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REMINGTON ARMS COMPANY, INC.

RESEARCH DEPARTMENT

SECOND QUARTER PROGRESS REPORT - 1982

JUNE 1982

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RESEARCH AND DEVELOPMENT

SECOND QUARTER PROGRESS REPORT - 1982

HIGHLIGHTS

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Firearms	
• Five of the six XSG prototype shotguns have been completed and are being test fired to document function and endurance. Projected minimum capital investment to implement the XSG design into production has been reduced by 30%.	1
• Model 7400 Research prototypes in 25-06 and 7mm-08 calibers have been function tested. Test results were satisfactory.	1
• A prototype Model Four Carbine featuring an aluminum receiver reduces gun weight by 12 ounces.	1
• Model 870 Competition Trap endurance testing has been completed. One gun reached 50,000 rounds with no cracking and one sustained a cracked receiver at 40,000 rounds.	2
• Model 870 trial and pilot 1982 Ducks Unlimited Commemorative and Special Dinner models have been inspected and accepted. Warehousing began in June.	2
• Model 1100 prototype 1983 Ducks Unlimited Commemorative and Trade models have been furnished to Marketing.	3
• Model 700 Classic .257 Roberts (1982 Special) trial and pilot guns are being tested.	3
• Processing injection molded metallic components in continuous sintering furnaces looks very promising.	3
• Unground Model 870-1100 firing pins will be burnished using form-rolling techniques.	4

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HIGHLIGHTS

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Ammunition	
• New unibody process 2-3/4" 12 gauge product is being warehoused, 3" 12 gauge product is undergoing lot acceptance testing in Research, 20 gauge tooling is in the machine awaiting start-up, and 8 gauge tooling is being inspected prior to installation.	5
• The polymer support program equipped a Production extruder at Bridgeport with a prototype ultrasonics wall thickness control system. Improved yields at substantially improved throughput rates have been demonstrated.	6
• "Premier" shotshell equipment processing problems have been resolved for the buffering and sealing of magnum loads. A project for additional equipment to meet the forecast is being prepared by Corporate Engineering. Hand load development of all non-magnum loads is complete.	7
• The Extended Range Center Fire initial product introduction has been postponed until 1984.	8
• One ounce Target Load development indicates that the RTL wad is required for good load fit. A test loading run is planned.	8
• Primer Improvement Program testing continues to indicate that primer piercing improvement can be achieved by using domed primer cups.	8
• Forty-one thousand rounds of 357 Remington Maximum 158 SJHP were shipped to Sturm Ruger. Sturm Ruger was satisfied with the performance of this ammunition.	9

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FIREARMS

XSG/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.

Five of six planned XSG prototype shotguns have been completed and test fired to a combined total of 26,000 magnum rounds. Testing will be continued to establish endurance levels. These six prototypes are being fabricated and tested to provide information on design alternatives for locking, feed, and action systems. Completion of the sixth design has been delayed for approximately one month due to priority on plant support activity.

The projected minimum capital investment required to implement the XSG design has been reduced from $5MM to approximately $3.5MM by design revisions. Further reduction may be possible and a model gun is being fabricated for function and endurance testing of design revisions.

Other design alternatives being considered include use of an aluminum receiver and styling revisions to produce a distinctively different appearance. Aluminum receivers will provide further weight reduction by approximately one pound. Prototypes with aluminum receivers have performed satisfactorily for up to 6,500 magnum rounds with no significant damage to the receiver.

Model 7400 and Model 7600 Center Fire Rifles

The Model 7400 and 7600 rifles were developed as replacements for the Model 742 and 760, respectively, and were introduced into the product line in 1981. The Plant experienced a variety of start-up problems which have required continuing Research support. Furthermore, new calibers and carbine versions are being developed for future introduction.

Model 7400 Research prototypes in 25-06 and 7mm-08 calibers have been function tested. Test results were satisfactory. Introduction of these new calibers is planned for 1984.

Model Four Carbine

Prototype Model Four carbines have been fabricated for review by Marketing personnel, including one design featuring an aluminum receiver which reduces overall gun weight by 12 ounces. Endurance test results with the aluminum receiver prototype have been satisfactory.

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Bolt Action Rifles

The objective of this program is to design a bolt action rifle to replace the Model 700. Major features incorporated into the new design include an octagonal receiver, "diamond finish" barrel, and a restyled stock.

Model 870 Competition Trap Shotgun

The Competition Trap Shotgun is a version of the standard Model 870 that has been modified to include a gas operated recoil mechanism. At the 1981 Grand American Trap Shoot small cracks were discovered on some receivers. During subsequent testing it was found that close control of bolt-receiver dimensions and increasing the bolt height eliminated this condition.

Endurance testing of two guns with the new bolt to receiver clearance dimensions has been completed. Testing was continued past the 25,000 round design test, to 50,000 rounds or failure. One gun reached 50,000 rounds satisfactorily. The other gun had a crack in the receiver at 40,000 rounds.

Marketing has indicated an interest in a 28" barrel for use with the Competition Trap Shotgun. (The standard barrel length is 30".) Prototypes of the 28" improved modified choke barrel have been fabricated and pattern tested. Point of impact and pattern percentage test results were within specification. These prototypes will be provided to Marketing for field tests.

Model 870 Ducks Unlimited Shotguns - 1982

1982 will be the second year of a four year program to furnish special shotguns to the Ducks Unlimited Organization. The following list of guns will be produced this year:

- Model 870 - 12 Ga. 3" Magnum - Commemorative Dinner Gun
- Model 870 - 20 Ga. Lightweight - Special Dinner Gun
- Model 870 - 12 Ga. 3" Magnum (32" barrel) - Trade Gun

Commemorative and Special trial and pilot models have been inspected and accepted. Revised panel roll mark drawings for the Trade model have been completed and one will be completed by August 15, for 1983 catalog photographing.

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Model 1100 Ducks Unlimited Shotguns - 1983

1983 will be the third year of a four year program to furnish special shotguns to the Ducks Unlimited Organization. The following guns will be produced for 1983:

- Model 1100 - 12 Ga. 30" Full V.R. barrel - Commemorative Dinner Gun
- Model 1100 - LT-20 Ltd. - 23" Modified V.R. barrel (short stock) - Special Dinner Gun
- Model 1100 - 12 Ga. 26" Full V.R. barrel - Trade Gun

Prototype models of the Commemorative and Trade models have been furnished to Marketing and a model of the Special Dinner Gun has been completed. Parts lists will be furnished to Process Engineering by June 30 for preparing costs.

Model 700 Classic in .257 Roberts Caliber

The .257 Roberts caliber is a non-catalog item offered on a one-time basis for 1982.

Trial and pilot guns are being evaluated by Research. Warehousing is scheduled for July.

Injection Molding of Metal and Ceramic Components

Manufacturing parts from near net-shape blanks can provide a significant savings in material and labor cost. Processes such as forgings and investment castings produce blanks that are fairly expensive and still require secondary operations. Conventional powder metallurgy will provide blanks of near net-shape at a resonable cost, but at a sacrifice in physical properties and surface appearance. Parmatech Corporation has developed a process for injection molding very fine powders to produce close tolerance parts with near wrought material properties, at a cost between conventional powder metallurgy and investment casting. Remington has obtained a non-exclusive license to use the process to make parts for commercial markets.

Start-up of the pilot line is proceeding on schedule. The first part of the process verification phase has been completed with Witec 2% and 50% Ni-Fe test bars and summary report issued. Mechanical testing produced results comparable to what Witec advertises. Dimensional control, however, was poorer than expected. Tighter molding control will be tried to improve dimensional control.

Parmatech 2% Ni-Fe test bars have been molded. They will be sent to EDL for debinderizing, and returned to Ilion for sintering.

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Form-Rolling

Form-rolling is a deformation process, similar to thread rolling, which may be applicable to manufacturing symmetrical, basically cylindrical parts such as firing pins. A preliminary evaluation of five parts, presently produced by other processes, shows a $280M annual savings, and a 46% R.O.I. Initial development work is being done jointly with Rol-Flo Engineering, Inc., West Kingston, Rhode Island. The successful application of form-rolling to make trigger plate pins has been demonstrated.

A purchase order has been issued for unground Model 870-1100 firing pins to be subsequently burnished by Rol-Flo. Omitting the grind will reduce the purchase price by at least $.09 each. At 1981 production rates (approximately 340M) that is equivalent to an annual savings of $31M.

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AMMUNITION

New Unibody Shotshell Process

For the past decade, Remington has supported two shotshell body processes: the SP process for two-piece construction and the RXP® process for an integrated body-basewad one-piece design. While the latter is superior in design, inherent process disadvantages restrict its application to limited 12 and 20 gauge product specifications. Difficulty in producing straight bodies and extremely tight slug tolerances are major controlling factors. The new unibody shotshell process has been developed to overcome these disadvantages, be cost competitive and permit production of quality unibody shotshells in all gauges.

Approximately four million 2-3/4" 12 gauge bodies have been fabricated on the Bridgeport production machine with generally excellent product results.

A quantity of 3" 12 gauge bodies has also been produced and product loaded by Production is currently under test by Research.

To accommodate heavy high performance loads, such as the steel shot or buffered 1-7/8 oz. heavy magnums, a 12 gauge body with a larger internal volume is required. Some experimental bodies have been produced on semiworks equipment and are under test. This product is scheduled for production start-up in November of this year.

One quadrant (three stations) of the prototype machine has been tooled for 20 gauge production and a trial and pilot run is scheduled for July.

An experimental run of smooth 8 gauge bodies from semiworks equipment have been assembled and loaded on production equipment. Early testing of this product has revealed gas leaks and loose heads which are probably interrelated and created in the assemble, head and prime operation. Previous samples did not exhibit these problems. Similar problems observed in 12 and 20 gauges were readily corrected by minor changes in assemble, head and prime tooling.

Production tools for 8 gauge body forming have been received and inspected. Some must be returned to the vendor for correction of dimensions and hardness. These tools are scheduled for completion by mid-July.

Reloading performance of experimental 16 gauge semiworks product has been improved markedly through tooling and skiving cutter changes. High base and low base cap configurations have recently been tested and appear acceptable except for occasional loose heads. Correction is being pursued through changes in the heading operation.

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New Unibody Shotshell Process - Cont'd

28 gauge, reloading life of experimental semiworks samples is well beyond current product, but the failure mode on some bodies is indicative of low tensile strength. Improvement is being sought through tooling changes. An experimental run in semiworks is scheduled for July.

Development of 10 gauge is continuing with steady progress being made toward goal dimensions. The experimental run is scheduled for August.

Early in the program, .410 bore product was produced in semiworks to demonstrate feasibility of producing straight bodies. Although this work was successful, the bodies produced did not offer an acceptable reloading life. This work preceded our current technology on increased work ratios which permit substantially higher tensile strength. Initial tooling for continued development on .410 bore is now approximately 75% complete. An experimental run of the improved product is anticipated in September.

Polymer Support Program

The objectives of this program are to eliminate body cutoffs which occur at times in reloading and to increase the productivity of the body manufacturing system through improvements in the extrusion area. Heavy emphasis has been placed on dimensional control via an understanding of extrusion dynamics and on control system development.

ETL has essentially completed their program and presented a summary of their findings (final report is forthcoming). ETL concludes that the extruder basically performs very well but cannot, by itself, control the mass flow rate to the required accuracy of 0.8%. Bubble diameter measurement is currently used to control the system and is sensitive to temperature and viscosity changes and therefore is not an accurate measure of mass flow rate. Gear pumps (which are expensive) or improved control systems are required. Tests on Lonoke's gear pump system indicate that the pump accurately controls the mass flow rate, however, the bubble control system may actually be detrimental to obtaining accurate dimensions.

A relatively low cost experimental control system has been installed on line "D" at Bridgeport. This system controls the wall thickness as the extruded pipe enters the cooling tank. Wall thickness is measured with ultrasonics at this location and controlled by adjusting die pressure through manipulation of screw speed. The puller speed is held constant. Substantial rate increases have been achieved with significant increases in yield. Additional improvements such as temperature compensation for the ultrasonics are planned.

Final recommendations for converting additional extruders, including the gear pump systems at Lonoke, are being developed.

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"Premier" Shotshell Program (Previously Extended Range Shotshell)

Remington does not currently offer a complete line of field shotshell loads to match competitive offerings. A Marketing appraisal indicates significant ammunition sales could be lost if Remington does not expand its line in the near future. Marketing has designated the proposed improved line as "Premier".

It is planned to offer two versions of buffered magnums: "Premier" with plated shot and "Nitro Magnum" with unplated shot. In addition, non-magnum "Premier" with copper plated and hard shot, not buffered, will be offered.

Federal "Premium" and "Super Magnum" shotshells have been evaluated, resulting in a definition of short term specifications to match competitive product performance (i.e., antimony levels, copper plating thichness, and buffer).

All non-magnum loads in 12 and 20 gauge with plated and hardened shot with no buffering have been developed. This represents all Lonoke production.

Buffered magnum loads in 12 and 20 gauge with and without plated shot are being developed in hand loads with completion expected in July. Development of 10 gauge will begin following availability of new unibody shells which are expected in August.

The 1-7/8 oz. 12 gauge 3" buffered magnum load is key to the Marketing plan. A new larger volume shell is being developed for this load due to insufficient capacity in the standard 3" shell. Consistent acceptable ballistics have not been demonstrated to date, and additional powder/primer combinations are being evaluated.

The 20 gauge 3" (nominal) body which is currently produced to 2-7/8" also has insufficient capacity for its buffered load. It has been recommended that the length be increased to 3" which would match competition and be equivalent to SAAMI minimum chamber specifications. This presents an unanticipated addition to the new unibody development program.

Addressing the area of process changes required to expedite the "Premier" line, a method of buffering shot sizes BB through 7-1/2 has been demonstrated and is in production. Further improvements are being evaluated which could reduce the cost of additional equipment expenditures for meeting the forecast. An acceptable method of sealing the crimp with Elvace has been demonstrated and is in production.

For the non-magnum product (Lonoke only), hardened shot is required. Lonoke has demonstrated their ability to drop larger shot with the necessary antimony levels. They do not anticipate any problems dropping shot sizes 4 and smaller with the specified level.

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"Premier" Shotshell Program - Cont'd

A project for appropriating the capital necessary to modify the loaders for the "Premier" shotshell is being prepared by Corporate Engineering. It is anticipated the necessary Duplex modifications will be completed in the fourth quarter of 1982. A proposal to move up the original scheduled completion date for the Simplex from the first quarter of 1983 to the third quarter of 1982 has been given to Production.

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 program offering improved down range ballistics is intended to counter similar competitive products. Introduction of eight cartridges with purchased boattail bullets was originally planned for 1983 followed by an additional 11 cartridges in 1984.

The initial eight cartridge introduction has been postponed probably until 1984 pending results of a center fire case basics analysis. Product and machine modification developments are continuing.

12 Gauge 1 Ounce Target Load

Development work on this load is geared toward a September 1st production start-up. Tests of handloads have indicated that to obtain proper load fit with a 1 oz. payload in a PTL shell, an RTL wad, with its increased bridge section length is necessary to eliminate low centers. All tests to date, including patterns, with this PTL shell/RTL wad combination are acceptable.

Wads are currently being molded at Lonoke in preparation for an experimental loading run. The RTL wad has never been used in production loads and some feeding problems are anticipated.

Primer Improvement Program

The objective of this program is to develop a shotshell primer which will equal or surpass competitive primers from a performance standpoint and to develop basic interrelationships between major variables in primer design. This information is necessary to ensure that future primer modifications do not create product and process problems and also to serve as background information for future primer design.

Du Pont-supplied NC (ground rifle powder) from SNPE will probably no longer be available due to what appears to be complications caused by French regulations. We currently have enough NC on hand to produce about 250-300MM primers. Several new sources of supply are being investigated and samples were received from Hercules, "EXPRO" (formerly Valleyfield) and China. A sample of .007" diameter uncoated ball powder from Olin has been shipped and will be tested in early July.

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Primer Improvement Program - Cont'd

Tests are being conducted to determine the contribution that each of the ingredients in the mixture makes in ballistics performance. Qualitatively, for the fuels, the order of decreasing contribution to -20°F. ballistic improvement in target loads is Al>NC>Sb_2S_3. Similar tests are currently being conducted with Magnum loads. Tests at -20°F. in both target loads and SP12 Mag. indicate that aluminum is mainly responsible for breech flash. One mixture which was high in Polnol (54% vs. the usual 38%) and high in aluminum was an exception. This mixture was ballistically superior to other mixtures but would be difficult to charge due to the high level of moisture.

A significant improvement in primer piercing was achieved through the use of domed cups. The cups were made at Lonoke with standard tooling, the only modification being a radius ground on the end of the punch. The primers were tested in the pierced pendulum gun and the domed cup reduced piercing by about 50%. The sensitivity as tested in off-center loaded round firing showed only a slight decrease. Different length cups and metal thicknesses are currently being produced in an attempt to regain this loss in sensitivity and further improve piercing.

357 Remington Maximum 158 SJHP

Two lots of WC 669 propellant have been evaluated ballistically with satisfactory results. A third lot (No. 21) of powder is available in production quantities and a sample of two pounds is being tested.

An experimental run (10M) of the modified 158 SJHP bullet will be made and tested.

Two Ruger production revolvers have been received and will be used for testing the gun-cartridge system.

A trial and pilot run consisting of 200M service cartridges and 40M proof loads is scheduled to begin in the near future. Actual start of the trial and pilot run will be contingent upon performance of WC 669, Lot No. 21.

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RESEARCH PERSONNEL

Remington Roll

	Actual 5-31-82	Actual 6-30-82	Forecast 12-31-82
EXEMPT	65	64	69
NONEXEMPT	22	23	23
WAGE ROLL	25	24	24
Total	112	111	116

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PATENTS & TRADEMARKS

Summary of Activity

June 1982

Patent Applications Filed

N O N E

Trademark Applications Filed

"REMINGTON" (word) filed in Class 8 for Pocket and Hunting Knives — U.S.A. T-1 US #11

Patents Received

RECOIL-REDUCING AND PISTON SHOCK ABSORBING MECHANISM — RA-0200 Mexico, Sweden
Hasypany
ABSTRACT: The recoil-reducing system now in use in the Model 870 "Competition" trap gun. A free gas piston is driven rearwardly by tapped propellant gases, which concurrently apply a forward thrust against a gas cylinder. This lowers the peak recoil force, and delays the application of the recoil energy against the shooter's shoulder, so that recoil sensation is significantly reduced.

EXTRACTOR ARRANGEMENT FOR FIREARMS — RA-0228A Canada CIP
Rowlands
ABSTRACT: A cartridge extractor, developed for Models 7400 and 7600, is assembled in a shrouded bolt face simply by snapping it in place. No rivet is required, which will greatly facilitate replacement in the field.

Trademarks Received

N O N E

Inventions Reports

N O N E

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