PRESENTATION FOR BOARD OF DIRECTORS

NOVEMBER 22, 1966

TOPIC: CHEMICALS GROUP RESEARCH & DEVELOPMENT

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INTRODUCTORY REMARKS

In this presentation of Chemicals Group R & D, I do not plan to take fifteen minutes trying to justify every dollar that we are spending, or give you a ten-year history of past expenditures, or those projected for the future. These statistics have been covered before, or are dealt with in some detail in the Group's Five-Year Plan.

I would rather talk about what we are actually doing today in relation to our current business strategy so that I may leave you with the impression, not so much that we have a solution to all our problems, but that we are operating with awareness, that our research organization is reasonably well organized and oriented, and that progress is being made.

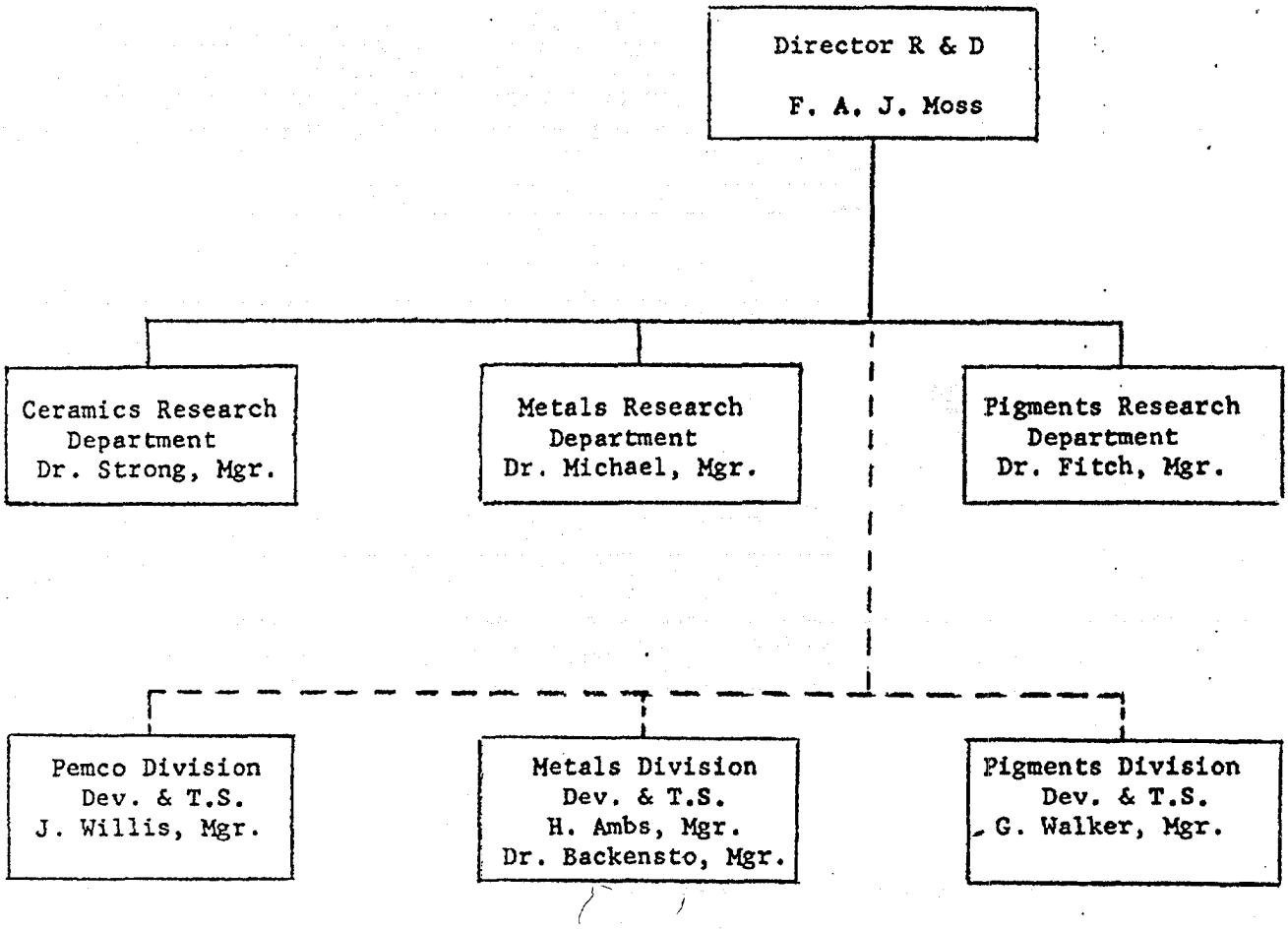
Specifically, I plan to touch upon the following:

1. ORGANIZATION

2. BUDGETS

3. SCOPE

4. PROGRAM - UNDERLYING ISSUES
   - MAJOR PROJECTS



BUDGETS
($000)

Fiscal Year 1967	Pemco	Metals	Pigments & Color
R & D	473	519	880
T.S.	490	54	238
Total Technical Effort	963	573	1,118

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SCOPE

We assign the following priorities to our work:

FIRST: Maintenance and improvement of the existing business in order to remain fully competitive:

(a) lower cost manufacturing process

(b) better quality product in terms of customer needs

(c) variation on old products to reach new markets

SECOND: Creation of the next generation of products for the present markets:

(a) May require highly speculative and exploratory research

THIRD: Diversification into wholly new business areas.

METALS R & D

UNDERLYING ISSUES

1. OPERATE THE H-IRON PROCESS TO MAXIMIZE PROFIT.

Short range - market M-G product. Longer range - learn how to lower growth, without having to change raw materials.

2. NEW RAW MATERIAL SOURCES NEEDED FOR BOTH COPPER AND IRON.

The price of copper scrap is too high. Our iron processes are presently designed for only mill-scale and Sorel as feedstocks, both of which will be in future short supply.

Our copper powder business is threatened by material obtainable by the basic metal producers from the leaching of their ores and mineral concentrates.

Our iron powder business is threatened by:

a) The steel companies deriving powder from their waste acid pickle liquor.

b) Direct entry by the steel companies if a market develops for mill shapes produced by P/M.

3. INCREASING OUR SHARE OF THE COMPACTING IRON MARKET.

Must improve compressibility and sintered strength.

4. RESTORING OUR POSITION IN COPPER POWDER.

a) We must continue to improve copper quality - significant progress made in past few months.

b) Consider entry into brass and bronze pre-alloy powders.

5. NEW PRODUCT GOALS.

Presently emphasizing market research. Considerable thought is being given to:

a) High-alloy powder (and maybe parts through forward integration)

b) Brass powder and bronze pre-alloys

c) Enter new markets where P/M process offers advantage, for example, high speed cutting tools from special alloy steels and refractory carbides; magnetic materials, for example, core powders, ferrites, etc.

METALS R & D

MAJOR PROJECTS

1. SEARCH FOR NEW RAW MATERIAL SOURCES FOR BOTH COPPER AND IRON.

   Joint effort with Metals Division.

   Screening underway of various iron ores, steel scrap, pig iron, iron oxide from pickle liquors, copper ores and concentrates.

2. BASIC STUDIES AIMED AT DETERMINING AND RELATING THE FACTORS AFFECTING COMPRESSIBILITY, GROWTH AND SINTERED STRENGTH.

   Development of higher compressibility and strength would increase market size and also add flexibility in our choice of raw materials.

3. ATOMIZATION - PROCESS IMPROVEMENT AND INVESTIGATION OF NEW TECHNIQUES.

   (Spinning discs, etc.)

   Significant advances made recently in nozzle design - usefulness demonstrated on a pilot scale.

CERAMICS R & D

UNDERLYING ISSUES

1. THREAT TO PORCELAIN ENAMEL (54% OF PEMCO'S BUSINESS)

Plastics and paint are strongest competitors. There is a lack of adequate cost information.

Both the PEI and Glidden have cost studies underway in the appliance field (68% of total market). This information is needed to direct our research efforts.

In the interim, we have taken a stand on one approach to lowering overall costs; i.e., ceramic coil coating.

2. HIGH COST OF TECHNICAL SERVICE AND DEFICIENCIES OF NEEDED BASIC KNOWLEDGE.

The industry is service oriented. We supply frits, together with recipes for applying them. We are using computers to determine property vs. composition relationships and thereby reduce the time and expense of developing new frits.

3. SLOW NEW PRODUCT DEVELOPMENT.

a) Industrial ceramic coating business is mature. There is too much publicity given to small volume space and military needs.

b) Our experience and know-how in ceramic coating is not a broad base from which to develop new business - even structural ceramics.

c) The marriage of ceramics and metals to produce composite properties has not been successful commercially.

4. GLAZING FRIT BUSINESS (25% OF SALES) IS THREATENED BY LOW COST FOREIGN COMPETITION.

Pemco's dominant position (50%) is being maintained by:

a) The development of faster firing glazes

b) The development of glazes for low-expansion bodies not previously glazable

5. EFFECT OF ONE-TRIP GLASS CONTAINERS ON THE GLASS COLOR MARKET.

We could lose this business. Have recently de-emphasized R&D support.

PIGMENTS R & D

MAJOR PROJECTS

1. MATCHING "CHLORIDE" COLOR VIA THE SULFATE PROCESS.

Considerable effort has been devoted to determining the complexity and magnitude of the problem. It appears to be a very difficult task and, as mentioned earlier, may prove not to be feasible economically.

2. NEW PRODUCTS

a) F.P.S. - wet process underway and dry process being explored.

b) Ethylene glycol titanate for C & R - pilot planting about to start.

3. CATALYTIC PROPERTIES OF TiO_2

Basic study. Of longer term value in developing superior chalking resistance.

4. MECHANISM OF INORGANIC AND ORGANIC SURFACE TREATMENTS.

Could be very valuable. Start awaiting hire of a surface chemist.