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### SECOND QUARTER PROGRESS REPORT - 1981

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RESEARCH AND DEVELOPMENT DEPARTMENT  
SECOND QUARTER PROGRESS REPORT - 1981

HIGHLIGHTS

| <u>Ammunition</u>                                                                                                                                                                                                                                                                                                  | <u>Page</u> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| ● Marketing has approved the appearance of the new unibody process corrugated 12 ga. field load, and Research has released drawings for Production tooling. Tooling for 8 and 20 ga. bodies is now being developed and some live firing tests have been performed on 20 ga. with no immediately apparent problems. | 3           |
| ● Load fitting tests with the new component wad in various brands of shells indicates that the diameter of the base of the shot pouch will have to be reduced slightly to fit properly in the PTL and rotary cam shells. A request for quotations for the Production mold is being prepared.                       | 4           |
| ● Research has completed the integral anvil battery cup press and die performance demonstration following production of 8,000,000 cups with acceptable tool costs. A strategy for introducing this product has been developed and approved by Management.                                                          | 6           |
| ● The marginal TLX primer mixture produced at Lonoke has been traced to impurities in the nitrocellulose. To correct this problem, a technical specification for purchasing has been prepared.                                                                                                                     | 7           |
| ● A new Hercules "Bulls Eye" type powder with special deterrent coatings has been tested in the "Scorpion" rim fire cartridge with positive ballistics results.                                                                                                                                                    | 8           |

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## HIGHLIGHTS

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| <u>Ammunition</u>                                                                                                                                                                                                       |             |
| ● Extended range center fire ammunition experimental work is underway to develop rifle cartridges with tapered heel bullets. These products will be designed to yield higher downrange velocity and increased accuracy. | 9           |
| ● Initial feasibility tests of a center fire modernization progressive draw process to manufacture center fire ammunition cases and bullet jackets are very encouraging.                                                | 10          |
| <u>Firearms</u>                                                                                                                                                                                                         |             |
| ● Design testing continues with four 3" magnum XSG autoloading shotguns. Approximately 600 rounds have been fired through each gun. The fabrication of eight new XSG's is on schedule.                                  | 11          |

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RESEARCH AND DEVELOPMENT

SECOND QUARTER PROGRESS REPORT - 1981

AMMUNITION

New Shotshell Unibody Process

The production prototype rotary cam machine for cold forming of HDPE shotshell bodies is in the final phase of check-out and debugging at EDL, in preparation for installation at Bridgeport during the third quarter. The machine is capable of producing four different plastic shotshell bodies simultaneously, at a production rate of 1000 pieces per minute. This new machine system will obsolete 10 machines used currently and reduce labor requirements by 15 manyears per year. Pretax savings on new investment of \$1,300M are forecasted to be \$750M per year.

One quadrant of 12 gauge tools has been run successfully at speed, producing good quality plastic bodies within dimensional specification tolerances. An extended process and product acceptance run is scheduled for early July, prior to shipment of the machine to Bridgeport in mid-July.

Tooling for the remaining gages is being developed on the semiworks unit, with emphasis currently on 20 and 8 gauge. 20 gauge bodies have been made on the semiworks unit and assembled with caps on the production assemble head and prime unit. Samples are now in test. Wall tensile strength is good at 22kpsi. Wad and load fit were also good. The work schedule has the objective of providing production tooling for 8 and 20 gauge for the fourth quarter start-up of the new process.

Marketing has approved the visual appearance of the corrugated shotshell bodies for field loads, and testing confirms that the product meets design objectives. As a result, 12 gauge tooling design for the rotary cam has been frozen, and drawings for production tooling have been released.

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### Polymer Process and Body Cutoff Study

A program has been initiated with ETL to develop a method of treating the internal surface of the shotshell body. Internal heat treating has been shown to substantially reduce the number of body cutoff failures which can occur in firing reloaded shells.

This program will also study methods to improve body performance and body manufacturing efficiency. The two aspects are strongly interrelated. As the tensile strength of the shell is increased through cold working, the frequency of body cutoffs in reloading decreases; however, the number of visual defects in the body is increased. The present level in the production process is already unacceptably high. If the causes of these visual defects can be determined and methods found for eliminating the causes, additional cold working could be done and the tensile strength increased.

This will be carried out in conjunction with ETL and other DuPont departments and Remington production. Other sources of body material and an improved polymer extrusion system are also under investigation. Reduction of the sources of visual defects and out-of-dimension slugs are major project goals.

### Wad Cost Reduction

The original intent of this program was to develop a low cost 12 gauge shotshell component wad. Emphasis is now being redirected toward a wad that could also be used in loaded rounds. Reduced wad costs will be achieved through reduced cycle time (12 sec. max.) and reduced weight. The part weight reduction will more than offset the higher price LLDPE material required for failure-free -20°F. performance. The wad will also handle 1 ounce of shot as well as the usual 1-1/8 ounces.

The compression section of the initial wads had too low a spring rate resulting in low crimp centers. The tooling was revised to stiffen the compression section. Evaluation of these wads with extreme maximum and minimum charges of shot and powder in both 1-1/8 and 1 ounce loads in various brands of shells and reloading machines is being conducted. The wad appears to be satisfactory in RXP® and WW shells with both the 1 and 1-1/8 ounce loads.

The base of the shot pouch is snug in some of the PTL shells and slightly tighter in the rotary cam shells. A reduction in diameter will be required to accommodate these shells.

#### Wad Cost Reduction - Cont'd

A request for quotation for a mold to fit production machinery is being prepared.

#### 21MM Seismic

The sales forecast for 1981 has been cut approximately in half to 1,150M rounds apparently due to less guns in the field than MAPCO had projected. Slightly over 700M rounds have been produced in 1981 and 500M rounds are currently in the warehouse. Over 300M primers are on hand for priming.

The technical data package was transmitted for most of the process. The data packages for high voltage inspection of dry assemblies and insulator forming will be transmitted when the equipment is installed. Information for the vendor-supplied contact button and support cup will be transmitted when acceptable product has been supplied. The process for manual resistance inspection of the shells was transmitted since the AH&P inspection device has not been developed.

HOB Industries submitted sample contact buttons which appear to be dimensionally acceptable but have not been works tested. An order for 750M primer cups has been placed and support cup tooling development work will commence upon completion of that order as some common tooling is used.

The insulator forming unit has been debugged and has produced over 500M units on the bench. A support frame is being vendor fabricated and will be installed when received.

Wads and slugs lodged in the barrel were encountered on several occasions in the field. Testing of returned product at -20°F has not yielded any defective ammunition to date. The defect was duplicated by reducing the primer charge weight substantially and testing at -20°F. This is the suspected cause. Tests indicate the #97 battery cup produces more uniform ballistics and may provide a slight safety factor. A pilot run of 170M primers was made and is being evaluated.

#### Asbestos Elimination

The objective of this program is to eliminate the dry molded asbestos basewad from Remington's shotshell products by conversion to a high density polyethylene component. At the Bridgeport Plant, all gauges with the exception of 8 and 10 have been converted and are in production.

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#### Asbestos Elimination - Cont'd

The recent product design modification which added primer bore prongs to the inner cap has appeared to solve the 8 gauge product integrity problem based on test firings of product assembled in the research semiworks heading press.

A modification to the Plant "versa-cutter" machine has now reduced cut slug skewness and length variability to acceptable limits for use at the AH&P operation.

An AH&P run of this product is now planned for July.

#### Rifled Slug Improvements

The objective of this program is to improve the terminal ballistics of rifled slugs in selected gauges. Heavier slugs for 12 and 20 gauge will provide more energy since velocity pressure and accuracy specifications will be maintained. Work on a 20 gauge 3/4 ounce slug is presently underway to replace the 5/8 ounce slug.

A large sample of experimental 20 gauge 3/4 ounce hollow point rifled slugs were produced early in May. Only minor machine adjustments were required to fabricate the slightly longer slug. Plant Ballistics developed a load which met Remington specifications for velocity and pressure. However, product acceptance tests of this load indicated unacceptable 50 yard accuracy performance. Several retests with different barrels were performed with similar results and it now appears that, rather than machine adjustments, tool redesign will be required to produce an accurate, increased weight 20 gauge slug.

Three new swaging punches have been designed and are now being made which will allow for an increase in slug weight to 3/4 ounce but will maintain the same exterior dimensions of the 5/8 ounce component. The punches will produce slugs with differing centers of gravity to explore the relationship of accuracy to this variable.

#### Integral Anvil Battery Cup

The objective of this program is to develop an integral anvil battery cup to reduce primer manufacturing costs, improve consistency of primer quality and provide greater opportunity for process automation.

#### Integral Anvil Battery Cup - Cont'd

The Lachaussee press and die have produced more than eight million cups. Tool costs were consistently at \$.25 per thousand acceptable parts with anvil support punches and flash hole piercing punches being the major contributors. Production personnel have been trained and have operated the equipment for a short period of time without Research assistance.

A strategy for product introduction has been developed. Approval has been granted to initially load promotional shot-shell on a limited basis without formal announcement. This will give Production experience in making components and permit them to develop accurate cost data. Effects of any process problems would also be minimized with this approach.

Research has begun to load experimental sample of 12, 16, and 20 gauge promotional ammunition for product acceptance testing. Each sample will be processed through normal approval channels prior to manufacturing product for sale. An announced introduction is scheduled for late next year after all improvements have been incorporated into the ABC primer design.

#### TLX Priming Mixture Process Evaluation

TLX is our designation for our patented primer mix wherein the final reaction takes place during drying. As a result, a safe mix which will not detonate or burn is handled in the process; and the final reaction takes place after the mix is placed in the primer cup.

As previously reported, the TLX mixture that was prepared and charged at Lonoke during February, proved difficult to handle presumably due to differences in the Nitrocellulose used at Lonoke. Now these differences have been verified. Marked differences in chargeability were seen in the TLX shotshell mixture made at Bridgeport containing both lots of nitrocellulose (Lonoke and Bridgeport). The mixture containing Lonoke nitrocellulose adhered to the knock-out pins with considerable tenacity resulting in partially filled primer cup plates. Chemical analysis of both lots revealed further compositional differences. A specification has been issued to Purchasing regarding future lots of nitrocellulose.

In order to further evaluate the TLX process, a drum of Bridgeport nitrocellulose will be shipped to that location and a special shotshell charging plate needed to achieve a nominal pellet weight of .98 grains is on order.

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#### TLX Priming Mixture Process Evaluation - Cont'd

Since TLX mixtures require longer mixing times than conventional mixtures, larger batch sizes are needed to maintain current production rates. To determine if any difficulties would be encountered with larger batches, a thirty-pound sample using the recently purchased, large mixing bowl was prepared and no major problems were found. Some electrical rewiring to the mixer is indicated due to the increased mixing loads.

The Ilion gallery test of 110M rounds of TLX primed 22 long rifle high velocity rim fire ammunition has been completed with positive results; the misfire rate was less than that encountered with current product.

Nedox® and Wearcoted® rim fire charging plates and knock-out pins have been received and will be tested in a production environment for improvement in the processing of TLX rim fire mixture at the charging machines. Internal lubricants, for blending into the TLX mixture are on order as an alternate or additional solution to the TLX adhesion problem.

#### TLX Priming Mixture Safety

A limited test to determine the safety aspects of TLX wet mix versus Eleyprime® premix with Polnol wet mix as a control gave the following results:

| <u>Initiator</u>  | <u>Polnol (Control)</u> | <u>Eleyprime®</u> |             |
|-------------------|-------------------------|-------------------|-------------|
| Direct Flame      | detonated               | burned            | no reaction |
| Mechanical Impact | no reaction             | detonated         | no reaction |
| Shotshell Primer  | detonated               | burned            | no reaction |
| #8 Blasting Cap   | detonated               | detonated         | no reaction |
| Static Charge     | detonated               | TBD               | no reaction |

Eleyprime registered Trademark for Eley Corporation (U.K.) patented primer mix process.

#### "Scorpion" Rim Fire Cartridge

The objective of this program is to develop a solid point truncated cone, high performance rim fire cartridge.

A few months ago, three powder samples specially prepared for "Scorpion" development work were received from Hercules and based on tests with handloads, all three powders appeared capable of obtaining "Scorpion" goal ballistics (1440 ft/sec), but with

"Scorpion" Rim Fire Cartridge - Cont'd

higher than acceptable charge weights. One of the powder samples (1293) was selected for blending with the faster, standard Hercules 1292 rim fire powder and several blends were prepared and tested. Results were disappointing; either the charge weights remained too high or when reduced for autoloader compatibility the ballistics did not meet the goal.

In the interim, Hercules has delivered another powder designated BS-184 and preliminary tests indicated the powder has promise. Thirty rounds were handloaded and gave the following results:

|                        | <u>Minimum</u> | <u>Maximum</u> | <u>Average</u> |
|------------------------|----------------|----------------|----------------|
| Muzzle Velocity (FPS)  | 1417           | 1480           | 1457           |
| Chamber Pressure (PSI) | 19,050         | 23,150         | 21,600         |
| Goal Velocity          | 1440 FPS       |                |                |

A 100-pound sample of the BS-184 powder was ordered for ballistics and autoloader assessment and delivery had been expected by the end of May. Difficulties at the Hercules plant have caused a four to six week delay in delivery and the experimental run is now scheduled for late July.

Extended Range Center Fire Ammunition

An extended range concept has been developed for center fire rifle ammunition products which should increase the customer's perceived value of Remington products. Eight popular cartridges are to be initially introduced containing tapered-heel bullets which will result in two "extended range" benefits: increased downrange velocity and superior accuracy performance. A total of nineteen cartridges will be involved in this concept.

Quantities of tapered heel bullets have been purchased from Sierra for evaluation in the eight cartridges and Hercules has agreed to develop some new rifle propellant powders for this product line. Research is investigating three options for achieving the desired bullet pull in finished cartridges: bullet cannelure, segmental crimp and controlled mouth anneal.

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357 Remington Maximum 158 Grain SJHP

High pressure problems after storage at elevated temperatures continue to be experienced with both WC680 and WC295 powder. Additional load development work has indicated that Valleyfield 2585 may be a candidate for this cartridge and further testing is in progress. Assistance from Hercules will be requested in a meeting to be held at Lonoke the week of June 22, 1981.

Progressive Shell Draw Development

Initial feasibility tests to demonstrate a new process and tooling for progressive shell draw of center fire brass cases and bullet jackets without interdraw anneals have been run at EDL. Results are encouraging; 11B cups, annealed once, were run very successfully. The equipment is being modified based on these tests to increase spring force in the knockout punches and automatic feeding is being added.

The current schedule is to complete development of two calibers (30-06 and .357 magnum) during the fourth quarter, 1981, and provide a data base for development of tooling for additional calibers.

## FIREARMS

### XSG/XPG Shotguns

New autoloading (XSG) and slide action (XPG) shotguns are being developed as potential replacements for the M/1100 and M/870. Objectives of the program include decreased weight, increased reliability, and reduced manufacturing cost. Completion of the preliminary design is scheduled for July.

Four 3" magnum XSG's have been field tested with four M/1100 3" guns as a control. Initial testing showed that the XSG needed a larger orifice to increase bolt velocity, and adjustments for feeding. After these adjustments were made, the XSG performed equally with the M/1100.

Work is continuing on improved gas system and feed system designs. Guns with these new designs will be ready for testing in July.

The fabrication of eight new XSG shotguns is on schedule. Four XPG shotguns will be delayed in order to concentrate on the XSG autoloaders.

Twenty-five XSG's are being fabricated, and are scheduled to be completed in September.

### Model 7400 (Autoloading) and Model 7600 (Pump Action) Center Fire Rifles

These new models were introduced in six popular calibers in the 1981 Model year, replacing the popular Models 742 and 760 Center Fire Rifles which were introduced in 1960 and 1952 respectively. We plan to expand the product line with additional caliber offerings, and with carbine and limited edition models.

Three new calibers are being developed for the 1983 and 1984 Model years. Eight guns have been chambered in both 25-06 and 7mm-08 calibers for test lab evaluation and qualification, leading to product performance acceptance in September. More extensive design modifications are required to develop the popular 223 caliber chambering for a carbine version of the Model 7400, including new breech bolts, a modified gas system, and a new magazine box. The prototype design of the new breech bolts has been completed and parts are being fabricated. Design of new magazine box, with a larger capacity and a new release for the hold-open mode of operation, is in progress, completion of the prototype design is scheduled for January, and product performance acceptance in September, 1982.

Model 7400 (Autoloading) and Model 7600 (Pump Action) Center  
Fire Rifles - Cont'd

Styling of the stocks and fore ends for the proposed Model 4 Limited Edition has been specified by Marketing, and prototypes are being fabricated. The stock will be a sanded Model 7400 stock with rosewood grip cap, presentation butt pad, no cheek piece, and a new checkering pattern. The Model 4 fore end design will be used, but with an improved finish, and no white line spacers.

Newcut continues to improve the quality of their etching. The latest receiver samples were well done, but lacking in artistic value compared to the Model 1100 Limited Edition design.

JPGlas:j1  
Attachment

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RESEARCH PERSONNEL

Remington Roll

|           | <u>5-31-81</u> | <u>6-30-81</u> | <u>Forecast</u><br><u>12-31-81</u> |
|-----------|----------------|----------------|------------------------------------|
| Exempt    | 64             | 64             | 63                                 |
| Nonexempt | 22             | 22*            | 22                                 |
| Wage      | 20             | 20             | 20                                 |
| Total     | <u>106</u>     | <u>106</u>     | <u>105</u>                         |

\*Does not include 2 LSE in Ammo.

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