TABLE OF CONTENTS

		Page
1.	Plant Facilities	1
2.	Equipment and Supplies	3
3.	Associated Machine Shop and Chemical Plating Facilities	7
4.	Personnel - Experience and Accomplishments	9
5.	Government Contracts to which our Personnel has contributed	13
6.	Equipment and Services which our Organization is qualified to handle	14
7.	References	15

PLANT FACILITIES

General

Microwave Associates, Inc. is situated at 303-301 Columbus Avenue, Boston 16, Massachusetts. The building is a modern structure of near fireproof construction and completely isolated from neighboring buildings. Although only a single entrance is provided at the front of the building, emergency fire escapes make possible other exits in case of fire or other emergency. Microwave Associates, Inc. occupies the entire second floor of this building which consists of approximately 2800 square feet of space. (All ceilings throughout the building are approximately ten feet (10 ft.) high.) To facilitate our business needs, space has been allocated as shown by the floor plan attached. The operating plant by virtue of its location with respect to neighboring buildings and with respect to other occupants within the building enjoys a freedom which should make its facilities of value in the undertaking of classified work. Owing to the "newness" of the undertaking, it is felt that both a general as well as a specific description will be of interest and value.

Reception Room

The reception room bears the only entrance to the stairwell. Its approximate dimensions are 17.5' x 10' or 175 sq. ft. Facilities include accommodations for receptionist, chairs, tables, magazine racks and lamps.

Office

The business office may be entered from both the reception room and from the drafting room. Its approximate dimensions are 19' x 10' or 190 sq. ft. Facilities include three desks, filing cabinets, book cases, conference table, small safe and typewriter.

Mechanical Design & Drafting Room

The Mechanical Design and Drafting Room enters on to the main manufacturing floor and the business office. It occupies approximately 500 sq. ft. of space and may accommodate ten drafting tables with boards and associated equipment. Also included is a small library with appropriate periodicals, literature, books and conference table.

Research, Development & Manufacturing Area

The Research and Development Area is by far the largest of the available areas mentioned occupying nearly 2000 sq. ft. of space. It is equipped with 220 volts 3-phase and single phase lines and 110 volt single phase lines. Seven work benches are

Research, Development & Manufacturing Area (continued)

provided for performing the functions of a business of this nature. The r. f. induction heating area is used for glass to metal sealing, case hardening of metals and r. f. brazing. Space for the glass lathe and hydrogen furnace is provided at the rear of the building. Also provided in this area are experimental machine facilities for rough out work and for the making of sample parts, storage space for equipment and supplies, and space for shipping receiving and packing. In the rear of this area are convenience stations for both sexes.

EQUIPMENT AND SUPPLIES

The equipment and supply inventory of Microwave Associates, Inc. as of the above date is shown below. This list is only a preliminary one due to the "newness" of our organization. More equipment will be added as our organization grows.

1. General Equipment

1 Mega therm Model MD-3A, R.F. heating unit made by Federal Telephone and Radio converted for induction heating

1 Polarigraph (on order)

1 Hydrogen Furnace (C I Hayes, medium muffle) (on order)

1 Annealing oven (on order)

1 Glass Lathe (on order)

1 Parker 12" Bench Vise

1 Power King Drill Press with Attachments

1 6" Atlas Lathe with Attachments

1 8" Power Saw

2. R.F. Test Equipment

1 Klystron Power Supply, Type M2 for 707 A/B or 2K28 Oscillator

1 Klystron Power Supply, for 723 A/B or 2K25 Oscillator

1 " " " for high voltage tubes (2K39, etc.)

1 I.F. Power Supply (300V - 100 ma.)

1 TAA-16 HU standing wave amplifier

5 High voltage power supplies (3120V - 300 ma.) suitable for construction of spectrum analyzers, test racks, etc.

2 X-Band shielded Oscillator tube mounts with power set attenuators

1 X-Band Oscillator tube mount (unshielded)

5 X-Band Oscillator tubes Type 723 A/B

3 X-Band wavemeters auto ordnance reaction type

1 X-Band wavemeter waveguide tee TPX-31

1 X-Band standing wave detector Type TPX-46 with traveling probe

2. R.F. Test Equipment (continued)

3 X-Band crystal holders

3 X-Band shorting plungers

2 X-Band waveguide to Type N adaptors

1 X-Band thermistor mount Type TPX-64

2 K-Band Oscillator tubes Type 2K33

3 K-Band wavemeters TPK-6HU

2 K-Band wavemeters RL 4075

3 K-Band crystal mixers TPK-28HU

2 K-Band thermistor mounts TPK-33

3 K-Band crystal mixers TPK-15HU

1 100 mc Oscillator (acorn tube)

2 K-Band Littlefuse Bolometers Type TPK-27

5 K-Band waveguide shorting plungers Type TPK-2TX

2 K-Band standing wave detectors TPK-21HU

2 Narrow Band Tunable McNally Type Cavities

1 S-Band Oscillator Cavity Type TPS-59

1 S-Band wavemeter loop Type TPS-49

1 S-Band crystal mixer (Sharpless)

8 Oscillator Tubes Type 707B

1 Oscillator Tube Type 2C42 with mounting accessories

Miscellaneous waveguide fittings and adaptors

3. Test Instruments

1 3" Triumph Oscilloscope

1 5" Special Oscilloscope

3 Test meters, volts-ohms-milliamperes

3. Test Instruments (continued)

1 continuity tester

9 ammeters, milliammeters, etc. (Weston & G.E.)

6 voltmeters (Weston & G.E.)

4. Supplies

Misc. receiving and transmitting tubes (appx. 70)

" high voltage mica condensors (appx. 65)

" power transformers (11)

" filament transformers (4)

" filter chokes (5)

" paper condensors (100)

" Button mica condensors (200)

" Bathtub condensors (30)

" assorted resistors ½ watt to 300 watt sizes (5% tolerance)

" assorted resistors (shollcross 1% tolerance) (75)

" assorted soldering irons (25 w. to 500 w.)

12 High voltage Oil Filled Condensors

1 Set Crystal Headphones

2 5-inch Dynamic speakers

3 2 and 3 gang air plate tuning condensors

Miscellaneous metal and woodworking tools

Miscellaneous relays

1 1 amp. variac

1 5 amp. variac

3 5" Oscilloscope tubes (Type 5NP1)

1 1000 w. immersion heater

2 110 v. 1.4 amp. ballast lamps

Assorted BT and RT bra zing wire (3 lbs.)

4. Supplies (continued)

Assorted cables with Type N and Amphenol Connectors (50Ω, 70Ω)

Assorted Stand-off and Feed Thru Insulators (appx. 40)

Assorted Terminal Strips (120)

Assorted Screws & Bolts (4000 or 5000)

Miscellaneous hook-up wire (#12 to #26 solid and stranded)

6' Metal Cabinet (completely closed)

4' Metal Cabinet

Matched Set of Drills (0 to 60 plus miscellaneous larger drills and reamers ¼" to 5/8")

ASSOCIATED MACHINE SHOP AND CHEMICAL PLATING FACILITIES

I. Machine Shop Facilities

A. Machinery

1. Presses

one 100 ton press made by Bliss
one 50 ton press " " "
one 20 ton press " " "
one 10 ton press " " V & O

2. Lathes

two 16" Monarch Lathes
two 11" South Bend Lathes
two 9" South Bend Lathes

3. Milling Machines

two Bridgeport milling machines
one Nichols milling machine
one Van Norman milling machine

4. Grinders

one #13 Universal Surface Brown and Sharp
one Tool grinder

5. Miscellaneous

three drill presses
one 36" foot gear, 15 KVA, water cooled, spot welder
one 200 ampere electric welder
gas welding equipment
one air furnace for brazing or heat treating up to 2000° F
one hydrogen furnace for brazing or heat treating up to 3000° F

B. Supplies

Associated accessories for all machines listed above
Miscellaneous stocks of brass, copper, kovar, steel, tantalum, nickel, molybdenum, monel and bronze.
Miscellaneous tools, jigs and fixtures

II. Chemical Plating Facilities

Motor-Generator capable of delivering 400 amps at 12 volts
Rectifier " " " 1500 " " 12 volts

II. Chemical Plating Facilities

Miscellaneous small rectifiers for experimental work, capacity 10 to 20 amps
Copper plating solutions
Nickel plating solutions
Brass plating solutions
Silver plating solutions
Stationary and rotating plating bath containers
Buffing and tumbling equipment
Hand-brazing equipment for small parts
Spray painting equipment

PERSONNEL

The following is a brief description of the educational background, experience and accomplishments of the present personnel of Microwave Associates, Inc. In the near future, the group will be increased to about twelve (12) by adding technicians and office personnel.

RICHARD M. WALKER, Chief Engineer, B.S. in Electrical Engineering, University of Kansas, June, 1943. From July, 1943 to February, 1946, Mr. Walker was a staff member at Radiation Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts. His work at Radiation Laboratory consisted of research, design and development in the field of microwave transmission line components and test equipment. At the close of World War II, Mr. Walker remained at Radiation Laboratory to write two chapters for Volume 9 (Microwave Transmission Circuits) of the Radiation Laboratory Technical series published by the McGraw-Hill Publishing Company.

From February, 1946 to July, 1950, Mr. Walker was employed by the Sylvania Electric Products, Inc., Electronics Division, Boston, Massachusetts as head of the Microwave Components Group. In this capacity, he was responsible for the design and development of microwave components for radar systems, F.M. test sets and test equipment for other groups in the Electronics Division. At Sylvania, Mr. Walker made contributions in the development, manufacture and testing of crystals, TR and ATR tubes and magnetrons. He acted as a technical advisor to the Research and Development Board.

1) Waveguide Committee, Sub-Panel on Transmission Lines

2) Panel on Electron Tubes, RF Tubes Sub-Panel

in connection with microwave crystal rectifiers.

At Radiation Laboratory, M. I. T., Mr. Walker wrote several technical reports on classified work which were published by the Laboratory and distributed to authorized personnel in military and industrial organizations. The following is a list of these technical reports.

R. L. No. 567 - Dielectric Windows in Waveguide
R. L. No. 585 - Corners, Bends, and Twists in Rectangular Waveguide
R. L. No. 723 - X-Band High Power Water Load
R. L. No. 847 - Broad Band Test Loads
R. L. No. S-29- X-Band Waveguide Corrosion Proofing

Mr. Walker made six (6) patent disclosures at Radiation Laboratory and approximately eight (8) at Sylvania Electric Products, Inc. Patent applications have been made

PERSONNEL (continued)

to the Washington Patent Office for most of these disclosures. The patent disclosures include original ideas for attenuators, waveguide windows, waveguide switches, cavity resonators, power stabilizers, directional couplers, hybrid junctions, water loads, and TE_{01} circular waveguide transitions.

Mr. Walker is a senior member of the Institute of Radio Engineers. He is also a registered professional engineer, Massachusetts Certificate No. 4425.

VESSARIOS CHIGAS, Production Manager, B.S. in Electrical Engineering, Northeastern University, June, 1944. He is also a candidate for a B.B.A. in Engineering Management at Northeastern University with 12½ semester hours of credit to complete. He attended Northeastern University under the cooperative plan at which time he was employed by Heinze Electric Company of Lowell, Massachusetts as a General Inspector and at the General Electric Company in Lynn, Massachusetts as a student engineer. He was employed by Sylvania Electric Products, Inc., Electronics Division, Boston, Massachusetts in June, 1944. He was first employed as a test engineer which entailed the set up of test equipment and test procedures for microwave tubes such as TR and ATR tubes, magnetrons, etc. in K, X, and S bands. He then worked as a product engineer in the manufacture of hydrogen thyratrons, magnetrons, germanium diodes, silicon diodes, TR and ATR tubes. In 1948, he became Technical Foreman in charge of electrical testing, test equipment maintenance, factory inspection, and a section of process quality control. About 40 employees in his section performed the above duties related to magnetrons, TR and ATR tubes, hydrogen thyratrons, silicon diodes, strobotrons, radiation sensitive tubes, flash tubes, glow modulators, gas pressure measuring tubes and a few other miscellaneous types.

Mr. Chigas is an associate member of the American Institute of Electrical Engineers and an Associate Member of the American Society for Quality Control.

LOUIS W. ROBERTS, General Manager, A.B. Physics, Fisk University, Nashville, Tennessee, June, 1935. From September, 1935 until June, 1936, Mr. Roberts acted as a teaching assistant in the Department of Physics of Fisk University and at the same time held the position of Research Assistant in Gasoline Studies for Standard Oil of New Jersey. In September, 1936, he attended the University of Michigan and was granted an M.S. degree in Physics in 1937. During his stay there, he worked with Dr. Hans Boutler in Reflection Spectroscopy and assisted in the publication of a paper in Zeitschrift der Physik. In the fall of 1937, Mr. Roberts accepted the position of Professor of Physics at St. Augustine's College in Raleigh, North Carolina where he remained until June, 1943 except for a leave of absence in 1940. During his leave, Mr. Roberts pursued work leading to the Ph.D. degree at the

PERSONNEL (continued)

University of Michigan. At the outbreak of the war, Mr. Roberts taught courses in Physics and Radio under the ESMWT program in addition to his college duties and for one summer (1942) taught Radio Communications at the U. S. Signal Corps School in Lexington, Kentucky. In 1943, he joined the staff of the Howard University Physics Department in Washington, D. C. and held this post for one year before entering industry with the Sylvania Electric Products, Inc.

Mr. Roberts entered Sylvania in May, 1944 as Senior Engineer in the Test Department. His duties included research and development work on TR's, ATR's, magnetrons, thyratrons and crystals. In 1946, while working part-time at Sylvania, he attended the Graduate School of the Massachusetts Institute of Technology in Physics and completed course work there for the Ph.D. degree. In 1947, he was made Section Head of the Tube Development of Sylvania and in 1949, was again promoted to the position of Engineering Manager of Tube Development. In this capacity, he directed research and development activities of more than 100 people in various phases of all types of hard vacuum and gas tubes of both microwave and non-microwave character.

Mr. Roberts has held various scholastic honors and scholarships and has contributed much to the development of many types of tubes now in use. He has contributed both technical articles and patents in the field of microwave gas tubes. He is a member of the American Physical Society and the American Mathematical Society.

HUGH WAINWRIGHT, Sales Manager, who, in 1936, after attending Massachusetts Institute of Technology, joined Castalloy Company, Cambridge, Massachusetts as designer. His experience there consisted of the design of non-ferrous castings and stampings. During the course of the work, he was responsible for the development of a process for making aircraft quality precision castings. He was responsible for plant layout of a new foundry and control of the factors involved in production such as supervision of melting techniques and sand control.

He left Castalloy Company in 1940 to join General Electric River Works, Lynn, Massachusetts as a designer on high-precision tools for the manufacture of ships reduction gears which previously had been made on a "hand-tailored" basis.

From 1942 to 1943, Mr. Wainwright was employed by E. B. Badger and Sons, Co., Boston, Massachusetts as a designer of special machinery for the manufacture of airborne heat exchangers. He also worked on the layout of synthetic rubber plants and oil refineries.

After joining the Navy in 1943, where he was given an

PERSONNEL (continued)

intensive course of mathematics and radio physics covering the theory of radio, radar and underwater sound, he went to sea aboard a repair ship and saw active service in the Western Pacific. He was discharged from the Navy after the cessation of hostilities.

Early in 1946, Mr. Wainwright was employed by Sylvania Electric Products, Inc., Electronics Division as an equipment designer for radar. He worked on the mechanical design of both microwave radar and test equipment on which his wartime experience proved invaluable. During this time, he acted as project engineer in charge of the development and production of a large quantity of radioactivity detecting devices as well as serving as a consultant to other manufacturing groups within the corporation.

At the close of the "radiac" job, he was assigned as Senior Engineer in charge of the mechanical design of the large scale electronic digital computer known as "Whirlwind", which was built by Sylvania for Massachusetts Institute of Technology. In this capacity, he supervised the activities of six to eight mechanical engineers and designers as well as those of twelve to sixteen draftsmen. In the course of the foregoing activities he was required to know and be completely familiar with machine shop and drafting room practices as well as having a full knowledge of manufacturing problems to be avoided or overcome.

At the successful completion of this work late in 1947, Mr. Wainwright was transferred to the Sales Department of the Electronics Division as Government Sales Representative. In this capacity, he maintained liaison with the Engineering and Purchasing Departments of prime contractors and with the Contracting Officers Representatives in the government agencies procuring electronic equipment.

Mr. Wainwright is a member of the American Society for Metals.

SOME OF THE GOVERNMENT CONTRACTS TO WHICH OUR PERSONNEL HAVE CONTRIBUTED

	Tube Type or Equipment	Contract Number	Product Description
1.	AN/SPS-7	NObsr 39358 NObsr 49005	Radar Design and Dev. Radar Production
2.	AN/TPS-10B	W-28-099ac-85	Radar Design and Dev.
3.	AN/SPS-10	NObsr 49015	Radar Design and Dev.
4.	AN/SPS-3	NObsr 06600-06601	Radar Design and Dev.
5.	AN/FPN-13	AF28(099)109	Radar Beacon Design and Dev.
6.	TS-541	W-28-099ac-182	FM Test Set Design and Dev.
7.	Mag 400	NObsr 43391	Magnetron
8.	X7109	NObsr 42519	Magnetron
9.	4J78	NObsr 29419	Magnetron
10.	4J50	N 126s - 1473	Magnetron
11.	4J52	W36-039sc-37362	Magnetron
12.	A325	NObsr 39311	Interactive TR
13.	1B55	NObsr 42204	S Band TR
14.	TR361	NObsr 39306	TR Tube
15.	TR331-ATR332	NObsr 39361	APS/41 TR & ATR
16.	TR409-ATR410	NObsr 49099	TR & ATR
17.	X7047	NObsr 42508	Dual Gas Switch Tube
18.	1B58	NObsr 43055	
19.		W36-069-ORD-4480	High Power X Band TR
20.	TR350-381	W30-069-ORD-4276	S Band TR
21.	1B53	N130-126s-32391	S Band ATR
22.	1B37	N130-126s-32207	X Band ATR
23.	1B50	N130-126s-33197	
24.	1B56	DA36-039sc-1001	ATR - S Band
25.	TR368	AF33-038-9739	TR Tube
26.	1B35	19459-Ph-50-7	X Band ATR
27.	BW320	W28-09-ac-300	Broad Band Window
28.	GG322-24	NObsr 39235	Geiger Mueller Tube Research
29.	1N53M	19400-Ph-50-2	Silicon Crystal
30.	1N21B	N130-126s-32391	Silicon Crystal
31.	1N23B	N130-126s-33198	Silicon Crystal
32.	SN4	N130-126s-32207	Strobotron
33.	R1130B	NObsr 43236	Glow Modulator Tube
34.			Digital Computer
35.			Alpha, Beta, Gamma Survey Meter
36.		W36-039sc-44574	Gas Recovery Time Research

ELECTRONIC EQUIPMENT AND SERVICES WHICH MICROWAVE ASSOCIATES, INC. IS QUALIFIED TO HANDLE

I. Design, Development and Manufacturing of:

*A. Waveguide and coaxial transmission line components

B. Microwave discharge tubes (TR and ATR tubes)

C. Microwave Attenuator Tubes

D. Microwave Magnetrons and Klystrons

*E. Microwave Test Equipment

*F. Microwave Pressurized Windows for Waveguide or Coaxial Transmission Lines

G. Hydrogen Thyratrons

H. Silicon and Germanium Crystal Rectifiers

*I. Circuit work for Radar and Computer applications

J. General Purpose Gas and Hard Vacuum Tubes

II. Consulting Services in the above fields

III. Fundamental Research in the above fields

* These items we are prepared to manufacture immediately.

REFERENCES

The following government employees are familiar with the technical ability and previous record of one or more of our engineers:

I. DEPARTMENT OF THE ARMY

A. Camp Evans Signal Laboratory, Belmar, New Jersey

1. Dr. John E. Gorham, Chief Thermionics Branch
2. Mr. Kenton Garoff " "
3. Mr. Beverly Kumpher " "
4. Mr. Harry Owens " "
5. Mr. William Gould Weather Radar
6. Mr. William J. Jones Test Equipment Section

B. Squier Signal Laboratory, Ft. Monmouth, New Jersey

1. Mr. Abe Zeitz Components & Materials Branch
2. Mr. Al Swartz " " " "

II. DEPARTMENT OF THE NAVY

A. Navy Department, Washington 25, D. C.

1. Mr. R. W. Grantham, Bureau of Ships, Code 936A
2. Mr. Robert Hecksher, Bureau of Ships, Code 921D
3. Mr. Edwin A. Mroz, Bureau of Ships, Code 934B
4. Mr. A.E.Zdobysz, Bureau of Aeronautics, Room 1W91

B. Naval Research Laboratory, Anacostia Station, Washington 20, D. C.

1. Mr. Harold Herman, Radio Division I
2. Mr. Owen A. Tyson, Antenna Research Section
3. Dr. John I. Bohnert, " " "
4. Mr. L. V. Blake, Radio Division II
5. Dr. Harry Krutter, Naval Air Dev. Center, Johnsville, Pennsylvania

REFERENCES (continued)

III. DEPARTMENT OF THE AIR FORCE

A. Army Air Force, Wright Field, Dayton, Ohio

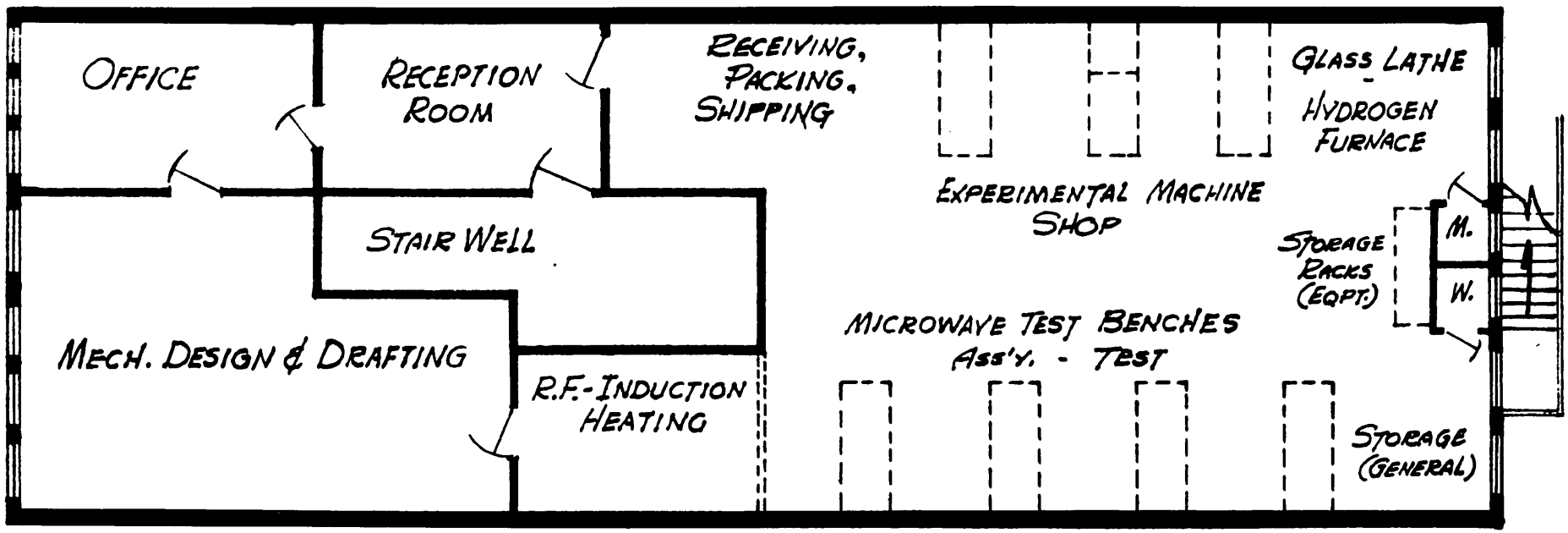
1. Mr. John R. Hayes, Components & Systems Laboratory MCREES 33
2. Mr. Rex S. Whitlock, Components & Systems Laboratory MCREES 33
3. Mr. R. P. Cherpeski, Components & Systems Laboratory MCREES 33
4. Mr. William Kennedy, Applied Physics Unit, MCREER 33
5. Dr. Paul J. Ovrebo, " " " " "
6. Mr. Arthur D. Clark, Exp. Systems Unit, MCREEC 42

B. Army Air Force, Cambridge Field Station, Cambridge, Mass.

1. Dr. L. M. Hollingsworth
2. Mr. Jack Barbakian
3. Dr. Benjamin Lax
4. Mr. Lawrence C. Monsur

C. Army Air Force, Watson Laboratory, Red Bank, New Jersey

1. Mr. Frank Tomaini, Development Branch
2. Mr. Joseph H. Vogelman, Development Branch
3. Mr. Irving Eitches, Radar Branch
4. Mr. Leonard Sheer, Radar Branch



FLOOR PLAN

MICROWAVE ASSOCIATES, INC.
303-301 COLUMBUS AVE.
BOSTON, 16, MASS.

1) Work History (Dates)

2) Formation of Microwave
People & Dates.
Brochure
Termination from Syl.

Early ownership
Board History

Product History

Price fixing

Cheating in Specifications

Time card changing + time charges

Review trip reports — where did we lose business &

DWA
AV
JCB
VC
LG.
Cahi
D. J.