

Highlights

<u>Firearms</u>	<u>Page</u>
• Shotguns - XSG (Autoloader) prototypes are complete and XPG (Pump Action) prototypes are nearing completion. Work is continuing on several contingency designs.	7
• Function and accuracy testing of the Bolt Action Carbine has been completed for most calibers. All drawings except the stock and magazine follower have been transmitted to Production.	7
• A maximum bolt to receiver clearance of .035 in. is required to keep the receiver stress at an acceptable level in the Model 870 Competition Trap.	8
• Prototype 1982 Ducks Unlimited Commemorative and Trade guns have been delivered to Marketing for review.	8
• Prototype upgraded Model 700's have been sent to Marketing for review.	8
• Model 552 receivers with deflectors attached by drive screws have been assembled and are awaiting test.	9
• The four-slide machine is being installed in the Research N/C area. Start up is expected in December.	9
• A preliminary economic evaluation of form rolling shows a \$280M annual savings and a 46% ROI.	9
• Progress on the Injection Molded Powder Metal Program is reported.	10

REMINGTON ARMS COMPANY

RESEARCH DEPARTMENT

FOURTH QUARTER PROGRESS REPORT - 1981

AMMUNITION

New Unibody Shotshell Process

The present RXP® process for manufacturing one-piece plastic shotshell bodies is not cost competitive due to high reject rates and low machine productivity. Relatively high cost two-piece plastic body constructions are employed in most of our shotshell products, and exclusively in gauges 8, 10, 16, 28 and .410. A new, high speed, 960 parts/min. machine for production of one piece plastic shotshell bodies in all gauges has been developed by the Engineering Development Laboratory, Bridgeport field group. The machine employs a rotating cam to optimally control draw rates of a HDPE slug through a four-step tool progression. Low reject rates have been demonstrated on prototype semiworks equipment, and tooling has been developed to produce higher tensile strengths to match the best offered by competition. The first machine is currently being installed at Bridgeport. First quarter, 1982 startup on 12 gauge unibodies is planned.

Tooling development for 20 gauge has been completed. Procurement of production tooling for 20 gauge is scheduled during 1Q-1982.

Development of 8, 28, .410, 16 and 10 gauge tooling will continue through 1Q-1983 on a volume priority basis, with production phase-in planned sequentially as tooling is procured.

Tooling development for 8, 28 and 16 gauges is in progress. A semiworks run of 8 gauge product has been completed, and product evaluation tests are currently in progress.

Experimental 28 gauge bodies are being developed on the semi-works equipment. Further tooling development to reduce mouth defects and fisheye rejects is in progress. "First-try" tooling for 16 gauge is 90% completed.

Polymer Process and Body Cutoff Study

The objectives of this program are to eliminate body cutoffs and increase productivity of the extrusion system. The effort has focused on improving the way in which Soltex HDPE is processed. The effort is being supported by Du Pont (ETL), and efforts have

Research Department

-1-

December 1981

Polymer Process and Body Cutoff Study - Cont'd

concentrated on (1) understanding extrusion dynamics to help increase productivity and (2) better filtration in an effort to reduce body cutoffs by permitting higher draw work ratios with minimum visual defects.

A major cause for extrudate regrinding is the result of out-of-specification slug dimensions. To more fully understand extrusion, a week long test was conducted at Du Pont's Pencader Pipe Division plant which extrudes pipe similar in size to Remington's. Remington's resin (Soltex) was used for the test. The objective was to determine what perturbations in the extruder and downstream draw process cause wall thickness variation. Some of the performance parameters and responses monitored include barrel and melt temperatures, die pressure, screw rpm, motor load, wall thickness, outside diameter and line speed. Upsets were purposely introduced into the system to determine the effect on the product and processing parameters. After analysis, a similar test will be conducted using an extruder at Bridgeport.

Several methods of reducing body cutoffs have been investigated in the past. The two most promising methods are to increase the strength of the shell wall and/or heat treat the inside surface of the shell. One way of increasing the strength without changing the plastic is to increase the work ratio. Current work ratios of about 4.2 (4.8 for rotary cam) can not be increased due to an unacceptable amount of body defects (fish-eyes). Examination of these defects has shown that a small particle has been associated with each one and the most of these particles are high in silicon and are larger than 50 microns in size. Current filter openings in the extruder are 100 microns. New filters (30 and 45 micron) are on order for testing.

Primer Basics

The objectives of this project are to develop a shotshell primer which will equal or surpass competitive primers from a performance standpoint and to develop basic information relative to primer design. This information will be useful in assessing and correcting future product and process problems and serve as background information for future primer design.

Both plants have been producing the new 117XA primer which employs a new mix formulation (1024), incorporating nitrocellulose, covered flash holes, and improved control of metal hardness and grain size. Lonoke has been experiencing ballistic problems in

Primer Basics - Cont'd

the form of occasionally low velocity shots. Bridgeport has not experienced the problem but the production level has been substantially less also. Many tests have been conducted to identify the cause of the occasionally low velocity shot or to reproduce it. The tests have not been conclusive as to cause. A comprehensive investigation of product and process variables is in progress in an attempt to improve performance of the 117XA primers.

Ballistic comparisons of 1024 mixture using four lots of nitrocellulose, three supplied by Du Pont and one by Hercules, are underway. The outcome of these tests will aid in establishing a specification for nitrocellulose and mixture weights. Results to date suggest that the "amber" NC (Du Pont) provides slightly better ignition than Hercules and the Lonoke plant reports a significant production uniformity improvement with "amber" vs. Du Pont "gray" NC previously used.

W.C. Morrison, Du Pont ESD consultant, has completed a comparison of Remington, Winchester, and Federal shotshell primers and analyzed the piercing mechanism.

The piercing failure mechanism can be described as the "squashing out" of a soft material, the primer cup, when compressed between two hard materials, the firing pin and primer anvil. This situation is aggravated when the anvil and firing pin tips do not line up. The primer cup material is then sheared.

He has found that most of the Federal primers that we believed had survived the pendulum gun piercing test had actually been pierced. The pierces, however, were sealed by the anvil, probably due to the rigidity of the anvil in the cups. The actual piercing mechanism is identical to that observed with Remington primers. The Remington primers sometimes show a tendency for the anvil to slide along the bottom of the primer cup during firing. This could account for the greater tendency of the Remington primers to leak gas after piercing.

Morrison's data, along with data obtained from a test evaluating the interactions of brass primer cups and anvils of varying hardnesses, will be analyzed in detail to help establish criteria for optimum mechanical aspects of primer design.

Integral Anvil Battery Cup

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

Research Department

-3-

December 1981

Integral Anvil Battery Cup - Cont'd

A misfire test was conducted at Ilion, with zero misfires observed from 97,500 rounds.

Production has been authorized to load four million 12 gauge promotional rounds with this new primer assuming satisfactory evaluation of an additional experimental run. This is scheduled to take place during the first half of 1982, depending upon production schedules. The purpose of the production run is to determine how efficiently Production can operate the anvil battery cup press and die.

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, 10 and 12 gauges 3" have been converted and are in production.

Taking advantage of "Versa Cutter" Machine modifications which have reduced cut slug skewness and new processing techniques which have improved dimensional control of the extrudate, a 20,000 round Simplex AH&P run of 8 gauge plastic basewad shells featuring a pronged reinforcement cap and an annular crimp at the upper edge of the outer cap has been completed. The primer bore prongs and cap crimp were modifications added to eliminate basewad movement, cap rotation and to improve head pull. Major emphasis during the experimental run was placed on the determination of allowable dimensional control limits for the basewad slugs. Samples were segregated by degree of basewad slug skewness and inside diameter variations and were then loaded in the Plant. The product is presently undergoing acceptance tests to determine basewad control limits that may be required in production. This work is expected to be completed during December. Results from a less extensive test performed by PE&C indicates that ballistics and function and casualty results from Plant loaded product was acceptable and in many cases superior to the present dry-molded basewad shell design.

It is expected that this process will be obsoleted by the new unibody process by year-end 1982.

Extended Range Center Fire

An "Extended Range" concept, (increased accuracy, flatter trajectory, and higher retained velocity), has been developed for center fire rifle cartridges. This product is expected to enjoy good customer response at a premium price and counters similar

Research Department

-4-

December 1981

Extended Range Center Fire - Cont'd

products offered by competition. Introduction of eight cartridges with purchased boattail bullets is planned for 1983 followed by an additional eleven cartridges in 1984.

The 223 Remington was loaded with 55 grain Sierra Spitzer boattail bullets and a new powder, HRP50 formulated by Hercules. Satisfactory accuracy and downrange velocity were measured during ballistic tests.

Several alternatives for achieving acceptable bullet pull with the purchased bullets have been evaluated. The method involving a light bullet cannelure is more suited to in-place manufacturing equipment than an approach requiring that cases be stress relief annealed. An experimental loading run on 7mmRem Mag 175 grain PSPBT cartridges will be conducted to evaluate both alternatives for bullet pull.

"VIPER" Rim Fire Cartridge

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

A 25,000 round experimental production run was completed in early October with the following specifications:

- Shell - Standard long with "U" headstamp
- Powder - Du Pont 8159
- Bullet - 36 grain, solid nose, truncated cone  
copper plate, double knurl, standard  
shoulder break, lead knife and crimp
- Velocity- 1385  $\pm$  47 fps control
- Accuracy (at 100') - 3.4" (SAAMI)  
2.72" (Remington)

Finished product met all preliminary ballistics, accuracy and function and casualty criteria.

In order to permit product announcement at the Outdoor Writer's Conference on November 17th, a more extensive, 375,000 round trial and pilot run of the subject cartridge was conducted in early November with no problems encountered. Comprehensive product evaluation testing indicated that the product was acceptable although some minor failure to feed problems in two handguns were observed. "Yellow Jacket" control also experienced these malfunctions because of the

Research Department

- 5 -

December 1981

"VIPER" Rim Fire Cartridge - Cont'd

truncated cone nose profile. A product evaluation report has been prepared (Test #224) and production startup is expected in February, 1982 when packaging material arrives.

Research Department

-6-

December 1981

FIREARMSXSG/XPG Shotguns

New autoloading (XSG) and slide action (XPG) shotguns are being developed as potential replacements for the M/1100's and M/870's, respectively. Objectives include decreased weight, increased reliability, and reduced manufacturing costs.

Fourteen prototype XSG's are complete and four prototype XPG's are near completion. These include a modified A3 locking system, a square wire action spring forward around the magazine tube, improvements to the fire control system (one-piece connector, improved trigger, and modified hammer), a barrel contour redesigned for weight reduction and strengthened in the chamber area, integral ejector, wide extractor, improved feed latch system, and simplified interceptor latch. Work is continuing on contingency designs for the locking, gas feed, and fire control systems.

The current XSG design satisfies all of the major program objectives. However, due to the significant capital investment projected for implementing the design and concern about value of the added features, contingency designs for reduced investment requirements are being evaluated.

Bolt Action Carbine

The Bolt Action Carbine is a short, lightweight center fire rifle being developed to replace the Model 600 which was discontinued in 1979. It will be strategically placed within the Model 700 line.

Function testing and accuracy have been completed with satisfactory results on all calibers except the 7mm-08 which is being retested with hand loads because of unsatisfactory accuracy using the factory 140 gr. load.

All drawings except those for the stock and magazine follower have been transmitted to Production. The stock is being completed on the computer to tie in with the master stock. Sample followers were not to dimensions and new parts will have to be obtained.

A new model, with the butt stock slimmed-down per Marketing's request, will be completed prior to the January Operations Committee meeting.

Model 870 Limited Edition

A special, high grade Model 870 shotgun has been proposed to commemorate the 75th anniversary of Remington's first slide-



Model 870 Limited Edition - Cont'd

action shotgun, the Model 10, introduced in 1907. This will be a follow-on to the Model 1100 and Model Four Limited Editions offered in 1981 and 1982, respectively.

Research is reviewing etched plates, illustrating the proposed receiver artwork. These plates were received from the vendor (Newcut) in November. The remaining parts for a prototype gun are currently available.

Model 870 Competition Trap Shotgun

The Competition Trap is a version of the standard Model 870 which has been modified to include a gas operated recoil mechanism. Small cracks were discovered on some receivers used in the 1981 Grand American Trap Shoot.

Test results indicated that the strain on the receiver increased as the clearance between the bolt and receiver increased. Further testing indicated that a maximum clearance of .035" would keep the strain at an acceptable level. Additional guns will be endurance tested to verify these results.

1982 Model 870 and 1100 Ducks Unlimited Shotguns

1982 will be the second year of a four year program to furnish special guns to the Ducks Unlimited organization. Guns planned for 1982 are as follows:

- M/870 - 12 ga. 3" Magnum Commemorative Dinner shotgun;
- M/870 - 12 ga. 3" Magnum (32" barrel) Trade Shotgun;
- M/870 - Lt 20 ga. (26" barrel) Special Dinner Shotgun.

Prototype Commemorative and Trade guns have been delivered to Marketing for review. The Special has been delayed until January because of a change requested by Ducks Unlimited.

Model 700 Upgrade

The Model 700 center fire is Remington's top-of-the-line bolt action rifle. To meet increasing competition, this model will be upgraded for 1983 introduction.

Research Department

- 8 -

December 1981

Model 700 Upgrade - Cont'd

Machined, no-bind, followers have been tested in all calibers with favorable results. The .222 caliber exhibited a spring related feeding problem which will require further development.

Prototype assemblies have been provided to Marketing for review.

Model 552

The Model 552 autoloading rim fire rifle has a deflector to divert bolt opening and spent cartridge ejection. This deflector is attached with two standard screws. However, the screws and deflector can be removed with no special tooling, thus exposing the shooter to a potential hazard from flying debris.

Replacement of the present screws with drive screws has been proposed. The drive screws would be considerably more difficult to remove than standard screws. Six receivers have had deflectors attached using drive screws, and are awaiting live round and pull testing.

Four-Slide Machine

In April 1980, Project TI-121 was approved to purchase and install a four-slide machine for the manufacture of prototype stamped parts, and, the manufacture of precision formed stampings for Production.

The four-slide machine has been delivered and is being installed in the Research N/C Shop. Start-up is expected in December.

New drawings of the M/7400 and 7600 long magazine followers, the first parts to be manufactured with this machine, has been transmitted. Other production parts, suitable for manufacture on the four-slide machine, are being investigated.

Form Rolling

Form rolling is a deformation process, similar to thread rolling, which may be applicable to manufacturing of symmetrical, cylindrical, parts such as firing pins.

Industrial Engineering has issued a preliminary evaluation, based on five parts (M/7400 firing pin, M/1100 firing pin, M/7400 ejector, M/1100 front trigger plate pin, and M/1100 rear trigger plate pin), which shows that a \$280M annual savings and a 46% ROI can be realized by successfully implementing form rolling technology.

Research Department

-9-

December 1981

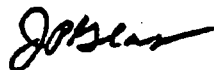
Form Rolling - Cont'd

Justification of a research project to provide for interactive part design and tool development will be evaluated.

Injection Molded Powder Metal Parts

Capital funds have been approved to provide research semiworks facilities at Ilion for development of the injection molded powder metal (and ceramics) parts technology licensed from Parmatech. Equipment for the thermal extraction process, including a binder burn-off oven, a hydrogen atmosphere (reducing) sintering furnace and a computer control system is scheduled for delivery in March. The injection molding machine, and associated equipment have been specified and procurement is in progress. Specifications for the solvent extraction equipment are being prepared.

Installation of the thermal extraction process equipment will follow building renovations which are expected to be completed by 2Q-1982. Start-up of the thermal extraction semiworks facilities is forecast in mid 2Q-1982, and solvent extraction facilities in late 3Q-1982.



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Director of Research

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Attachments

Research Department

-10-

December 1981

RESEARCH PERSONNEL

Remington Roll

	<u>Actual 11-30-81</u>	<u>Actual 12-31-81</u>	<u>Forecast 12-31-82</u>
EXEMPT	60	61	62
NONEXEMPT	21	21	20
WAGE	23	23	24
	<hr/>	<hr/>	<hr/>
TOTAL	104	105	106

Research Department

i

December 1981

PATENTS & TRADEMARKS

Summary of Activity

December 1981

Patent Applications Filed

N O N E

Trademark Applications Filed

N O N E

Patents Received

N O N E

Trademarks Received

"YELLOW JACKET" Registration No. 1,177,128  
Issued November 10, 1981  
In International Class 13 for Ammunition

Docket T-51 US

Inventions Reports

N O N E

Research Department

ii

December 1981