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FIREARMS RESEARCH DIVISION

RESEARCH DEPARTMENT

THIRD QUARTER PROGRESS REPORT - 1982

SEPTEMBER 1982

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HIGHLIGHTSFirearms ResearchPage

- A prototype Model 1100 12 ga. Special - Field shotgun has been approved by Management. Parts and drawings are being completed for testing and transmittal. 4
- A joint program has been initiated with Ammunition Research to develop electric ignition firearms and ammunition for sporting applications. Initial development will concentrate on shotgun applications. 4
- Design is in progress on three different prototype bolt action rifles for replacement of the Model 700 BDL in 1985. Completion of prototype rifles is scheduled for February. 4
- Model Seven Lightweight Rifles in 7mm-08 caliber are being assembled for the 1982 Gun Writers' Seminar in November. Production expects to complete trial and pilot of the .308 caliber during October. 5
- Model 700 ADL Restyle is being tested with long action stamped no-bind followers. Three 30-06 caliber rifles have been completed for the Writers' Seminar. 5
- Model 1100/870 - 20 gauge Lightweight shotguns with the modified choke barrels do not meet pattern density specifications. Competitive barrels are being shot to compare results. 5
- Model 1100 prototype models of the 1983 Ducks Unlimited Commemorative guns have been completed and furnished to Marketing. 6
- A CNC machine has been identified which will meet all of the goals of the cut checkering machine development program. An Italian machine has been identified which also looks promising. 6
- A pilot run is scheduled to burnish shotgun firing pins by form-rolling. 6

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Firearms ModernizationPage

- Receiver Flexible Manufacturing System

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Final vendor selection for the prototype CNC machining center is expected in October. The construction cost estimate for the prototype system is progressing on schedule.

- CNC Long Stock Inletter

8

The CNC router for secondary machining of long stocks is scheduled for delivery in December. Site preparations are progressing on schedule.

- GFM Automation

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The construction cost estimate for the prototype GFM automation system is complete. The Appropriation Request will be ready for approval in October.

Ammunition Research

- New Unibody Process 12 and 20 ga. product was in production in late August when the machine was shut down due to a crosshead roller shaft failure. Tooling for 8 ga. production requires slight additional trimming. Orders have been placed for 16 ga. production tooling. Other gauges are progressing in semiworks.

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- Handloaded samples of all "Premier" magnum and non-magnum shotshell (except 10 ga.) have been successfully demonstrated at test temperatures. The Cu plating and antimony specifications have been transmitted to Production.

11

- Testing of the 12 ga. 1 oz. Target Load gives product performance superior to Winchester at -20°F. Trial and Pilot run is scheduled for November.

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Ammunition Research - Cont'd

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- Improvements to integral anvil battery cup integrity should be achieved before production levels extend beyond trial runs. 11
- Primer Improvement Program testing indicates that selection of NC is narrowing to Olin, however, testing of a new fuelless mixture shows that NC may not be necessary. A designed experiment produced primer samples which surpassed Federal in piercing-sensitivity balance. 12
- Velocity of the 357 Rem. Max. can be increased to 1800 fps. 12
- The blown primer laser inspection unit for the Lachaussee loader has been modified to reliably detect blown primers of the paper covered flash hole variety, at loader speeds. 12
- The six prototype machines that make up the Center Fire Modernization program are in various stages of startup at Lonoke. 13

Specialty Metal Products Research

- Development of a process for injection molding components is receiving top priority. Parmatech equipment should be operational in October. 14
- A fourth set of powder metal samples has been shipped for cryogenic processing by an external vendor. 14
- Research is in progress to investigate coatings to reduce corrosion of monel stainless steel powder metal parts. 14

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FIREARMSModel 1100 12 Ga. and LT-20 Special Shotguns

The Model 1100 Special is being developed to offer the shooter a lighter weight (7-1/2 lb.), faster pointing M/1100 with a significant change in appearance. It is intended to supplement the current Model 1100 line. As currently defined, the gun features a 21" barrel, a slimmed down and shortened fore-end, English stock, cut checkering, medium gloss finish, and no scroll marking. Introduction in 12 and 20 ga. is planned for 1983. Extension to Deer and Waterfowl Model 1100's and a complementary series in the Model 870 is planned for 1984 through 1986.

A prototype of the Model 1100 Special - Field, 12 ga. has been approved by Management. Additional prototypes are being prepared for function testing. Model drawings are being completed for design transmittal in October. Warehousing of guns is scheduled for June, 1983.

Electric Ignition Shotgun

A joint program has been initiated with Ammunition Research to develop electric ignition firearms and ammunition for sporting applications. Initial development will concentrate on shotgun applications and will provide the basis for a new generation of sporting firearms. Use of electric ignition will provide advantages in cost, safety, design simplification, and styling flexibility. Preliminary studies will employ the existing electric primer used in the Remington 8 Ga. Industrial Gun. However, long range development will concentrate on a primer and fire control design which can be used in both shotgun and center fire rifle applications. Introduction of the first generation shotgun is scheduled for 1986.

New Bolt Action Rifle

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

Three different prototype rifles are being developed to illustrate design options including revisions to receiver contour, stock shape, feed system, safety, and fire control. Completion of these prototypes, include custom stock and receiver designs by Bob Emmons, has been delayed until February. An additional sample from Emmons, which will feature revisions to the stock to facilitate high volume production is expected this month.

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Model Seven Lightweight

The Model Seven Lightweight is a short, bolt action, center fire carbine rifle, intended to round out the Model 700 product line.

Forty Model Seven Lightweight Rifles in 7mm-08 caliber were shipped from Ilion on October 1, along with 4,000 rounds of ammunition for the 1982 Gun Writers' Seminar in November.

Production is running a trial and pilot of the Model Seven Lightweight in .308 caliber. Expected completion is early October.

New .222 caliber follower springs are expected in October. Tests will be run with current and new no-bind followers.

Model 700 ADL Restyle

The Model 700 Restyle is an upgraded ADL version which will feature improved wood and metal finishes.

Prototype ADL long action no-bind stamped followers, with the original formed spring stop surfaces were tested using the current production magazine spring. Feeding from the magazine was satisfactory and only one gun showed a slight shifting of the magazine spring. An endurance test is being run on this gun to determine the total amount of magazine spring movement.

Experimental short action .222 Rem. no-bind stamped followers and new magazine springs have been ordered. Testing is scheduled to begin the first of November.

Three long action 30-06 caliber rifles for the Writers' Seminar have been tested.

The parts list and all model drawings, except for the stock, checkering and .222 Rem. short action magazine follower drawings, have been transmitted.

Model 1100/870 - 20 Ga. Lightweight with Mod Choke Barrels

Marketing has requested that 20 Ga. lightweight shotguns with 3" Magnum chamber in 28", vent rib, modified choke barrels be added to the line in 1983.

Barrels have been tested in the Model 1100 and 870. Patterning tests do not meet our specifications. New ammunition and competitive barrels have been secured to compare results. Testing will be completed in early October.

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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:

- o Model 1100 - 12 Ga. - 30" Full Vent Rib Barrel - Commemorative Dinner Gun
- o Model 1100 - LT-20 LTD - 23" Modified Vent Rib Barrel (Short Stock) Special Dinner Gun
- o Model 1100 - 12 Ga. - 26" Full Vent Rib Barrel - Trade Gun.

One prototype of each gun has been furnished to Marketing. Parts lists and drawings have been completed and manufacturing costs established.

Warehousing of the Commemorative and Special Dinner Guns is scheduled for July, 1983. The Trade Model will be warehoused in October 1983.

Cut Checkering

Contrary to most competitors, Remington currently cut checkers only its higher grade guns. The goal of this program is to develop a cut checkering system capable to producing acceptable quality at a lower price than our present N/C machines.

A Bostomatic CNC machine has demonstrated satisfactory cut checkering of press formed stocks, and will be reviewed for fore-ends. This machine meets all of the project goals.

CO.RE.MA. (Italy) has supplied a sample from a new type of machine. The quality appeared very good, and the price is well below CNC machines.

A project will be submitted in the 4Q82 to purchase a prototype machine. Early project approval will provide equipment for checkering development, and product capability for the M/1100 Special.

Form Rolling

Form rolling is a deformation process, similar to thread rolling, which may be applicable to manufacturing solid cylindrical parts such as firing pins. 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. Form rolling burnishing of shotgun firing pins has been selected as a second application.

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Roll Forming - Cont'd

Initial samples of form roll burnished shotgun firing pins look good. A pilot run of both soft and heat treated firing pins is scheduled for this month.

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FIREARMS MODERNIZATION

Receiver Flexible Manufacturing System

Remington and EDL personnel have developed a conceptual system for manufacturing rectangular receivers based upon a four spindle CNC machining center.

Heian Iron Works (Japan) and New England Machine Company are being seriously considered as sources for the prototype machine center. The final selection is expected in late October when the purchase order for a prototype machine is to be released on an existing P&E.

The prototype project scope will include a demonstration of all critical system technology including, the machine and fixturing, tooling and tool support, the inspection and material handling concepts and the computer communication system required to tie these components together. The prototype project is scheduled to be ready for authorization in the first quarter of 1983.

To assure development of a system compatible to firearms manufacturing, representatives of each plant department have been selected to act as a liaison between the plant and the receiver manufacturing development team. Initial meetings of this liaison team have focused on providing basic manufacturing information that will be required for the computer

CNC Long Stock Inletter

A program is in progress to modernize manufacturing processes in the wood machining area.

A purchase order has been issued for a Heian dual turret CNC router which can perform the majority of current secondary requirements for all long stocks. Delivery is expected in December with startup 1Q83.

Investigations are also in progress to determine the feasibility of inletting and secondary machining all long stocks in one fixture. A purchase requisition was placed with Ekstrom, Carlson and Company to demonstrate twenty-two (22) long stock machining operations. Ekstrom is to provide a tool package and the minimum cycle time for the required operations. Fifty (50) carved but un-inletted stocks have been shipped to Ekstrom for testing scheduled this month.

Rotary Bell Atomizers and Wood Finishing Automation

Remington's wood finishing process consists of numerous hand operations which generate large amounts of scrap and rework. Development is progressing on a conceptualized system that would

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Rotary Bell Atomizers and Wood Finishing Automation - Cont'd

automatically fill open grain, spray finishes, scuff sand, and tack wipe to eliminate the hand operations while also improving quality and productivity.

The current Graco electrostatic spray system is only capable of spraying the base coat of wood finishes. Top coat finishes require higher quality than the present system can provide.

We have determined that DeVilbiss rotary bell atomizers for electrostatic spraying will reduce material usage over 40% and increase the finish quality.

Equipment has been ordered and delivery is expected in late December. Upon installation, development will begin on utilizing the improved electrostatic system to spray final coats as well as base coats.

GFM Automation

A robot based system capable of loading and unloading the GFM machines, stripping the finished barrel from the mandrel, reassembling the barrel blank and the mandrel, and loading and unloading the automatic cutoff machines has been developed with EDL. The automated system will require purchase of a commercial robot and construction of a mandrel assembly/stripping machine.

The construction cost estimate for the prototype system is approximately \$280M. An appropriation request is complete and should be ready for circulation in early October for approval.

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AMMUNITIONNew Unibody Shotshell Process

The rotary cam shotshell body forming machine is out of service due to the fatigue failure of one of the main cam follower shafts. Examination of the failure, with the assistance of the Engineering Department, indicates that a redesign of the shaft and follower assembly is necessary in order to solve the problem. Production will not resume until early January.

Approximately 5.6 million 2-3/4" and 0.8 million 3" 12 gauge bodies have been produced on the Bridgeport production machine with generally excellent product results. Slight tooling modifications have improved product dimensions and reduced the incidence of related machine jams. Control of primer bore diameter is tighter and well within the limits specified.

To accommodate heavy, high performance loads, such as the steel shot or buffered 1-7/8 oz. heavy magnum, a 12 gauge body with a larger internal volume is required. Tests of experimental bodies produced on semi-works equipment have shown good initial performance.

Production of 20 gauge bodies on one quadrant of the production machine was underway. Trial and Pilot runs through All&P and loading are in progress but will be delayed until additional bodies are available.

Trimming in of production 8 gauge tools was nearly complete when the machine was put out of service. A slight mouth defect is expected to be solved by a minor change to the extrusion die.

Product testing of 16 gauge bodies produced on semi-works equipment shows excellent performance. An experimental run of 50,000 bodies has been completed for use in developing All&P and loading processes in the Plant. Orders have been placed for tooling the production machine.

Development of the 28 gauge body continues to progress toward elimination of body cutoffs as the principal failure in a small percentage of bodies. A 50,000 body experimental run is scheduled at the end of October.

Development of 10 gauge has reached the point at which basic body dimensions have been achieved. Tooling refinement to meet product specifications is scheduled to culminate in a 50,000 body experimental run in mid-November.

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New Unibody Shotshell Process - Cont'd

The initial set of .410 bore semi-works tools are complete. Development will begin immediately with a 50,000 body experimental run scheduled for mid-December. A project to demonstrate manufacture of .410 bore bodies on the production machine is being circulated.

"Premier" Shotshell

Federal and Winchester have a line of shotshells with buffered, hard, Cu plated shot called "Premier". These shotshell perform better at longer ranges due to their improved patterns (up to 15% improvement). Marketing has forecasted Remington's shotshell business could decline without an equivalent offering.

We have defined hand loaded product specifications in all 12 and 20 gauge "Premier" (Cu plated) and "Nitro Mag" (no plating) loads. Ten gauge development will follow contingent on availability of the New Unibody Shell. Specifications for all product have been transmitted to Production. Trial and Pilot loading runs are scheduled.

A capital project for the loader modifications required to produce all "Premier" product is expected to be approved in October.

Continued Research efforts will be directed at achieving further shotshell pattern improvement. Testing is in progress to evaluate other plating materials, lubricants, buffer geometry relative to shot size and shot sphericity.

12 Gauge - 1 Ounce Target Load

A 1-ounce Target Load is being developed for introduction this Fall. An experimental run was made at Lonoke using the RTI wad. Testing of this product has shown it to be completely satisfactory. Pattern performance was comparable to Winchester and -200F performance was superior in gun function and off-sounds.

The Trial and Pilot run is scheduled for early November when packing material arrives.

Integral Anvil Battery Cup

Production is presently making preparations to run 4000M ABC-202 primers in a 12 gauge promotional load to gain operating experience. The ABC primer should not be adopted for full scale production beyond trial runs until battery cup integrity is improved. Work will continue to improve battery cup integrity through increasing flash hole area, stress riser elimination and reduced pressure mixtures.

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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. Ballistic performance, sensitivity and piercing resistance are receiving greatest emphasis.

The development of a nitrocellulose source has been continuing. Olin NC appears to be the best compromise of all the materials evaluated to date. Excess moisture will have to be removed prior to mixing to obtain good chargeability as it does not absorb moisture well. The charging plate tends to slip on the charging table due to the ball bearing nature of the NC and this will require minor equipment alteration. An additional sample is on order for testing at Lonoke and more testing at Bridgeport.

An experiment was conducted to determine the contribution of each of the ingredients of priming mixture. A fuelless mixture, that is, one containing only polinol, sensol and barium nitrate, appears to provide excellent ballistic performance when the pellet weight is increased to the 1.2 gr. level. Testing in 12 gauge Target and 12 gauge H-Mag has shown very promising results. This mixture would eliminate the NC supply problem. Evaluation of this mixture will continue.

A test was conducted to examine dimensional variables affecting sensitivity and piercing. Cup blend radius, blend thickness, edge support (cup mouth bearing on anvil shoulder) and anvil/primer cup interference were the primary variables being investigated. All anvils were annealed to eliminate anvil metal variables. Several samples surpassed Federal in performance. Early indications are that cup geometry is more important than anvil dimensions.

357 Rem. Max. 158 S&W

Evaluation of WC 669 propellant is continuing and it appears that a velocity of 1800 fps (instrumented, vented test barrel) can be achieved at a pressure level of 400 CUPS. This load is presently being evaluated ballistically and for function and casualty in two recently acquired Ruger revolvers. Approximately 300M unprimed cases and 500M bullets are available for Trial and Pilot.

Lachaussee Loader - Blown Primer Laser Inspection

A request was made to convert the laser inspection unit to detect blown primers with paper covered flash holes. This was successfully accomplished with optical changes and associated electronics. The inspector has been thoroughly tested and shipped to Lonoke.

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Center Fire Modernization

The six prototype machines are in various stages of completion, as follows:

- Bullet Assembly - The machine is installed and all modifications, except addition of a swaging feature, are complete. Experimental run is expected to be complete in early October.
- Bullet Jacket Draw - The machine is in Trial and Pilot. Productivity and product quality goals are being achieved.
- Header - The machine is installed and being debugged. An experimental run is underway.
- Turret Trim/Headturn - The equipment is installed and the experimental run is complete. Trial and Pilot will be scheduled by Production.
- Anneal/Taper/Anneal - The carburation system is installed and in routine production use. The taper press is installed and being debugged. The annealing units are in fabrication and scheduled for October 30 delivery. Installation of the combined system is scheduled for early November with start-up November 15, 1982.
- Loader - The loader is in check-out at EDL. Delivery to Lonoke is expected about November 1, 1982. Startup in-plant is scheduled for November 29, 1982.
- Progressive Shell Draw - Some problems are being encountered with excessive wall variation in the mouth area of 30-06 cases. Although the product dimensions are within production specification for wall variation, this condition must be improved to insure high quality cases which would be virtually free of defects after the taper operation. Equipment modifications are being made in effort to correct the problem.

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SPECIALTY METALS PRODUCTS RESEARCHInjection Molding of Metal and Ceramic Components

Injection molding is a technique for producing intricate, three dimensional shapes in metals and ceramics. Remington has a license from Witec and Parmatech Corporation and is developing the processes for external commercial sales and internal production of firearms parts.

Stainless steel development is receiving priority. One acceptable run of Witec premixed 316 stainless was made earlier in the month, but a second run to verify the results proved unsatisfactory. Witec uses an elemental mix which may not be possible with stainless. Parmatech 316, stainless blended using prealloyed powders, will be run in early October, as will a Remington mix, again using prealloyed powder.

Additional alloy development is progressing. A higher strength Ni-Fe (100,000 psi tensile range) and Kovar (Fe-40% Ni) have been processed. Properties of both materials must be verified.

Johnson and Johnson has inquired about a development program for injection molding ceramic and stainless steel orthodontic appliances. Norton has responded negatively to our proposal for injection molding their technical grade ceramics. Norton feels that they would reveal too much proprietary information.

Cryogenic Processing of Powder Metal Parts

This process involves slow cooling of parts to about -320°F and holding for approximately 24 hours. Significant improvements in properties for wrought parts are claimed. This has been verified for high nickel powder metal alloys, where results have consistently surpassed the goal of 200,000 psi tensile strength.

Corrosion Reduction of Monel and Stainless Steel Powder Metal Parts

After a lengthy testing period, corrosion of monel and stainless steel parts has been traced to free iron contaminant in incoming powders. This has now been confirmed by the vendor. The degree of iron contamination varies from lot-to-lot.

Of all the slugs tested (Monel, 316L, 316LSC, and 830), the 316LSC appears to be the most corrosion resistant. Even this material shows some corrosion after 2 - 3 days in salt water.

An immediate solution to the corrosion problem appears to be the use of coatings. Several contacts have been made to provide coatings of various forms. Research is continuing.

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RESEARCH PERSONNELRemington Roll

	<u>Actual</u> <u>8-31-82</u>	<u>Actual</u> <u>9-30-82</u>	<u>Forecast</u> <u>12-31-82</u>
EXEMPT	64	65	70
NONEXEMPT	23	23	27
WAGE ROLL	24	24	21
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TOTAL	111	112	118

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PATENTS & TRADEMARKS

Summary of Activity

Patent Applications Filed

None

Trademark Applications Filed

"SLUGGER" filed in Intl. Class 13 for Ammunition	T-54 US
"VIPER" filed in Intl. Class 13 for Ammunition	T-55 US

Patents Received

PERCUSSION FIRING MECHANISM FOR INDUSTRIAL GUNS Palmer/Rowlands ABSTRACT: The hammer and sear profiles are so formed that they cooperate to automatically cock and fire the gun as the breechblock closes. The timing of hammer release is easily adjustable to compensate for wear.	RA-0236:
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FIRING PIN BLOCK FOR A FIREARM HAVING A RECIPROCATING BREECH BOLT Bauman/Kast ABSTRACT: A major safety feature of the XSG shotgun. The slide block positively retracts the firing pin inside the bolt face prior to unlocking the action, and blocks the firing pin from protruding until the action has been relocked.	RA-0232
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Trademarks Received

None

Inventions Reports

None

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