so it faces forward and is not binding any ropes. The engine installation is now complete.



34) Attach the canard. Begin by swinging the front wheel forward. Next insert the two nosebooms into the tubes extending from the hang cage. Secure with the proper clevis pins and safety rings.

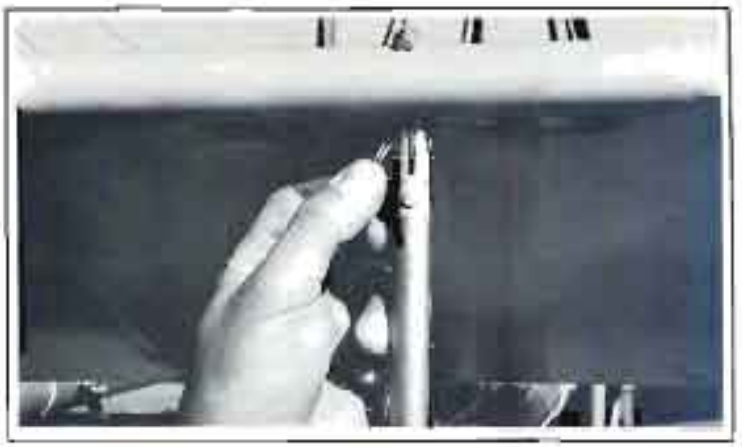


35) Attach the noseboom cables, one from the front axle and another from the nose plate. By attaching the top cable first, you can then push down to match the lower tang to the bolt.



36) Secure the noseboom cables with the proper wing nuts and safety ring.

37) Carefully place the canard in position so as to prevent punching any holes in the fabric. Attach the canard with the proper clevis pins (2) and safety rings.



38) Attach the pushrod to the control arm on the canard using the proper clevis pin and safety ring.

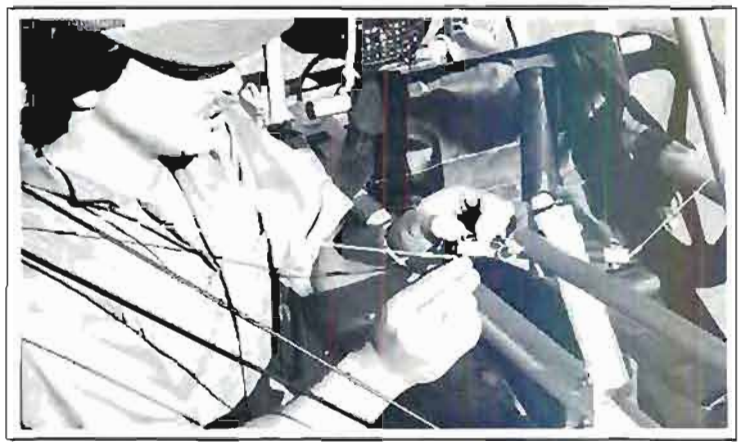


39) Connect the pushrod to the control stick with the proper bolt, wing nut and safety ring.

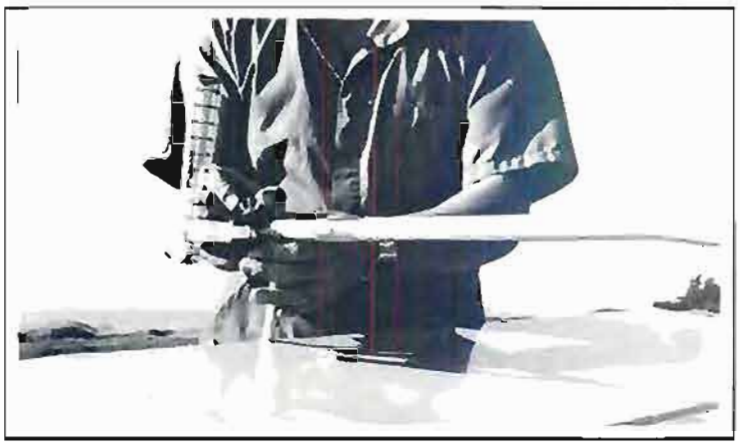


40) Some people leave their control cables attached to the stick all the time. If you do not, make sure you connect the control cables now.





41) Secure the airspeed indicator to the from of the pushrod.



42) Now is a very good time to take a short break, relax, and clear the head. The next step is very important and should be done each time you setup and before you fly. Go back and recheck each step and make sure everything is properly assembled, attached, adjusted, and airworthy. This is known as the "Preflight" and is absolutely essential.





After a full day of flying, your airplane is now ready to go home; and probably won't see the light of day for another week. Sometimes you meet those pilots lucky enough to have hangars who just put their planes away for the night. As for the remaining 95% of us, the takedown procedure is a time to take special care. Not only will your plane be dismantled, transported home, and stored, but will experience the return transport and eventual set up. We mentioned before that airplanes do not wear out flying through the air ... you will now begin to understand what we were talking about.

Basically the takedown process is the opposite of the setup. There are many things to look out for, primarily wear points. Wear points develop because you forget to fold the wing covering properly, crumple cables into incoherent messes, don't pad your car racks properly, etc. The takedown is no more a mystery than the setup; and if done properly leaves you with a confident feeling that everything will be in order the next weekend. It's all part of being an intelligent pilot. You might want to read the following sections in advance and know what you will be doing before you get there.

Begin by picking an area that is "clean" and the less abrasive (rocks, etc.) the better. Sometimes you will be doing this on a dirt road and so compromises must be made. Just think in terms of potential damage ... and protecting your investment.



1) Look around you. Figure you have a 33 foot wingspan that will have to fold into a package approximately 18 feet long. Is there enough room to fold in the wings without snagging some other object? Next, where is the wind coming from? While you are taking the plane down is it going to start blowing away? There are plenty of stories of pilots having to takedown in some pretty tight situations under adverse conditions ... successfully!

2) Prepare to remove the canard. Disconnect the pushrod and remove the airspeed indicator. Generally it is a good idea to remove wing nuts, safety rings and bolts - disconnect - and then

put the nuts, rings and bolts back where they came from. This way you know where they are the next time you put the wing together. Whenever you do, make sure the bolts and sharp points are not going to be wearing on something, like your wing cover.

3) Disconnect the canard by removing the two clevis pins and safety rings. It is a good idea to put the canard somewhere safe; dogs and people have a way of stumbling/stepping on such important items.

4) Remove the two noseboom tubes. Again, keep track of all pins, rings, and nuts and move the tubes to a safe place. Always know where you put everything. Check the equipment as you move along. Each time you handle tubing you should check for dents. Each time you handle cables, check for frays and kinks.

5) Now that the "front" of the airplane is safely tucked away, you can fold back the nose wheel and lower the front of the plane. Until now, if windy, you probably had someone holding the plane. Once the wheel is folded back the plane should stay where it is. (If you plan to remove the wheels and springrods, remove the tangs of the anti-sway cables from the rear carry through).

6) Get ready to remove the "bulk" of the airplane - the power plant. Begin by making certain the engine and exhaust is completely cooled off! Disconnect the throttle and altimeter. Most pilots like to wrap the throttle cable around the engine so all remains in one neat package. Never kink a cable.

7) Disconnect the pull starter from the keel (replace clevis pin and ring) and disconnect the fuel line. For cleanliness sake, shake all the remaining gas from the line and wrap it so as to protect from damage, dirt, ect. Cover the gas tank with the spare cap. The fuel tank and fuel line is no place for dirt!

8) The engine should look like you can now pick it up and walk away with it. It should not be connected to anything, except for the four bolts that hold it to the airplane. If you think you might want help (at first), get someone. Look at the setup photos again and see how our "model" pilot did it. Remove the wingnuts and safety rings from the four bolts and pull the bolts part way out. With your knee under the engine and foot on the rear axle, you can support the weight when you remove the two bolts from the two diagonal braces. Next place your arms along side the engine so that your hands will be able to pull the final two bolts and walk away with the engine in one movement. Always place the engine in as clean a place as possible. Preferably, disconnect the engine and walk directly to the car.

9) Remove the fuel tank. Since you are in the same area, be sure to disconnect the forward braces that attach to the hang cage. It is always best to have a routine that takes you from one step to the next and does not waste time or motion.

10) Now that most of the weight is off the plane, you can get ready to fold up the wing. First, remove the winglets. Carefully rock the plane to each side so you can reach the winglets. Disconnect all rings and clevis pins and replace them. These little items are real easy to lose and have delayed many flights the following weekend. Store the winglets immediately with the canard to prevent damage.

11) Loosen the top cable tensioners. Remember to pinch the cables together before sliding the tensioners. Again, continue checking all cables as you go along.

12) Remove the ribs, starting at the tips and working toward the center. For obvious reasons, ribs should be stored immediately. Heavy boots and 1/2" aluminum tubing are not an even match. Once you have removed the tip ribs and droop tips from the wing covering, the ribs should come out real easy.

13) Get ahold of two sail ties, little cords or whatever and prepare to disconnect the compression struts. Start on one side and work to the other. Always disconnect the inboard struts first. The wing will still be suported by the outboard struts. Next go to the outboard strut and disconnect. Place the leading edge onto the trailing edge and secure with one of the sail ties. You never want the leading edge to drop as it will damage the nose plates. Work on one side of the wing at a time, and always zip the zippers closed. While you are inside you can also continue checking the equipment, especially the control cables.

14) Now that the spars are well secured together, you begin the final phase of folding the wing. The next steps are when your wing covering will start touching the ground so hopefully you have chosen a clean spot. Disconnect the front struts from the nose plate and fold them back to the main struts.

15) Turn the brackets on the hang tubes (which the forward braces were attached to) so they won't touch the rear struts when they are folded down onto the hangcage.

16) Be careful on this step. When you remove the main struts from the hang cage, and lower the wing to the cage, the entire assembly may want to roll backwards. You will also be supporting all the weight in your hands until the wing is completely lowered to the cage. This is when you also want to place that "board" under the keel (on top of the rear struts) to prevent any stretching of the wing covering. As you unbolt the main struts, swing them out and up to the keel. Be careful of the keel here. You should never use it for a handle as you may dent the tubing on the nose plates. The wing is now lowered. Don't step on the cables.

17) With one hand under the bottom nose plate, pull the pip pin out of the nose plate assembly and the wing will begin to collapse as the plate slide back down the keel. Watch the keel! Carefully push back on the plates until you find that the kingpost will also fold back completely on the keel. Unless the plates are pushed back completely, you will dent the keel when you fold in the wing spars.



18) Go to each wing tip and walk them toward the center. Lift them up and onto the back of the cage, being careful not to snag any cables or the wing covering on any brackets. Do the same for each side. Make sure the wing covering is not getting pinched between the spars at the nose plate area. Untie the sail ties that were holding the spars together and lie the spars next to each other.

19) This is a very important step! Folding/rolling up the wing covering. This is when some frustrated pilots end up with a mess of cables, crumpled wing covering, plenty of wear points, etc. Hold the spars as shown so the wing covering drapes between them. Lay the spars back down with the wing covering



neatly straightened out. The trailing edge of the wing covering will eventually be wrapped around all the spars and cables. Gather all the flying wires and pull forward, laying them neatly in the wing covering. Carefully wrap the wing covering (roll) into a smooth clean package, making sure that it is not too tight. Wrap so everything is in order and secure with the sail ties. Again, not too tight. Repeat on the other side.





20) Slip the cover bag over the keel snout and work it back as closely to the strut/keel junction as possible. Go to the back of the spars and slip the end of the bag over the wing tips. Begin zipping the bag closed, usually up to the hang cage.



21) Carefully turn the entire wing over, preventing any twisting of the cage against the keel. By lifting (first) the front of the cage and then the back, you will want to gather all the cables. You will also want to arrange the wing covering here so as to prevent any pinching, wearing, etc. Zip the bag closed. There are many variations of this final step and each pilot has his/her own procedure. Find one that works for you but always think about wear points. Tie the hang cage to the wing, front and rear. (You can use the fuel bungee to tie the front horizontal strut up to the wing). Secure any loose cables.



22) Finally, lift your wing onto the car racks. Get help if possible, making sure you helper understands that YOU NEVER USE THE KEEL SNOUT AS A HANDLE! Secure to your well padded racks (not too tight). The plane should be secured to keep it on the rack but so that it doesn't flex up and down or grind against the racks. Usually two tie-ropes to the bumpers help. Make sure everything else (ribs, rudders, canard) is stored where someone will not confuse them with a chair or equipment rest.

In time you will develop your own rythm for this operation. Just keep an eye out for incorrect takedown procedures that result in wear points and damage.

PTERODACTYL

ENG

ENGINE OPERATION
AND MANUAL

INTRODUCTION

This is the first edition service manual for the Cuyuna 430D, 430R, 340D and 340R Experimental Aircraft Engines. Most of the information comes directly from a Scorpion service manual for snowmobiles using very similar engines. The troubleshooting chart mentions some difficulties which could only occur with snowmobiles, please ignore them. The 429cc engines (430D, 430R) are designated "440s" in snowmobile terminology, for the purposes of this manual, 430 and 440 are interchangable.

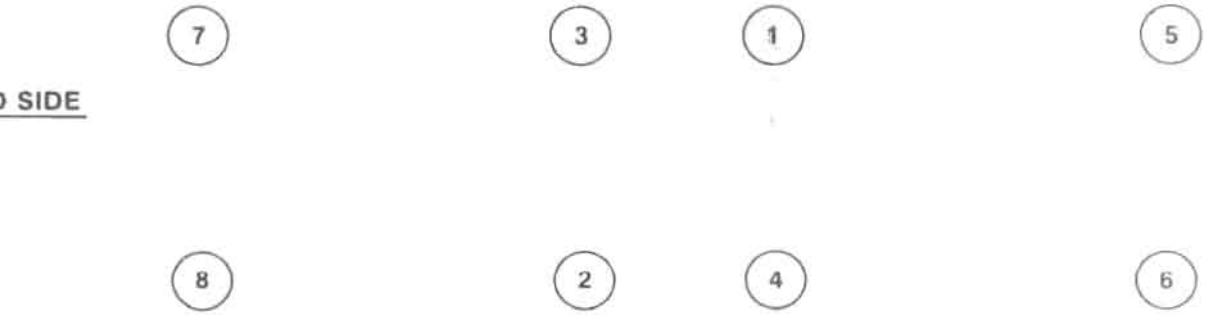
At this time we do not intend to produce 290 or 400cc aircraft engines, although some information on their snowmobile counterparts is included. The 340D and 340R engines are in the final development stage. When they go into production, a supplement to this manual will be available.

1989?

SPECIFICATIONS	340	440
Bore	2.362	2.657
Stroke	2.362	2.362
Displacement	338 cc	428 cc
Point Gap	.015	.015
Timing/Full Advance	.110	.110
Spark Plug Type	N-4	N-3

INDER HEAD NUTS	28-32 Ft.-Lbs.	16-18 Ft.-Lbs.
INDER BASE NUTS	16-18 Ft.-Lbs.	
WHEEL NUT	44-50 Ft.-Lbs.	
AKE MANIFOLD NUTS	16-18 Ft.-Lbs.	
HOUSING SCREWS	16-18 Ft.-Lbs.	
WHEEL NUT	20-24 Ft.-Lbs.	
G GEAR SCREWS (6 mm)	6-7 Ft.-Lbs.	
G GEAR SCREWS (8 mm)	10-12 Ft.-Lbs.	

Tightening Sequence for Cylinder Base Nuts
All Models



Tightening Sequence for
Cylinder Head Nuts



MODELS 290, 340, 400, 440

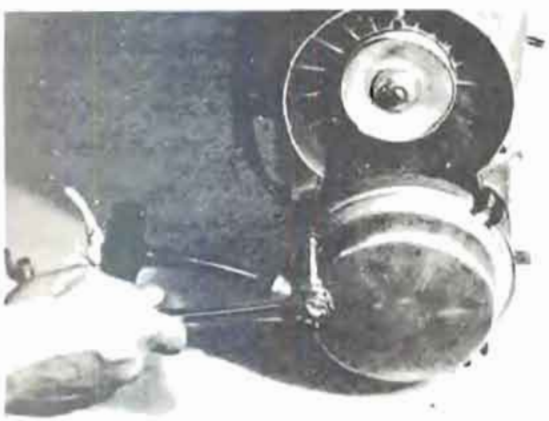
DISASSEMBLY

A. Recoil Starter

Remove four (4) screws holding the recoil assembly to the fan housing.

See pages 1-12 and 1-16 for Recoil Starter Disassembly.

Fig. 1-4



B. Lower Fan Pulley and Carrier Assembly

Remove the three (3) hex head bolts on the carrier. Remove carrier, lower pulley assembly and V-belt (see Figs. 1-5 and 1-6).

Fig. 1-5

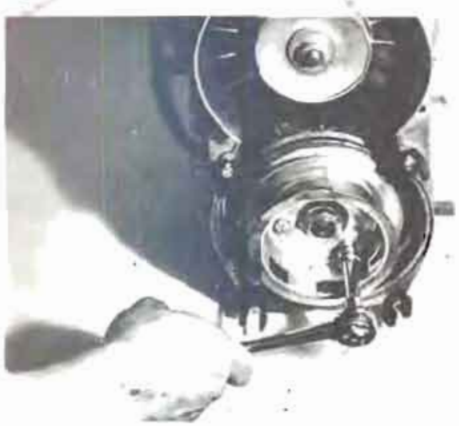


Fig. 1-6



C. Upper Fan Belt Pulley Assembly

Insert a 3/16" drill or a suitable punch through the indexing hole into the impeller body hole. With a 17 mm socket wrench, remove the fan nut, lock washer, pulley halves and spacers (see Figs 1-7, 1-8 and 1-9).

Fig. 1-7

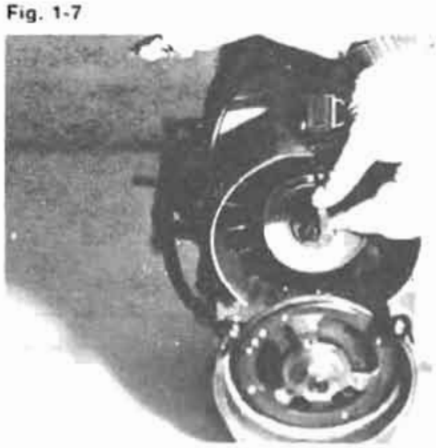
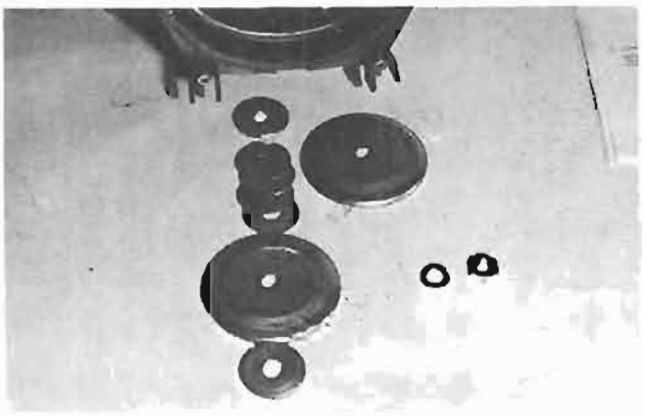


Fig. 1-8



Fig. 1-9

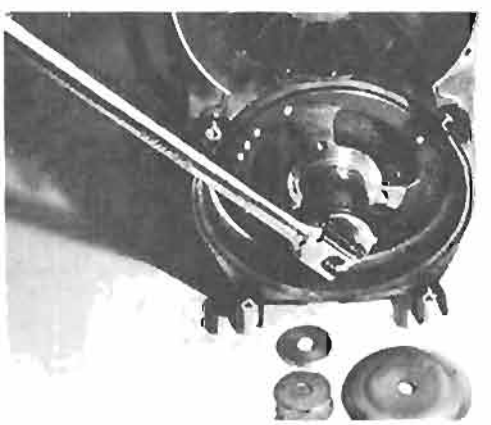


D. Flywheel Magneto

Remove the crankshaft nut using a 27 mm socket wrench. Pull the flywheel by attaching flywheel puller 444-31-843-2 to the flywheel flange using bolts provided. Screw the three bolts through the puller into the flange and tighten evenly. With a socket wrench, tighten the puller bolt until the flywheel loosens on the crankshaft (see Figs. 1-10, 1-11 and 1-12).

NOTE: Bolts provided with puller must not be screwed into the flywheel so far that they hit the magnet wheel. So doing could cause damage to the advance mechanism.

Fig. 1-10

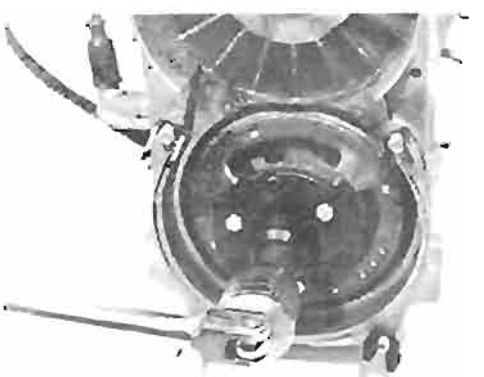


NOTE: It is important that care be taken in removing the flywheel assembly because the positioning key located in the keyway may stay in its original position and thereby cause damage to the advance mechanism. A small icepick or screwdriver may be used to loosen and remove the key.

Fig. 1-11



Fig. 1-12



E. Intake Manifold Assembly

Remove the four (4) intake manifold nuts and washers. Remove manifold assembly and insulators (see Figs. 1-13 and 1-14).

Fig. 1-13

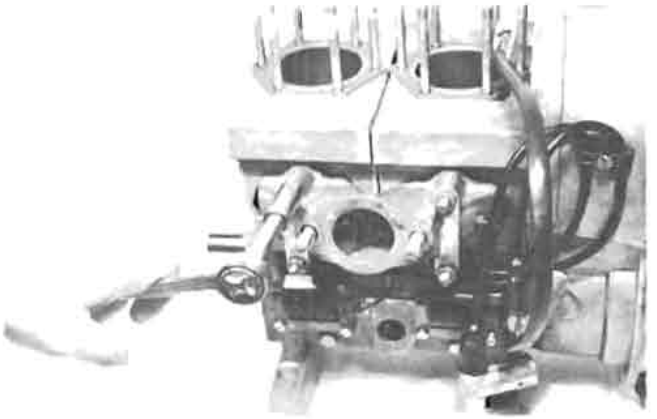
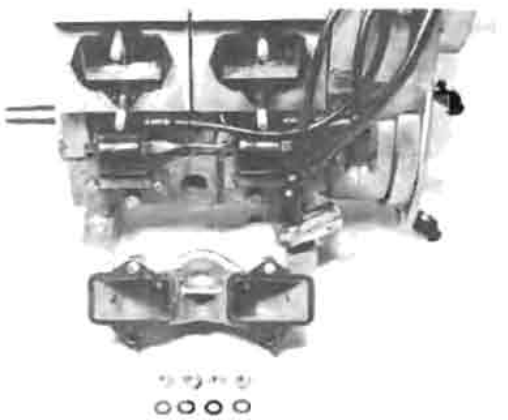


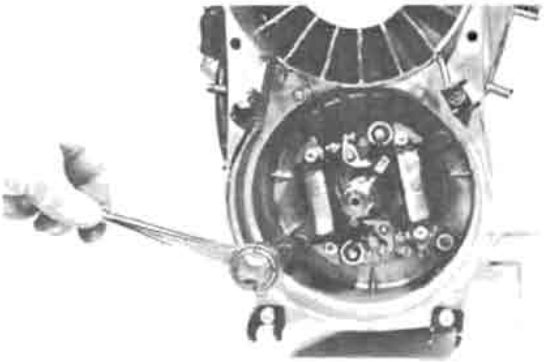
Fig. 1-14



F. Fan Housing and Armature Plate Assembly

Remove screw holding spark plug wire bracket to fan housing. With a socket, type 5 mm Allen Wrench remove the four (4) mounting bolts holding fan housing to crankcase (see Fig. 1-15). Remove fan housing from crankcase (see Fig. 1-16).

Fig. 1-15



Unplug connector housing coil wires. (Note color coding of wires.) Remove armature plate assembly and wires, as a unit, from fan housing.

Fig. 1-16



Remove the fan by tapping the end of fan shaft with a soft hammer. With a flat punch and hammer, tap the inner race of the furthest bearing in the housing (see Figs. 1-17, 1-18 and 1-19).

Fig. 1-17



Fig. 1-18

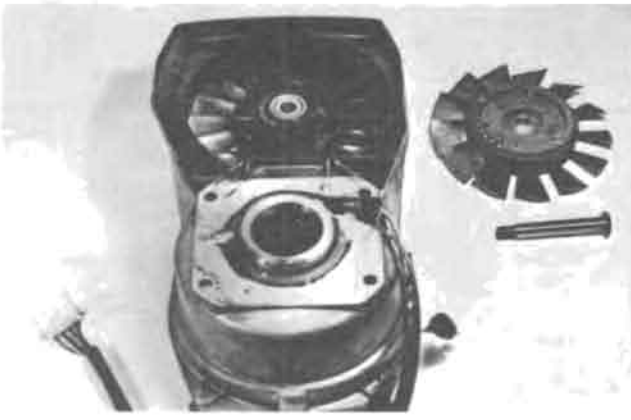
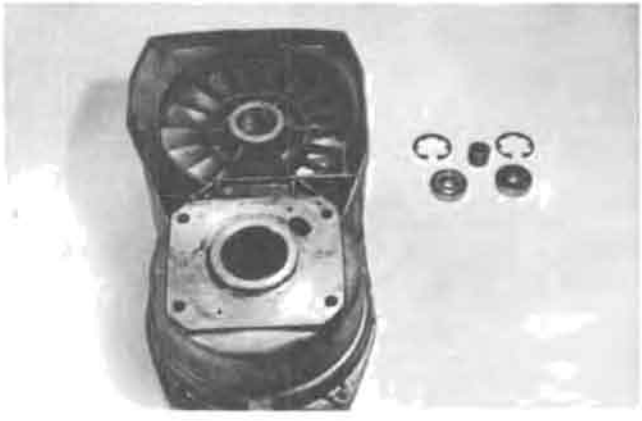
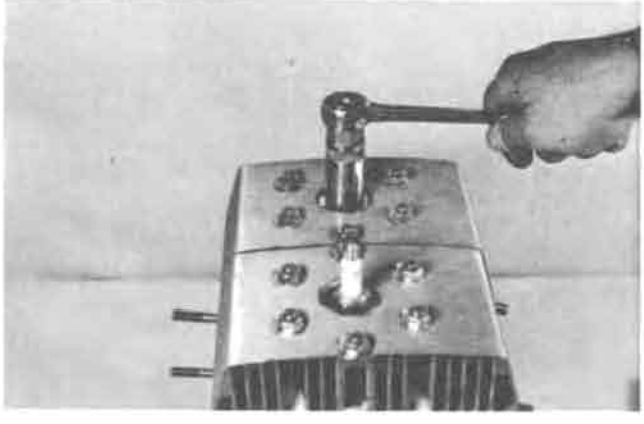


Fig. 1-19



G. Remove spark plugs with spark plug wrench (Fig. 1-20).

Fig. 1-20

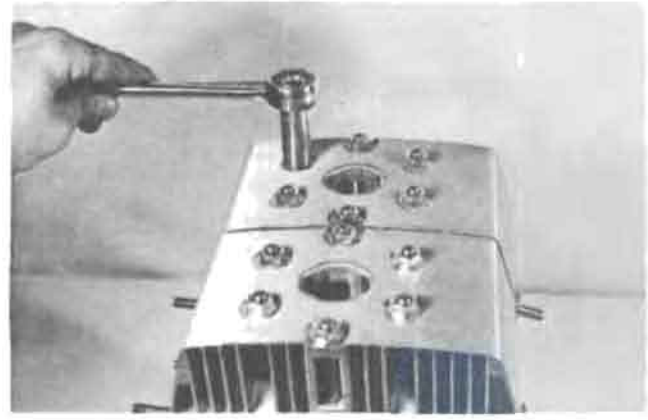


Models 400, 440 Shown

H. Cylinder Heads

Remove cylinder head nuts with a 13 mm socket wrench. Mark cylinder heads before removal from cylinder. Remove and discard gaskets (Fig. 1-21).

Fig. 1-21

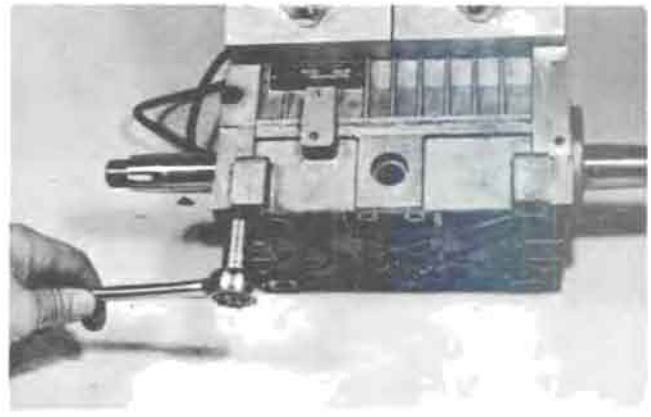


Models 400, 440 Shown

I. Cylinders

Remove the eight (8) cylinder base nuts using a 13 mm socket wrench and remove the eight (8) spring washers. The cylinders may be removed (Fig. 1-22).

Fig. 1-22

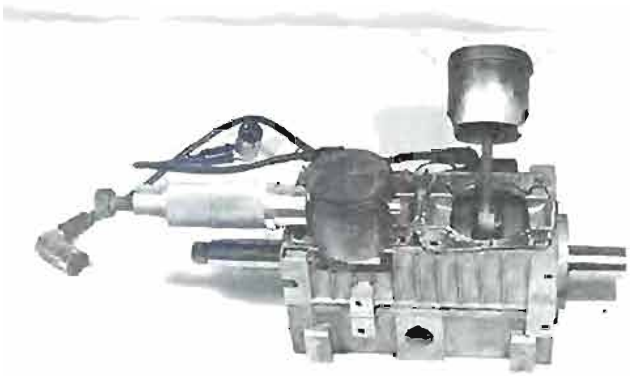


NOTE: IMPORTANT - If removal of cylinders only is required, care must be taken that the crankcase seal is not disturbed. The removal of the PTO cylinder will allow the placement of two bolts and nuts with flat washers to apply constant pressure to crankcase assembly. Bolts should be placed in the center two holes (adjacent to the fan side cylinder). The second cylinder may now be removed.

J. Piston and Wrist Pin

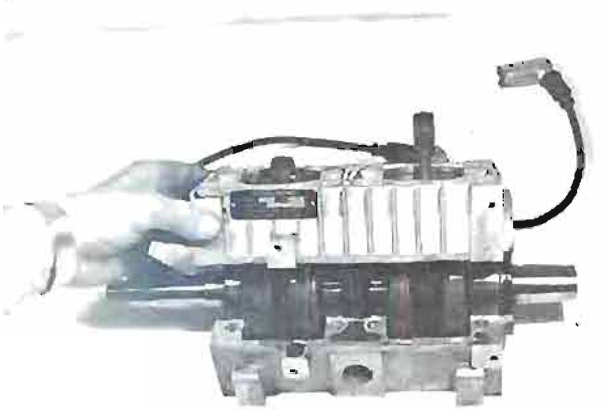
With needle nose pliers, remove circlips from pistons. Heat the piston with a heat gun or propane torch. Heat only to the point where piston may still be held in hand. Push the pin out. Alternate method use piston pin pusher.

Fig. 1-23



K. To separate the crankcase halves, hold upper portion of crankcase assembly in one hand lifting slightly and tap the end of the crankcase with a soft hammer. The crankcase will separate and the crankshaft may be removed (Fig. 1-24)

Fig. 1-24



L. Crankshaft Bearings

To remove crankshaft end bearings, use bearing puller 444-31-807-0 (see Figs. 1-25, 1-26 and 1-27). Slip the puller half shells around the outer bearing race and around puller assembly. Slide the retaining ring over the half shells. Using two (2) 27 mm wrenches, turn the center bolt clockwise with one wrench and use the second wrench to hold the puller body. Before removing the PTO side crankshaft bearing, insert a 1/2" 20 UNF bolt, 1/2" long, to protect the internal thread of the crankshaft.

Fig. 1-25

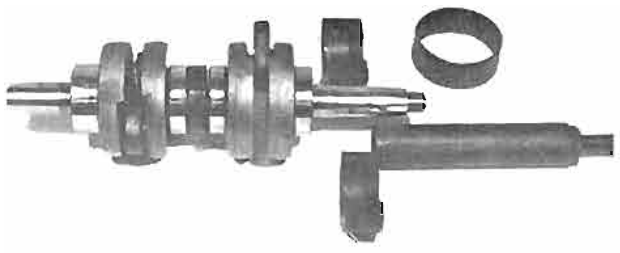
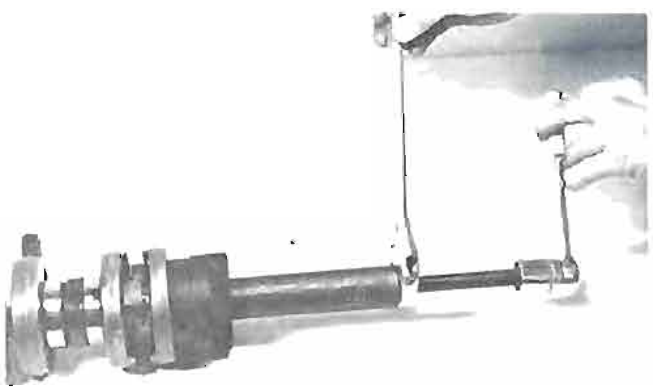


Fig. 1-26



Fig. 1-27



ASSEMBLY

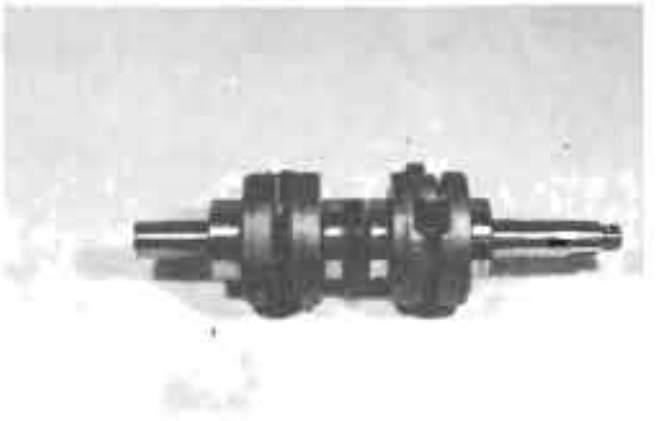
A. Crankshaft Bearings

NOTE: The open or uncaged side of the bearing should face outward.

Heat crankshaft bearings in oil (or oven) to approximately 180°.

Slide bearing on crankshaft.

Fig. 1-28



Before installing crankshaft into crankcase lower half, it will be necessary that all bearing outer surfaces be wiped clean of foreign material so that proper sealing will occur. After installing PTO thrust washer and oil seal (inside groove of oil seal coated with light grease) place the crankshaft carefully into lower crankcase half and properly position all components (Fig. 1-30). Placement of the upper crankcase half may now be made. Be certain that the center seal is lined up with the crankcase split line.

Tap upper crankcase half to seat with lower half.

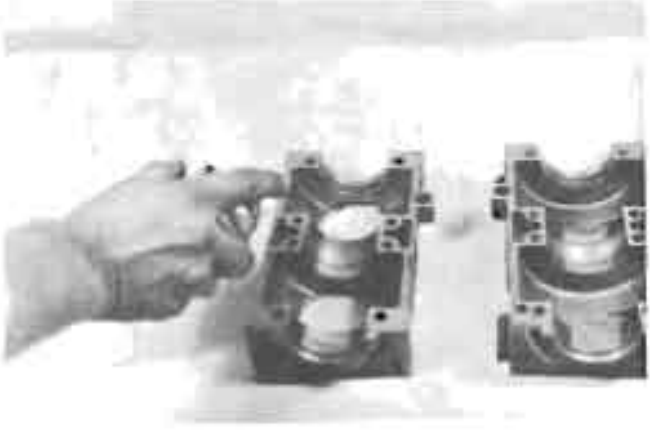
Fig. 1-30



B. Crankcase

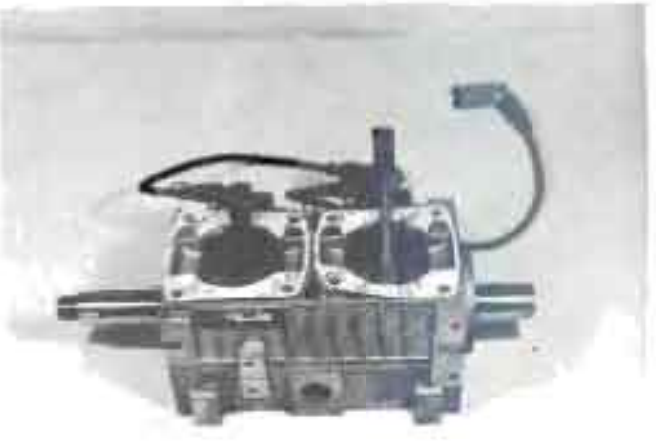
Inspect and clean both halves of crankcase. The crankcase sealing surfaces should be sealed with HY-TACK spray or a non-hardening sealer of good quality (Fig. 1-29).

Fig. 1-29



Install two crankcase holding bolts in the center holes of the PTO side of crankcase (Fig. 1-31). Tighten finger tight.

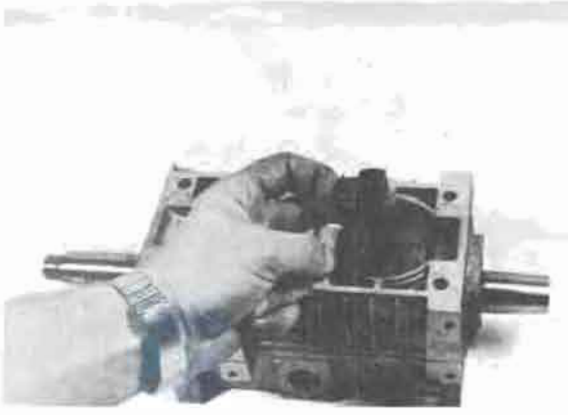
Fig. 1-31



C. Piston, Cylinder and Cylinder Heads

The piston must be clean and free from carbon deposits and the piston rings must fit freely in their grooves. Rings are marked for proper side up. The arrow on the crown of pistons must point toward exhaust side of engine. Piston pins, needle bearings, check plates and circlips may now be installed according to the procedure below. (Always use new circlips.) (See Figs. 1-32, 1-33, 1-34, and 1-35.)

Fig. 1-32



1. Oil the piston pin end bearings.
2. Install one circlip in piston.
3. Heat the piston sufficiently to allow pin to push into piston and install pin.
4. Install second circlip. (See Fig. 1-33 for correct orientation of circlips.)

Fig. 1-33



Fig. 1-34

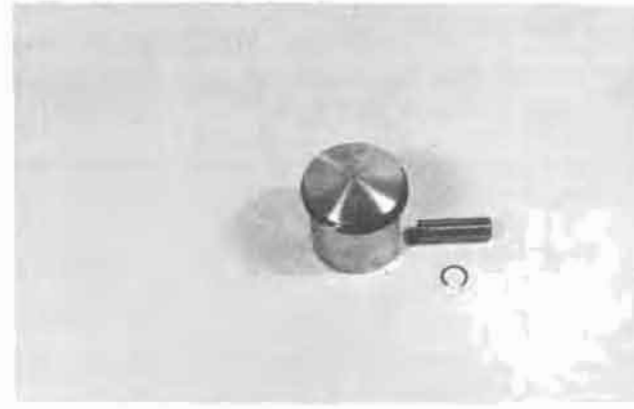
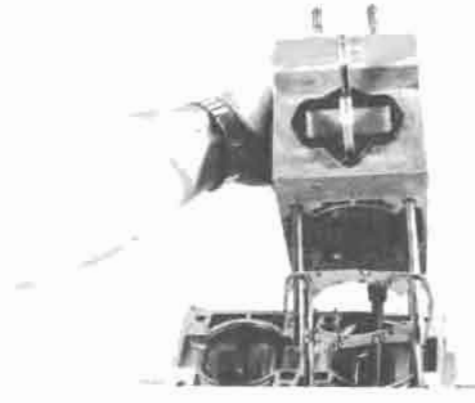


Fig. 1-35



Install base gaskets on the cylinder studs and position against the cylinder flanges (see Fig. 1-36). With the use of a ring compressor, lower cylinders one at a time over the pistons. Install base washers and nuts finger tight (see Figs. 1-37 and 1-38).

Fig. 1-36



Temporarily install the intake manifold without gaskets and tighten manifold nuts to sixteen (16) to eighteen (18) foot pounds (see Fig. 1-39). Cylinder base nuts may now be torqued to sixteen (16) to eighteen (18) foot pounds as outlined on specification page. The proper piston height can be measured at the top of the cylinder. The edge of the piston must not protrude above the top of the cylinder with the piston in the top dead center position more than .008 measured with a feeler gauge. If the piston does protrude above the cylinder, a thicker base gasket must be used. It is important that only one cylinder at a time be adjusted or the crankcase will separate and lose its seal.

Fig. 1-37

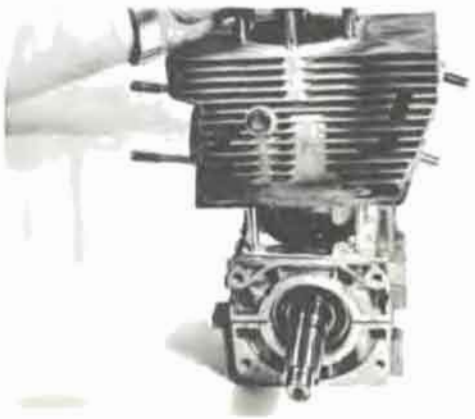
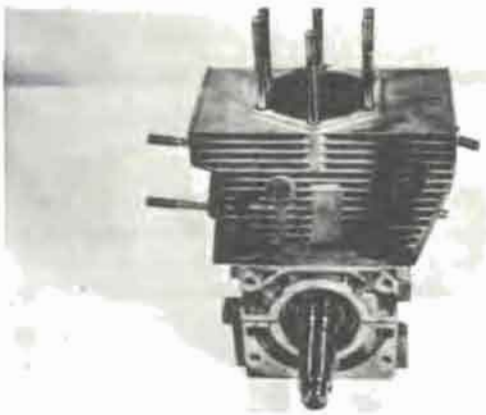
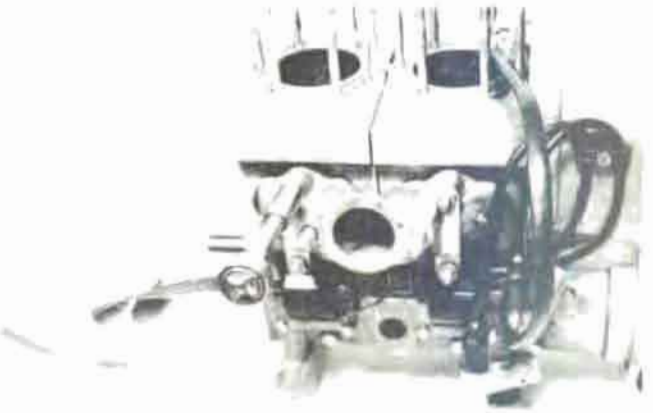


Fig. 1-38



Oil cylinder and pistons before installing cylinder heads. Install head gaskets with the wide side of inner metal flange of the gaskets up toward the cylinder heads. Torque cylinder head nuts - refer to Table of Specifications (pages 4-5) for Torque Requirement.

Fig. 1-39



Models 400, 440 Shown

NOTE

Two head gaskets are used for each cylinder on 430D and 430R.

D. Fan Housing and Impeller Bearings

Clean fan shaft hub. Install circlips and spacer. Use grease to hold spacer in place. Pack bearings in medium grease into housing with sealed surface outward (see Figs. 1-18 and 1-19). Install fan and shaft.

E. Fan Housing and Armature Plate.

Install new seal in fan housing. Lubricate the inner groove of the oil seal with a light grease. (See Fig. 1-40.)

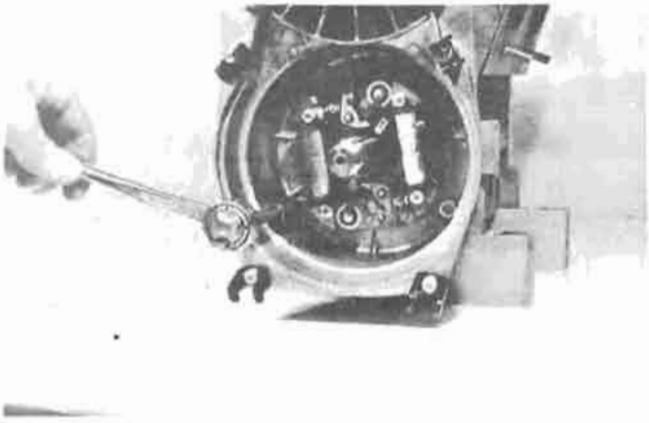
Fig. 1-40



Install new O-ring and apply silicon sealant material around O-ring surface (see Fig. 1-40). Install the armature plate wires through hole in fan housing and install armature plate with hold down screws, washers, and lockwashers (see Fig. 1-41).

Place fan housing assembly over crankshaft and position to crankcase assembly. Install the four Allen head screws and lockwashers and tighten evenly until fan housing is against crankcase assembly (Fig. 1-41)

Fig. 1-41

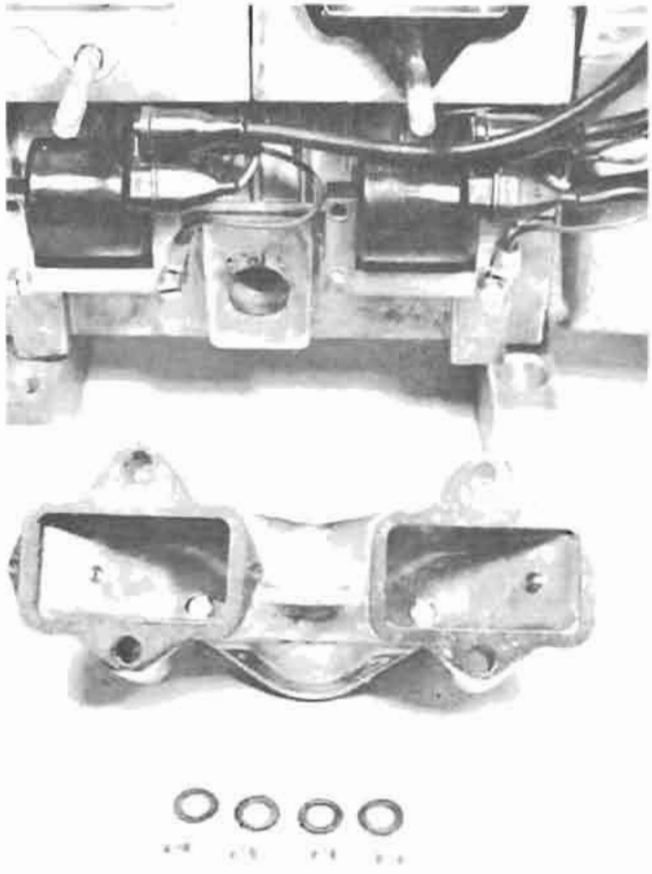


Torque to sixteen (16) to eighteen (18) foot pounds. Connect ignition wires to external ignition coil and to connector housing. Check ground wires for proper position. Install ignition cable bracket to fan housing.

F. Intake Manifold.

Install spacers, gaskets and intake manifold (Fig. 1-42). Torque nuts evenly to sixteen (16) to (18) foot pounds.

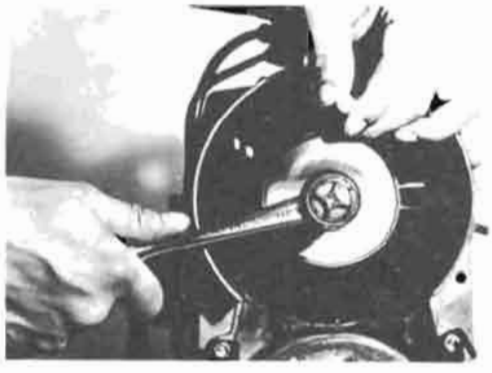
Fig. 1-42



G. Upper Fan Pulley Assembly.

Install the tapered washer. Install pulley half, shims, second pulley half, tapered washer, lock washer and nut. Use 3/16" drill bit or punch to hold fan assembly and tighten nut (Fig. 1-43).

Fig. 1-43



H. Flywheel Assembly

Check advance mechanism for free operation, lubricate inside cam surface (grooved area) Slide assembly over crankshaft and align key ways.

Install key, lockwasher and nut in that order. Tighten securely (Fig 1-44) Follow Timing Procedure Section as next step.

Fig. 1-44

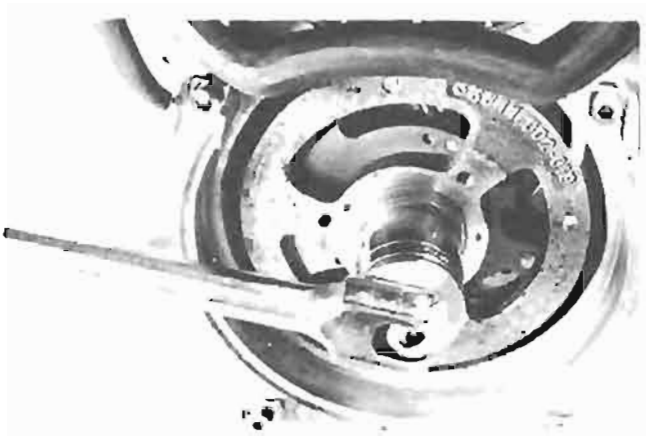
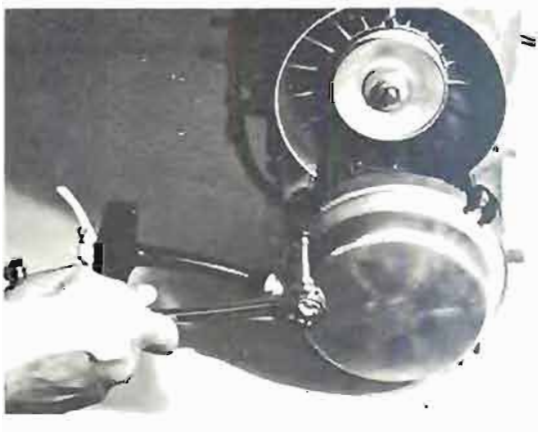


Fig. 1-46



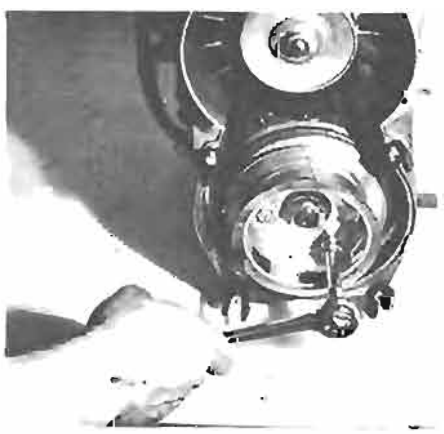
J Recoil Starter.

Install the recoil starter assembly and tighten securely.

I Lower Fan Pulley Assembly

Install pulley half, belt, second pulley half, recoil carrier, lockwashers and bolts evenly while rotating crankshaft The proper belt deflection should be 1/8" on each side Proper adjustment can be made by adding or removing shims between upper pulley halves

Fig. 1-45

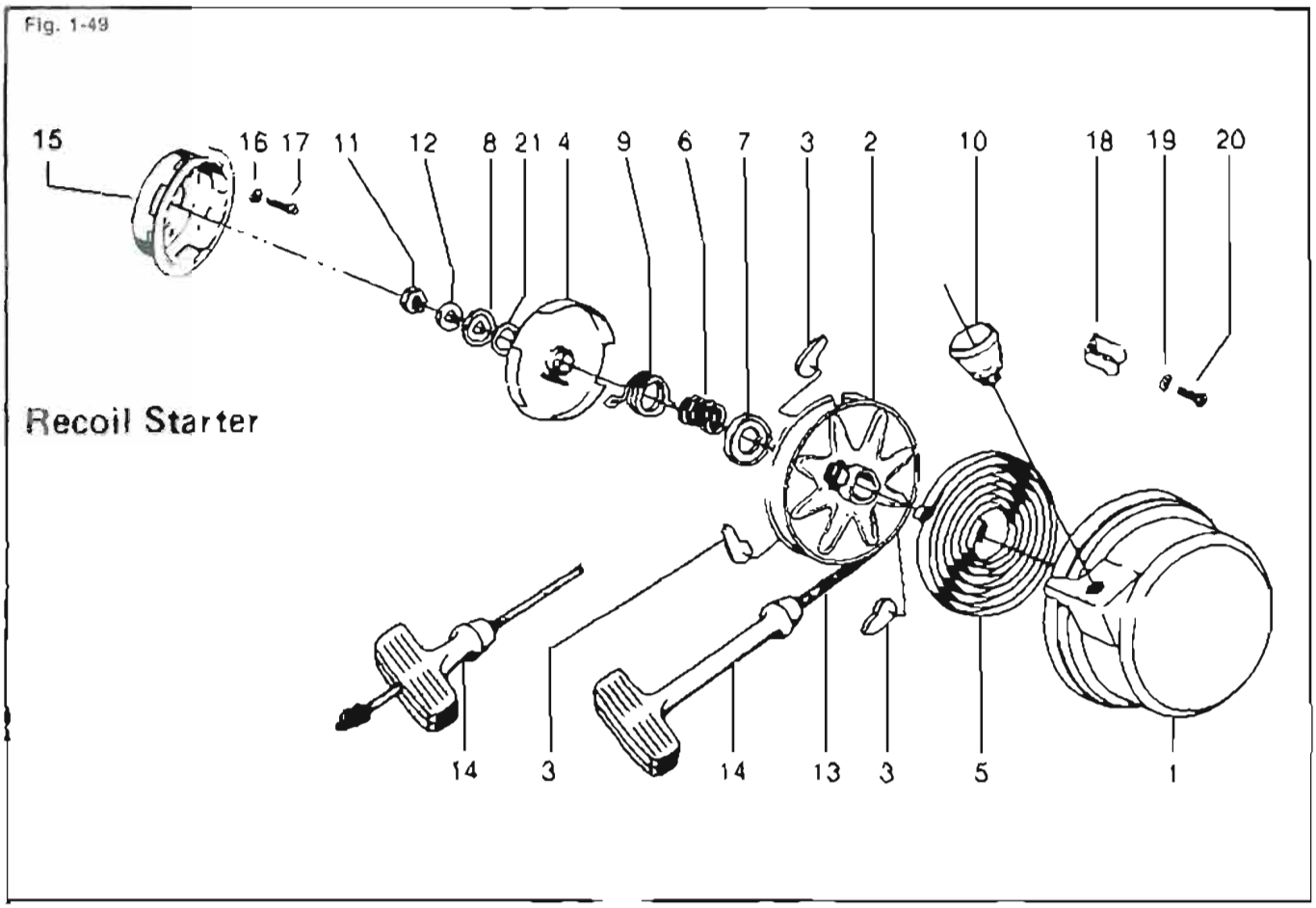


Recoil Starter

DISASSEMBLY

(See Fig. 1-49 for recoil start breakdown, and Fig. 1-50 for Recoil Starter Assembly.)

Fig. 1-49



1 Remove retaining nut (11), spring washer (12) and thrust washer (8) from threaded shaft of reel hub (Fig. 1-51).

Fig. 1-50



Fig. 1-51



2. Manipulate friction plate (4) on reel hub until eye end of return spring (9) aligns with retaining slot. Remove friction plate (Figs. 1-52 and 1-53).

Fig. 1-52



Fig. 1-53



3. Remove the three pawls (3), (Fig. 1-54).

4. Remove return spring (9), spring (6) and cup washer (7), (Fig. 1-54). Note position of plain end of return spring in the spring retaining hole in reel hub.

Fig. 1-54



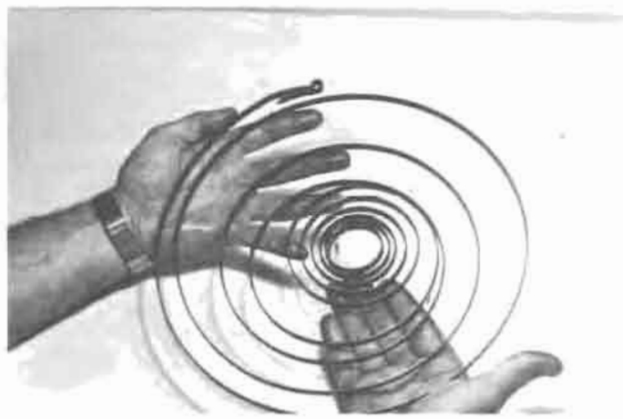
5. Unwind the rope; lift and untie the knotted end from center hub of reel, remove reel (2). (Fig. 1-55).

Fig. 1-55



6. Lift long rolled end of main springs (5) from the fixed spring retaining pin in the case and carefully remove the spring (Fig. 1-56).

Fig. 1-56



7. Clean all parts, except rope, using a suitable cleaning solvent. If rope requires cleaning, wash it in a solution of soap and water. Thoroughly dry all parts after cleaning.

8. Inspect all parts for obvious damage and wear.

ASSEMBLY

1. Replace defective parts.

2. Install main spring as follows:
   a. Secure main spring winding tool, part number 43-0797-60, or equivalent tool, circular end up, in a suitable bench vise.

   b. Start with the long rolled end of main spring (5) and wind spring into circular end of tool in a clockwise direction (Fig. 1-57).

Fig. 1-57



   c. Remove tool from vise. Grasp the tool by its handle and lower the tool, with spring installed, into case (1), (Fig. 1-58).

Fig. 1-58



   d. Secure the long rolled end of spring over the fixed spring retaining pin. Remove winding tool (Fig. 1-60). Apply a light film of Lubriplate, or equivalent, to spring.

Fig. 1-60



3. Secure case, open side up, in bench vise.

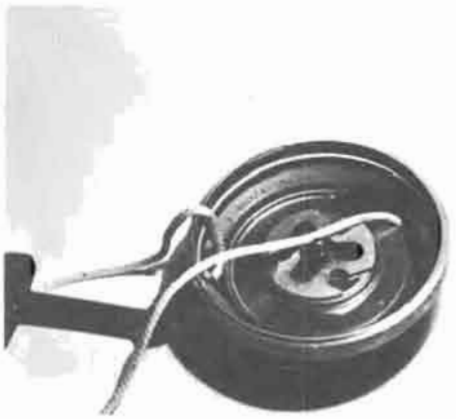
4. Tie a knot at one end of the rope. Secure knotted end in the center of reel. Pull rope taut and wind entire rope around reel in an anti-clockwise direction until the free end protrudes through the notched section of the reel.

5. Apply a light film of Lubriplate, or equivalent, to center hub of case and install the reel. Push down and rotate reel in an anti-clockwise direction until the hook engages with the free end of main spring. Tension will be felt when reel and spring are properly engaged (Figs. 1-61 and 1-62).

Fig. 1-61



Fig. 1-62



6. Rotate reel a maximum of three complete turns in an anti-clockwise direction. Do not exceed three turns; hold reel in this position and feed free end of rope through case at the rope guide hole. Install rope guide. Loosely knot the rope to prevent recoil.

7. Apply a light film of Lubriplate or equivalent to pawls (6) and install them on the reel in the pawl retainers (Fig. 1-63). (See Fig. 1-49 for part identification numbers.)

Fig. 1-63



8. Install cup washer (7) flat side down, spring (6) and return spring. Ensure that plain end of return spring is properly engaged in the retaining hole in reel hub.

9. Install friction plate (5) over reel hub. Manipulate plate until eye end of return spring engages and locks crosswise in retaining slot.

10. Rotate friction plate until the three notches are aligned with pawls when pawls are at the recoil position.

11. Install flatwasher (8), lockwasher (12) and nut (11). Tighten nut securely.

12. Untie the temporary knot in free end of rope and install the rope handle. Tie a permanent knot and fit handle securely.

13. Check starter for proper operation. When handle is pulled outward, pawls should move outward.

NOTE: If main spring is to be installed without the use of a spring winding tool, wind main spring into case in an anti-clockwise direction. Clockwise installation on the winding tool is necessary to ensure correct anti-clockwise installation of the spring when tool is placed upside down in the case.

Recoil Starter (Eaton)

DISASSEMBLY

1. Remove screw, washer, dog cam, brake spring and steel washer from center hub (Fig. 1-64).

Fig. 1-64



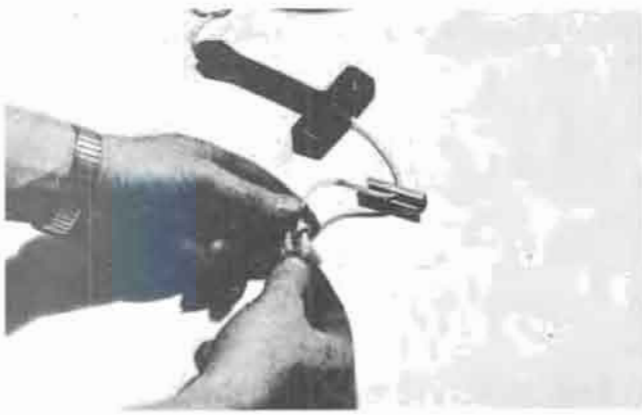
2. Pull rope out of rewind approximately 18 inches and tie a slip knot in rope at housing (Fig. 1-65).

Fig. 1-65



3. Remove reinforcement (7) from rope handle, untie rope and remove handle (6), (Fig. 1-66).

Fig. 1-66



4. Hold center pulley (4) and untie slip knot from rope. Let spring tension loose by allowing center pulley to turn slowly and the rope wind around pulley.

5. Remove center pulley by pulling upward (Fig. 1-67).

Fig. 1-67



6. Remove dog retainer, dog and spring (Fig. 1-68).

Fig. 1-68



7. Remove center bearing by pressing from bottom to top.

8. Remove rope.

9. Remove spring and spring keeper by lifting up (Fig. 1-69).

Fig. 1-69



10. Clean all parts except rope in a suitable cleaning solvent. If rope requires cleaning, wash it in a solution of soap and water thoroughly. Dry all parts after cleaning.

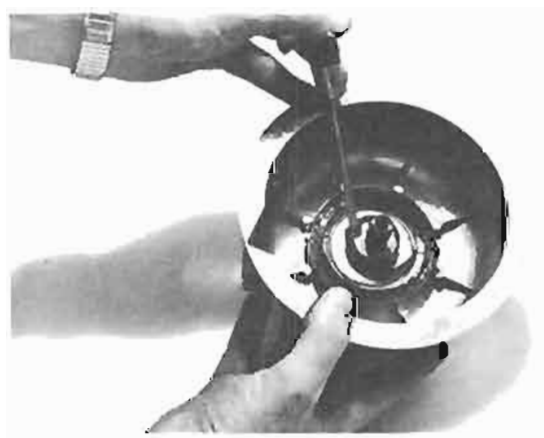
11. Inspect all parts for obvious damage and wear

ASSEMBLY

1. Replace defective parts.

2. Install main spring by placing spring and keeper over center shaft and aligning inside end of spring in notch on center hub (Fig. 1-70).

Fig. 1-70



3. Replace center bearing in pulley.

4. Replace dog spring, dog and retainer (Fig. 1-71).

Fig. 1-71



5. Place center pulley over the center shaft and spring. Be sure pulley is all the way down. Shaft should protrude slightly out of center bearing (Fig. 1-72)

Fig. 1-72



6. Wind pulley counterclockwise six (6) turns, push rope through hole on outside of pulley and out the hole in the housing. Tie a slip knot about halfway down the rope to prevent it from winding back inside housing (Figs. 1-73, 1-74).

Fig. 1-73

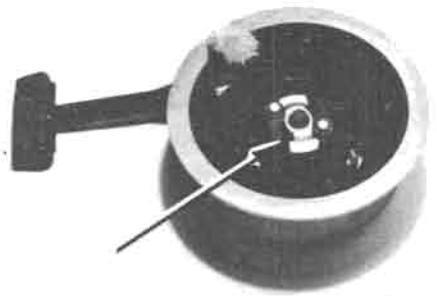


Fig. 1-74



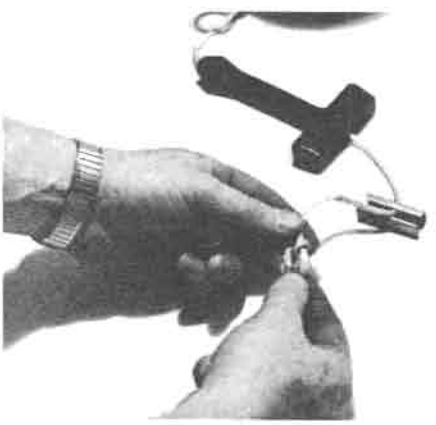
7. Replace retaining washer, spring, dog cam (bent portion down) and retaining screw. Be sure dogs are positioned so there is a slight preload on them before installing cam (Fig. 1-75).

Fig. 1-75



8. Reinstall handle and reinforcement on the rope, tie a good knot in end of rope.

Fig. 1-76



9. Untie the slip knot and check spring tension by pulling on rope.

Timing Procedure

NOTE: Recoil starter, carrier, lower pulley assembly and spark plugs should be removed before beginning timing procedure.

A. Install the dial indicator assembly into spark plug hole of No. 1 cylinder (P.T.O. side) (Fig. 1-77.)

Fig. 1-77



Model 440 Shown

B. Attach continuity light, one lead to ground, the other lead to the black wire of No. 1 cylinder in connector housing (Fig. 1-78)

Fig. 1-78



C. Rotate flywheel counterclockwise until points are on the high side of cam on No. 1 cylinder. Points are at maximum open position observed through opening in flywheel. Check gap with wire gauge and adjust to .015 if necessary (Fig. 1-79)

Fig. 1-79



D. Rotate flywheel counterclockwise to top dead center and adjust dial to zero (Fig. 1-80). Continuity light should be on a dim intensity.

Fig. 1-80



Model 440 Shown

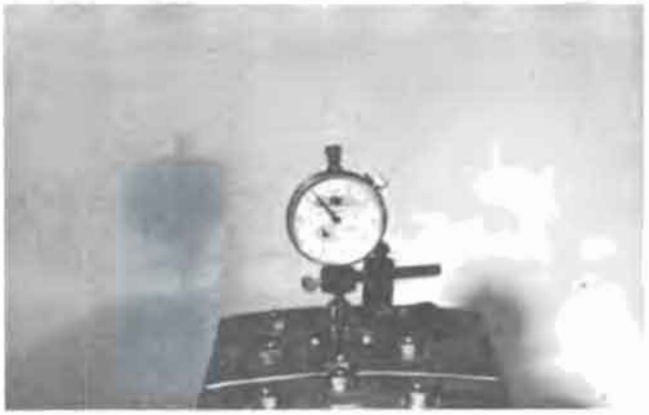
Move the centrifugal weights in flywheel to the full advanced position (Fig. 1-81)

Fig. 1-81



Rotate flywheel counterclockwise one complete revolution of dial indicator to between .102 and .112 (Fig. 1-82).

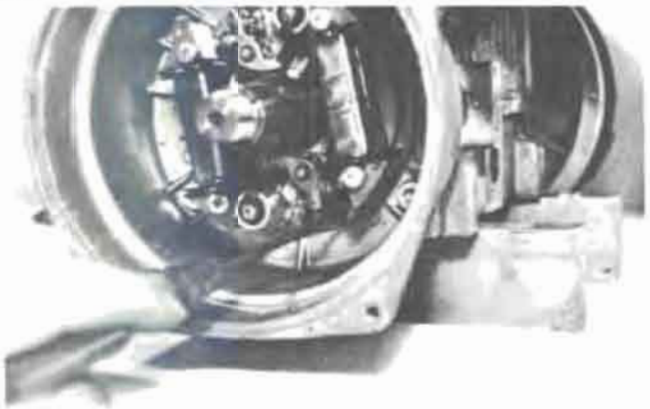
Fig. 1-82



Model 440 Shown

At this point the breaker points for No. 1 cylinder should open (break contact). This will show on the continuity light. Light will get brighter. If this does not occur, the armature plate needs adjusting. This is accomplished by loosening the hold-down screws and turning plate either left or right while observing needle action. With proper positioning, light should get bright with slight movement of armature plate and dim with opposite plate movement. Tighten hold-down screws securely. Re-check procedure (Fig. 1-83).

Fig. 1-83



NOTE: In Fig. 1-83 flywheel has been removed for clarity of illustration.

E. Remove dial indicator assembly and install in No. 2 cylinder (fan side), (Fig. 1-84).

Fig. 1-84



Model 440 Shown

Attach lead of continuity light to No. 2 cylinder terminal in connector housing.

Rotate flywheel counterclockwise to top dead center. Set dial indicator to zero. Again move centrifugal weights in flywheel to full advanced position. Rotate flywheel counterclockwise while watching dial indicator. The needle must make one full revolution and stop at between .102 and .112. At this point, light should get bright indicating point contact open. If this does not occur, points need slight adjustment. Re-check procedure.

Troubleshooting Chart

TROUBLE	PROBABLE CAUSE	REMEDY
Manual starter rope comes out but pawls don't engage.	1. Lack of friction plate return spring action. 2. Defective pawls.	1. Check friction plate return-spring. Replace as required. 2. Check for broken or bent pawls. Replace pawls as required.
Manual starter rope doesn't return.	1 Recoil spring broken or bent. 2. Pulley housing warped or bent. 3. Starting pulley worn.	1 Replace spring. 2. Replace housing. 3. Replace pulley.
Electric starter inoperative.	1. Loose electrical connections. 2. Poor ground. 3. Faulty battery or circuits. 4. Faulty electric starter.	1. Retighten connections. 2. Secure ground connection. 3. Check, recharge or replace battery. 4. Check starter solenoid. Repair or replace. 5. Inspect starter motor for evidence of moisture and broken or worn brushes. Dry out as necessary. 6. Check starter switch. Replace if required. 7. Check harness or connector for broken wire. Repair or replace.
Hard to start or won't start.	1. Fuel enrichening valve not not pulled up to start. 2. Spark plugs improperly gapped, dirty or broken. 3. Magneto breaker points improperly gapped or dirty. 4. Head gasket blown or leaking. 5. Water in fuel system. 6. Weak coil or condenser. 7. Obstructed fuel system. 8. Air leak in crankcase or inlet system. 9. Primary wire broken. 10. Engine not timed properly. 11. Secondary wire not connected or spark plug protector not installed properly.	1. Ensure enrichening valve is pulled up. 2. Remove plugs. Clean, adjust or install new plugs. 3. Clean, adjust or replace points. 4. Replace gasket. 5. Drain fuel from carburetor. Add carburetor de-icer as required to fuel. 6. Replace faulty coil or condenser. 7. Disconnect fuel lines. Clear obstruction. Flush system. Connect fuel lines. 8. Check crankcase pressure (3-6 PSIG). 9. Repair or replace primary wire. 10. Re-time engine. 11. Secure secondary wire or spark plug protector.
Impossible to adjust idle.	1. Spark advance mechanism not working properly. 2. Pistons or rings worn. 3. Faulty carburetor.	1. Repair advance mechanism. 2. Replace as necessary. 3. Check carburetor, check valve. Refer to Carburetor Section.

Troubleshooting Chart

TROUBLE	PROBABLE CAUSE	REMEDY
Missing at low speed or won't idle smoothly or slowly.	1. Incorrect carburetor idle adjustment.	1. Adjust idle.
	2. Spark plugs improperly gapped or dirty.	2. Clean, adjust or install new plugs.
	3. Head gasket blown or leaking.	3. Replace gasket.
	4. Loose or broken magneto wires.	4. Repair or replace wires.
	5. Magneto breaker points improperly gapped or dirty.	5. Adjust, clean or install new points.
	6. Weak coil or condenser.	6. Replace coil or condenser.
	7. Improper fuel mixture. (1) Too much oil (2) Too little oil.	7. Refuel, using specified fuel/oil mixture.
	8. Leaking crankshaft seal.	8. Replace seal.
Missing at high speed or intermittent spark.	1. Spark plugs improperly gapped or dirty.	1. Clean, adjust or install plugs.
	2. Loose or broken magneto wires.	2. Repair or replace wires.
	3. Magneto breaker points improperly gapped or dirty.	3. Clean, adjust or install new points.
	4. Weak coil or condenser	4. Replace coil or condenser.
	5. Heat range of spark plug incorrect.	5. Install specified spark plugs.
	6. Leaking head gasket.	6. Replace head gasket.
	7. Engine improperly timed.	7. Re-time engine.
Coughs, spits slows down, surges.	1. Idle or high speed jets too lean.	1. Adjust carburetor. Refer to Carburetor Section.
	2. Leaking gasket flange.	2. Adjust carburetor. Refer to Carburetor Section.
	3. Inlet control level set too low.	3. Adjust carburetor. Refer to Carburetor Section.
	4. Pulsation line obstructed.	4. Adjust carburetor. Refer to Carburetor Section.
	5. Fuel pump not supplying enough fuel due to: (1) Punctured diaphragm (2) Inoperative inlet check valve.	5. Adjust carburetor. Refer to Carburetor Section.
	6. Crankcase not properly sealed.	6. Reseal crankcase.
	7. Idle or main carburetor nozzle obstructed.	7. Refer to Carburetor Section.
	8. Fuel line obstructed.	8. Remove fuel line. Clear obstruction. Replace line.
	9. Carburetor inlet needle and seat obstructed.	9. Refer to Carburetor Section.

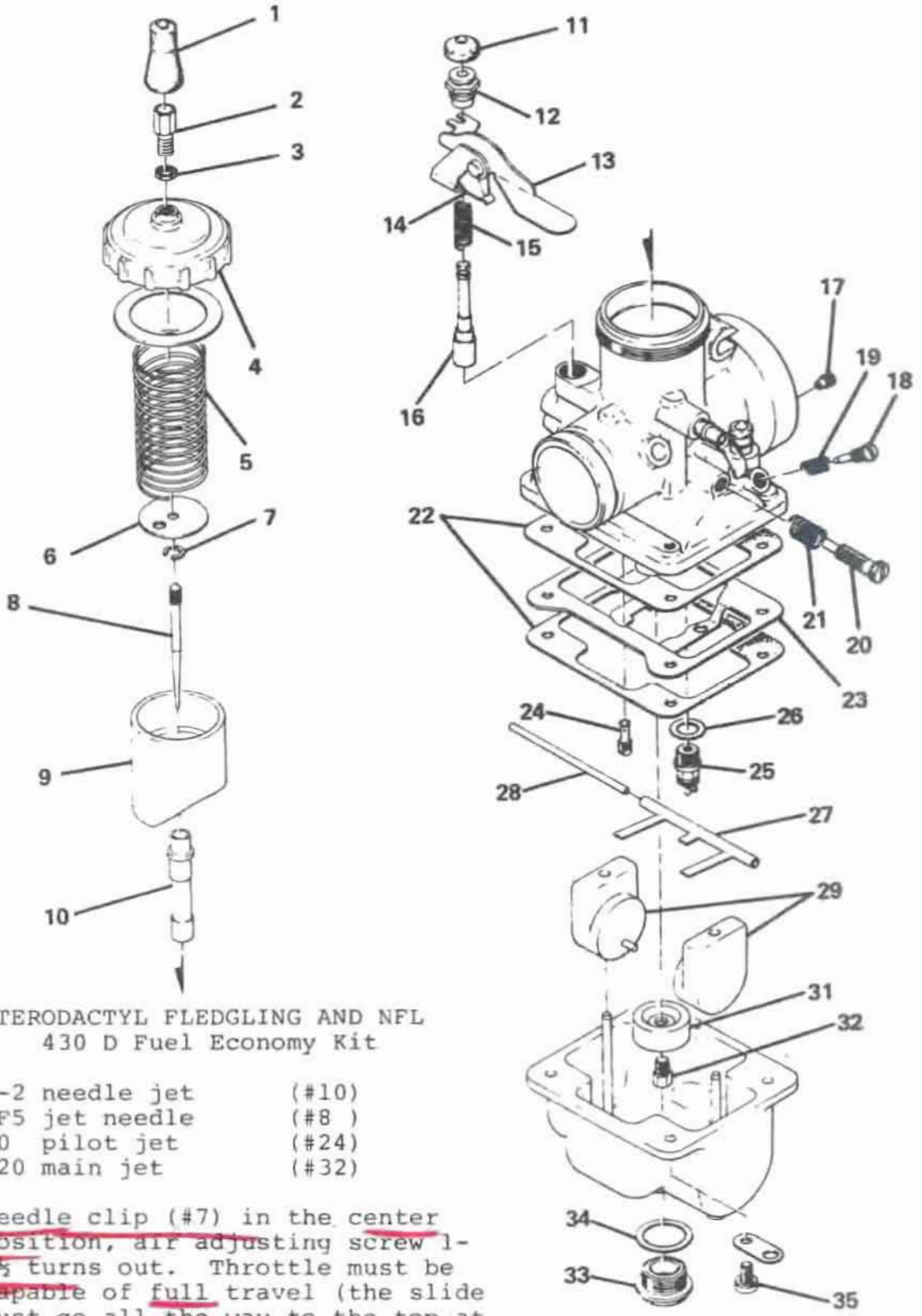
Troubleshooting Chart

TROUBLE	PROBABLE CAUSE	REMEDY
Overheating.	1. Carburetor too lean.	1. Adjust carburetor.
	2. Incorrect timing.	2. Re-time engine to Specifications.
	3. Excessive carbon.	3. Remove cylinder heads. Clean top of pistons and inside compression chamber. Clean out exhaust port.
	4. Spark plug type incorrect.	4. Install specified spark plugs.
	5. Engine fan belt loose or broken.	5. Replace or adjust.
	6. Air leak in manifold.	6. Tighten nuts or change gaskets.
	7. Crankcase seal leaking.	7. Fit new seal.
	8. Gas line obstructed.	8. Remove obstruction or install new gas line.
Vibrates excessively or runs rough and smokes.	1. Idle needle or high speed carburetor jet too rich.	1. Adjust needle or change jet. Refer to Carburetor Section.
	2. Enrichening valve not operating properly (bent Linkage).	2. Adjust needle or change jet. Refer to Carburetor Section.
	3. Float lever too high. (Carburetor floods.)	3. Adjust needle or change jet. Refer to Carburetor Section.
	4. Air bleed plugged.	4. Adjust needle or change jet. Refer to Carburetor Section.
	5. Muffler obstructed.	5. Check and clear muffler.
	6. Engine not secured tightly to engine support.	6. Tighten engine mounting bolts.
	7. Water in gas.	7. Add carburetor de-icer fluid as required.
	8. Primer valve leaking raw gas into intake manifold.	8. Replace primer pump assembly.
Won't start, kicks back and backfires.	1. Spark plug wires reversed.	1. Install wire correctly
	2 Flywheel key missing or sheared.	2. Replace key.
	3. Faulty condenser.	3. Replace condenser.
	4. Improper timing.	4. Re-time engine.
	5. Faulty breaker points.	5. Adjust or replace points.
	6. Unhooked spark retarding mechanism - or spring broken.	6. Reconnect mechanism or replace spring.
No acceleration, low top RPM, hard to start.	1 Spark plugs improperly gapped or dirty.	1. Clean, adjust or install new plugs.
	2. Magneto breaker points Improperly gapped or dirty.	2. Clean, adjust or install new points.
	3 Faulty coil or condenser.	3. Replace coil or condenser.
	4. Loose or broken magneto wires.	4. Repair or replace magneto wires.
	5. Blown head gasket.	5. Replace head gasket.
	6. Float adjustment too high.	6. Refer to Carburetor Section.
	7. Crankcase leaking.	7. Install new seal
	8. Main (high speed) jet too rich.	8 Change jet.
	9. Scored piston and cylinder.	9. Disassemble engine and replace damaged parts.

Troubleshooting Chart

TROUBLE	PROBABLE CAUSE	REMEDY
Good spark but engine runs on one cylinder.	1. Leaking cylinder head	1. Check head for warps, cracks. Install new gasket and cylinder head.
	2. Magneto wires broken inside (coil ground broken)	2. Repair or replace wires.
	3. Cracked cylinder wall	3. Replace faulty cylinder.
	4. Defective spark plug	4. Clean, adjust or install new plug.
	5. Breaker points improperly gapped.	5. Re-adjust points.
	6. Crankcase seal leaking.	6. Install new seal.
No acceleration idles well but dies down when put to full throttle.	1. Low speed needle set too lean.	1. Adjust carburetor. Refer to Carburetor Section.
	2. Dirt behind needle and seat.	2. Adjust carburetor. Refer to Carburetor Section.
	3. High speed jet obstructed.	3. Adjust carburetor. Refer to Carburetor Section.
	4. Float lever set too low.	4. Adjust carburetor. Refer to Carburetor Section.
	5. Silencer obstructed.	5. Adjust carburetor. Refer to Carburetor Section.
	6. Fuel pump not supplying enough fuel due to: (1) Punctured diaphragm (2) Non-functioning check valves	6. Adjust carburetor. Refer to Carburetor Section.
	7. Fuel line obstructed	7. Remove fuel line. Clear obstruction. Replace line.
	8. Breaker points improperly gapped or dirty.	8. Adjust, clean or install new points.
	9. Engine improperly timed.	9. Re-time engine to Specifications.
No power under heavy load.	1. Magneto breaker points improperly gapped or dirty	1. Clean, adjust or install points.
	2. Ignition timing too far advanced.	2. Adjust timing.
	3. Magneto coil plate loose.	3. Check magneto and secure coil plate.
Cranks over extremely easy on one or both cylinders. Loss of compression.	1. Scored piston.	1. Replace faulty piston.
	2. Blown head gasket.	2. Replace head gasket.
	3. Loose spark plug.	3. Check plug for security.
	4. Head bolts not tight.	4. Torque head bolts to proper specifications.
Engine won't crank over. Unable to rotate flywheel.	1. Piston rusted to cylinder wall.	1. Remove piston and cylinder. Replace defective parts.
	2. Crankshaft seized to bearing (main or rod).	2. Disassemble engine. Replace defective parts.
	3. Broken connecting rod.	3. Disassemble engine. Replace defective parts.
	4. Flywheel seized to coil plate.	4. Remove flywheel. Replace defective parts.
	5. Engine improperly assembled after repair.	5. Recheck re-assembly procedure.

MIKUNI CARBURETORS



PTERODACTYL FLEDGLING AND NFL
430 D Fuel Economy Kit

P-2 needle jet	(#10)
6F5 jet needle	(#8)
30 pilot jet	(#24)
320 main jet	(#32)

Needle clip (#7) in the center position, air adjusting screw 1-1½ turns out. Throttle must be capable of full travel (the slide must go all the way to the top at full throttle, all the way closed at zero throttle). These modifications increase fuel economy by allowing the engine to run leaner, particularly at cruise throttle settings. It is essential that jetting tests be done to assure adequate richness for local conditions or engine damage may result.

VM32

JETTING THE MIKUNI CARBURETOR

Rich fuel-air mixtures burn cooler than lean fuel-air mixtures. Lean fuel-air mixtures are more economical than rich fuel-air mixtures. Lean mixtures also produce more power, that is until the engine overheats and siezes. Obviously compromises must be made.

To understand the compromises made in this jetting kit you must understand the following flight conditions:

1. The 430D powered Fledge and NFL can cruise at 50% power or less. (Most other ultralights cruise at full or nearly full power.)

2. The 430D powered Fledge and NFL have more than adequate climb performance.

3. At 50% power it is very difficult to overheat an engine, even if it is running lean.

4. As altitude increases, horsepower (and heat) decreases.

It follows from these conditions that:

1. As the majority of flight time is spent in cruise, the greatest improvement in fuel economy will be gained by optimizing fuel mixture for cruise (50% power and less.)

2. At full power we can easily afford to sacrifice some performance (and fuel economy too, since full power is used for only a small percentage of a given flight) for reliability by running the engine rich at full power.

3. As overheating is not a likely problem in cruise, we can afford to sacrifice some cooling for improved fuel economy by running the engine lean at 50% power and below.

4. At higher altitudes, the engine can be run leaner (so as to gain back some of the power lost from reduced air density) without overheating.

From these observations we can conclude that optimum carburetion (at least for our 430D powered Fledge and NFL) will be with a fuel-air mixture which varies with power requirements. It should be richest at full throttle and gradually get leaner as throttle is reduced. Also it should have the ability to be made leaner at full power at high altitudes.

This jetting modification satisfies these conditions. Take your carburetor and the blow-up carburetor drawing and install the new components as follows. If your carburetor has allready been modified, go through the steps to assure it has been done correctly. Mistakes can happen, even at Pterodactyl and Mikuni. Going through these steps will increase your familiarity with your carburetor.

Unscrew the mixing chamber top (#4) from the carb body and pull out the spring, slide and jet needle (parts #5 through #9) Install the 6F5 jet needle (with the clip in the center position) in the slide.

Remove the drain plug (#33) from the float bowl with a 17mm (or 11/16" wrench) Unscrew the main jet (#32) one turn with a 6mm (or 1/4") socket. Push up on the main jet to break the needle jet (#10) free from the carb body. Remove the main jet and needle jet. Replace them with P-2 needle jet and 320 main jet (the numbers are stamped on the parts.) Replace the drain plug and mixing chamber top. Install the carb and air filter.

Compared with the earlier jetting, this needle and needle jet combination is more fuel restrictive, particularly in mid-throttle positions. Its slight restriction at full throttle requires the use of a larger main jet to provide an adequately rich mixture at full throttle. This gives us a gradual increase in richness as the throttle is opened.

As the slide (#9) goes past the edge of the carb throat at full throttle, there is a range (from about 9/10 throttle to full throttle) where air flow does not increase with increased throttle. In this range the tapered needle (#8) still effects fuel flow. This gives a very definite increase in the richness of the mixture when you go from 9/10 to full throttle. This is to provide cooling in climb-out (at full throttle while allowing mixture control at high altitudes. Backing off the throttle slightly at altitude will lean the mixture, giving back some of the power lost through the lowered air density. It is very important that you do not have excessive slack in the throttle cable or you will not be able to achieve full throttle in climb and overheating will result. The main jet must also be sufficiently large to avoid overheating, this will be somewhat larger than a main jet which would provide maximum power. Its a small sacrifice for reliability.

OPERATING INSTRUCTIONS

START

The carburetor is now set for lean operation at low throttle settings. A cold engine requires more fuel than a warm engine due to fuel condensation in the crankcase and cylinders, so opening the enricher will be required for starting. Start the engine at 1/8 to 1/4 throttle and close the enricher when RPM's start to drop (as the engine warms, fuel in the crank case and cylinders will evaporate, causing an over-rich mixture, power loss and rough running.) Go to half throttle for warm up, and give occasional

bursts of enricher to keep revs up. When you no longer need a shot of enricher to get peak RPM's (at half throttle) the engine is warm enough for flight. It will take around half a minute.

RUN-UP

Gradually move the throttle to full open, going slowly and smoothly to allow the engine to gain full RPM's. From 9/10 throttle to full throttle there should be a significant decrease in RPM'S. The decrease should be quite obvious, if you have to think about whether the power reduced significantly, it didn't. If not, the main jet size must be increased. Any Japanese motorcycle dealer will have main jets in stock, they are called Mikuni long hex main jets and they come in increments of 10 (300, 310, 320...) If RPM drops drastically and the engine starts running rough (usually accompanied by lots of smoke and unburned fuel out the exhaust) the main jet size must be decreased.

Now back the throttle off to peak RPM. Open the enricher for a moment. RPM should drop drastically. Go down to 3/4 throttle and repeat with a quick burst of enricher. RPM should drop, although not as much. If anywhere above half throttle RPM does not drop when a warm engine is given enricher, it is a sign the engine is running excessively lean at high power settings and the jet needle must be raised by adjusting the clip in the needle's five grooves. At settings below half throttle revs may actually increase with application of enricher, indicating a lean mixture. This is desirable because it increases fuel economy, whereas a lean mixture at high power settings will cause overheating and must be corrected.

TAKEOFF

Open the throttle smoothly, allowing gradual buildup of RPM. You can start your roll at 9/10 throttle but be sure you're at full throttle before liftoff.

CLIMB

Climb out must be at full throttle. You can reduce to 3/4 or less throttle as soon as you like, but don't go down to 9/10 for that extra little boost of power. No flying site chosen with good judgement will need maximum power, and any friends you might impress with a max-performance lean takeoff will be unimpressed if the engine siezes.

CRUISE

Smoothly ease the throttle setting back to cruise. Check your altimeter now and then to see that you're staying at your chosen altitude. You can use slight changes of throttle for gradual descents and climbs.

This is a good time for another jetting check. Run through the same test you did in run-up. If it doesn't behave as it should, return to your base and correct as needed.

HIGH ALTITUDE CLIMB

In full throttle climb you may reach an altitude where the engine runs too rich, looses RPM and starts to run rough. If so, back off the throttle as needed to regain power. You may need to do a shallow dive to increase speed to get the revs back up, then

go back to climb trim. Don't do this at lower altitudes than needed or overheating will result.

DESCENT

A slightly richer pilot jet (item #24 on the drawing) is used to help keep the engine running smoothly at low power settings. In a long descent you should occasionally run the engine up to half throttle (or more) and back down, to keep the engine running clear.

AIR START

Set to half throttle trim for a slight dive (going about 35 lets the prop help turn over the engine) and pull the starter smoothly and firmly. Don't jerk at it, it will upset your trim. If it doesn't seem like it's going to start, perhaps you've been soaring long enough for the engine to get cold. Open the enricher and try again, shut off the enricher as soon as it starts. You may need to give the enricher little jabs for the first thirty seconds to keep it running.

1. **Enrichment or Starting Circuit:** Air is drawn through the starter air passage across the starter jet drawing fuel into enrichment passage located on the engine side of throttle valve.

2. **Idle Circuit:** Air is drawn through idle orifice, past the air screw as fuel is drawn up housing through pilot jet feed through part throttle holes into airstream.

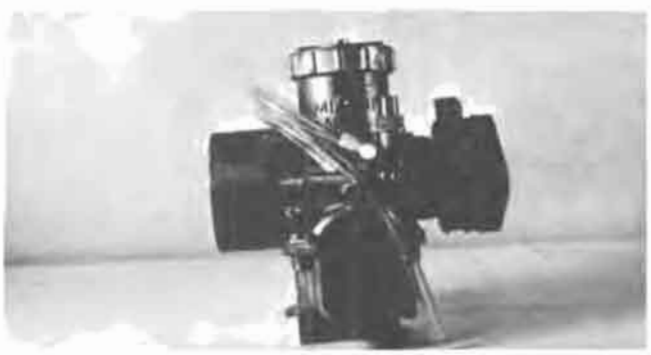
3. **Full Throttle Circuit:** As throttle valve is raised, increased Venturi air flow draws fuel upward through needle jet. As jet needle moves upward, diameter decreases allowing increased fuel flow.

4. **Power Jet:** At maximum throttle air flow past power jet orifice, located in front of Venturi, draws fuel through power jet located in bowl, up external fuel line, through orifice into Venturi.

DISASSEMBLY

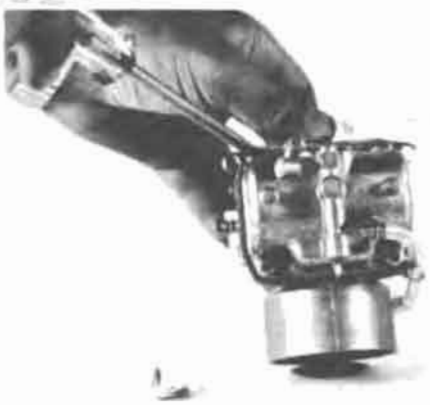
1. Mikuni Carburetor side view (Fig. 2-14).

Fig. 2-14



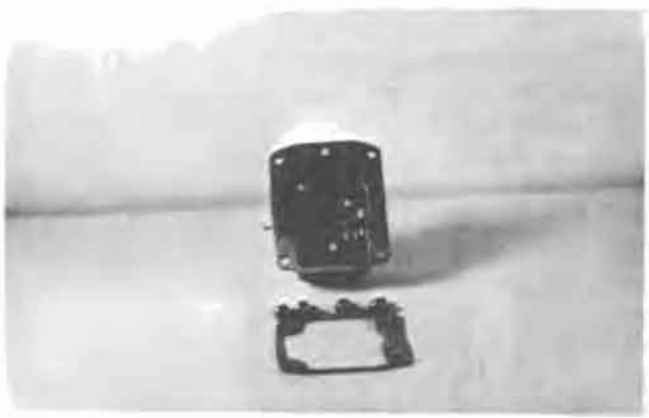
2. Remove the four screws holding float bowl in place (Fig. 2-15).

Fig. 2-15



3. Remove float bowl and gasket (Fig. 2-16).

Fig. 2-16



4. Remove float pin caps (Fig. 2-17)

Fig. 2-17



5. Remove float arm by pushing float pin through float pin towers (Fig. 2-18)

Fig. 2-18



NOTE: Float pin can only be removed from one side.

6. Remove inlet needle and seat. These should be removed as an assembly to prevent damage to spring clip (Fig. 2-19)

Fig. 2-19



Remove main jet and washer. Remove the top of carburetor. Needle jet and throttle valve can be removed from linkage by depressing spring and moving cable through slot (Fig. 2-20)

Fig. 2-20



7. Remove power jet from mixing bowl chamber (Fig. 2-21).

Fig. 2-21



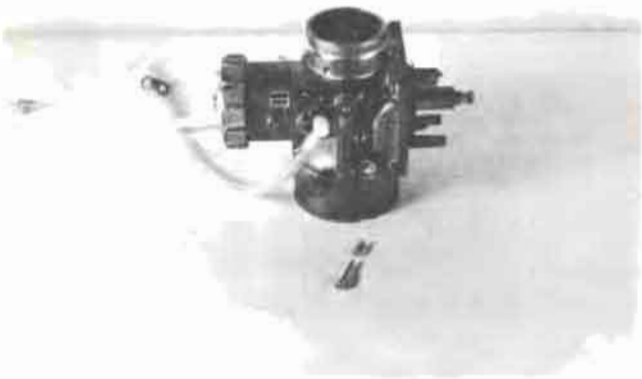
8. Remove throttle stop screw and spring from side of carburetor (Fig. 2-22)

Fig. 2-22



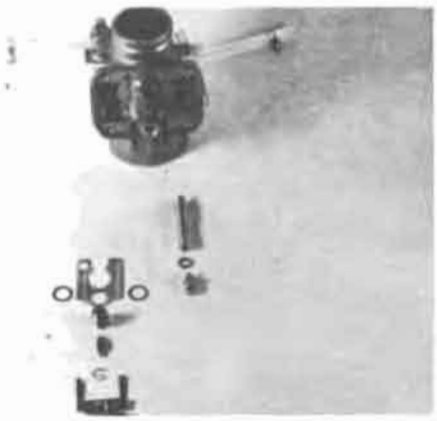
9. Rer

Fig. 2-23



10. Remove enrichener assembly (Fig. 2-24).

Fig. 2-24



Complete Disassembly

> **● CAUTION ●**
>
> **Any air leaks between carburetor and engine will cause a lean condition and damage to engine.**

4. Check floats for damage.
5. Inspect needles and valves for damage.
6. Check insulator block for distortion on a surface plate. Sand down if slightly distorted. If distortion is excessive, replace.
7. Check mounting flange.

11. Corr

Fig. 2-25



CARBURETOR CLEANING

1. Wash all metallic parts with a good quality carburetor cleaner.
2. Dry components with air, making sure all holes, orifices and channels are clear.

> **● CAUTION ●**
>
> **Do not use wire or drills to clean orifices. Damage can result.**

INSPECTION

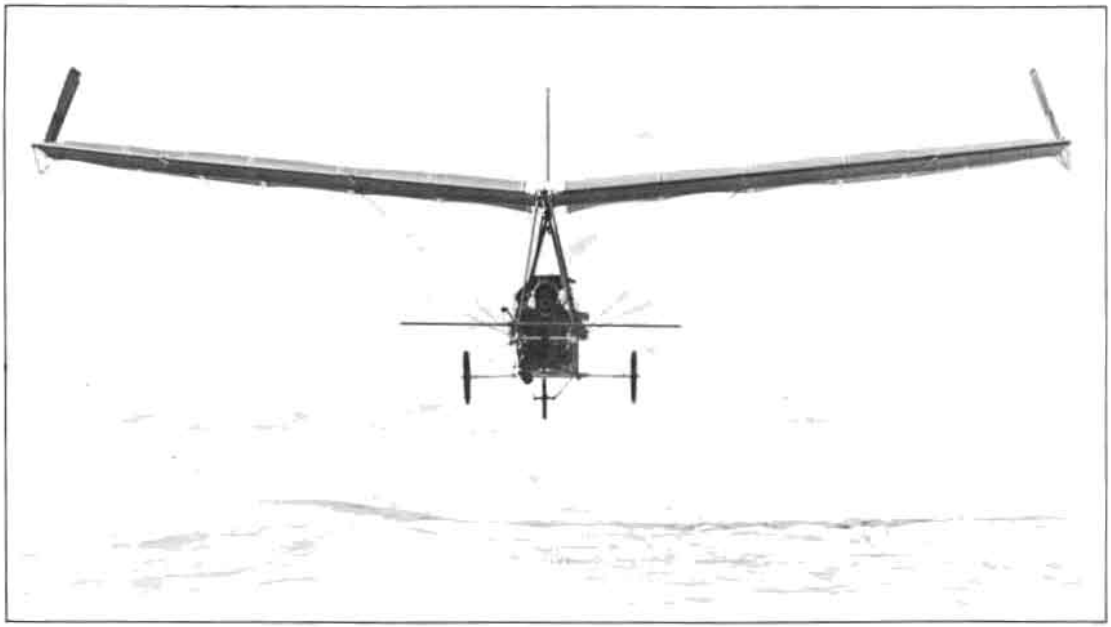
1. Check body, float bowl and caps for nicks, cracks, stripped threads, etc.
2. Examine throttle valve for score marks.
3. Inspect all gaskets and O-rings.

PREFLIGHT



PTERODACTYL

PREFLIGHT

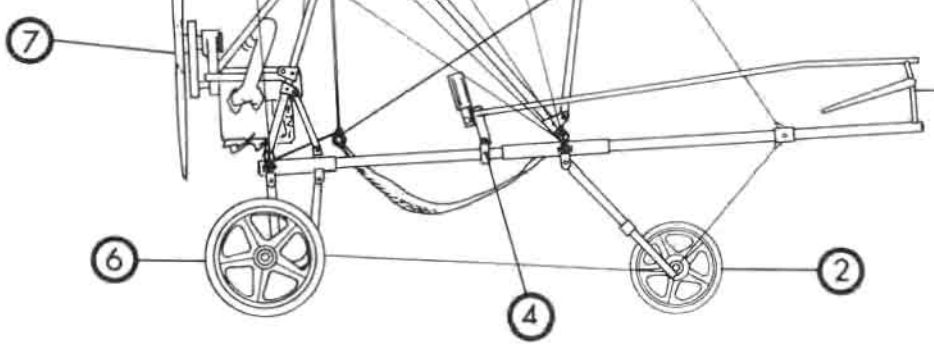


Flying is a hazardous sport. Even under ideal conditions it can lead to injury or death. You can't eliminate the risk but you can influence the likelihood tremendously by the way you fly and the way you prepare for flight. The purpose of this manual is to give you information which (if used) can influence the odds in your favor.

In the five years Pterodactyl ultralights have been flying, roughly half the fatal or serious accidents would have been avoided by following these preflight procedures. In each case, the pilot had the necessary information but chose not to implement it.

The time you spend on your preflight could be the most important minutes of your life. Haste makes widows.

Enclosed is a preflight checklist which goes on one hangtube, forward of the joystick. A flight limitations decal goes on the other hang tube. Put them on and use them. Follow them every flight. On the following page is a thorough preflight list. You may develop a preflight list that works better for you. If so, write it down and follow it. Until that time follow the



CANARD

a) Check that the canard has not been bent or torn.
b) Check that the clevis pins which hold the canard to the nosebooms have safety rings.
c) Lift up on the pushrod to assure that the pushrod and control arm are joined by the clevis pin and that the pin has a safety ring.
d) Check the noseboom cables for kinks and that they are attached correctly with wingnuts and safety rings.
e) Check that the nosebooms are not bent, dented or scratched and that they are connected to the noseboom sleeves with clevis pins and and safety rings.
f) Check the air speed indicator.

2. NOSE WHEEL ASSEMBLY
   a) Check the wheel for proper play.
   b) Check tire inflation.
   c) Check that the connection between the front forks and the front axle is secure and that the bolts are not bent.
   d) Check the cables.

3. BOTTOM RIGGING ATTACHMENT
   a) Check that the thimbles are not kinked at the shackles and that the shackles are attached securely to the front carry-through.
   b) Check that the bolts and brackets attached to the hang cage are not bent.
   c) Check the front strut and main strut tubing is in good condition.
   d) Check that the bolts which attach the main struts to the hang cage have wingnuts and safety rings.
   e) Check all bottom rigging cables for kinks, frays, abrasions, broken strands, etc.
   f) Check each end of the bottom rigging cables for bolt security, and check that the thimbles are not twisted.

4. CONTROL STICK
   a) Check that the control stick bracket is attached firmly.
   b) Check that the pushrod is connected to the control stick with wingnut and safety ring.
   c) Check that the control cables are attached to the control stick with clevis pins and safety rings.
   d) Check the control cables for kinks, frays, broken strands, etc.
   e) Check the control cables where they go through the cable guides on the outboard compression struts.
   f) Check the hang tubes for dents.

5. WINGLETS, WING COVERING AND RIBS
   a) Run your hand down the leading edges and feel for dents, stick your head through the zippers and look on the inside of the wing.
   b) Check that the tip ribs are in place and secured with a wingnut and safety ring.
   c) Check the winglets for freedom of motion, proper adjustment and firm attachment to the aircraft. All the clevis pins and safety rings must be in place.
   d) Inspect the wing covering for tears or abrasion.
   e) Check that all the ribs are in place.
   f) Check the rear spar for dents.

6. MAIN WHEEL AND AXLE ASSEMBLY
   a) Check main tire inflation.
   b) Check axle and axle hardware.
   c) Check that the shock cord is sound and properly attached.
   d) Check wheels for proper play.

7. POWERPLANT
   a) Check that the engine mount hardware is in place and is secured with wingnuts and safety rings.
   b) Grab the prop near the hub and shake it fore-and-aft. Be sure that the prop, pulleys, hub, engine, engine mount and airframe are securely attached together.
   c) Inspect the engine mount plate and muffler mounts for cracks.
   d) Examine the muffler for cracks, particularly the header pipe which is subject to wide variations in temperature. See that it is securely fastened to the engine.
   e) Check the security of the carb, air filter, throttle cable and electrical wire.

f) Check that the fuel harness is secured with a wingnut and safety ring.
g) Check over the electrical connections. A broken wire will make the ignition switch unable to switch off the engine.
h) Inspect the propeller for cracks and dings. They're most likely to appear around the tips and leading edge.
i) Check your fuel (quality as well as quantity). Look for water and dirt in the bottom of the tanks.
j) Check belt tension and general condition of the belts.
k) Check that the diagonal braces are securely fastened to the rear struts.
m) Check that the pullstarter is attached to the keel with a clevis pin and safety ring.
n) Check that the engine forward bracing is connected to the hang cage with a wingnut and safety ring.

8. COMPRESSION STRUTS
a) Check that the outboard compression struts are secured.
b) Check that the inboard compression struts are secured.
c) Close the zippers.

9. KINGPOST
a) Check kingpost attachment to keel.
b) Check that the top rigging adjusters are in the proper place.

10. KEEL
a) Check that the keel has no dents and is straight.
b) Check that the front struts, main struts and rear struts are secured to the keel.
c) Check that the pip pin is properly in place.

11. SEAT AND HARNESS
a) Check the seat for wear or damage.
b) Check harness for wear or damage.
c) Sit in aircraft and adjust seat to correct position.
d) Put harness on and adjust straps for security.
e) Check that the throttle assembly is securely attached to hang tube.
f) Check that the throttle action is smooth.

12. PILOT
a) Healthy? Rested? Sober? Relaxed? Dressed comfortably? (It's going to be cool up there.) Don't wear anything that is loose enough to interfere with the operation of the aircraft.
b) Helmet on and fastened? If your hair is long enough to get back into the engine, restrain it before putting on your helmet.
c) Goggles in place and clean?

13. RUNUP
a) Clear the area.
b) Start the engine and set it to idle.
c) Check the controls, both winglet and canard.
d) Check the ignition switch.
e) Plant you feet firmly on the ground and open the throttle. Are you getting full power? Is the engine running smoothly? Is there any unusual vibration? Throttle back down to idle.
f) Check the wind direction and strength.
g) Look for other air traffic on landing approach.
h) Taxi into position on the runway.
i) You are now ready for takeoff. Have a <u>safe</u> flight.



PTERODACTYL

TRAINING MANUAL

If you wish to fly an ultralight aircraft you must first learn how. Previous flight experience can actually work against you, particularly if you feel your expertise qualifies you to fly without learning.

You are going to be self-taught and you will be responsible for your own safety. Any indication that someone else will teach you and take care of you (such as the confident presence of a qualified instructor or the sage advice of this manual) is an illusion. An instructor can make it easier to teach yourself by helping with such things as crowd control, engine starting and objective commentary on your progress. Unfortunately an instructor cannot give you flight experience and that's what you really need to learn to fly. You're on your own and nobody else can take over the controls and cover your mistakes. Your instructor can suggest what to do next but only you can decide if you'll do it.

For example, let's say you've been taxiing for a while and have good ground control. You've got this neat manual and a competent instructor and we both say it's time to move on to the next step. Your instructor tells you to taxi at one quarter throttle until you reach flying speed and then shut off the engine as soon as the wheels leave the ground. Your engine is started and you are left alone on the runway. You are now in the position to try anything you please. You can follow your instructions, you can fly as high and far as your fuel supply allows, or you can compromise and fly low and level until you run out of runway. Your safety and our reputation depend on what you decide to do and we can't do a damn thing about it. Your instructor's standing next to the runway and I'm in Watsonville. You're on your own.

Incidentally, if you choose not to follow instructions it is customary to give your instructor a lame brain excuse. In the above example you would say, "I was about to cut the engine when a gust caught a wing so I gave it power, just a natural reaction for a pilot with my skill and experience. Once above the low-level turbulence it was obvious I should get some air time and practice approaches before committing myself to landing. As pilot-in-command it is my responsibility to remain flexible and use my excellent judgement to deal with variables in flight conditions. It's only a cornfield, it would have been a lot worse in the hands of a novice." or else, "When you said shut off the engine as soon as the wheels leave the ground I naturally assumed you meant fly up a few feet, level off and then kill the engine. I must have tried for a quarter mile and it never did get level, in fact every time it bounced off the ground it got worse. I wish you had been more clear, shut the engine off as soon as the wheels leave the ground can mean a lot of different things. I thought it was just a figure of speech, how do you expect me to learn how to fly if I shut off the engine as soon as the wheels leave the ground? I'm sure the nosegear can be straightened."

Of course, your instructor won't believe any of this guff, but aviation tradition demands you try.

BASIC FLIGHT SKILLS

The most important part of flying safely is landing safely. Landing safely requires:

1. Low sink rate
2. Low ground speed
3. Accurate positioning

This means when you touch down you should be coming down slowly, moving forward slowly and landing where you intended. Number one keeps you from hitting the ground hard. Number two keeps you from bouncing and from hitting obstructions on the ground after landing. Number three puts your landing in a safe place.

There's a couple catches to these three simple requirements. The most important is that airspeed provides lift, so if you fly too slow (below stall speed) you'll come down fast.

The primary purpose of this section of the training program is to teach you to land safely without damaging yourself or your aircraft while you learn.

EQUIPMENT AND SITE REQUIREMENTS

1. Aircraft: As my experience is mostly with Pterodactyls this manual leans toward them. There are a number of other ultralights available which are suitable for training. Choose one with a reputation for easy handling and crash survivability. These aircraft are being flown by human beings and there will be errors of judgement and there will be crashes. The aircraft should offer the pilot enough protection to limp away from your average mild crash.

If the ultralight you're considering hasn't been around long enough to develop a reputation, it might be wisest to leave it for more experienced pilots. If it is your own new design (by the way, a modified aircraft is a new design) there is no ethical option to test flying it yourself. Your evaluation will be more useful if you learn to fly a proven design first.

2. Landing Gear: I consider landing gear essential. It makes takeoffs and landings easier and absorbs the energy of most minor mishaps. As a rule of thumb, any damage done to the undercarriage would otherwise be done to the pilot.

At the time of this writing, the FAA is tolerating landing gear on unregistered ultralights as long as they retain foot launch capability. If they change their mind, I think it would be wiser to register your ultralight as an airplane than to remove the gear. When choosing your landing gear, consider its purpose. If you'll be flying from unimproved fields, you will need suspension. The gear should be strong, rugged and firmly attached to your aircraft.

In event of a crash, a well designed landing gear should absorb energy before getting all twisted and bent and broken, but after it's all over it should still be roughly landing gear shaped and the pilot should still be protected by it. In a serious crash the airframe should get twisted and bent and broken too. The pilot should be the last to go. It takes more

energy to bend up metal than to bend up human beings. The idea that a landing gear should be designed to shear off on impact to minimize damage to the airframe is real dumb.

3. Apparel: A helmet is required. I recommend a motorcycle type which covers the ears rather than the surfer style. It will help muffle engine noise and improve your concentration. Get one that's comfortable, hopefully you'll be spending a lot of time in it.

Eye protection is required. A mid-air with a June bug will blind you for about thirty seconds, you can be in heaven in ten.

A shoulder harness is required. One is standard equipment on your Pterodactyl. A shoulder harness is an effective safety device, although only when worn.

Gloves are recommended, boots are recommended, heavy pants and a heavy longed sleeved shirt are recommended. Floppy clothes and jewelry should not be worn, particularly those long scarves like Isadora Duncan used to wear. Otherwise dress in accordance with weather and fashion.

If you have long hair, wear a hair net under your helmet.

4. Training Site: The ideal site is a big open field covered with short grass. The minimum is any reasonable smooth ground ten feet wide and five hundred feet long, longer is better. If you can find a couple thousand feet it will make training much easier. More width helps too. Don't learn on asphalt, it is most unforgiving.

As you look for your site, keep an eye on prevailing winds. Your first lessons call for no wind or light breeze coming straight down the runway. The wider your field, the easier it is to face the wind. The site should not be surrounded by power lines, trees or buildings.

The site should be off the beaten track enough to avoid crowds. You'll be under enough pressure without having to perform in front of an audience.

Last but not least, if it's somebody else's land you'll need permission to use it. Don't be afraid to ask, the worst they can say is no. This learning experience is going to take some time, don't think you won't be noticed. People are generally agreeable when asked and generally disagreeable when they catch you doing something behind their back.

5. Assistants: You will need at least one assistant and two won't hurt. More than that and you'll be dealing with crowd control.

The best assistant is an experienced ultralight instructor, who is familiar with you and your aircraft. The next best is a fellow ultralight pilot. The next is someone else who wants to learn. The next-to-worst is someone you want to impress with your skill, like your sweetie or your parole officer. The absolute worst is a cameraman from your local TV station.

You are now ready to start your training. The first lesson you can do at home.

LESSON 1 — FAMILIARIZATION WITH AIRCRAFT, ENGINE AND CONTROLS

Step 1. Set up and preflight your aircraft, just as if you were going to fly. Dress for flight (helmet, goggles, the works) and get in. Put on your shoulder harness. Adjust your seat and make yourself comfortable. Nice, huh? Adjust your shoulder harness, tight enough so you can't be thrown forward into the struts, loose enough for good control. The harness shouldn't be between your back and the seat, the buckle would make you uncomfortable. Work the controls and think about their effect on the plane in flight.

This is a difficult lesson if other people are around, because they won't think you're doing anything. The urge to perform is a great one, it's part of our cultural heritage. Just having a neighbor kid who wants to hear the motor run is enough to cause most people to breeze right through this step. Please don't.

The purpose of this step is to make you feel at home in the aircraft. It can save you from having to think where a control is when you need it. Move the controls and think about what they do. Work the throttle, switch the ignition switch, move the stick fore-and-aft and side-to-side. Watch what happens when you move the stick and think about how it controls your flight.

Go in your house and get something to eat. After you're done, get back in the plane. Before you leave this step you should know your aircraft like the inside of your car. How long would you last on the highway if you had to hunt around for the brake pedal?

There's another advantage to spending plenty of time on this step. This is the only part of your flight training where you can't get hurt. So relax. Get the feel of things.

One quick quiz before you move on. Get out and wander around a bit. Walk back to the aircraft, close your eyes and get in. Put on your shoulder harness and work all the controls. Does everything come easily to hand?

Step 2. Invite your assistant over. Get five gallons of gas and mix in one quart of 30 weight automobile oil. This will be used for engine break-in. Take a couple spoonfuls of this fuel and rinse out the oil can with it. This will give you a bit of very oil-rich fuel mix. Pour it down the spark plug holes and crank the engine over a few times. Replace the spark plugs.

Put a gallon of fuel in your fuel tank. Secure the aircraft so it can't move. It should be tied down, pushing on a building or similar solid object. I'm sure I don't have to tell you how much trouble you'll be in if this thing gets loose.

Check your aircraft and the surrounding area to see that nothing can get sucked into the propeller. Station your assistant thirty feet or more behind the airplane. Get in the aircraft wearing your helmet and other protective gear. Look over the area to be sure there are no stray animals and human beings in harm's way. Say "clear prop" with good volume and diction. If your assistant sees that, sure enough, you're all alone out there, the traditional reply is "clear". You may now start the engine as instructed by your owner's manual. Stay away from the propeller. Run the engine at low RPMs for about a minute and then shut

it off.

Well now, let's review that last minute and let me explain all the chit-chat. The phrase "clear prop" is a contraction of "I'm going to start this engine in a second. I don't think there's anybody in range who might be hurt by it. Please confirm my opinion and stay clear of the prop." The reply "clear" means, "I can see you and you're right, everybody is clear of the prop." Seventy five years of aviation history has condensed this conversation down to three words, but it's still a conversation.

Propellers are killers and deserve the utmost respect. Hundreds of people have been buried or received nicknames like Lefty and Stumpy because of bodily contact with propellers. The "clear prop" ritual is one safeguard.

A few conventional airplane pilots (the folks in Cessnas, Pipers and other popular spam cans) have developed bad habits. They yell "clear prop" and then hit the starter. Sometimes they barely say it loud enough to hear even inside the plane. Sometimes a line boy collects some workman's compensation, but for the most part the seclusion of modern airports and the fences around the runways keep spectators safe. You're going to be out in the real world where there's lots of people. What's worse, your aircraft looks so cute some of them won't think it's dangerous. Don't assume the reply will be "clear". One time in a thousand it might be "Hold it. There's a dog right behind you and kid right behind the dog." And if a person or other living thing comes within a wingspan of the engine while it's running, shut it off.

I also use the phrase "clear prop" to remind me of an interesting fact. When the engine is running, the propeller disappears. A faint disk is sometimes visible, sometimes the illusion that the propeller is gone is quite convincing. It will be difficult to remember exactly where it is and how big around it is, so stay well clear of it.

Now that the engine is running, the serious stuff has begun. Every step of your education from here on will have an element of risk. The primary purpose of an assistant in this lesson is to drive you the hospital if needed. Remember this simple truth whenever you run the engine: Any portion of your anatomy which touches the propeller will be instantly transformed into hamburger. Let your vivid imagination dwell on that for a moment. The propeller is going as fast as a bullet, what kind of a wound would you expect from a three pound bullet? The two major dangers of aviation are impact with the ground and contact with the prop. A propeller is virtually harmless unless something gets in it, but if you forget its capabilities for destruction the doctor will not be able to sew all the itty bitty pieces together.

I hope I've made my point without rattling your confidence. Look, most people are a few feet from death a hundred times a day. Every time an oncoming car goes by, you have to remember to stay in your own lane. You don't lose sleep worrying about it but you don't ever forget either. That's the sort of respect you should give your prop.

Step 3. Repeat step #2 a few times, adjusting the carb as needed for smooth running. DO NOT ADJUST ANYTHING ON THE PROPELLER SIDE OF THE CARB WITH THE ENGINE RUNNING. Shut the engine off, make the adjustment and try again.

Step 4. Get in the aircraft, wearing your helmet and other protective gear. Say "clear prop", your assistant will confirm and say "clear". Only then will you start the engine. Turn off the ignition switch momentarily to see that it kills the engine, then turn it on and restart. Close the throttle and check that you can kill the engine with the throttle. It should not idle, or even cough and sputter. With the throttle closed it should just plain stop. This gives you two ways to kill the engine. You need two seperate systems because something could go wrong with one (a broken wire, a kinked cable, etc.). It is extremely disconcerting to have an aircraft engine running when you would prefer it was stopped. The amusing stories you may have heard about this situation were not amusing while they were happening. If either of your engine-stopping systems don't work, fix them.

If you restarted the engine after the ignition switch test, without clearing the prop (look, shout 'clear prop', wait for reply, look, start engine, keep looking) go to bed without dessert.

There should be a hand signal by which the assistant can tell you to cut power. A finger across the neck is the old standby. If you see this signal, shut off the engine first and ask why later. They may see something you don't.

Step 5. Repeat step 4, running the engine up to five minutes at a time at varying power settings (including occasional five second bursts of full power). Don't overheat the engine, and don't forget the "clear prop" routine. As well as breaking in the engine you're breaking in yourself. This is the easisest time to develop these habits. Repeat until the gallon of fuel is gone. When shutting off the engine, use both the throttle and ignition switch.

Step 6. Fold up your aircraft and ready it for transport to the training site. Look it over good as you tear down, particularly look for signs of vibration loosening things up. Put it away for the rest of the day. Get a good night's sleep before going on to lesson 2.

LESSON 2 — TAXIING AND GROUND HANDLING

Step 1. Drive out to the training site with your assistant, your aircraft and the mixed fuel left over from lesson 1. How does it look today? Walk the full length of the runway and look it over carefully. Any puddles or potholes? How about wind? If it's blowing under 5 MPH it's OK, as long as you can taxi straight into the wind. Otherwise you'll have to get back in the car and do something else today. Tomorrow try getting up earlier, it's usually quiet just after dawn.

It's not unusual for a training site to look pretty good when you first see it, but look a little iffy when your plane is on the roof rack. If close inspection has given you second thoughts about your site now is the best time to find another one. The minimums given earlier are minimums, doubling those dimensions will make life easier, quadrupling them is even better.

Step 2. If the site and the weather are up to snuff, unload your aircraft, set it up and preflight it. Do this just as if you were going to fly. Improper assembly can hurt you on the ground, too. Put in a gallon of fuel. Adjust the seat for proper C.G. For training, a 220 pound pilot should have the seat back where it nearly touches the diagonal braces, lighter pilots should move 1" forward for every 10 pounds less they weigh (a 200 pound pilot should move the seat backrest tube forward 2", a 150 pound pilot should move it 7" etc.). Install the "training 1" throttle stop from your dealer's training kit, so the aircraft is just barely capable of flight. As the amount of throttle required varies with pilot weight, field elevation, air temperature, field length and a number of other conditions, you will need the aid of your local Pterodactyl dealer for proper installation. The best check is to have a qualified Pterodactyl Ascender/Ptraveler pilot of your weight test fly it, to verify you have enough-but-not-too-much power for current conditions. Please note that you, the student, are not yet capable of flight, although your aircraft is.

Step 3. Walk the plane to the runway. Get in with it facing down the runway (and directly into the wind if any). Start the engine, as in step 4, lesson 1. There's a checklist just forward of the stick, you should follow it. Hold yourself in place by putting your feet on the ground.

Step 4. Put your feet on the forward carry-through (the tube connecting the hang cage tubes together). Open the throttle as required to accelerate smoothly. At 10 MPH shut off the engine, push the stick forward and put your feet on the ground (hope you're wearing your brake shoes). This is the basic stop and should be mastered before going on.

Notice that this step does not call for steering. You'll be getting to that shortly but the first skill you should have is shutting it down and stopping it. Get out and wheel it back to your starting point.

Step 5. Same as step 4 except you throttle back to stop accelerating at 10 MPH. Now you can use the tip draggers for directional control. Turn out the right one to go right, the left one to go left. Remember to release them once you've turned. The object is to go straight down the runway. If you lose control, stop the engine, stop the aircraft, analyze what happened and try again. Your assistant will be helpful with analysis.

As you're going slowly, the tip draggers will only be marginally

effective. They are four times as powerful at 20 as they are at 10, nine times as powerful at 30. Don't use subtle movements at this stage, put them all the way out and hold them there until they have had the desired effect on your course.

When you reach the end of the runway, shut off the engine, stop and get out. If there is any wind, walk it back. The exercise will do you good. If not, turn it around, get back in and taxi back the same way you came.

Through this entire lesson, keep your feet up and DO NOT steer with the nose wheel. I know it's a temptation (especially if you paid extra for steerable nose gear) but you should use aerodynamic controls only. You're learning to fly, not drive. If sometime in the future you should hit something hard enough to collapse your nose gear, you will be glad you developed the habit of keeping your feet up. Repeat step 5 until you can taxi nice and straight down the runway.

Step 6. This is step 5 at 15 MPH. That's airspeed, not ground speed. You'll find this easier than taxiing at 10 because the controls are so much more effective. You'll also find that if you overcontrol you'll go right off the runway. You are now going fast enough for the wings to lift you some, so you're going fast enough to groundloop.

Groundloop is another charming aviation phrase. It is a sudden and uncontrolled turn, one of the quirks in the never-never land between taxiing and flying. It is easiest to do when the wind is blowing.

Here's what happens. You turn to the left and the left wing slows down and the right speeds up. This banks the plane to the left, because the faster wing lifts more than the slower wing. If there's wind, now that you've turned left it's coming from the right, which banks you even more to the left. If the left wing tip touches the ground, the drag on the ground will turn you more to the left which lifts the right wing more which pushes the left wing into the ground more, so it turns more and banks more and spins around on the left wingtip until you cut power and stop.

To keep this from happening shut off the engine and stop if you find yourself getting out of control. And, of course, you must shut off the engine and stop if you're running out of runway. If there's any wind, walk the aircraft back to the starting position. You can see this lesson is less work in still air.

If everything is going smoothly, you may be tempted to stop with the engine idling, turn around without getting out of the aircraft and taxi back. You should not do that, and there's a number of good reasons.
- A landing isn't over until the aircraft is stopped. Your landings as a beginning ultralight pilot will all be dead engine (I'll explain why shortly). As well as teaching directional control, this lesson teaches important landing skills, namely what to do after touchdown, how to control roll-out and how to stop.
- A dead engine eliminates the danger of contact with the prop while stopping and turning around, and also (if you're on the ball) if you should happen to ground loop, run off course or otherwise loose control.
- Dragging your feet on the ground will kick up rocks and dirt, these will damage the prop if the engine's running.
- If you are so badly out of shape that walking your aircraft, getting out of your aircraft or starting the engine is difficult, maybe your body is trying to tell you something. Ask your doctor what it's saying.

- Exiting your aircraft will give you a few moments of peace to think about your latest taxiing attempt. People learn faster with little breaks in their training.
- The goal of each trip down the runway is to learn a bit more without damaging anything. If you add "keeping the enging running" to this goal, you'll compromise the "without damaging anything" part, which requires that you KILL THE ENGINE AT THE FIRST SIGN OF TROUBLE.

Step 7. Same as steps 5 and 6 but you'll be throttling back at higher speed. Work yourself up gradually until you're very close to flying speed. Each attempt should follow the same pattern, the "clear prop" exchange, starting the engine, acceleration at partial throttle, reducing throttle to maintain speed, killing the engine and stopping.

As the indicated takeoff speed varies with gross weight, ASI calibration and other factors (around 25 MPH usually) it may be hard to find "very close to takeoff speed" without overshooting once. Read lesson 3 so you know how to deal with this possibility. Don't go on to lesson 3 if this happens, simply use less throttle so it doesn't happen again and continue this step until you have mastered it.

There are ways to tell you are about to fly besides taking off and then going back a notch. When you are about to fly there is very little weight on the wheels and very little traction. The ground will feel fluid, you'll skate along on top of it. Another indication that you're almost at takeoff speed will be visible only to an observer on the ground. The main wheels may be above the runway an inch or so for short distances, leaving you taxiing on your nose wheel. This step is to teach control in this transitional stage. The wing are supporting most of your weight. You aren't having to work in three dimensions yet, so concentrate on directional control. Next lesson gives you a taste of pitch control, before you get to it, directional control should feel natural and precise. Before you leave this lesson you should be able to hit a fris-bee with your nose wheel at any speed short of actually taking off. Sometime during this step you will probably have to add another gallon of fuel.

When you feel you have mastered lesson 2, either call it a day or take a break. your decision will depend on the weather, the amount of daylight left and how tired you are. Don't push yourself too hard out of a determination to learn to fly by Tuesday. I guarentee you'll learn faster by quitting while you're ahead than trying to do too much to soon. If you're tired and you go home you can come back tomorrow. If you're tired and you try to continue your training, if you're lucky you can spend tomorrow doing minor repairs. If you're unlucky everything will go smoothly and you'll have learned a bad habit. You'll have learned that you can fly at a level beyond your ability and get away with it. If you develop this habit, you will soon be doing major repairs.

LESSON 3 — TAKEOFF AND LANDING

Are you rested and fresh from lesson 2? Is the weather cooperating? Even a slight breeze can make this lesson unnecessarily difficult, as you'll have trouble telling what you're controling vs. what the wind is controling. If the wind is smooth, no higher than 5 MPH and straight down the runway, it is possible to do this lesson (although unnecessarily difficult). If it's higher or rougher, do this lesson some other time. Go to your training site with your assistant, set up your aircraft and preflight it. Give it roughly a gallon of fuel, put on your helmet and other apparel. You are now ready for lesson 3.

Step 1. Hold the stick so the trailing edge of the elevator (canard) is 2" to 3" above the nosebooms. Repeat step 7, lesson 2 as a review. If you have difficulty making side-to-side motions without making fore-and-aft motions, continue to review lesson 2 until your high speed taxi is controlled, smooth, natural and the canard stays where you want it.

Step 2. Hold the elevator in the same position as step 1. This run will be just like a high speed taxi except for one thing. You're not going to throttle back just before reaching takeoff speed, you're going to continue to accelerate until you are airborne. As soon as your wheels leave the ground, smoothly close the throttle. The aircraft will settle back down and land.

Review those two last lines. If you follow the instruction in the first line, the aircraft will follow the instruction in the second. Simple, huh? With a low throttle opening and normal reaction time you should have a dead engine by the time you're a foot off the ground. From there (assuming you don't try to flare and you keep directional control like you learned in lesson 2) the aircraft will slow a bit, lower the nose the fly itself back on.

Now I can't say that every ultralight behaves that way, but my Ascender does and if your ultralight does something different you had better find out why before you go on.

It is important that you only use enough power to just barely take off. More power will give you more altitude (a moment of indecision at full throttle can put you ten feet off the deck) and will exaggerate trim changes.

Repeat this step until:

A. You are not surprised by takeoff and can recognize it instantly, and know your minimum takeoff airspeed.

B. Your rollout after landing is smooth and controlled, all the way to full stop.

C. You are fully aware of your aircraft's landing behavior when you kill the engine and do not attempt to flare.

In the next steps you will be controlling pitch, this step will give you something to compare your efforts with.

Step 3. Same as step 2 but you leave the engine on for a couple of seconds after takeoff. Two seconds isn't long enough to get you in trouble unless you've got too much throttle, wind gusts or you've breezed through the previous steps too fast. Let the stick go forward slightly to keep from gaining altitude. Try to fly level a foot off the ground.

Moving the stick forward brings the nose down and increase your airspeed. Hold it in this slightly forward position, kill the engine by smoothly pulling back the throttle, and let the aircraft fly itself back on. It may bounce a bit. Just let it. If you try to correct and get out of synchronization with the bounce, you may get a severe bounce. Concentrate your efforts on maintaining one foot altitude, and if you're off by a foot either way (if you get up to 2 feet altitude or if you hit the ground) kill the engine and let it land. By now, maintaining directional control and stopping should be second nature. Repeat until competent.

Step 4. Work your way up gradually to five second flights. As you will be going faster with each second, your landings will be faster, your rollout (after touchdown) wil be harder to control and you'll be more likely to bounce. So don't use any more power than you have to. This step will teach you pitch trim control and will give you a reference for future steps. It will also give you a good seperation between take-off and landing, which will make landing training much easier. Stay with this step until you can maintain your one foot altitude for the full five seconds and you are fully aware of your aircraft's behavior in an unflared dead stick landing at this speed.

"Dead stick" is a term meaning "with engine shut off". Your aircraft is basically a powered glider and quite well suited to dead stick landings. The major reasons you are learning to land dead stick are:
- You will be soon reaching speeds and altitudes where a serious error on landing will result in a crash. As well as eliminating the possibility of post-crash danger from the prop, you are eliminating the possibility of powering into the ground. You can hit quite hard enough without the engine helping push.
- If you are skilled at landing your aircraft as a glider, an engine failure will not be an emergency. Since your engine is considerably more likely to quit while you're under power than it is to suddenly start up while you're gliding, dead engine landings are more dependable.
- Landing with a live engine is more difficult than landing with a dead engine. It causes you to drift beyond your intended landing point because your Pterodactyl doesn't require much power to keep flying and even an idling engine may double it's gliding distance. This means if you set up a powered approach, you'll land short of your target if the engine quits. And when an engine is idling is when it is most likely to quit.
- A dead engine doesn't allow you the option of going around, so you're going to learn to get your landing right the first time. My experience of observing missed approaches in various aircraft leads me to believe that second and third attempts aren't likely to be any better than first and by the fourth attempt you might as well call the crash truck, because the pilot will be too rattled to make a controlled landing.

Step 5. You are now going to do a partial landing flare. Your takeoff and 'cruise' will be like step 4, but your landing will be like step 2. In your five second flight, you've had to move the stick forward gradually to increase speed and keep from gaining altitude. Now after killing the engine you will slowly pull the stick back until it is in the same position it was when you took off, at which point the aircraft will settle in and land just like step 2. You should have no bounce and your motion should be slow and smooth enough that you do not gain altitude.

If you pull it back too slowly the aircraft will fly back on before you've slowed down all the way. As you know from steps 3 and 4, this is

really no problem. If you pull it back too fast you will gain altitude and lose airspeed, which could have you stalled several feet above the runway. That could be a problem, so as you perfect this technique make sure all your errors are on the "too little too late" side rather than the "too much too soon" side.

Repeat this step until you're real good at it.

Step 6. You are now going to learn to do flared landings. A landing flare is when the pilot brings the nose up and reduces speed on landing so that the aircraft touches down at minimum flying speed (stall speed). This eliminates bounce because there isn't enough speed for the craft to lift back into the air. It also gives you the shortest possible landing roll (excluding a crash where you don't roll at all). In most situations it's the best way to land. It's been put off until now because it is more difficult than the "fly it on" landing.

As your aircraft will drop to the ground immediately after stall, it is very important that you do not flare while still several feet off the ground. Step 5 taught you altitude control while bleeding off speed for landing, this step will continue that all the way down to stall.

Repeat step 5, through killing engine and slowly moving the stick back to takeoff position to maintain your one foot of altitude. Now push yourself back so the seatback tube touches the front diagonal struts. This will move the center of gravity rearward, which will bring the nose up a bit more. Pull the stick back smoothly so the elevator trailing edge touches the boom tubes. Just before the elevator stalls it will lift the nose even a little higher. Work up to a full flare from the "too little, too late" end. Try a bit more nose up each time, but keep it smooth. Landing too soon won't hurt, but flaring too soon will.

Practice makes perfect. Develop your skills to where you have precise altitude control from the moment the wheels leave the ground to the moment of gentle, flared touchdown. Then practice until you can do it easily and consistantly. Take plenty of breaks. You'll need a break to put in more gas, get some food, you may need a break because the wind is coming up or the sun's going down. You can even break for a couple beers as long as it's an end-of-the-session break and you don't start again until tomorrow.

Don't keep pushing yourself until you're tired. Tired people make mistakes. Come back to this lesson as many times as needed to get it down perfect. In the long run it will be well worth the time invested.

In general, the success of any given flight is judged by the landing. This may be the most difficult lesson, but it's clearly one of the most important lessons. Strangely enough, it is the lesson which is most commonly breezed over or skipped completely. If you do, you will pay for it in your future flights. Here is a true story to illustrate this fact.

I have a good friend who flew transcontinental with me in the summer of '79. He was a private pilot and an experienced hang glider pilot when he first got his PF. His first lesson was at a farmer's field, he and his assistant (another ultralight flier who should have know better) had not asked for permission to fly there. The landowner appeared just after they got their ultralights set up and fueled and told them to get out of his field, so to satisfy him they started their engines and flew away.

Now that's no great trick, it really doesn't take any skill or experience to fly these things. In no wind you could throw a couple sacks of dog food in the seat, start the engine and stand back. The aircraft is perfectly capable of takeoffs all by itself, it will even do a presentable landing most of the time. But not all of the time.

Anyway, they got where they were going that first flight and the landing was OK. In the next week he got about twelve hours in, mostly cross country so he only had a half dozen landings. By the time the transcontinental flight came around he was filled with confidence, his flight skills were good and so far all his landing had been just fine.

At the beginning of the transcontinental flight, conditions were not optimum and he aborted his takeoff. He stalled and crashed, bringing the crash truck onto the field. This caused the airport management to rethink their policy on this type of aircraft and close off Monterey Airport to ultralights. It also took a day to repair the damage and move to another airstrip. The day after that another stall on landing wiped out another rear axle and bent a main gear carrier. The day after that it was a wheel. By the time we reached Oshkosh he was one of the most skilled and experienced ultralight fliers in the world and he still couldn't land four times in a row without breaking something. As his first landings had been all right he attributed his later problems to bad luck and never went back and practiced landings.

He lands well now, but he learned how at the school of hard knocks. It took him a hundred hours of flying and many days of repairing to learn to land as well as you will after completing lesson 3.

Don't go on to lesson 4 yet. You'll need a good night's sleep for lesson 3 to soak into your brain.

LESSON 4 — LEVEL FLIGHT AND LANDING APPROACH

It's time to take another long look at your training site. In this lesson you'll be landing about a thousand feet from where you start your takeoff roll. You only need smooth firm ground for takeoff, so if your runway ends at 500 feet in tall grass, plowed dirt etc, you're still OK. Just remember it's going to be more difficult to walk back. Walk the landing area, make sure it's all usable (no old fenceposts or derelict cars hidden in the grass).

Step 1. Do a flight just like the last flight in lesson 3 and grade your performance. If it's lower than A-, polish up lesson 3 before you go on.

Note that I didn't tell you to preflight, put on your helmet, clear the prop. You should know all that by now.

Step 2. Using the same amount of throttle as in lesson 3, climb up to three feet, level off, kill the engine and land. You'll want to let it get down to a foot off the ground before you start to flare. This will get you down with enough speed to give you good control. Repeat as needed for a good landing.

Step 3. Work your way up from step 2 a little at a time until you are leveling off at 5 or 6 feet. Repeat as needed for a good landing.

Step 4. Level off at 5 or 6 feet and maintain your altitude the full length of the runway. As you only have marginal power, you'll find this takes some work. Land as usual.

This would be lots easier with more power, but you're learning the hard stuff first on purpose. If you can fly well with marginal power you'll find it extremely easy to convert your skill over to more power. The reverse is not so true. And remember you're still learning so you might make a mistake. The more power, the more dramatic the results of mistakes.

If you should fly too low and bounce off the runway, fly too high and exceed six feet, or start porpoising up and down, kill the engine, ease the stick and when near the ground land as usual. Repeat as needed for controlled level flight.

Step 5. This is a "what not to do" instruction. You're going to do this once so you can recognize what's happening if you ever do it accidently. Take this step with a certain amount of fear and trepidation.

Level off around five feet, lean forward and pick up a little speed while maintaining altitude. Kill the engine and slowly start to flare while flying level. It's just like lesson 3, step 5, except you're flying five feet off the ground instead of one foot. This isn't a good place to be, ease the stick forward to bring the nose down and pick up speed, when you're close to the ground, land as usual.

Never let yourself get that slow on landing approach again. If it should happen from outside influences like a gust of wind (or your own error) correct immediately by pushing the stick forward.

Got that? Good, now don't mess around with step 5 any more. Just remember to speed up if you get too slow and it's better to fly onto the runway fast and level than to stall five feet off the ground.

Step 6. Remove the "training 1" throttle stop and install the "training 2" throttle stop. This makes roughly 50% power available, which is more than plenty. The Ascender with this throttle stop will outperform most other ultralights. This stop is not a substitute for judgement and in no way eliminates the need for discretion on the part of the pilot. It is simply a training tool which allows the student pilot to learn good habits (i.e. smooth throttle increase to "full power" for takeoff) while developing skills and experience. We do not use actual full power here for the same reason the Navy does not use catapult launches when first training their pilots.

Yes but what if somewhere in the next few lessons you need just a teeny bit more power to clear some trees? If you put yourself in that position, you won't clear the trees and you'll crash. So there's nothing in this manual on how to just barely clear trees, or in any other way rely on the engine to keep you out of trouble. You're flying a powered glider which for numerous reasons could turn into an unpowered (or underpowered) glider at any moment. Anyone who gives "insufficient power" or "power failure" as an excuse for a crash gets very little sympathy around here. Never go anywhere or do anything where a problem powerplant could be hazardous to your health. Right now all you're risking on the reliability of your engine is if it quits on you, you'll have to walk back. That's about as far as you should ever trust it.

Step 7. Do another flight just like step 4, except this time you'll have to set the throttle yourself instead of relying on the throttle stop to make the decision for you. This step will show you the proper throttle position for minimum power level flight. It will also show you, you can be trusted with throttle control. If you can do this one without cheating (giving more power to make the lesson easier) you should have no trouble with shortcutting or fudging future lessons.

Step 8. Like step 7 but with more power. Increase throttle until you are leveling out and cruising at 10 MPH faster than takeoff speed. You'll note that your takeoff roll is shorter, your climb rate is higher and it's easier to overshoot six feet of altitude. You'll also find you're pulling yourself farther forward and it's not so comfortable to keep your feet up. Keep them up anyway, you've still got things to learn before you start shuffling around. Practice until you have good control of the entire flight.

Step 9. Like step 8 but you're going to level off at a whopping ten feet. Repeat until you're comfortable and able to tell how much sooner you have to kill the engine to avoid gliding over your intended landing spot.

Step 10. Like step 9 but with gentle S-turns over the runway. After you get into your level cruise, turn left (away from your normal flight line), turn right (back toward your normal flight line) and turn slightly left again (so you're back on your normal flight line). Don't go so far afield that you can't safely land if the engine quits. Practice until you can make repeated S-turns the full length of the field. Keep them very gentle, a steep turn will cause you to lose either altitude of airspeed. If you are blessed with a large enough field, you may be able to do full 90 degree turns.

Step 11. Like step 9 but after you're cruising at 10 feet, takeoff speed plus 10 MPH, you're going to push the stick forward even more, which will increase your speed and cause you to lose altitude. When you get down to 5 feet, pull back to level off at takeoff speed plus 10 MPH again. Kill the engine and land as usual. Repeat as needed to perform this maneuver smoothly.

Step 12. From this step on you will want to take off at full throttle to give you maximum flight time for a given length of runway. This is to acquaint you with your aircraft's behavior at full throttle.

Step 12 is like step 9 but with full throttle takoff roll and climb. At ten feet of altitude, ease back the throttle and push the stick forward to level off at takeoff speed plus 10 MPH cruise. Maintain level flight, than land as usual. If anything in this flight was not as expected (for example, early or late takoff, unusual angle of attack, overshooting 10' altitude) repeat until accustomed to and in control of full throttle performance.

Step 13. Take off at full throttle. At 10 feet altitude, kill the engine and land. As you will be climbing when you kill the engine, the nose will be high and the aircraft will slow down rapidly. Remember step 5 and don't let it happen, push the stick forward to maintain (or recover) airspeed and land as usual. This step is to show you what to expect if you should have a power failure during climbout.

Step 14. Take off at full throttle. At twenty feet of altitude back the throttle off and push the stick forward to maintain level flight at takeoff speed plus 10 MPH. Kill the engine and land as usual. Notice how far you flew from the moment of killing power to the moment of touchdown. Repeat until you can predict roughly where you'll land.

You may have trouble estimating 20 feet altitude. Your assistant(s) can help, they're in a better position to observe your height.

Step 15. Put a marker on the landing area (a bright colored frisbee is good). Kill the engine at 20 feet, takeoff speed plus 10 MPH and try to land on the mark. It's much easier said than done, but by the time you leave this step you should be landing within ten feet of the spot. If you're getting within five, you deserve a round of applause.

As well as giving you glideslope control, this game will teach you to handle distraction. This is important because you'll be going around the pattern tomorrow and you'll have a lot to think about. You may find that since you're concentrating on target practice your speed control is getting sloppy. Be sure you aren't getting slow except during landing flare.

Step 16. Let me remind you that any wind should be straight down the runway, smooth and no faster than 5 MPH for these lessons. In this step you will be high enough to thoroughly kill yourself (mind you, you can do it from twenty feet too, it's just harder) so you'll want to double check that the wind won't give you trouble.

This step is the same as 15, except you will increase your altitude about 5 feet every repetition until you've reached fifty feet. Continue repetitions at fifty feet until your spot landings are pretty good. At touchdown you should be coming down slowly, moving forward slowly and landing where you intended.

During this lesson, give yourself lots of breaks so you don't get worn out. This lesson deserves at least a day's study and a couple days wouldn't hurt. Don't go on before you've mastered this lesson and put a good night's sleep between this lesson and the next.

LESSON 5 — BEGINNING PATTERN FLIGHT

It's time for another hard look at your training site. You're going to be flying around it and you need to be sure that an engine failure will not put you (or anyone else) in any danger. You should have at least five hundred feet to one side of the runway with no obstructions such as lines, trees and buildings, for at least the full length (minimum 1000 feet) of your combined runway and landing area. These are minimums, another 500 feet in every direction will make this lesson more comfortable.

Consider you flight plan for step 2. Is there a safe place to land in event of power loss anywhere during the flight? This motorized glider is different from a conventional powerplane in two major respects.

1. The Cuyuna engine (like every engine) was designed with compromises between aspects such as cost, weight and reliability. Is isn't as reliable as a certified aircraft engine and it isn't as heavy, and it isn't as expensive. Your aircraft should never be flown into a situation where maintaining power is necessary for the safety of the pilot, or anyone else.
2. It has better flight behavior (quicker pitch control, gentler stall characteristics, better oscillation damping, etc.) as a glider (with the engine off). Added to the obvious fact that if you should crash the thrust from the engine will make you crash harder, it is clear that the engine should be killed at the first sign of trouble. Look over the field well enough that you won't delay killing the engine while you find a place to land.

This lesson is to be done in no wind and before the sun wakes up the thermals. In most cases this will be fairly early in the morning. This is necessary so you won't have turbulence and so you wil be able to safely land facing any direction. If there's any wind, do something else today and come back some other day (tomorrow if you can get the morning off).

Step 1. Observing the usual safety precautions (preflight, helmet, assistant, one gallon of fuel, clearing the area, checking your ignition switch, etc) climb out at full throttle to an altitude of fifty feet, reduce power and level off at takeoff speed plus 10 MPH. Look over the terrain you'll be flying over in the next step. Kill the engine (push the stick forward to maintain air speed) and land as usual.

As well as being a quick review of your last lesson, this gives you a look at where you're going. Sometimes a new perspective makes a difference. If the prospect of possibly landing over there makes you uncomfortable, you're going to have to find another flying site. Review this last flight as you walk back, was it as good as it should have been? Any hesitancy, lack of control, lack of confidence or other difficulty with any aspect of the flight indicates you should polish up Lesson 4 before going on.

Pay particular attention to the leveled off part of your flight. It is important that you fly smoothly, maintaining your altitude (50 feet) and airspeed (takeoff speed plus 10 MPH). Fluctuating altitude and airspeed (porpoising) is not acceptable and corrections under power (at this stage in your training) are likely to make things worse rather than better. It's called overcontrolling and it's caused by putting too much force in your corrections or by correcting too late, after the aircraft has all ready started correcting itself.

Remember when you were learning to ride a bicycle? The first few times you fell off because you didn't know what to do when it started to tip over. After a while, you knew what to do and overdid it and tipped the other way and fell off. As your skills developed you could wobble side to side half a dozen times, each wobble worse than the last and then fall off. That's overcontrolling. Since you can't afford to fall off your aircraft, kill the engine and land at the first sign of pilot induced oscillation or PIO as the military fliers say. They have the same training problems you do, they just make theirs sound classier by using initials when they talk. In this next step you'll be in the air a lot longer than your previous flights, so if you have any porpoising problems, take care of them now while they're little ones. Repeat this step as needed for smooth, positive control of takeoff, level flight and landing.

Step 2. Take off and climb at full throttle to roughly 75 feet. Reduce power and level off at takeoff speed plus 10 MPH. Fly level for ten seconds, that's long enough to show you how good your control is. If you have an oscillation or difficulty maintaining altitude at takeoff speed plus 10 MPH, kill the engine, land, analyze your difficulty and correct it. The correction may be to make your next attempt at a slightly different throttle setting, it may be to brush up more on a previous lesson. You're in the best position to judge. If your ten second cruise was up to your standards (and by now they should be pretty high) of smoothness and control, make a gentle 180 degree turn, keeping the speed at 30. You will need to use more control force to start the turn than to keep turning, keep the turn even. When you reach the end of the turn, use opposite control force to level the wings and staighten out. If you find your turn is 'tightening up' (the bank angle is increasing as you progress through the turn) or airspeed is changing, level the wings, kill the engine and land as usual. Determine the cause of your difficulty and correct as needed to fly smoothly through the turn and straighten out smoothly at the end of it.

Now you're flying level at takeoff speed plus 10 MPH, parallel to the runway. Keep an even distance from the runway, there is sometimes a tendency to get homesick and close in on it. This would spoil the symetry of your next turn. If your altitude is different from when you first leveled off, make a note of it. This flight is long enough that if you weren't quite level it will gradually effect your altitude. If you have lost significant altitude (fifteen or twenty feet) kill the engine and land, at this rate you may not be high enough in your final turn for safety. If your altitude is good, continue flying straight until you are at right angles with the end of the runway. Make a 180 degree turn just like the last one and straighten out. Now look down. You should be right over the end of the runway and flying in line with it. Kill the engine and land as usual.

Here's a summary of this step. You're going to take off and climb to 75 feet, reduce throttle and level off at takeoff speed plus 10 MPH. You're going to turn slowly 180 degrees, fly staight, turn 180 degrees again and land. You're going to maintain speed and altitude and if anything goes awry you're going to kill the engine and land. Since there's no wind you can land facing any direction.

Step 3. Take a brief break to review that last flight. Congratulations, that was a pretty big step. Since there was so much happening and it required the use of lots of different flying skills, you may see room for improvement. Did your speed and altitude stay steady? Were your turns half-circles, was your bank angle constant through the turn? Did you feel comfortable and confident? Repeat step 2 until all these answers are yes.

Step 4. This is the same flight but with four 90 degree turns instead of two 180 degree turns. Your turns will have to be a bit steeper and the entries and exits to them should be clean and precise. You want a rectangular pattern with straight sides and curved corners, not a big oval.

Take off, climb and level out at 75 feet, takeoff speed plus 10 MPH. Fly level for ten seconds, turn 90 degrees and straighten out. You are now flying at right angles, away from the runway. Fly level for five seconds, turn 90 degrees and straighten out. You are now flying parallel to the runway, when you reach the end of the runway, turn 90 degrees again. Straighten out and fly level for five seconds. Turn 90 degrees and straighten out. You should now be directly over the end of the runway. Kill the engine and land. Repeat this step as needed for smooth turns, staight legs and complete control.

Step 5. Same as step 4 but you'll climb to 100 feet and (here's the exciting part) kill the engine immediately after the third turn. You will fly level five seconds, turn 90 degrees and land, all with a dead engine. Be sure to keep your speed up to takeoff speed plus 10 MPH in your glide and turn. If your speed gets too low, immediately push the stick forward and speed up. This is particularly important in a turn, as stall speed is somewhat higher (since you're putting an extra load on the wing by banking) and the results of a stall in a turn are more dramatic than a stall going straight. If you should stall in a turn, the turn will tighten up which increases the load even more. The correction is to push the stick forward and release the winglets. If you're flying at 30 in no wind, the problem will never come up but it's nice to know what to do. Repeat this step as needed for good speed control.

Step 6. Put a target on the runway where you're landing and try landing on it, repeating step 5. This is educational, there's no prize for hitting it. It's more important to keep smooth control in the air. Repeat as needed to land in roughly the same place every time.

Step 7. That straight stretch between the third and last turns is called the 'base leg'. This flight, cut the engine after the third turn as in steps 5 and 6, but don't fly a five second long base leg. Turn toward the target just a second after you kill the engine. This will shorten your flight path by a hundred or more feet and you will overshoot the target accordingly.

Repeat the flight, but this time stretch out the base leg a couple seconds. This time you'll be past the runway at the end of the last 90

LESSON 6 — PATTERN FLIGHT

Don't start this lesson unless weather conditions are ideal, you're rested and you've had a night's sleep to absorb lesson 5. Preflight your aircraft. It should have one gallon of fuel in its tanks. Put on your flying duds. Clear the area of everyone but yourself and your assistant. Start the engine in accordance with proper ritual and attention to safety. You know all that stuff. Since you know it, there's no reason not to do it.

Step 1. Refresh your memory by repeating step 6 from lesson 5. Grade your performance and decide if you need more review or if you're ready to go on. Lean the target in place for step 2.

Step 2. Climb out and level off at 150 feet, takeoff speed plus 10 MPH. Depending on the performance of your aircraft, you may have to climb through your first turn. It's OK, just don't slow down in the turns and don't throttle down and level out in a turn. On your downwind leg (that' what they call the straight stretch between the second and third turns) kill the engine when you are at right angles to the target and turn to base when you reach the end of the runway. You should come out of the turn at 100 feet, stretch out your base leg, if too low cut it short. Repeat as needed for reasonable accuracy and consistant speed control.

Step 3. Same as step 2 but you're going to level off at 200 feet and you're going to move the corners of your rectangular pattern farther apart, so you can kill the engine at right angles to your target, keep the corners of the pattern square (and the sides straight) and land at the target. Repeat as needed for accuracy (and don't forget the speed control).

Step 4. Same as step 3 but this time when you level off, move your feet down and forward to the nose gear. You'll find you're more comfortable now. After your final turn and before your flare, lift your feet back up to the front carry through. It's important that your feet be up for every landing. Repeat as needed for speed control, landing accuracy, comfort and smoothness. This will be your standard landing.

Step 5. Same as step 4 but you won't land right away. Fly around the pattern a few times, then make a standard landing.

Step 6. Same as step 5 but after the first circuit push the stick forward to increase speed another 5 MPH, and increase throttle to maintain altitude.. Make your change at the beginning of your downwind leg, in aircraft most engine failures occur during throttle changes so you want to be in the best position to land when you make them. After a few laps, reduce speed back to takeoff speed plus 10 MPH, with the stick, reduce power to maintain altitude, go around once more and make a standard landing. By the way, have you been checking your fuel before takeoff?

Step 7. This time you can climb up to 500 feet. Level off at a comfortable cruise speed, 30 to 35 with your feet on the nose gear and enough power to maintain altitude. Stay in the pattern and look around. Notice how many places you could glide to if the engine quit. See what other places you could land besides the runway below you and file them away for future reference. From this height you could glide quite a ways, so you can make the rectangle you're flying in a lot bigger and still know you can get back if the engine goes tummy-up. Expand your

flight territory a thousand feet in all directions (assuming of course there's no other air traffic to conflict with) and fly around in it.

After fifteen minutes (or signs of tiredness, whichever comes first) back the throttle off so the engine is idling and descend back down to 200 feet. Try and guage your rate of descent and adjust your flight path so you are at the position you kill your engine at for a standard landing (we'll call this the 'key position') when you get down to 200 feet. If you're there, kill the engine and land. If you're not, open the throttle and level off. Cruise around the pattern until you reach the key position and make a standard landing.

That's enough flying for today. On your way home, check out those alternate landing spots you saw from the air. Was your judgement good or are there defects you didn't notice (fences across the field, power lines on approach, etc.)? If you're going to make cross-country flights, you're going to have to develop this judgement.

LESSON 7 — FLIGHT TEST AREA AND LOCAL FLIGHT RESTRICTIONS

If you're a private pilot or a student who's passed the written test for a private license, you can do this lesson yourself. If you're not, you'll need outside help. A Certified Flight Instructor or USHGA Ultralight Instructor can show you. Anyone with a pilot's license should have the necessary knowledge, although the professionals should be better at passing it on. You can find a CFI under 'aircraft schools' in the yellow pages.

If you go with a CFI, find a good one and be prepared to pay for their time. Call and tell them what you're doing, an unsympathetic instructor will usually show their true colors by telling you how you're crazy and offering lessons in a real airplane. You don't need those people around, try somebody else.

The purpose of this lesson is to give you a limited area where the flight rules are simple, so you can concentrate more on developing flying skills. You have no business leaving your pattern until you have completed this step.

Take a current local sectional and Part 91B of the FARs. Find your training site on the sectional. With the information from the FARs, draw an area around the site where you can fly without breaking any of the regulations which would apply to a pilot. You want enough room to explore a bit, but not enough to get lost. It won't take too much, there's more than a hundred square miles of land within six miles of your airstrip.

Define your limits with landmarks, so you can tell where you are in flight. Set an altitude limit, a few thousand feet is plenty. Set weather minimums, right now I'd suggest unlimited visibility, no clouds and no wind. There may be places inside these limits you won't want to fly over (lakes, cities, etc.), crosshatch over them to remind you. Go through Part 91B and put a check by each regulation pertaining to flight in your limited area. Commit these to memory and ignore the rest (For example, 91.101 regards flying to Cuba. If Cuba isn't in your area, you don't need that information).

LESSON 8 — PATTERN EXIT, PATTERN ENTRY

I'm leaving the step-by-step format because you know how that works now and should be able to pace yourself without it.

You can leave the pattern on any leg by simply not turning when you reach the end of it. Depending on the availability of alternate landing areas, you may wish to climb to cruise altitude while still in the pattern. The main thing you need to develop is keeping your eyes open for places to land if the engine konks out (or starts making a funny noise or you wish to kill it for any other reason). Never fly anywhere you can't safely land.

Reenter the pattern at a 45 degree angle from the downwind leg. Come in at pattern altitude. Aim a bit behind your key position so you can turn 45 degrees, enter the downwind leg, kill the engine and land.

As long as the day stays clear and wind free, you can cruise around in your flight test area. Practice your turns going the other direction from your in-pattern turns. Spend a few days in here polishing up general flying skills and stay alert for other air traffic.

If there's an appropriate alternate site for landing and takeoffs within your flight test area, check out its suitability by inspecting it on the ground, get permission and make some flights back and forth between the two sites.

Don't fly long enough to get exhausted, short flights interruped by breaks will do you more good.

GENERAL FLIGHT SKILLS

Before leaving the flight test area, go back to your CFI. You may wish to expand the area or (depending on your sectional skills and your knowldge of the FARs) you may wish to eliminate it. Get some outside counseling to verify your ability. You still don't need to know about Cuba but you'll have a lot more check marks in Part 91 than you did in lesson 7.

You should have no problem finding a helpful CFI. Most of them are aviation enthusiasts and will take an interest in what you're doing. And they know you may get bitten hard by the flying bug and come back for real airplane lessons.

Since the wind blows sometimes, you will want to develop skills for it. Go back to the training site some day when it's blowing a bit (5 MPH or under) and practice takeoffs, pattern flight and landing. Remember it's airspeed, not groundspeed that keeps you flying. Your speed upwind, and your spotlanding techniques will have to be adjusted accordingly.

Work your way up to higher winds as desired but take it from me, it's not much fun over 10 MPH.

Your Ascender will land fine with the power on. You're learning dead stick landings to assure you are skilled at them. Every landing so far has been a simulated emergency. To stay sharp, I'd suggest at least half your landings be simulated emergency, from now until you retire. Back in the old days of ultralight aviation we didn't have to simulate engine failures, we were using modified go-kart engines and their unreliability was legend. Nowdays we have to practice so if it happens it doesn't catch us by surprise.

By the way, the most common cause of power failures these days is running out of gas. Look at the tanks now and then, it could save you a long walk.

Crosswind takeoffs require lots of control force and you'll take off crabing somewhat. To make them easier, start from the downwind side of the runway and make your takeoff roll diagonally across it. Also note how much less room is needed to take off with wind blowing, you may have enough room to take off straight into it.

On a crosswind landing immediately turn and face the wind after touchdown, and land into the wind whenever possible. Don't feel bad if you roll off the side of the runway and into the weeds, it'll make it easier to stop.

To practice stalls and stall recovery, go up to a thousand feet, idle the engine and <u>gently</u> flare, like a landing flare but real slow and subtle. When it starts to stall (the nose should get heavy and it may shudder and buffet a bit) lean forward and push the stick forward. <u>Don't</u> apply power, I know that's what you're supposed to do with most airplanes but this is a motorized glider, the elevator doesn't require prop blast to be effective, and you're better off without it. The only reason for leaving the engine idling is so you can power back up after recovery and try again. Repeat as needed to recognize a stall and immediately recover, but quit if a little voice inside you says, "Gee, this is fun". You're learning how to recover from a dangerous situation, you're not learning a new trick. <u>Do not</u> practice whip stalls (where you zoom up into a stall

at a very high angle of attack) and do not practice spins (where you stall while turning). The recovery is the same as a conventional stall. I presume neither you or your aircraft is rated for aerobatics, and it's real easy to push a little more and a little more for the cheap thrill of losing control and recovering. Resist the impulse.

Get advice from local fliers on local flying conditions. For general advice, I heartily recommend Dennis Pagen's Hang Gliding and Flying Conditions, available from Dennis Pagen, 1184 Oneida Street, State College, PA 16801 for $5.95 and 50 cents postage. It's also at most hang glider shops.

If you're invited to fly at an airport, find out what their pattern is and fly it as fast as practical, to avoid stacking up other aircraft behind you. Practice at your own site first.

In turbulence, don't exceed maneuvering speed (it's 35 MPH) and in smooth air, stay under the never-exceed speed (it's 55).

Remember that our continued self regulation depends on how well we all behave without the government telling us what to do. If we can't do it by ourselves, someone else will do it for us.



PTERODACTYL

MAINTENANCE

ANNUAL (OR 100 HOUR) INSPECTION

By this time you should know your plane quite well, so we won't go into great detail.

Throughout this inspection check:

- Bolts — Check that they are not bent, worn or corroded and that the threads are not worn.
- Tubing — Check that all tubes (spars, struts, hang tubes, etc) are not bent, scratched, dented, worn or corroded and that the holes are not enlarged.
- Brackets — Check that they are not distorted, cracked or worn, and that the holes are not enlarged. (Stainless, check that rivets are secure and remove and check the bolt.)

Replace any part which is not in perfect condition. (If you're not sure about it, replace it. Parts are cheaper than medical expenses.)

After you complete each step, check it off the list so you don't accidentally skip any.

Check the washout when the plane is set up with the rigging tight, and decide if you need to replace any cables.

With the plane folded down, on the wheels, spread the wings slightly.

Cut the winglet control cables and pull them out of the wing covering.

Remove the screws at the tips of the leading edges and the rear of the keel.

Remove the bolts which hold the rigging to the rear spar, putting the tangs (top and bottom cables) back onto the bolts.

Remove the front compression struts, put the tangs and saddles back onto the bolts.

Label the rigging left and right, and remove it from the carry-throughs and the kingpost. Undo the Velcro and straps at the keel.

Slide the wing covering off the spars, bringing the wings together.

Remove the rear compression struts, leaving the sweep wires attached to them.

Take the compression struts (front and rear) out of their brackets, check the bolts, holes and brackets.

Replace (with new) the cable guides on the outboard compression struts.

Unbolt the spars from the keel. Check them thoroughly. Sight along the spars for bends, rolling one end along the bench or floor. Check (with eyes and hands) for dents and scratches. Take the sections apart to check for wear at the ends of the sleeves. Check for enlarged holes.

Remove the tip rib brackets, check the bolts and holes.

Remove and inspect the seat, shoulder harness and suspension rope. Check for wear and fraying and loose stitching.

Remove the keel from the struts, remove the brackets, take apart the noseplate, check the bolts, holes, brackets, tubing and pip pin.

Remove the struts from the hang cage, check the tubing, holes, and stainless steel brackets (rivets and bolts). Remove the diagonal braces and forward braces and check the bolts, holes and tubing.

Turn over the hang cage, remove the landing gear, and take it apart, inspecting the bolts, holes, tubing, wheels and bearings, cables, brackets and shock cord.

Take apart the hang cage, inspecting the bolts, holes, tubing and brackets.

Take apart the control stick and remove the bolt from the control post bracket, checking the bolts, holes and tubing.

Take the engine and muffler off the mount plate, take apart the mount, checking bolts, holes, dampers, engine plate, tubes, brackets and rivets.

Take off the prop, repair and balance it. Check the bolts.

Take off the reduction system, check the belts, shaft and bearings, bolts and holes.

Inspect and service the powerplant: carb, throttle, ignition, pullstart and fuel system.

Take apart the fuel system, inspect and replace parts where necessary, reassemble with new fuel line and filter.

Remove the cylinder head. Decarbon the head, piston dome and exhaust port.
Reassemble with new head gaskets.
Take apart the carb, clean, inspect and reassemble.
Remove the throttle cable, inspect and lubricate it.
Take apart the pullstart and grease the mechanism, check the pulley and rope.
Check the fanbelt.
Check and adjust the ignition system.

SEE ENGINE MANUAL.

Rigging Check all the cables, including the sweep wires, noseboom cables and the cable on the noseplate. Remove the heat shrink, check for broken strands, corroded swages and straightened thimbles (when a thimble is flattened or straightened, the cable should be replaced, since this indicates that the cable has been overstressed). Check with eyes and hands the full length of all cables.

Where the plastic coating is damaged, cut away the coating, and check the cable thoroughly.

Ribs Look and feel the full length of each, check with the profile drawing. Check the tip ribs, remove the winglet plugs, check the tip rib stops. Check that the droop tip sockets are secure.

Nosebooms (and pushrod) Check the tubing, bolts and holes, and check each clevis for wear. Remove and inspect the canard mounting tubes.

Canard Check the shape and condition - remove and check the eyebolts for wear. If the sun has damaged your wing covering, recover the canard too.

Wing covering Check the seams and stitching, and look for holes and tears. Patch where necessary, including enlarged bolt holes etc. Contact your dealer about sail repairs. Clean with soap and water. Long exposure to the sun damages and weakens the fabric, as well as fading it. If this has happened to yours, replace it and don't leave the next one tied down outside so much.

Winglets Check the nylocks, replace the cotter keys and plastic washers at the pivot points and on the adjuster on the bellcrank.

Reassembly basically consists of putting it back together in reverse order, unless you wish to retension the wing covering. If so, fit the wing covering onto the inverted airframe, as in SECTION V, moving the sail stops back along the tip ribs, fitting larger spacers inside the tip rib brackets, and fitting spacers inside the outboard leading edge sleeves (try 1/2"), (making new holes for the tip rib bracket bolts and the leading edge clevis pins.)

If you're replacing a cable, fit the tang on the bolt, and when the plane is set up, set the washout with kearnys etc. reading off the bottom of the compression struts (using the readings recorded in SECTION II D, step #15.)

Replace (with new) all nylocks, lock washers, safety wire and heat shrink. To fit the shrink tubing, spray inside the tube with WD 40, push it onto the tang, reach in with needle-nosed pliers and pull the tang through).

Twist the bracing cables on the landing gear, if needed, to tighten them. Regrease the wheel bearings or replace them if necessary.

Replace (with new) all control cables.

Don't postpone your inspections. You should be able to take it apart in one weekend, order your replacement parts, and put it back together another weekend. It's time well spent. Even the most thorough and detailed pre-flight check cannot determine if an aircraft is safe to fly if it has not been regularly maintained.

NOTE: After any unusual load has been put on the aircraft (a heavy landing, ground loop, flight in severe turbulence, etc), check that the spars are straight. Look along the leading edges from the noseplate. To check the rear spars have someone push up on the outboard cables of one wing to bring

PERIODIC MAINTENANCE SCHEDULE

	AFTER FIRST 5 HOURS	EVERY 10 HRS	EVERY 50 HRS
ENGINE			
–SPARK PLUGS		★	□
–CYLINDER HEAD BOLTS	■		
–MOUNT BOLTS	■		■
–FAN BELT	●		●
–IGNITION			●
REDUCTION BELTS	●		★
–BOLTS	■		
PROP			
–BOLTS	■		
PULLSTARTER			
MUFFLER DAMPERS			★
–SPRINGS			
FUEL LINE			
–PRIMER			
–FILTER			□
THROTTLE CABLE			†
CARBURETOR			
WHEEL BEARINGS			†
RIBS		★	
ALL BOLTS			■
SHOCK CORD			★
CONTROL CABLES			

† LUBRICATE
● ADJUST
■ CHECK BOLT OR TENSION NUT

★ REMOVE, INSPECT, REPLACE IF NECESSARY
○ OVERHAUL
□ REPLACE



PTERODACTYL

ASCENDER II+2 RETROFIT KIT



Before you start to convert your II+ to a II+2, complete and mail the registration application form. Then contact your local F.A.A. office about obtaining a 'Special Airworthiness Certificate' for your 'Experimental-Amateur Built Aircraft.'

To fit the passenger seat to the Ascender II+ 2, you will need the plane set up. If it's already set up, slide the tensioners up to the kingpost before starting. If it's not set up, just spread the wings and set up the struts; you won't need the engine, nosebooms, ribs, etc. in place.

The following instructions describe fitting the passenger seat to the right of the hang cage. To fit it to the left of the hang cage, go through the text and substitute 'left' for 'right' and 'right' for 'left'.

Some of the references to drawings are to those in the Ascender II+ Assembly Manual.

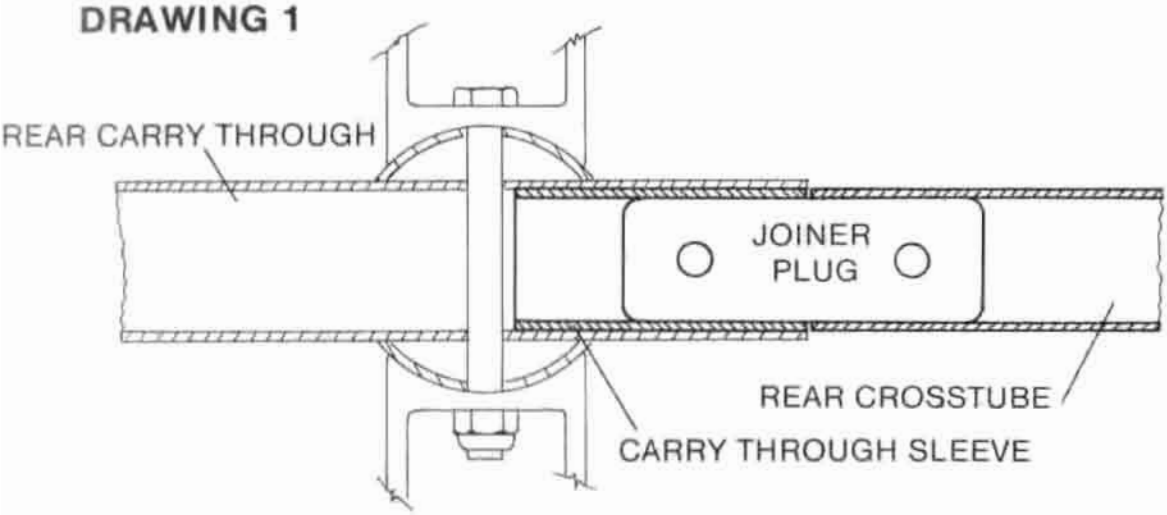
If you have not yet assembled your II+ kit, make one of the maingear bracing cables (in section IV - steps #1 and #4) from 1/8" cable, using the swages and tangs supplied in the retrofit kit. (See step #3, below)

NOTES

1. Remove the bolts and tangs from the right-hand ends of the carry-throughs. Fit the carry-through sleeve (4587) and a joiner plug (4225) into the end of the rear carry-through. Line up the holes and replace the bolt with the tangs of the hang cage centering cables and the anti-sway cables. Fit the wingnut. See drawing # 1.

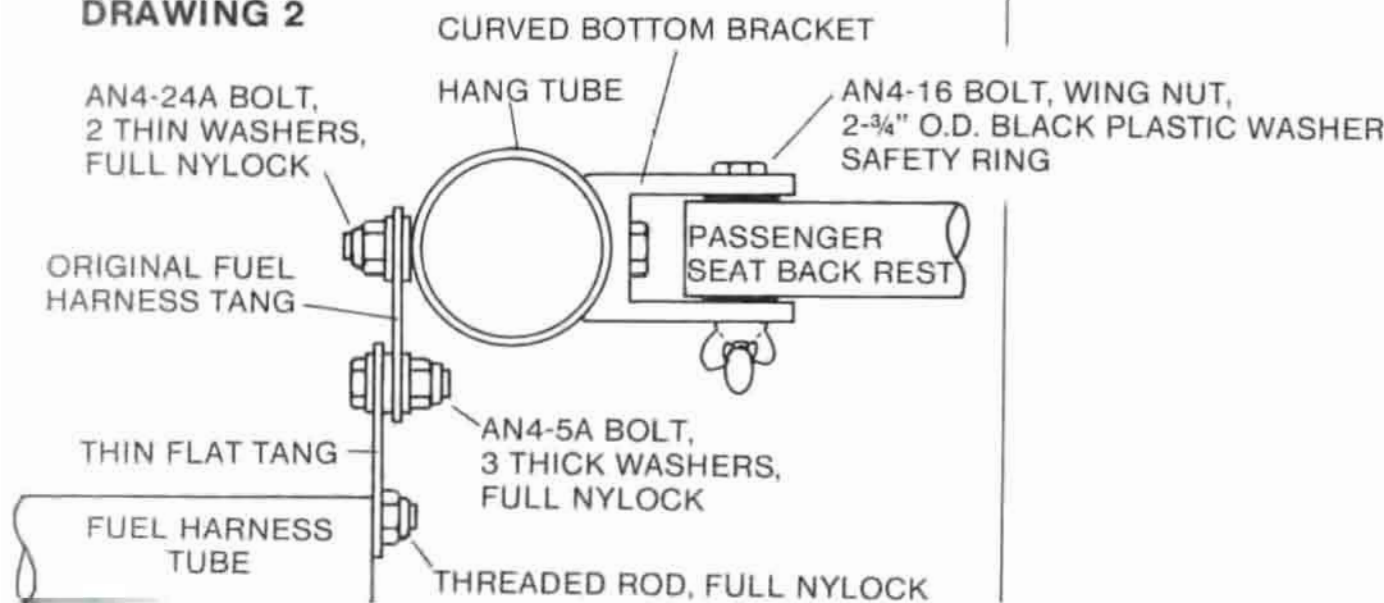
Fit a joiner plug into the end of the front carry-through. Replace the bolt and the tangs of the bottom cables. Fit a new nylock and tighten it.

DRAWING 1



2. Remove the fuel harness tube and threaded rod. Remove the bolt which holds the tang to the right-hand hang tube. Use this bolt (with a new nylock) to fit the curved bottom bracket (3772) for the passenger seat backrest tube to the outboard side of the hang tube. Replace the tang on the end of the bolt, on the inboard side of the hang tube, with a thin washer either side of the tang. Tighten the nylock. See drawing # 2.

DRAWING 2



3. Replace one of your original maingear bracing cables with a new one made from 1/8" cable. Support the maingear (use woodblocks, toolbox) so that the wheels are off the ground. Remove the bracing cable which runs from the left of the main axle to the right-hand hang tube.

Swage a thick flat tang (2860) to one end of the 1/8" cable (2666) with a thimble (2687) and two 1/8" swages (2686), after stripping 6" of coating. Mark the coating 15 1/2" from the clamped swage and strip the coating beyond this mark. Bolt this cable to the left maingear carrier, fit the axle, fit a new nylock and tighten it. Remove the supports from the maingear carriers.

Bend the other thick flat tang about 1/4" to 3/8" from the center of the smaller hole, to about 45 degrees (use vice or pliers). Bolt this tang to the bracket under the right-hand hang tube with a wing nut. Attach the bare end of the 1/8" cable to this tang with a large kearny, 2 swages and a thimble. Adjust the length of this cable (as you did with the original one in Section IV) to make the maingear carriers square with the hang cage and axle. Unbolt the tang, clamp the swages, replace the tang, fit a new nylock and tighten it.

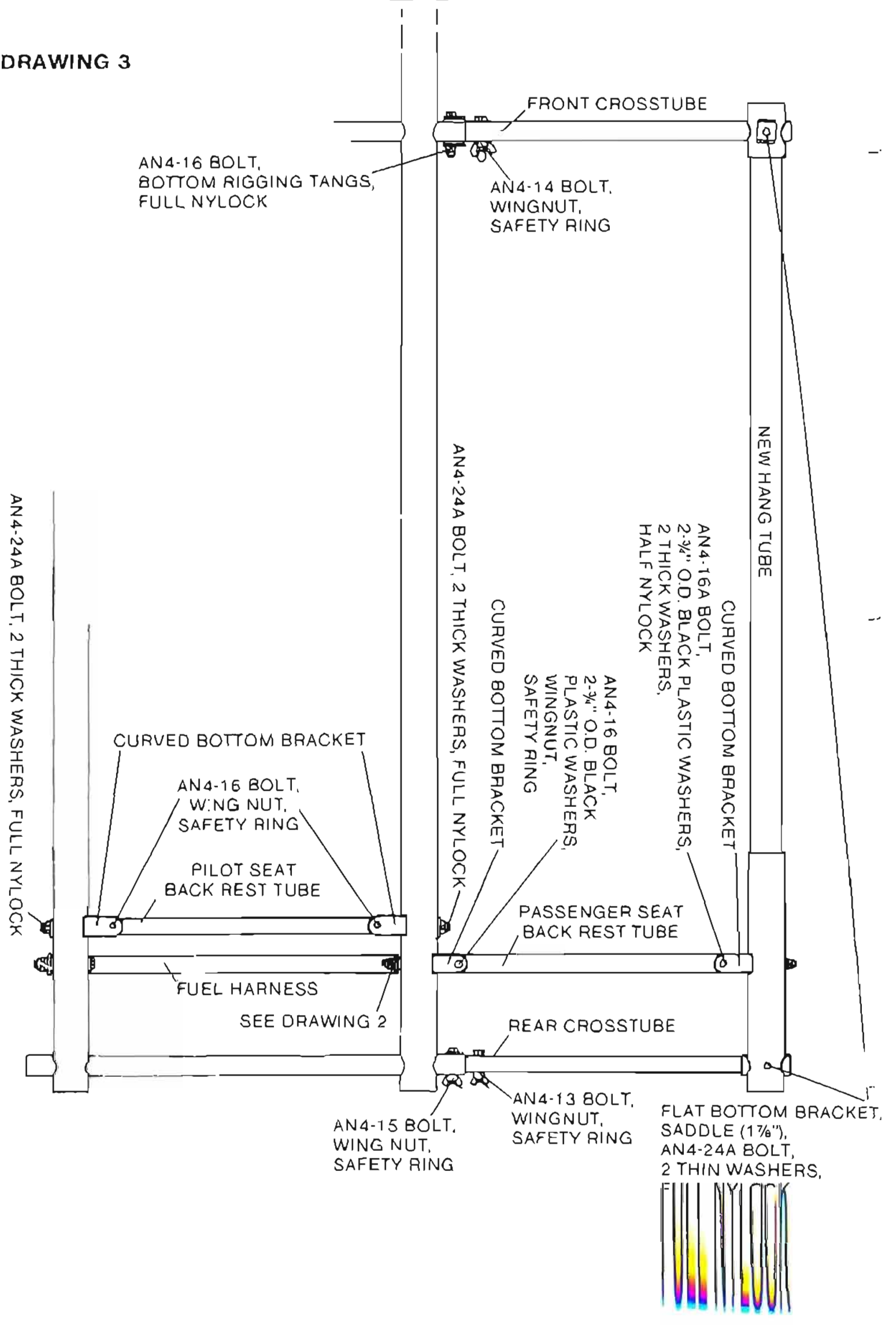
4. Fit the front and rear crosstubes (4585, 4586) to the new hang tube (4550) and bolt on the flat-bottom brackets (3765) and saddles (4325) (on top at the front, below at the rear) as shown in drawing # 3. Tighten the nylocks.

Bolt a curved bottom bracket (for the passenger seat backrest tube) to the inboard side of the new hang tube at the rearmost 1/4" horizontal hole. Tighten the nylock.

SEE DRAWING NEXT PAGE

5. Holding the new hang tube level with the hang cage, fit the ends of the crosstubes onto the joiner plugs and fit the bolts and wingnuts.

DRAWING 3

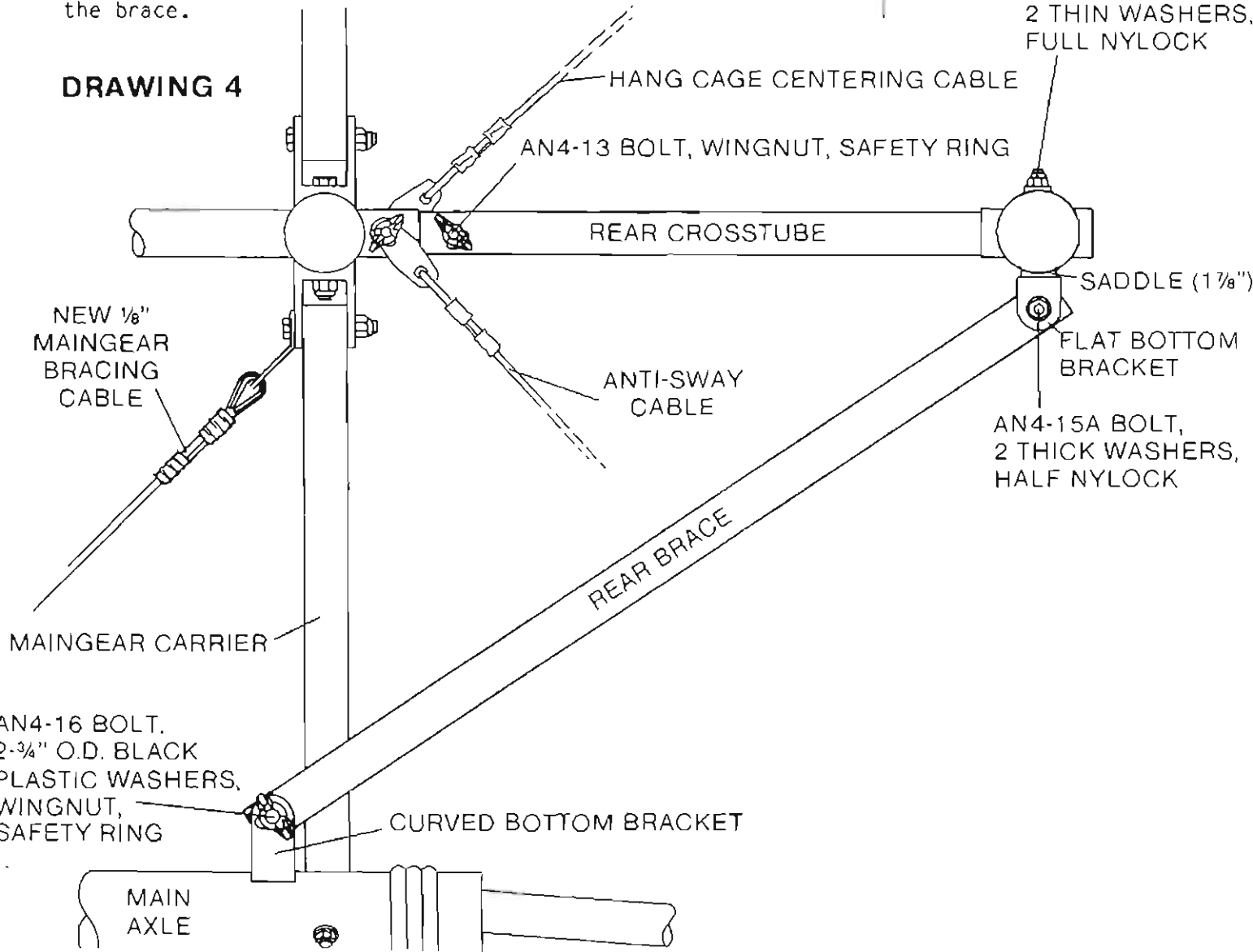

FRONT CROSSTUBE
AN4-16 BOLT,
BOTTOM RIGGING TANGS,
FULL NYLOCK
AN4-14 BOLT,
WINGNUT,
SAFETY RING
NEW HANG TUBE
AN4-24A BOLT, 2 THICK WASHERS, FULL NYLOCK
CURVED BOTTOM BRACKET
AN4-16A BOLT,
2-¾" O.D. BLACK PLASTIC WASHERS,
2 THICK WASHERS,
HALF NYLOCK
CURVED BOTTOM BRACKET
AN4-16 BOLT,
2-¾" O.D. BLACK
PLASTIC WASHERS,
WINGNUT,
SAFETY RING
AN4-24A BOLT, 2 THICK WASHERS, FULL NYLOCK
CURVED BOTTOM BRACKET
AN4-16 BOLT,
WING NUT,
SAFETY RING
PILOT SEAT
BACK REST TUBE
PASSENGER SEAT
BACK REST TUBE
FUEL HARNESS
SEE DRAWING 2
REAR CROSSTUBE
AN4-15 BOLT,
WING NUT,
SAFETY RING
AN4-13 BOLT,
WINGNUT,
SAFETY RING
FLAT BOTTOM BRACKET,
SADDLE (1⅞"),
AN4-24A BOLT,
2 THIN WASHERS,

6. File one end of the rear brace (4584) on one side (as in drawing II#4) so that it clears the bolt head when you bolt it into the flat bottom bracket under the rear of the new hang tube (nylock finger tight). Bolt a curved bottom bracket to the other end. See drawing # 4.

Locate the curved bottom bracket (inboard of the maingear carrier) in such a position that the three hang tubes are perfectly in line (lay a straight edge across all three). Mark the outline of the bracket where it touches the main axle.

Remove the bracket from the bottom of the brace and hold it on the outline marks while you mark the main axle at the center of the hole in the bracket. Drill a 1/4" hole through the main axle at this point, bolt the bracket to the axle and tighten the nylock. (If you're using a large drill, you may need to unbolt the axle from the carrier to drill this hole straight). Attach the rear brace with bolt, washers and wingnut, and tighten the nylock at the top of the brace.

DRAWING 4

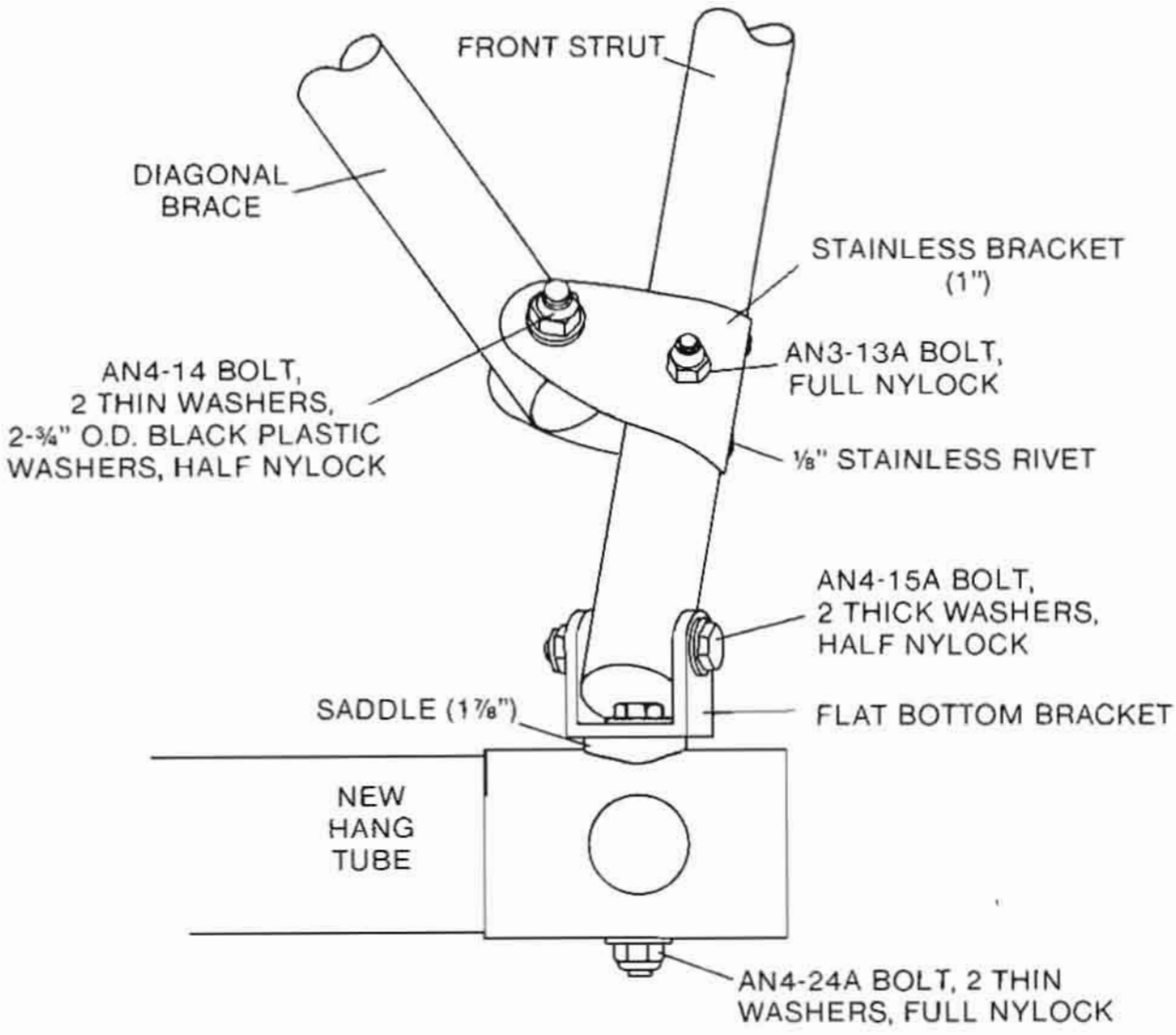


NOTES

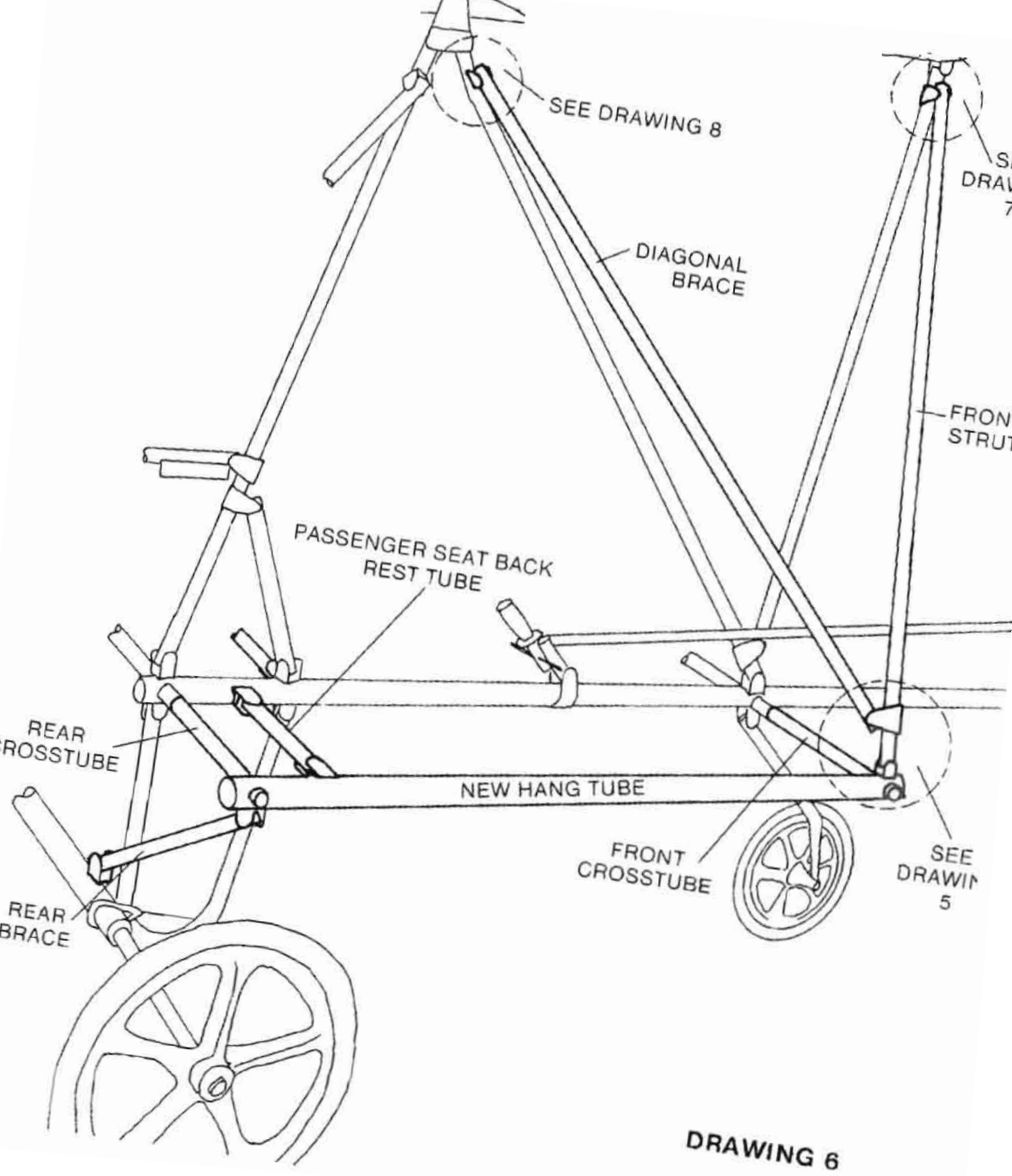
7. File one end of the new front strut (4577) (to clear the bolt head) and bolt it into the flat-bottom bracket on the front of the new hang tube, nylock finger tight. See drawing # 5.

Fit a stainless bracket (3850) around the top of the existing front strut and bolt the top of the new front strut

DRAWING 5



to this bracket. See drawing # 6. Now you have to locate the stainless bracket on the front strut so that the three hang tubes are perfectly in line. If you have a helper, he or she can hold the new hang tube in line with the other two (using a straight edge) while you temporarily secure the stainless bracket with two 1/8" aluminum rivets (4241), one each side. If you have to do this alone, remove the nosebooms and fold the nosewheel under, and with the front of the hang cage resting on the ground, support (with woodblocks or books) the front of the new hang tube so that the straight edge shows that all three are perfectly in line.


SEE DRAWING 8
DIAGONAL BRACE
PASSENGER SEAT BACK REST TUBE
REAR CROSSTUBE
NEW HANG TUBE
FRONT CROSSTUBE
REAR BRACE

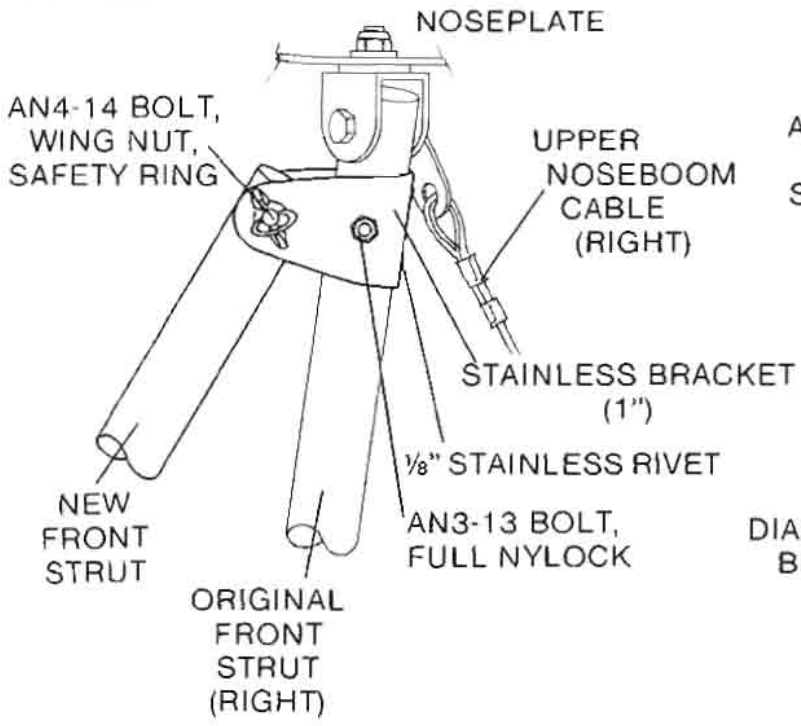
DRAWING 6

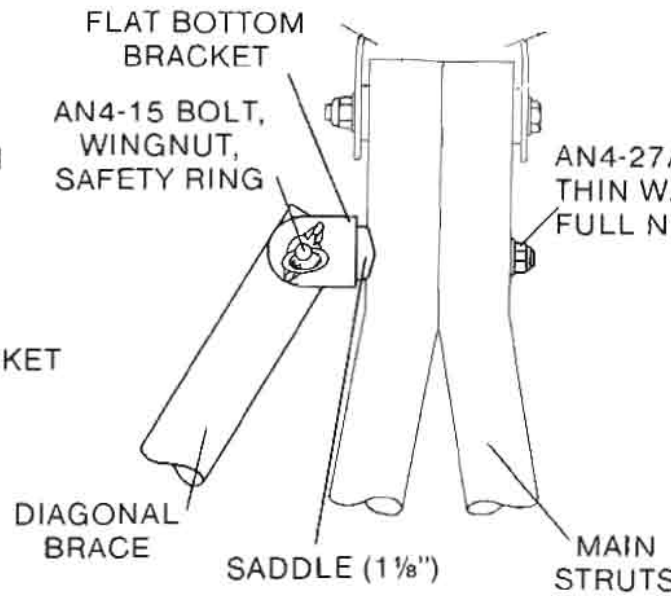
NOTES

Remove the strut, then rivet and bolt the stainless bracket as you did when you built your engine mount. Bolt the strut back into the bracket and tighten the nylock at the bottom. See drawing # 7.

(You will need to move the tangs of the upper noseboom cables to the inboard side of the flat bottom brackets under the noseplate.)

DRAWING 7



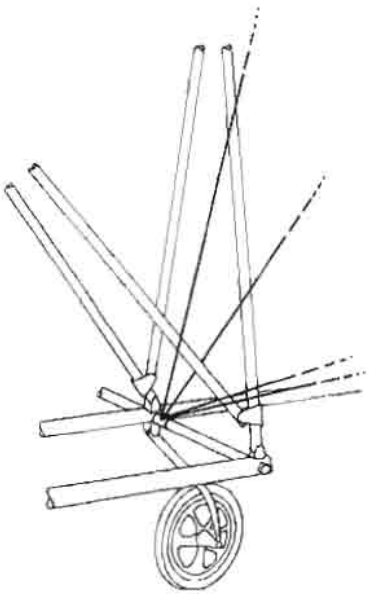


DRAWING 8

8. Remove the bolt from the lower of the two holes at the top of the main struts. Bolt a flat bottom bracket and saddle (4327) to this hole as in drawing # 8. Tighten the nylock so that the bracket just turns.

File the drilled end of the diagonal brace (4583) and bolt it into the flat bottom bracket. Hold a stainless bracket around the front strut and hold the lower end of the diagonal brace in this bracket while you use the holes in the bracket as a guide to mark the position of the hole you will be drilling in the brace. See drawing # 6 and # 9. This hole must be at least 1/2" from the end of the tube. Drill the 1/4" hole and bolt the bottom of the brace into the bracket with the nylock finger tight. Locate the stainless bracket on the strut, secure it temporarily with 2 aluminum rivets, unbolt the brace, rivet and bolt the bracket, attach the brace and tighten the nylocks. Refer to drawing # 5.

9. Fit the strap of the passenger seat (7070) to the front crosstube as in drawing VII #1(c). Slide the seat back padding (1448) onto the seat backrest tube (4565), fit this through the back of the seat and bolt it to the brackets on the hang tubes. Tighten the nylock at the outboard bracket.

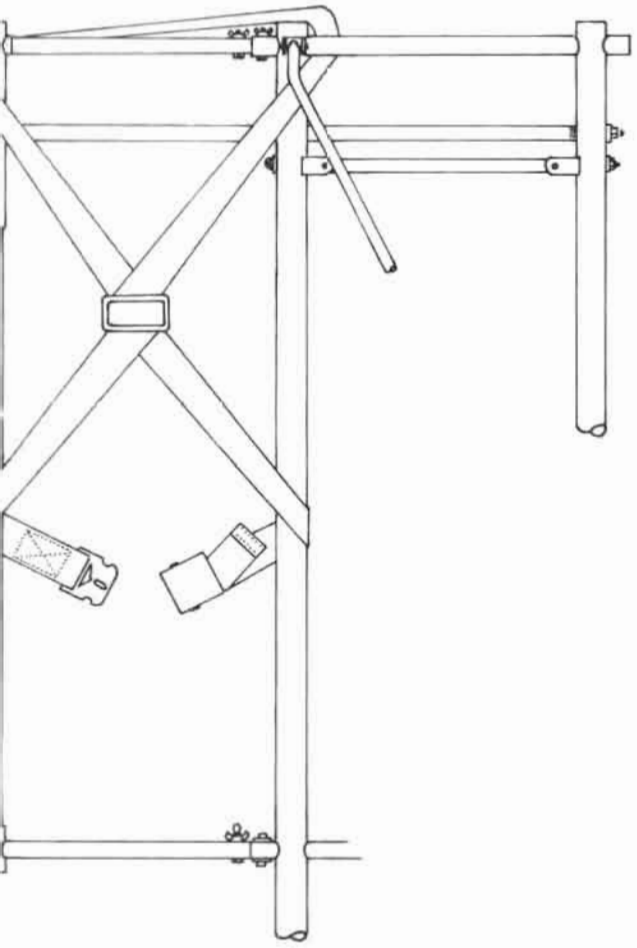


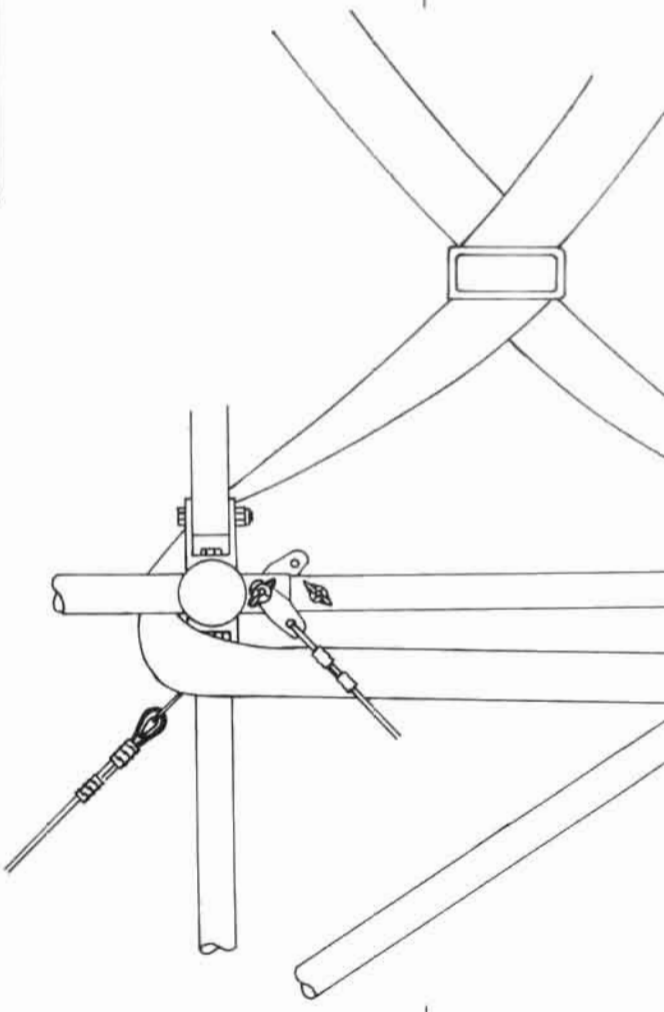
DRAWING 9

Fit the passenger shoulder harness (7075). Remove the release box from the end of the harness strap, noting how the strap is threaded around the sliding bar (you will be re-threading it later).

Position the buckle about 3-4 feet along the strap from the tongue. Rest the tongue on the seat and the buckle on the seat back rest. Feed the strap in front of the rear strut, under the rear crosstube, behind the main gear carrier, around the rear brace and around the hang tube as in drawing #10. Thread the end through the buckle and then through the release box.

Cut the harness cover (8541) (the black plastic spiral) into 4 equal pieces and fit one piece onto the inboard end of each bottom cable to protect it from wear and tear from your passenger's boots.

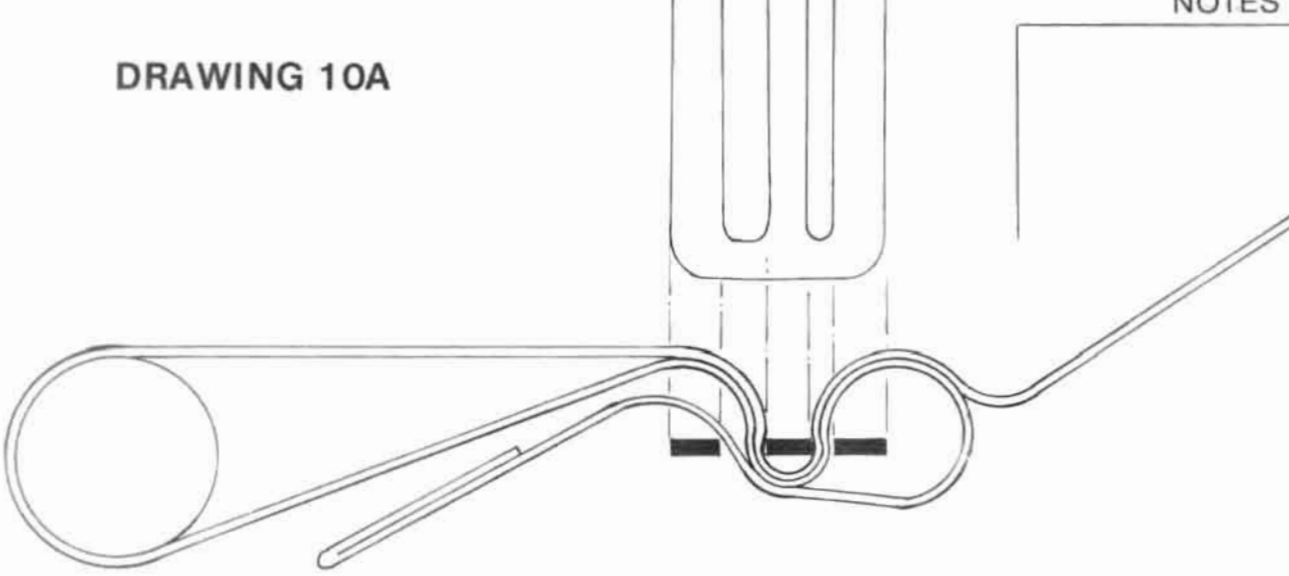




DRAWING 10

10. Attach the footrest strap (4397) to the hang tubes behind the front crosstube using the buckles (4010) as in drawing # 10A. Adjust for comfortable heel support with feet on the crosstube.

DRAWING 10A



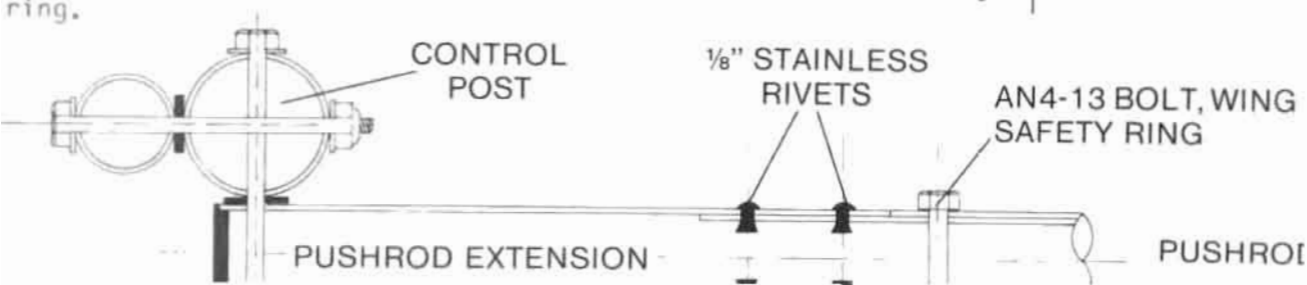
11. Install a similar fixed seat back for the pilot seat. Remove the shoulder harness and untie the seat rope from the rear carry-through, the seat backrest tube and the keel, and set them aside.

Drill 1/4" holes horizontally through both hang tubes, in line with and 2" in front of the fuel harness holes (i.e. 1/2" behind the vertical bolt at the base of the forward brace). Bolt curved bottom brackets to these holes (on the inside of the hang cage) and tighten the nylocks. Fit the new seat back padding onto the new sleeved seat backrest tube (4564), fit this through the back of the seat and bolt it to the brackets on the hang tubes with wingnuts. Refit the shoulder harness. Refer to drawing # 3.

12. Unbolt the pushrod from the control post and remove the bolt which secures the control post bracket. Slide the bracket forward temporarily while you drill a 3/16" hole horizontally thorugh the hang tube 7" behind the hole from which you just removed the bolt. Slide the control post bracket back to this new hole, fit the bolt and tighten the (new) nylock.

Use four 1/8" stainless rivets (4251) to secure half the length of the pushrod joiner (3033) inside the undrilled end of the pushrod extension (3037), as you did in Section IV - C Step #1. Bolt the drilled end of the pushrod extension to the control post as you normally would attach the pushrod itself. Slide the pushrod joiner into the end of the pushrod and use the hole in the pushrod as a guide to drill a 1/4" hole through the joiner. Fit the bolt, wingnut and safety ring.

DRAWING 1



13. The fuel tank(s) need to be lower than before to clear the pilot seat back rest. Bolt a thin flat tang (2850) to each of the fuel harness tangs as in drawing 2. Tighten the nylocks.

Cut 2" from the fuel harness tube and deburr the end. Remove the nylock from the threaded rod, cut 2" from this end, deburr it, and fit a new nylock. Refit the tank(s).

14. The wingtip counterweight assembly (3150), as supplied, is a container to hold enough weight at the left wingtip to balance the weight of the passenger, which is right of center. Remove one end and add weights (preferably something useful like tools and spare parts) equivalent to 1 lb. for every 10-15 lbs. of passenger weight.

Remove the wingnuts from the bolts which hold the left hand tip rib to the spars. Fit the tangs of the counterweight to these bolts, underneath the tip rib, and replace the wingnuts.

15. When flying the II+2 solo (with the passenger seat still attached), move the wingtip counterweight from the left wingtip to the left noseboom (to compensate for the fact that the fixed pilot seat back is further back than the normal solo flying seat position). Drill a 1/4" hole vertically through the left hand noseboom and sleeve, 5 3/4" in front of the center of the front carry-through. Drill another 1/4" hole vertically through the noseboom and sleeve 41 1/4" in front of the center of the carry-through. Fit bolts in these holes (AN4-23 to the rear, AN4-22 to the front) and bend the tangs until you can attach the counterweight underneath the noseboom with wingnuts. Also, secure the passenger shoulder harness so that it cannot be blown back into the prop.

16. Fit safety rings to the bolts which have wing nuts, and add them to your preflight safety ring count.

Top of front strut	1
Top of diagonal brace	1
Joiner plugs	2
Passenger seat backrest	1
Bottom of rear brace	1
Pilot seat backrest	2
Wingtip counterweight	2
Pushrod extension	1
Total	11

17. To remove the passenger seat, unbolt the front strut, diagonal brace, rear brace and passenger seat back rest. Remove both shoulder harnesses. Remove the bolts which hold the crosstubes onto the joiner plugs, and pull the whole assembly off to the side. The struts and braces should (if you filed the ends enough) rotate and fold down along the hang tube. Remove the pilot seat back rest tube. (Replace all the bolts, wingnuts etc. so that you don't lose them.) Remove the wingtip counterweight. Refit your original seat back, rope and shoulder harness. Remove the pushrod extension and move the control post bracket back to its original position.

Complete and mail the registration application form as soon as possible. Then contact your local F.A.A. office about obtaining a 'Special Airworthiness Certificate' for your 'Experimental-Amateur Built Aircraft'.

SOME IMPORTANT NOTES ON FLYING THE ASCENDER II+2.

You're flying an airplane, and you have some new rights and responsibilities. The FAA lets you fly ultralights without a license because you're unlikely to hurt anyone but yourself. Now that you're flying an airplane, you can give another person the same risk of death or injury as the pilot. Ethically and legally, it's a whole new ball game.

Legally, (and these are the requirements for the pilot; there are also requirements for the aircraft) you need a private pilot's license, a third class medical and three takeoffs and landings in type before carrying a passenger. Those are the legal minimums. The reason the experience-in-type requirements are so low is because it's assumed all single engine land airplanes are pretty much the same. They're not.

Ethically, you must be a very competent pilot of this type of aircraft before carrying a passenger. There is no substitute for experience. The easiest way to get it is start at the beginning of the training manual and work your way to the end. If you've got lots of Ascender time, this won't take long. If you don't, expect to invest twenty to forty hours in becoming a competent solo pilot before considering taking someone else up.

Once you're fully qualified to fly the II+2 solo, go through the training manual again with a hundred pound sandbag in the passengers seat and ten pounds of tip ballast. You'll find the extra weight will have changed the aircraft's personality. It will use more runway for takeoff and landing, require more room for turns, climb slower and sink faster. You'll have to pay more attention to airspeed, minimum flying speed will be higher and the nose will be heavier, but maneuvering speed and never-exceed speed will remain the same, so you'll have less margin between "too slow" and "too fast". A day spent on lessons-two-through-nine-with-optional-sandbag may save you and your first passenger some unpleasant surprises.

Speaking of unpleasant surprises, affix the sandbag securely to the passenger seat (a couple dozen wraps of filament-reinforced strapping tape does nicely). One reason is obvious, if it falls out it will destroy anything it hits. Another reason is that the tip weight is far enough behind the CG to throw you horribly out of trim, and you'll destroy anything you hit too.

Your first passenger should be a licensed pilot, preferably with ultralight time, and with no emotional ties to you. Someone who isn't a pilot can't really know what they're getting into, and your mom or your sweetie would have a

distorted image of your skills and abilities. Spend an hour in a conventional airplane with your prospective first passenger, they deserve to assess your skills and abilities firsthand before committing themselves to flight in your experimental aircraft.

Pick an ideal day for your first dual flight, windless, cool and clear. Choose a site you're familiar with, unobstructed and with a couple thousand feet of runway. Ballast the tip opposite the passenger's seat with one tenth the passenger's weight. Preflight and install your passenger. Do one long hop, a couple feet high and a couple hundred feet long. Note your landing speed. From your solo flights and your sandbag flights, you should have been able to anticipate how it would fly with a bit more weight. As you roll to a stop, consider the performance of that short flight. Did you and your aircraft behave as expected? If not, you need more familiarization time.

Ask your passenger if they wish to continue. There may have been something about the behavior of the aircraft (or the pilot) which was unsatisfactory, and if so they deserve a clear opportunity to express their feelings and get out.

If you're satisfied and your passenger is satisfied, take off and fly once around the pattern. Compared with your solo flight, it will require lots of power and lots of room. After landing, take five to review the flight. If you were both pleased and satisfied by the flight, go fly some more.

For the first day, stay over familiar terrain and always stay within glideslope of large, smooth, unobstructed landing areas. Carrying a passenger will make emergency landings more critical for a number of reasons. In event of a power failure, the extra weight will cause you to sink faster so you'll have less time to find an appropriate landing area. The extra weight will increase landing speed and landing gear load, so appropriate landing areas must be larger and smoother than when flying solo. Lastly, if you crash, the extra weight will make you crash harder and twice as many people will be injured. Remember you're thinking for two now, your passenger will bear the consequences of your actions. Now be careful out there.