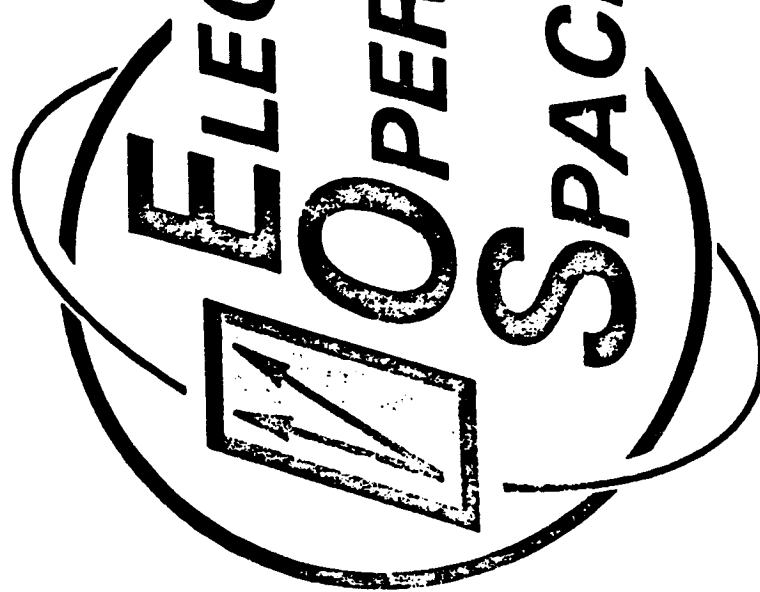


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**ELECTROPHORESIS
OPERATIONS IN
SPACE**

DAVID W. RICHMAN
SATELLITE SERVICES WORKSHOP
22-24 JUNE 1982

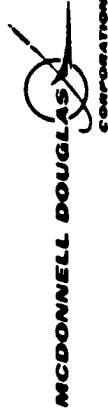
APPLICATION OF ELECTROPHORESIS

90-610

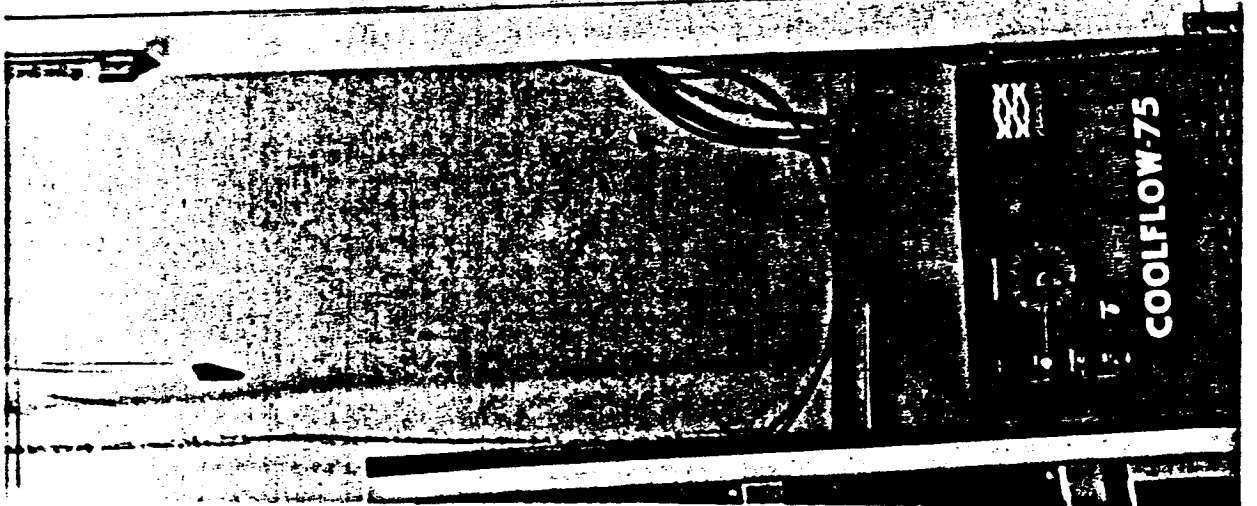
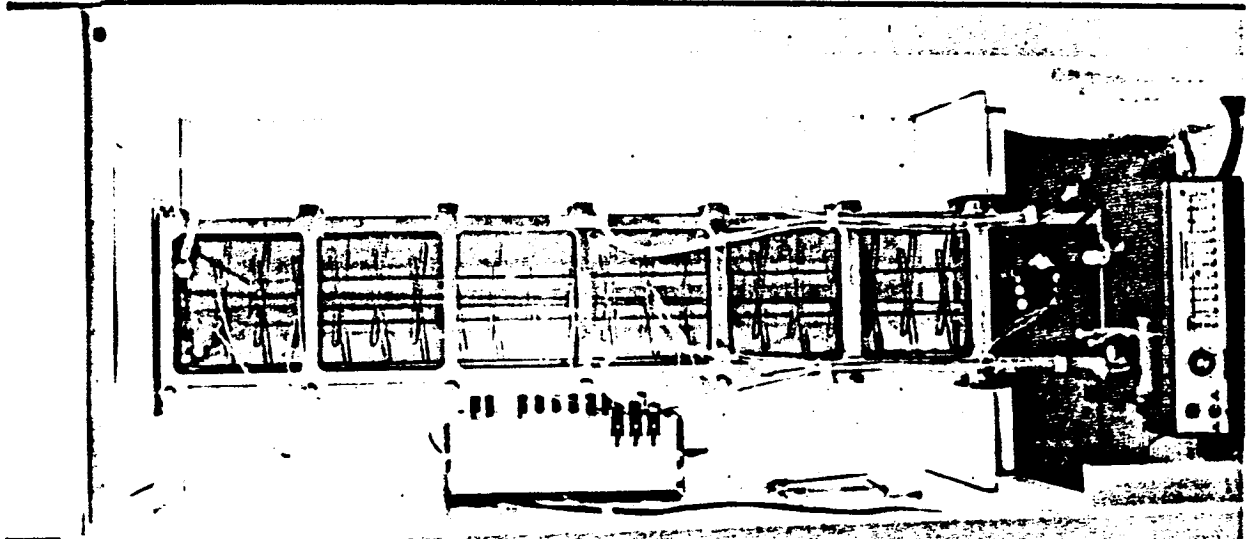
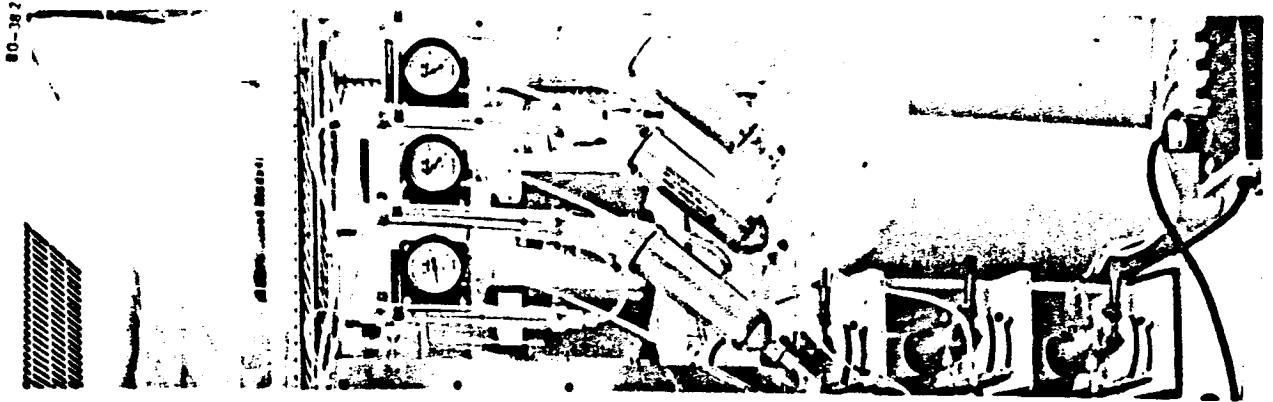
- o NATURAL PRODUCTS
 - NATURAL MATERIALS CONTAIN MANY POTENTIAL PRODUCTS
 - PRODUCTS LIMITED BY SEPARATION CAPABILITY
 - AHF FROM BLOOD PLASMA LESS THAN 1% PURE
- o ELECTROPHORESIS SEPARATION
 - STATIC ELECTROPHORESIS RECOGNIZED DIAGNOSTIC TECHNIQUE
 - STATIC ELECTROPHORESIS LABORATORY SCALE BATCH PROCESS
- o PRACTICAL PRODUCTION REQUIRES CONTINUOUS PROCESS
 - CONTINUOUS FLOW ELECTROPHORESIS POTENTIAL COMMERCIAL PROCESS

308

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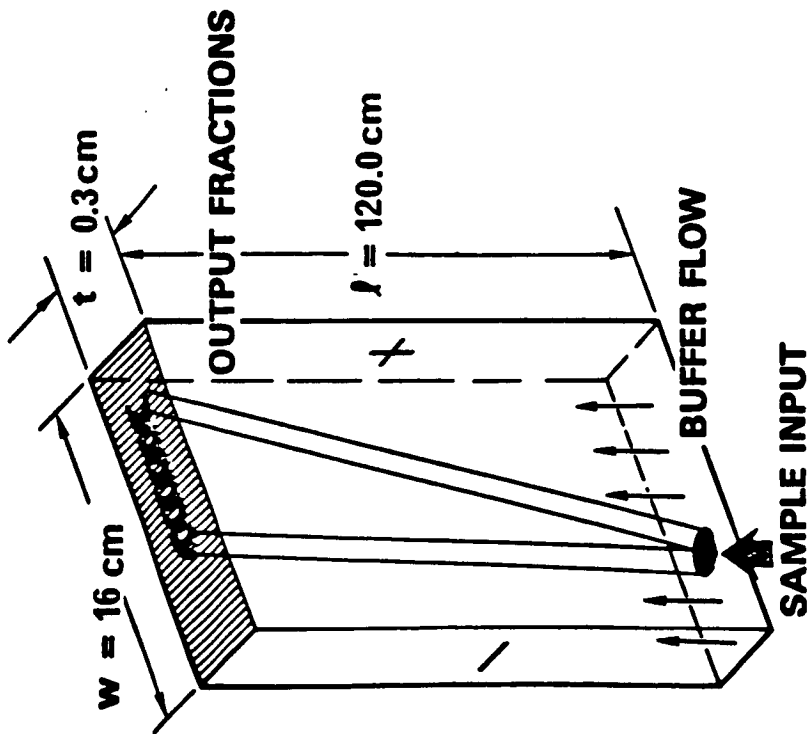


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PROCESS DESCRIPTION
CONTINUOUS FLOW ELECTROPHORESIS

01-037

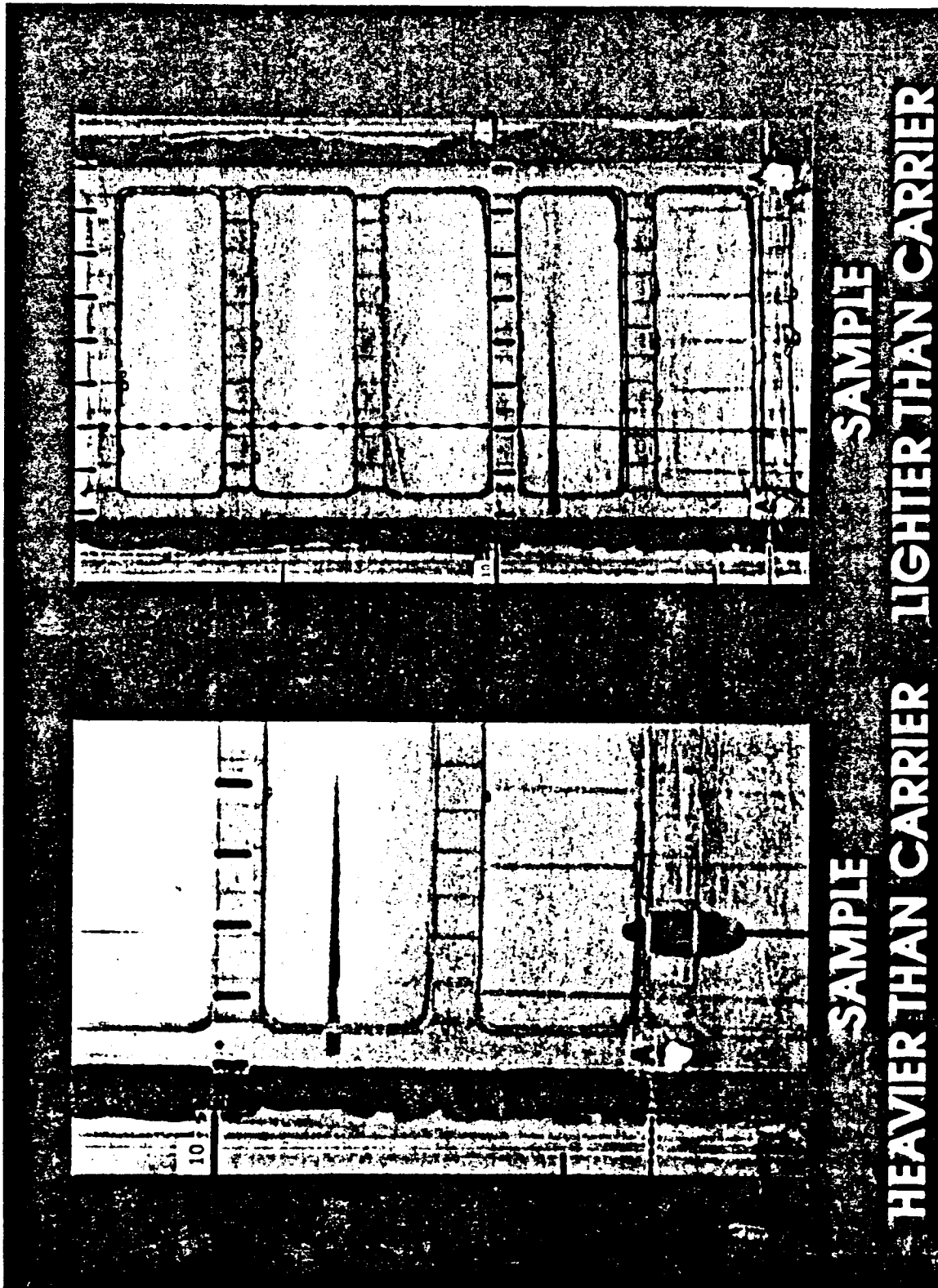


- o SAMPLE INPUT INTO LAMINAR BUFFER FLOW
- o LATERAL FORCE ON PARTICLES PROPORTIONAL TO CHARGE AND ELECTRICAL FIELD
- o LATERAL VELOCITY DEPENDENT ON VISCOUS DRAG
- o PARTICLE MOBILITY IS LATERAL VELOCITY/FIELD STRENGTH

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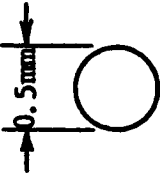
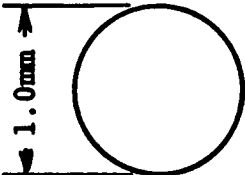
SAMPLE GRAVITY EFFECTS

80-269A



BASIS FOR INCREASED PERFORMANCE IN SPACE
DEMONSTRATION TEST SCHEDULED ON STS-4, JULY 1982

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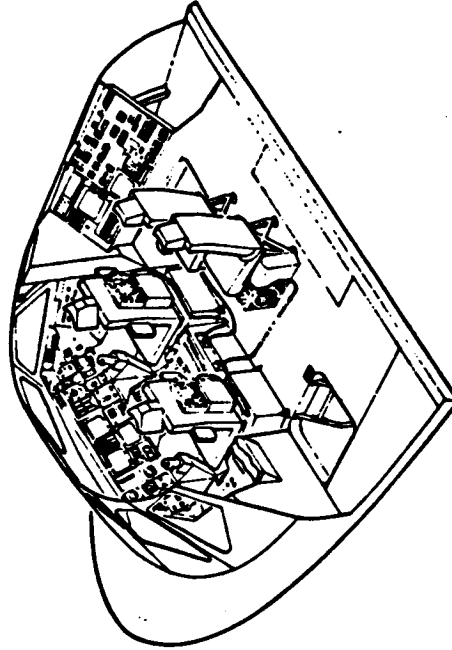
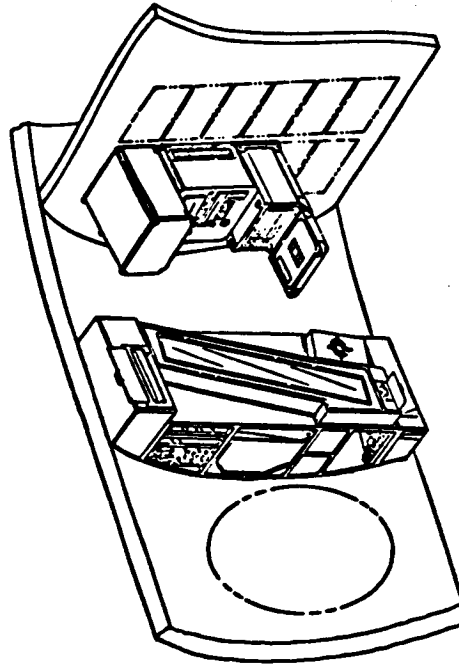
	<u>GROUND</u>	<u>SPACE</u>	<u>ADVANTAGE</u>
o CONCENTRATION	 0.25%	 25.0%	100X
o SAMPLE SIZE	 0.5mm	 1.0mm	4X
o SPACE ADVANTAGE			<u>400X</u>

312



17-792A

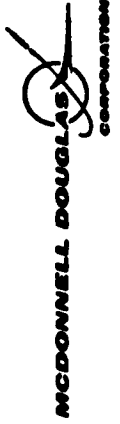
MIDDECK CONTINUOUS FLOW ELECTROPHORESIS SYSTEM GALLEY LOCATION



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- MIDDECK UNIT: 6 FT HIGH MODULE, 580 LBS
- SINGLE CHAMBER, SEMI-AUTOMATIC SYSTEM, SUPPORTED BY ASTRONAUT
- DEVELOP AND VERIFY PROCESS AND HANDLING PROCEDURES FOR PRODUCTS OF INTEREST
- SIX FLIGHTS PLANNED 1982 THROUGH 1984

313

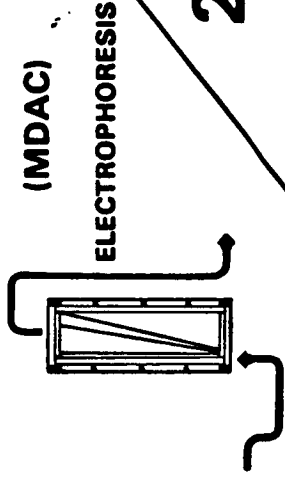


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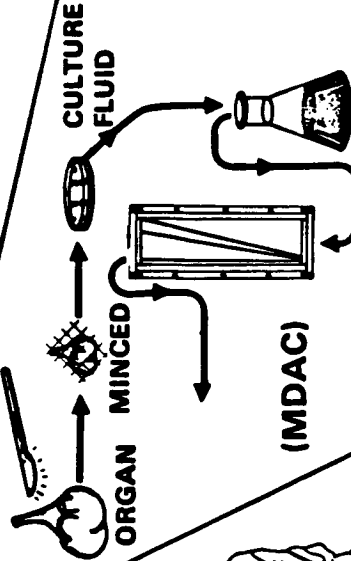
17-772A

ELECTROPHORESIS OPERATIONS IN SPACE

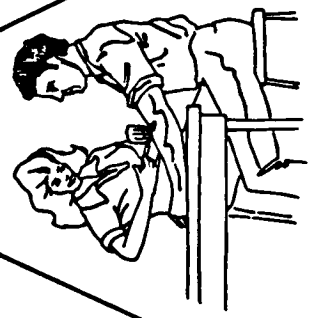
1 PROCESS DEVELOPMENT



2 PRODUCT DEFINITION & MARKET ASSESSMENT (ORTHO)

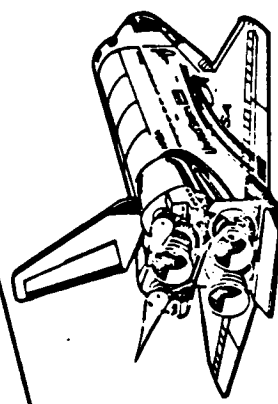


3 PRODUCT ISOLATION & PROCESSING



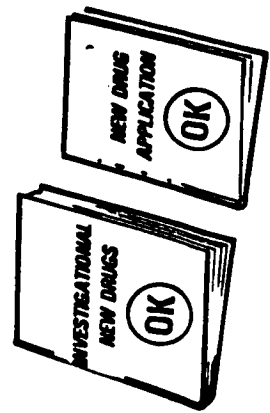
4 PRODUCT DEVELOPMENT (ORTHO)

8



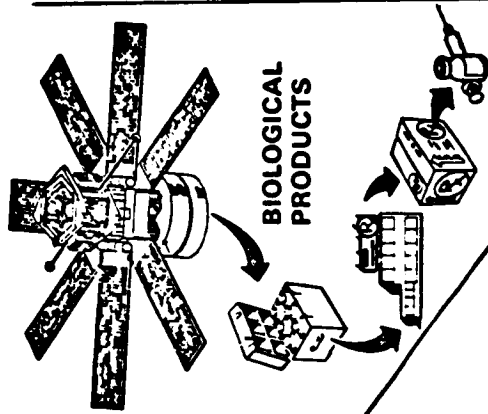
SPACE VERIFICATION OF PROCESS IMPROVEMENTS

5 GOVERNMENT SUPPORT (MDAC)



6 FDA APPROVAL (ORTHO)

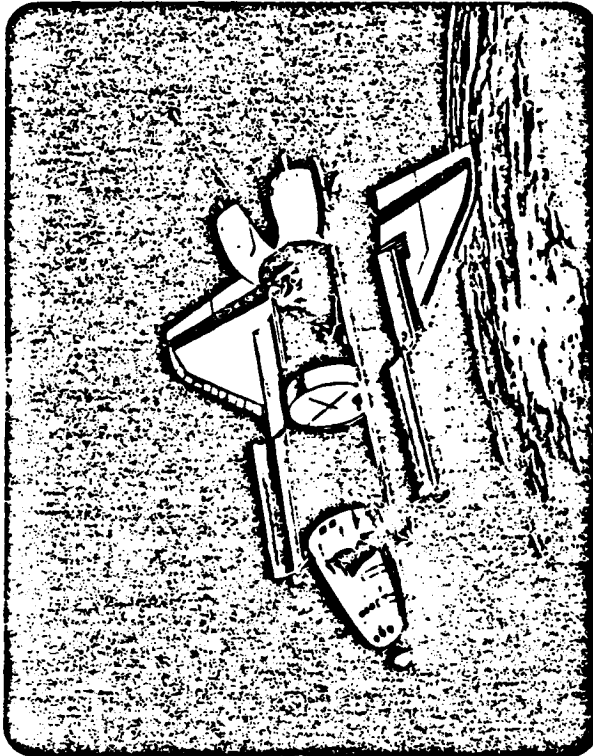
7 COMMERCIAL PRODUCTION (MDAC & ORTHO)





17-703A

PRODUCTION PROTOTYPE IN SHUTTLE PAYLOAD BAY



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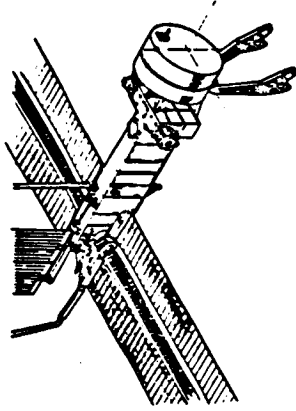
- PRODUCTION PROTOTYPE UNIT: 4 FT X 14 FT-DIAM., 5,000 LBS
- 24 CHAMBER, AUTOMATED SYSTEM
- CHECK OUT CONTINUOUS OPERATION FOR FIVE DAYS DURING SEVEN DAY SORTIE
- PRODUCE DOSES FOR PHASE III CLINICAL TESTS
- SCHEDULED AS JEA FLIGHT #7 IN 1985

315

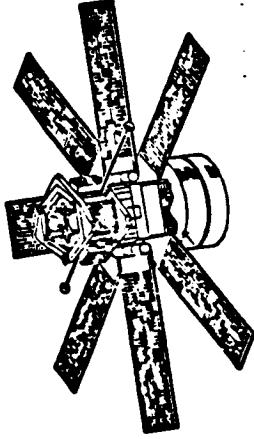

MCDONNELL DOUGLAS
CORPORATION

PRODUCTION PROTOTYPE

WITH NASA POWER SYSTEM



WITH MULTIMISSION MODULAR SPACECRAFT



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316

- PRODUCTION PROTOTYPE UNIT: 8 FT X 14 FT-DIAM., 10,000 LBS
- COMPLETE TECHNOLOGY VERIFICATION OF COMMERCIAL FEASIBILITY AS JEA FLIGHT #8 IN 1986
- PRODUCTION RATE OF 72 GMS/HR WILL BE USED TO FINISH CLINICAL TRIALS
- START COMMERCIAL OPERATION FOLLOWING FDA APPROVAL IN EARLY 1987
- WILL BE REVISITED EVERY SIX MONTHS



17-841

EOS SHUTTLE UTILIZATION

	86	87	88	89	90	91	92	93	94	95
JEA →										
SPACECRAFT LAUNCHES AT 11K LB			2	2	2	2	2	4	3	2
FACTORY MODULE LAUNCHES AT 5K LB			2	2	2	2	2	4	3	2
RESUPPLY MODULE LAUNCHES AT 5K LB		2	5	9	13	15	19	23	26	26
FLIGHT SUPPORT SYSTEM LAUNCHES AT 3K LB		2	2	2	2	3	4	4	4	4
TOTAL MASS UP — K LB		16	63	83	103	116	139	191	190	174
SPACECRAFT RETRIEVALS AT 6K LB						1		2	2	2
FACTORY MODULE RETRIEVALS AT 5K LB						1		2	2	2
RESUPPLY MODULE RETRIEVALS AT 5K LB		2	3	7	11	14	17	21	25	26
FLIGHT SUPPORT SYSTEM RETURN AT 3K LB		2	2	2	2	3	4	4	4	4
TOTAL MASS DOWN — K LB		16	21	41	61	90	97	119	159	164

NOTE: ASSUMES 5 YEAR LIFE FOR SPACECRAFT AND FACTORY MODULE

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17-839

STEPS FOR NEW BIOLOGICAL PRODUCT DEVELOPMENT

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	UNMANNED FREE FLYER MODE			MANNED SPACE STATION MODE
	MIDDECK OR SPACELAB	PAYLOAD BAY	UNMANNED FREE FLYER	
CHARACTERIZATION	✓			✓
CLINICAL TRAILS MATERIALS		✓		✓
INITIAL COMMERCIAL PRODUCTION		✓ (INTERIM)	✓	✓
EXPANDED PRODUCTION			✓	✓

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17-883

CONCLUSIONS

- POTENTIAL FOR MANUFACTURING NEW AND IMPROVED PRODUCTS IN SPACE IS REAL
- WITHOUT LONG DURATION CAPABILITY MARKET PENETRATION FOR ANY ONE PRODUCT IS LIMITED
- UNMANNED FREE FLIGHT SUPPORT WILL ALLOW MARKET DEVELOPMENT FOR ONE OR MORE PRODUCTS WITHIN THE LIMITATIONS OF THE SPACE TRANSPORTATION SYSTEM
- MANNED LONG DURATION FACILITY CAN PROVIDE THE BASIS FOR INDUSTRY GROWTH WITH IMPROVED ECONOMICS

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