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RESEARCH DEPARTMENT

PROGRESS REPORT

JANUARY 1980

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HIGHLIGHTS

FIREARMS

Product Development

Model XSG Shotgun

A new, lighter weight, high performance autoloading shotgun is under development for introduction in 1983, 1984. The current prototype model has been fired 3000 rounds using 2-3/4" magnum loads without a major component failure. (Page 3)

Model 7400-7600

The first Model 7400 assembled in caliber 30-06 passed the gallery tests. (Page 3)

Model 870 Competition Trap

Production of this new model is in delay as a result of failure of the action bar and fore end tube assembly during endurance testing of two trial and pilot guns. Design modifications are under test. (Page 4)

Process Development

ASEA Manipulator

An automatic manipulator is being developed for polishing of rifle receivers. All polishing machines for M742 and M760 receivers are installed. Testing will begin in February. (Page 5)

Integral Ejectors

Additional endurance testing of small caliber rivetless extractors in bolt heads without anti-rotation projections has been completed with no problems encountered. (Page 5)

AMMUNITION

21mm Shell for Seismic Exploration

Twenty-five thousand rounds of electric primed shells were shipped in December and January. Progress of the development program to reduce cost and increase capacity is reported. (Page 7)

Highlights - Cont'd

Degradable Shotshell Wad

DuPont's ethylene/carbon monoxide bipolymer resin, which is ultra-violet degradable, is the only surviving candidate resin. (Page 9)

Airborne Lead Reduction Studies

Dramatic reductions in airborne lead concentrations result when jacketed bullets are used in place of lead bullets. (Page 9)

One-Piece Shotshell Body Process

Progress is reported on the status of this new development which has a cost reduction objective of $1MM per year. (Page 11)

High-Speed Load and Pack

Progress is reported on the start up of the new high speed Lachaussee load and pack unit installed at the Lonoke Plant. (Page 12)

FIREARMS

Model XSG Shotgun

A new autoloading shotgun is under development for introduction in the 1983 or 1984 model years. Lighter weight and lower manufacturing cost goals are incorporated in the prototype currently under test. This prototype has been fired 3000 rounds using 2-3/4" magnum loads without a major component failure. The design goal is 5000 rounds without major component failure.

Performance of the action spring is a major design uncertainty, and is being monitored every thousand rounds. At 3000 rounds it has set 1.560 in. (The spring is 13 in. long.) No major breakages have occurred.

The Locking Block - Actuating System is being redesigned for better mass distribution at unlock. Our objective in doing this is to reduce operating velocities of the magnum loads and reduce the spread of velocities between magnums and light loads.

To expedite the XSG program which is behind schedule for a 1983 model year introduction, a team consisting of six designers has been assigned.

Model 1100 Commemorative (75th Limited Edition)

One receiver of five has been shipped from Aurum Etching. All other components have been completed and will be assembled to this receiver. The remaining four will be received the first week in February.

Model 7400 - 7600

Production has started assembly of trial & pilot 7400s. The first rifle assembled in caliber 30-06 passed the gallery tests. As more rifles are assembled, additional samples will be evaluated by Research.

A sample pewter insert and grip cap has been assembled to a rifle and turned over to Marketing for review.

Bolt Action Carbine

A complete parts list and prints of new parts has been furnished to Process Engineering for a cost estimate of this model. Five prototypes in each caliber requested by Marketing are scheduled for completion in February, with testing to follow.

Per our conversation - the decision to cancel date a few for 1980 introduction ??

Model 870 Competition Trap Shotgun

Introduction: Summary on background

During the past month intensive endurance tests were conducted to finalize the design of the recoil reduction system. The cause of "sticky pistons" was determined to be a result of peening the face of the piston on impact with the gas cylinder upon completion of the cycle. This has been corrected by slightly reducing the diameter of the piston between the face and the sealing band. Design parameters of the system have been finalized and production has been advised. These include the lighter piston, heavy spring and no vent hole in the buffer.

During these tests another problem has surfaced. Action bar and fore end tube assemblies are failing prematurely.

Initially action bar assemblies were tested in the soft condition, the same as current 870, and exhibited three modes of failure:

1. Action bar failure
2. Separation of the tube through the threads
3. Failure of the tube at the braze joint.

Test history (January thru March 1979) shows a total of fourteen assemblies tested with failures ranging from 2200 rounds to 20,000 rounds. The average life of these action bar assemblies was 9,000 rounds.

Heat treatments were developed that resulted in four assemblies surviving shooting endurance tests for 38,000 rounds, 34,000 rounds and 17,000 rounds before failure. The fourth assembly endured 20,000 cycles (including 5,000 express loads) and did not fail.

P.E. & C. is continuing to refine their heat treatments by carburizing the assemblies to two different levels, heat treating and drawing them to increase impact strength. Research will:

1. Establish a recommended assembly torque on the tube nut.
2. Test the effect of an "O" ring buffer between the tube nut and the fore end.
3. Test the effect of a shock ring between the fore end assembly and the gas cylinder to reduce tensile loading of the tube during firing.
4. Evaluate effect of reduced thread depth on fore end tube.

Model 870 Competition Trap Shotgun - Cont'd

Parts have been modified and samples of each of the experimental assemblies are in test. One model incorporating features (2) and (4) above has exceeded 13,000 rounds without failure. Marketing has established an endurance level of 25,000 rounds for a minimum acceptable product.

Heavy wall tubing has been ordered as a backup solution. Delivery is expected in mid-February.

Process Research

Background statement - goal & justification.

ASEA Manipulator - All polishing machines for M742 and M760 receiver polishing are installed. A new manipulator polishing program will be tested in February. Dust collector ducts will be altered by mid-February.

Testing of the receiver repositioning system, designed to correct misalignment of the receiver with the polishing jack contract wheel, was moderately successful. If 100% success cannot be achieved with the current microswitch system and further refinement in the manipulator programming, a higher resolution, digital system based on the linear variable differential transformer (LVDT) might be necessary. An LVDT system was quoted by Schaevitz Engineering at $3,500.

The part handling conveyor was quoted by A&M Tool at $24M. Quotes from Techni Products and Sjogren Tool are expected in February. Conveyor fixtures high precision parts, are being made by the Research N/C group. Conveyor chain, a long delivery item, was purchased and will be delivered in February. The cost of these items, approximately $4M, will be subtracted from the conveyor quotes.

Integral Ejectors - LT-20 tooling is being modified to reduce the "bulge" in the area of the ejector, as requested by Marketing. Modifications will include a new clamp to prevent deformation of the outer barrel surface as well as a thinner punch and a shallower die recess. The ejection surface will also be moved .030 away from the critical edge.

P.E. & C. will not proceed with the transmittal of the LT-20 barrel until this problem has been solved.

Rivetless Extractors - Additional endurance testing of small caliber rivetless extractors in bolt heads without anti-rotation projections is now complete. Four (4) guns were tested, each firing a minimum of 1400 rounds with no extraction problems. A "rusty chamber" test will be scheduled shortly.

Process Research - Cont'd

Rivetless Extractors - Cont'd

Three (3) XP-100 7mm BR Rem. Pistols with rivetless extractors were function tested with no problems.

Thirty (30) bolt assemblies with rivetless extractor cuts have been completed for the new bolt action carbine.

M700 and M788 bolt head and bolt assembly drawings for regular and magnum caliber rivetless extractors have been transmitted. All will have anti-rotation projections.

Tooling to coin anti-rotation projections into M788 regular caliber and M700 magnum caliber bolt heads has been started in the Model Shop. M788 regular caliber L.H. and M700 magnum caliber L.H. will follow.

Regular caliber rivetless extractors have been installed in pilot run quantities of M700 7mm-08 and M7400 rifles by Production personnel using special assembly fixtures. No problems were encountered.

High Energy Beam Applications - Two designs of the Ducks Unlimited emblem, laser carved in stocks, were received from Lasermation. Stocks were finished and forwarded to Marketing for review.

Lasermation will proceed with two grip designs. They cannot carve full fore end radius with the current tooling. Some fore end designs will be narrowed and others reduced by approximately 70% for sample preparation. Lasermation estimates they would be able to handle the full fore end radius with an investment of $10M to $20M for tooling and 6 months of development time.

Free machining steel samples were forwarded to EDL for welding trials. Preliminary results are expected in March.

Other Work

New Owner Manual Format - Final draft version of the M700 Owner's Manual has been received from Smart Communications Inc. Minor revisions are being made before forwarding to Marketing and Legal Department for approval. The finalized draft is expected to be completed by February 15.

AMMUNITION

Shotshell

Dick - good Introductory Statement.

21mm Seismic

A 21mm (8 gauge) cartridge and gun system is being developed for MAPCO which is to be used for seismic exploration for oil and gas. An electrically primed version of the 8 gauge industrial load was developed at Bridgeport and a modified electric fire control system for a standard 8 gauge kiln gun was designed by Ilion. Present ammunition commitments are to deliver 25,000 rounds per month to MAPCO until October at which point the rate will be increased to 250,000 per month. Twenty-five thousand rounds were shipped just prior to January 1 and 25,000 rounds will be shipped by February 1.

Fabrication of the primer insulator component and its subsequent assembly with the primer cup and contract button to form the dry assembly, are currently limiting the production rate. Product and process design are not completely firm and are evolving to improve in-process product quality and ease of fabrication. For example, during the last 25,000 round product run, the blank diameter of the insulator was increased to form a longer insulator cup. This modification resulted in a more rigid assembly and substantially reduced the scrap throughout the assembly and priming process.

A 53-hole transfer plate system is used to assemble the three components of the dry assembly. Presently the insulator is blanked and positioned in the insulator transfer plate. A considerable productivity improvement will result with successful development of this method.

The 21mm primer currently utilizes a short battery cup which is made using a special setup in the Plant's Henry & Wright progressive die set machines. The existing process has proved troublesome and inefficient. We are currently investigating replacement of the short battery cup with a standard #97 shotshell component. Concurrently, the short cup process is being studied to identify the necessary modifications for attaining acceptable quality and productivity levels. The standard battery cup approach is the preferred alternative.

A manufacturing plan is being developed

~~Research, ER&D and the Plant are working closely together~~ to assure that the 250M per month production scale-up scheduled for October, 1980 proceeds according to plan.

BARBER - PRESALE R 0107825

1-1/4 Oz. "BB" Steel Load

The successful development of a 1-1/4 oz. "BB" steel load has been deterred by choke strain and unburned powder problems. High choke strain (and ultimately, barrel damage) are produced when faster burning powders are used. When slower powders are substituted to reduce choke stain, high levels of unburned powder residue are encountered.

In a study to determine if shot diameter adjustments might affect shot column nesting characteristics and thus strain performance, sample quantities of size "T" (.200 dia.), size "B" (.170 dia.) and "Air Rifle" (.175 dia.) were ordered from Superior Steel Ball Company and the samples are now undergoing tests. Load development to obtain acceptable ballistics has been completed and choke strain results will be available in early February.

In a related development, unburned powder tests of the Winchester 3" magnum 1-1/2 oz. steel shot loads have been completed and the results are as follows:

	Unburned Powder Residue (grains)	
	-20°F	R.T.
Win. 3" 1-1/2 oz. - #1 Stl.	18.5	8.3
Win. 3" 1-1/2 oz. - #4 Stl.	27.5	17.6

This completed our series of tests on competitive 3" magnum steel shot loads and the results show that by our standards, Federal produces unacceptably high unburned powder levels and Winchester performance in this respect is marginal.

3" 12 Gauge RXP Shell

The development of a 3" field version of the integral basewad RXP shell is underway with the objective of eliminating the asbestos basewad from our 12 gauge magnum line products. Only minor tool changes have been required for experimental production of the shell on the Perkins press.

All effort to date on the 3" RXP has been directed toward the fabrication of smooth body shells for use with the proposed "Premier" shotshell line. However, emphasis has now been redirected toward a corrugated body for use with the standard magnum product line. Corrugating tools have been designed and are presently being fabricated with an estimated completion date of February 8.

3" 12 Gauge RXP Shell - Cont'd

Approximately 30M slugs were extruded in January and an extended Perkins press run will be conducted upon installation of the corrugating dies. The Perkins run will be followed up with experimental runs at A.H.&P. and loading. Goal completion date for this work, including product testing, is March 15.

Degradable Shotshell Wad

After investigating several possible materials for a degradable shotshell wad, the DuPont PE 4971-3 Ethylene/Carbon monoxide bipolymer resin (ultra-violet degradable) is the only surviving candidate. The resin has good injection molding characteristics (similar to standard LDPE) and after several days under ultra-violet light, POWER PISTON wads molded from PE 4971-3 became brittle and fractured into smaller pieces under mild pressure. Wads exposed to New England winter sunlight for several weeks are also beginning to degrade in a similar manner. The wads have been test fired at room temperature with no casualties observed and hot and cold firing tests are planned. The Ethylene/CO wads have also been loaded into semi-transparent green and opaque green shotshell bodies and placed under ultra-violet light to determine the probability of wad degradation within typical Remington shotshells.

CENTER FIRE

Airborne Lead Reduction Studies

Recent testing of 38 caliber ammunition has shown that dramatic reductions in airborne lead concentrations result when jacketed bullets are used in place of lead bullets. The most recent evidence of this was the low readings obtained after firing several samples of experimental zinc jacketed 38 caliber bullets prepared at Lonoke.

In order to improve our measuring techniques and determine residual lead levels in the test environment, handloaded 38 caliber ammunition using machined brass bullets was fired. It was found that the levels obtained correlated reasonably well with the percentage of lead contained in the priming mix. This background lead level will be taken into consideration during all future testing.

A sample of copper plated 38 caliber lead bullets were received from Lonoke, handloaded and test fired. The results indicated that with a copper plating thickness of .0010" to .0015", airborne lead contamination was reduced from about 4000 micrograms per shot with lead bullets to about 1300 micrograms per shot with the plated bullets. These data still do not meet the Smith & Wesson "Nyclad" bullet (550 micrograms) or the Remington 125 grain Semi-Jacketed H.P. (400 micrograms) results obtained during earlier testing.

Airborne Lead Reduction Studies - Cont'd

We have requested that Lonoke copper plate another sample of 38 caliber lead bullets to approximately .002" thickness. Cost data for the thin (relative to POWER LOKT) plate process have also been requested.

44 Rem Mag 180 Gr. SJHP - Lonoke Probably not include in Lo Report

Acceptance testing of this product at Bridgeport is complete. Initial accuracy results at Bridgeport were out-of-specification, however, subsequent testing at both Lonoke and Bridgeport has been within acceptable limits. Additional accuracy testing is planned to verify these results.

The high muzzle flash associated with this product is also being investigated. In conducting load development for this cartridge, two powders were viable candidates out of twelve originally evaluated: WC 294 and WC 295. WC 295 was selected because of experience and availability. A sample of WC 294 has been ordered with flash suppressant and will be tested at Lonoke for effects on muzzle flash. This work will not interfere with production start up.

The Plant has scheduled production of bullets for February. Loading and pack-out will be accomplished in March depending upon availability of packaging materials.

ENGINEERING RESEARCH & DEVELOPMENT

PROCESS DEVELOPMENT

One-Piece Shotshell Body Process

Introduction - Objective, what we have

Laboratory Facility - The concepts for design of the production equipment have been developed in a laboratory facility which prototypes each of the twelve station operations of the production unit. The unit will prove process feasibility for each of the thirteen body types required, providing bodies for product testing.

Checkout of the new experimental equipment is underway. Initial product runs and equipment debugging will begin in mid-February. Demonstration of the process, including heat set, at production speeds is the principal research objective.

Production Facility - An approved experimental project provides for the first production machine system which will have a capacity of 220MM shotshell bodies annually. Start up is scheduled for second quarter, 1981. A total of three systems would be required for complete conversion to the new process. Combined savings at both ammunition plants, with complete conversion, would exceed $1MM.

Design of the body former is complete and final vendor quotes are being solicited. Design of the heat set and electronic/electrical control system is scheduled for completion by the end of March, 1980. The three major sub-systems (body former, heat set, and control system) will be fabricated and completely assembled by outside vendors followed by interfacing at the Engineering Development Laboratory for software checkout, dynamic testing of the entire system, and debugging prior to plant installation.

A detailed program review is scheduled for production personnel from both ammunition plants and Corporate Engineering on March 12-13, 1980.

Shotshell Load & Pack Optimization

Set goals if possible

This project provides funds to upgrade Bridgeport's load and pack equipment to increase efficiency and improve cost performance in that area of shotshell manufacturing. Program completion is scheduled for first quarter, 1981, and will provide estimated annual savings of $400M.

The scope of work includes converting three surplus duplex shotshell loaders to 8 gauge industrial, 12 gauge rifled slug, and 12 gauge magnum steel with suitable packing equipment for each, and modification to two simplex loaders to accept additional products.

Shotshell Load & Pack Optimization - Cont'd

Design modifications for the 8 gauge loader conversion are 70% complete. The slug transfer for the 8 gauge and 12 gauge rifled slug conversion has been detailed and checked. Work is proceeding on design of wad transfers for both gauges.

New rack reject units are on order for the five existing duplex loaders. The additional three loaders are already so equipped.

Quotations have been requested on all feeders needed for this project. Design of a new automatic 8 gauge packing machine will be completed in February. Fabrication will follow. The overall program is proceeding on schedule at this time.

A meeting was scheduled with plant personnel last week to review progress to date and discuss the effect of a changing forecast and reduced schedule in steel shot loads. The plant has been asked by ER&D to increase their participation in the program.

Shotshell High-Speed Load & Pack

The new high-speed loader and packer are in production use at Lonoke. Operating speed is now approaching the goal 600 parts per minute. A sustained six minute run at goal speed was achieved last week. Because of minor difficulties, the loader acceptance run to be conducted with Lachaussee is expected to take place in early February.

The blown primer detector is installed and operating. Its effectiveness is limited due to the product (dull primer, excess plastic flash around the inspection target, and clean burning mix).

Inspection performance can be made near 100% reliable by simply improving the surface finish of the primer battery cup or by switching to a paper covered flash hole primer. A report on this laser application was completed and given to Remington attorneys for filing with the Bureau of Radiological Health.

Development of a prototype dry offset printer for retrofit on the loader is complete. The new printer, because of improved features, will provide better print appearance than the existing letterflex printer. The printer will be installed at Production's request, probably in February after loader acceptance.

Joseph P. Glas

Joseph P. Glas
Director of Research

JPG:jl
Enclosures

GENERAL

Personnel

	1/31/80	12/31/79	1/31/79
Exempt	59	57	74
Nonexempt	23	21	28
Wage Roll	23	20	38
Total	105	98	140

Agreements

None

Reports

None

P A T E N T S

Summary of Activity

JANUARY, 1980

Applications Filed

N O N E

Patents Received

RECOIL REDUCING AND PISTON SHOCK ABSORBING MECHANISM (Nasypany) D-200 CANADA

Patent Issued 1-8-1980; Patent Recd. 1-14-1980

ABSTRACT: Gas operated piston recoil reducing system (used in M/870 competition gun).

Inventions Reports

Bridgeport:

8 Gauge Industrial Shotshell - Automatic Packing MDB-172