PRODUCTION SCHEDULING IN INDUSTRY

L123

6 February 1952

CONTENTS

Page

INTRODUCTION--Colonel D. B. Diehl, USAF, Member of the Faculty, ICAF..... 1

SPEAKER--Mr. R. E. Harris, Manager, Production and Parts Control, Manufacturing Staff, Ford Motor Company..... 1

GENERAL DISCUSSION..... 25

Publication No. L52-92

INDUSTRIAL COLLEGE OF THE ARMED FORCES

Washington, D. C.

Mr. R. E. Harris, Manager, Production and Parts Control, Manufacturing Staff, Ford Motor Company, was born in Saginaw, Michigan, 29 October 1899. He completed grammar school and was graduated from high school in Saginaw, Michigan. He enlisted in the U. S. Navy during World War I and studied at the Submarine School in New London, Connecticut. Upon leaving the Navy, he entered the Schedule and Follow-up Division, Purchasing Department, Chevrolet Motor Company in Flint, Michigan. He transferred to Chevrolet Gear and Axle Division, Detroit, at the time the division was formed. Mr. Harris left Chevrolet in 1926 to enter the employ of the Dodge Brothers to assist in the reorganization of the Follow-up Division of the Purchasing Department. He remained with the Chrysler Corporation after it purchased "Dodge" from Dillon and Reid in the capacity of Manager of Scheduling and Follow-up-Chrysler, Dodge Division. He transferred to Chrysler-DeSoto Division in 1936 at the time this division was formed as Production Programming and Control Manager. In 1940 he transferred to the Plymouth Motor Division. Mr. Harris entered the Ford Motor Company in 1948 as director of Central Follow-up, to assist in the decentralization program. After the decentralization program in 1949, he transferred to the position he now holds.

PRODUCTION SCHEDULING IN INDUSTRY

6 February 1952

COLONEL DIEHL: Scheduling of materials into the assembly or production line is no hit-or-miss proposition. It is an exacting science. To watch an automobile assembly line turning out cars at the rate of more than one a minute, in a variety of colors, body styles, and interiors, brings home forcibly to the viewer the enormity and complexity of this operation; and to realize further that this flow is accomplished generally without large stocks of parts warehoused in the immediate vicinity serves additionally to increase your respect for the abilities of those responsible for such scheduling. But this smooth operation is not achieved without detailed and minute planning, hard work, liberal use of aspirin, and a chronic crop of ulcers.

To tell us how a large industry foresees and solves these continuing and varying problems, and applying it to the Tank program, the college has been fortunate in obtaining Mr. R. E. Harris, of the Ford Motor Company, who will discuss "Production Scheduling in Industry."

Mr. Harris, as Manager, Production and Parts Control, has literally cut his eye teeth in this art, having been associated with the industry all of his adult life. In this period he brings to you 32 years' experience in production.

Gentlemen, it is a pleasure for me to welcome to the platform of the Industrial College of the Armed Forces, Mr. R. E. Harris.

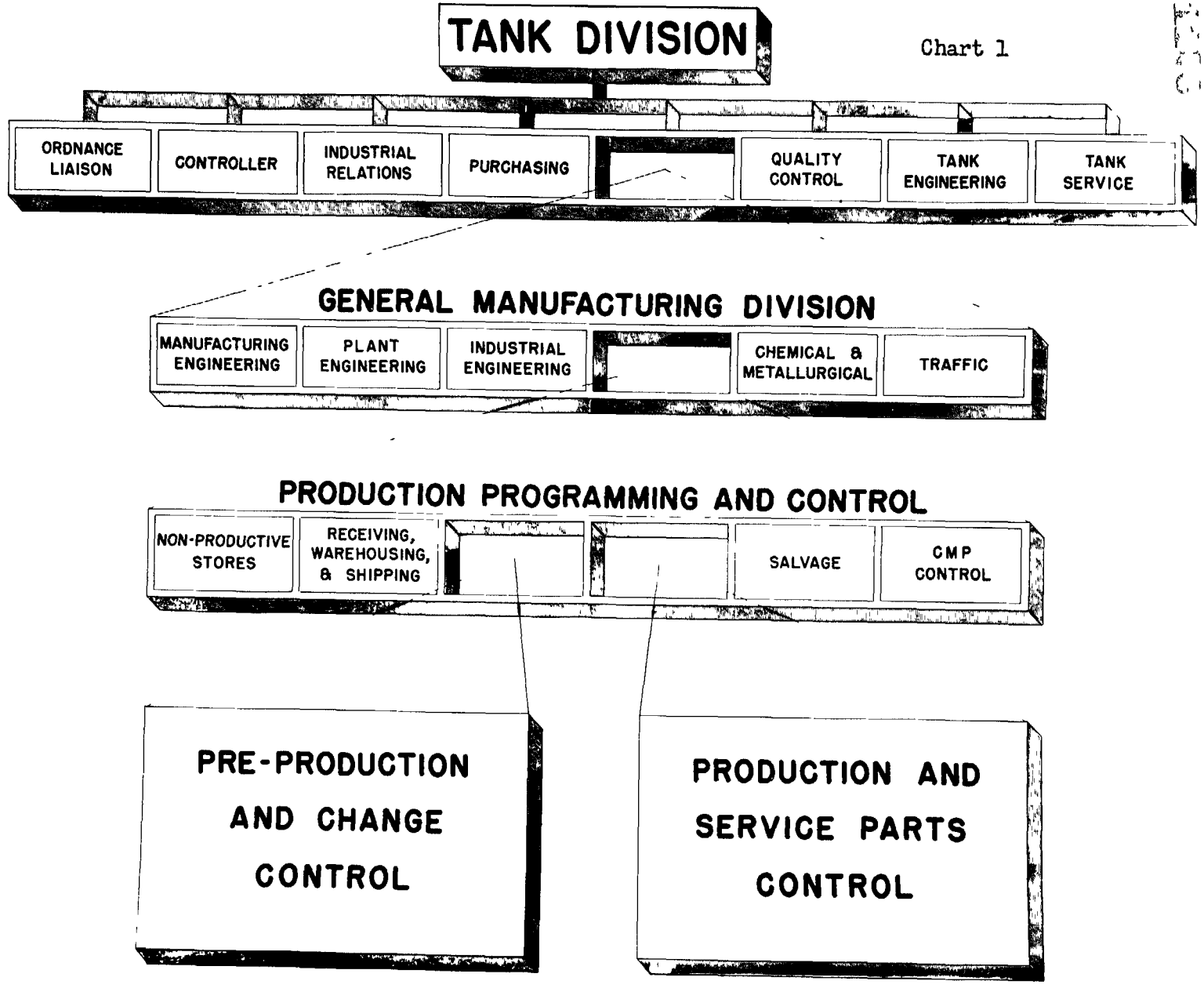
MR. HARRIS: I have been asked to discuss this morning, the functions of production scheduling and control. What it is, and what organization and procedures are necessary for accomplishing it.

Before discussing the production programming and control responsibilities in connection with this subject, I feel it is necessary that we briefly review a typical plant organization structure--to show where production programming and control fits into this picture and what the basic responsibilities of the affected divisions of production programming and control are in relation to the subject under discussion.

Referring to chart 1, following page, while we have elected to confine our discussion to the Ford Motor Company Tank Division, the organization structure, principles, and methods are applicable to all divisions and plants in both defense and commercial production.

The first line of the chart shows the various divisions within the operation:

Chart 1


TANK DIVISION
ORDNANCE LIAISON
CONTROLLER
INDUSTRIAL RELATIONS
PURCHASING
QUALITY CONTROL
TANK ENGINEERING
TANK SERVICE
GENERAL MANUFACTURING DIVISION
MANUFACTURING ENGINEERING
PLANT ENGINEERING
INDUSTRIAL ENGINEERING
CHEMICAL & METALLURGICAL
TRAFFIC
PRODUCTION PROGRAMMING AND CONTROL
NON-PRODUCTIVE STORES
RECEIVING, WAREHOUSING, & SHIPPING
SALVAGE
CMP CONTROL
PRE-PRODUCTION AND CHANGE CONTROL
PRODUCTION AND SERVICE PARTS CONTROL

1. Ordnance Liaison.
2. Controller.
3. Industrial Relations.
4. Purchasing.
5. General Manufacturing.
6. Quality Control.
7. Tank Engineering.
8. Tank Service.

The second line shows the General Manufacturing Division:

1. Manufacturing Engineering.
2. Plant Engineering.
3. Industrial Engineering.
4. Production Programming and Control.
5. Chemical and Metallurgical.
6. Traffic.

We shall return to this chart a little later on in outlining the responsibilities of Pre-production and Change Control and Production and Service Parts Control.

Upon completion of contract negotiations and the receipt of the necessary authority to proceed with the manufacture of a product, the necessary design, engineering specifications, approved blueprints, and other pertinent data must be furnished the producing division's product engineering department.

The product engineering department compiles a parts list and issues Engineering Releases from the available information and forwards copies of the Parts List and Engineering Releases, together with blueprints, to the division's "make or buy committee" and to Production Programming and Control Department.

The "make or buy committee," in the way of further explanation, generally consists of the department managers of:

1. Manufacturing Engineering.

2. Industrial Engineering.

3. Administrative.

4. Production Programming and Control.

Based upon available and planned manufacturing facilities, the "make or buy committee" determines that a part is to be manufactured by the division or purchased from an outside supplier. (The outside supplier, in this instance, may be another division or plant of the Ford Motor Company.) The "make or buy committee's" decision is forwarded to the Pre-production and Change Control Section of the Production Programming and Control Department.

In dealing with the problem of production scheduling today, we have elected to explain the basic fundamentals and forms used by Ford Motor Company in scheduling tank final line assembly operations; machining operations in the Tank Plant; the ordering of parts and materials from outside suppliers and Ford manufacturing plants, together with the action necessary within the Ford plants to properly schedule, manufacture, and deliver as requested.

So that we may proceed with the least possible delay to the actual procedures followed in scheduling the final assembly of tanks, together with the parts and materials used in the assembly operations, let us assume, that Pre-production and Change Control has received proper engineering release authority and source information; Ford Motor Company Production Releases have been issued and Purchase Requisitions for the parts and materials required have been forwarded to the Purchasing Department; also, that the Purchasing Department has finalized its contracts, in the form of Purchase Orders, with both outside suppliers and Ford Motor Company manufacturing locations.

It would be well to explain at this point, that, purchasing negotiations for parts and materials between divisions within Ford Motor Company are handled on the same basis as purchasing negotiations with outside suppliers. This results in maintaining a customer-supplier relationship with both Ford Motor Company suppliers and outside suppliers.

Now, let us start at the tank assembly plant and follow the sequence of steps necessary to arrive at the point where we are prepared to issue Shipment Release and Planning and Commitment Authorizations to both outside suppliers and our company manufacturing locations and to schedule internal assembly and production operations.

Returning again to chart 1, page 2, the third line details Production Programming and Control into:

1. Nonproductive Stores.

2. Receiving, Warehousing, and Shipping.

3. Pre-production and Change Control.

4. Production and Service Parts Control.

5. Salvage.

6. Control.

Analyzing the scope of Production Programming and Control responsibilities within Ford Motor Company, you will find that their responsibilities begin with the receipt of orders for their division's or plant's products and are discharged only when the finished product is delivered in accordance with these orders.

The fourth line of the chart emphasizes Pre-production and Change Control and Production and Service Parts Control, which are the two divisions of Production Programming and Control we are primarily concerned with in this discussion.

Pre-production and Change Control has the following responsibilities:

1. Receive, register, and review all Engineering Releases and Blueprints, received from Engineering.

2. Obtain source and routing information; print and distribute Production Releases.

3. Prepare a Schedule Control and Material Record Card for each purchased or manufactured part or assembly.

4. Issue Purchase Requisitions requesting Purchase Orders to be placed for new parts and materials.

5. Issue and maintain progress reports for positive control on all new programs and running changes.

6. Develop, maintain, and distribute assembly breakdowns, bills of material, and miscellaneous parts listings.

7. Review Engineering Change Requests and establish effective points on engineering changes.

8. Issue and process Material Change Notices and Cancellation of Commitments. Pre-production and Change Control's next step after issuing Production Releases and Purchase Requisitions is to prepare a Schedule Control and Material Record Card, containing the basic information necessary to compute requirements for production parts and materials required in the manufacturing and assembly operations of the tank assembly plant.

The importance of extreme accuracy in the preparation and making of entries on this record cannot be overemphasized, as this record is the key to all future calculations. Errors in usage or effective points will repeat themselves through the entire chain of requirement calculations for subassemblies, components of subassemblies, rough foragings or castings, in fact right down to the raw materials, with resulting shortages or surpluses. Surpluses which could result in costly obsolescence to Ford Motor Company, as these losses would not be recoverable against the contract.

The "Schedule Control and Material Record Card" when forwarded to Production and Service Parts Control, contains the following information: Chart 2, following page, a replica of the "Schedule Control and Material Record Card" has been blocked off to show this step:

1. Date issued; supersedes; superseded by.

2. Part name, part number.

3. Shop department performing manufacturing operation, shop department or plant to be delivered to.

4. Purchase or manufacturing line-up; material specifications requirements, including model, number of units per vehicle, effective point showing date, and the unit number on which the part enters production.

5. Number of parts per assembly and the assembly part number.

6. Purchase requisition date, number, and quantity.

Production and Service Parts Control have the following responsibilities:

1. Receive vehicle building schedule approved by Tank Plant management.

2. Receive Purchase Orders for parts and materials to be purchased.

FORM 2001 A 1
REV 9 1 51

TANK PLANT Chart 2

SCHEDULE CONTROL AND MATERIAL RECORD

PURCHASE OR MFG. LINE UP: CANTON PUR STEEL - FORGE; MOUND ROAD MACH. - H.T., TANK PLT. ASSEM., SHIP IN ASSY. 7427741 FOR SPARES.

MAT'L SPEC: SAE 1040

UNIT FIN WT: 3.43 UNIT RGH WT: 5.07

DATE ISSUED: 12-5-51

SUPERSEDES: _____ DATE: _____

SUPERSEDED BY: _____ DATE: _____

PART NAME	PART NO
IDLER SPINDLE	7379452

FLOAT CLASS	SHIPPING FREQUENCY A	B	C	D	MIN RUN	CARD SHOP DEPT	OF DEL TO
C	DAILY	WEEKLY	SEMI MO	MONTHLY		D-109	D-112

REQUISITIONS

DATE	NUMBER	QUANTITY	ACCUM TOTAL
12-5-51	379	5700	

PURCHASE ORDERS

SUP'L NO	DATE	ORDER NO	EXPIRES	% OR QUANTITY	TOTAL	ACCUMULATIVE TOTAL
1	12-15-51	82543		5700		

SUPPLIER

SUP'L NO	NAME AND ADDRESS	ROUTING & SHIPPING POINT
1	MOUND RD DIV - CENTERLINE, MICH	TRUCK - CENTERLINE, MICH.

SUPPLIER'S RELEASE

SCH NO	DATE	SUP'L NO	RELEASE NUMBER	FABRICATION	RAW	SUPPLIER TOTAL	ACCUMULATIVE TOTAL
1	12-16	1	9842	500	5200	5700	
2	1-10	1	10006	660	5040	5700	

SUPPLIER'S RELEASE

SCH NO	DATE	SUP'L NO	RELEASE NUMBER	FABRICATION	RAW	SUPPLIER TOTAL	ACCUMULATIVE TOTAL

REQUIREMENTS

MODEL	CODE	PER VEHICLE	DATE CARD CHGD	EFFECTIVE UNITS DATE	IN	OUT
M-48		10		12-5-51	#1	

INVENTORY

LOOSE	0
SUB ASSY	0
MAJOR ASSY	0
TOTAL ON HAND	0
IN TRANSIT	0
GRAND TOTAL	0

FLOAT IN DAYS

IN TRANSIT	0
OPER RCS	10
SYSTEM (420 PCS)	–
SHP'G BANK	0
CYCLE	0
TOTAL	420 PCS + 10 DAYS

RELEASE CALCULATION

1	2	3	4	5	6	7	8	9	10	11
SCH NO	PERIOD	UNIT REQTS	SPARES	FLOAT REQTS	FLOAT ADJUSTMENT	SCRAP ACCUM	INVENTORY ADJUSTMENT GENERAL	INVENTORY ADJUSTMENT SPECIAL	TOTAL REQUIREMENTS MONTH	TOTAL REQUIREMENTS ACCUM
2	THRU JUNE	170	0	530		0	0	0	700	
	JULY	320	0	670		0			460	1160
	AUG	470	0	770		0			570	1730
	SEPT	630	0	1215	10	0			1075	2805
	OCT	1250	0	1290	11	0			1325	4130
	NOV	1400	0	1090	190	0			1200	5330
	DEC	1460	0		1050	0			370	5190
	TOTAL	5700								
	THRU									
1	2	3	4	5	6	7	8	9	10	11
	TOTAL									

ENGINEERING CHANGE RECORD

DATE	LETTER	REMARKS
		WHEN REQUIRED

☒ USED IN ASSEMBLIES
☐ DETAILS OF ASSEMBLY

ER ASSY	PART NUMBER
1	7427741

3. Classify parts based on value into "A", "B", "C", or "D" groups and determine days' float required for each part. (This step will be explained in detail very shortly.)

4. Calculate delivery requirements for purchased and shop-made parts and raw materials based upon vehicle building schedule.

5. Issue Shipment Release and Planning and Commitment Authorizations to suppliers for parts and materials.

6. Issue manufacturing schedule for parts to be made by Tank Plant.

7. Follow suppliers and shop to assure that shipments and production are made as scheduled.

8. Maintain record of supplier shipments and shop production.

9. Prepare Behind Schedule Reports and forward to suppliers and shop where shipments and production are not made as scheduled.

10. Prepare Critical Shortage, listing parts and materials where their status endangers production.

In further explanation of how the correct floats for parts or materials are established, it is important to point out that parts and material floats are adjustments in time only and are not in addition to an authorized total quantity requirement.

Our Company Policy directs that commitments beyond authorized totals must have prior approval of Manufacturing Staff, Production Programming and Control Office, except in cases where minimum runs develop such excess or the purchase of parts in standard packaging likewise is deemed economical.

Floats consist of the following:

1. Transit time.

2. Shipping frequency.

3. Operational reserve.

4. System.

5. Shipping bank.

The proper establishment of these time compartments is a very important step in good production scheduling and the resulting control of inventory dollars, space, and a smooth flow of production.

The upper portion of chart 3, following page--the "Cost Class Group Chart"--shows the factors to be considered in establishing the number of days' requirements, ahead of the first operation, to be stored within the plant. This we call operational reserve.

These factors are:

Column 1--Total Cost of One Day's Requirements.

Column 2--Cost Class Group.

Column 3--Normal Operational Reserve in Days.

If the total cost of one day's requirements of a part, used in our commercial operation, is over 30,000 dollars, it receives an "A" classification and the operational reserve is limited to a two-day supply.

Fifteen thousand to thirty thousand dollars per day is considered a "B" class item, and the operational reserve is established at five working days.

Five thousand to fifteen thousand dollars per day is considered a "C" classification and the operational reserve is set at 10 working days.

Less than 5,000 dollars per day are "D" class items with a 20-working-day operational reserve.

Factors, in addition to cost, which must be considered in establishing operational reserve, are storage limits--difficulty or ease of procurement and most economical shipping frequency; therefore, the operational reserve is first classified in accordance with costs, but may later be reclassified into another cost class group as varying factors indicate.

I would like to add, that the total cost factors used in our commercial operations would not necessarily apply to lesser operations, however, the same basic principles could be used by proper consideration of these factors.

The lower portion of chart 3, page 10, covers the elements necessary to develop float requirements:

Column 1--Transit Time--meaning the number of days the part or material is in transit from the source of supply.

Column 2--Shipping Frequency--representing the number of days' requirements in a normal shipment.

Chart 3

COST CLASS GROUP CHART
FOR DETERMINING OPERATIONAL RESERVE

1			2	3
TOTAL COST OF ONE DAY'S REQUIREMENTS			COST CLASS GROUP	NORMAL OPERATIONAL RESERVE IN DAYS (MFG PLANTS)
OVER		$ 30000	A	2
15000	TO	30000	B	5
5000	TO	15000	C	10
LESS	THAN	5000	D	20

FACTORS TO BE CONSIDERED IN ESTABLISHING OPERATIONAL RESERVE ARE COST, AS ILLUSTRATED ABOVE, STORAGE LIMITS, DIFFICULTY OR EASE OF PROCUREMENT, AND MOST ECONOMICAL SHIPPING FREQUENCY

THE OPERATIONAL RESERVE IS FIRST CLASSIFIED IN ACCORDANCE WITH THE ABOVE CHART, AND WHEN NECESSARY, RECLASSIFIED TO THE PROPER GROUP AS VARYING FACTORS INDICATE

ELEMENTS NECESSARY TO DEVELOP
FLOAT REQUIREMENTS

1	2	3	4	5		6
TRANSIT TIME	SHIPPING FREQUENCY	OPERATIONAL RESERVE	SYSTEM	SHIPPING BANK		
NUMBER OF DAYS THE PART IS IN TRANSIT FROM SOURCE OF SUPPLY	NUMBER OF DAYS' REQUIREMENTS IN A NORMAL SHIPMENT	NUMBER OF DAYS' REQUIREMETS NEEDED FROM SUPPLIER AHEAD OF FIRST OPERATION	NUMBER OF DAYS' REQUIREMENTS OF EACH PART NEEDED FROM THE FIRST TO THE LAST OPERATION WITHIN THE PLANT EXCLUDING THE SHIPPING BANK	NUMBER OF DAYS' REQUIREMENTS OF EACH PART INCLUDING THOSE PARTS WITHIN ASSEMBLIES HELD FOR SHIPMENT	=	FLOAT REQUIREMENTS

Consideration must be given to this factor as storage space must be provided to accomodate both the operational reserve and a normal shipment which when combined represents the minimum space requirements.

Column 3--Operational Reserve--the number of days' requirements ahead of the first operation, based upon cost class grouping or necessary reclassification.

Column 4--System--number of days' requirements of each part needed from the first to the last operation within the plant, excluding the shipping bank.

Column 5--Shipping Bank--number of days' requirements of each part, including those parts within assemblies held for shipment.

Column 6--Float Requirements--the total of all elements.

Straying from the tank problem for just a moment, I'd like to have you look at Chart 4, following page, which shows the result of the type of float treatment we have just discussed.

The black bar under the cost classification shows the percent of dollars the classification represents of our Company's total production parts inventory investment.

The white bar indicates the percent of total parts these dollars represent.

You will note under class "A," that approximately 57 percent of the total dollar inventory investment of the Ford Motor Company is contained in only 9 percent of the total parts.

Class "B"--18 percent of our dollars in 10 percent of the total parts.

Class "C"--15 percent of our dollars in 20 percent of the total parts.

Class "D"--10 percent of our dollars in 61 percent of the total parts.

It is evident from these facts, that if we assign our most capable personnel to the control of the "A" and "B" classifications, to insure protecting an uninterrupted flow of production, we can afford to carry many more days of protection on the smaller value items, with little effect to our over-all dollar inventory position.

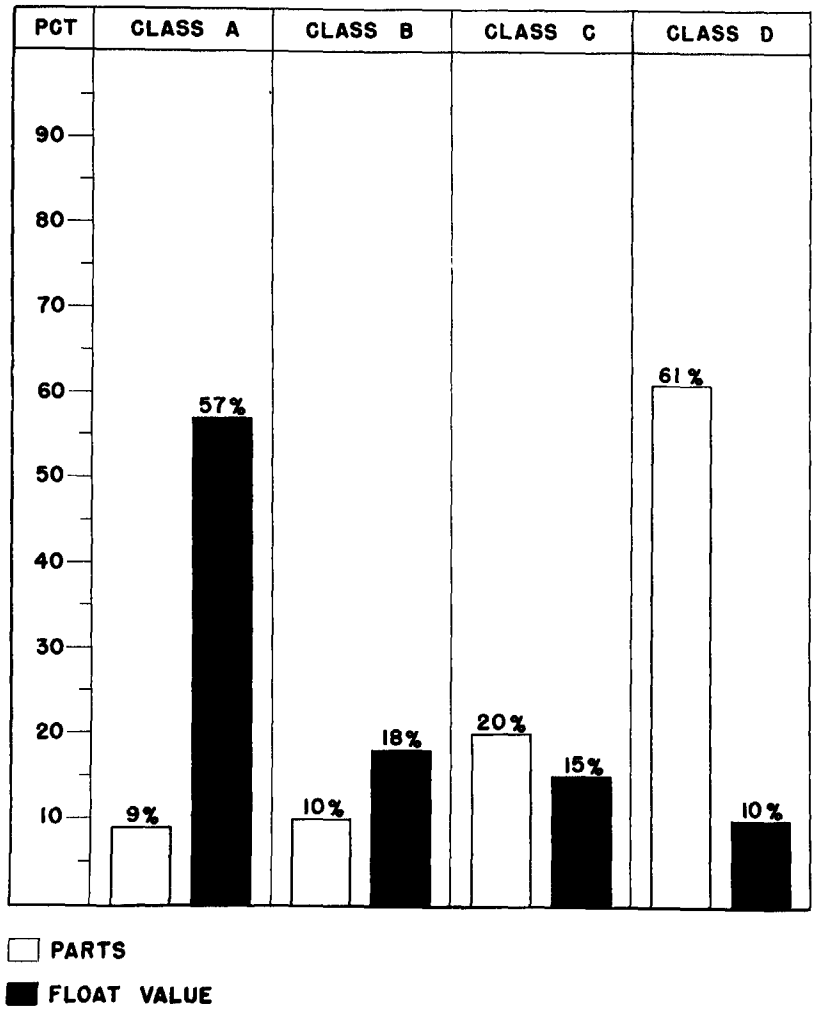
These classifications are also used in determining the shipping frequency of parts.

FLOAT ANALYSIS CHART

Chart 4

CONSOLIDATED SUMMARY

FORD MOTOR COMPANY



"A"--items are scheduled to be shipped on a daily or semiweekly basis.

"B"--items on a weekly basis.

"C"--items on a semimonthly basis.

"D"--items on a monthly basis.

Proper policing of the suppliers, to assure adherence to our shipping instructions, has resulted in very substantial savings in the handling and posting of shipping information--invoicing, payment of invoices, typing and posting of Receiving Reports, and physical material handling, in the receiving and storage areas.

Going back to tank production again--necessary floats have now been determined and we are ready to calculate requirements.

Our present tank contract specifies the delivery of tanks in accordance with the schedule shown in line 1, chart 5, following page.

July	August	Sept	October	November	December	Total
25	45	90	120	130	160	570
	70	160	280	410	570	

To effect delivery in accordance with this schedule, consideration must be given to all "time elements" from the point the tank leaves the final assembly line to the actual shipment of the finished product. These elements include: the time necessary to complete test track operations, final adjustments, Ordnance inspection, and acceptance-preparation for shipment, which includes application of necessary protection for shipment and storage.

After analyzing the foregoing factors, we have determined that 15 calendar days will be required to complete these steps, therefore, our tank assembly line schedule must be moved ahead an equivalent amount of "time."

The resulting Official Tank Assembly and Parts and Material Releasing Program is shown in line 2, Chart 5, page 14.

June	July	August	Sept	October	November	December	Total
17	32	47	63	125	140	146	570
	49	96	159	284	424	570	

LEAD TIME ANALYSIS

Chart 5

	JAN.	FEB.	MAR.	APR	MAY	JUNE	JULY	AUG	SEPT.	OCT	NOV.	DEC.
TANK SHIPPING SCHEDULE (TANKS)							25	45	90	120	130	160
TANK ASSEMBLY LINE (TANKS)						17	32	47	63	125	140	146
TANK ORDER TO MOUND ROAD (UNITS)						1700	460	570	1075	1325	1200	370
MOUND RD ORDER TO CANTON (UNITS)					700	460	570	1075	1325	1200	370	
CANTON SHOP SCHEDULE (UNITS)				700	460	570	1075	1325	1200	370		
CANTON RAW MATERIAL FLOAT (EQUIV WT)			700	460	570	1075	1325	1200	370			
STEEL ORDER PLACEMENT (EQUIV WT)	700	460	570	1075	1325	1200	370					

The releasing activity, within Production and Service Parts Control, upon receipt of this Official Releasing Program, compute monthly requirements for parts or assemblies; including spares--reported scrap-general inventory and approved inventory adjustments--estimated quantities for anticipated scrap, and manufacturing losses. Requirements are then advanced to provide the approved manufacturing floats. The resulting net monthly requirements are those to be used for the purpose of issuing Shipment Release and Planning and Commitment Authorizations to our outside suppliers or other company manufacturing locations, also, to schedule shop manufacturing activities within the Tank Division.

Referring back to chart 2, page 7, the "Schedule Control and Material Record Card" under the heading "Release Calculations" we show the detail of the entries on the record and how these net monthly requirements are determined:

Column 1--Authorization Number.

Column 2--Period--the months to be considered in the calculations (in this example--from the established production starting date through December).

Column 3--Tanks--unit requirements per month based upon the Official Releasing Program.

Column 4--Spares--unit requirements per month, after giving consideration to the necessary time elements of preparation and packaging. (For the purpose of simplification and to allow for a direct comparison of actual "tank" assembly line requirements later, we will not consider spares, although in actual practice, these requirements are highly important.)

Column 5--Floats--the approved float requirements. (The small daily volume of tank production, compared with the size of the Tank Plant system, makes it necessary to treat the system requirements in "pieces," rather than days.) We have, therefore, established our float, using the minimum system requirements of 42 tanks, plus 10 working days' or 15 calendar days' requirements of parts.

Column 6--Float Adjustments--deletion of the previous month's float to prevent pyramiding of float requirements and overcommitments of Official Releasing Program.

Column 7--Scrap--cumulated scrap reported to the date of the calculation and estimated future scrap allowances by months. (We will not consider "scrap" in this example, for the same reason we have not considered spares, although, in actual practice, this factor must be considered.)

Column 8--General Inventory Adjustment--this column is used to record available inventory, if, as, and when, a General Inventory of the plant is taken. In all probability, the Tank Plant's General Inventory date will be timed to coincide with the balance of the Ford Motor Company operations. It is possible that the inventory will be taken on the first of October or November 1952.

If this General Inventory is taken, the Official Releasing Programs and Production Control records will be revised as of the General Inventory closing date, reflecting the monthly shipping schedules and requirements, starting at number one tank, from the General Inventory date forward.

All parts and materials available as of the General Inventory date, including those in unshipped finished products, must be considered available for production after inventory and deducted from the total computed requirements to arrive at the correct "after inventory" monthly and cumulated monthly requirements.

Column 9--Special Inventory Adjustment--This column is used to record inventory "losses" or "gains" between General Inventory periods. Inventory losses are entered in black and gains, in red. Losses or gains must be finally approved by the Production Control Manager and it is good policy not to accept these adjustments as permanent until procurement time makes it imperative.

Our recommended policy is to advance or retard fabrication and shipments of sufficient parts or materials, staying within our Official Releasing Program to offset the loss or gain, until it has been positively established by additional inventories, that they have actually occurred.

Column 10--Total Monthly Requirements--the sum of all monthly entries, plus or minus the adjustments.

Column 11--Total Cumulative Requirements--this column represents cumulative monthly requirements for number one unit through the total authorized by the Official Releasing Program.

Monthly requirements have now been established and the Tank Plant's next step is to relay its needs to its suppliers. We have used the Ford Mound Road Plant as the supplier in this particular case.

We would like to state at this point, that the methods and forms used to authorize the purchase of material, the fabrication, and shipment for "company suppliers" are identical with those used for our outside suppliers.

Our purpose in using the Mound Road Plant in this example is to simplify the job of tracing the action necessary at the supplier level when the requirements are received from the Tank Division.

Purchase Orders for parts and materials required for the execution of government contracts differ from our standard Purchase Order used for commercial programs to this extent:

Blanket Purchase Orders used on commercial programs specify the percentage of our company requirements to be furnished by the supplier over a specified period of time. These blanket Purchase Orders also provide that the supplier shall not fabricate any of the supplies covered by the Purchase Order, or procure any of the materials required in their fabrication, or ship any of the supplies, except to the extent authorized by our company in the form of the Shipment Release and Planning and Commitment Authorization.

We use, what we term, an "open delivery Purchase Order" for government contract requirements. These Purchase Orders cover a specific quantity but also provide that the supplier shall not fabricate, procure materials, or ship, except to the extent authorized by the Shipment Release and Planning and Commitment Authorization.

This type of quantity order is essential when dealing with government contracts, as it prevents overordering in relation to the specific quantities covered by our contract and, at the same time, allows the flexibility necessary to control deliveries in line with our Official Releasing Program requirements, thereby, maintaining our desired inventory position.

Chart 6, following page, is a replica of the Shipment Release and Planning and Commitment Authorization and when received is the supplier's authority to purchase materials, fabricate, and ship, as specified.

This form provides space for:

1. The part number and part name.

2. Supplier's name and address.

3. Balance due on open Purchase Orders after the last shipment considered in the calculation of the release.

4. Where to ship and bill to.

5. Other pertinent information and instructions.

Item 1, on the form.--This space is provided for entering the cumulative shipments, since the General Inventory date or number one piece,

FORM 3086 GBK
9-1-51

FORD MOTOR COMPANY

Chart 6

SHIPMENT RELEASE AND PLANNING AND COMMITMENT AUTHORIZATION

THIS AUTHORIZATION SUPERSEDES PREVIOUS AUTHORIZATION AGAINST THE PURCHASE ORDER INDICATED AND IS THE SUPPLIER'S AUTHORITY TO PURCHASE MATERIAL FABRICATE AND SHIP AS SPECIFIED BELOW

PART NO	PART NAME	BUYER	MAT CL	BOOK NO
7379452	IDLER SPINDLE	10	C	3

THIS RELEASE 10006

SUPER SEDES RELEASE NO 9842

SHIP TO
TANK DIVISION
FORD MOTOR CO.
LIVONIA, MICH.

BILL TO
SAME

SUPPLIER NAME AND ADDRESS
MOUND ROAD DIV.
FORD MOTOR CO.
CENTERLINE, MICH.

ADVISE IMMEDIATELY IF CUMULATIVE SHIPMENTS IN ITEM 1 DO NOT AGREE WITH YOUR RECORD

ADVISE IMMEDIATELY IN WRITING IF YOU ANTICIPATE ANY DIFFICULTY IN FABRICATING PARTS OR OBTAINING RAW MATERIALS IN TIME TO COMPLY WITH THE PROVISIONS OF THIS AUTHORIZATION

MATERIAL OR PARTS RETURNED TO SELLER WILL BE RETURNED FOR FULL CREDIT AT PURCHASE ORDER PRICE AND ARE TO BE CONSIDERED AS REDUCTIONS OF THE TOTAL QUANTITY THAT HAS BEEN SHIPPED IN ACCORDANCE WITH TERMS AND CONDITIONS SHOWN ON PURCHASE ORDER

NOTIFICATION OF SHIPMENTS INABILITY TO SHIP OR INFORMATION REGARDING CUMULATIVE SHIPMENTS SHOULD BE SENT TO

SAME

BALANCE DUE ON OPEN ORDER(S) AFTER LAST SHIPMENT CONSIDERED IN ITEM 2

ORDER DATE	ORDER NUMBER	QUANTITY OR PERIOD
12-15-51	82543	5700
	TOTAL	5700

REMARKS

ITEM 2

LAST SHIPMENT CONSIDERED

DATE	QUANTITY	ITEM 1 CUMULATIVE SHIPMENTS SINCE 12-15-51
	NONE	NONE

AFTER LAST SHIPMENT CONSIDERED FABRICATE AND SHIP AS SPECIFIED BELOW

PERIOD OF SHIPMENT	QUANTITY TO SHIP	CUMULATIVE RELEASED SINCE DATE SHOWN ON ITEM 1
BEHIND SCHEDULE AS OF 1-10-52	0	
JUNE 2	510	
JUNE 16	660	1170
JULY 1	280	1450
JULY 15	280	1730

3 RAW MATERIAL AUTHORIZATION

IN ADDITION TO THE RAW MATERIALS REQUIRED TO PRODUCE THE QUANTITY OF SUPPLIES SHOWN IN ITEM 2 SELLER IS AUTHORIZED TO PROCURE BUT NOT TO FABRICATE THE QUANTITY OF RAW MATERIALS TO PRODUCE SUPPLIES SHOWN IN THIS ITEM 3

MONTH AUG.	570
MONTH SEPT.	1075
MONTH OCT.	1325
MONTH NOV.	1200
MONTH DEC.	370

4 CUMULATIVE QUANTITY RELEASED SINCE DATE SHOWN IN ITEM 1 — 5700

AUTHORIZED BY	DATE	SHIPPING POINT	SCHEDULE NO
JOHN DOE	1-10-52	CENTERLINE, MICH.	2

1 KINDLY ACKNOWLEDGE THIS AUTHORIZATION BY SIGNING AND RETURNING THE NO 2 COPY

whichever, is applicable. (In this example, there have been no shipments, so we have entered the date of the Purchase Order as our starting point.)

The form requests the supplier to advise us immediately if the total cumulative shipment shown in item 1 of the form does not agree with his record. It is extremely important that our records are in complete agreement with the supplier's at this point, as future fabrication and shipping instructions are established from this point forward.

Item 2, on the form.--We have entered the date and quantity of the last shipment considered in arriving at the cumulative shipments shown in Item 1. (Again, there have been no shipments.) This item, also, instructs the supplier that after considering this last shipment, to fabricate and ship as specified below. (Requirements used below have been transferred from chart 6, page 19.)

Period of shipment	Quantity to ship	Cumulative released since date shown in item 1
2 June	510	
16 June	660	1,170
1 July	280	1,450
15 July	280	1,730

Item 3, Raw Material Authorization.--In addition to the raw materials required to produce the quantity of supplies shown in item 2, the seller is authorized by item 3, to procure, but not fabricate, the quantity of raw materials to produce the following totals by months.

1.	August	570
2.	September	1,075
3.	October	1,325
4.	November	1,200
5.	December	370

Item 4, Cumulative Quantity Released Since Date Shown in Item 1 or 4,390 pieces.--The Shipment Release and Planning and Commitment Authorization now represents a statement to the supplier, of the requirements which were computed on the Schedule Control and Material Record Card and, after proper signatures, is forwarded to the Production Control Department of the Mound Road Plant.

The quantities shown on this release have been entered in line 3, chart 5, page 14.

The Mound Road Plant, upon receipt of its copies of the Shipment Release and Planning and Commitment Authorization, uses it as its Official Releasing Program, determining the components of the assembly, if applicable, and enters the monthly quantities authorized in column 3 of its Schedule Control and Material Record Card.

The balance of the steps, used to arrive at the total monthly and cumulative monthly requirements, are identical with those used by the Tank Plant, with the exception that they will apply their own approved "float" (in this case, 20 working days or 30 calendar days) in computing these requirements.

Mound Road has the job of finish-machining and heat-treating the part under discussion. The rough forging is purchased by it from our Canton, Ohio, Forging Plant.

The requirements as computed on its Schedule Control and Material Record Card are forwarded to the Canton Forge Plant, using the Shipment Release and Planning and Commitment Authorization (reproduced on chart 7, following page), specifying deliveries and authorizing raw material procurement on the following basis:

Period of shipment	Quantity to ship	Cumulative released since date shown in item 1
1 May	700	
1 June	466	1,160
1 July	570	1,730
	Raw material authorization	
August	1,075	
September	1,325	
October	1,200	
November	370	5,700

The quantities of this release are also shown on line 4, chart 5, page 14.

The Canton Forge Plant, upon receipt of this Shipment Release and Planning and Commitment Authorization, computes its forging schedules on its Schedule Control and Material Record Card, using the Shipment Release and Planning and Commitment Authorization as its Official Releasing Program, following the same steps outlined previously, but again, applies its own float. The float in this location comprises only the "system and shipping float" for the forging itself and amounts to five working days or seven calendar days.

FORM 3086 GBK
REV 9 1 51

FORD MOTOR COMPANY

Chart 7

SHIPMENT RELEASE AND PLANNING AND COMMITMENT AUTHORIZATION

THIS AUTHORIZATION SUPERSEDES PREVIOUS AUTHORIZATION AGAINST THE PURCHASE ORDER INDICATED AND IS THE SUPPLIER'S AUTHORITY TO PURCHASE MATERIAL FABRICATE AND SHIP AS SPECIFIED BELOW

PART NO	PART NAME	BUYER	MAT CL	BOOK NO
7379452	IDLER SPINDLE	7	D	5

THIS RELEASE 5001

SUPERSEDES RELEASE NO 4895

SHIP TO
MOUND ROAD DIV.
FORD MOTOR CO.
CENTERLINE, MICH.

BILL TO
SAME

SUPPLIER NAME AND ADDRESS
CANTON FORGE DIV.
FORD MOTOR CO.
CANTON, OHIO

ADVISE IMMEDIATELY IF CUMULATIVE SHIPMENTS IN ITEM 1 DO NOT AGREE WITH YOUR RECORD

ADVISE IMMEDIATELY IN WRITING IF YOU ANTICIPATE ANY DIFFICULTY IN FABRICATING PARTS OR OBTAINING RAW MATERIAL IN TIME TO COMPLY WITH THE PROVISIONS OF THIS AUTHORIZATION

MATERIAL OR PART RETURNED TO SELLER WILL BE RETURNED FOR FULL CREDIT AT PURCHASE ORDER PRICE AND ARE TO BE CONSIDERED AS REDUCTIONS OF THE TOTAL QUANTITY THAT HAS BEEN SHIPPED IN ACCORDANCE WITH TERMS AND CONDITIONS SHOWN ON PURCHASE ORDER

NOTIFICATION OF SHIPMENTS INABILITY TO SHIP OR INFORMATION REGARDING CUMULATIVE SHIPMENTS SHOULD BE SENT TO

SAME

BALANCE DUE ON OPEN ORDER(S) AFTER LAST SHIPMENT CONSIDERED IN ITEM 2

ORDER DATE	ORDER NUMBER	QUANTITY OR PERIOD
12-25-51	37440	5700
REMARKS	TOTAL	5700

ITEM 1

LAST SHIPMENT CONSIDERED DATE	QUANTITY	ITEM 1 CUMULATIVE SHIPMENTS SINCE 12-25-51
	NONE	NONE

ITEM 2

AFTER LAST SHIPMENT CONSIDERED FABRICATE AND SHIP AS SPECIFIED BELOW

PERIOD OF SHIPMENT	QUANTITY TO SHIP	CUMULATIVE RELEASED SINCE DATE SHOWN ON ITEM 1
BEHIND SCHEDULE AS OF 1-15-52	0	
MAY 1	700	
JUNE 1	466	1160
JULY 1	570	1730

ITEM 3 RAW MATERIAL AUTHORIZATION

IN ADDITION TO THE RAW MATERIALS REQUIRED TO PRODUCE THE QUANTITY OF SUPPLIES SHOWN IN ITEM 2 SELLER IS AUTHORIZED TO PROCURE BUT NOT TO FABRICATE THE QUANTITY OF RAW MATERIALS TO PRODUCE SUPPLIES SHOWN IN THIS ITEM 3

MONTH	AUG.	1075
MONTH	SEPT.	1325
MONTH	OCT.	1200
MONTH	NOV.	370
MONTH		

ITEM 4 CUMULATIVE QUANTITY RELEASED SINCE DATE SHOWN IN ITEM 1 — 5700

AUTHORIZED BY	DATE	SHIPPING POINT	SCHEDULE NO
JOHN DOE	1-15-52	CANTON, OHIO	2

1 KINDLY ACKNOWLEDGE THIS AUTHORIZATION BY SIGNING AND RETURNING THE NO 2 COPY

The quantities of this schedule, taken from chart 8, following page are entered on line 5, chart 5, page 14.

In addition to the "system and shipping float" a minimum "raw material float" of 20 working days or 30 calendar days must be provided. (This adjustment is shown on line 6, chart 5.)

Retracing these steps from the Tank Delivery Schedule to where we are now, let us see what happens to our "lead time."

Line 1, chart 5--Tank Delivery Schedule.

Line 2--shows the effect of the necessary forward time adjustments for the Tank assembly line (15 calendar days).

Line 3--forward time adjustments for Tank Plant floats (15 calendar days).

Line 4--forward time adjustments for Mound Road floats (30 calendar days).

Line 5--forward time adjustments for Canton manufacturing floats (7 calendar days).

Line 6--forward time adjustments for Canton raw material floats (30 calendar days).

Line 7--includes necessary ordering time for steel (60 days ahead of the first day of the shipping month), or a total of approximately six months ahe d of the time the first tank is to be delivered.

It is quite evident from this picture that we will be in serious procurement trouble after the second quarter of this year, unless an additional tank authorization is received in sufficient time to allow us to obtain third quarter steel coverage.

We have succeeded now in relaying our requirements down through the second-tier subcontractor and into the steel mills, so let's take a brief look at the problem of scheduling our own Manufacturing Operations.

Scheduling the "tank final assembly line" is relatively simple. The daily schedule of tanks to be built will be set by dividing the monthly schedule by the number of working days in the month. The production of major assemblies will be controlled in direct relation to the "tank final assembly line."

PPG - 12
REV 8-17-51

MANUFACTURING SCHEDULE NO. 1

Chart 8

SHEET NO. _____ OF _____

DATE ISSUED 5-1-52

PLANT MOUND ROAD DEPT _____

PART NUMBER AND PART NAME	PERFORMANCE RECORD FROM _____ THRU 5-1	
7379452 IDLER SPINDLE	SCHED	0
	PROD	0
	+ OR -	0
	SCHED	
	PROD	
	+ OR -	
	SCHED	
	PROD	
	+ OR -	
	SCHED	
	PROD	
	+ OR -	

ACTUAL SCHEDULE												TENTATIVE SCHEDULE MONTH OF JULY
5-19 THRU 5-23		5-26 THRU 5-30		6-2 THRU 6-6		6-9 THRU 6-13		6-16 THRU 6-20		6-23 THRU 6-27		
WEEK	DAILY	WEEK	DAILY	WEEK	DAILY	WEEK	DAILY	WEEK	DAILY	WEEK	DAILY	
120		120		130		130		40		40		245
M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	
M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	
M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	
M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	

REMARKS

ISSUED BY _____

PHONE _____

1 2 3 4

23

PPG 12
REV 8 17 51

MANUFACTURING SCHEDULE NO. 1

SHEET NO _____ OF _____

DATE ISSUED 4-1-52

PLANT CANTON FORGE DEPT _____

PART NUMBER AND PART NAME	PERFORMANCE RECORD FROM _____ THRU 4-1	
7379452 IDLER SPINDLE	SCHED	0
	PROD	0
	+ OR -	0
	SCHED	
	PROD	
	+ OR -	
	SCHED	
	PROD	
	+ OR -	
	SCHED	
	PROD	
	+ OR -	

ACTUAL SCHEDULE												TENTATIVE SCHEDULE MONTH OF JUNE
4-21 THRU 4-25		4-28 THRU 5-2		5-5 THRU 5-9		5-12 THRU 5-16		5-19 THRU 5-23		5-26 THRU 5-30		
WEEK	DAILY	WEEK	DAILY	WEEK	DAILY	WEEK	DAILY	WEEK	DAILY	WEEK	DAILY	
500		0		0		0		160		0		335
M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	
M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	
M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	
M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	M T W	T F S	

REMARKS

ISSUED BY _____

PHONE _____

Manufacturing schedules for the balance of the parts manufactured within the Tank Plant will be computed on the "Schedule Control and Material Record Card." Using the Official Tank Assembly Program as the basis for the calculations, in the same manner as parts purchased from outside or company suppliers, again, the exception of applying the approved float, in this case, consideration is given to only the "system" as explained previously on the "Float Analysis" chart.

Chart 8, page 23, is a replica of the "Manufacturing Schedule Form" used to relay production requirements to the Manufacturing Departments.

Column 1--"Part Number and Part Name."

Column 2--"Performance Record".--This column shows the total cumulative schedule through a certain date; actual cumulative production through the same date; the quantity ahead or behind the previous schedule.

Column 3--"Actual Schedule".--It shows the amounts to be manufactured daily and weekly for the current month after the last production date and amount shown in column 2.

Column 4--"Tentative Schedule" for the next succeeding month.--All other manufacturing locations within the Ford Motor Company will use the same methods and forms for scheduling their internal manufacturing activities, using the Shipment Release and Planning and Commitment Authorization as their Official Releasing Program.

We have now covered, rather broadly, **the basic methods and forms** used in scheduling both our outside suppliers and company manufacturing locations. If it were not for engineering changes, our job would be fairly well accomplished; however, where there is a product, there will be engineering changes. To illustrate this point more forcibly, it is a matter of record that there are 6,619 parts required to complete the final tank assembly. To date we have received 7,702 engineering changes against this total. Most of these changes are mandatory and effective with number one tank; however, considering the time element necessary to effect a change and if we are to produce and ship tanks in accordance with our contract, it becomes necessary to delay changes beyond number one tank.

To establish the effective points beyond number one tank on approved engineering changes, the following determinations must be made:

1. Is the change to be incorporated with or without obsolescence?

2. Is raw material affected?

3. Is tooling affected?

Changes to be incorporated with obsolescence require the following action:

1. Obtain availability date of the new part or raw material.

2. Obtain tooling availability date.

The effective point will be established, based on the earliest date material and tools will be available and allowing necessary time safety factors to prevent production interruptions. Changes to be incorporated without obsolescence require the following action:

1. Obtain inventory and commitment status of the replaced part.

2. Obtain material availability date of the new part.

3. Obtain tooling availability date for the new part.

The effective point will be established as follows:

1. If material and tools will be available prior to the date the supply of superseded parts will be used in production, the effective date will be based on the date the present supply of superseded parts will be depleted.

2. If the supply of the superseded parts will be depleted prior to tooling or material availability, the effective point will be based on the earliest date both tools and materials will be available and a sufficient supply of the superseded part will be made available to meet that date.

Gentlemen, we have covered a very complex subject in a rather short period of time. I hope that the broad treatment given will help your understanding of the problem. If I have completely confused everyone, maybe our question and answer period will help straighten some of it out. Thank you.

COLONEL DIEHL: Mr Harris, it has been obvious from your discussion that any one breakdown in the line of suppliers would cause considerable difficulty--financially, in overhead, and in personnel lay-offs. Would you briefly give us a description of how you actually run your schedules with your suppliers to insure against such a breakdown of any one item?

MR. HARRIS: I think probably the best way to look at how it is accomplished is to assume that each manufacturing location within the Ford Motor Company is just an extension of the final assembly line of the assembly plant. Each one of our major outside suppliers holds the same position in relation to the end of that assembly line.

Let us take wheels as an example. Let us say that one of our assembly plants required X number of wheels per day. In setting up floats, I have said that on major items like wheels, we carry a two-day supply in our plants and, in addition, we have in transit an average of a six-and-a-half or a seven-day supply of wheels in boxcars between the supplying plant and Detroit, Boston, Norfolk, or wherever the assembly plant is located. Your boxcars become part of your assembly line, if you want to look at it that way.

We allow a small safety factor in our average transit time of a day or a day and a half, so that in case of an unforeseen delay in delivery, we have time to expedite and obtain the material for the plant by the time it is needed.

I think that is as good an explanation as I can give--to look at each supplier as a continuation of the assembly line.

In the case of major stampings, such as side panels, these major stampings travel on conveyers right down to the shipping area. There they are taken off the conveyers and loaded into boxcars. When the boxcars arrive at the assembly plant, they are switched into the plant and unloaded direct from the cars to the conveyers that feed the assembly lines.

QUESTION: In this particular case you did not state whether the tank was developed by the Ordnance Corps or whether it was developed by Ford itself.

MR. HARRIS: It was not developed by Ford. Our engineering comes through Chrysler. Fisher, Chrysler, and Ford are the three manufacturers of this particular tank. The engineering comes from Ordnance to Chrysler and they work together on the development and the changes.

QUESTION: Are all the parts used in that tank carried under the ordnance parts list? For instance, you have a part that happens to be a bearing section, which is used possibly someplace in your automotive vehicles and also may be used on some tank. Do you use the Ford part number or the Ordnance part number?

MR. HARRIS: We will use the Ordnance part number on all government contracts, because we buy those bearings against a government controlled purchase order.

QUESTION: You mentioned the fact that there were something like 7,700 change orders already on this particular tank. Can you tell us something about what those changes entailed and who pays for them?

MR. HARRIS: I am sure that we couldn't go through with any one tank order if we had to pay for the changes. Many of these changes

are more or less major. A good many of the changes are dimensional changes, minor changes.

But, as I said, if there are changes--I am not criticizing now the fact that there are changes, because I know they are also necessary in the case of commercial products even before we get into the production of the new Ford, new Mercury, or new Lincoln--I don't believe the percentage of changes in the government contracts is any greater than the number of changes that we have in our commercial products. In order to have progress, we must have changes. I am sure that those changes are necessary. So if you worry about them, you are just in a mess.

QUESTION: Would you expand your remarks a little bit further on "CMP"?

MR. HARRIS: It is very difficult to talk about that. We have commercial lines and we have government lines. If we had one or the other, I don't think CMP would be in our hair so much. But when you are trying to build 100 percent of what the boys over in the front office or in Washington want and CMP says: "Gee, that is fine. We will give you 80 percent to build 100 percent with, because we are going to squeeze some of the water out"--we have done pretty well in squeezing the water out.

I think most of the water is gone right at the present time and I think we all realize that we need this commercial production. I am convinced that it is almost a necessity. It may be necessary to make some changes. There are certain materials that are critical, such as copper and some types of steel.

This is no direct criticism of CMP or what it is trying to do, but I am convinced that we have a little bit too much of it sometimes.

QUESTION: Would you say something about your system of scheduling spare parts?

MR. HARRIS: Yes, to this extent--that each contract naturally differs; generally, spare parts are spelled out in relation to a contract. The contract will state so many spares or certain groups or sets of spares for the number of main product delivered or that a contract covers.

You do have to consider the time involved in obtaining the extra materials for the spares and the time it takes to manufacture and prepare them for shipment. You have to establish the lead time involved to put them through your program, so that they will be available in time to meet the government requests.

I know that at the beginning of World War II spares were more or less looked down upon. We realized within a few months that there wasn't

much use in having a plane, a tank, or a gun if a wheel fell off somewhere and there was noting with which to replace it. So spares after about six months' experience in the last war gained a high priority over the end product.

QUESTION: I am troubled by the statement that you made with regard to the expediter or follow-up man that you might have on the supplier. Where does he fit within your organization and what authority would he have? I know he has a very tough problem keeping the production line going.

MR. HARRIS: That is right. I skipped the whole problem of the follow-up of materials from the suppliers. You do have to follow them up from production control. When I say "production control," that is what we call it at Ford and at Chrysler they call it "planning". Within this production control responsibility lies the job of expediting materials, which is the follow-up man's responsibility.

There are two kinds of follow-up people: One is the fellow who runs the job from the desk; he watches the suppliers' shipments and "hollers" his head off very often and sends a wire to somebody and says, "You had better hurry and get my things in." Then there is the other type of expediter who is a pretty well-qualified engineer, whom we can send to these various suppliers' locations if they are falling behind; he will give them h--- but also will help; and he has the authority to help, in getting shipments up to where they belong.

Our whole system is based on the supplier doing his job. It doesn't take very long if the supplier is off schedule, for us to lose a lot of production.

QUESTION: Would you discuss the feasibility of this dual type of plant, where you run a civilian product in one part and maintain a tank line in another, even if it is not in operation? Say you have a tank line being set up with the tooling and the production methods and you are keeping up with any changes and maintaining it for the next 10 years--is it feasible?

MR. HARRIS: The Tank Plant that Chrysler had during World War II was left intact. Whether it has been maintained so that it is capable of producing tanks, I don't know.

I think it is feasible and practical. But when you are not in trouble, how do you convince the people that it is necessary to do these things? I think it is necessary to keep the equipment up, but again, we must have any knowledge in advance of what is planned for these facilities. We wouldn't have had as many tank changes if that had not been so. So your answer is as good as mine.

1152a

QUESTION: On each one of these items, taking the Idler spindle as an example, you apparently have three or four different record cards which are built up around that particular item. Do you do that for every individual piece that goes into a tank? Do you have that for every subassembly that goes into it in addition to the working drawing that is sent to the shop to make the parts by?

MR. HARRIS: We make one of those Material Record Cards for every part, every assembly, and every subassembly, so that we can control the flow of parts that go into the assembly or subassembly. We must have a record of what we want and what we have to manufacture, on every piece or assembly that goes into the end product.

All of our calculations, again, are based on the end products that are on order. So you must know the components that go into making up that order, because you have to schedule each machine operation and each assembly operation.

QUESTION: I am trying to follow this back along the line to what might be the weakest link. Would you say a little about what would happen in case of labor trouble, like a strike, in the business of one of your critical suppliers?

MR. HARRIS: Again, that is considered in relation to our dollar controls or money controls. Where there are protection factors for labor trouble and so on to be considered, we endeavor to establish the maximum feasible protection.

In commercial production--I can't say on government contracts--we have, whenever possible, two or more suppliers on volume production parts. In the case of tank parts, it would be costly to have more than one supplier because of the expense involved and such protection is not practicable. If we know that we are dealing with organizations that are apt to have labor troubles, say they have a contract with the union expiring in two or three months, we have to take those things into consideration in determining how much we will pay to have that protection, because of these unknown factors. We don't know whether they will have a strike and, if they do, whether it will last for a week, a month, or two months.

QUESTION: Are your quarterly controls of materials that are required developed pretty much along the lines of CMP?

MR. HARRIS: Your requirements, that is, the amount that you require through CMP, are developed through that method. There can be no other way to develop them.

For example, Canton uses steel in its forgings and steel is a controlled material. Based on the number of pieces that Canton must forge, and based on the over-all materials that go into the forgings,

1152e

plus other considerations, a determination must be made and the steel requirements set up following this method.

QUESTION: You mentioned earlier that when it comes time to buy, you consider each division of Ford as just another plant. In all your examples you included some other division of Ford. When you do have an outside concern, how do you go about establishing the production control in those outside firms?

MR. HARRIS: We do it exactly the same way with the outside suppliers as we do it with one of our own company suppliers. The minute that an order leaves Ford Motor Company--say it goes to Bower Roller Bearing--our problem of production scheduling is then finished. Our job then is to make Bower Roller Bearing deliver in accordance with what we asked for. It is Bower Roller Bearing's job to do its own production planning.

QUESTION: Is it all part of the negotiation?

MR. HARRIS: The negotiation of a commercial contract amounts to about this: the Purchasing Division sends out quotation requests to several different suppliers. The Purchasing Division will get back from those suppliers quotations on the products that it wants to buy from those suppliers. Then it makes up its mind, based on the price and the delivery, where it will buy them. Those things are all considered. Probably two suppliers will be chosen and 50 percent of the business goes to one and 50 percent of the business goes to the other.

The suppliers are given a blanket purchase order. The blanket purchase order specifies that "Over a specified period of time"--six or eight months, whichever is convenient--"they will furnish X percent of our production requirements." The actual commitments against those orders will be given to them on the Shipping Release and Commitment Authorization. In other words they have a blanket order, but they have no authority to go out and buy anything, fabricate anything, or ship anything without a Shipment Release and Planning and Commitment Authorization.

QUESTION: In connection with the CMP, how do you tie in your allotments and your suballotments? Say that you get an NPA allotment of steel and it goes down to a subcontractor, how do you tie that in with your materials control system which you have already explained?

MR. HARRIS: Again, I am not a CMP man, although CMP is part of our operation. Maybe I should explain it this way: Each one of these cards is identified as to the contract. The part numbers identify them. The usage records identify them. In other words the Material Record Card that you use will show it is a part that is used on a tank:

if it is one that is used on a wing assembly, it will show that. The part number identification will relate it back to the product, so that those orders within the Ford Motor Company are identified as "tank orders," or whatever contract it may be.

The CMP allotment is also identified as applying to the tank contract. By just looking at the customer's order you have an identification as to what contract these orders apply against.

COLONEL DIEHL: Mr. Harris, on behalf of the student body, the faculty, and for myself, I thank you for an outstanding discussion of this difficult problem of production scheduling.

(20 June 1952--750)s/fil