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REMINGTON ARMS COMPANY, INC.
RESEARCH AND DEVELOPMENT - FIREARMS

THIRD QUARTER PROGRESS REPORT - 1980

September 23, 1980

HIGHLIGHTS

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New Product Development

- o Warehouse quality audits are in progress on the M7400, M7600, M4 and M6 center fire rifles. Audit results will be available by mid-October. 3
- o Revisions to the M870 Competition Trap shotgun gas piston, barrel support, and locking block have been successfully test fired to 25,000 rounds. Design drawings have been transmitted to Process Engineering. 3
- o Component parts for two new locking systems and action bar assemblies for the XSG shotgun are in process. Assembly and testing should resume by mid-October. 4
- o Delay fire and high misfire rate problems with the Model 979 Seismic Gun have been solved and the first lot of 15 guns has been shipped to MAPCO. 4
- o Prototypes of the bolt action carbine were provided to Marketing for field testing. Results indicate that the gun was well accepted, but needs some weight reduction. 5
- o New format Owner's Instruction Manual for the M7400/7600 and M4/6 rifles has been completed and released to Production. 5

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Current Product Development

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- o Cost savings of \$84.3M per year will be realized by introduction of the rivetless extractor in the M7400/7600 center fire rifles. These extractors have been approved for production and introduction should be completed by the end of October. 5
- o Cost savings of \$60M per year will be realized by introduction of the integral ejector design to the M1100 12 Ga., 16 Ga. and 20 Ga. shotguns. Testing of M1100 LT-20 barrels has been completed and the design approved for production. 6
- o An aesthetically acceptable design of a bolt lock separate from the safety on the M700 rifle has been completed and is scheduled for testing in October. 6
- o Test models of the M788 rifle incorporating an improved safety button design are being fabricated. 7

Process Development

- o The Auto-Drill line is now under power and full automatic operation is scheduled for October 10. The saw and south lathe have been cycled automatically and final adjustments and lube modifications are in progress. 8
- o Savings of \$61M at a 23% ROI will be realized with ASEA Manipulator polishing of M7400/7600 receivers. The Shaevitz LVDT repositioning system to overcome tolerance problems in receiver panel polishing is due September 30. 9
- o Delivery of the wire electrical discharge machine for the Four Slide Machine is expected by October 15. M7400/7600 long magazine followers have been selected as the first parts to be formed. 9
- o Metallurgically sound laser welds of 1018 steel slide blocks to action bars have been obtained by ETL. However, adequate weld strength has not been achieved. 10

STATUS - 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 and are scheduled for announcement in December 1980.

Warehouse quality audits are in progress on the M7400, M7600, M4 and M6 rifles. Visual audits and functional tests will be performed and results available by mid-October.

M7400 guns have been withdrawn from the warehouse for the sports writers' seminar. Five guns have been scoped and accuracy is within specifications.

The Limited Edition Model Four is being prepared for release to production. Completed artwork will be ready for review by the end of September. Sample guns will be ready by mid-October 1980 for product acceptance.

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 Handicap 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 involved addition of a buffer on the piston, a barrel support to retain the barrel, and a shot peened locking block. The latest design of the gun has been successfully tested to 25,000 rounds and drawings have been transmitted to Process Engineering. Updated costs show no significant change. We are working with production to improve warehouse dates. Presently we are drilling barrel support and gas cylinder positioning holes in barrels.

XSG/SPG Shotgun

New autoloading (XSG) and slide action (XPG) shotguns are being developed. The objective of the program is to replace the Model 1100 autoloading shotgun and the Model 870 slide action shotgun with improved versions which will be lighter in weight. The guns are being designed simultaneously to take advantage of common parts for reduced manufacturing costs.

The two new locking systems are near completion. Component parts are in heat treat. Assembly and test will begin in mid-October. Action bar assemblies are now being heat treated and testing will resume on the new round and square wire action springs.

Layouts and detail drawings are being prepared for the XPG. A new feed system is in the layout stage. The system is designed to work in both XSG and XPG shotguns.

Four new XSG prototypes are scheduled for assembly in December for design verification.

Model 979 Seismic Gun

The first lot of 15 Model 979 Seismic guns has been shipped to MAPCO. The next lot of 25 guns will be completed by October 7, 1980 and will be shipped in small lots of 5 to 10 as soon as they are available.

The first fifteen guns were delayed approximately six weeks due to a "delay fire" phenomenon and a high misfire rate in multiple firing from a single source. These problems were solved by changing ammunition lots in the case of the "delay fire" and by adding a resistor in series with each gun for the parallel fire mode. The "delay fire" phenomenon was discovered to be a misfire which fired on a second pulse generated by the firing system.

There were two guns returned to us on September 12, 1980, one for bad ejection and the other due to a blanked primer. The one that had the bad ejection was found to be excessively dirty; when cleaned ejection returned to normal. The one that had a blanked primer was damaged but repairable. The fired shell showed signs of extremely high pressure; the cap was bulged into the ejector and the body was partially missing. Damaged parts in the gun were replaced and the gun is now serviceable.

There was no injury to personnel and no parts or debris left the gun when the blanked primer was encountered.

Bolt Action Carbine

The carbine is a short barreled, bolt action center fire rifle that is being developed as a replacement for the Model 600.

Prototype models were provided to Marketing for field testing. Results indicate that the rifle was well accepted, but needs some weight reduction.

Marketing requested that we investigate ways to reduce the overall weight of the rifle. A list has been compiled of the options. A meeting will be held in October with Marketing to define model requirements.

New Owner's Manual Format

Our present Owner's Manuals contain words that are often technically slanted, making it difficult for the average person to read and understand. New manuals are being prepared using a controlled language with the key principle being one word-one meaning.

Instruction books for the Models 7400, 7600, Four, and Six have been completed and released to Production.

Mechanical illustrations for the Model 700 standard and classic grades have been completed. Instruction books are scheduled to be printed and ready for packaging October 15, 1980. Mechanical illustrations for the Model 700 Left Hand are scheduled to be completed October 1st.

Draft of the text for the Model 870 Competition Trap instruction book has been completed for reviewing. Work is proceeding to complete camera copies for proof printing.

STATUS - Current Product Development

Rivetless Extractor

Cost savings of \$84.3M per year will be realized by introduction of the rivetless extractor in the M7400/7600 center fire rifles. These new extractors in small, regular and magnum sizes will replace the troublesome riveted types. Part cost will be reduced, a number of

bolt head operations eliminated, and gun reliability and ease of replacement will be improved.

All three extractor sizes have been extensively tested and approved for introduction in all center fire rifles. Regular and magnum extractors require an anti-rotation projection in their respective bolt heads to prevent them from rotating out of position. Tooling to coin the anti-rotation projections in all center fire bolt heads has been designed and built. Some of the tooling is already being used for production. Trial of the remainder should be completed by the end of October.

Integral Ejectors

Currently the ejectors in the Model 1100 12 Ga. and 20 Ga. shotguns are spot welded to the barrel extension and machined to size. A process has been developed to form the ejector as an integral part of the barrel extension. Use of an integral ejector will eliminate three process operations, as well as the ejector pin, and will result in a more durable ejection system. Tooling to coin ejection surfaces into 12 Ga., 16 Ga. and standard 20 Ga. barrels has been developed and transmitted to Production. Savings of over \$60M per year can be realized by this procedure.

Field and endurance testing of M1100 LT-20 barrels has now been completed. No ejection problems were encountered and ejection surfaces showed negligible wear. Drawings are being prepared for transmittal and tooling for coining the integral ejectors has been turned over to Production.

Model 700 Bolt Lock and Fire Control

New bolt lock and fire control designs for the 700 bolt action center fire rifle are being developed as part of an ongoing program to improve the functional characteristics of our current firearms line.

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 M700 rifle have been designed to operate independently of each other. A lever that is aesthetically acceptable has been designed and is scheduled for testing by the end of October. New cost estimates are being prepared by Industrial Engineering.

To date four fire controls have been designed and are in various stages of assembly. New components for the original (No. 1) design have been fabricated, assembled and evaluated. Sear engagement, trigger pull and operating forces have all been satisfactory. However, safety operation has been unreliable. The safety fails, at times, to support the sear as intended. A method of insuring engagement, possibly the use of interlocking angles, would solve this problem.

Tolerance problems, along with sear safety engagement in Design No. 2, have been eliminated. Another area of concern is that of sear return after firing. Replacement of the sear spring should solve that problem. A new spring has been designed and fabricated. Assembly and testing is planned for the first of October.

The third design has been fabricated and assembled. Initial tests indicate proper functionality. Further testing is planned.

Design No. 4 is being fabricated and will be assembled and tested the second week in October. This fire control features a blocked sear as well as a blocked trigger, and is intended to be used with the new bolt lock.

Model 788 Safety

The present Model 788 rifle has been in the line for several years. A continuing effort is made to improve operation of the current firearms line in conjunction with reports from Production, Process and the field.

Experience indicated that the safety button could be contacted by the first web space of the hand when holding the gun by the grip of the stock and resting the gun on the shoulder. This could possibly cause the safety to be moved to the off safe position. The safety button has been redesigned to correct this condition. Drawings have been forwarded to our vendor to investigate manufacturing problems. Reports are satisfactory to date.

The force to move the safety to the off safe position is on the light side. The detent and detent spring have been redesigned to increase the off safe force. Preliminary models have been tested satisfactorily.

Models incorporating the new safety button, detent hole, detent, and detent spring are being fabricated for final testing and should be ready for assembly in October.

Model 1100 Ducks Unlimited Shotgun

The Ducks Unlimited program consists of special model shotguns that are sold to the Ducks Unlimited Organization which auctions them off at a fall dinner meeting to raise money for their organization. Marketing has developed, in conjunction with Ducks Unlimited, a four year program with an option for the fifth year, where Remington will furnish these special shotguns in limited quantities.

The program consists of three special production shotguns each year. The first year there will be a Commemorative Model 1100 - 12 Ga. Dinner Gun, a secondary M1100 LT20 Dinner Gun, and a M1100 - 12 Ga. trade gun.

We have provided Marketing with preliminary models of the Commemorative and Secondary dinner guns. Using these models and preliminary artwork furnished by Marketing, Ducks Unlimited agreed to the first year model requirements for all three models.

Drawings will be transmitted to Process Engineering in October 1980. Hand engraved models with the final agreed upon artwork will be completed in October.

STATUS - Process Development

Auto-Drill Line

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

The complete line is now under power. The saw and the south lathe have been cycled fully automatically cutting steel. The installation of the smoke system ductwork is nearly complete and final adjustments are in progress. Bearing and lubrication revisions will be performed by the vendor starting September 29. All work is scheduled for completion by October 10, with the line in fully automatic operation at that time.

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 automatically polishing Model 742 and Model 760 receivers utilizing their industrial robot.

Updated economics on this project now reflect a savings of \$61M per year at a 23% ROI for completely polishing the Model 7400 and 7600 receivers. An adequately uniform finish has been achieved on the radii. Flat polishing tolerance problems will be solved by adapting the feedback of a Shaevitz LVDT repositioning system into the manipulator programming. The LVDT is due on September 30.

Additional investigation into M870 polishing will be conducted by Research, while improved panel polishing will be reviewed in conjunction with ESD.

The system will be available for limited manual load production on the M7400/7600 during the first half of 1981.

Four Slide Machine

This automatic manufacturing for in-house production of precision formed stampings will enable Remington to develop an expertise in stamping manufacture required to eliminate our total dependence on costly outside suppliers. Additional benefits will be improved quality and reduced new product lead times.

Support equipment will include a wire electrical discharge machine (EDM) which will be used to manufacture four-slide tooling and prototype gun parts. Delivery of the wire EDM is expected by mid-October. Because of the complexity and size of the first parts chosen for manufacture, M7400/7600 long magazine followers, some additional attachments have been ordered for the four-slide machine. Equipped with these additional items, the machine will be more versatile and will enable us to manufacture more complex formed stampings than originally contemplated.

Laser Welding

Model 1100 and Model 870 shotgun slide blocks are currently being brazed to action bars or slide plates. The brazed joints are inherently unreliable and difficult to inspect without destructive testing. Scrap rates run as high as 20% in subsequent operations. A laser welding process was proposed to replace the troublesome brazing operation. The estimated gross savings are \$30M per year at a 38% ROI.

Metallurgically sound laser welds of 1018 steel slide blocks to action bars have been obtained by ETL. However, adequate weld strength has not been achieved. ETL will continue to experiment, using different laser welding techniques, until satisfactory weld strength has been achieved.

Laser Wood Carving

Laser wood carvings offer improved aesthetics over the current pressed checkering method of stock and fore end decorating. Laser carving is comparable in detail to the traditional and expensive hand carving methods but at greatly reduced cost.

Marketing has approved a laser engraved emblem for the M1100 LT-20 Ducks Unlimited shotgun stock. Artwork has been sent to Lasermation for sample preparation.