

RESEARCH DEPARTMENT

REMINGTON ARMS COMPANY, INC.

RESEARCH DEPARTMENT

FOURTH QUARTER PROGRESS REPORT - 1980

DECEMBER 1980

Distribution

J.P. McAndrews	J.E. Preiser
E.F. Barrett	L.J. Scott
E. Hooton, Jr.	J.R. Ayers
J.G. Williams	P.S. Helfert
E.B. Beattie	C.B. Workman
R.A. Partnoy	

NOTE: Please destroy the report when it has served your needs.

REMINGTON ARMS COMPANY
RESEARCH AND DEVELOPMENT
FOURTH QUARTER PROGRESS REPORT - 1980

HIGHLIGHTS

<u>AMMUNITION</u>	<u>PAGE</u>
• Testing of new unibody shotshell process 12 gauge field and target loads was completed.	4
• Extensive testing indicates a polymer change alone cannot guarantee a significant improve- ment in body quality. Other process and product changes are being investigated to supplement the polymer program.	4
• Process and product problems continue to be encountered with the 8 gauge conversion to plastic basewads.	5
• A new process to manufacture center fire ammu- nition cases and bullet jackets is under develop- ment.	5
• The improved target load primer has shown sensitivity equal or superior to competition under all test conditions.	6
• Progress on the anvil battery cup process development and product evaluation is reported.	6
• Test results with TLX in rim fire primers show encouraging results.	7
• A case for a new pistol and revolver cartridge; designated 357 Rem Max, has been developed.	8
• Progress on production of 21MM Seismic shells is reported.	7

Research Department

-1-

December 1980

HIGHLIGHTS

AMMUNITION - Cont'd

PAGE

- Progress on the development of a new rim fire cartridge is reported.

8

FIREARMS

- Production of Models 4, 7400 and Models 6, 7600 Center Fire Rifles has been authorized and announced. 9
- In tests of XSG prototype components, a long square-wire action spring, located forward around the magazine tube, continues to function well after over 5,000 baby magnum rounds. 10
- The revised Model 870 Competition Trap shotgun has been successfully tested and drawings transmitted to the Plant Trial and Pilot testing and warehousing is scheduled for after the first of the year. 10
- 40 Model 979 Seismic Guns required to satisfy the first two orders have been shipped and plans are being implemented to produce 100 more guns in 1981. 11
- New designs featuring separate bolt lock and fire control safety's for the Model 700 have been completed and tests are scheduled for January. 11
- Testing is complete, Marketing has approved artwork, and drawings and parts lists have been transmitted to Production for the first year Ducks Unlimited Shotguns. 12
- Based on favorable test results and cost estimates, electroless nickel plating has been recommended for piston seals for all Model 1100 Shotguns to reduce the potential for malfunctions due to corrosion of these components. 12

Research Department

-2-

December 1980

HIGHLIGHTS

FIREARMS - Cont'd

PAGE

- Redesign of Model 1100 links is being evaluated in an effort to reduce the frequency of fatigue related link failures. 13
- The Auto-Drill Line system is operating in the fully automatic mode and Plant personnel are being trained to operate the line 14
- The Schaevitz LVDT positioning system for the ASEA manipulator has been delivered and is being installed. Prove out is scheduled for January 1981 and trial and pilot for February 1981. 14

REMINGTON ARMS COMPANY
RESEARCH AND DEVELOPMENT
FOURTH QUARTER PROGRESS REPORT - 1980

AMMUNITION

New Unibody Shotshell Process

The improved one-piece plastic shotshell body process being developed will be capable of producing the complete range of shotshell specifications and is expected to result in an annual cost reduction of about one million dollars.

Testing of the 12 gauge product in high base, low base and target cap configurations was completed. Areas which will require product or process modification include cracked basewads which were traced to faulty heading pins, primer backouts which are correctable through a reduction in primer bore diameter, and cap deformation under high pressure conditions which will be eliminated by reducing the gap between the metal cap and plastic base of the body. The .410 bore bodies loaded in both body lengths, are currently being tested. The evaluation program is nearly three-quarters completed, with the experimental bodies being equal to or superior to the control in all respects tested to date.

Development of the full-scale prototype production equipment system, capable of producing shotshell bodies at a rate of 960 parts per minute, continues. Fabrication of the body forming machine is in progress at the vendors, and is scheduled for delivery in February, 1981. The heat set modules are on order with delivery expected in April, 1981, for the first module, and May, 1981, for the remaining three modules. The control system design is complete and hardware has been delivered. Start-up of the equipment at Bridgeport is scheduled for third quarter, 1981.

Polymer Improvement

After evaluating several dozen polymers, it was concluded that a trade-off will be required between processability and product quality. Polymers which significantly improve product quality do not process well and polymers which process most readily do not provide the desired product quality. Therefore, product and process modifications are being evaluated to supplement any proposed polymer change. Possible product changes include a thicker wall for added strength and modified skive for a controlled failure mode. Process changes under evaluation include a higher work ratio for increased longitudinal tensile

Research Department

- 4 -

December 1980

Polymer Improvement (Cont'd.)

strength, and a lower transverse work ratio to induce body splits as a controlled failure mode. Evaluation of these alternatives will be made by mid-January.

Asbestos Basewad Elimination

The objective of this program is to eliminate the dry molded asbestos basewad from Remington's shotshell products by conversion to high density polyethylene.

At the Bridgeport Plant, all gauges with the exception of 8 and 10 have been converted and are in production. Development of the 8 gauge plastic basewad is underway, but both process and product difficulties are being encountered. Tooling modifications at the extruder corrected unacceptable wall thickness variation; however, changes to the tube puller and slug cutter were not successful in improving slug length stability and skew. It now appears that this problem cannot be corrected without significant engineering effort on slug cut-off techniques. Results of 8 gauge plastic basewad product tests showed a high incidence of gas leakage between the body and cap, and basewad movement. Heading pin modifications eliminate the leaks, but basewad movement continued due to poor basewad-to-cap retainment. This deficiency can be attributed to the double cap which takes up all available free volume in the rim and thus, prevents basewad swaging into this section during the heading operation. As a result, acceptable product performance for current design 8 gauge product with a plastic basewad does not appear achievable. Therefore, two product design changes will be investigated to resolve the problem. These are to add primer bore prongs to the inner cap, and substitute a single piece cap with increased metal thickness to provide additional free volume in the rim. Both options are currently being investigated.

Center Fire Ammunition - Progressive Shell Draw Development

Development of an improved process for manufacturing center fire ammunition cases and bullet jackets is in progress at the EDL location. The process is based on progressive drawing of components without the customary interdraw anneals. This development is expected to greatly simplify manufacturing operations.

The press to be used with this process was delivered to Wilmington in November. The die set and tooling are in the design stage. The plan is to have all hardware ready for initial testing during the second quarter, 1981.

Research Department

- 5 -

December 1980

117X Primer

The objective of this effort is to develop a target load primer with sensitivity equal or superior to that of competition.

The objective has been achieved through a series of design changes including a soft (.035-.070 grain size), straight wall primer cup with .019" metal thickness; a .005" increase in the minor width of the anvil; a paper covered flash hole; and use of 1024 (8% nitrocellulose) priming mix.

To confirm both laboratory and limited field test results, the Lonoke and Bridgeport plants are manufacturing approximately 500,000 rounds each of 12 and 20 gauge target loads using the improved 117X primer. The field test on the 12 gauge will be conducted in mid-January. Pending positive test results, conversion to the 117X primer on a production basis can begin immediately for both 12 and 20 gauge target loads. Across-the-board conversion of field loads can proceed concurrently with the required load development work.

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.

To gain experience with the press, die set and product, four coils of copper plated steel and two coils of bare steel were run through the press to produce 1.5 million parts. Three small anvil support punches were broken, one on the last coil of copper plated steel and two with the bare steel which is harder. Otherwise, the die performed well. A 25 million piece experimental run is now in progress with the objective of fully establishing the recommended manufacturing process and more accurately defining process costs. This run will be completed by the end of the first quarter, 1981. Primers and loaded rounds produced with these battery cups will be used in target loads for a full scale marketing field evaluation. It has been agreed with Marketing that initial commercial introduction of the integral anvil battery cup will be made in target loads and expanded to other loaded round specifications upon successful process and field acceptance demonstration.

Loaded product development work is continuing with emphasis on sensitivity. Thirty-three thousand 12 gauge shells containing primers with integral anvil battery cups were loaded and used in a test conducted with guns fired from the shoulder. Misfire performance of the integral anvil primer exceeded standard Remington product, Remington Grand American product, Winchester plastic and Federal Champion paper shells.

Research Department

-6-

December 1980

TLX Priming Mixture

The purpose of this program is to improve primer manufacturing safety by developing a priming mixture which is significantly less sensitive to detonation during manufacture.

A successful plant run of 200,000 primed 22 caliber shells was made with the candidate rim fire mixture. The product was found to be equivalent to control samples for accuracy, ballistics, sensitivity, and compatibility with the automatic inspection system. Approximately 35,000 rounds containing this mixture were tested in pistols and rifles without a misfire or gun malfunction. Additional quantities of product are being sent to Ilion for gallery evaluation. In the meantime, emphasis is being increased on developing shotshell mix, which in preliminary work has shown encouraging results. It is anticipated that process feasibility and costs will be clearly defined by the end of March, 1981.

Product and Process Development

21MM Seismic

An electrically fired cartridge, designated as the 21MM seismic shell, has been developed for MAPCO for use in seismic exploration work. The shell requires an electric primer which is being developed and produced at Bridgeport, and a compatible gun and firing system designed at Ilion.

The third quarter production commitments of 50,000 rounds per month were met using research produced components and dry assemblies. About 400,000 rounds have been produced to date, and 24,000 rounds are currently in the warehouse. It is planned to produce 250,000 loaded rounds in January on production equipment now in start-up. The charging booth was converted to assemble the button, insulator and primer cup; and 170,000 of these assemblies were produced. Design rate of 50,000 assemblies per shift was achieved.

Hob Industries is behind schedule in producing sample components due to the interference of their other production demands. If no substantial progress is shown in their effort by January 1, termination of their contract will be considered. Initial investigation indicates that components can be fabricated on existing plant equipment with new die sets and tooling. Design and fabrication times of the die sets and tooling will be determined prior to any decision to terminate Hob. Sufficient components to meet first quarter 1981 requirements have been produced on research equipment and are on hand.

Research Department

-7-

December 1980

357 Rem. Max. 158 Grain SJHP

A case for this cartridge has been developed. It is made in a three-draw process and does not require a stress relief anneal. The case which has a thicker wall construction in the head and body than the standard 357 Magnum product has not split when fired in a hand gun at proof pressure. Production has been requested to conduct an experimental loading run. The resulting product will be tested for creep and accuracy in handguns in addition to the normal tests, and a quantity will be made available for Ruger evaluation.

"Scorpion" Rim Fire Cartridge

Ballistic results from an experimental autoloader run of the "Scorpion", a rim fire cartridge with solid point bullet, indicate that average velocity, using Du Pont 8159 propellant, was approximately 30 feet per second below the 1440 ft/sec. goal. Du Pont, Hercules and Olin were contacted in an attempt to identify a powder with improved ballistic properties. Hercules has agreed to forward three experimental samples of rim fire propellants for preliminary handloading tests. Because of requests by Remington and other rim fire cartridge manufacturers, Hercules is making a concerted effort to increase the efficiency of their rim fire propellants. To date, no propellant samples have been received from Du Pont although they have agreed to forward a modified version of 8159. Olin has no propellant available that would be compatible with our high speed equipment. Product evaluation tests on available powders will be conducted in January, 1981.

Research Department

- 8 -

December 1980

FIREARMS

NEW PRODUCT DEVELOPMENT

Model 7400 Autoloading and Model 7600 Slide Action Center Fire Rifles

These rifles have been developed as replacements for the current Model 742 and Model 760 rifles. Production of the new guns has commenced, a warehouse position established, and the new line of firearms was announced at the December Gun Writer's Seminar.

The Plant continues to experience excessive gallery rejects due to feeding malfunctions and a task force of Plant and Research personnel has been formed to identify causes of the problems and implement solutions. These malfunctions are due in part to variations in the magazine box which is a carryover design from the Models 742/760s. However, analysis of the gallery reject guns indicates that the rejects are due to cumulative effect from a variety of different sources. The task force is currently conducting a carefully monitored test program to identify the causes of malfunctions to establish actions required to decrease reject rates to an acceptable value (less than 5%). That test program is scheduled for completion by early February.

Plant and Research personnel have visited the magazine box vendor (H&P Die Stamping) to discuss problems with fabrication of the box. Efforts have centered on establishing acceptable gages for documenting critical dimensions on the box and providing the vendor and the Plant with an identical set of gages. Tests with 100 boxes from the most recent production lot indicate continuing problems due to variations in the spring and follower. Tests are continuing on a new box design featuring revised spring and follower geometries.

Preliminary drawings of the Limited Edition Model Four have been provided to Production for cost estimates. Marketing has approved use of a rosewood tip on the fore-end and is currently evaluating two receivers from Aurum Etching which feature revised artwork. Approval of receiver artwork and tests to demonstrate durability of the rosewood tip are the only items which remain to be completed.

Research Department

-9-

December 1980

XSG/XPG Shotguns

New autoloading (XSG) and slide action (XPG) Shotguns are being developed as potential replacements for the Model 1100s and Model 870s, respectively. Objectives of the program include decreased weight, increased reliability, and increased use of common parts for reduced manufacturing costs. New designs are in progress on the gas system, action spring, feeding system, and locking system. Completion of the preliminary design is scheduled for July 1981.

Weight reduction is being accomplished by redesign of the barrel and by movement of the action spring to a forward position around the magazine tube. A new gas system and action spring design are required to provide a system which will function with regular and magnum rounds with no manual adjustment. Work on a gas system metering and cut-off to control bolt velocities is continuing. In tests with a long square-wire action spring in a standard Model 1100 gas system, the spring has taken a 1.5 inch set and continues to function well after over 5,000 baby magnum rounds.

Tests are in progress on two locking systems; one a new rear lock design and the other a new front lock design. A prototype rear lock system exhibited a premature failure due to the locking block cam that picks up on the slide block. This design is being modified to pick up on the breech bolt. Tests have begun on a prototype of the new front lock design with successful functioning after one hundred 2-3/4 magnum rounds in combination with a long square-wire forward action spring.

Model 870 Competition Trap Shotgun

The Competition Trap Shotgun is a special single shot version of the present Model 870. It has a unique gas operated recoil reduction system. The gun was previewed at the Grand American Trap Shoot in August 1979 and announced in December 1979. During initial Trial and Pilot testing, problems were encountered with vent ribs and magazine caps becoming loose during test. Design revisions were required.

Revisions consisted of an elastomeric buffer ring added to the piston and a barrel support to retain the barrel. Dry cycle testing confirmed a successful design. These design changes were then successfully tested to 25,000 rounds each through two guns. Drawings have been transmitted to Process Engineering. Updated costs show no significant changes.

Research Department

-10-

December 1980

Model 870 Competition Trap Shotgun - Cont'd

Trial and pilot has commenced, with warehousing after the first of the year. Research is working with Production on long leadtime items. Presently we are drilling barrel support and gas cylinder positioning holes in barrels and increasing the size of the magazine tube hole in the barrel support.

Model 979 Seismic Gun

Forty guns required for the first two Seismic Gun orders have been delivered and plans are being implemented to produce 100 more guns in 1981. Initial orders have been placed with outside vendors for many of the smaller components required for the next 25 guns. These components will serve as a check on quality and dependability of those vendors for future orders.

During exploration work at Wellsville, N.Y., SSC experienced freezing of the firing pin mechanism in cold weather conditions. However, in two days of testing at Ilion, in below freezing temperatures, the firing pin mechanism of a clean breech block did not freeze up. When modifications were made to the 3 guns at Wellsville, N.Y., all were found to have firing pin mechanisms that had not been cleaned in a large number of rounds and it is presently assumed that this was the major cause of the freezing problem.

Cold weather kits incorporating a manual firing pin retract option have been developed which will enable a gun with a dirty firing pin mechanism to be shot in cold weather. The SSC guns at Wellsville were retrofitted with these kits and MAPCO has ordered 12 additional kits.

Twenty five percussion breech blocks will be shipped to MAPCO as soon as an instruction sheet for installation and adjustment of the fire-on-closing mechanism has been completed.

CURRENT PRODUCT DEVELOPMENT

Model 700 Bolt Lock and Fire Control

New bolt lock and fire control designs for the 700 Bolt Action Center Fire rifle have been developed as part of an ongoing program to improve the functional characteristics of our current firearms line.

Research Department

-11-

December 1980

Model 700 Bolt Lock and Fire Control - Cont'd

The objective of the bolt lock program is to give the shooter the ability to open and unload his firearm with the safety in the ON position. To do this, the bolt lock and safety on the Model 700 rifle have been designed to operate independently of each other. A spring actuated safety lever that is aesthetically acceptable combined with a reshaped bolt plug has been designed. Tests of the new safety lever combined with a new fire control featuring blocked trigger and sear will be initiated in January.

Model 1100 Ducks Unlimited

Marketing has developed a four year program with the option for a fifth year, to build special model shotguns for the Ducks Unlimited Organization. This program will consist of adding special features to our present shotguns. The Ducks Unlimited Organization will purchase a limited amount of these special shotguns which they plan to auction off at their fall dinner meetings. A different Trade Model in unlimited quantities is sold through normal trade channels and Remington contributes an amount to the Ducks Unlimited Organization for each one sold.

The programs will include three special production model shotguns each year. The first year there will be 2400 Commemorative Model 12 Ga. Magnum shotguns, 2400 Ducks Unlimited Special Model LT-20 shotguns, and approximately 8000 special Trade Model 1100 - 12 Ga. Magnum shotguns.

Models have been furnished to Marketing. Artwork for first year requirements for all three models has been agreed upon. Testing of an emblem fastened to the side of the Commemorative Model has been successfully completed.

Drawings and parts lists have been transmitted to Production. Receiver artwork for the Trade Model will be finished by the end of December. Warehousing is scheduled to begin in July for the Dinner shotguns, and October for the Trade shotguns.

Model 1100 Piston and Piston Seal Rusting

Over the years there have been a number of customer complaints concerning the failure of their guns to operate after a period of time in storage. The majority of the complaints come from coastal and high humidity areas. These complaints centered around parts of the gas system, pistons and piston seals, which become rusted while in the gas cylinder and/or on the magazine tube. These parts do not have a protective surface treatment or finish. During firing of the shotgun, they become covered with a burned powder residue. Subsequent exposure to moisture will cause rusting and over a period of time the parts can become inoperable. If the shotgun is dis-

Research Department

-12-

December 1980

Model 1100 Piston and Piston Seal Rusting

assembled after use and the parts are dried, there is very little chance of this happening.

Several methods have been investigated to circumvent this problem; including material changes and various surface treatments and finishes of the parts involved. The latest method has involved electroless nickel plating of the Piston and Piston Seal. Test results from in plant functional firing, environmental salt spray, and field testing have been positive. Use of electroless nickel plating has been recommended for the Pistons and Piston Seals of all Model 1100 shotguns.

Model 1100 Link Breakage

During a competitive shotgun evaluation this past year, a number of links were broken. Furthermore, returned parts that were replaced at the Grand American Trap Shoot this past summer included approximately 70 broken links. Plant records indicate that last year approximately 5000 links were sold as spare parts.

Fracture surface analysis on 10 of the Grand American parts by Du Pont ETL personnel indicate crack initiation by fatigue (cyclic) loading. Redesign of the links to decrease operating stresses and possible use of shotpeening are being investigated. A number of the present parts are being shotpeened in our Plant facilities.

A redesign of the link at the point of maximum breakage has been completed by adding approximately 17% more material. The vendor that presently makes this part has been requested to quote on making prototype parts to this latest design. He will also quote on making the present design from high carbon and alloy steels.

Process Development

Auto-Drill Line

The present method of preparing shotgun barrel blanks for the swaging machines is difficult to control and requires an unacceptably high degree of technical and engineering support. A drilling process has been developed utilizing proven machining methods and completely automatic part handling to replace the current process.

Research Department

-13-

December 1980

Auto-Drill Line

The Auto-Drill system is running in the fully automatic mode and Plant personnel are being trained to operate the line. Current production rates are approximately 800 - 1000 barrel blanks per day with a single shift operation. Total project cost is estimated to be less than that authorized on Part II and within the 10% limit. There are currently no major problems with the system. However, we are continuing to work with Plant personnel on a variety of minor problems and adjustments.

ASEA Manipulator

Rifle and shotgun receivers are rough and finish polished by a labor intensive hand process. ASEA Inc., an industrial manipulator manufacturer, demonstrated the technical capability of automatic polishing M/742 and M/760 receivers utilizing their industrial robot.

The economics on this project indicate a potential gross savings of \$61M per year and a ~~25% NROI~~ for completely polishing M/7400 and M/7600 receivers. Adequate finish has been demonstrated on M/7400 radii. Side panel tolerance problems will be overcome with the Schaevitz LVDT system now being installed.

System development completion and LVDT system prove out is scheduled for January 1981 and trial and pilot for February 1981.

Investigation of shotgun receiver polishing will be conducted by Research. Improved panel sizing and polish are being investigated by E.S.D.

The system will be available for limited production on a manual load basis for M/7400 - M/7600 receivers in the first half of 1981.